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STRATEGY AND EFFICIENT MECHANISMS TO IMPROVE SECURITY AND SUSTAINABILITY OF NATURAL GAS SUPPLY IN THE BALTIC STATES

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Abstract The share of natural gas as an efficient resource in the deficient Baltic primary energy balance is and will be significant (power generation, district heating, households, industry, etc.). Therefore, in the paper the risk of gas supply is evaluated and appropriate actions are recommended to assure reliable availability of affordable and sustainable energy in the Baltic States. Macro-region's base (including supply and transit countries), risk and cost assessments, timely introduction of non-market measures, high cyber security level of information processing and management systems are the components of the security strategy. The extension of Incukalns UGS, interlinked pan-Baltic LNG receiving terminal and upgrade of cross-border trunk pipelines are recommended as the most efficient tools. Complex realization of all instruments and solidarity of the countries are the key issues to implement proposed strategy.

Keywords: Energy Policy, Sustainable Energy, Gas Supply, Security of Gas Supply, Gas Storage, Estonia, Latvia, Lithuania.

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JEL Classifications: F10, F15, F21, F43, F51, F52.

1. Introduction: Energy Policy and Energy Balance

It is well-known and even evident that energy is not only a sector of the economy. The EU classification, which includes energy supply in the services of the general economic interest, clearly shows their significance. Energy has always been a category of basic level of Maslow's hierarchy of human needs, particularly for the Baltic region (the second coldest EU macro-region following Scandinavia). Nowadays sustainable energy supply is becoming a significant (even the most significant) component of the national security of any country. Energy security is not a synonym for energy independence, natural or closed economy is not a model for today likewise.

Therefore, increasing regulation of the processes in the energy sector in the interests of society is going on worldwide including the EU (e.g., recently approved normative acts EC 2009a, EC 2009b, EC 2009c, EC 2010b).

To achieve adequacy of the regulatory activities with current political, economic and social situation, the EU energy policy is based on three closely interlinked pillars (Fig. 1a) including sustainability and security of supply. An indicative feature in the previous years (EC 2008) is the reduction of energy costs; naturally, competitiveness includes costs issues but it was not a primary issue for the welfare Western society. Presently the EU energy policy is updated (EC 2010a) in accordance with the current global economic situation. The policy points out that the prices for the energy products and services should be affordable for all the consumers. The policy model is slightly modified to increase the significance of the energy costs (Fig. 1b). The shift also relates to the energy security costs.

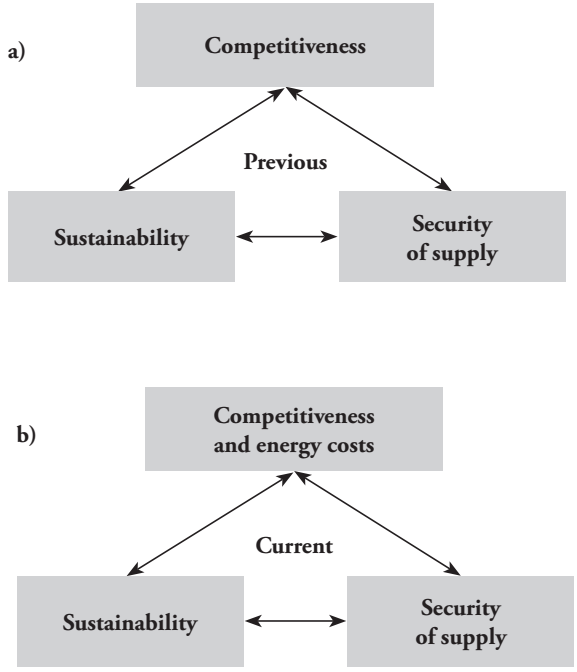

Fig. 1. Models of energy policy.

The policy of the Baltic States' always was consistent with the modernized policy model. The costs of energy have been much more significant for the society and business due to the economic situation.

An important priority of the updated energy strategy is turning towards much more general accent on low carbon energy (instead of swift development of the renewables only) due to the ongoing economic crisis and necessity to invest in recovery and jobs on one hand and slow global progress in the climate matters (low willingness of the US, China, Russia, etc.) on the other hand. According to this objective, natural gas as the economically efficient and comfortably used energy source, as the fuel, which CO_2 emission is only 60% of wood and 51% of coal emission, as a backup for renewables "will continue to play a key role in the EU's energy mix in the coming years" (EC 2010a), thereby balancing affordability and environmental demands.

The share of natural gas in the EU primary energy balance currently is significant (power generation, district and local heating, industry, households), nevertheless it is far from the dominant position (Fig. 2). The proportions of the Latvian and Lithuanian balances are quite similar (here and further statistical data of Eurostat are used), however, the proportions of the Estonian balance are much smaller (due to the Estonians' oil shale). All energy mixes are quite balanced (Kaderjak P. *et al* 2007); Herfindahl-Hirschman Index for the EU energy balance was 2452, for the Latvian balance – 2683 in 2009. But gas consumption per capita in the Baltic States remains significantly lower than in the EU – only 44% of EU27 level in Estonia, 58% in Latvia and 70% in Lithuania (2009). One can see that populists' expressions like "the Baltic States are sitting on the Russian gas needle" are not based on facts.

