EVOLUTION OF THE METHODS TO GUARANTEE SECURITY OF GAS SUPPLY AND DEMAND ON DIFFERENT STAGES OF GAS MARKETS DEVELOPMENT

TATIANA MITROVA
SKOLKOVO ENERGY CENTER

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Background

During the last decade threats for the security of gas trade on supply and demand sides are one of the most discussed issues on the international agenda and in public debates about the future role of gas. Disruptions in gas supply, transit conflicts, severe price disputes and rigid pipeline competition are becoming commonplace in the modern gas markets. Eternal opposition between producers and consumers is currently aggravated by the economic crises and increased vulnerability of the markets. Different geopolitical considerations, which determine the behaviour of the countries participating in the international gas trade, may place countries at conflict with each other – so much so that even a term “gas weapon” has been introduced by analysts to describe the situation. This “insecure” image is seriously hampering position of gas in the inter-fuel competition and might limit its share in the global energy mix.

Gas industry operates for more than century; during this period the markets developed several mechanisms to secure gas supply and demand. At the present stage rapid growth of international gas trade leads to the integration of separate pipelines and liquefied natural gas (LNG) facilities in more complex international systems which include many participants with different institutional frameworks and levels of risk, requiring new mechanisms to guarantee security of gas supply and demand.

Aims

The aim of this research is to identify the main challenges for supply and demand security in the modern international gas trade, to find out the main methods and mechanisms that market participants are using to reduce risks on each stage of gas market development and to analyze the future development of these mechanisms.

Methods

The role of security considerations in the gas market design was assessed from the transaction costs theory perspective using holistic approach to the energy security (including security of supply and security of demand) and assuming the growing role of energy (and gas in particular) as geopolitical factor.

Main historical stages of gas markets evolution were analyzed. Institutional and historical analyses of the development of different regional gas markets and trading between different regions were launched, with focus on security issues and tools, utilized by market participants. Several past experiences starting from the beginning of the 20th century and real cases in Commonwealth of Independent States (CIS), Europe, North America and Asia were examined.

Results

Security considerations are one of the important factors shaping the institutional and contractual structure of gas industry

According to the institutional theory transaction costs include costs incurred in:

1) searching for the best supplier/partner/customer,
2) establishing a supposedly "tamper-proof" contract,
3) monitoring and enforcing contract implementation.

To a certain extent these transaction costs coincide with that “security costs” which counterparties in the international gas trade pay to guarantee reliable supplies and predictable demand for gas. As market participants are trying to minimize their full costs (including production costs, transportation costs and transaction costs), this “security costs” plays an important role in defining the gas market institutional design (including corporate structure, modes of governance, organizational arrangements, property rights, enforcement mechanism, contract design and etc.).

High level of risks and insecurity in international gas trade is an objective process driven primarily by specific features of the gas industry. First of all this industry is characterized by very *high specificity of assets* especially in very specialized and inflexible pipeline transport, which raises the probability of opportunistic behavior (when one party uses the relationship to better their position at the expense of the other). From the theoretical point of view, once the contract is awarded to the supplier, the relationship between customer and supplier changes from a competitive environment to a monopoly/monopsony relationship, known as a bilateral monopoly. This means that the customer has greater leverage over the supplier such as when price cuts occur. To avoid these potential costs, "hostages" may be swapped. These hostages could include partial ownership, revenue sharing or long term take-or-pay contracts. Due to the *high capital intensity* of gas industry risk of the opportunistic behavior here is especially prominent.

Technological features of the industry lead to *long term relationships*. Gas trade (both pipeline and LNG) has also very *high degree of uncertainty* due to long investment cycle and long period of the subsequent operation of the specific assets. Normal commodity cycles are much deeper in gas markets, as there is a significant delay in reaction from the production and transportation sides. Therefore periods of deficit and periods of gas glut are rather strong, destroying the trust of the market participants and incentives for producers to invest and for consumers to choose gas as preferred type of fuel.

Moreover, strategic, social and infrastructural importance of the gas industry and its role in the formation of state budgets motivate *active states interventions in the institutional structure of the industry*. This is sometimes done via "revolutionary" transformations - changes in the legislation governing the operation of the industry (like nationalization or liberalization).

