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Cooperation of EU with Russia in the Field of Energy: A Review

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Abstract
Purpose of Review Natural gas is of immense importance in the energy relationship between the European Union (EU) and Russian Federation. Over the past half century, the Soviet Union initially and the Russian Federation since the early 90 s' have been vital suppliers of natural gas to the EU member states. Since 2000, the two parties' trade relations in the field of natural gas and other energy commodities trading can be characterized as turbulent. The purpose of this review study is to present the main aspects of the cooperation of the EU member states with Russia in the field of energy.
Recent Findings Aspects of the EU-Russia dialogue, as well as of the Roadmap for the Energy Cooperation between the EU and Russia, are also discussed. Through a literature review of some prominent studies on EU-Russia energy relations, the main challenges of the EU-Russia gas cooperation are identified.
Summary This study aspires to provide further insight to energy security aspects of the European Region.

Keywords Natural gas · Russia · EU · Pipelines · Energy security

Introduction

Energy security is a multidimensional concept including aspects such as security of supply, security of demand, affordability issues and revenues from energy, geopolitical considerations associated with security and defence policy, other political risk factors, economic risk factors and energy poverty, as well as technological and environmental risk factors. However, in most EU policy documents, the main energy security aspect discussed is security of supply [1]. Energy security is important for all countries and substantially more important for countries that are simultaneously exposed to multiple supply vulnerabilities. As such, EU countries present a distinct case study since ambitious GHGs reduction targets, 2008 financial crisis and the turbulent situation on EU peripheries challenge their capacity to strategically secure their energy supply [2•]. Reducing the quantities of imported energy and improving energy self-sufficiency are important measures for boosting energy security [3].

Over the past half century, the Soviet Union initially and the Russian Federation since the early 1990s have been vital suppliers of natural gas to the EU member states. While the gas quantities are not as large as the trade in crude oil products, the importance of this market for a significant number of EU member states in Central and Eastern Europe is greater, due to the high level of dependence on Russian gas. The significance of both parties in this market is equal: Russia is the main energy exporter to the EU, and the EU, with half a billion energy consumers in a unified internal market, is the main consumer of the Russian energy commodities. The importance of energy security subjects involves a move of EU-Russia energy relations from a plain supplier-consumer liaison to a further technology-based collaboration. Noteworthy mutual cooperation between the EU and the Russian Federation in the growth of a ground-breaking sector of the economy will be crucial in converting the European region into a reference for feasible development and stability.

To mitigate the risks related to energy production, both the EU and the Russian Federation showed an interest in multiple ways in recent years to strengthen their cooperation on safety issues. These initiatives include both the fields of exploration and production of hydrocarbons, as well as better cooperation on nuclear safety. The comprehensive cooperation of both parties in these fields will be of key importance for the economic development of the EU and the Russian Federation.

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Currently, the EU is going through a transition aiming towards a low-carbon energy system, with concrete targets for 2020. The Russian Federation is on the path of an innovative and efficient energy sector development, meeting the energy needs of its growing economy as well as the foreign economic interests of the country, with concrete targets for 2030 [4].

Theoretical Background

Russian Natural Gas Deliveries to Europe

The exploitation of natural gas in Europe started at the late 1950s. At that time, the Groningen natural gas deposit in the Netherlands was discovered, followed by the discovery of the deposits in the North Sea, which were exploited by both the UK and Norway. The latter, due to its small domestic consumption needs, proceeded in the early 1970s to the construction of natural gas pipelines to export natural gas to other continental European countries. The Soviet Union did not have active role in the gas market in Europe until the early 1970s. After the discovery of the large deposits at Medvezhe, Urengoy and Yamburg in the late 1960s, the Soviet Union proceeded with the construction of pipelines for the transport of the Siberian natural gas to Europe. This resulted in an increase of the Soviet imported gas to Europe from 3.4 billion cubic meters in the 1970s to 26 billion cubic meters in the 1980s and 63 billion cubic meters in the 1990s [5].

The EU's relations with the Russian Federation, in terms of natural gas trade, have gone through several stages in the recent years, in a context where the economic stakes are very high. While EU is trying to ensure the security of supply of fossil fuels, Russia is concerned over the long-term guarantee of gas demand, in order to be able to invest heavily to the expansion of its export capacity.