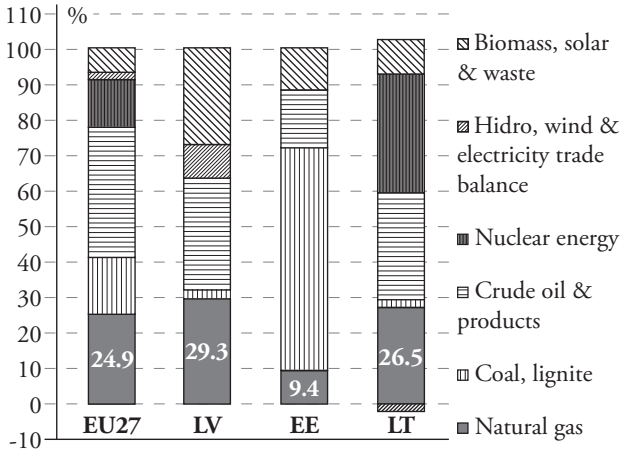

Fig. 2. Energy balance (Baltics, 2009)

The future expectations on the EU gas market development are very different (e.g. instabilities during the crisis), even up to 32% share in energy balance in 2020. The baseline scenario (EC 2010c) shows 7-12% increase till 2020 in Estonia and Latvia and much more in Lithuania (more than 40% increase) that is related to the replacement of nuclear energy, especially in the mid-term. Liquefied natural gas (LNG), unconventional and deepwater gas consolidate conventional gas sector. In any case gas sector will be of strategic significance for the economy and social life of the EU and the Baltic States.

The EU gas import dependency is high (more than 60%) and it will increase (up to 85% in 2030). Hence the importance of the security of gas supply (SoS) problem.

The approval of the special EU Regulation (EC 2009c) was intensified by the recurrent gas crises (2006, 2009) due to the disputes between Russia and Ukraine. But it is impossible to solve the problem only by the activities in consuming countries without strong partnership with supply and transit countries. For the exact reason strengthening the external dimension is another priority of the updated EU energy strategy.

2. The Baltic States: Individualities of Gas Supply

There are very different and mutually unlinked security levels in various EU regions. The gas crisis in 2009 affected 18 European countries, some of them significantly, some countries could withdraw gas from their underground gas storages (UGS) or switch to another sources. Whereas the Baltic States as well as Spain, Portugal, UK, Scandinavia were not confronted with the problem.

Therefore, macro-regional approach to the improvement of the SoS is one of the key issues of the EU position. It is fully acceptable; the security problem cannot be solved at the national level as countries themselves cannot develop necessary infrastructure. Security tools are transnational instruments; they are effective if they are based on the transnational cooperation and solidarity of the neighbouring countries. Equal general principles (mainly at the political level) should also be implemented throughout Europe.

The gas fields are not discovered in the Baltic region. Unlike many EU countries, the Baltic States depend 100 % on Russia as it is the only gas supplier. The region's (incl. Kaliningrad) peak demand is 40 Mcm/day. The supply is provided by two trunk pipelines (EEGA 2008) with the capacity adequate to the current consumption. One pipe is direct, the other is a transit one via Belarus (Fig. 3). The capacity of each pipe is 30 Mcm/day. There are two bidirectional pipelines: Estonia – Latvia (2 Mcm/day) and Latvia – Lithuania (5 Mcm/day). Two old small pipes (St. Petersburg – Estonia and Belarus – Lithuania) are not used but can be activated. The system of gas supply is fully isolated from the EU system. This individuality of the Baltic region is unique on the EU scale.

Fig. 3. Baltic gas supply grid

Isolation of the Baltic gas system is linked with the following historical causal relationships and consequences:

- From the very beginning (1960s), the Baltic natural gas system has been integrated into the system of Russia – trunk pipelines, centralised dispatching, supply to Kaliningrad via Lithuania.
- The Eastern Baltic region countries (Latvia, Estonia and Finland) are the only ones that have border with Russia; direct gas import without transit routes is a substantial advantage.
- Russia is the owner of the richest gas reserves. It has been a reliable gas supplier since the restoration of the Baltic States' independence in 1990 despite the complicated interrelations with Russia. Nevertheless, the problem of supply would arise if domestic market increased sharply and the Eastern export developed in the future (ИЭС 2009).
- Development of gas infrastructure in Russia is a crucial issue. The new pipeline from Yamal gas fields as well as Nord Stream and Shtokman pipelines can have an impact on the supply to the Baltic region in the future. It depends on the actual operational

capacity of all pipes (Nord Stream will be connected with Yamal trunk pipes).
- Technical skills and know-how of the Russian specialists are recognized internationally; the Baltic gas companies also exploit their knowledge potential.
- *Gazprom* is the shareholder in all Baltic gas companies;
- *Incukalns UGS* (delivery capacity 24 Mcm/day) is the third supply source that is an extremely significant security guarantee for the most substantial – winter – period (injection is taking place during summer). The use of the UGS is practical experience of solidarity as Estonia, Lithuania and even Russia exploit the capacity of the UGS during winter.
- Following the Romanians, the Baltic consumers enjoy the lowest gas prices in the EU (Estonia – 69%, Lithuania – 72%, Latvia – 60% of EU27 average price for domestic consumers in 2010S1).

