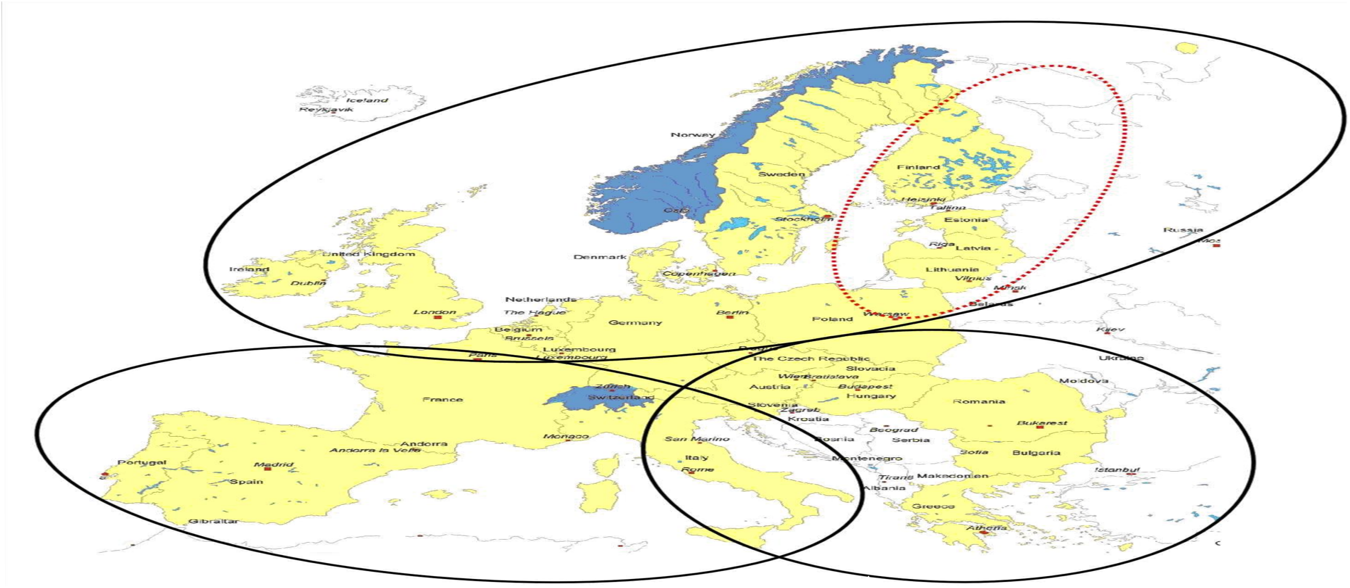

Prepared for the European Commission

T E N - ENERGY Priority Corridors for Energy Transmission

Part One: Legislation, Natural Gas and Monitoring

November 2008

RAMBØLL mercados ENERGY MARKETS INTERNATIONAL

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Methodology

The following report on Priority Corridors for energy transmissions is divided into four main sections. Two sections concern the electricity side as well as the gas side (legislation and monitoring) and two individual sections, one on gas and one on electricity.

This approach has been chosen due to two fundamental main differences between gas and electricity in terms of priority corridors for energy transmission. The main difference is that natural gas transmission with regards to priority corridors primarily deals with large multilateral projects, whereas electricity projects are often bilateral. Gas transmission in this context, is the issue of connecting gas supply with gas demand and further security of supply is the question of connecting the EU gas market with gas supplies in third-party countries outside the EU. Priority corridors in terms of electricity, on the other side, deal with issues of security of supply, interconnection etc. between member states and electricity transmission corridors interact to a much higher degree in electricity compared to gas.

This difference makes issues of regions, stakeholders, capacity analysis, selection criteria and the issue of revising the TEN-E guidelines energy source specific, i.e. the results and conclusions depend on whether the issue is gas or electricity. Therefore the report has been divided into sections that enable us to focus on the sector specific issues of gas and electricity separately i.e. where they differ but also allows us to look at where there is a common ground.

The report is structured in the following way: Natural gas, legislation and monitoring are handled in the Natural gas report and issues concerning only electricity in the Electricity report, i.e. the report is divided into two reports. The natural gas report begins with an introduction and a conclusion chapter that outlines the issues, the setting and the main findings on natural gas of the report. This is followed by Section I, which deals with the legislative issues concerning the priority corridors and is not energy specific, i.e. the section concerns both the gas and electricity. Section II of this report deals with natural gas specific issues. Section III deals with Electricity specific issues and is the second part of the report. Section IV on monitoring is found in the gas section, but deals with both gas and electricity as was the case with legislation.

This division of the report should allow readers to read the report focussing on either gas or electricity.

1. Introduction

This first section introduces the report and the next section, the executive summary, presents the main findings.

1.1 The final report

T E N-ENERGY - Priority Corridors for Energy Transmission - Action stipulated in the

Methodology for the selection and accelerated implementation of projects of European interest in preparation of the forthcoming (2008) revision of the TEN-E guidelines.