Since the start of the Russian gas export to Europe until the late 1990s, the relations were relatively smooth. During this period, the contractual relations, which were based on long-term contracts, led to stability in energy trade between the two parties. In the late 1990s, the decision of EU's natural gas industries to open up the competition [6, 7], together with the aspiration to establish a single gas market, led to an ongoing destabilization of the market relations between EU and Russia. Since 2000, the two parties' trade relations be characterized as turbulent. The decision by the Russian Federation to cut the natural gas supplies to Europe through Ukraine over a 20-day period in January 2009, and its withdrawal from the process to ratify the Energy Charter Treaty was the culmination of the tense relations. This incidence was also the starting point for the adoption of a series of policies on the European energy policy scene, aimed at reducing Europe's dependence on Russian gas.

Cross-border pipelines constitute physical-commercial ventures for moving natural gas that are subject to economies of scale and distance, long-life cycles, large upfront investment and natural monopolies. As a fixed infrastructure prone to market failure, the commercial value of a pipeline is directly affected by the dedicated upstream supply, price of throughput, availability of alternative supply options and form of state intervention. These unique, physical and fixed attributes of cross-border pipelines effectively "lock in" relationships of deep dependency among supplier-, transit- and customer-states that create opportunities for both rent extraction and extra-commercial bargaining leverage [8].

As of 2017, Russian natural gas was delivered to Europe through 12 pipelines [9]. Particularly Russia delivers natural gas

- Directly to Latvia, Estonia, Finland, Germany (through Nord Stream pipeline) and Turkey (a candidate EU member country, through Blue Stream pipeline)
- Through Belarus to Lithuania and Poland
- Through Ukraine to Romania and Slovakia

The gas transmitted through Belarus and Ukraine is then delivered to the vast majority of EU member states, with the exclusion of Spain, Portugal, the UK and Ireland, countries which have other sources of natural gas [10]. Cyprus and Malta are also excluded from this discussion, as they do not exploit natural gas in their energy mix.

The main Russian natural gas pipelines delivering natural gas to Europe include:

1. *Yamal-Europe*: The transnational Yamal-Europe gas pipeline runs across Russia, Belarus, Poland and Germany. The current overall length of the pipeline is over 2000 km. The pipeline has 14 compressor stations, of which three are in Russia, 5 in Belarus, 5 in Poland and 1 in Germany. Its design capacity is 32.9 billion cubic meters per year [11].
2. *Nord Stream*: Nord Stream is an export gas pipeline running from Russia to Europe across the Baltic Sea. The first line of the line was commissioned in 2011 and the second in 2012. The pipeline has a length of 1222 km, and it can discharge a maximum of 55 billion cubic meters per year [12].
3. *Trans-Siberian Pipeline*: The Urengoy-Pomary-Uzhgorod pipeline (also known as the Trans-Siberian Pipeline) is one of Russia's main natural gas export pipelines, partially operated by Ukraine. Commissioned in 1984, the pipeline has a length of 4500 km, carrying over 100 billion cubic meters per year. The pipeline delivers natural gas to Slovakia, the Czech Republic, Austria and Germany [13].

4. *Blue Stream:* The Blue Stream gas pipeline transits Russian natural gas to Turkey across the Black Sea. Commissioned in 2005, the pipeline has a length of 1213 km and a maximum discharge of 16 billion cubic metres per year [14].

The numbers published in the statistical pocket book of the EU, entitled Energy in Figures [15], shed light to the current gas dependence of the EU from the Russian Federation. The data contained in this pocketbook is drawn from the European Commission's services, from the European Environment Agency and the International Energy Agency. In year 2014, 30.4% of the crude oil, 37.5% of natural gas and 29% of solid fuels of the total energy imports of the EU were imported from the Russian Federation. In all three sources of energy, the Russian Federation is the main exporter to the EU.

