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Economic and Monetary Affairs

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Gas and Oil Pipelines in Europe

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DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICIES

INDUSTRY, RESEARCH AND ENERGY

An Assessment of the Gas and Oil Pipelines in Europe

AN EXTENSIVE BRIEFING NOTE

The EU-27 existing gas and oil pipeline infrastructures are quite complex and in need for improvement. This briefing note is an objective presentation of technical, economic and political issues related to oil and gas pipelines. Among others, the challenges related to security of supply, energy efficiency, transparency as regards Third Party Access to infrastructures are identified and discussed.

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LIST OF ABBREVIATIONS

BPS	Baltic Pipeline System
bcm	billion cubic meter
BGI	Baltic Gas Interconnector
ECT	Energy Charter Treaty
EFET	European Federation of Energy Traders
ERGEG	European Regulators' Group for Electricity and Gas
ENTSO	European Network of Transmission System Operators
EU	European Union
GALSI	(Gasdotto Algeria Sardegna Italia) : Gas pipeline Algiers, Sardinia, Italy
GTE	Gas Transmission Europe
ICT	Information and Communication Technologies
IEA	International Energy Agency
IED	Improvised Explosive Device
IKL	Ingolstand-Kralupy-Litinow pipeline
LNG	Liquefied Natural Gas
mcm	million cubic meters
MEPs	Members of European Parliament
MS	Member State
MVL	Pipeline Mineralölverbundleitung
NEPS	North European Pipeline System
TAL	Transalpine Pipeline
TEN-E	Trans-European Energy Network
TGI pipeline	Turkey-Greece-Italy pipeline
TPA	Third Party Access
TSO	Transmission System Operators
UK	United Kingdom
US	United States

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EXECUTIVE SUMMARY

The EU's increasing dependence on oil and gas imports is one of the major energy challenges at today's agenda. Thus the EU has a strong interest in a well-functioning and robust oil and gas market.

It is evident that the current EU energy map is in need for improvement. As means of transportation of natural gas is limited to inflexible pipes, the EU gas infrastructure is quite complex. Oil transport infrastructure is less complex as oil is often transported by alternative transport means, i.e. tankers. In the light of the recent gas supply disruptions as a result of the political turbulence between Russia and Ukraine, the security of supply issue is at today's agenda. Against this background there is an urgent need to reconsider the existing oil and gas infrastructures including ways of improving these.

The purpose of this extensive briefing note is to present the main problems related to pipelines that should serve as a factual document for decision-making. It also contains a brief presentation and evaluation of options. The issues presented here relate to the existing technical capacities, market aspects and political considerations.

The current European gas network is quite young and well functioning from the operational point of view. To increase the import capacity and reduce the dependency on suppliers, a number of infrastructure projects supported by the EU have recently been initiated. There are, however, still a number of challenges facing the EU gas market which need to be resolved. These include inter alia reducing the vulnerability to gas supply shocks, facilitating the development of an integrated gas market, planning for increasing import dependency and addressing climate change issues. The major feature of the EU internal pipeline is the limited connections between the Western pipeline network and the Eastern infrastructure. There are issues concerning the technical part of gas transmission, those related to reverse flow, energy efficiency and different standards. Only 20% of the oil are imported through pipelines, whereas pipelines account for 85% of the natural gas. The gas infrastructure is subject to Third Party Access (TPA) where oil infrastructure is subject to general competition rules in the EU.

While the market for oil transmission services has generally been considered open, efforts have been required by the legislator to regulate the free access to the market of gas transmission services. Security of supply is one of the priority objectives of the EU's new energy policy. The Commission is concerned that Europe's energy networks are no longer up to the task of providing secure energy supply in the foreseeable future. The physical ruptures of energy transport networks following the crises with transit countries (Ukraine in 2006 and 2008 and Belarus in 2007) have forced the EU to adopt the strategy of diversifying supply routes which would gradually reduce its dependence on transit countries.

Due to its transnational character involving a diversity of stakeholders, the cross-border pipeline projects require close cooperation between states. As the existing EU gas market has a regional character, there is a need for improving energy networks. Regional cooperation is in particular crucial for gas infrastructure to ensure a timely response in case of crises. Energy networks must take a more prominent place in energy policy development and implementation. Transparency should be improved to resolve the issue of consolidation and concentration of national markets which constitute a barrier to a sufficient expansion upstream. EU legislation needs to be improved to provide a special decision-making process to respond to oil emergencies. There is likewise a need to harmonise security of supply standards among Member States as well as to improve information requirements to ensure transparency as concerns third party access to TSOs. To reduce the import dependency on Russia and unstable transit countries, a diversification of supply routes is needed.

1. OIL AND GAS SUPPLY CHAINS

KEY FINDINGS

- The supply chains for gas and petroleum products differ from each other;
- Natural gas transmission is regulated by provisions on Third Party Access (TPA);
- For the oil sector transportation and storage is cheaper and more flexible. General EU competition rules apply for transportation of oil products.

The delivery of petroleum products and natural gas to final consumers requires long chains of sequences activities involving large-scale investments. The supply chains for gas and for petroleum products differ from each other, and it is important to understand how.

1.1 Gas Supply Chain

The gas supply chain comprises:

- Exploration and production;
- Delivery to connected transmission pipelines or liquefaction, sea transport, import, gasification and input to transmission pipelines;
- Transmission, storage and bulk supply to large consumers directly connected to the transmission system and to distribution companies;
- Distribution, storage and retailing of gas to industrial, commercial and residential consumers.

The price of natural gas is normally specific and linked to supply source and the specific usages of the natural gas at the end-user. Only in the most developed markets (US) there exists a liquid short-term market for natural gas. Traditionally, gas is traded on long-term contracts, unlike oil products which are traded on a competitive world market.

Due to the structure of the gas supply chain, where the means of transportation of natural gas is limited to inflexible pipes requiring large investments, natural gas transmission has traditionally been a monopolistic industry. Today it is regulated by specific EU legislation on Third Party Access and open access to the infrastructure.¹ A number of other specific rules ensuring competition in natural gas apply to the sector and its pipeline systems.

1.2 Oil Supply Chain

The oil supply chain comprises:

- Exploration and production;
- Transport by pipeline, rail or ship;
- Refining of petroleum products;
- Storage and distribution of products by pipeline, rail, road tanker or ship;
- Retailing to final consumers;

According to the Commission Staff Working Paper: Oil Infrastructures - An assessment of the existing and planned oil infrastructures within and towards the EU², the EU oil market has generally been considered as an open market where crude and refined products³ move smoothly and freely. Nevertheless, doubts have recently been raised whether legal, technical and logistic obstacles might prevent genuine free trade and circulation of crude and oil products.

¹ Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the Internal Market in natural gas and repealing Directive 98/30/EC.

² COM (2008) 782, Brussels 13.11, 2008 SEC (2008)2869.

³ Petrol, diesel, kerosene and others.

The oil sector differs from other energy sectors in terms of storage, transmission and distribution since oil and its products can be transported easier and cheaper than gas and electricity. In particular, transport and distribution of oil and refined products in the EU Internal Market can be assured by many different competing infrastructures: pipelines, short-sea shipping, inland waterways, and railway and road transportation, as further described in chapter 2.3 and table 2.

Due to this multiple choice of transport options in contrast to the gas markets, the oil sector has not been regulated by specific EU legislation on third party access (TPA) for transport and distribution. General EU competition rules apply.

2. MAPS OF OIL AND GAS PIPELINES

KEY FINDINGS

- There is an increasing gap between the EU-27 gas consumption and own production, which will change future supply patterns both internally in the EU-27 and from outside the EU-27. Strengthening of existing supply corridors and establishment of new ones will be important;
- The internal EU-27 gas pipeline system has shown to be flexible and well functioning even under cold conditions, but with very high capacity usage at some interconnections;
- The 20-20-20 climate objectives will affect the gas demand significantly. Gas demand could increase due to the need for gas-fired power plants to cover the demand when the wind does not blow. How climate objectives will affect the future demand patterns and pipeline infrastructure should be investigated further;
- Only a small fraction of oil products import and transportation uses pipelines. 80% are transported by vehicle, ship and train.
- The oil pipeline link between Eastern and Western Europe is weak;
- Eastern Europe is vulnerable to the supply of Russian oil and changes in Russian means of transportation and export terminals.

To understand the underlying challenges and future opportunities of the oil and gas pipeline infrastructure, an understanding of current capacities and utilization is necessary as well as of the balance between the current and expected future supply and demand situation.

2.1 Oil and Natural Gas Network Capacities, Supply and Demand

The gas demand in the EU-27 has increased during the last 50 years and today amounts to approximately 500 bcm⁴. A consumption forecast has a high level of uncertainty. Consumption depends on level of gas prices, on financial growth and political priorities. A major driver is the increased focus on climate challenges (the 20-20-20 objectives)⁵, which will accelerate renewables and increase the energy efficiency considerably. Even in a renewables and energy efficiency scenario, the EU-27 energy consumption by 2020 (see figure 1 in the annex) is assumed to be approximately at the level of today⁶. The figure also shows a high degree of uncertainty where scenarios are varying from minus 5% to plus 21% by 2030.

The EU-27 gas production is expected to decrease from the level of around 200 bcm today to approximately 100 bcm in 2020⁷. Even in the renewables and efficiency scenario, net imports will increase by approximately 100 bcm, corresponding to a 30% increase compared with today.

New predictions of the EU-27 energy supply picture (based on the PRIMES model) showing the picture when 20-20-20 objectives are fully implemented will still increase the import demand by approximately 10%. All predictions are quite uncertain, and in case of higher demand than predicted, additional investments in import capacity will be the consequence.

In addition, it is very difficult to predict how the 20% renewables scenario will affect the natural gas demand. If the wind does not blow, there is a need to increase the generation capacity. Gas generation is very well suited for this due to its flexible production ability (can quickly be turned on/off) and relatively low capital cost, but high operational cost.

⁴ BP Statistical Review of World Energy 2009.

⁵ COM(2008) 30 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions 20 20 20 by 2020 Europe's climate change opportunity.

⁶ IEA and European Energy and Transport (PRIMES).

⁷ European Energy and transport trends to 2030.

The EU-27 import capacity is under normal cold conditions utilized in average between 70-80%. Under exceptionally cold conditions this is seen to be 90%⁸ plus, but varying considerably from different entry points, and nearly 100% utilization from the Eastern corridor.

Having a minimum 10-30% import increase by 2020 in mind, it is evident that the future EU-27 import capacity has to be increased.

The gap between consumption and the EU-27 own production of 300 bcm is today covered by imports from Russia of 115 bcm, from Norway of 90 bcm and from Algeria of 50 bcm, in all three cases by means of pipelines, and 45 bcm further imports were Liquefied Natural Gas (LNG). Closing the future gap due to a decline in own production is foreseen to be covered by increased exports from the Norwegian area, by an increase in LNG imports and the remaining part to be covered by projects under construction, e.g. Nord Stream (50 bcm), Medgaz (8 bcm) and Nabucco (31 bcm). Together with other possible import projects and interconnections (see chapter 4) this will create a flexible, diverse and robust import capacity system.

The present utilization of below 50% for LNG facilities is a good possibility to increase the LNG imports, thus diversifying even more.

In the long term, focus will shift to ensure the availability of gas by filling the import pipelines and LNG import facilities. The largest reserves within pipeline distance and with LNG capacity are found in the Russian Federation, Iran and Qatar. Russia alone would be able to supply the EU-27 consumption of 500 bcm for 90 years.

2.2 Natural Gas Pipelines

The European gas network has been established gradually during the last 70 years. Generally, the European gas infrastructure is quite young and replacement is only considered a major issue in a few Member States. Initially, the European gas system was developed around national gas fields in Southern France, Northern Italy, Germany and Romania.

In the 1960s the large gas field Groningen was found in the Netherlands. Large scale gas import from Norway, Russia and Algeria took over as the main source of gas supply in the 1980s after the two oil crises.