Priority Interconnection Plan (10/01/2007):

This report includes reporting of task 1 to task 5 of the Scope of Work. However, due to the importance of the Task 4 of the Scope of Work: *"To propose adequate legislation for transforming projects of European interest to highest priority projects on a national level, which would allow concluding the authorisation and permitting procedures within the appropriate timeframe (maximum time span of 5 years)."* we have decided to present the result of this task in the beginning of the report.

Task 1 to Task 3 have been prepared in parallel for gas and electricity and can be read independently.

Task 5 monitoring is presented here in the Gas report but the monitoring section is also applicable and relevant for the electricity side of the report.

The report has been prepared by the consultants Ramboll and Mercados with input from the EU Commission in several progress meetings. Meetings have also been held with a number of stakeholders, including the organisations of transmission system operators. At the end of the project a workshop was held for both gas and electricity, testing the idea of establishing regional forums with the agenda of dealing with the problems that exist in the gas and electricity markets in term of implementation of transmission projects on a regional level.

Further, a special note was prepared on the oil supply situation and inclusion of oil infrastructure in the guidelines. The result of this work was presented in the first progress meeting.

1.2 Introduction and comments to recent developments in energy market

1.2.1 Urgent actions still needed despite two silent years on gas and electricity

In the communication from the EU Commission to the Council and Parliament on the Priority Interconnection Plan (Com(2006) 846 dated 10 January 2007), the focus was on the urgency for implementation of energy interconnections.

We still agree with this viewpoint, that urgent actions are needed to meet the EU objectives of sustainability, competitiveness and security of supply. This despite two relatively silent years on gas and electricity transmission where there has not been any major disruptions. Some of the reasons for this calm period are the following:

- Very mild winters were experienced in Northern Europe in 2006/2007 and 2007/2008 which resulted in gas and electricity demand below the overall trend and EU natural gas consumption actually declines as compared to 2006.
- Wind power production increased considerably due to the same climatic variation and due to installation of new capacity.
- Hydro power was abundant in Scandinavia.
- High oil prices and hereby natural gas prices, where these were linked, also contributed to lower demand of natural gas and thus also in the electricity sector.
- A number of new gas infrastructure projects were commissioned including the BBL pipeline from The Netherlands to the UK and the Langeled pipeline from Norway to UK, compensating temporarily the decline in gas production within the EU.
- New electricity infrastructure has been taken in use, including the NorNed cable from Norway to The Netherlands, which by-passes some of the problems encountered on implementation of PEI electricity projects.
- No major disruptions of gas or electricity supply were encountered from external or internal sources. Also, a high reliability of nuclear power was achieved.

It is not likely that all these factors will continue for the years to come. In particular, the decline in gas production within the EU continues and the decisions with respect to increased use of renewable energy for electricity production will require longer transmission distances.

The urgency consequently has moved from the day-to-day headlines of the news to the requirements for meeting long term objectives with respect to sustainability and competitiveness. Also, sustained high oil prices may shift energy supply from oil to gas and electricity if a competitive environment is created.

1.2.2 Oil prices and supply is moving higher on the agenda

The most urgent energy issue in 2007 and 2008 has been the rapid and unexplained increase in oil prices. It still has to be seen if the high prices will persist or if they are partly a response to unrest in the financial sector.

The response of the oil producing countries to the tight supply situation has been re-nationalisation of oil fields in many cases. This means that EU oil companies will increasingly find it difficult to get access to concessions or production sharing agreements.

Instead it could be argued that a well functioning oil infrastructure, including pipelines and terminals leading to the EU is the best safeguard for securing oil supply to EU.

Outside the scope of the present assignment we will hence recommend that oil infrastructure is included in the next guideline for trans-European energy infrastructures, with particular focus on pipelines leading to EU.

This could include:

- Oil pipelines from Russia to the EU, which would also protect the Black-Mediterranean and Baltic Seas.
- Oil pipelines from the North Sea instead of the offshore loading, which in many occasions result in shut down of fields.
- Oil pipelines from the Caspian Sea area to the EU.
- Oil pipelines from North Africa and Middle East to the EU.
- Oil pipelines to new oil producing countries in Africa.

1.2.3 Gas demand data and increased uncertainty due to explosion in 2008 oil prices

The present report is based on use of the so-called Primes data published in the EU-27 Energy Baseline Scenario to 2030 in April 2008. For other scenarios the Primes data was prepared in 2005. This means that the demand data does not take into account the recent dramatic price development and the likely impact on gas demand. The updated primes data are based on “a high oil price environment with oil prices of 55 USD/bbl in 2005 rising to 63 USD/bbl in 2030 (prices are in 2005 prices)”

As oil prices in the summer of 2008 actually reached 147 USD/bbl the Primes data may not catch the most recent development and may therefore also create uncertainty about the need for new infrastructure.

High oil prices will impact the gas demand in two opposite directions. The high oil prices will spill over to high gas price, which will make gas less competitive for electricity generation and will give an overall decline due to price elasticity among direct users of natural gas. On the other hand the high oil prices may result in an accelerated shift from oil to gas in the domestic heating sector, in the industry and in some cases also in the transportation sector.