In the case of international transactions, the gas industry is often *affected by the geopolitical relationships* between the countries and itself became an important geopolitical factor. In the 20th century unprecedented growth in capacity and complexity of anthropogenic energy structure and increased use of high quality resources turned energy into one of most important factor of modern geopolitics, characterized by the following specific features:

- Distribution of geological reserves of gas, high quality energy resources, among countries and regions is uneven;
- In some countries and regions, growth of energy demand has been more rapid than in others. Specific uses of energy were confined to one type of energy resource: petroleum motor fuels in the automobile and defense, petroleum products and gas in the petrochemical industry and others, etc.;
- Supply of indigenous resources in developed countries over time started to lag behind the demand;
- The need to secure energy supply from foreign sources became a national security issue, driving foreign policy priorities in developed states;
- Successful implementation of those priorities has led to an unprecedented increase in trans-regional flows and corresponding energy transportation infrastructure development. Then, governments began to seek control over the key elements of this infrastructure. An increase in global energy trade together with some possibilities to manage prices turned the ability to dominate the energy sector into a powerful political and economic lever.
- For the most part of the 20th century, the energy industry was the most technologically advanced sphere of human activity. Electricity transformed all aspects of people's lives and enabled electronic communication and information technologies; oil resources and later nuclear power caused a revolution in defense capabilities, and so on. New energy technologies have vastly expanded the resource base of the energy sector and are increasing the effectiveness of all stages in its conversion from natural sources to and including the consumers. Therefore "the technological race" in the energy sector and inter-state transfers of technology has become the aims and the means of the foreign policies of various countries. Distribution of nuclear weapons (one of the "fruits" of anthropogenic energy sector) since the middle of the 20th century has become one of the most acute geopolitical issues.

These specific features of the energy sector development are characterized by the *exclusivity of energy resources, infrastructure, and technologies*. This exclusivity poses high risks to economic resilience and state security of many countries and makes the energy sector an important factor of geopolitical motivation. This role of the energy sector will not change significantly in the next decade.

Gas industry with its unique resources and infrastructure (in terms of capital intensity and technical complexity), huge maritime and transit infrastructure and limited access to technologies (like LNG and GTL production) is a good example of the energy trade becoming geopolitical factor. Numerous gas price and transit disputes on the post-Soviet space, in South America and North Africa; "Southern Corridor" pipeline race are just a few examples of this new role, which international gas trade got during the last decades. In many cases decisions of the market participants are regarded from geopolitical angle, not just as an economic decision.

Summing up, market participants in the gas business face transactions with high degree of specificity, uncertainty, risk of opportunistic behavior and difficulties with the contractual regulation of long term relationships, aggravated by active states interventions in the institutional structure of the industry and different geopolitical considerations.

Transaction cost economics suggests that these characteristics of transactions and difficulties of regulation of long relationships by contracts favor vertical integration, allowing to save on transaction costs. When vertical integration is impossible, its substitutes – bilateral long term contracts with rigid obligations of the parties or international consortiums including suppliers and consumer side or other their substitutes are used. In this case the parties remain formally independent.

Security includes both security of supply and security of demand

In this paper holistic approach to the energy security, which includes both security of gas supply and security of gas demand, is applied. Both producers and consumers are exposed to the above mentioned risks and security threats in international gas trade, both sides have to develop mechanisms minimizing their “security costs”.

It is necessary to stress, that the term “energy security” is multidimensional and varying over time. The very concept of "energy security" appeared after the oil embargo was introduced in 1973 - energy security was defined as adequate energy supply for a nation and its economy. Very often this notion was reduced to energy self-sufficiency. CERA President Daniel Yergin gives the following definition: the aim of energy security is to ensure adequate, reliable energy supplies at reasonable prices and so as not to jeopardize the main national values and objectives. Paul Leiby of the U.S. Oak Ridge National Laboratory gives a shorter definition: energy security is "energy available when and where needed, at a predictable price."

Experts of the World Bank Group believe that energy security means that a country can steadily produce and consume energy at reasonable prices in order to promote economic growth and, by doing so, to reduce poverty and directly improve the population's living standards by expanding access to modern services in the energy sphere. In 1992, the World Energy Council defined a country's energy security as a state of protection of individual citizens, society, economy and nation from threats to reliable fuel and energy supply. The International Energy Agency defines energy security as access to a sufficient amount of reliable energy at an acceptable price.