In the 1990s gas was introduced and developed in Greece, Portugal and Ireland. After 2000 there has been focus on connecting the UK gas market to the continent and the Norwegian gas fields, connecting new Member States to the EU-integrated system, creating new import channels as pipelines from North Africa, the Caspian Sea and establishing new LNG import facilities⁹.

Please see map 1 for a detailed mapping of both existing and planned gas pipelines and LNG facilities¹⁰ (in map 1 of the annex, a compressed view is shown for overview purpose).

When presenting and discussing gas infrastructure for the purpose of understanding infrastructure challenges and opportunities and to prioritize between them, the gas infrastructure map has been divided into 4 regions: i) The Northern Region, ii) The South-Western Region, iii) The South-Eastern Region, and a sub-region iv) Baltic integration region¹¹, see table 1 in the annex for details. The criteria for those regions are primarily the origin of the main source and secondary source of gas, geographical distances to new sources and pooling of gas storage.

⁸ Estimated on data from GTE Winther Outlook 2008/2009, Source: www.energy-regulators.eu.

⁹ Historical development based on: Energy Priority Corridors for Energy Transmission, Ramboll/Mercados, November 2008.

¹⁰ Source: Petroleum Economist, 2008 edition.

¹¹ Priority Corridors for Energy Transmission, Ramboll/Mercados, November 2008.

2.2.1 Pipelines from Third Countries (Import Pipelines)

There are roughly speaking four main possible gas corridors, with different maturity, challenges and future possibilities, see map 3 in the annex, showing existing main corridors and planned future strengthening projects:

- *The main North-Eastern corridor from Russia:*
This is the main external source of supply with 23% of the EU-27 consumption (115 bcm). From the northern Russian sources two main supply traces (Northern Lights and Druzhba Gas Pipeline) with pipelines in parallel mainly supplying the EU-27 Northern (via Poland) and South-Eastern region (via Slovakia).
- *The North-Western corridor from Norway*
Imports from Norway account for approximately 18% of the EU-27 consumption (90 bcm). From the sources in the North Sea several pipelines connect to the EU. The Langeled, Cats, Seal, Sage, Pulsmar pipelines connect to the UK for consumption in the UK or transit. Europipe I/II, Norpipe, Zeepipe are pipelines connected directly to the continental EU import points in Emden and Zeebrügge.
- *The South-Western Corridor from Algeria*
Imports from Algeria account for approximately 10% of the EU-27 consumption (50 bcm). The GPDF pipeline via Morocco to Spain and the Trans-Mediterranean pipeline to Italy.
- *The South-Eastern Corridor from Caucasus/Central Asia/Middle East via Turkey/the Black Sea).*
This import route is under development and is seen as a major priority area for the EU-27 security of supply, as this route has considerably future supply potential.

2.2.2 Pipelines within the EU

From the main import points for gas and LNG, shown in map 3 in the annex, gas is distributed across the EU-27. The internal transmission grid is especially dense in areas with many import points, e.g. in the Emden and Zeebrügge area and at the Eastern boundaries. Because of the cost of transportation, the gas is normally consumed as close as possible to the source. Therefore only few pipelines internally are dedicated to transmission over large distances. Transgas I/II is an example of a long distance transmission connecting to the Druzhba Gas Pipeline. Each Member State transmission system is well integrated in the overall system and Transmission System Operators (TSOs) are managing cross-country transmission.

Underground gas storage facilities are used to balance demand and supply. Especially Germany, Italy and Austria have high storage capacity.

The internal integrated EU-27 gas pipeline system is relatively young and well functioning from an operational point of view. Supply and demand have shown to be balanced in a satisfactory way, even under extremely cold conditions. Gas Transmission Europe has in the GTE Winther Outlook 2008/2009 performed an analysis confirming this picture where the EU-27 internal gas capacity/demand balance has shown considerable flexibility in normal cold conditions, and in several countries even in exceptionally cold conditions. This indicates that the internal gas pipeline system is functioning well. Some interconnections (see section 4.2), however, have a very high degree of utilization, and due to the security of supply aspects strengthening of selected interconnections should be considered.

One could argue in a future demand scenario with renewables and energy efficiency that there will be a reduced need for infrastructure upgrade internally. To some extent, this could be true. The decline in own production and increased imports will, however, affect the flow patterns significantly, and may call for infrastructure change projects in the EU-27, especially increased investments in storage capacity, additional capacity at import entry points and interconnectors (see section 4.1).

2.2.3 New Pipelines and Supply Routes for Gas

As for the construction of new infrastructure, the Commission decided on a list of ten gas and electricity projects (not oil) of "European Interest," with the goal that seven of them would be up and running between 2010 and 2013.

The following projects have begun service:

- Green Stream, connecting Libya and Italy through Sicily;
- Balgzand-Bacton between the Netherlands and the UK;
- The Turkey/Greece section of the Turkey-Greece-Italy pipeline (TGI).

The following projects are under development:

- Transmed II, between Algeria, Tunisia and Italy, through Sicily;
- Medgas, connecting Algeria and Spain;
- The Greece-Italy section of the TGI Pipeline;
- Nord Stream, between Russia and Germany;
- Galsi, connecting Algeria to Italy via Sardinia with a branch to France via Corsica;
- Nabucco 2010 connecting the Caspian region, Middle East and Egypt via Turkey, Bulgaria, Romania, Hungary with Austria and further on with the Central and Western European gas markets.

These infrastructures will increase the import capacity by around 80 to 90 bcm, covering between 16% and 17% of the gas needs in 2010. In map 3, existing and planned import points are shown. New planned import points will strengthen imports to the South-Eastern region (especially Nabucco), to the Northern region (Nord Stream) and to the South-Western region (Galsi, Medgaz).

2.2.4 Future Trends

Despite of progress in the EU infrastructure priority projects, there are still major future challenges facing the EU gas market, amongst others:

- i) to reduce the vulnerability to gas supply shocks;
- ii) to plan for increasing import dependency and the uncertainty about the availability of gas reserves;
- iii) to facilitate the development of an integrated gas market, due to the EU enlargement;
- iv) to handle the climate challenge where natural gas will be both a bridging and a future energy source;
- v) to prepare the coming investments for climate change impacts on the pipeline routing and other infrastructure in order to integrate increasing climate risks into investment planning¹².

As part of the Commission's five-point Energy Security and Solidarity action plan¹³, the above mentioned four areas for gas will be strengthened. The development of a Baltic interconnection plan will improve the integration of the missing continental members. Development of a Southern Gas Corridor for Caspian supply source and future Middle-East sources will improve the security of supply. An LNG action plan for all Member States will improve the diversity and security of supply, especially for countries relying on sole suppliers.

¹² This issue is further addressed in the Acclimatise (2009): Building Business Resilience to Inevitable Climate Change - the Adaptation Challenge. Carbon Disclosure Project Report 2008, Global Oil and Gas. Oxford.

¹³ Second Strategic Energy Review - Securing our Energy Future.

Completion of the Mediterranean ring by connections to Italy-Greece, Algeria-Sardinia and internal Italy-strengthening projects will improve the security of supply and diversity. Development of a North-South gas interconnector in the Central/South-Eastern Europe (e.g. Poland-Slovakia-Hungary) will strengthen the supply of the countries in the region while reducing their dependency on Russian supplies. In its Non-legislative Resolution¹⁴, the Parliament sets out the following priority objectives that require special attention in the nearest future:

- Diversification of sources and routes of supply, particularly the development of a Southern gas corridor including the Nabucco, the TGI and South Stream¹⁵ projects.
- It is of great importance that supplies from other countries in the region, such as Uzbekistan and Iran, in the long term represent a further significant source of supply for the European Union.
- The development of gas and electricity interconnections through Central and South-Eastern Europe along a North-South axis is of importance.
- The networks in the Baltic Sea region should be developed and integrated into the Western European network.
- Relations and partnerships with key energy suppliers, transit countries and consumer countries are important and must be deepened. MEPs call for a trilateral agreement between the EU, Russia and Ukraine concerning the transit of gas from Russia to the EU to guarantee the security of supply in the coming years.
- Sufficient LNG capacity consisting of liquefaction facilities in the producing countries and LNG terminals and ship-based regasification in the Union should be available to all Member States, either directly or through other Member States on the basis of a solidarity mechanism.
- There is a need to include Ukraine in the European arrangements for an ongoing dialogue with Russia on account of the key role which Ukraine plays as a transit country.
- In the light of the recent gas crisis between Ukraine and Russia, MEPs call on the European Commission to propose, by the end of 2009, a revision of the Council Directive 2004/67/EC concerning measures to safeguard the security of natural gas supply.

2.3 Oil Pipelines

Oil import to the EU is significant and import is assumed to increase from 84% in 2006 to more than 90% of total oil demand in 2020 when only 53 Mtoe will be produced in the EU due to the depletion of EU's own indigenous oil resources. In 2006 oil and petroleum products covered 37% (673 Mtoe) of the EU-27 primary energy demand¹⁶. In the same year, the EU indigenous production of oil was 123 Mtoe.

The 2007 PRIMES Baseline Scenario, , indicates that oil with 702 Mtoe will still represent more than 35% of the EU's primary energy demand in 2020¹⁷. PRIMES has also developed a number of different scenarios, assuming various future oil prices leading to different levels of demand, but the import share will be more than 90%

Oil import through pipelines, however, only accounts for a limited share of the total import. Most of the imported crude oil (80%) is brought in by tankers and vehicles, and only 20% arrive through two pipelines: Druzhba and Norpipe. Oil pipelines from third countries are therefore currently of limited importance for the energy supply in the EU¹⁸.

¹⁴ EP non-legislative resolution 03/02/2009.

¹⁵ <http://south-stream.info/?L=1>.

¹⁶ Eurostat: "Energy - Yearly Statistics 2006".

¹⁷ http://ec.europa.eu/dgs/energy_transport/figures/trends_2030_update_2007/Index_en.htm.

¹⁸ COM (2008) 782, Brussels 13.11.2008 SEC (2008)2869.

Transportation of oil has various forms: pipeline, marine, rail and truck. The characteristics of these and their advantage and disadvantages are shown in table 2 in the annex.

Pipelines and marine transport are mainly used for transportation of crude oil, while rail and trucks are mainly used for transportation of refined products.¹⁹ Transportation in pipelines are characterised by large volumes, high capital cost and very limited flexibility. Transportation in pipelines has also environmental advantages, i.e. lower emissions compared to the other means of transportation.

2.3.1 Pipelines from Third Countries²⁰

Druzhba, the longest pipeline in the world (around 4,000 km) was put in operation in 1964 with the scope to supply oil to western regions of the former Soviet Union and countries of Central and Eastern Europe. The pipeline begins in South-Eastern Russia, where it collects oil from Western Siberia, the Urals and the Caspian Sea. It runs to Mozyr in Belarus, where it splits into a northern and a southern branch, see map 4 in the annex, showing the route of the Druzhba oil pipeline.

The Northern branch crosses the remaining part of Belarus across Poland and Germany supplying the refineries in Poland, Germany and the Baltic countries. The Southern branch runs through Ukraine and splits into two lines to Slovakia, Druzhba and another to Hungary. Druzhba is also connected to the Adria pipeline via Croatia. It is also connected to the Odessa Brody pipeline.

The owner of the pipeline, Transneft²¹, has also constructed the Baltic Pipeline System (BPS). The BPS was completed in 2001, and in 2006 reached a capacity of 65 Mtons per year allowing Russia to divert oil export to the Russian port of Primorsk.

The full capacity of the Druzhba line of 85 - 100 Mtons per year is not utilised due to leaks that have not been repaired yet because of disagreements between Lithuania, Belarus and Russia and due to decreasing oil consumption in Hungary, the Czech Republic and the Balkan States. The current capacity usage level is 65 - 70 Mtons per year.