These individualities have to be taken into account during the evaluation of the risks that could affect gas supply to the Baltic consumers. Nevertheless, the major problem regarding the only gas supplier is evident.

Diversification of the suppliers and supply routes is a cornerstone of the EU policy (Bilgin 2009). In addition to the major suppliers (Russia – 33.2%, Norway – 28.8%, Algeria – 14.7% of total EU27 gas import in 2009), there are a large number of smaller sources. In addition, 18% of total gas import was covered by the LNG; it was provided by Algeria, Qatar, Nigeria and some other countries. Nowadays the EU is searching for additional sources of gas supply from the Caspian and Middle East countries.

Diversification of the gas suppliers, sources and routes is the strategic task for the Baltic gas sector to increase its sustainability and security.

3. The Baltic States: Risk Assessment

There are a lot of interpretations of the gas supply security in the political documents and scientific publications. The essence summarized is "the guarantee that all the gas volumes demanded by non-interruptible customers will be available at a reasonable price" (Luciani 2004).

In any case, the SoS is a multi-dimensional issue, it includes energy aspects (source security), availability aspects (security of delivery) as well as aspects of affordability (economic security). More detailed analyses include a number of components (see, e.g., Jansen *et al* 2004, Jansen, Seebregts 2010, World Energy Council 2008). The problem includes very different sets of aspects, which form the base for the assessment:
- European, regional and national issues;
- Short-term and long-term aspects;
- Evaluation of disruption risks vs economic reasonability, security costs;
- System risk – centralized vs distributed/networked system;
- Stakeholders' impact – private (quoted in stock exchange?) and state owned actors;
- Unbundling / market measures vs vertical integration / non-market measures.

Disruption of the gas supply far exceeds the losses of suppliers and consumers (Umbach 2010). They affect inflation and payment imbalances, unemployment and broadening social programmes. At the same time the care of security on national scale should not exclude problems of any household supply security.

It is very popular in the Baltic States to speak on political risk and Russian energy policy supervised by the political interests. This approach nowadays is characteristic of any country (the called *resource nationalism*). In Russia, the US and China economics, particularly energy, is not separated from politics (Linde 2007). Not only superpowers have implemented such policy, the governments of the Baltic States have adopted the policy as well.

Stability (lack of investments, political and social instability) in the transit countries is highly evaluated and is very important for the SoS, particularly because these countries usually are not direct partners of the gas supply contracts (Hetland, Gochitashvili 2004). Some small problems of supply in the Baltic region also have arisen due to the transit pipe only, e.g., in 2010 a short (24 hours long) sharp partial reduction (up to 40%) took place in the supply to Lithuania via Belarus. Interconnection Lithuania – Latvia was ready for use but there was no necessity to do it (small consumption because of the summer time).

Quantitative criteria, which characterize various security aspects, also are different (see, e.g., Kruyt *et al* 2009). In addition, remote authors not always are very familiar with the past and present situation in the Baltic gas sector. The result is very different and sometimes subjective assessment.

Detailed analysis of the risk (Ramboll 2009) can be

evaluated as the most comprehensive, detailed and well-grounded. In a large measure it was used as the basis for development of the BEMIP – Baltic Energy Market Interconnection Plan (EC 2009d). The security of Latvia is evaluated as high and comparable with Norway primarily due to the existing Incukalns UGS (Fig. 4). Other security components for Latvia also are assessed as higher ones. Estonia and Lithuania are assessed as lower security countries because of weekly diversified supply – only one pipe of the main supply to each country and small capacity of pipes from Incukalns (Lithuania's situation is evaluated as better – higher pipe's capacity in comparison with Estonia). In addition, the geopolitical risk decreases Lithuania's SoS due to transit via Belarus. Nevertheless, it should be mentioned that partial supply to Estonia from Incukalns during winter is a normal process but one of the short-time problems for Lithuania caused by Belarus – Russian relations was operationally solved exactly by the gas delivery from Incukalns.

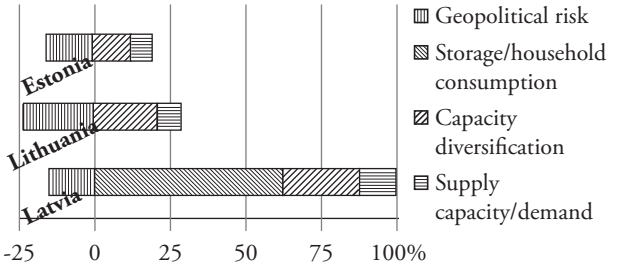

Fig. 4. Ramboll SoS index

Preliminary calculations of n-1 parameters (EC 2009c) reflect the possibilities of the gas supply to non-interruptible consumers if there is a failure of the largest supply infrastructure or source. It has been done for the Member States according to the core postulate of the gas security Regulation (EC 2010b). N-1 is significantly over 100% for Latvia (163%) and Estonia (144%), while Lithuania (57% only) is the least secure of the three.

Academic analysts also offer various security evaluations. Because of the incomprehensible reasons, their approaches sometimes are one-sided. E.g., special risky index is developed by combining import dependency risk and economic importance of gas (Coq le, Paltseva 2009). Another proposal is based only on the ability of a country to replace all the disrupted gas supply by alternative gas and/or alternative fuels (Findlater, Noel 2010). In contradiction to the described above, the assessment find a low level of gas supply security in all the Baltic States. Latvia is evaluated as the least secure of the three (Table 1).