But this approach is relatively limited, as all these definitions are focused on security of supply and represent only the interests of sovereign importers of energy resources, which do not always coincide with those of other players on the global energy market.

For example for producers future demand development, guarantees of reasonable investment return and acceptable pricing is crutial. For developing nations energy supply is an inalienable part of measures to combat poverty. Energy contributes to growth of labor productivity and incomes of the poor.

Moreover in gas industry characterized by continuous cycle along the gas supply chain, energy security and system reliability can only be provided by considering and coordinating the technical, economic and institutional facets of gas supply, transport and end-use. As drivers for the governance of the gas system, these two perspectives from producers and from consumers sides cannot be considered independently.

As Mark Hayes wrote, “the concept of gas market security should incorporate all segments of gas delivery infrastructure as well as natural gas demand. Market security is inclusive of supply security, including concerns about the physical availability of gas – e.g. are absolute volumes delivered, or do users have the flexibility to switch to other fuels? Market security is dually concerned with the financial aspect, e.g. what price do customers pay for gas (or alternative) energy sources consumed? This broader conception of market security is particularly applicable to natural gas markets where demand (and price) is much more highly variable than actual gas supply”.

Mechanisms used by the market participants to reduce "security costs" on each stage of gas market development

Several different stages are visible in the evolutionary development of gas markets, which consists of gradual changes occurring in the process of accumulation of peripheral changes in the structure of industrial assets (development and integration of the infrastructure, depletion of gas fields, etc.), and of modification of contract principles. Transition from one stage to another happens with infrastructure development, increase in the traded gas volumes, evolution in institutional gas market structure and first of all contract evolution; development of the regulation, growing competition between different market players and, paradoxically, increasing number of security threats.

Development of gas markets is usually presented as an evolution towards a more transparent, free and predictable environment. However, a review of the real history of their development shows that security threats in gas trade have been growing.

Risks are increasing in more sophisticated and developed stages as more participants (with completely differents institutional frameworks) get involved in each transaction, while capital intensity of average project is growing due to the need to develop more remote and challenging resources.

Risks division between the parties is changing, and new mechanisms of transaction (and in particular – security) costs reduction evolve - vertically integrated companies, long term inter-governmental agreements, multilateral international agreements, swaps of assets, consortiums, etc. So these mechanisms of market participants` adaptation should be regarded as an essential part of energy security guarantees, not just a failure of the market.

The table below demonstrates the way the markets were structured at each stage of the evolution. It also shows what mechanisms were used to reduce transaction costs and energy security risks.

<u>Local Markets</u>

The initial stage of the gas markets evolution is characterised by pair interactions between producers and consumers. Local gas markets are emerging (1920-s in US and Europe, 1940-s in the USSR, 1990-s in China and India). This period is characterized by an underinvestment risk because of the need for starting capital in the conditions of high uncertainty about the volume of the future market and its prices. At this stage questions of energy security are also linked with the technological and physical safety of supplies, as local companies don't have sufficient experience. Price and investment risks are lowered by:

- using super long term contracts – for example, "depletion" contracts (in which the consumers agree to buy all gas from the declared field),
- vertical integration (local monopolies)
- using long term franchise contracts, giving exclusive rights to provide services in the given territory.

<u>National Markets</u>

In the second stage, as reliable long-distance high pressure gas pipelines are set up, there is a prompt and rapid expansion of isolated local markets and national markets are formed. At this point, in addition to the technological and physical security, another factor becomes important for each country - the threat of underinvestment in sufficient large-scale production, transportation and distribution. At this stage of evolution of the gas markets, the concept of

national energy security usually comes to the forefront. National energy security is frequently defined as an energy supply adequate for a nation and its economy. Very often this notion is reduced to self-sufficiency in gas. In order to provide the growing national economy with the necessary gas resources, governments in many countries have introduced state regulation involving direct administrative interventions, price control, and frequently, the nationalization of gas companies. Transaction costs are minimized by “cost plus” pricing and long-term "take-or-pay" contracts, which guarantee returns on investments.