Due to the dispute in 2007 on oil transit through Belarus, Russia is planning a BPS-2 from Unecha to Primorsk with a transport capacity of 50 Mtons and an enlargement of the Primorsk oil terminal, further diversifying their export routes. The construction of the BPS-2 has started in 2009 and is expected to be finalised in 2013.²² The implementation of the BPS-2 will increase the tanker traffic in the Baltic Sea considerably, creating a risk of accidents and leaks in environmentally sensitive areas. The other concern is that oil targeting Eastern Europe will be more expensive, as the cost of transportation by tanker is higher than that done by pipeline. Russian plans to connect Russia with the EU via the Baltic Sea have not yet been developed.

The 354 kilometre Norpipe starts in Norway and lands in the UK, see map 4. Norpipe carries oil from different Norwegian and British fields. The capacity is 45 Mtons per year, but due to capacity limitations at the receiving point in the UK, only 40 Mtons are utilised. Norpipe is owned by Statoil, the Norwegian state oil company.

¹⁹ Petrol, diesel, kerosene and others.

²⁰ This section is based on Susanne Nies: Oil and Gas Delivery to Europe, IFRI 2008 and the Commission Staff Working Paper: Oil Infrastructures COM(2008) 782 / SEC (2008) 2869.

²¹ Russian national state owned company responsible for oil pipelines.

²² http://www.stroytransgaz.com/press-center/smi/itar-tass/2009_05_14.

2.3.2 Pipelines within the EU²³

The EU internal pipeline network is characterized by the limited connections between the Western European pipeline network and the Eastern infrastructures. Currently, the only pipeline connection between Eastern and Western EU oil networks is the Ingolstand-Kralupy-Litinow (IKL) pipeline with a length of 349 km and a capacity of 10 Mtons per year, corresponding to less than 2% of the consumption in 2006. An additional short link between Bratislava and Vienna has been discussed, but it crosses environmentally sensitive areas around the Danube.

Map 5 in the annex shows the major oil pipelines inside the EU, which ensure transport and distribution of crude oil and refined products in its Internal Market.

The system comprises about 33,000 km of pipelines in the EU-27.²⁴ The owners of the infrastructure in the EU are typically joint ventures of companies from the countries crossed by the infrastructure. TAL (Trans Alpine Pipeline) bringing oil from Trieste in Italy to Austria and Germany is owned by a TAL consortium from the three countries (Germany, Austria, and Italy).

Two other major internal oil pipelines are the SPSE (23 Mtons year) connecting the French port of Fos sur Mer to the French refinery of Feyzin and further up to the German refineries and the RAPL, which connects Rotterdam with Antwerp and Germany.

Another important feature of the internal EU oil network is that the Western part is connected via pipelines to major European ports while most of the Central and Eastern European refineries are supplied through the Druzhba pipelines. If the Russian policy of redirecting its oil export from Druzhba continues, Central European countries might face difficulties and increased costs of their supply of oil and oil products through alternative routes. This points to the fact that there is a clear need for upgrading the oil pipeline infrastructure in the Eastern European countries, which today is left to the market actors to solve.

Another important network of pipelines is managed by NATO, which has operated its own pipeline system since 1950. It covers 11,500 km and operates in 13 countries.²⁵

The NATO network consists of ten separate military storage, transport and distribution systems for oil products. Eight are single nation systems.²⁶ Two are transnational North European Pipeline System (NEPS) covering Denmark and Norway, and a large Central European Pipeline System covering Belgium, France, Germany, Luxembourg and the Netherlands. The total length of CEPS is 5 200 km.

2.3.3 New Pipelines and Supply Routes for Crude Oil

New pipeline projects have been proposed to bring additional Caspian oil production to the international market and the EU, see map 6 and table 3 in the annex²⁷.

The advantage of these projects is that they will permit diversification of routes and sources of supply to the EU and to the international oil market, and some of them link directly to the EU's internal network. It should be noted that the Burgas-Alexdroupolis line represents the first transport pipeline in the territory of the EU controlled by a Russian consortium.

²³ This section is based on the Commission Staff Working Paper: Oil Infrastructures COM(2008) 782 / SEC (2008) 2869.

²⁴ EU Energy and Transport in Figures 2009. Statistical Pocketbook. DG TREN

²⁵ http://www.nato.int/cps/en/natolive/topics_49151.htm.

²⁶ Iceland, Italy, Greece, Norway, Portugal, Turkey, UK and Spain.

²⁷ Based on the Commission Staff Working Paper: Oil Infrastructures. 2008 ((COM (2008) 782) and Susanne Nies: Oil and Gas Delivery to Europe, IFRI 2008.

2.3.4. Future Trends and Conclusions

By 2020 it is foreseen that the North Sea production will decline and 90% of the oil products to the EU will be imported from third countries. Currently, most oil is arriving via ports and tankers and this trend is expected to continue. As increased tanker traffic can be foreseen in the next decades, this raises concerns in relation to the environment: greenhouse gas emissions, air quality, oil spills and accidents. Special attention thus needs to be drawn to mitigate further environmental impacts from oil transportation. Construction of new pipelines can contribute with environmentally viable alternatives.

In particular, Eastern European countries are facing security of supply problems, which could be mitigated by a better oil pipeline infrastructure, improving the security of supply. Due to the lack of regulation of the oil sector in the EU, it is left to the private sector to take initiatives to create new structures. It could be considered, however, whether it is not in the interest of the EU to take complementary political and investment initiatives due to their importance for the security of supply and the environment. The Commission is inter alia looking at these aspects in an upcoming study.²⁸ Initiatives that could be considered in relation to oil infrastructure are:

- Carry out investigations of the functioning of the Internal Market for crude oil and oil products in order to define possible new policy measures;
- Undertake an independent study of the pro et cons of different alternative pipeline options;
- Develop an oil dimension in the Energy Community; so far, only electricity and gas are included;
- Include oil infrastructure in Trans-European Networks; only gas and electricity are included;
- Investigate whether the current environmental obligations are sufficient to mitigate increased environmental pressure due to increased maritime transport of oil;
- Consider the climate change impacts on the oil pipelines and infrastructure in order to integrate increasing climate risks;
- Ensure that the EU's current energy dialogue with the major oil suppliers also pays attention to the issue of oil transportation²⁹.

²⁸ Survey of the Competitive Aspects of Oil and Oil Product Markets in the EU.

²⁹ Oil Infrastructures. 2008 (COM (2008) 782).

3. ISSUES IN RELATION TO PIPELINES

KEY FINDINGS

- Technical issues for gas are more complex and the costs of handling gas are higher than those of oil;
- While the market for oil transmission services has generally been considered open, efforts have been required for the legislator to regulate free access to the market for gas transmission services;
- The framework ensuring fair and non-discriminating access to natural gas networks and a free flow over national borders that has gradually been established by the EU Commission is in need of improvement. In particular, information requirements should be improved;
- Measures should be taken to ensure efficient transnational allocation of available pipeline capacity;
- The transparency of available pipeline capacity needs to be improved;
- Security of supply concerns, i.e. those related to transit routes crossing unstable countries, which poses a big challenge for the EU to secure its long-term energy needs.

3.1 Technical Issues

3.1.1 Gas

Gas transmission by pipeline is the transportation of gas over large distances and under high pressure. The pressure is typically over 80 bars and the pipeline diameter above $\varnothing 500$ mm. The flow is established by a number of compressor stations along the pipeline, and measurement and regulation stations are used to regulate and measure actual flow and gas conditions. Underground storage is gas stored under high pressure in caves, underground formations, depleted fields, etc. Each Member State has a distinct control and supervision system for handling daily operations of the gas transmission system.

There are some issues worth recognizing with regard to the technical part of transmission:

- *Reverse flow:* Despite of several initiatives from the Commission to strengthen competition in the internal gas market and implement rules for access to the transmission systems, there are still a number of restrictions on the reverse flow in the main pipeline systems, which both hinder competition and decrease the security of supply. Establishing reverse flow possibilities is technically relatively easy, as normally only metering stations have to be modified. Missing reverse flow should be identified and improved within a few years time frame to ensure better competition and secure supply.
- *Energy efficiency:* Historically there has been only limited focus on energy efficient design in transmission systems and up till 5% of the energy is used for transportation. Improvement potential should be considered.
- *Standards:* Different standards are used across Member States - both for technical construction and daily operations. A higher degree of standardization will ease the integration and transmission among countries. This will also improve the project execution and the timely delivery of future projects.

3.1.2 Oil

Oil transportation by pipeline involves less complex technical issues, for example an issue such as grid balancing. The oil pipeline transmission grid is relatively simple and easy to balance, as there is less direct integration with consumers. Security of supply is more important for gas than for oil, because of high diversity in supply sources for oil and supplies by oil tanker. Environmental issues differ significantly: where transportation by gas involves a risk of explosion, risks of oil transport are primarily spills to the environment. Because of less complexity in oil pipelines, the costs of transportation are considerably lower.

3.2 Economic Issues

3.2.1 The Nature of Transmission Pipeline Investments

Transmission pipeline investments are specific in three respects. Firstly, they are locked in physically to a specific location between the field of collection and the point of delivery. Secondly, they are specific to the item transported and have little or no value in alternative use. Thirdly, they are characterised by high investment expenditures and very low operational cost, i.e. very capital-intensive investments. The payback time is long and the uncertainties and risks are high. The recovery of the investments in transmission pipelines is therefore normally based on long term agreements.

Due to these specific characteristics, it cannot be expected that private investors will ensure sufficient capacity for gas supply. For oil supply it is different because oil often is more efficiently transported by other means.

The gas transmission systems are located in the EU and are therefore the responsibility of the Transmission System Operators, who have natural monopolies. The task of the TSO is to build, own and operate the backbone infrastructure (transmission pipelines and often also storage facilities) and it is a regulated industry.

The pipeline tariff regulation is based on actually incurred costs and there are detailed rules and regulations in each Member State governing the derivation of the tariff. Tariffs are published by the TSOs and can be found on their websites. The cost of using pipeline capacity depends on the volumes and the transportation distance. For storage capacity the cost depends on the amounts, time and speed of withdrawal from the storage.

The allocation of the transmission capacity is undertaken by the TSOs according to country-specific procedures. Map 7 in the annex displays the companies' and the existing capacity allocation models applied to various cross-border pipelines.

The investors in the pipeline transmission capacity inside the EU are primarily TSOs. Investors in the pipelines from third countries are primarily the companies purchasing and supplying natural gas in co-operation with state-owned or private companies in the selling country.

3.2.2 The Market for Oil Transmission Services

The EU oil market has generally been considered as an open market where crude and refined products move smoothly and freely. Doubts have recently been raised as to whether legal, technical and logistic obstacles might prevent genuine free trade and the circulation of crude and oil products.

For example, one issue of particular concern is the limited connections between the pipelines of Eastern and Western Europe currently connected only through the Ingostadt-Kralupy-Litinov pipeline (see the previous section).³⁰

Oil is not part of the internal energy markets and not covered by the Treaty on the Energy Community. As also mentioned earlier, oil pipelines are typically owned by a consortium of private oil companies in the countries that the lines cross. Extensions and strengthening of the oil pipelines are solely based on private initiatives.

Conditions for access to, purchase and sales of capacity of oil pipelines are determined by the owner and are not regulated by the EU.

3.2.3 Market for Gas Transmission Services

The so-called 'Single Buyer Model' with an integrated economic organisation was the dominant structure for national gas industries until the 90s. The integrated company had monopoly on gas transmission and storage of gas, and exclusive rights to import gas.

Over the last 10 years, beginning prior to the enactment of the first Gas Directive³¹, the Commission has introduced effective unbundling of pipeline and supply activities. It also introduced the concept of TPA (Third Party Access). The initial Gas Directive was followed by a second Directive in 2003³², which requires a more thorough separation of transmission, storage and distribution activities from trading, wholesaling and retailing of gas. Resulting from this process, transmission pipelines have remained a natural monopoly, typically in the hands of state-owned TSOs as mentioned above.

With the liberalisation of the natural gas markets in the 1990s, the access to pipeline transportation has been opened on fair and non-discriminating conditions. A system of pipeline (transportation) tariffs has been established based on actual costs, standardised contracts and detailed regulation of the calculation of these tariffs. Primary markets for trading pipeline capacity have been established. This market is separated from the market where trading with natural gas itself takes place.

