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Environmental and geological impact assessment within a project of the North-South Gas Interconnections in Central Eastern Europe

Lukáš Karch¹, Erika Škvareková² and Artur Kawicki³

Security, environmental, technical, and economic factors form a basis for selection of routes for new high-pressure gas pipelines. Environmental protection and protection of inhabitants shall be factored in when designing a new gas pipeline route. In the European Union, the final gas pipeline route is determined based on the environmental impact assessment process (EIA). In general, when designing a gas pipeline route, it is necessary to consider especially the following factors: minimization of the gas pipeline length, minimization of interventions into the protected areas of national and European networks (for example, NATURA 2000), avoiding of urban areas of villages and cities, areas featuring high levels of groundwater, rocky and land sliding areas, protected deposit areas, mining and survey areas, protection zones of water sources, flood areas, and areas with possible presence of historical ammunition discoveries. A proposed route leading across the areas exposed to the risk of landslides and across mining areas shall be resolved already in the Intention that represents the first step within the EIA process, and it shall also be discussed with mining authorities and operators of protected deposit areas, mining areas, and survey areas. The final version of the gas pipeline defined in the Final EIA Opinion shall be implemented into the zoning and development plans of higher territorial units, cities, and villages. The Final EIA Opinion is binding for further legal approval proceedings concerning the pipeline project.

Key words: transmission pipeline, natural gas, EU regulations, PCI, EIA, SEA

Introduction

The Poland-Slovakia interconnecting gas pipeline is a pilot project in Slovakia within which Regulation (EU) of the European Parliament and the Council no. 347/2013 on guidelines for trans-European energy infrastructure is applied. The Regulation (2013) sets out a framework for identification, planning, and implementation of projects of common interest (hereinafter referred to as “PCI”) necessary for implementation of 9 strategic priority corridors of energy infrastructure in the area of power, gas, and oil for the entire European Union (hereinafter referred to as the “EU”).

In Annex VII to Regulation (2013), the gas pipeline interconnection between Poland and Slovakia is included in Cluster 6.2 - Interconnection between Poland, Slovakia, Czech Republic and Hungary with the related internal reinforcements, including the PCI: 6.2.1 Poland – Slovakia interconnection.

In Central Europe, the natural gas transmission has been historically realised from the east to the west, (Škuta et al., 2017). Therefore, priorities of the EU include development of the North-South gas corridor that will enable transmission of natural gas from the Baltic Sea from the liquid natural gas terminal (hereinafter referred to as the “LNG Terminal”) at Świnoujście, Poland, to the countries of Central and Eastern Europe as well as from the Adriatic Sea where an LNG terminal is planned at the Island of Krk, Croatia. The Regulation (2013) establishes the common interest procedure for PCIs while imposing a special responsibility to only one national competent authority in each Member State of the EU for coordination of the process of granting permits for PCIs and supervision over the process (Article 8) of the Regulation (2013), determines the minimum transparency and public engagement standards and the maximum admissible period of time for the legal permit granting procedure, (Ministry of Economy of the SR, 2013).

Poland – Slovakia interconnecting gas pipeline will enhance the energy security in both countries and form a basis for the establishment of the North-South gas corridor that represents one of the priority corridors within the EU’s energy policy entitled “Priority Corridor North-South Interconnections of Gas Pipelines in Central-Eastern and South-Eastern Europe”. This corridor will allow bidirectional flows of natural gas among Poland, Czech Republic, Slovakia, and Hungary and interconnection with LNG terminals in Poland and Croatia, (Central European University Press, 2000).

The Poland – Slovakia interconnecting gas pipeline is included in the 3rd PCI List of 2017, which enables the project to benefit from the financial support of the Connecting Europe Facility (CEF) funding instrument. Poland – Slovakia interconnecting gas pipeline will contribute mainly to:

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- / Natural gas resource diversification and reduction of the level of dependence on the supply of natural gas from the Russian Federation;
- / Improvement of technical reliability of the natural gas supply to customers through diversification of natural gas import routes;
- / Possibilities for construction and connection of new underground gas storages in the region and enhancement of natural gas availability within that region;
- / Utilization of the available capacity of the Slovak transmission system (implementation of new transit corridors in Europe may cause a reduction in the use of the Slovak transmission system and lead to the creation of new redundant capacities);
- / Support for the process of integration of gas markets within the EU territory through the creation of the EU common natural gas market;
- / Development of opportunities for access to the natural gas from the LNG terminal at Świnoujście, Poland, in connection with other projects such as the Slovak – Hungarian interconnector and the planned gas pipeline project “Eastring” (Regulation EU, 2013).

In addition to the Final Opinion under the Act no. 24/2006 on environmental impacts assessment, the major supporting documents within designing of the route in the Slovak territory are Slovak technical standard STN EN 1594: Gas infrastructure – Gas pipelines with the maximum operating pressure over 16 bar: 2014 Operating Requirements, Technical rule for gas TPP 702 10: High-pressure gas pipelines and connections issued in 2017, and Act no. 251/2012 on the energy industry and amendments and supplements to certain other acts, (Act, 2006; Slovak technical standard, 2014; Slovak Chamber of Commerce and Industry, 2017; Act, 2012; Ministry of Environment of the SR, 2016).

In Poland, the environmental impact assessment process is set out in Act no. 199 of 3 October 2008 on environmental information provision, environmental protection, and participation of the public in environmental protection and environmental impact assessment. The main supporting document serving to design the route in Poland is Decree no. 1055 of the Ministry of Economy of 30th July 2001 on the technical requirements applicable to gas networks. Another important document is the technical standard concerning designing of high-pressure gas pipelines of the GAZ-SYSTEM S.A. company - ST-G-002: 2008 Gas pipelines crossing terrain barriers (Act, 2008; Regulation, 2001; Technical standard ST-G-002, 2008; Wołoszyn, 2004).

