Market Simulation and Analyses of the Planned Slovenia – Hungary Bi-Directional Gas Interconnector

Executive Summary

REKK

May 2017

The Executive Summary was prepared for PLINOVODI d.o.o.

This paper serves as a summary of the main findings of the modelling analysis and it is an accompanying document to the final report.

Contact: Borbála Takácsné Tóth (borbala.toth@rekk.hu)

Prepared by: REKK Energiapiaci Tanácsadó Kft.

Phone: +36 1 482 70 70 Fax: +36 1 482 70 37

E-mail: rekk@rekk.hu

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Project Background

Transmission System Operator for natural gas in the Republic of Slovenia, PLINOVODI d.o.o., commissioned the REKK Energiapiaci Tanácsadó Kft. to carry out a model-based assessment of the planned Slovenian - Hungarian bi-directional gas interconnection pipeline in order to identify opportunities and risks related to the project and to monetise its benefits at regional level. The interconnection is planned to allow Slovenian suppliers to access Hungarian underground storages and the gas sources, which will be available in Hungary in the future (Black Sea production, Caspian sources, Russian gas), as well as allow Hungarian suppliers to access the west gas sources in Italy and Northern Adriatic, including the LNG sources.

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Brief Description of the Project as was Analysed

The new bi-directional interconnector between Hungary and Slovenia is planned in the Nagykanizsa — Tornyiszentmiklós (HU) — Lendava (SI) — Kidričevo (SI) corridor (see Slide). The project is nominated as the project of common interest[1] (PCI) and is an actual candidate for the PCI list 2017. It could be realised in three distinct phases (see Table 1).

Slide: Project Corridor

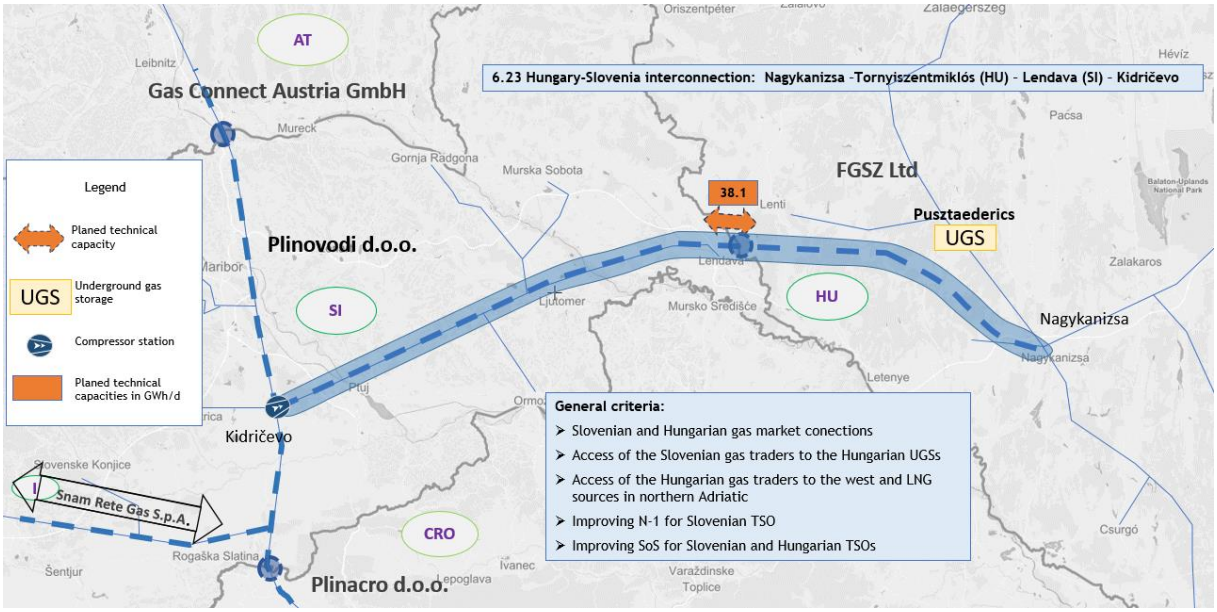

Table 1: Technical capacities of the project phases in GWh/d

Directions	Phase 1 (End of 2020)		Phase 2 (End of 2023)		Phase 3 (End of 2026)	
	Winter	Summer	Winter	Summer	Winter	Summer
SI – HU	3.30	5.08	8.89	12.70	38.10	38.10
HU – SI	3.05	1.78	12.70	8.89	38.10	38.10

Total investment cost – Capital expenditures (CAPEX) is assumed at € 154 million (2017 prices)[2].