More prominently, with regard to the EU's dependence on the Russian Federation in the field of energy, are the figures concerning the evolution of the exports in the three main energy resources, liquid, gaseous and solid, to the European Union over the past 25 years. While the dependence on the Russian Federation in the gas sector has always been high, in the liquid and solid fuel sector, dependence in the early 1990s was much smaller. The prevalence of the Russian Federation, however, in relation to the other exporting countries in the energy sector resulted to Russia now holding the first place in the export sector for all three forms of fuel.

EU-Russia Energy Dialogue

The EU-Russia Energy Dialogue, initiated in 2000, made an important contribution to the better understanding of the functioning of the respective energy markets in the EU and the Russian Federation. The energy dialogue was aimed to enable the resolution of difficulties faced by Russian companies in the internal energy market by establishing clear and predictable rules for companies operating in the single market. The Dialogue also intended to create a path for European companies seeking to enter Russian markets.

The main milestones of the EU Russia energy dialogue can be summarized as follows [16]:

- In 1994, the EU-Russia Agreement on Partnership and Cooperation was signed, establishing a legal framework for cooperation between the European Union and Russia. This agreement included a provision on political Dialogue and provided the legal basis for an Energy Dialogue. The agreement entered into force in 1997. All energy-related cooperation was discussed in the PCA Energy Sub-Committee on Energy, Environment and Nuclear Safety.
- In 2000, during the EU-Russia Summit in Paris, an agreement to initiate a regular Energy Dialogue with the aim of establishing an energy partnership between Russia and the European Union was achieved. Energy was chosen at the Paris EU-Russia Summit of 30 October 2000 as the component in bilateral relations with the most potential to lead the European subcontinent into deeper, mutually beneficial integration. From February to October 2001, the initial analytical phase of the dialogue occurred. During that period, work was carried out in four working groups of EU and Russian experts and representatives of industry, on analysing the areas of common interests in the following energy sectors: Energy Strategies and Balances, Infrastructure and Technologies, Investments and Energy Efficiency and Environment.
- In the EU-Russia summits from 2001 to 2005, a remarkable progress was achieved. In the 2001 EU-Russia Summit in Brussels, the short- and long-term guidelines for the EU-Russia Energy Dialogue were identified, in order to promote investment, increase energy security and boost commercial relations in the sector. In 2003, during the EU-Russia Summit in St. Petersburg, a political decision was taken to establish a format of Permanent Partnership Council to deal with all areas of cooperation. During the Summit of Moscow in 2005, a Road Map for the EU-Russia Common Economic Space was adopted, with a key objective the intensification of cooperation in the field of energy. Particular emphasis was put on addressing issues related to sustainability and continued reliability of the production, distribution, transportation and efficient use of energy.
- In 2007, the thematic groups agreed during the 2000 EU-Russia Summit were reorganized as follows:

  – A new Thematic Group on Energy Strategies, Scenarios and Forecasts
  – A Sub-Group on Energy Economics under Thematic Group I established
  – The Thematic Groups on Trade, Investments and Infrastructure merged into a single Thematic Group on Energy Market Developments
  – The mandate of the Thematic Group on Energy Efficiency prolonged

- In the 2008 EU-Russia Summit in Khanty-Mansiysk, negotiations for a new EU-Russia Agreement were launched, with the aim to replace the Partnership and Cooperation Agreement (PCA). In late 2009, an "Early Warning Mechanism" to ensure rapid communication and to prevent further supply interruptions in the field of gas, oil or electricity was agreed.

Roadmap EU-Russia Energy Cooperation until 2050

In February 2011, the European Commission and the Russian government agreed to establish a long-term perspective to their mutual energy relations, based on both parties' commitment to the long-term strategic EU-Russia energy cooperation, a perspective which is essential in cooperation on energy issues. The EU-Russia Energy Cooperation 2050 Roadmap [4], issued in 2013, introduced specific scenarios and their possible impact on EU-Russia energy relations, identifying the new potential for long-term cooperation. As a whole, the Roadmap was meant to serve as generalized terms of reference for the future of the EU-Russia Energy Dialogue. The continuous monitoring of the Roadmap progress would be regularly presented in the annual EU-Russia Energy Dialogue report. Necessary future revisions of the document are agreed to be timely performed, in compliance with the achieved advancements and results of the joint monitoring and refining of the integrated energy scenarios field. The Energy Collaboration Roadmap is expected to support the upgrading of the EU and the Russian economies.