The primary duty of gas regulators inside the EU is the regulation to ensure the establishment of efficient operations of the primary market in transmission capacity. It involves control oversight and approval of:

- The allocation of the capacity and the level and quality of transmission services;
- The pricing of transmission and storage capacity;
- Providing sufficient transmission system investments to ensure efficient markets.

In the EU despite the existence of an interconnected transmission system, the parts of the system within national borders are owned and operated by national or even sub-national entities. The pipeline capacity is therefore allocated on a national basis - not on the EU wide basis - even if more than 60% of the EU supply cross more than one internal border.

³⁰ DG TREN has in 2009 launched an ongoing study "Survey of the competitiveness aspects of gas and oil products markets in EU.

³¹ Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the Internal Market in natural gas.

³² Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the Internal Market in natural gas and repealing Directive 98/30/EC.

Strong pipeline structures and EU-wide regulation of the trade with transmission capacity constitute an important condition for the natural gas market in the EU to become efficient, and for the Member States to benefit from a well-functioning market.

3.2.4 Regulation of the Transmission Infrastructure's Role in Ensuring Competition

In a Memo of 25 June 2009³³, the Commission stresses the need for a more transparent access to a cross-border gas network infrastructure. In the Commission's view, there is a need to enlarge the historical boundaries of the national markets to stimulate competition between market participants across Europe. There is also a need for more transparent information on capacity calculation. Without knowing the capacities available and how they are allocated and calculated, companies cannot participate in the energy market using all the available capacity.

The current regulatory framework has limited scope as far as transparency is concerned. The 2003 Gas Directive³⁴ requires that the TSOs publish their allocation methods for transmission capacities and that the national regulatory authorities (Regulators) approve those methods and standards. Since TSOs are monopoly providers of energy transmission services, their internal procedures and dealings are subject to regulatory scrutiny. The Commission's analysis has shown that some TSOs either do not publish this information with the required contents or it is not approved by the Regulator. Therefore, in order to increase market participants' trust, their work has to be organised transparently.

Also, EFET³⁵ considers that the level of information provided by some TSOs needs to significantly improve. The lack of consistency in cross-border information indicates a need for stronger regulatory control over the operational aspects of international pipelines.

The Gas Directive³⁶ requires storage operators to provide users with the information needed for efficient access to storage facilities. EFET stresses that the information must be provided on a non-discriminatory basis. Any information available to one storage user (including the storage operator's affiliated supply or trading businesses) should simultaneously be made available to all users.³⁷

To enhance the functioning of the internal energy market, an amendment³⁸ to the current Regulation (EC) No 1775/2005³⁹ has been proposed. The main proposals for amendment relate to the formalisation of the European groups of transmission system operators for better coordination and, in particular, the drawing-up of joint market and technical codes, improved market operation, in particular greater transparency and effective access to storage facilities and LNG terminals. The amending Regulation 715/2009⁴⁰ has been signed 2009/07/13 and shall apply from September 2009.

³³ Memo/09/297 of 25 June 2009, available at

<http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/09/297&format=HTML&aged=0&language=en>.

³⁴ Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the Internal Market in natural gas and repealing Directive 98/30/EC.

³⁵ Established in 1999, the European Federation of Energy Traders (EFET) is an industry association representing over 90 trading companies operating in more than 20 countries. The EFET mission involves improving conditions for energy trading in Europe and fostering the development of an open, liquid and transparent European wholesale energy market. More information about EFET views and activities is available on www.efet.org.

³⁶ Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the Internal Market in natural gas and repealing Directive 98/30/EC.

³⁷ EFET, Improved publication of information to promote transparency and competition in the European gas market August 2006.

³⁸ Proposal for a Regulation of the European Parliament and of the Council of 19 September 2007 amending Regulation (EC) No 1775/2005 concerning conditions for access to the natural gas transmission networks COM(2007) 532 final - Not published in the Official Journal.

³⁹ Regulation (EC) No 1775/2005 of the European Parliament and of the Council of 28 September 2005 on conditions for access to the natural gas transmission networks.

⁴⁰ Regulation (EC) No 715/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.

3.3 Political Issues

3.3.1 Transnational Pipeline Structures Call for Corporation between States

In the absence of a single overarching jurisdiction, the transnational pipeline structure requires balancing of local law and international considerations. As the diversity of players may aggravate a conflict, each cross-border pipeline project requires transparency and alignment of the interests of all stakeholders.

Specific problems arise in the case of cross-border pipeline projects or regional projects involving different regulatory regime, such as:

- no obvious mechanism for conflict resolution;
- rights and obligations of stakeholders in different States can differ;
- the nature of the gas or oil market may differ greatly between the two countries connected by a pipeline;
- integration of different legal regimes may increase the transaction costs of constructing and operating a pipeline;
- security of imports may be hampered⁴¹

To ensure regulatory coherence and enhanced security of supply, cooperation between States is crucial. As set out in the Commission's second Strategic Energy Review⁴² and the Commission's Green paper "Towards a secure, sustainable and competitive European energy network"⁴³, the EU will be unable to deliver its climate and energy goals without new and improved networks. Energy networks must take a more prominent place in energy policy development and implementation.

3.3.2 Coordination of Allocation of Capacities between Member States

Transparency of available capacity is very important, as sufficient network capacity is essential for market integration and market opening. The European Parliament sets out the allocation of infrastructure capacity among the affected countries, as well as co-ordinated dispatching as one of the key elements to be included in national and EU emergency action plans.

The tendency towards consolidation and concentration of national markets continues, however. In cases where national incumbents are shareholders in transport networks on their markets, their interest in limiting competition in the national market is often a barrier to sufficient upstream capacity expansion.⁴⁴

The ERGEG's⁴⁵ monitoring in 2007 of the implementation of the Electricity and Gas Regulation shows inadequate compliance in areas of core relevance for the development of liquid markets such as transparency and primary capacity allocation. Some 15% of the European gas TSOs do not comply with the gas transparency requirements concerning cross-border energy network access.

⁴¹ Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP) "Cross-Border Oil and Gas Pipelines: Problems and Prospects", June 2003, available at <http://siteresources.worldbank.org/INTOGMC/Resources/crossborderoilandgaspipelines.pdf>.

⁴² Second Strategic Energy Review, COM(2008) 744.

⁴³ Green Paper: Towards a secure, sustainable and competitive European Energy Network {SEC(2008)2869}.

⁴⁴ Report from the Commission to the Council and the European Parliament Progress in creating the internal gas and electricity market Brussels, 15.4.2008 COM(2008) 192 final .

⁴⁵ European Regulators' Group for Electricity and Gas http://www.energy-regulators.eu/potal/page/portal/EE_HOME.

Coordinated planning of investment and testing of market demand are fundamental to capacity provision. Voluntary arrangements such as coordinated demand surveys for gas flows on the Iberian Peninsula, regional transport and a storage investment analysis in the South-East Gas Region have taken place within the Regional Initiative driven by the ERGEG.⁴⁶

3.3.3 Terrorism

Terrorist attacks at the individual oil or gas pipeline may cause significant local and global damage. Local effects are gas leakages and a possible gas explosion. The global effects are possible turbulences in the gas supply and natural gas market, which could burden consumers to a certain extent. Pipelines are vulnerable, as they are 'soft' and hardly defensible targets, relatively easy to hit.

The most common *modus operandi* in terrorist attacks against pipelines as energy-related targets is bombing of pipelines by explosive devices (including bombs, rockets, IED etc).⁴⁷ Although energy supply chains in Europe have so far *not been targeted*, the threat of oil supply disruptions is real and the risks are growing. In order to cope with a disruption, the European Union has to have a robust and reliable system in place which is able to react coherently and credibly in the event of a supply crisis. The threat to offshore pipelines may be reduced by the depth at which they traverse the seabed, thereby presenting a significant difficulty for would-be attackers.⁴⁸

3.3.4 Political Dependence on Transit Routes crossing Unstable Countries

EU natural gas supply is concentrated in a handful of countries (primarily Russia, North Africa and Middle East), some of which are exposed to high geopolitical risks. Supply and pipeline transmission from these countries can be threatened by wars, internal conflicts, export or import embargos and terrorism. Gas transportation through these countries often involve transport along long and vulnerable pipeline routes.⁴⁹

Pipelines constitute a powerful factor of integration with extra-Community regions, with producers (Russia, Norway, Algeria), and with transit countries. The physical ruptures of energy transport networks following the crises with transit countries (Ukraine in 2006 and 2008⁵⁰ and Belarus in 2007) have forced the EU to adopt the strategy of diversifying supply routes which would gradually reduce its dependence on transit countries.⁵¹ The EU speaks thus in strong favour of the construction of new pipelines and direct links, even if the price is higher than using the existing networks or the construction of parallel gas pipelines.⁵²

⁴⁶ Report from the Commission to the Council and the European Parliament Progress in creating the internal gas and electricity market Brussels, 15.4.2008 COM(2008) 192 final.

⁴⁷ Forsvarets Forskninginstitut The Terrorism Threat to Energy Supply Chains, Presentation in Brussels, March 3rd 2009 by Brynjar Lia, PhD Research Professor.

⁴⁸ Civil Protection Network Working Paper 2007:3 "North European Gas Pipeline", Sven Friedrich and Jürgen Neumüller INFRASTRUKTUR & UMWELT Professor Böhm und Partner, available at <http://www.europarl.europa.eu/document/activities/cont/200801/20080129ATT19856/20080129ATT19856EN.pdf>.

⁴⁹ Ibid.

⁵⁰ The recent supply disruption of 31 December 2008 was a result of a payment dispute between Russia and Ukraine, when Russia stopped supplying natural gas destined for Europe to Ukraine. As a result, supplies to Romania, Bulgaria, Greece, Macedonia, Serbia and Croatia were completely halted. It also emerged that several countries, including Bulgaria, did not have enough reserves to make up for a supply cut.

⁵¹ Oil and gas delivery to Europe. An Overview of Existing and Planned Infrastructure des études GOUVERNANCE EUROPÉENNE ET GÉOPOLITIQUE DE L'ÉNERGIE Susanne NIES, available at http://www.ifri.org/files/Energie/OilandGas_Nies.pdf.

⁵² European Energy Programme for Recovery - EEP Regulation (EC) N 663/2009 of 13 July 2009 provided financial assistance to new infrastructure projects in the field of gas supply.

4. INTERCONNECTORS

KEY FINDINGS

- Interconnectors have an important role in establishing both security of supply and to fuel competition in the gas market;
- Zeebrugge and Emden are too important hubs, and development of other hubs should be considered in order to strengthen the flexibility and security of supply;
- New interconnectors are mainly driven by the security of supply, and relevant strengthening will probably demand focus from the Commission in the future.

What is the difference between an interconnector and an “ordinary” gas pipeline? While interconnectors are pipelines, they have also the role of connecting separated systems or markets. They can be reversible, if necessary, and change the direction of supply. In the case of a crisis, during temporary shortages etc, an interconnection thus guarantees supplies to the countries that it connects. Interconnectors have an important role in facilitating the establishment of hubs, where multiple gas flows meet, trading intensity is high and is thereby stimulating competition.

4.1 Identification of Interconnectors

A very important interconnector is the Bacton-Zeebrugge European interconnector, an underwater gas pipeline spanning 235 km, completed in 1997 and in service since 1998. This interconnector has played a considerable role since 1998, because it has put Russian, Norwegian and British gas into competition with each other as well as with LNG. Zeebrugge maintains a key role because of both the arrival of LNG and of the underwater Norwegian pipeline Zeepipe. With Bacton-Zeebrugge came the first natural gas hub in Europe; the two British and Belgian networks were thus connected. Exports through this interconnector doubled between 1998 and 2005. A second interconnector connecting Bacton (Norfolk) to Balgzand (Netherlands) was put into service in December 2006 and strengthened “free gas” imports to continental Europe. Please see table 4 in the annex on the major existing interconnectors⁵³.