Moreover, thanks to the classification of the projects aimed at natural gas supply security enhancement and development of the national natural gas market as national priorities, the Act no. 84 of 24th April 2009 on investments into the regasification terminal for liquified natural gas at Świnoujście, from now on referred to as the “Special Purpose Act”, was adopted in Poland. The Special Purpose Act is to increase the energy security of Poland and support the EU’s objective to create a common natural gas market. The reasoning stated in the Special Purpose Act specifies the following key tasks for the natural gas sector:

- [1] diversification of natural gas supply resources via:
 - o construction of a terminal for receiving of liquified natural gas at the Polish shore, o
 - o a direct pipe interconnection to Scandinavian natural gas sources (Norway),
- [2] enhancement and interconnection of the transmission system (with neighbouring countries),
- [3] the increase of the capacity of operated underground natural gas storages, (Act, 2009; Végsovová et al., 2017).

Materials and methods

Methodology for assessment of a selection of international gas pipeline routes

The impact assessment is stipulated by Convention of the United Nations Economic Commission for Europe on Environmental Impact Assessment in a Transboundary Context adopted on 25th February 1992 in Espoo, Finland (from now on referred to as the “ESPOO Convention”). The ESPOO Convention determined that signatory countries shall implement procedures for assessment of impacts in a transboundary context into their legal regulations. This Convention represented one of the major reasons for commencement in 1991 of the work on preparation of the Act (Act, 2006; Karimi et al., 2014). The Convention became valid on 10th September 1997. The purpose of the Convention is to implement the environmental impact assessment principle into national legislation of individual countries and to enable other countries to step, in a precisely defined manner, in the preparation of activities carried out outside their territories, which may have an unwanted impact on their environment, (E/ECE/1250, 1991).

The mandatory assessment of transboundary impacts is focused on the activities proposed within the territory of the Slovak Republic and specified in Annex no. 13 and the proposed activities specified in Annex no. 8 of the Act (2006) that may have a serious environmental impact beyond the state borders of the Slovak Republic. The subject-matter of the environmental impact assessment in a transboundary context will include the

country of origin, i.e. the country within the territory of which the relevant strategic document is drafted, and the relevant activity is planned (the Slovak Republic in our case) and the party concerned, i.e. the country that may be affected by a significantly adverse impact of the drafted document and planned activity (the Republic of Poland in our case). Where both countries propose a joint planned activity (an interconnecting gas pipeline in our case), the assessment of transboundary impacts is carried out usually once upon the request of the country that notifies its planned activity first (Zvijáková et al., 2014; Blišťan, Pačaiová, 2011).

The initial considerations about the construction of a transit gas pipeline between Poland and Slovakia date back to the year 2000 when a feasibility study was drawn up for the “Belarus – Poland – Slovakia Interconnecting Transit Gas Pipeline”. The purpose of the study was to check the possibilities for the construction of a gas pipeline with a connection to the JAMAL gas system, measuring and delivering station, and a connection to the existing network of transit gas pipelines at the Veľké Kapušany Compressor Station (from now on referred to as “CS”) (Raclavský, 2008). The study was drawn up with the participation of representatives of Russian GAZPROM, and it was primarily intended to check the possibility for and profitability of natural gas transmission via a transit gas pipeline connecting transit corridors - Belarus (Kobrin) – Poland – Slovakia (Veľké Kapušany, CS).

The study suggested two border crossing points for the transit gas pipeline and those two alternatives were discussed by both parties. Both suggestions were based on the configuration of the protected zone of the “Carpathians” mountain range within the Polish territory so that the route of the transit gas pipeline avoids the areas declared as protected. The first state border crossing alternative concerned the area around the village of Lupków in Poland, which overlaps with the cadastral area of the village of Palota in Slovakia. The second state border crossing alternative was determined in the north-west from the city of Bardejov, in the cadastral area of the village of Tylicz, Poland, and the cadastral area of the village of Kurov, Slovakia.

The connection to the existing transit network in Slovakia was recommended in the Veľké Kapušany CS or the Jabložov nad Turňou CS. The state border crossing across the cadastral area of the village of Čertižné supported by representatives of Slovenský plynárenský priemysel (from now on referred to as “SPP”) was rejected by Polish representatives. The connection of the new transit gas pipeline to the existing transit network within the territory of Slovakia at the Jabložov nad Turňou CS was rejected by SPP due to significant investments made by SPP into the Veľké Kapušany CS and the line section of the gas pipelines between the Veľké Kapušany CS and the Jabložov nad Turňou CS in the 90's (Feasibility study, 2000).

This project had not been implemented due to the disagreement on the Polish side. In 2011, the European Committee emphasised the need to modernise and extend the energy infrastructure in Europe and to interconnect networks across boundaries in order to enhance the solidarity among the Member States, to create opportunities for alternative supply or transit routes and energy sources, and to develop renewable energy sources in competition with traditional sources. It was agreed that after 2015 no Member State should be isolated from European gas and power networks or deem its energy security to be exposed to the threat of a lack of relevant connections.

The importance of Poland – Slovakia interconnecting gas pipeline was confirmed on 22nd November 2013 when Governments of the Slovak Republic and the Republic of Poland signed the Cooperation Agreement concerning the construction of a gas pipeline connecting the Polish transmission network and the Slovak transmission network. The Agreement follows the provisions of the Plan for development of the V4 regional gas market adopted on 16th June 2013 by Prime Ministers of the Visegrad Group countries and in that Agreement, contracting parties undertake to support implementation of the Project and specify the mechanisms of cooperation among the contracting parties within the preparation and implementation of a project involving construction of a gas pipeline connecting transmission networks of Slovak Republic and Republic of Poland by strategic investors (transmission system operators eustream, a.s. and GAZ-SYSTEM S.A.) and the mechanisms for supervision over the preparation and implementation of the project, (Notice, 2014).