The vision of the roadmap is that both the EU and Russia should be part of a common energy market by 2050. To enable the establishment of this market, the gradual approximation of rules, standards and markets in the field of energy will be required. This long-term target is expected to be achieved gradually, taking into consideration the development of the legal framework which will govern the relations between the two parties.

The roadmap sets specific recommendations and actions at given milestones.

- Before 2020, the roadmap places emphasis on three areas in the EU-Russia gas relations: in the mitigation of the infrastructure and regulatory risks, on the mitigation of the supply/demand risks and on specific gas infrastructure projects, continuing close and regular proactive exchanges on relevant domestic policy measures, including new developments in gas use and their development and promotion via favourable investment and regulatory regimes. Other aspects of the pro 2020 targets of the EU-Russia roadmap also include the consultations to provide short-term security of gas deliveries to the EU in the context of the Early Warning Mechanism, the cooperation on energy efficiency measures in the gas sector, the participation of Russian and EU gas sector companies' representatives in major summits, the development of joint training programmes for gas specialists and the communication to stakeholders and citizens about the positive results of the cooperation.
- Up to 2030, the roadmap targets the further development of technology and research cooperation in the areas of production and transportation, including unconventional natural gas sources and biogas. In this time frame, the roadmap examines gas scenarios on possible pathways for the development of a strategic cooperation between the two parties, as well as the use of a joint platform for gas transmission system operators. In this period, the further development of novel gas uses, as well as the continuation of training programmes and communication with stakeholders, is also aimed. Another important aspect is the approximation of market rules and standards to smoothen the trade of natural gas.
- Finally for the time period up to 2050, the removal of all barriers for the integrated functioning and coordinated development of gas infrastructures and markets is targeted. The roadmap also includes advanced joint technology programmes for the development of future uses of natural gas.

Literature Review on EU-Russia Energy Relations

In the study of Deane et al. [17•], a number of hypothetical scenarios, in which gas supply routes were interrupted for yearly periods, were examined, and the impact on the power system operation and the gas flow in Europe were observed. The model was constructed using power plant portfolio and existing gas infrastructure data by employing PLEXOS software [18]. The "No Russian supply" scenario in this study assumed that no gas flowed from Russia or Ukraine for 1 year. The main findings of this scenario were the following:

- The average electricity price across the EU rose by 12%.
- In countries with a high percentage of CCGT plants (the Netherlands, the UK, Germany), the increase in the electricity price was over 20%.
- An increase on the average gas price of 28% in the Baltic countries was observed.
- Finland saw a dramatic increase of the average gas price of over 50%.
- In countries on the periphery of Europe which do not import Russian natural gas (Ireland, Spain), there was also an increase in the price of electricity. While these countries do not import gas directly from Russia, the interconnected gas and power systems response by increasing exports of power when available.
- Countries with LNG capacity utilized their LNG terminals to some degree, although LNG could not provide even 1% of the total supply of natural gas.
- The much larger levels of gas moved through pipelines and also increased the cost of natural gas, due to the additional wheeling charges incurred.

- Natural gas used for power generation fell by 10% with the balance made up by coal generation which had an increase of 5% of capacity utilization on average when compared to the reference scenario. This, coupled with a rise in the amount of oil-fired generation, led to the average increase of 2% in greenhouse gases emissions.

Bouwmeester and Oosterhaven [19] used a non-linear programming approach to predict the wider interregional and interindustry impacts of natural gas flow disruptions in Europe. The model used revealed that, in the short run, economic actors would attempt to continue their business as usual and would follow established trade patters as closely as possible. In this study, four scenarios that simulated Russian export stops to different regions in Europe of natural gas were analysed, using a model calibrated on an international input-output table with six sectors. The findings of this study showed that the impacts of all four examined scenarios at the aggregate level of the whole economy were negligible for Europe and only a little less so for Russia itself. The effects on the size of the economy, as measured by its GDP, were surprisingly found to be predominantly positive for the various European regions, but negative for Russia. The effects however on the welfare of the populations involved, as defined by the size of the domestic final demand, were predominantly negligible but negative for the European regions and slightly positive for the Russian population.