Besides the interconnectors mentioned above, two more are planned: the Baltic Pipe and one between Greece and Italy, with a length of 800 km, will enter into service in 2011.

Please see the detailed map 8 in the annex for an overview on existing and planned interconnection points and internal strengthening projects.

As seen from the map, the density of existing interconnection points is high at the western and eastern German borders as well as at the Austrian borders. In the South-Eastern region, several new interconnections are planned to strengthen South-North transits to prepare for supply from the Caspian area and potentially the Middle East.

In tables 4 and 5 in the annex, there is a summary of the existing and planned interconnectors, their location and capacities (if known) and other relevant characteristics. We have also added other possible internal projects to be considered.

⁵³ Source: Oil and Gas Delivery to Europe, Gouvernance Européenne et Géopolitique De L'Energie, IFRI, Paris 2008.

4.2 Challenges in Relation to Interconnectors

In general, interconnectors are facing the same problems and issues as described in the previous section 3 for pipelines in general. The connection of suppliers and consumers through interconnectors is essential to be able to balance demand and supply, taking into account normal differences due to temperature and economic development. Further interconnectors have the function of establishing competition and increasing the security of supply by creating alternative supply routes. For some of the new Member States, interconnectors will secure integration into the existing EU pipeline system.

An analysis from the GTE (see section 2.3) indicates that the EU-27 integrated flow pattern is functioning well from an operational point of view, even under exceptional cold conditions. Nevertheless, the interconnections between Poland/Germany, DK/Germany, the Slovakian Rep./the Czech Rep., the Slovakian Rep./Austria, Austria/Italy and the Netherlands/Belgium are all utilized up to 95%+ under cold conditions, and from an internal security of supply and vulnerability perspective one could consider to strengthen the most utilized internal connections.

As the EU-27 interconnector pipeline system is relatively mature, new interconnectors are mainly driven by the security of supply perspective, and further relevant strengthening will probably demand focus from the Commission in the future.

The depletion of the EU-27 gas fields is one of the most notable changes in the EU gas market at present. Own production is primarily consumed in the UK, Germany, the Netherlands, Italy and Denmark. Reduction in own production will result in a need for an increase in import capacity in those countries. Even more notably the maximum daily delivery capacity will have to be increased, as the gas fields so far have been used as swing producers. The consequences of depletion and the following need for investments in interconnections should be considered. In addition, the 20-20-20 objectives will probably call for a restructuring of the power generation area, which could significantly change gas demand patterns internally in the EU-27. New demand patterns have to be facilitated by an increased capacity in existing or planned interconnectors (along with storage increase and capacity increase at import points).

Many interconnectors are unidirectional because of the nature of the demand pattern. Establishing a reverse flow possibility could strengthen the security of supply in some countries in case of a major disruption, e.g. in the import system. A recent example during the gas crisis in January 2009 has shown the insufficiency of the reverse flow system. There were sufficient amounts of gas available in Austria and Germany, but they could not be transported to the countries hit by the interruption of natural gas supply like Czech Republic, Slovak Republic and Hungary.

5. ISOLATED REGIONS

KEY FINDINGS

- The Baltic countries and Finland are not integrated in the EU-27 gas network, and although they are solely supplied by Russia, they are considered as isolated;
- The northern parts of Poland and central Sweden are undeveloped with regard to gas infrastructure;
- There are political and economic benefits from providing access to isolated regions.

5.1 Identification of Isolated Regions

An isolated region is a region in the EU-27 not yet developed or underdeveloped compared to the gas potential.

5.1.1 The Baltic Region is Supplied, but Not Integrated in the EU Network and Not Diversified

Four continental Member States: Finland, Estonia, Latvia and Lithuania are not connected to the integrated EU network. The Member States have enough day-to-day supplies from Russia, but there is no possibility for diversification. Interconnector projects like Small Amber (Lithuania-Poland) and Baltic connector (Finland-Estonia) could establish integration into the EU network. At the moment there are no firm plans and sponsors to develop the infrastructure. In The Second Strategic Energy Review, actions toward integrating the Baltic region have been proposed. Planning of specific infrastructure activities and integration activities are scheduled to be issued during 2009.

5.1.2 Potential Development of the Northern Regions of Poland

Northern Poland is not developed because of the reliance on coal in the power sector in this area. Natural gas has been less competitive and supply to other regions and industries have been prioritised in Poland. New climate objectives will possibly change this picture.

5.1.3 Potential Development of Gas Infrastructure in Central Sweden

Sweden has is a relatively undeveloped gas market, only the Swedish west-coast is developed to some extent. There is a major potential for developing the Stockholm area and industries in the southern part of the country. This has been discussed for several years, but political priorities have been on other energy sources. The planned BGI pipeline could stimulate competition for supply to Sweden, and may strengthen the possibility of further gas growth. The recent cancelation of the Skanled project (import from Norway to Sweden and Denmark) is a major pushback for the future development of the Swedish gas infrastructure.

5.1.4 Still Some Islands Are Isolated, but Initiatives in Progress

The planned GALSI pipeline project from Algeria via Sardinia to Italy will enable the possibility of developing gas infrastructure at Sardinia. A planned LNG import terminal in Cyprus will give access to gas for the island. For Malta there are no firm plans.

5.1.5 Isolation from a Security of Supply Point of View

Due to a lack of a reverse flow from Germany to Poland, Poland has limited alternative supply in case of disruption from Russia or Ukraine. A project establishing reverse flow possibility has been discussed. The North-South connection between Poland-Slovakia-Hungary has been considered, but not yet decided upon.

5.2 Economic and Political Reasons for Isolation

Among factors behind isolation should be mentioned low energy demand density, the availability of other resources, high transportation costs compared to demand, political revolts etc. The reasons for isolation vary greatly. Political and economic benefits from providing access to isolated regions are, however, evident. Access to isolated regions would inter alia reduce the dependence on suppliers, enhance the integration of the European gas and oil markets, and increase the import capacity.

6. SECURITY OF GAS SUPPLY FOR THE EU

KEY FINDINGS

- There is a need for harmonisation of security of supply standards among Member States;
- A diversification of suppliers is needed to reduce the EU dependency on Russia and unstable transit countries;
- A number of infrastructure projects have been launched (including the Nabucco pipeline project, the Nord Stream and the Amber project), but commitments from exporters are still lacking.

6.1 General Aspects

Security of gas supply is defined in COM (2008)769 final⁵⁴ as "the availability of gas to users at affordable prices". A distinction is made between *long-term* and *short-term security of gas supplies*, as the risks, the ways to prevent supply problems and the possible mitigation tools are different.

Security of supply is one of the three underlying objectives of the EU's new energy policy. For importing countries, the questions about relationship with exporting countries as well as diversification of sources of supply and among other things resources are of importance in relation to the security of supply. For countries with a degree of self-sufficiency, the security of supply raises questions of the adequacy of known reserves and possible resources to cover domestic needs as well as export demands. The Commission is concerned that Europe's energy networks are no longer up to the task of providing secure energy supply in the foreseeable future.

6.2 Russia as a Supplier, Experiences and Risks on Supply and Transit Routes

The European Union as the major consumer and Russia as the major supplier are extremely interdependent in terms of their energy policies. Figure 2 in the annex illustrates the EU-27 oil and natural gas import dependency from Russia. The transportation infrastructure, including oil and gas pipelines, plays a vital role in this relationship of interdependence. The existing and projected routes are, however, subject to a great deal of political and economic power play, which potentially undermines or endangers their efficiency.

Along with the Russian-Ukrainian dispute during the winter months of 2006 and 2008, the EU is becoming increasingly worried about the stability of oil and gas exports from Russia. There has been a growing concern that Russia is becoming an unreliable supplier or is using its dominant position to promote its political aims. As a reaction, the EU has begun to eagerly promote the need for energy diversification aiming to improve the overall energy security level within the EU borders.⁵⁵

⁵⁴ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions on the Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard the security of natural gas supply.

⁵⁵ Center for European Reform: Pipelines, politics and power - The future of EU-Russia energy relations Pavel Baev, Vaclav Bartuska, Christian Cleutin, Clifford Gaddy, Roland Götz, Daniel Gros, Barry Ickes, Andrey Konoplyanik, Konstantin Kosachev, Tatiana Mitrova, Andris Piebalgs, Jeffery Piper, Pawel Swieboda, Dmitri Trenin and Sergey Yastrzhembsky, available at http://www.cer.org.uk/pdf/rp_851.pdf. Edited by Katinka Barysch.

In this respect, the EU is rethinking its infrastructure policy with a global vision, including Russia, Central Asia and the Caucasus, and is linking this work to current energy forecasts. Under the new 'strategic energy review'⁵⁶ and the green paper for the Trans-European Energy Networks, a new pipeline strategy that links the Internal Market with third countries is defined.

As part of its policy to enhance the EU's security of energy supplies, the Commission is promoting a diversification of sources of gas supply and routes. To enhance the EU's energy security, it is important to diversify both the geographical sources of energy and the transportation routes. The EU is seeking a balanced energy partnership with Russia and is pushing for the renewal of a wide-ranging Partnership and Cooperation Agreement, which includes energy relations as part of a broader trade arrangement. The Nord Stream pipeline, which will diversify transportation routes, has been labelled a project of European interest in the latest guidelines on TEN-E adopted in September 2006 by the Parliament and the Council. High priority has also been given to the Yamal II project promoted by Poland, which would more than double the capacity of existing Yamal pipeline. The Amber project, which would pass onshore through the Baltic States to Poland rather than through Belarus, is a variation of Yamal II and is labelled as a project of common interest in the TEN-E guidelines. The Nabucco project represents a new gas pipeline with a length of approximately 3,300 km connecting the Caspian region, the Middle East and Egypt via Turkey, Bulgaria, Romania, Hungary with Austria and further on with the Central and Western European gas markets. The Commission takes the view that investment decisions, including optimal routing, whether underwater or on shore, have to be taken by the investors on the basis of their own commercial interests and judgments. Therefore the Commission does not express its preference for one project over the other in this context.⁵⁷

6.3 Middle East as a Supplier and Risks on Supply and Transit Routes

Due to problems encountered in Russian gas exports to Europe, the European countries face a major challenge in diversifying energy supplies, and Middle East countries with their oil and gas reserves are considered to be a natural energy partner for the EU.

There are, however, certain geopolitical risks attached to energy export activities in the regions outside Europe. Those are inter alia exporters' reliability and transit risks. The Middle East has had security-related problems such as Arab-Israeli wars and conflicts, Arab-Iranian war and conflicts, Arab-Arab war and conflicts and more recently radicalism. The main concern for exporters' reliability is that gas and oil producers may link their export policies to political considerations using the EU dependence as a tool of political pressure. Furthermore, there are transit risks associated with terrorism, riots and political downturn in countries with undemocratic regimes.⁵⁸

6.4 Diversification of Natural Gas Supplies

The European Union's effort to curb Russia's supply monopoly has been ongoing for many years and seemed to gain ground in July 2009 by the signing of an agreement on the Nabucco pipeline, which will connect Europe to the gas-rich Central Asia via the Balkans, Turkey and Caucasus with back-up from the main transit countries: Austria, Hungary, Romania, Bulgaria and Turkey.

The Nabucco has a capacity of 30 mcm of gas per year, i.e. one fifth of the current Russian export to Europe and could be finished in 2015. The source of natural gas for the Nabucco, however, remains unclear. Azerbaijan is a small supplier, Iran has large gas resources, but there are serious political obstacles to making trading agreements with Iran.

⁵⁶ Second Strategic Energy Review - Securing our Energy Future.

⁵⁷ Parliamentary Questions E- 0547/2008 of 28 March 2008.

⁵⁸ CEPS Working Document Long-Term Energy Security Risks for Europe: A Sector-Specific Approach, No. 309/2009 Arianna Checchi, Arno Behrens, Christian Egenhofer.

In Iraq's northern part (Kurdistan) efforts are made to extract natural gas amounts that could feed half of the Nabucco's needs.