Table 1. Evolution of natural gas markets and instruments reducing “security costs”

Features	Local markets	National markets	International markets	Transcontinental markets/ Global market
Main product	Pipeline gas	Pipeline gas	Pipeline gas, LNG	Pipeline gas, LNG
Infrastructure	Few unlinked gas pipelines between producer and consumer	National gas supply systems	Development of large scale long-distance cross-border pipelines and bilateral LNG supply	LNG and pipeline gas supply from many countries, development of international pipeline systems
Market volume	A few BCM	10-102 BCM	A few hundred BCM	Several TCM
Institutional gas market structure	Local vertically integrated monopolies	National vertically integrated monopolies, independent gas production companies	Bilateral international contracts between two national companies	Multiple contracts between many companies, transnational vertically integrated energy companies
Competition	Absent	In certain conditions competition in gas production is possible	Competition between domestic production and imports	Competition between domestic production and multiple import sources
Aspects of energy security	Investment Physical	Investment Physical National energy security	Investment Physical National energy security Bilateral international (security of supply, security of demand)	Investment Physical National energy security Bilateral international (security of supply, security of demand) Security of transit
Instruments to reduce “security costs”	Local monopoly, super-long-term contracts	National monopoly	National monopoly, long-term inter-governmental agreements	Multilateral international agreements, asset swaps and joint ownership, consortiums

Bilateral International Markets

Gas demand growth stimulates the beginning of the third stage of the market evolution – the development of bilateral international markets and the construction of large cross-border gas pipelines and LNG plants.

The USA started to export small volumes of pipeline gas to Mexico and Canada in 1949. In Europe, the oil price rise in 1970 led to a considerable increase in the share of natural gas in the energy balance. Deliveries came from the Netherlands, Norway, USSR and Algeria. In the early 1960-s, the USSR set up a number of pipelines exporting gas to Europe. The development of gas-transport networks has been limited in the Asia-Pacific region due to its geography. There, priority was given to LNG trade. Japan started developing gas transport networks in 1969; later South Korea and Taiwan joined this market.

At this stage political risks and problems of bilateral energy security (i.e. security of supply and security of demand) arise for the first time, in addition to other energy security problems. As it becomes impossible to provide both national energy security and lower transaction costs merely by controlling national companies, international guarantees covering demand and supply security become necessary. The equilibrium is achieved primarily by inter-governmental long term agreements which guarantee necessary volumes of gas supply for the consuming country and a return of investments for the producing country. Usually these are “package deals”, including agreements in different spheres of cooperation and guaranteed on the state level. Price risks are reduced by oil linkage in price formulas. There are no transit problems yet at this stage, as the trading countries border each other.

The Present Stage of Gas Market Evolution – the Emergence of Transcontinental Markets and Global LNG Market

At the present stage the rapid development of bilateral international gas trade leads to integration of separate pipelines and liquefied natural gas (LNG) facilities being integrated into more complex international systems. Volumes of world LNG trade, including intercontinental and spot trade, are constantly growing. Increasingly this means that national and even regional markets are no longer isolated from each other.

Due to the active expansion of national gas-transportation systems, several regional gas markets have already evolved. The single European market and the Asia-Pacific LNG markets have appeared alongside with the North American market and the former Soviet UGSS (Unified Gas Supply System). Pipeline from Central Asia to China links the whole Eurasian space (including North Africa, Middle East, Western Europe, CIS and China) - a huge transcontinental gas market.

Theoretically, when well-developed, these integration processes could decrease the influence of each particular element on the whole system by using flexibility and system effects. They reduce project risks by eliminating a supplier’s dependence on one particular consumer and increase security of demand and security of supply. These systems have a considerable number of branches and parallel transmission routes. As such, they offer a substantial reliability margin and are able to uninterruptedly supply gas under different loads. But untill this “ideal” state of infrastructure is achieved, it is necessary to pass through difficult transitional period.

This transitional period introduces new challenges to energy security, as gas markets become more integrated and the scale of global energy trading grows substantially. Long-distance, cross-border pipelines are becoming an ever-larger fixture in the global energy trade.

As the market develops, interdependence is increasing dramatically. Integration creates new vulnerabilities in a broader sense because a break anywhere in the system – whether the links are financial, physical, or communication – can cripple large segments of an economy. Exposure to an increase in the number of natural disasters and potential terrorist attacks underline these vulnerabilities.