Table 1. Comparison of the risk assessment results in the Baltic States

	Evaluated security level		
Source	*Best*	*Medial*	*Worst*
Ramboll	Latvia	Estonia	Lithuania
n-1	Latvia	Estonia	Lithuania
Coq le	Estonia	Lithuania	Latvia
Findlater	Estonia	Lithuania	Latvia

In general, the risk of supply in the Baltic States could be evaluated comparatively low although quite differently. Due to several aspects, it can and should be decreased further. There are several well-known basic tools to increase the SoS, let us analyse them shortly in the context of the Baltic States.

4. Extended UGS System: Stability of Supply

Underground gas storage is one of the most efficient instruments to increase the SoS. It serves as a secure gas storage facility near customers (shortened supply chain decreases supply risks; the UGS can be used in emergency case) or even equivalent of terminated own gas field for the import countries. The last-mentioned advantage is extremely important for the Baltic States (UNECE 2007). Unique, concentrated geological formations in Latvia (porous sandstone with a good collector capacity in an optimal depth 700-800 m that is covered by gas impenetrable carbonate stratum layer) and Lithuania (definitely there are no storage possibilities in Estonia and Finland) enables the Baltic States to expand efficient use as well as further development of the UGS.

Currently the Incukalns UGS, which is one of the largest storages (4.5 Bcm; active volume – 2.3 Bcm) in Europe, is already exploited for the gas supply during many years. Gas is injected in the low-demand summer period (available and/or cheaper gas) and is withdrawn during high-demand winter period. Evaluation of the gas supply using local Incukalns UGS shows a radical decrease of the supply disruption probability (statistical data of the emergency situation have been used) – around 200 times lower in comparison with the use of more than 3000 km long trunk pipeline from the gas fields in Russia (Davis *et al* 2009).

Operation of the UGS is an excellent example of the

existing long-term successful regional solidarity. Gas is delivered not only to the Latvian customers; partial winter season supply is provided to Estonia and NW region of Russia and occasionally to Lithuania (Fig. 5). Tariff payment for the Incukalns UGS services is approved by the National Regulator Authority of Latvia (16 EUR/1000 cm).

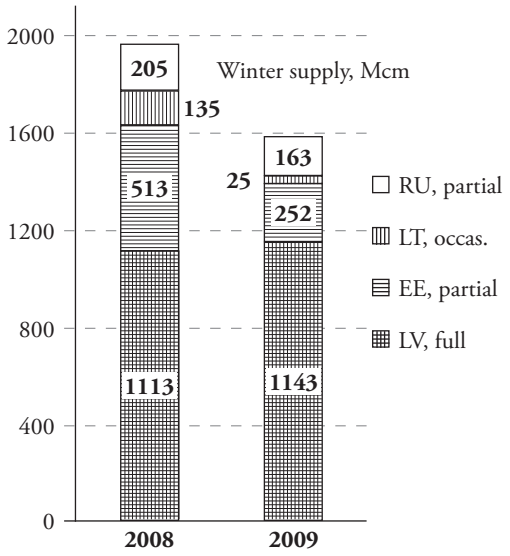

Fig. 5. Delivery of gas from Incukalns UGS (Latvia, 2009)

Natural question arises – can the volume of gas storage guarantee high SoS in the whole Baltic region including Finland and Kaliningrad? Estimating the growth of the annual winter volumes that should be delivered from the UGS till 2020 (up to 3 Bcm), currently existing peak demand (up to 60 Mcm/day) and the growth of the total annual consumption of the isolated Baltic region (up to 15 Bcm), one can find that current capacity is sufficient only for partial supply (even taking into account the planned development of volumes in the Russian Nevskoye and Gatchinskoye UGS) and cannot guarantee perfectly secure supply for the Baltic States.

The actual possibilities to increase significantly the volume of the gas storage in the Baltic region are as follows:

- The extension of Incukalns storage is the major and immediate activity. Technical project of the extension has been elaborated to increase the volume of the storage to 6.2 Bcm including the increase of the active volume to 3.2 Bcm. The evaluated investments for the extension (0.9 Bcm active volume) is 160 MEUR/Bcm (here and further investment figures from Ramboll 2009 and EC 2009d).
- Latvia has at least 11 storage facilities with the total active volume of up to 50 Bcm. Dobele and Blidene are the most explored (including studies and analysis of storage potential and the number of drilled wells) and the perspective UGS. Their active volume would be up to 10 Bcm. The evaluated investment for the Dobele UGS (6 Bcm active volume) is 400 MEUR/Bcm. The development is not reasonable for the Baltic demand only but it would be real and even the best solution for the Central and Western European countries (connection with some trunk pipeline is necessary).
- The exploration of the geological structure in Syderiai (Lithuania) was started in order to determine the suitability of Syderiai to store the natural gas. (potential active volume up to 0.5 Bcm). The evaluated costs are very high – up to 700 MEUR/Bcm. Taking into account previous options, these investments are unreasonable for such a small UGS.