[1] Commission Delegated Regulation (EU) 2016/89 of 18 November 2015 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest.

[2] During modelling calculations, all data is discounted to 2015 resulting a total CAPEX of 143 million EUR.

Evaluation Methodology

The REKK performed a model-based assessment using the European Gas Market Model (EGMM), a competitive equilibrium gas market model for Europe.

In line with the ACER[3], ENTSOG[4] and related[5] documents, a socio-economic Cost Benefit Analysis (CBA) was carried out to capture and monetise the welfare change for all stakeholders (consumers, local producers, long term contract holders, traders, transmission system operators (TSOs), underground gas storage operators (SSOs), and LNG terminals operators) affected by the implementation of the project.
Since the project has also a regional-price effect, welfare effects were monetised for Slovenia and Hungary, as well for the entire region as follows:

- Welfare effects of the project are compared to the reference case and changes from the reference are the benefits of the project;
- The total benefits are aligned with the CAPEX of the project[6];
- The financial NPV of the project for different scenarios are calculated, as a difference between the change of the TSOs profit due to the project operating and investment costs.

For the purpose of the project analysis, "the region" is a synonym for the neighbouring countries of Slovenia and Hungary.

[3] ACER Recommendation 5/2015 on good practices for the treatment of the investment requests, including cross-border cost allocation requests, for electricity and gas projects of common interest. Publishing date: 18/12/2015.
[4] Energy System-Wide Cost Benefit Analysis Adapted Methodology (INV0175-14; 13 February 2015).
2nd ENTSOG methodology for cost-benefit analysis of gas infrastructure projects – Draft for ACER and Commission opinions (2017).
[5] Guide to Cost Benefit Analysis of Investment Projects (European Commission, December 2014).
[6] The lifetime of the infrastructure is assumed at 35 years, the social discount rate is 4%, and all values are discounted to 2015.

Results of the Analyses

The Project Effect in the Reference Scenario[7]

The project serves trading purposes – in the case that Hungary or the Balkan needed additional supply from the West, this pipeline creates an additional route with an opportunity of a new gas source (gas in direction from the Italian market). In this perspective, the project has a price effect, which is higher in later years due to the capacity increase and expiry of long-term contracts (see Table 2). A positive regional price-convergence effect is noticeable especially in Hungary, and there is a negligible negative effect in Slovenia.

Table 2: Project price effect in the reference scenario to Hungarian and Slovenian gas markets

Price change compared to the reference, €/MWh	HU	SI
Year 2021	-0.06	0
Year 2024	-0.17	0.01
Year 2027	-0.71	0.04

The welfare effect of the project is in line with the price effects. Modelling directs that the project would result in a regional social welfare increase of yearly € 4.2 million in 2021, while these net regional benefits increase up to € 43.5 million in the year 2027 (see Table 3).

The largest benefits are in Hungary, where in 2024, for example, an € 18-million increase in consumer surplus comes at a cost of only € 3 million in losses for the producers, and the storage arbitrage profit surpasses the combined loss of long-term contracts (LTCs) buyers and the TSO. The balance of these effects in 2024 is a € 19.1-million increase in total welfare. The total welfare effect modelled for Hungary in 2027 is the result of the very optimistic Hungarian demand forecast applied; hence, it might be overestimating the welfare effect in Hungary.

Slovenia's benefit accrues mainly to its TSO, and can be estimated at € 2.9 million in 2021, which increases up to € 11 million by 2027.