Boussena and Locatelli [20] overviewed the evolution of EU-Russia gas relation since the 1990s. The authors concluded that the problems of defining new gas relations between the EU and Russia stemmed from a clash of values in the patterns of trade and particularly from the denial of Russia to accept the EU's power to enact rules for the gas industries and markets. The model of vertically unbundled network industries promoted by the EU is not the one Russia intends to implement in its gas sector. The authors also emphasize on the fact that the energy relations between the two regions are increasingly organized on a bilateral basis between gas companies and member states rather than on a collective basis, revealing the inability of the EU to define a common policy with respect to Russia.

Kratochvíl and Tichý [21] explored 201 textual units between the years 2004 and 2009 related to energy relations between the EU and Russia, identifying three energy discourses: the integration discourse, the liberalization discourse and the diversification discourse, both existing within the EU and within the Russian Federation. The analysis focused on the common and the differing aspects of the individual discourses, their major topics and the mutual perception. The study revealed that the predominant energy discourse in the EU is the integration discourse, which is closely linked to the liberalization discourse, and emphasizes the mutual benefits derived from the energy cooperation between the EU and Russia based on the interdependence of the two actors. Like in the EU, the integration discourse was found to clearly dominate in Russia as well. Another important discourse in Russia was the Russian liberalization discourse, which differed from the EU liberalization discourse in the sense that it focused on the efforts of Russian energy companies to establish themselves on the EU internal energy market. The discourse that was the most different in the EU and Russia was the diversification discourse, the differences lying in the diverging assessments of Russia's reliability as an energy partner and also in the different approaches to diversification and the different perceptions of energy dependence.

Kropatcheva [22] analysed what the shale gas developments mean for Russia's energy policy and its power capabilities vis-à-vis the EU, how the Russian political elite perceived this development and Russia's reaction, reaching the conclusion that Russian power capabilities look more moderate. She concluded that although the EU remains dependent on Russian energy, Russia's leverage over it is shrinking, as the EU policy has become more active in trying to reduce its dependence on Russia, being compelled to make more concessions in different aspects of energy trade, even in its long-term principles.

Skalamera [23] relied his study on more than 20 in-depth semi-structured qualitative research interviews, held in Brussels and Moscow between 2012 and 2015. He discussed on the reasons of the fragmented governance architecture between Russia and the EU, despite the high degree of mutual dependency, as well as the reasons the EU and Russia lack legally binding instruments to govern their energy relationship. By examining the role of all key partners into the EU Russia gas market, the author concluded that energy companies remain the pivotal actors in defining energy policy preferences with external partners, such as Russia. EU member states, despite their arrangements at the intergovernmental level, still zealously guard against the EU's excessive interference with their foreign policy goals acting in the field of energy as supporters of their own national companies. In key member states, energy security seems to be interpreted as maximizing the energy companies' market shares and corporate strategy.

Vanatserver [10] examined Russia's entire oil and gas export network and revealed that there is a considerable surplus pipeline capacity, which is likely to endure in the future. The article provided three explanations on Russia's surplus capacity for oil and gas exports.

- Russia's institutional setting has been conducive for a surge in new pipelines, as economic considerations have played a less significant role.
- Russia's energy "pivot to Asia" has already contributed to a widening surplus capacity in westbound oil pipelines,

and it is likely to have a similar impact on gas once it starts flowing to China
- Russia's energy security concerns, namely, about minimizing transit risks, have played a key role in its active pipeline diplomacy and new pipeline ventures.

The implications of Russia's surplus capacity for oil were described as an option of Russia to abandon an entire route of its choice. For gas, Moscow was likely to enhance its bargaining position with Ukraine, while Gazprom acquired more flexibility to deliver gas abroad. With new Europe-bound gas export pipelines on the horizon, Moscow would likely acquire an even stronger bargaining position when negotiating the terms of gas trade with its European clients.