5. Liquefied Natural Gas (LNG): Real Diversification of Supply Sources

LNG supply is a more revolutionary instrument in comparison with the UGS. New gas resources and suppliers (Algeria, Nigeria, Qatar, Trinidad & Tobago) are available for the EU countries on the basis of the natural gas infrastructure (only non-principal technological actions are necessary) and market demand. All LNG technologies are being developed and the costs are decreasing rapidly. Global LNG production capacity is growing (current forecast is 130 Bcm/year till 2013). LNG supplies to EU27 have increased by 23% in 2009. It is forecasted that the increase till 2030 will be 3-6 times bigger.

Furthermore, the *Medgaz* gas pipeline Algeria – Spain (currently LNG covers 60% of Spain gas demand) started operating. It is possible to forecast growing LNG supply possibilities in other European regions. If Russia develops the planned Shtokman and Yamal LNG export terminals, there will be extra options. In general LNG sector is more flexible, it was adjusted to the uncertainties of demand and spot proportion is much higher in comparison with natural gas market.

Therefore, the LNG market is well adjusted to the role of the diversified supplier when gas shortage is in the Baltic States and/or to soften supply conditions. Even high-ranking *Gazprom* officials have admitted that in case of development of additional purchasing capacities on 1/3 of *Gazprom* volume scale (total volume for the three Baltic States is 6 Bcm) by means

such as LNG terminal, *Gazprom* will take actions to reduce prices and/or offer other more attractive supply conditions.

Nevertheless, there are several specific individualities that will make the LNG supply to the Baltic States more expensive in comparison with Northwest Europe. The price premium would be around 8 EUR/1000 cm higher than the UK prices (Ramboll, 2009) because of the following factors:

- Longer transportation distance;
- The Baltic Sea is quite shallow, the capacity of vessels will be less than 50 000 cm of the LNG (30 Mcm of gas); transportation by small vessels is more expensive and reloading (e.g., in Zeebrugge) from typical 145 000 cm ocean vessels is necessary;
- The Baltic Sea is colder; therefore additional re-gasification costs are involved.

The investments in the LNG terminal (related to 1 Bcm capacity) are reverse to the total capacity of the terminal. The terminals with the capacity of less than 2.5 Bcm/year become unprofitable. Considering the consumption of the Baltic Sea region, one joint terminal has to be constructed. Unfortunately, current plans remain uncoordinated, a lot of terminals are recommended even in the BEMIP (Finland, Lithuania, Estonia, and Latvia).

The target costs for 2,5 Bcm/year terminal are around 500 MEUR including storage volume that costs nearly 200 MEUR; therefore, it is unambiguous that the Baltic States has to take up the opportunity to exploit Incukalns UGS as a storage volume and to interlink terminal with the expanded UGS (BEMIP also directly indicates project dependency of all potential LNG terminals with expandability of the UGS). Because of the very similar conditions in the Eastern coast of the Baltic Sea, the port of Riga becomes the top destination for the LNG terminal (onboard re-gasification on ships cannot be evaluated as a possible option for peak and emergency cases).

6. Network Configuration: To the Single Mesh Network via Baltic Ring

Sustainability and security of supply depends very much on the configuration of the supply system (both transmission and distribution networks). Perfect network configuration should ensure several gas flow ways to the consumers; thus delivery will not be cut in the case of pipe damage.

Current configuration of the Baltic gas system (Fig. 3) is a mix of bus-, star- and zipper-style systems (Fig. 6). Sometimes they are hierarchical ones. Low security level characterizes all the systems; any defect creates an outage for some or even many consumers and network configuration does not provide the ways for reserve supply. Only in Estonia there is some kind of imperfect ring transmission system (reverse flows are not technologically feasible).

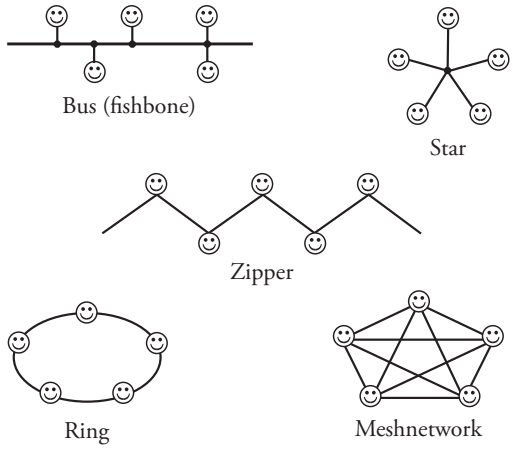

Fig. 6. Types of networks

The Baltic trunk pipeline ring is the first substantial step in order to increase the security of supply although it will be incomplete; reverse gas flows will be feasible to integrate all income gas flows.

Several projects have been included in the BEMIP to increase cross-border capacity and thus to form the Eastern segment of the *Baltic Ring* and to increase security on macro-regional scale. These recommendations are fully acceptable. The upgrade of the Lithuanian – Latvian and Latvian – Estonian trunk pipes is the substantial and cost-efficient activities. Next step – the trunk pipes Finland – Estonia (*Balticconnector* project, cost – 120 MEUR) and Poland – Lithuania (*Amber* project, cost – 300 MEUR). The significance of the last project for the Baltic States will sharply increase if the test drilling for the shale gas near Gdansk will be successful (1000 Bcm capacity of the shale gas field in Poland has been prognosticated).