There are also many chokepoints along the transportation routes of LNG that create particular points of vulnerability: the Strait of Hormuz, which lies at the entrance to the Persian Gulf; the Suez Canal, which connects the Red Sea and the Mediterranean; the Bab el Mandeb strait, which provides entrance to the Red Sea; and the Strait of Malacca. Ships commandeered and scuttled in these strategic waterways can disrupt supply lines for extended periods. Securing pipelines and chokepoints require augmented monitoring as well as the development of multilateral rapid-response capabilities.

In the past, long term contracts from individual suppliers to specific country consumers essentially isolated the problem of dips in supply and price spikes. In the integrated globalized market, disruptions or discontinuities in supply or demand will have global effects. As a result, “gas users in Japan, for instance, will have a vested interest in the stability of South American gas reaching the U.S. West Coast ... and the European Union will be compelled to monitor the political situation in gas-producing regions as remote as the Russian Far-East and Venezuela”1. Energy interdependence and the growing scale of energy trade require continuing collaboration among both producers and consumers to ensure the security of the entire supply chain, and malfunction of even one element creates enormous threats for all supply chain participants.

One of the best examples is transit, which has become a new problem for the intercontinental markets, as gas has to cross an increasing number of borders thus increasing transaction costs. Since transit countries are usually gas consumers themselves, transit and supply contracts are de-facto linked to rising transaction costs. In some cases increases in transaction costs can be extreme. In cases where transit countries are exporters themselves, they may not be willing to favour their competitors, which may again impede transit. Producing and consuming countries may get involved in disputes with transit countries, and the probability of such disputes is growing. Ukraine and Belarus relations with Russia are only two examples of this situation. Others include transit problems between the Central Asian states, in Northern Africa, in Latin America and problems related to the Iran-Pakistan-India pipeline. At the moment all these situations are “lose-lose-lose” cases.

Multilateral arrangements at this stage are clearly much more complex than bilateral ones. Interdependence raises energy security issues at a more global scale, including security of supply for consuming countries and security of demand for producing countries, as well as security of transit.

It is also necessary to mention that in many countries with well-developed domestic markets, liberalization is imposed on these integration processes with privatization, unbundling and introduction of consumer choice of suppliers and non-discriminatory third party access to gas transportation systems. This policy leads to the prompt development of spot gas trade. Agreed terms of long-term contracts are gradually weakened and the linkage to alternative energy carriers is replaced with a link to the spot market prices. This adversely affects supplying countries, as it becomes difficult to guarantee large-scale investments return within a framework of extremely volatile spot prices. Financing tools for large capital-intensive projects, which are developed on the basis of the long term contracts are facing a growing

[1] The Geopolitics of Natural Gas. James A. Baker Institute for Public Policy study 29, Rice University, Houston, TX, March 2005.

threat of destruction. This situation does not encourage large investments necessary for infrastructure and production development. Participants in the gas market simply delay their investment decisions because of high uncertainty. Today the question of timely investments in gas project development is more important than ever. This issue remains important not only for external supplies, but for the domestic infrastructure development as well, particularly in relation to incentives for the timely provision of peak supplies and storage facilities.The emergence of natural gas as a commodity presents the challenges of attracting capital and developing this essential resource to meet future demand within a volatile market.

This problem is aggravated by declining trust in governments' and inter-state guarantees. With institutional frameworks changing too fast (in producing, transit and consuming countries), there is a need for additional guarantees for the fulfilment of contracts. Mutual distrust of many market participants encourages "protecting their traditional territories" leading to energy nationalism and protectionism. Conflicts between the so-called national energy companies (representing mainly producing countries) and international energy companies or IOCs which represent consuming countries, are increasing. It is now difficult to speak of global energy security – we rather observe a period of seeking multilateral security with a strong need to find decisions acceptable to many parties. This becomes increasingly difficult and requires higher transaction costs.

All these factors – and first of all lack of harmonized "rules of the game" mean that despite all advantages of the big integrated energy systems, at the current stage of development one can observe a gap between infrastructure development and institutional rules available for the market. Mistrust between market participants and lack of coordinating mechanisms slow down and constrain the utilisation of advantages of this emerging integrated system. A growing number of market participants with different institutional frameworks leads to higher uncertainties and risks and therefore higher transaction costs. Actually these are the costs market participants pay for insecurity in gas trade. The higher the insecurity – the higher transaction costs.