Comprehensive assessment of expected impacts of gas pipeline construction

The final route of the gas pipeline in both countries was determined based on environmental impact assessment processes under the Act (2006). The purpose of environmental impact assessment is to prevent negative consequences of various human activities on the environment and health. It is carried out via comprehensive and expert assessments of expected impacts of strategic documents during their preparation and before their approval and assessment of proposed activities on the environment before any decision on the place of their execution or before granting permit to such activities under special regulations, (Jachim and Kalisz, 2010; Erickson and Lazarus, 2014). The assessment results in a selection of an optimum alternative and draft measures to eliminate or mitigate negative impacts of strategic documents and assessed activities on human health and the environment. The scheme of steps within the process of assessment of impacts of the proposed activities within the EU is shown in Figure 1.

CA – competent authority (Ministry of Environment), DA – departmental authority (Ministry of Economy), PA – Permitting Authority, AC – Authority concerned, IE – Implementing entity (Eustream, GAZ-SYSTEM), PCP – Professionally competent person

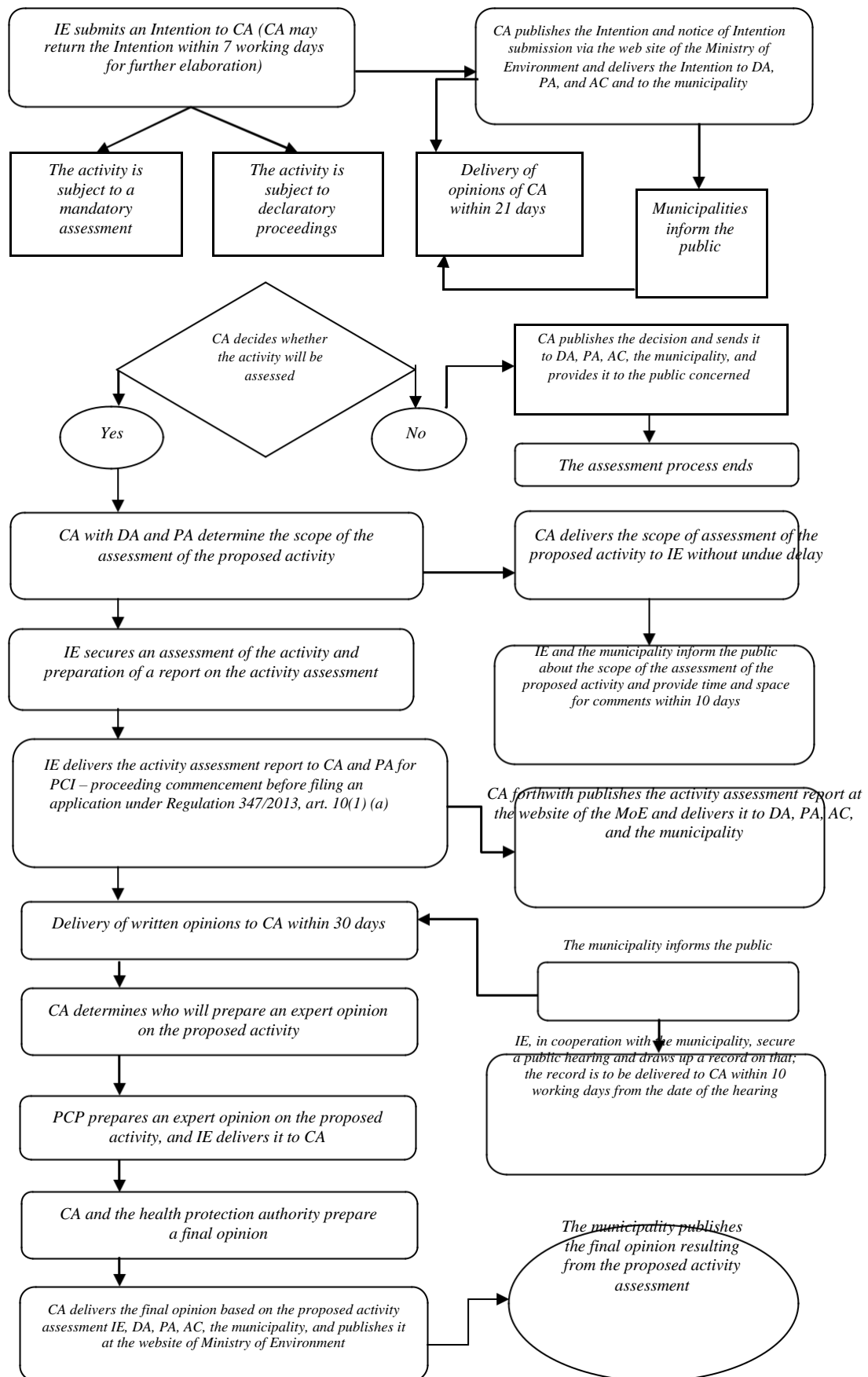


Fig. 1. Scheme of EIA process steps (Ministry of Economy of the SR, 2013).

Case study

Gas pipeline route alternatives

The proposal concerning possible routes of the gas pipeline is based on the common feasibility study of the Poland – Slovakia interconnection drawn up in 2013. The study considered three alternative routes (one in the west of Slovakia, and two in the east of Slovakia):

- 1 The alternative – a western route alternative featured the gas pipeline route leading from the existing Komorowice pipeline node in Poland across the state border in the Skalité/Zwardoń area and connecting of the gas pipeline to the Slovak transmission system at the Ivanka pri Nitre CS.
- 2 The alternative – an eastern route alternative featured the gas pipeline route leading from the existing Strachocina pipeline node, crossing of the state border in the area of Dukelský priesmyk, and connection of the gas pipeline to the Slovak transmission system near Košice.
- 3 The alternative – an eastern route alternative featured the gas pipeline route leading from the existing Strachocina pipeline node, crossing the state border in the area of Lupkov Pass, and connection of the gas pipeline to the Slovak transmission system at the Veľké Kapušany CS, figure 2 (Feasibility study, 2013).