Mesh networks form the most secure and sustainable supply system. They have already become the basic ones for the electronic communications sector. It is also a trend for a step by step development of the electricity infrastructure. Huge investments are necessary to implement this principle in the gas infrastructure. Careful risk assessment and cost-benefit analysis should be made to evaluate expediency of a

system segment conversion into the mesh network; it also relates to the networks of local distribution.

Synchronous increase of security on national/internal level in general is as much important for consumers as macro-regional security. Duplicate access to the Incukalns UGS, connection of the LNG terminal, and feasibility of reverse flows in distribution network are substantial issues for any consumer.

7. Implementation: Complexity of Actions

Complex and comprehensive implementation of the mentioned infrastructure instruments is a key topic in order to ensure efficiency, sustainability and security of the gas sector. All tools are closely interlinked and interdependent – the LNG terminal and the UGS, LNG terminal and pipelines, UGS and reverse flows, cross-border and national development, etc.

Furthermore, the coordinated systems of electricity and gas supply (e.g., BEMIP projects), networked power supply, that is an advanced basis for the CHP generation (the most efficient technology for the relatively cold Baltic Sea) should become a mainstream for the development of the energy infrastructure in order to modernize the energy sector (e.g., Weisser 2007).

There are several issues that have to be taken into account for the successive implementation. Some of them require modernized political and normative environment.

Risk assessment is an extremely substantial individual activity for any country and/or macro-region to be prepared for crisis situations. It should contain qualitative and quantitative evaluation of risk factors for the specific country/region and their probability. 100% security of technological system cannot be achieved in principle, real security level from consumer's position will be individual and in close compliance with economic situation and possibilities. Contingency and emergency planning that contains all measures and necessary investments is also individual as it is coming out of risk assessment and financial situation. The top-down n-1 principle established in Regulation (EC 2010b), which is binding for all the Member States, is contradictious in terms of the logical bottom-up approach (based on risk assessment).

Investment is a serious precondition for the SoS, the amount of necessary funding is directly linked with the chosen degree of the reasonable security level. Energy policy and security have become top issues in the national security policy; however, it does not always coincide with the interests of the energy companies (Umbach 2010). The focus on market development and competition is resulting in low business interest and responsibility for the SoS as well as the necessity for the adequate financing model that includes public investments. Good intentions and activities of gas supply companies are of crucial importance; public participation will also increase the motivation for the private investments.

There are some findings on the huge investment gap (EC 2010d) and the necessity to partly finance the security infrastructure projects from the EU and national public funds. Unfortunately, the connection between the strategic projects and investment sources on the EU and national level are vaguely defined. One of the possibilities to be discussed is the matching financing of the SoS projects from the national security budget.

Consumers are the most vulnerable stakeholders in the gas market. One of the basic tasks for the regulation is to ensure that the gas price is affordable. Statistics show that low income households (1st quintile) substantially limit the use of gas expending larger share of their comparatively small budget (Fig. 7).

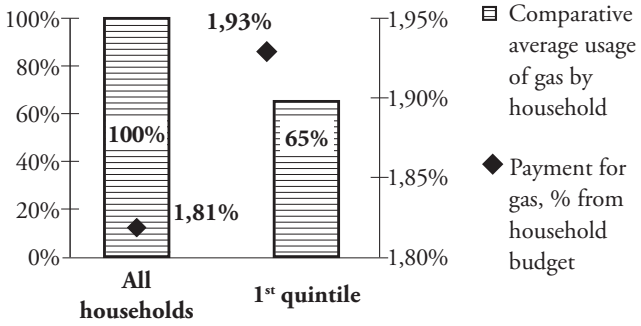

Fig. 7. Households' costs for gas supply (Latvia, 2009)

The EU normative acts have determined special protection rules for the low income and remote customers: „The shared values of the Union in respect of services of general economic interest … include in particular … a high level of quality, safety and affordability … and the promotion of universal access." (EU 2007). "Member States … shall, in particular, ensure that there are adequate safeguards to protect vulnerable customers… They shall take appropriate measures to protect final customers in remote areas who are connected to the gas system." (EC 2009a).

The universal service principle is regarded as a real instrument for the availability of various services throughout the country for any individual. The introduction of this instrument in the gas sector should be considered as a component of the security programme.

All security measures are directed mostly to the protection of non-interruptible customers; security level of customers will become different. Unanswered question is – should the tariffs be different too?

Growing volatility and unpredictability of the gas prices during previous years has initialized discussions on the optimum payment system – on spot or long-term contract basis; the main reason is the lowered prices of spot since the middle of 2008.

But nobody knows how long and how low they will remain Analysing the past situations, one can find alternating situations, e.g., in 2005-2006 and 2007-2008 the spot prices were higher. In addition, large and sudden price spices are typical for the spot market; however, it is not an issue for contract prices. The forecasts prices of spot even for 2011 are highly uncertain (within 100 – 500 USD/1000 cm).

Existing long-term contracts (Estonia and Lithuania – till 2015, Latvia – till 2030) are additional substantial aspects of the SoS for theBaltic States. They increase reliance on the sustainability of the gas supply. Therefore, contract basis should not be changed. Another topic is the achievement of the more balanced and better structured contracts, advanced shift from oil linkage to gas-to-gas (LNG and unconventional gas) competition.