This system requires a more unified institutional framework to be sustainable. The framework would need to reduce transaction costs and threats to energy security, as well as offer new mechanisms to guarantee security of gas supply, demand and transit. It could only be developed once there is a certain mutual compromise and agreement between all market participants.

Instruments ensuring security in international gas trade

There are several well-known tools to mitigate security threats in the gas trade:

<u>Reducing import dependence</u>

The traditional approach is to regard energy supplies which are produced domestically as "secure", and supplies which are imported as "insecure". But as J. Stern wrote in 2006, "…there is no evidence from Europe or anywhere else in the world that imported gas supplies have been – or are necessarily likely to be – less secure than supplies of domestically produced gas. Indeed history suggests that during the last 25 years the majority of serious security incidents – those in which customers have lost gas supplies for a considerable period of time – have stemmed from failure of indigenous supplies or facilities. While there is no guarantee that the future will be the same as the past, no empirical experience would lead to the conclusion that a country with substantial dependence on imported gas supplies is necessarily less secure, in other words, more prone to disruption, than one which is self-sufficient."

Diversification of supply sources and markets

This approach is based on the famous Lord Churchill's statement made more than 90 years ago that "safety and certainty…lie in variety and variety alone". Multiplying one's supply sources reduces the impact of a disruption in supply from one source by providing alternatives. This serves the interests of both consumers and producers, for whom stable markets are a prime concern. At the same time, producers are diversifying their export markets. While understanding the importance of this approach, it is necessary to remember that the reliability of the whole system depends on the reliability of its separate elements. As such, security of the gas supply chain is determined by the security of its weakest element. So in some cases consumers may undermine their security by diversifying for less reliable and secure sources. Diversification per se cannot be a goal, and it is necessary to make comparative analyses and evaluate risks of each supply source while attempting to increase diversification. For example, diversifying European gas supplies to Nigeria through the Trans-Saharian pipeline construction can hardly be regarded as a tool to increase EU energy security, as terrorists have already announced their intention to bomb it.

Diversification of transportation routes as one of aspects of supply diversification is one of the most discussed themes today. In the situation of increasing transit risks (which imply huge transaction costs for the consumers and producers), bypassing transportation routes become more attractive from the economical point of view in many cases. Although bypassing transportation routes are more expensive based on transportation costs alone, they become more competitive assuming possible losses due to transit disruption. Again, a very accurate assessment of the reliability of supplier and the route itself is necessary.

Resilience

Resilience or flexibility is a "security margin" in the energy supply system that provides a buffer against shocks and facilitates recovery after disruptions. Because of the high day to day and seasonal variability in gas demand, and the inevitable (while small) risk of physical outages in the delivery infrastructure, a 'buffer' of spare capacity on the system is required for gas supplies to be secure. This 'spare' capacity can take a number of different forms: for example, sufficient spare production and "reserve" transportation capacity, oversized import infrastructure; storage capacity; demand side flexibility (e.g. through fuel switching by power stations or large consumers), underground and LNG storages, backup supplies of equipment, as well as carefully conceived plans for responding to disruptions that may affect large regions.

It is clear, however, that no system can provide 100% certainty that there will always be enough supply to meet demand under any conceivable circumstance. And the costs of increasing security, when security is already at a very high level, may be greater than the benefits. There is a balance to be struck, requiring judgments on various factors: potential hazards, related costs and probabilities, and the costs of the possible means of mitigating or avoiding them (e.g. additional storage capacity). Security is not free – it becomes one of the characteristics of gas as a traded good and should be reflected in its price. Both the public and private sectors need to invest in building a higher degree of security into the energy system—meaning that energy security will be part of both the price of energy and the cost of homeland security.

Tools ensuring sufficient investments

This is one of the most challenging tasks, especially nowadays when global economic crises is destroying producers` confidence and forcing them to abandon many of their investment plans. Different coordinating mechanisms are necessary to restore this confidence.