The feasibility study recommended the 3. The alternative – the easternmost route for further development and environmental assessment because it was the most acceptable alternative as concerns the environment. The gas pipeline route is to start at the existing Strachocina pipeline node with an underground natural gas storage, then it is to continue and cross the state border via Lupkov Pass and end within the premises of the existing Veľké Kapušany CS which is the largest compressor station in the EU thanks to its total power capacity of 283 MW and is situated in Eastern Slovakia close to the borders with Ukraine. (Feasibility study, 2010; Feasibility study, 2013; EIA Documentation, 2015).

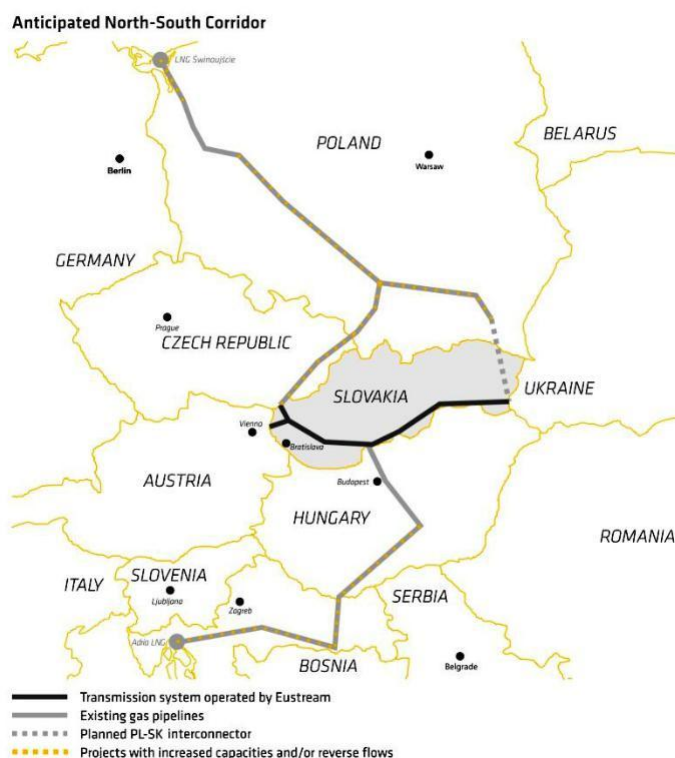


Fig. 2. North-South gas corridor (Karch and Olej, 2016)

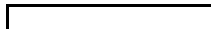




The summary assessment of anticipated impacts in terms of their importance and periods of existence within construction and operation phase is evaluated in Table 1. The proposed gas pipeline route crosses several elements of the territory ecological stability system, multiregional and regional bio corridors, multiregional and regional bio centres, and hydric bio corridors of regional importance. The limit values marked with colours (red and violet) may be deemed to be extreme and of extraordinary importance. Criteria have been assigned with relative values representing the level of influence as compared with extreme values. Where possible, the

difference as compared with the current situation or zero alternatives was factored in within the assessment of individual criteria (ENVICONSULT s.r.o., 2015).

Tab. 1. Assessment of anticipated impacts of gas pipeline construction (ENVICONSULT s.r.o., 2015).

CONSTRUCTION				OPERATION	
Impact significance					
Environment element	Impact type	negative	Positive	negative	positive
Air	Emissions – mobile sources				
	Dust pollutants				
Groundwater	Intervention in source protection zones				
	Source polluting				
	Intervention into mineral water protection zones				
Surface water	Pollution				
	Barrier effect				
Rock	Geo-dynamic phenomena				
	Pollution				
Relief	Modification of relief				
Soil	Permanent occupation				
	Temporary occupation				
	Pollution				
Biota	Intervention in the Natura territory				
	Intervention in protected areas of the national network				
	Impact on fauna – birds, aquatic life				
	Cutting off trees and bushes				
Infrastructure	Transport				
	Cultural and historical values				
Inhabitants	Impacts on health				
	Operational risks				
	Social and economic activities				
	Other impacts – noise				

Negative impacts:

	- Insignificant impact, no impact
	- Impact of little significance
	- Impact of medium significance
	- Significant impact
	- Very significant impact

Positive impacts:

	- Insignificant impact
	- Impact of little significance
	- Significant impact

The above-specified assessment shows that the period of construction of the gas pipeline will be accompanied by significant impacts on the environment due to temporary occupation of land, cutting of trees and bushes, and influences on protected areas. Commissioning of the gas pipeline will mean that the relevant environment will be rendered to its original condition to a substantial extent and except for the route leading across forest lands, it will represent only minor restrictions within the territory. The adverse impacts of construction and operation are not of a character and importance that may represent a barrier to construction of the gas pipeline. Emergency situations may have a more important effect, but such events will be subject to a system of preventive measures and emergency plans.

All impacts of the planned activity have been assessed in connection with valid legal regulations. Key regulations included the laws and decrees dealing with air protection, water protection, nature protection, waste management, health protection, agricultural land fund protection, protection of monuments, and zoning.

Direct and indirect impacts on the NATURA 2000 network

During construction of the gas pipeline, both direct and indirect impacts on the territory falling under the NATURA 2000 network could occur. The following Table 2 shows assessment of the importance of their effects and assessment as per individual alternatives (ENVICONSULT s.r.o., 2015).

Tab. 2. Assessment of the construction impacts on the NATURA 2000 network (ENVICONSULT 2015).