In Turkmenistan where gas is abundant, most of it is exported to Russia and its leadership avoids political steps that potentially undermine its good relation with Russia. However, the country maintains its interest in supplying natural gas to the Nabucco pipeline.

Egypt is also a possible supplier to the Nabucco pipeline, if a pipeline from Egypt over Jordan and Syria to Turkey is completed.

It has also been discussed to purchase Russian gas, but that would undermine the whole idea of diversifying the supply sources to the EU.

These countries are currently not committed enough to supplying gas for the pipeline and the EU and Russia are competing for the resources. Russia recently obtained commitments for additional supplies from Azerbaijan.

Furthermore, the Turkish Government has signed an agreement with Russia about building the 'South Stream' pipeline under the Black Sea to Bulgaria. The South Stream could possibly be finished by 2013. At this point in time, it is considered unlikely that both pipelines will be built simultaneously. It will be difficult to find investors for both of them and it will be difficult to find enough gas to supply both projects.

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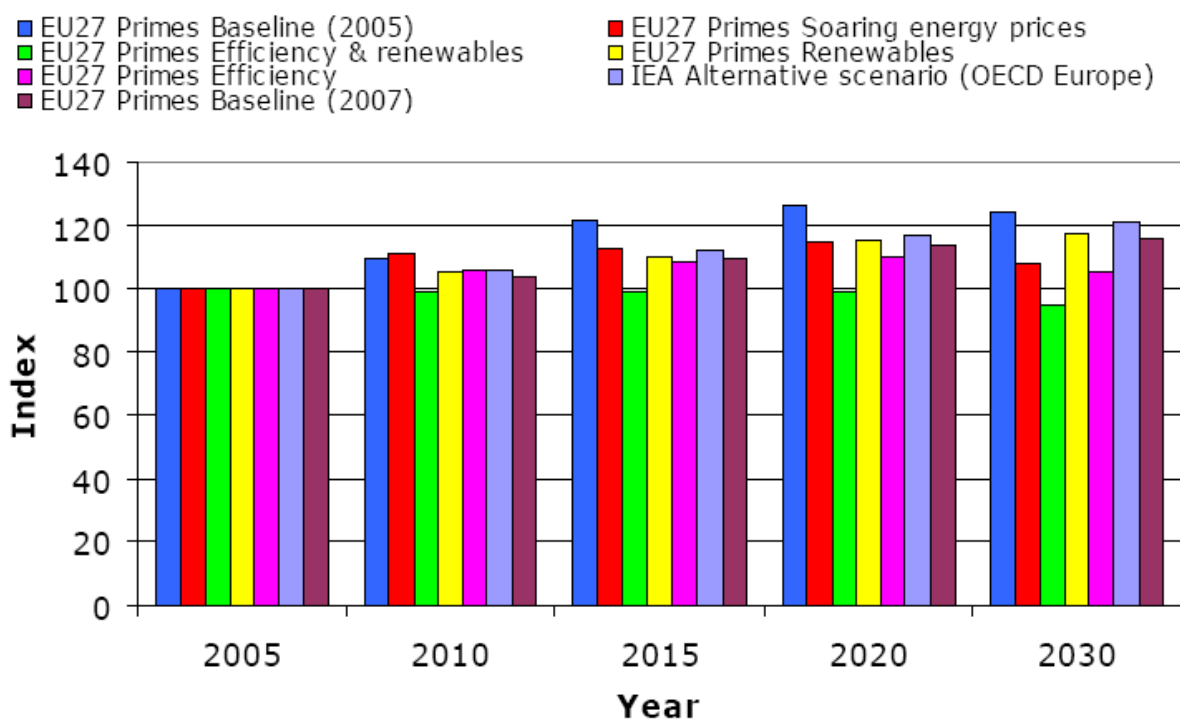
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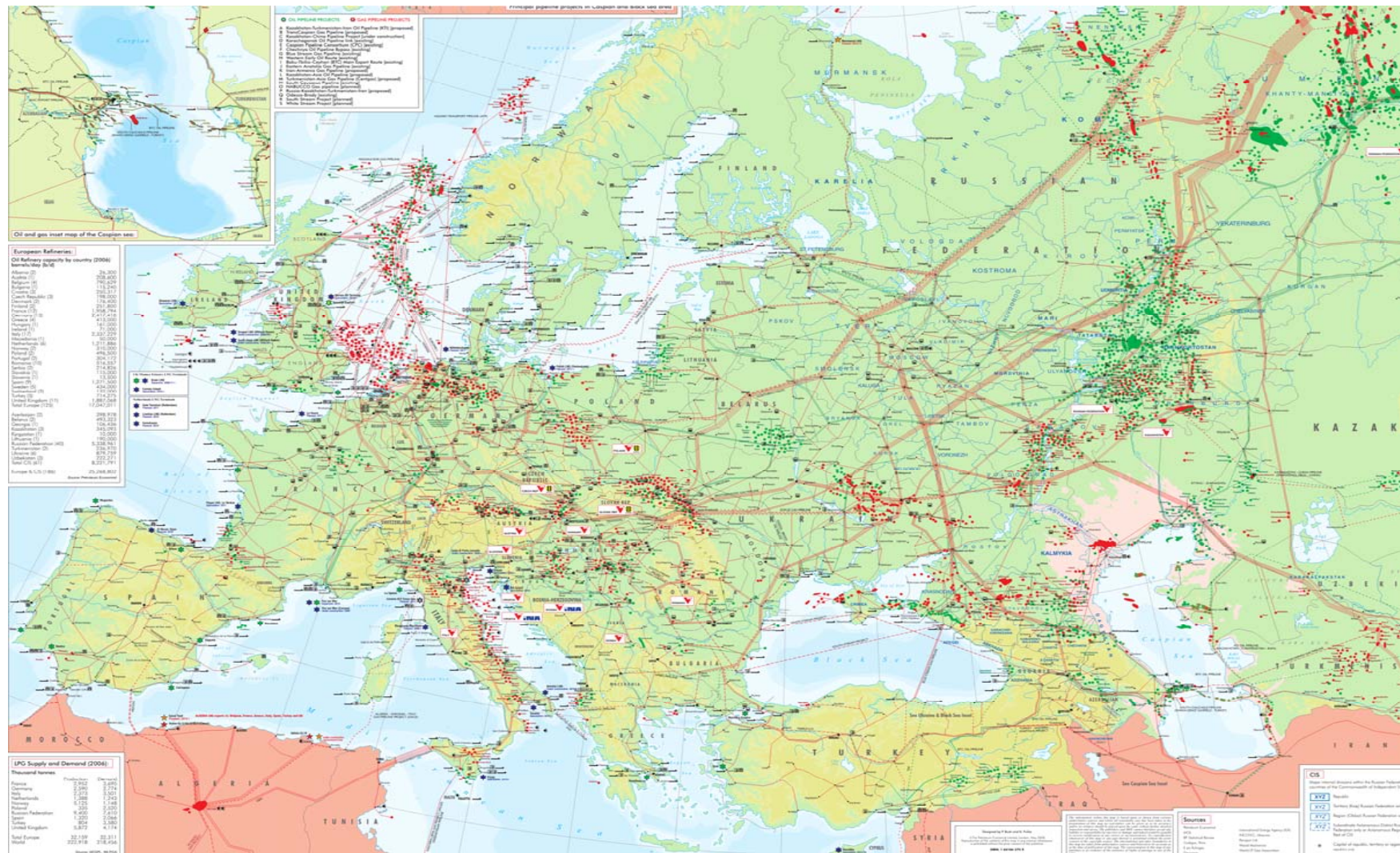
ANNEX MAPS, FIGURES AND TABLES

Figure 1: The EU-27 future demand scenarios



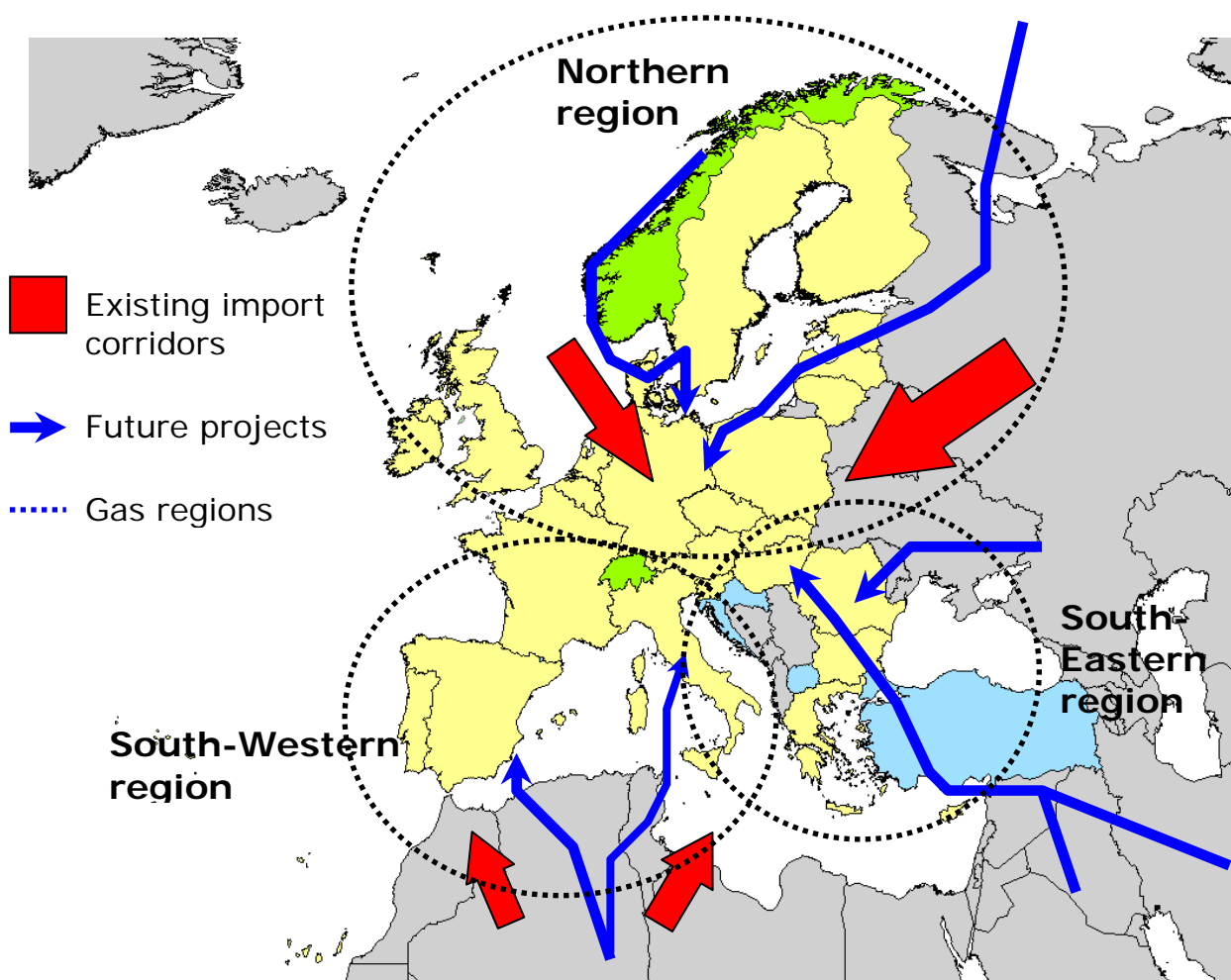
Source: IEA and European Energy and transport (PRIMES)

Map 1: Detailed map of oil (green) and gas (red) infrastructure



Source: Snapshot of map from the Petroleum Economist, latest edition (2008)