In order to handle these threats, markets have developed some unique tools and instruments which have proved to be efficient. Energy dialogues at the international level and long term contracts at company level are good examples of instruments to guarantee timely upstream and downstream investments. They are also absolutely justified from the transaction economy point of view. Transaction cost economics suggests that the above mentioned characteristics of transactions in gas business with a high degree of specificity, uncertainty, risk of opportunistic behaviour, and difficulties of regulation of long relationships by contracts favor vertical integration, allowing savings on transaction costs. Vertical integration is one possible solution. Development of huge international gas (and broader – energy) companies working in all market segments is a good example. However, these companies face strict anti-trust regulation and different forms of opposition given the desire of national authorities in many countries to protect their energy security.

Development of joint projects involving multiple participants from different countries is another form of market adaptation to the high transaction costs. This provides a degree of balance and some mutual guarantees. Stronger producer-consumer confidence can be achieved by introducing mixed capital in all parts of gas supply chain (including asset swaps and joint ownership). They ensure timely investments and their return and a reliable supply by building a gas chain. This involves a kind of economic regression to barter relationships: assets become guarantees in the context of weakening governmental guarantees as an alternative to vertical integration. On the other hand, such a market-based mutual penetration of capital between gas producers and consumers could be a valuable means for the reduction of transaction costs.

This process is already apparent in the LNG business where consortiums of 5-7 companies from different countries provide guarantees of supply and demand security. It is also increasingly evident in some pipeline projects – the Interconnector project could be mentioned here. Members of a given consortium may participate in several other projects with different configurations, even in competing ones. This policy helps to distribute risks. The future development of gas markets is likely to make this trend more widespread, leading to the mutual penetration of different national companies and interests and to competition between projects rather than suppliers. One more form of guarantee is asset swapping, as in the Nord Stream project. Here the parties are not buying shares in projects, but are simply exchanging their assets in different parts of gas supply chain, thus creating guarantees against opportunistic behaviour.

When vertical integration is impossible, its substitutes – bilateral long term contracts with rigid obligations of the parties - are used. In this case the parties remain formally independent. So these mechanisms of market participants` adaptation should be regarded as an essential part of energy security guarantees, not just a failure of the market.

Conclusions

To deal with these new challenges and to lower high transaction costs (including “security costs”) new approaches are necessary. Due to high underinvestment threat, long term relationships, guarantying these investments and their return, are still extremely important in gas markets. Vertical integration is one of the possible approaches. Development of huge international gas (and broader – energy) companies working in all market segments is a good example.

Another form of market adaptation to these high “security costs” is development of joint projects including many participants from different countries which provides a sort of balance and mutual guarantees. Strong producer-consumer interdependence can be achieved

through mixed capital in all parts of gas supply chain (including assets swaps). They ensure timely investments and their return and ensure reliable supply by gas chain building.

This process is especially obvious in LNG business with consortiums including 5-7 companies from different countries providing guarantees of security of supply and demand. This process is intensifying in pipeline projects as well – here Interconnector, Nord Stream, South Stream or Nabucco projects could be named. Members of the given consortium may participate in several other projects with different configuration, even in competing ones. This policy helps them to distribute their risks. The future development of gas markets will make this trend more wide-spread leading to mutual penetration of different national companies and interests and to competition of projects, not suppliers.

Further gas market evolution will demand more unified institutional framework to decrease threats to energy security and transaction costs. At the present stage of market development new multilateral international agreements become critical for the further development of gas markets, especially with the growing number of transit countries and market participants involved in each transaction. Additional insurance mechanisms are necessary to deal with growing security threats.

The fact that security of gas trade has become a very topical subject is no mere chance. At the present stage of gas markets evolution, there is an imbalance between physical asset development and infrastructure integration and the old “patchwork” institutional framework. This imbalance has become a severe issue, increasing transaction costs for the market participants and leading to growing threats to the security of gas supply and demand. This situation is extremely harmful for all market participants.

Market participants have developed several mechanisms of adaptation (vertical integration, mutual penetration of capital and long-term contracts) which should be regarded not as a market failure, but as an essential part of energy security system.

Nevertheless it is impossible to solve new problems using bilateral relationship alone – the markets are becoming global. At the present stage of market development new multilateral supranational agreements. This is especially the case given the growing number of transit countries and market participants involved in each transaction. Gas projects which are likely to be developed in the next two decades will require a new kind of guarantee. Support of multilateral agencies such as the World Bank and the Banks of Development, other international financial institutions or regional integration organizations is therefore frequently sought in the form of guarantees, to limit the business risk.