NATURA 2000 territory	Assessment of the importance of impacts within individual alternatives					
	1	1A	2	2A	3	3A
Number of NATURA 2000 areas with a significant negative impact of the Intention (-2)	0	0	1	1	2	0
Number of NATURA 2000 areas with a slightly significant negative impact of the Intention (-1)	8	8	6	6	6	8
Number of NATURA 2000 areas with the zero impact of the Intention (0)	19	19	20	20	19	19
Scatter	0.217	0.217	0.293	0.293	0.396	0.217
Standard variation	0.465	0.465	0.542	0.542	0.629	0.465

The following areas belonging to the NATURA 2000 network will be directly affected by construction and operation of the gas pipeline as concerns all assessed alternatives: SKCHVU011 Laborecká vrchovina (highlands), SKCHVU035 Vihorlatské vrchy (hills), SKUEV0387 Beskyd, SKUEV0763 Upper section of the Výrava river, SKUEV0049 Alluvial area of the river, SKUEV0386 Hostovické lúky (meadows), SKUEV0209 Morské oko (lake), SKUEV0205 Hubková, SKUEV0005 Drieňová, SKUEV0206 Humenská, SKUEV0050 Humenský Sokol, SKUEV0250 Krivoštica, SKUEV0235 Stretavka. Other territories are outside the areas of direct or indirect impacts (ENVICONSULT s.r.o., 2015).

Impacts of construction of the gas pipeline on the geological environment

The impact of the project on the geological environment is specific due to the character of the project, i.e. it is a line project. The route length exceeding 100 km within all alternatives results in the presumption of a heterogeneous environment as concerns both the rock environment and relief.

The final alternative 1A (Table 4) leading from the state border up to km 50 crosses the territory consisting of flyschoid rock. The territory features landslides, slope deformations and areas prone to landslides. Within the pre-project preparation phase – during the engineering and geological survey, it is necessary to specify the active, potential, and stabilised landslides. The gas pipeline construction requires specifically execution of cuts and crossing of steep slopes; creation of a working lane disrupts the stability of the territory and any unsuitable intervention into the territory may activate landslides. Land reclamation of landslides is demanding both technically and economically, and it may pose a threat to the local infrastructure and the gas pipeline itself.

In connection with the construction of the gas pipeline within the zone featuring active landslides of slope deformations, it would be appropriate to install, at a relevant point, a tensometric monitoring system with remote data transmission that would carry out long-term tensometric measurements in order to determine additional tensions within the pipeline body caused especially by a change in the load, effects of both dry and wet soil, any possible slope deformations, possible changes in the marginal conditions along the route of the pipeline within the area concerned, and pipe temperature changes. Based on long-term tensometric measurements, a plan for slope rehabilitation may be prepared (ILF Beratende Ingenieure GmbH, 2016; Hongfang et al., 2015; CEEP, 2015).

Based on the data obtained from the slope deformation map (available online at <http://apl.geology.sk/geofond/zosuvy/>), active landslides are situated within the sections specified in Table 3.

Tab. 3. Active slope deformation landslides (ILF Beratende Ingenieure GmbH, 2016).

Alternative	Stationing at km	Length in m	Impact extent
1A	31.400 – 31.600	200	The direct crossing of an active landslide in the vicinity of village Lubiša

According to the register of protected deposit areas and mining areas kept by the Košice District Mining Authority, within the 1A alternative, no contact with either protected deposit areas (from now on referred to as “PDA”) or mining areas (from now on referred to as “MA”) occurs (ENVICONSULT s.r.o., 2015).

Engineering and geological survey for gas pipeline construction purposes

Within the engineering and geological survey, a final summary and assessment of engineering and geological surveying works executed along the proposed route of Poland – Slovakia interconnecting gas pipeline from the border crossing point to the premises of the Veľké Kapušany CS and the sites of planned situation of block valve stations (from now on referred to as “BVS”) and the metering station in Výrava (from now on referred to as the “MS”), (ILF Beratende Ingenieure GmbH, 2016).

The following was subject to a determination within the engineering and geological survey:

- α engineering and geological and hydro-geological situation along the pipeline route;
- β geo-dynamic processes within the pipeline route and its close vicinity;
- χ engineering and geological and hydro-geological situations at points of individual overpressures, flow transits and BVS;
- δ the situation within the MS Výrava premises;
- ε climatic conditions and seismicity within the territory;
- ϕ groundwater aggression as concerns concrete and steel structures;
- γ soil classification at the site under valid standards;
- η determination of soil and rock workability along the gas pipeline route and within technological objects;
- ι preparation of a map with engineering-geological regions.

According to the well-arranged engineering-geological map, the surveyed area belongs to the Carpathian flysch region, the area of flysch mountain ranges – Ondavská vrchovina, the region of neogenic vulcanites, the area of volcanic rock – Vihorlat, and the region of neogenic tectonic sinks, the area of inner Carpathian lowlands – Východoslovenská nížina.

The following regions are determined in the map of engineering-geological regions:

Regions where the rock of the pre-Quaternary base reaches the surface of the territory or where covering Quaternary formations are not thicker than 2 m:

- A Sf i- flysch rock region with a major content of claystone;
- B Sfip – flysch rock region with the claystone-sandstone ratio approx. 1:1;
- X Stp – flysch rock region with a major content of sandstone;
- Δ Ni – fine-grain sediments region.

Regions where covering Quaternary formations, the thickness of which exceeds 2 m, reach the surface:

- E Fh - region with mountain stream deposits D – deluvial deposits region;
- Φ P – region with proluvial cones and deposits Ft- region of Pleistocene river terraces Fn- region with lowland stream deposits;
- Γ Fs – region with crescentic lakes Es – region of Eolic loess;
- H Ao – region with waste dumps (without distinction).