[7] The EGMM was calibrated and verified for a 2016-reference scenario to display the 2016 demand and supply patterns, as well as price levels observed in Europe. Demand and supply development from 2020 is as of Primes 2016 ref, except for the Hungarian and Slovenian demand where the latest demand forecasts of the project promoters were used, and the Croatian demand where the latest Croatian demand outlook was used. Infrastructure assumptions are based on ENTSO-G's TYNDP. In the case of LTC's annual contract quantity (ACQ), a 50% expiry is assumed (except for Slovenia, where it is 25%). The price of long-term contracted gas was linked to the Brent crude, based on the Primes 2016 forecast.

Table 3: Welfare effect of the project in the reference scenario

Total welfare effect (million €/y)	HU	SI	HU+SI	Region
Year 2021	2.76	2.86	5.62	4.2
Year 2024	19.1	7.25	26.35	14.6
Year 2027	75.44	11.07	86.51	43.5

The pipeline utilisation pattern (see Table 4) is similar for all modelled threshold years: it is used at 59-67% of its capacities for the entire year, with 100% utilisation from April to October, and no predictable flows for the rest of the year under a normal scenario.

Table 4: Utilisation of SI - HU pipeline in the reference scenario

SI - HU	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Year
Year 2021	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	67%
Year 2024	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	66%
Year 2027	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	59%

CBA of the Project in the Reference Scenario

In line with ACER and ENTSOG recommendations, the socio-economic NPV was calculated as the difference of total welfare change of all affected stakeholder groups and the investment costs of the project.

The regional economic (social) NPV is positive in all analysed scenarios, which yields that the project is socially desirable. Moreover, the economic NPV is positive in both host countries.

The financial (project) NPV is calculated as the difference between the change of the TSOs profit due to the project and the investment costs. The TSO profit change consists of two parts:

- The first one is the operational income (tariff multiplied by the flow); and
- The second one is the auction revenue that occurs if the pipeline is congested and the traders are willing to pay a surplus of the capacity use (this revenue is split 50 - 50% between the two adjacent TSOs).

According to the results, the SI - HU pipeline is used in full capacity in the summer time, and therefore modelled auction revenues are significant, even higher than operational income for the Slovenian side. Without these auction revenues, the financial NPV would be slightly negative for Slovenia (see table 5). The financial NPV is always negative for the Hungarian

TSO, which suffers from significant profit loss due to the decrease of flow and decrease of auction revenues on other pipelines (AT - HU) that would be less congested.

The positive economic NPV for Hungary, however, means that the consumer's surplus on the Hungarian market and the profit increase of traders due to the project can compensate the TSO's loss; the redistribution can potentiate the realisation of the project. **The overall positive social and negative financial NPV also imply that the project can be an optimal candidate for the CEF founding.**

Table 5: CBA results of the project in the reference scenario in million €

	SI	HU	SI+HU	Total region
Total benefits	185	754	939	498
Investment costs	84	59	143	143
Economic NPV	101	696	797	355
Change of total TSO profit	191	-394	-203	
• Change of TSO operational profit	78	-57	21	
• Change of TSO auction revenue	113	-337	-223	
Investment costs	84	59	143	
Financial NPV based on operational profit	-6	-116	-122	
Financial NPV including auction revenues	107	-452	-345	

Results of sensitivity analysis

- **Variation in Demand, the Effect of LTC-Expired and the Absence of Nord Stream 2**
  The sensitivity scenario using demand figures from the Blue Transition scenario of TYNDP 2017 (demand of countries that are not included in the TYNDP remained unchanged) was performed. While the welfare effect of the project in this scenario is significantly higher in the selected years of 2021, 2024, and 2027 than in the reference scenario, total benefits up to 2050 are lower. This is so because although the TYNDP demand in most countries is higher than the Primes demand, the Hungarian demand used in the reference (FGSZ data) scenario was significantly higher than the TYNDP data after 2030.
  In the sensitivity run, assuming that Nord Stream 2 and dependent projects are not to be built, we see lower utilisation of the SI – HU, because the price decrease in Hungary is less significant as more spot sources remain available through Hungaria – Austria - Gasleitung (HAG). Due to the lower utilisation and price differentials, welfare effects of

the project are less significant for both, Hungary and Slovenia (in fact, it is negative for Hungary in 2021), and for the entire region, as well.