Theoretically competitive environment provides lower gas prices. It could be achieved in stable periods (see, e.g., Kalashnikov, Kalashnykova 2008). It is also mentioned that "each player maximizes his profit under certain capacities constrains". Market practice shows that even the reduction of the small supply causes sharp increase of price. In emergency situations (e.g., if the significant reduction of supply takes place), constrain of competitors decreases or even disappears completely, in reality it means flashes of prices.

Traditionally in *force majeure* and even pre-emergency situations the market is not evaluated as preferable tactics. The Regulation (EC 2009b) also provides for the non-market based measures as the last resort in emergency situations that clearly accepts their higher efficiency in comparison with everyday market measures. The pre-emptive introduction of the non-market measures in alert or early warning situation would prevent this groundless increase. In addition, the proposed typical huge bureaucracy has to be revised: even in the emergency case 10 days are necessary for decision-making procedures.

The relevant and politically sensitive topic is the issues of the third party access to the gas infrastructure. Similar tactics has already been applied during the last few years in the electricity networks. This experience has to be taken into account.

It is the demand of the updated EU gas legislation (EC 2009a, EC 2009b) to facilitate the entry for the new suppliers to the gas market. Derogation of the corresponding articles has been approved for Estonia, Finland and Latvia because of the isolated infrastructure of the gas supply. There is no legal pressure on these countries to unbundle networks. Lithuania has not asked for derogation (reasons are not completely clear).

The owners of the infrastructure are not very interested to invest in transmission and distribution capacity reserve because they are not in the direct contacts with the consumers. Furthermore, sometimes it would be more profitable to ensure less than 100% peak demand (not speaking of the security demands) in order to cut down investments. The result is inadequate and ageing European electricity infrastructure (lot of blackouts in last years). Integrated company is more interested in the security and sustainability of supply.

The same relates to the third party access. It is also not an end in itself; it should be a tool to improve quality and security of supply as well as the affordability of the prices. If the vertical integration is the encouraging factor for the stability and sustainability of the oil markets (Hafner 2010), why would not it be acceptable to the similar gas markets (see also concerns in Ming-zhi 2009)?

It is necessary to evaluate the introduction of the mentioned open market instruments when the possibilities of the real competition exist (e. g. the LNG terminal will be constructed or interconnection with the European gas system created). While it is impossible to import gas from elsewhere than *Gazprom,* there is no practical sense to do it.

The shareholders' interest of *E.ON* and *Gazprom* is a closely related. Well-balanced composition of the shareholders (gas supplier and experienced manager

of the Western style gas business) in combination with the high-skilled regulation is the advantage of the Baltic countries (sustainable supply and the lowest gas prices throughout the EU in the non-competitive environment). We can add close cooperation factor of the shareholders in the European scale projects. Long term review of the processes in *Latvijas gaze* shows radical increase of the company efficiency and reliable gas supply. Naturally, both shareholders are already very dissatisfied with the political decision on currently premature unbundling activities that will decrease value of the assets in Lithuania and Estonia. It will lower neither the supply risks, nor the gas price.

The gas networks similarly to the electricity ones have gradually become more *intelligent* (management of flows, dispatching, process efficiency, etc.) due to the electronic information processing and management. Security and reliability of information systems in full measure determine the security of the gas supply. The high level of the information system cyber security is of the same importance. Physical harm of the infrastructure is of low-probability but to attack networked information system is comfortable in comparison with the damaging pipes and storages. The cyber attacks are highlighted as the greatest security threats for the infrastructure.

Intelligent energy grids are vulnerable to cyber attacks. Potential danger is expected not only from the terrorists, political or economic reasons may also harm. *I*n April 2009 the reports were made that the foreign spies had infiltrated the US electrical grid and installed software to be used to disrupt the system.

The issues of the cyber security in the critical infrastructure are now the top international priority; they should be included in the programme of the gas supply security.

8. Solidarity and Partnership of the Countries

Solidarity, partnership and conformity of the countries in policy, actions, investments is one of the strategic pillars to implement recommended strategy and instruments, and ensure efficient, sustainable and secure gas supply (EC 2010a). The security problem cannot be solved on the national level. The security of supply is a macro-regional problem and the above described security tools (interconnection of the pipeline systems, diversification of supply, LNG terminals, UGS) are transnational instruments. On the other hand, the global or European scale is not purposeful for the identical tools and measures due to very different situations.

Macro-regional priority of the security policy (EC 2010b) is the only way to achieve energy-efficient and energy-secure Europe. Despite the accumulated solidarity practically related to the exploitation of Incukalns UGS, some reasonable doubts remain on the capability of the Baltic States to cooperate in the energy sector. There are several unsuccessful cases, e.g., liquidation of the common dispatch centre *DC Baltija*, long-term stochastic activities related to *Visaginas Nuclear Power Plant* project. The evaluation of the current policy of the sector and shift to the more balanced cooperation and competition of the Baltic States is necessary for achieving reliable gas supply.