Romanova [24•] examined the institutional changes in EU-Russian energy relations since 2000, focusing on changes in intergovernmental, transgovernmental and transnational interactions. The article demonstrated that the politicization of energy relations and facilitation of regulative cooperation between the EU and Russia were inhibited due to the gradual strengthening of transgovernmental and transnational institutions. The potential of shared institutions was also found to be constrained by the insufficient top-down delegation of responsibilities in the Russian government and its great power aspirations. In the EU, key barriers were found to be the inter-institutional rivalries, the EU's propensity to impose its legislation on external partners and the integration of energy policy with foreign policy. The depoliticization of the EU-Russia energy relations would require the involvement of transit countries, such as Ukraine. The authors concluded that transgovernmental and transnational cooperation should be nurtured because this is a useful channel for regulative convergence of policy implementing mechanisms.

Van de Graaf and Cogan [25] performed an analysis on "energy wars" based on the incidences that occurred in Crimea and the Russian-Ukrainian conflict. On the causes of the crisis, the authors concluded that the significant potential energy-related causes of the crisis were the role of natural gas price disputes between Russia and Ukraine and the nature of Russia as a petrostate in facilitating aggressive foreign policy. The authors also reached the conclusion that overreacting in the case of EU-Russian energy relations should be avoided to threats based on the energy weapon, given the practical limits to its use. Discussing on the energy sanctions that have been imposed on Russia by EU due to the conflict of the former with Ukraine, the authors justified that these mainly cater to a short-term desire, bringing about exactly that which policy makers seeked to avoid, namely, the politicization of energy trade. The authors pointed out that EU should accomplish a great deal by creating a real internal energy market at home by stimulating the creation of interconnecting pipeline capacity, increasing storage capacity, and boosting "homegrown" energy sources.

Mitrova et al. [26] implemented a number of scenario studies to assess the share of Russian natural gas in the European natural gas mix. The authors concluded that little changes in the European natural gas mix are anticipated in the coming decades. They also justified that even in the case of absence of natural gas transit through Ukraine, in the long term, this would hardly have meaningful effect on the origins of natural gas in Europe, putting all the noise and upheaval about diversification of Russian gas in perspective. The study also showed that short term, the lack of market integration in Central and Eastern Europe continues to be a risk in terms of European energy security. In this study, it is also proven that the Russian pipeline natural gas will be very competitive until 2030, stabilizing at around 130 bcm, whereas a part of the loss of market share in terms of pipeline gas is compensated by LNG that comes from the Russian Federation, which we expect to increase up to 32 bcm by 2040.

Austvik [27] discussed the proposals for an Energy Union in the European Union and its impact on security-of-gas-supply. According to this study, security-of-gas-supply concerns divide the EU between Central/Eastern and Western Europe in the creation of an Energy Union. Gas security may be improved by internal measures and better interconnectedness to and within Eastern Europe, if external relations to Russia will not change. It is justified that more infrastructure may help the functioning of a Single Market for energy and make the Energy Union a unifying project between the East and the West. The author though reaches the conclusion that the Russian and EU political systems will remain unevenly matched, as the EU largely wants to create a single energy market decoupled from the dependence on Russia and to repair for the lack of jurisdiction over the whole market, as Russian gas policy is mainly seen as a market failure by the EU. The author also presents the alternative that the Energy Union may follow the usual path of EU integration conflicts, according to which the Commission compels Member States to agree on a policy framework a principle and then develop their own pragmatic and non-politicized regulatory progress for its implementation. In this case, it is anticipated that the member states will resist the convergence pressures and policy harmonization will become a formality than a reality.

Harsem and Claes [28] examined the interdependence of the European-Russian energy relations. This study focuses on how Russia can exercise power based on its energy resources and how the EU can compensate for its lack of power in the energy game with other trade-related capabilities. The authors reject the statement that resource dependence automatically leads to political influence. Instead, it is concluded that in cases where Russia enjoys the role as the sole supplier of a certain commodity to a recipient country, it has a potential coercive power capability. The study indicates that as long as the EU does not enforce a common foreign energy policy towards Russia, the best Russian strategy towards the EU

would be a highly differentiated strategy. The Russian elite will favour involvement in the near abroad, namely, in the Former East-European states, as the governing elite still considers it as a natural part of the Russian sphere of influence.