The analyses also examined the project with the assumption that the LTCs are not to be prolonged after their expiry. In this scenario, the price effects are slightly higher compared to the reference, contributing to more significant welfare gains. It is important to note, however, that the spot-pricing strategy of exporters is assumed to remain unchanged even if the LTCs expires, which probably overestimates the forecasted economic welfare benefits.

- **Infrastructure Scenarios**
  The sensitivity analyses consider some scenarios with variations of the infrastructural landscape included compared to the reference scenario. These include cases when the Bulgaria - Romania - Hungary - Austria gas interconnector (BRUA) or the Trans Adriatic Pipeline (TAP) was not built; when the Turkish Stream 2 or the Croatian LNG import terminal was built; and when the Aphrodite gas field (gas from the east Mediterranean) makes an additional 10 Bcm/y available to Italy.
  Out of these scenarios, the one without TAP results in lower utilisation of SI - HU, suggesting that the additional gas quantities that could reach Italy through TAP may contribute to flows on SI - HU in the reference. On the other hand, an additional 10 Bcm/y from the Aphrodite gas field would not add to the utilization of SI - HU compared to the reference, where the TAP is already included. In fact, none of the examined sensitivity scenarios involving infrastructural options would result in an increased use of SI - HU in the long term.

- **Tariff Scenarios**
  We have examined the effect of different tariff levels applied on the planned interconnector – the tariff-sensitive analyses. In the reference scenario, a tariff of 0.91 €/MWh is presumed and applied.
  The slight tariff reduction impacts higher utilisation rates, resulting in a higher TSO profit in both, Hungary and Slovenia. Raising the tariff would result in lower utilisation. The overall economic welfare of the two countries does not seem to be very sensitive to tariff levels.

Main Findings and Conclusions

- The planned project serves the market-integration purposes, and creates an additional route with an opportunity to reach new gas sources (gas mainly from the Italian market) for the region. There is no long-term contract-related capacity booking assumed on the pipeline in the modelling, hence the direction of flow and the amount of gas shipped are defined by market prices.
- According to the modelling results, the predominant gas flow direction is from Slovenia to Hungary, which prevails during summer. The yearly pipeline-utilisation rate varies between 59 and 67%.
- **Socio-economic Net Present Value** (NPV) of the project is positive in all analysed scenarios; however, the results are sensitive to the gas-demand assumption:
    - The project shows a positive effect in most of the analysed scenarios, which reflected the infrastructure development, planned gas-source diversification, as well as gas-price prediction on consumers, especially of the countries in the eastern part of the region.
    - The project effects on the gas-price lowering and with this to lower gas producer profits in the region.
    - The project impacts minor decreases of gas flows in the direction from Austria and Slovakia to Hungary.
- **Overall financial NPV** is negative, but the overall positive social welfare allows the redistribution of costs and qualifies the project for potential funding from the Connecting Europe Facility (CEF).
- The tariff scenarios show that the project-tariff reduction results in higher pipeline-utilisation rates and in higher Hungary and Slovenia TSO profits.
- The following project risks can be identified:
    - Although the Primes 16[8] gas demand data was used for the modelling as a basis, in the case of the hosting countries, the TSOs provided the gas demand forecast for Slovenia, Hungary, and Croatia based on the national development documents. Sensitivity assessment highlighted that assuming lower gas demand would result in lower utilisation and lower welfare effect.
    - If the Nord Stream 2 is not built and long-term contracts (LTCs) are delivered in their current routes, the west-to-east pipelines (e.g., HAG: Hungaria – Austria - Gasleitung) are less congested which decreases the utilisation and the welfare gains attributed to the SI - HU project.
    - If the Nord Stream 2 is built, there is a risk of the LTCs to be prolonged after their expiry, which would result in fewer opportunities for short-term trading which could affect the SI - HU project, negatively.
    - If the Trans Adriatic Pipeline (TAP) is not built, fewer sources would be available to be brought to the region from the Italian market, which could decrease the utilisation and the welfare effect of the SI - HU project.
    - The project utilisation is not sensitive to other infrastructure developments in the region.

[8] EU Reference Scenario 2016 Energy, Transport and GHG Emissions Trends to 2050, the Directorate-General for Energy, the Directorate-General for Climate Action, and the Directorate-General for Mobility and Transport.