Soil samples from 163 monitoring bores, 8 out of that from the MS Výrava premises, were tested in an accredited laboratory that examined the grain size analysis, humidity – A method, plasticity limit, liquid limit – Casagrande method. Soils from the surveyed territory are of the 2nd to 4th workability class classified under standard STN 73 3050.

The section of the final 1A alternative from the state border up to km 50 is significantly affected by slope defects that have been plotted in the map of engineering-geological regions based on studying of archived materials and terrain mapping. Within excavations, increased attention is to be paid to possible slope movements. Construction works should be carried out in dry periods and as per smaller sections where possible in order to not leave trenches open for a long time.

The section of the final 1A alternative from km 50 to the Veľké Kapušany CS is sporadically affected by slope defects that have been plotted in the map of engineering-geological regions based on studying of archived materials and terrain mapping. Construction works should be carried out in dry periods and as per smaller sections where possible in order to not leave trenches open for a long time, (ILF Beratende Ingenieure GmbH, 2016).

Results and Discussion

Selection of the gas pipeline route within the territory of Slovakia

The activities related to the environmental impact assessment have been carried out under the supervision of the Ministry of Environment of the SR (from now on referred to as “MoE SR”) since the MoE SR is the competent state administration body under Sec. 1 and Sec. 2 of Act no. 525/2003 that regulates state administration in the area of environmental care and amends and supplements some other acts, as amended by subsequent regulations, as well as the competent authority under Sec. 3 (k) of the Act (2006). An important change, when compared with the past, is based on the fact that according to an adopted amendment to the Act (2006), results of the environmental impact assessment are binding upon the investor in the project. The route corridor under the Final Opinion (Ministry of Environment of SR 2016) is, under the Act no. 314/2014 that amends and complements the Act (2006) is binding for further approval proceedings since 1st January 2015 in the Slovak Republic. An important change and obligation for the project investor is the obligation to execute at

least one public hearing before the commencement of the environmental impact assessment process in compliance with the Regulation (2013) in order to inform the public about the project Intention.

According to Annex no. 13 to the Act (2006), gas pipelines with large-diameter pipes are subject to a compulsory assessment as to their impacts on the environment in a transboundary context. The Ministry of Environment of the SR has notified under the Espoo Convention its Polish counterpart who determined the requirements applicable to the transboundary environmental impact assessment in the opinions sent by the General Directorate of Environmental Protection and the Regional Environmental Protection Directorate in Rzeszow of February 2015. The main requirement concerned an alternative location for border crossing to avoid or mitigate expected barrier effect on wildlife. Therefore, three alternative state border crossing points in Lupkov Pass have been defined altogether. Alternative border crossing points have been proposed by the State Nature Protection Authority of the SR (from now on referred to as the “SNPASR”) and the Polish operator of the transmission network - GAZ-SYSTEM S.A. company cooperating with experts from Regional Environmental Protection Directorate in Rzeszow. Furthermore, a request for assessment of impacts on the nature protection interests within the Polish border area has been presented.

The international assessment of impacts on the NATURA 2000 network in respect of Poland – Slovakia interconnecting gas pipeline was carried out in compliance with Articles 6.3 and 6.4 of Directive of the Council No. 92/43/EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora. The length of the route leading across forest lands was taken into account in respect of the NATURA 2000 territory. As concerns individual alternatives on both the Slovak side and the Polish side, it is not possible to compare them mutually based on species because on the Slovak side, there are forest habitats and more homogenous environment (fir-beech forests), and therefore the species bound with wetlands (*Dactylorhiza majalis*) and open areas (butterflies) are not present there. This does not mean a lower quality of habitats. Within the assessment, the species diversity of individual habitats and biodiversity of terrestrial vertebrates, not only important species in European terms (Ministry of Environment of the SR, 2006), have been factored in. In addition, it occurs that the species protected by national law within the territory of Poland can be found in Slovakia too, but they do not belong to the species under protection of Slovak law.

In December 2015, one of those three alternatives was selected – the common southern border crossing point – C (proposal by SNCASR) based on an agreement with companies Eustream, a.s. (from now on referred to as “Eustream”), and GAZ-SYSTEM S.A. (from now on referred to as “GAZ-SYSTEM”), which meets the requirements of environmental protection authorities both in Poland and in Slovakia. The southern state border crossing point was proposed and preferred by SNCASR given the Protected Country Area of Eastern Carpathians where the territory concerned is situated. Point C that is approximately 1 km southwards from the railway tunnel connecting Medzilaborce and Nowy Łupków was, during an on-site inspection executed by both companies, precisely surveyed and marked and its coordinates will be a part of the Connection Agreement between both transmission system operators (from now on referred to as “TSO”).

The proposed gas pipeline route was primarily based on the shortest connecting line between the point at the state border crossing with Poland and the Veľké Kapušany CS. The proposed route was supposed to secure minimum interventions in the areas sensitive in terms of protected areas of all categories. Within the statutory EIA process that such a gas pipeline is subject to, 6 alternatives were suggested in total (3 original alternatives 1, 2, and 3 from the Intention and 3 newly suggested alternatives 1A, 2A, and 3A that are based on the original alternatives assessed within the Intention, but due to their extent, they were deemed to be independent and equal) (Karch and Olej, 2016).

Based on the result of the environmental impact assessment process under the provisions of the Act (2006), the Ministry of Environment of the Slovak Republic recommended execution of the proposed project “Poland – Slovakia interconnecting gas pipeline” after achieving compliance with the requirements and implementation of the measures specified in the recommended requirements applicable to the phase of construction and operation of the proposed activity and upon execution of a post-project analysis through biota monitoring to the required extent. The uncertainties that occurred during the process of environmental impact assessment and presented requirements were to be solved within further approval process (zoning and building proceedings) under special regulations, (Karch and Olej, 2016).