Map 2: Existing main import corridors and future strengthening projects

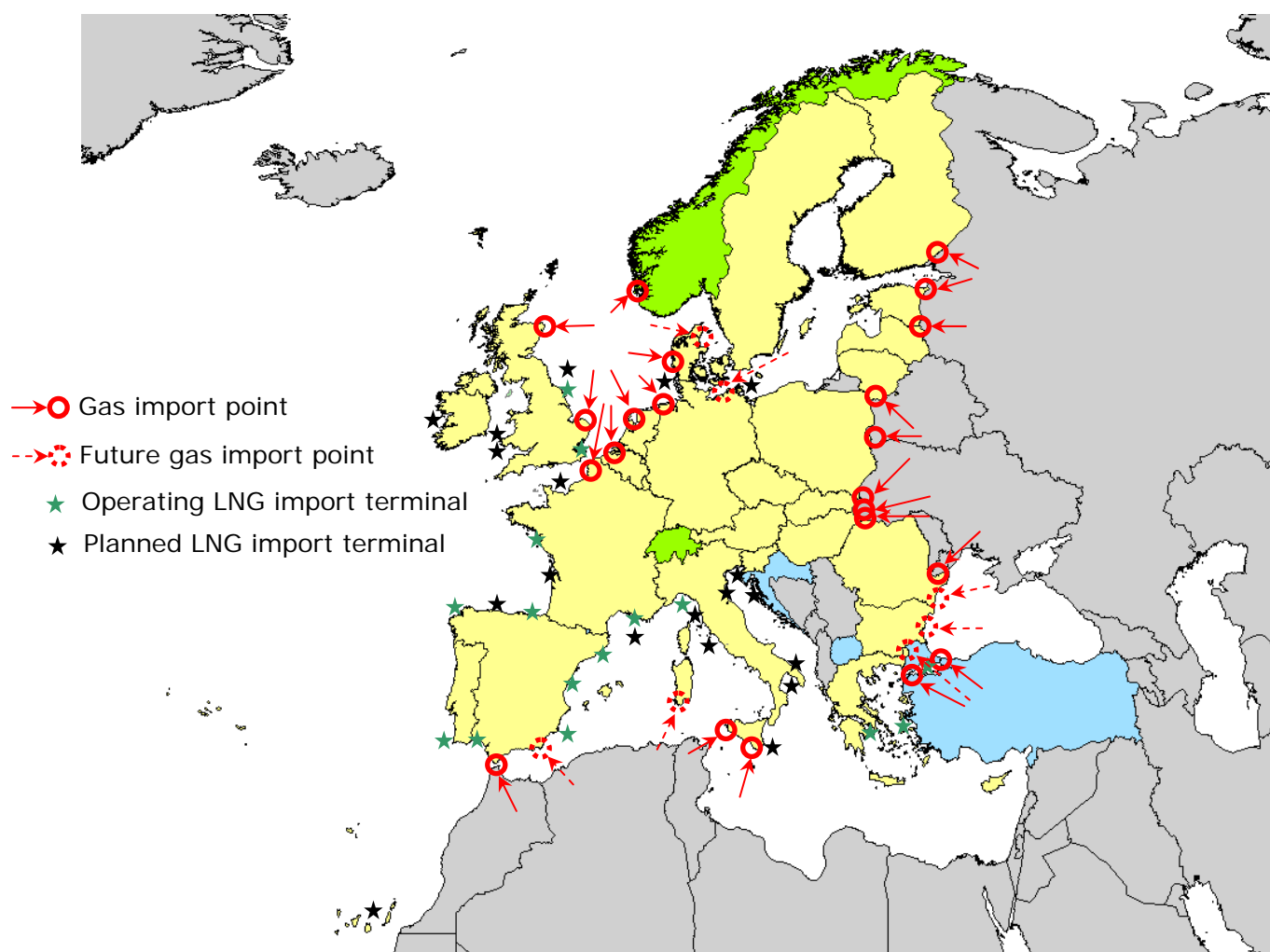


Source: COWI produced, background from COWI mapping division, based on information from the Petroleum Economist, (2008 edition).

Table 1: Gas regions in figure 3 (Underlined: Bridging countries are in more than one region)

Northern	South-Eastern	South-Western	Baltic
Netherlands, Belgium, Ireland, UK, Germany, Denmark, Sweden, Luxembourg, Finland, Poland, Lithuania, Latvia, Estonia, <u>Czech Rep.</u> , <u>France</u> , (Norway)	Austria, Bulgaria, <u>Czech Rep.</u> , Greece, Hungary, <u>Italy</u> , Romania, Slovakia, Slovenia, <u>Germany</u> , Cyprus, (Turkey), (Croatia).	Spain, Portugal, <u>France</u> , <u>Italy</u> , (Switzerland)	Finland, Estonia, Latvia, Lithuania, Poland

Map 3: Gas import points, pipeline and LNG



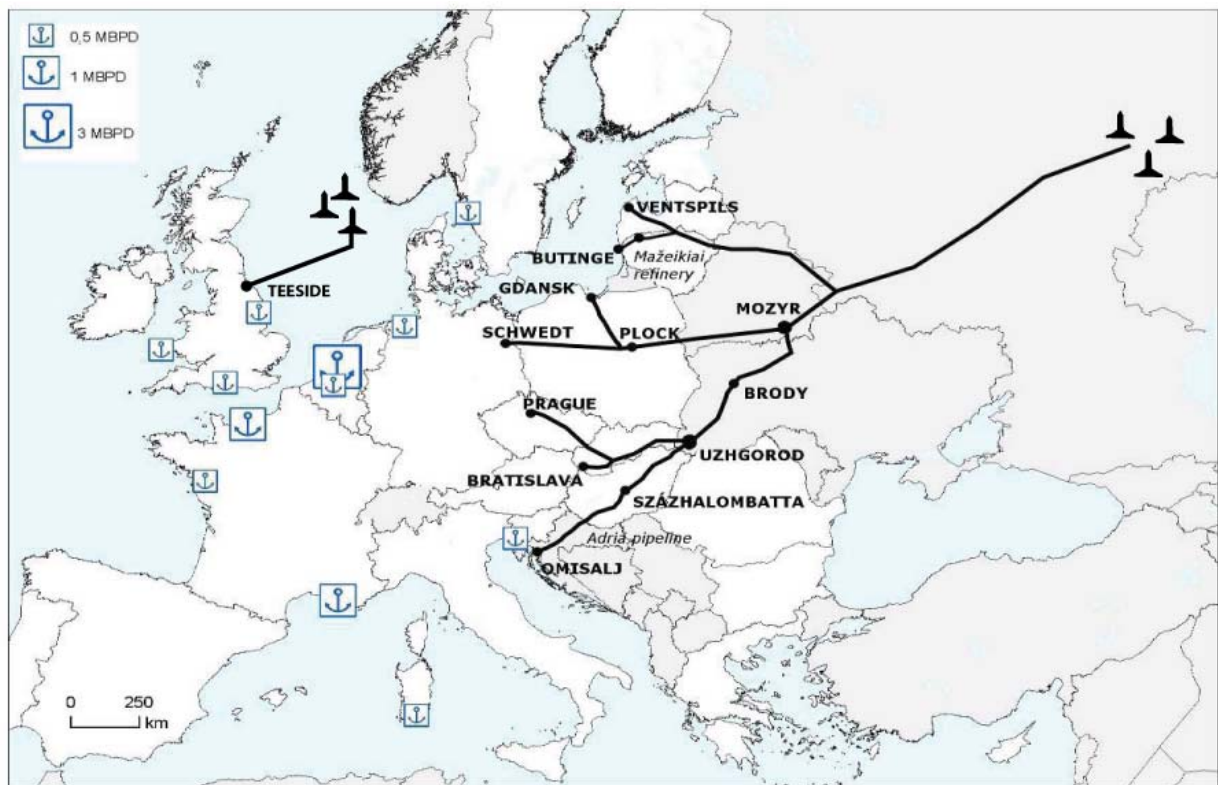
Source: COWI produced, background from COWI mapping division, based on information from the Petroleum Economist, (2008 edition).

Table 2: Characteristics of different oil transportation means

	Pipeline	Marine	Rail	Truck
Volumes	Large	Very large	Small	Large
Scale	2 ML+	10 ML+	100 kL	5-60 kL
Unit costs	Very low	Low	High	Very high
Capital costs	High	Medium	Low	Very low
Flexibility	Limited	Limited	Good	High

Source: COWI Oil and Gas Department.

Map 4: The Druzhba and the Norpipe oil pipelines (Teeside)



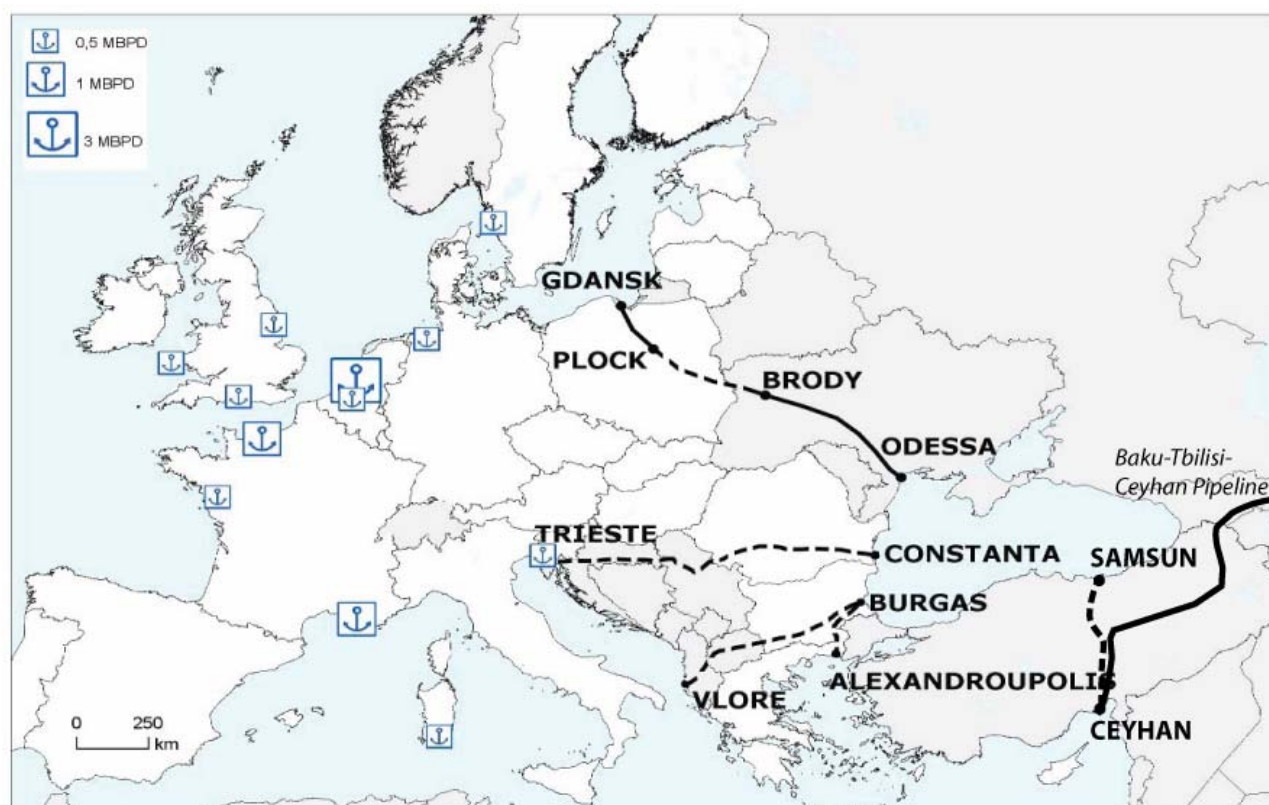
Source: Commission Staff Working Paper: Oil Infrastructures. 2008 (COM (2008) 782).

Map 5: Oil pipelines in territory of the EU and neighbouring countries



Source: Commission Staff Working Paper: Oil Infrastructures. 2008 (COM (2008) 782).

Map 6: Planned oil pipelines



Source: Commission Staff Working Paper: Oil Infrastructures. 2008 (COM (2008) 782).