Challenges of the EU-Russia Gas Cooperation

In order to identify the challenges of the EU-Russia gas cooperation, the strategic objectives of both the EU and the Russian gas industries should be clarified. For the former, its strategy is anticipated to be based on the following pillars:

- The exploitation of new deposits, in order to achieve an increase in the gas production and compensate the reduced gas production of existing fields
- The upgrade of its gas transport network, as well as the development of new pipelines, in order to verify that sufficient gas deliveries to the inland and abroad
- Promotion of geological exploration works in major gas-producing regions and on the continental shelf of the Russian Federation
- Development of the production and export of liquefied natural gas
- Development of gas-processing and gas-chemical industries aimed at the rational utilization of valuable fractions of hydrocarbons and associated petroleum gas
- Gas market liberalization, the creation of competitive environment and the further improvement of non-discriminatory access to pipeline and other gas infrastructure for all business entities
- The delivery of gas supply to the European market in line with its demand (and mainly on the basis of oil products price linked long-term contracts) while exports in the eastern direction will increase very significantly
- The gradual, economically sound, expansion of the Unified Gas Supply System in the east of Russia
- The participation of Russian companies in the development of gas deposits in other countries and the construction of new inter-regional gas pipelines
- A consistent energy savings policy with respect to gas production, transportation, processing and underground gas storage in Russia

Although both EU and the Russian Federation are anticipated to continue their diversification policy, close cooperation in the field of infrastructure development will still be mutually advantageous in the long term. In the following years, the energy sector is expected to change dramatically. The pathway to this new energy world, which will be cleaner and more affordable, is challenging for the EU and Russia, and it provides though at the same time ample opportunities.

1. Although the scenarios examined both in the Roadmap EU Russia Energy Cooperation until 2050, assume that the trade between the two parties will not decline several advancements in the field of economy indicate the opposite. Particularly, as energy demand in the emerging economies is increasing rapidly, it is estimated that 90% of the growth in energy demand until 2035 will be in the non-OECD countries, with a notable contribution in the adjacent to the Russian Federation China and in India. According to the International Energy Agency [29], the absolute growth in natural gas demand will be nearly equal to that of oil and coal combined, with trade in natural gas nearly doubling. This development will undoubtly have an implication for both the Russian Federation and the EU. The EU share of global fossil fuel markets will shrink, while emerging economies are expected to become more attractive to Russian exports. Also the relatively fast-growing Russian GDP is expected at some time to decline in the near future.
2. The price volatility of the oil and gas markets has amplified over the past time. Unconventional gas sources, including shale gas as well as liquefied natural gas (LNG), have become potential vital new sources of supply. Especially the greater use of LNG is expected to convert the global gas markets, resulting to a more independent of pipelines gas transport. Sustainable and affordable natural gas prices are vital for safeguarding the competitiveness of business in an increasingly global market as well as the well-being of the societies.
3. The climate challenge is now generally recognized, universal collaboration is growing, and numerous parties, remarkably the EU as well as industrial key partners, are following climate policies with tangible actions, particularly in the energy sector. The Paris Agreement brought all nations into a common cause to undertake ambitious efforts to struggle climate change and adapt to its effects, with enhanced support to assist developing countries to do so. The shift to a low-carbon energy mix is a fact, which will limit the use of fossil fuels, including natural gas. This will also have significant repercussions on the future development of the energy sector.

Conclusions

Inevitably, the establishment of a long-term EU-Russia collaboration in the energy sector is a requirement for both parties. The 2050 Roadmap of EU-Russia energy cooperation agenda can support the achievement of an advanced level of energy partnership. The planned target by 2050 should be to reach a functioning Pan-European integrated network energy infrastructure, with competitive, efficient and transparent

markets, which will contribute to the energy security and the achievement of the sustainable development targets of both the EU and Russia. Such a result would improve the energy security of both parties and strengthen their positions on the global energy market. In this study, it was though justified that this will only happen if both parties integrate the consistent topics of this agenda into the priorities of their energy strategy and follow up the advancement towards this collaboration goal.

Compliance with Ethical Standards

Conflict of Interest Paris Fokaides declares no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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