At the same time the macro-regional principle established as legally binding by the Regulation (EC 2010b) is too narrow. Internal market depends very much on the external supply. Let us remember the import of 60% in the EU current natural gas balance. Both 2006 and 2009 gas crises clearly showed that the EU cannot solve the problem alone. The Strategy (EC 2010a) shows the right way – harmonized external energy policy, consolidation of the gas supply, transit and consuming countries (adding Russia and Belarus to the Baltic macro-region). The expansion of the macro-regions and solidarity (centralized dispatching, coordinated and solitaire investments, etc.) will ensure more reliable supply (see also Roze 2007).

Recently approved EU Regulation EC 2010b provides a political and normative base only for the EU Member States as the long-term discussions with Russia were not very successful (e.g., Energy Charter and Transit Protocol). To incorporate third countries, a conjunctive political environment is necessary. Political contacts between the EU, Russia and Ukraine were the primary steps to solve the crises.

The United Nations regional branch the United Nations Economic Commission for Europe (UNECE) could become the right institution to manage this job. It corresponds to the major action line of the UNECE: promotion of the pan-European economic integration, policy advice and assistance to governments, cooperation with other players and key stakeholders, notably business community. The UNECE has already become a venue for:

- Dialog,

- Common position development,
- Coordinated policy and activities,
- Monitoring trends,
- Developing legally-binding international agreements and instruments,
- Assistance in implementation.

The UNECE is very qualified for this kind of work because it unites all the countries and sustainable energy supply is the major activity (see, e.g., UNECE 2010). The Commission has power to launch a wide range of activities (including diplomatic ones) that is necessary for successful implementation of the recommendations. The UN also has the experience that has to be learned from as it has started global activities related to the Internet security according to the resolution of the World Information Society Summit 2003-2005.

The National Regulatory Authorities have to become the basis of the experts delegated to the working groups. The experts have a long experience in reconciling the interests of the gas suppliers, consumers and the national interests. At the same time participation and cooperation with the gas providing companies is absolutely necessary. United expertise, experience and capacity will help to find optimum cooperation between the countries and optimum unified instruments on macro-regional level. Close cooperation with the councils of the European energy regulators will be very useful. It relates especially to the ERRA (that unites non-EU countries too) as well as to the newly established EU regulatory group ACER. It will also become possible to eliminate inconsistency of the regulatory environment in various EU as well as non-EU countries.

Conclusions

Current gradual shift in the EU energy policy is favourable for the Baltic States. The more pragmatic approach to energy costs, strengthening cooperation with the supply countries, huge investments in the infrastructure are relevant issues for the Baltic States. The role and significance of the stable, secure and sustainable natural gas supply is accented in the modernized strategy and accompanied by the normative documents.

Careful and comprehensive risk assessment shows high but different security level in the Baltic States; nevertheless, security level has to be improved further. Latvia enjoys the best situation of the three, mainly due to the existing Incukalns UGS. Other countries also exploit the capacity of this UGS. The Baltic States have already accumulated the practice of significant solidarity.

Only smart energy policy and associated advanced comprehensive instruments ensure more secure and sustainable gas supply for the affordable prices. Complex implementation of economically efficient infrastructure instruments, updating normative environment, strong partnership with the partners of supply and transit and their involvement in common activities is the right strategic way. Projects and measures for the increase of the SoS in the Baltic States are planned and first steps for their implementation already has been made.

The macro-regional principle is an advantageous one for the small Baltic States. The comparison of the potential infrastructure developments shows that the most efficient option is the pan-Baltic LNG terminal that is interlinked with the expanded UGS (Findlater *et al* 2010). Naturally, the upgrade of the cross-border pipes is necessary. Security tax on gas would be around 5% (Fig. 8). Any national-scale LNG project will be more expensive, especially those in Estonia and Lithuania. Figures show that Latvia is not interested to invest in the Baltic pipe because this option is more expensive in comparison to the national LNG terminal.

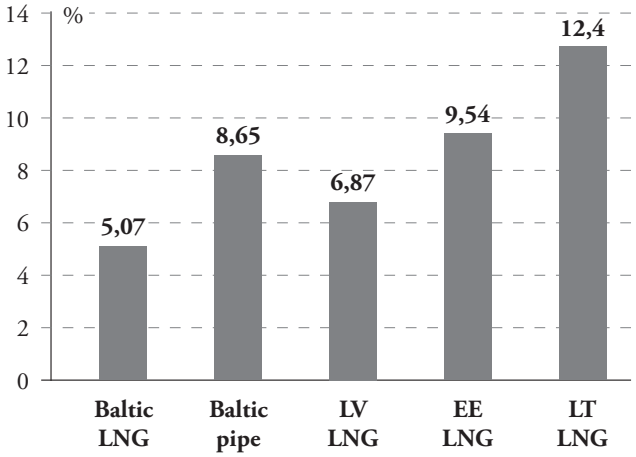

Fig. 8. Security tax on gas (%): options (Baltics, 2009)

The Baltic trading hub, which is based on the Baltic LNG terminal and Incukalns UGS, could be gradually developed in the future.

The pan-Baltic political and economic cooperation, efficient partnership of the gas companies is the cornerstone for success, some existing bottlenecks for the Baltic cooperation has to be overcome. But the

UNECE as a political venue for all the European countries would be very catalytic for the achievement of progress because of the UN plans to declare the year 2012 as "The Year of Energy Access".

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