Table 3: Options for new supply pipelines for oil products

Line	Ownership	Capacity / Length
Samsum - Ceykahn	ENI and Turkish consortium	Up to 75 Mtons/ 555 km
Burgas-Alexandropulus	owned by a Russian controlled consortium, Transneft, Rosneft, and Gazprom Neft	Up to 50 Mtons / 280 km
Burgas-Vlore	US controlled consortium	35 Mtons / 900 km
Constanta-Trieste	Under preparation	60 Mtons / year / 1,400 km
Odessa-Brody-Plock	Under preparation	

Source: produced by COWI based on Commission Staff Working Paper: Oil Infrastructures. 2008 ((COM (2008) 782) and Susanne Nies: Oil and Gas Delivery to Europe, IFRI 2008.

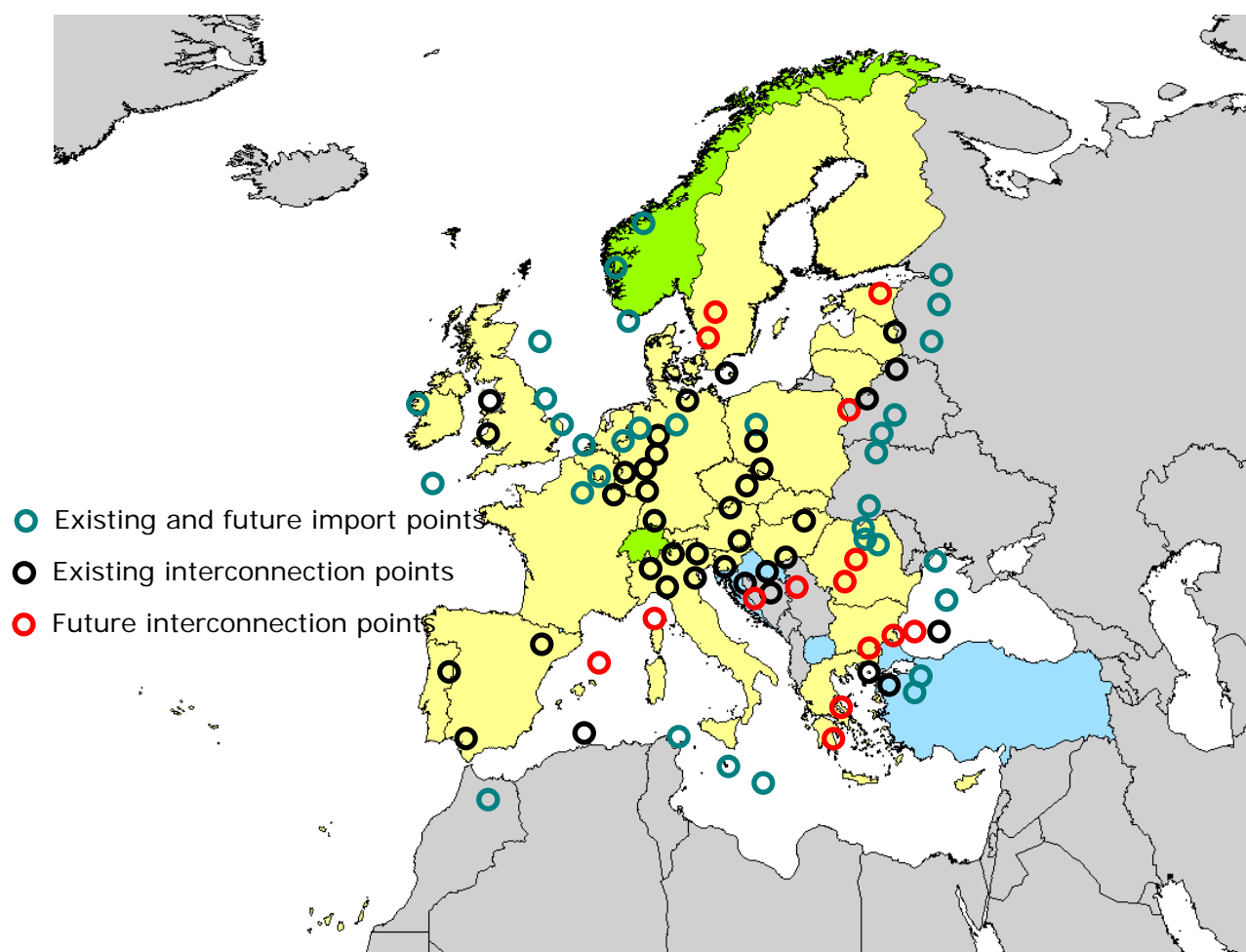
Table 4: Major existing interconnectors

Pipeline	Pipeline route	Owner/ Operator	Length (km)	Diameter (inches)	Capacity (bcm/y)	In service since
Balgzand Bacton Line (BBL) 1	Balgzand (Netherlands) / Bacton (UK/England)	Gasunie: 60% E.ON Ruhrgas Transport: 20% Fluxys: 20%	235	36	15	12.1.2006
UK Interconnector	Zeebrugge / Bacton	Caisse de dépôt et placement du Québec: 35% Distrigas: 16.41% E.ON Ruhrgas: 23.59% Gazprom: 10% ConocoPhillips: 10% ENI: 5%	230	40	Zeebrugge / Bacton: 25.5 Bacton / Zeebrugge: 20	10.1.1980

Source: http://www.ifri.org/files/Energie/Oil and Gas_Nies.pdf.

IP/A/ITRE/NT/2009-13

Map 8: Existing and planned interconnections and internal strengthening projects



Source: COWI produced, background from COWI mapping division, based on information from the Petroleum Economist, (2008 edition).

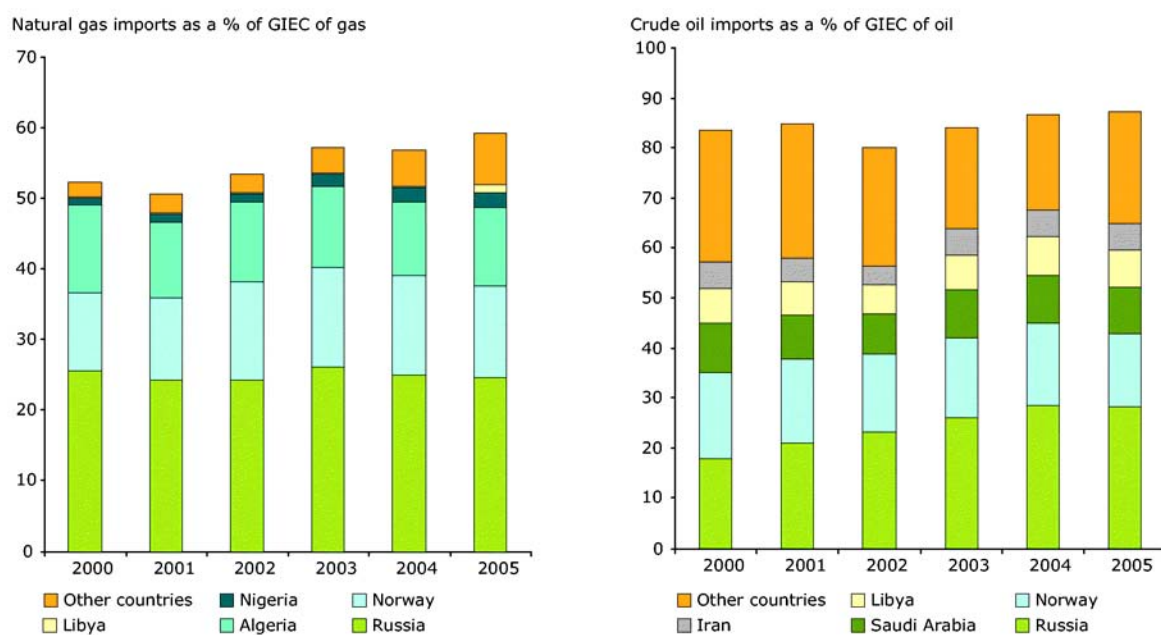
Table 5: New interconnectors and internal strengthening projects (long list)

Interconnectors and internal strengthening	Connecting	Primary driver for implementing project	Comments
Small Amber	Lithuania - Poland	<ul style="list-style-type: none"> Integration into the EU network Diversity of supply 	No firm description exists and there is no sponsor behind the project.
Balticconnector	Finland - Estonia	<ul style="list-style-type: none"> Integration into the EU network Diversity of supply 	Connecting Finland with the gas storage in Estonia. The finish operator Gasum is the sponsor behind and the planning is in progress
Baltic Pipe	Denmark - Poland	<ul style="list-style-type: none"> Diversity of supply for Poland and Denmark 	Project is on hold due to uncertainty on the demand side caused by the financial crisis
Baltic Gas Interconnector	Germany - Sweden (and DK)	<ul style="list-style-type: none"> Security of supply for Sweden 	Main sponsor is Eon Sweden. Lacking activity after authority approval.
UK-Denmark Interconnector		<ul style="list-style-type: none"> Creating more competition Depletion of own gas production 	Project was overtaken by the pipeline from DK to NL.
IGI	Italy - Greece	<ul style="list-style-type: none"> Import of Caspian gas to Italy 	Edison and DEPA are sponsors behind and construction is in progress.
TAP	Italy-Albania-Greece	<ul style="list-style-type: none"> Import of Caspian gas to Italy Access to an undeveloped Albanian market 	Sponsors behind are StatoilHydro and EGI Switzerland. Planned. More relevant after Nabucco decision.
France - Spain	France - Spain	<ul style="list-style-type: none"> Increase capacity for enable larger imports from Algeria Merge two big gas markets 	Two very small connections of today are insufficient. Enagas has this in the strategic planning.
Greece Bulgaria	Greece - Bulgaria	<ul style="list-style-type: none"> Security of supply for Greece 	Agreement signed in July 2009 between DEPA and Edison S.p.a to construct/operate the pipeline (1 bcm)
France - Italy	France - Italy	<ul style="list-style-type: none"> Market development Security of supply 	No direct connection today (via Switzerland, or Austria and Germany). No plans identified.
Germany-Poland	Germany - Poland	<ul style="list-style-type: none"> Security of supply for Poland in case of disruption from Russia or Ukraine 	Reverse flow possibility to be established in the Europol pipeline. Small investment, but challenge not solved.
Czech Republic-Belgium	Czech Republic-Belgium	<ul style="list-style-type: none"> To move Russian gas further to the west 	Planned by RWE

Interconnectors and internal strengthening	Connecting	Primary driver for implementing project	Comments
Italy - North-East	Italy	<ul style="list-style-type: none"> Increase import from Russia 	Under construction.
Hungary - Romania	Hungary - Romania	<ul style="list-style-type: none"> To establish connection between countries 	Decided. TSOs of Romania and Hungary, FGSZ and Transgaz are behind..
Netherlands Roundabout	Netherlands	<ul style="list-style-type: none"> Transit to UK (via BBL pipeline) 	The system increase is planned.
Poland - North-West	Poland	<ul style="list-style-type: none"> Develop market Import and/or export possibility through Baltic Pipe. 	Northern Poland is not developed because of reliance on coal in the power sector.
Poland - Slovakia - Hungary interconnector	Poland - Slovakia - Hungary	<ul style="list-style-type: none"> Due to lack of reverse flow in transit pipelines 	Weak business case. If there will be opened for reverse flow, the benefits will be reduced.
Baltic Interconnection Plan	Finland- Estonia, Poland and Lithuania	<ul style="list-style-type: none"> Integrating in the EU gas market Diversity of supply 	The project is a combination between the Small Amber, Balticconnector and an LNG terminal in the region.

Source: Produced by COWI. Data from different sources: i) Oil and Gas Delivery to Europe, Gouvernance Européenne et Géopolitique De L'Energie, IFRI, Paris 2008ii) Energy Priority Corridors for Energy Transmission, Ramboll/Mercados, November 2008.

Figure 2: The EU-27 crude oil and natural gas supply



Source: <http://www.eea.europa.eu>, Copyright EEA, Copenhagen, 2008.

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