Based on the prepared Expert Opinion (Badík, 2015) and established facts and consultations with the author and proposer of the Assessment report, an on-site inspection of the territory concerned, comments contained in opinions, public hearings, and negotiations of the project investor with the municipalities and organizations concerned, the adjusted final alternative 1A specified in Table 4 was recommended (ENVICONSULT s.r.o., 2015).

Taking this into account, implementing results of the Espoo consultation with Polish authorities, Ministry of the Environment of the SR granted the Final Opinion (Ministry of Environment of the SR, 2016) on implementation of the proposed activity, and recommended the point C for connection to the Polish side, with the route’s continuation from point C along the 1A alternative until the end of the section at the Veľké Kapušany CS; at the village of Lackovce, the 1A alternative is to be diverted more southwards. Under the recommended

condition no. 10 contained in the Final Opinion, it was necessary to discuss the final route with 4 municipalities that expressed their disagreement within the environmental impact assessment process. After three-party discussions among the village of Pozdišovce, the city of Michalovce and the Eustream company, the final 1A alternative was amended as concerns the cadastral area of Šamudovce so that the gas pipeline route leads along the western side of the village within that cadastral area. Due to this route change, the final alternative does not lead across the cadastral area of the Krásnovce village, but instead, it leads across the cadastral area of the Vrbnica village. In addition to that, the final alternative crosses the Bánovce nad Bebravou mining area with the consent granted by the NAFTA, a.s. Company and the Košice Regional Mining Authority.

Tab. 4. Villages affected by the gas pipeline route within the territory of Slovakia (Ministry of Environment of the SR, 2016).

Alternative	Region	District	Municipality
Alternative 1A	Košice	Michalovce	Oreské, Staré, Zbudza, Nacina Ves, Petrovce n/Laborcom, Michalovce (Topoľany), Suché, Michalovce (Močarany), Pozdišovce, Šamudovce, Vrbnica (formerly Krásnovce), Lastomír, Žbince, Sliepkovec, Budkovec, Drahňov, Vojany, Čičarovce, Krišovská Liesková, Veľké Kapušany
		Medzilaborce	Palota, Výrava, Čabalovce (only a high-voltage electricity connection), Svetlice, Zbojné
	Prešov	Humenné	Rokytov pri Humennom, Jablňoň, Koškovce, Hankovce, Lubiša, Veľopolie, Udavské, Kochanovce, Lackovce, Hažín n/Cirochou, Ptičie, Chlmec

Gas pipeline technological solution

Based on agreements of transmission system operators in both countries, the following specifications have been determined for the Poland-Slovakia interconnecting gas pipeline:

1. Route starts at the Veľké Kapušany CS
2. State border crossing point – the cadastral area of the Palota village (Lupkov Pass)
3. The route ends at the Strachocina CS, Poland
4. The route length max. 164 km (Poland - 58 km and Slovakia - 106 km),
5. Nominal pipe diameter DN 1000
6. Maximum operating pressure 7.35 MPa from Veľké Kapušany CS to MS Výrava and 8.4 MPa from MS Výrava to Strachocina CS
7. Capacity in the direction from Slovakia to Poland 6.128 billion Nm³/year (at 101.325 kPa and 20 °C)
8. Capacity in the direction from Poland to Slovakia 5.052 billion Nm³/year (at 101.325 kPa and 20 °C), (Ministry of Environment of the SR, 2016)

An optical fibre cable (from now on referred to as “OFC”) will be laid along the route for the gas pipeline control system and the transfer of data to support systems. The proposed gas pipeline control system collects data from the gas pipeline route for the existing technical dispatching centre in Nitra. Remote monitoring and control of the MS Výrava and BVS is considered.

The distances between BVSs are approximately 25 km. The number and situation of BVSs have been proposed based on hydraulic calculations and simulations carried out to find an optimum solution to the line section of the gas pipeline as concerns the speed and pressure relations and in connection with the bi-directional natural gas transmission and possibilities for land purchases.

The major technological objects within the Poland-Slovakia interconnecting gas pipeline are:

- **Metering Station (MS)** that will allow bidirectional automated measurement of quality and amount of the natural gas transported via the Poland – Slovakia gas pipeline. The natural gas transit will be carried out in both directions, i.e. from Slovakia to Poland and from Poland to Slovakia. The MS will be situated in the Slovak Republic, in the vicinity of village Výrava.
- **Optical Fibre Cable (OFC)** will allow construction of a telecommunication optical fibre network serving to transfer control system data, to make phone calls among individual network nodes, and to transfer data from individual structures along the route of the Poland – Slovakia gas pipeline. The protective pipe with OFC will be laid in a separate trench along the entire length of the gas pipeline and situated approximately 4 m away from the pipeline axis on the west side.
- **Block Valve Stations (BVS)** will consist of ball valves DN 1000 with hydraulic-pneumatic drives, the total bypass DN 300, exhaust flues DN 300, emergency protective equipment, and the devices for remote control from the technical dispatching centre in Nitra. Gas pipeline sections between two BVSs will not be longer than 30 km. Connection points for a mobile compressor pump will be at disposal. BVSs will be located within the premises of villages Šamudovce, Chlmec and Hankovce.

- 1 **Cathodic Protection Stations** (from now on referred to as “CPS”) will provide active cathodic protection of the gas pipeline. At points where the gas pipeline will cross other buried metal lines, interconnecting objects will be built ensuring electric potential set-off between the lines. Close to CPSs impressed current anodes will be installed as buried rails. Construction of 3 CPSs along the gas pipeline route and 1 CPS at the Veľké Kapušany CS is designed. They will be situated within the premises of the BVS Šamudovce, BVS Hankovce, and the MS Výrava.
- 2 **Cleaning Chambers** (from now on referred to as “CC”) intended for cleaning of the gas pipeline and inspection of its technical conditions during operation. CCs will be bidirectional (so-called “pig receivers/launchers”) allowing insertion and pulling out of cleaning pistons or monitoring devices into and out of the gas pipeline. CCs will be situated within the MS Výrava (1 chamber on the pipeline in the direction to Poland and 1 chamber on the pipeline in the direction to the Veľké Kapušany CS) and within the Veľké Kapušany CS (1 chamber at the point of connection of the pipeline to the Veľké Kapušany CS), (Ministry of Environment of the SR, 2016; Act, 2012).

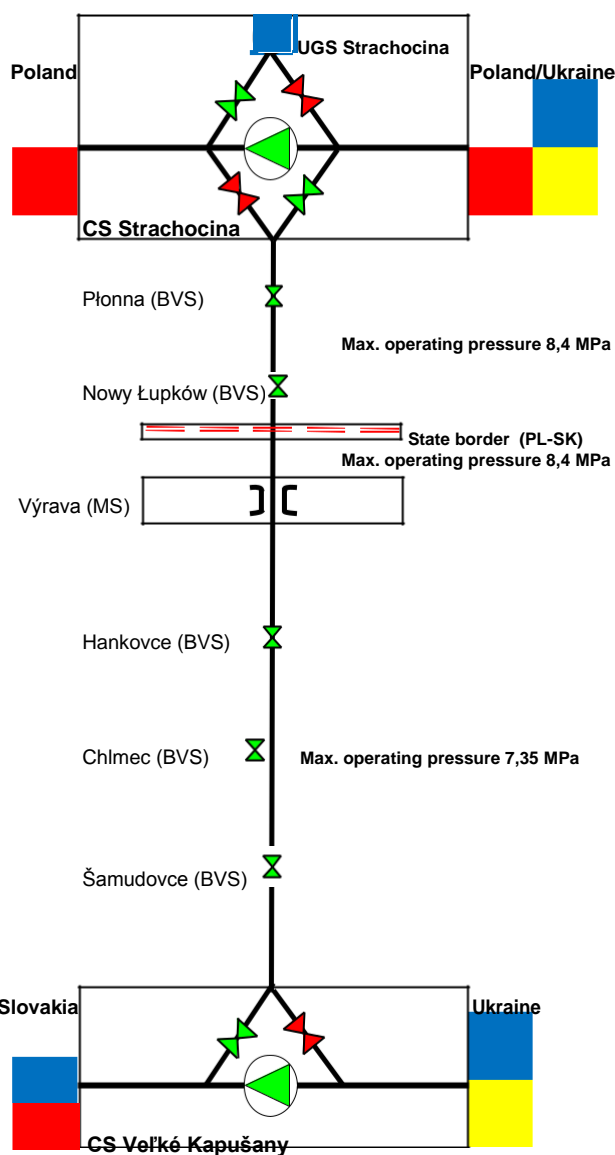


Fig. 3. Scheme of the Poland – Slovakia interconnecting gas pipeline

Conclusion

In Central Europe, the natural gas transmission has been historically realised from the east to the west. Therefore, priorities of the EU include development of the North-South gas corridor that will enable transmission of natural gas from the Baltic Sea, from the Polish liquid natural gas terminal at Świnoujście, to the countries of Central and Eastern Europe as well as from the Adriatic Sea where an LNG terminal is planned at the Island of Krk, Croatia.

The Slovak TSO Eustream received the Slovak Ministry of the Environment's Final Opinion on Poland - Slovakia interconnection gas pipeline project on 21st January 2016. The environmental impact assessment process was completed by Polish TSO GAZ-SYSTEM on 28th April 2017. The Final Opinion represents the final summary of the entire process of environmental impact assessment and is valid for 7 years from its issue, (Ministry of Environment of the SR, 2016). The results of the EIA of the proposed activity show that the recommended alternative of the proposed activity specified in the Final Opinion is acceptable after factoring in the relevant measures as concern overall (negative and positive) impacts on the environment. Provided that the proposed measures aimed at prevention, elimination, mitigation, and compensation of adverse environmental impacts of the proposed activity are accepted and implemented and based on a thorough post-project analysis, the implementation and operation of the proposed project may be considered to be environmentally acceptable.

The final alternative 1A involves the connection point C from which the route continues to the end point of the section at the Veľké Kapušany CS, Table 5. Near the village of Lackovce, it is necessary to divert the 1A alternative more eastwards, i.e. behind the existing shooting range area, while complying with 74 recommended conditions determined for the construction and operation of the proposed project. The 1A alternative is approximately 100 km long. More complicated preconditions for construction of the gas pipeline along its route are based on the vertical and horizontal relief of the land, terrain morphology, etc. within the territories of the district of Medzilaborce and Humenné and the northern part of the district of Michalovce (the area of Humenské mountain range and Krivošťianky). Východoslovenská rovina (flatland) offers seemingly simpler conditions. The relief of highlands, upland, foothill, and hilly areas of the "North" featuring erosion grooves (the Prešov region and the northern part of the Košice region) creates more demanding conditions for any line project route, including a gas pipeline; especially the valleys within the Laborec river network are to be made use of. In next project stages (zoning and building proceedings), the final gas pipeline routing will be defined within the 1A alternative corridor where the route might be diverted by up to 50 m on each side, (Ministry of Environment of the SR, 2016).

Based on the above experience, we suggest that national legal regulations (for example, Building Act, Act on Important Investments, Energy Act) explicitly define PCI projects under Annex VII of the Regulation (2013), which will be assigned the status of projects in national public interest. This would clearly define the "Priority Status" of PCIs, i.e. that all competent authorities shall ensure prompt settlement for project investors of documents in compliance with valid laws so that they are able to meet the deadlines under Article 10 of the Regulation (2013). We deem speeding up, and increased efficiency of approval proceedings for European energy projects in a transboundary context to be very important and the implementation of Regulation (2013) into the laws of the relevant Member State should contribute towards this objective.

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