In light of the recent oil and gas price developments we strongly recommend that the possibility for increased use of gas in other sectors than the power sector should be analysed in more details. This should include accelerated shift from oil to gas for heating, use of small scale combined heat and power, cooling, cooking and use of gas for the transportation sector (cars, lorries, city-buses, commuter trains, ferries, fishery ships) and also supply to areas not covered by natural gas at present such as islands, rural districts, Scandinavia, etc. Most of these sectors will reduce the need for gas oil, which is the driver behind the recent oil price peak.

1.2.4 Increased use of renewable will shift focus from gas to electricity

The 20/20 decisions (EU's climate package) with respect to increased use of renewable energy and reduction in CO_2 emissions will shift the focus of trans-European networks inside the EU from gas to electricity.

With the rapid increase in oil, gas and coal prices there may even be a market oriented shift to increased use of renewable energy in the electricity sector. In particular there is a rapid acceleration in the installation of wind turbines, which is now only limited by shortage of components.

2. Executive summary

The following sections summarize the main findings and conclusions of part one of the report

2.1 Conclusions on legislation

The difficulties in securing a rapid implementation of energy projects are not unique for the EU. In the USA new legislation has been passed to accelerate the implementation via the possibility for DOE to designate a national interest electric transmission corridor.

In this report three different options for acceleration of implementation of projects in the EU are analysed and draft legislation has been prepared:

1. **Harmonisation of timetable**. The EU establishes a time limit for the authorisation of each PEI
2. **Harmonisation of procedures and criteria on authorisation of PEI**. The EU adopts common uniform procedures and criteria for the authorisation of PEI and further considers whether to integrate assessments under the EIA-Directive, the SEA-Directive and the Habitat directive in this process.
3. **Endorse the power of authorisation of PEI to the Commission**. The Commission will be responsible for the permits under the EIA, SEA, and Habitats directives, and the Commission will have the power – subject to conciliation – to decide location of a PEI and in this respect de facto is in power on physical planning.

Within the legislative power of the Community, the three legislative options represent basically three different political approaches to the way the Community could respond to common major challenges as related to the need for priority corridors for energy transmission.

While the existing guidelines take a legal approach close to international soft law without clear substantial obligations, the formal harmonisation of timetable represent the first step towards the usual EU approach towards common problems: minimum requirements on certain procedural aspects. The second legislative option represents the principles applied in the internal market harmonisation reflecting that minimum requirements on few procedural aspects have not been able to solve the problems. The third option follows the principles in more advanced internal market legislation in which the Commission has been given the power to authorise certain activities or products.

All three options are found legally possible within the Treaty and it is therefore a political decision to choose between the different options in view of the urgency of energy supply as compared to other political objectives.

Impact of legislation is summarised in the below table.

Table 1 Impacts

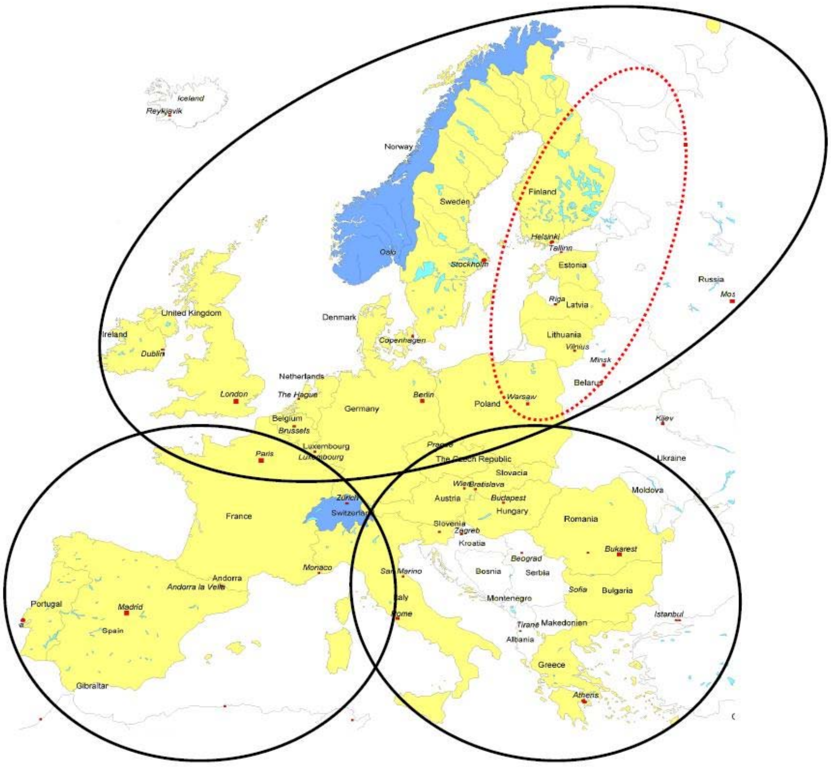
Economical	Social	Environmental
Economical benefits from quicker and in-time implementation of projects Lower implementation costs Economical benefits from increased Security of supply Potential costs from uncoupling of the market	Lower prices – globally More stable energy prices Locally prices could increase	Global environmental benefits Support of EU Climate package and goals of Climate package Local environmental costs

2.2 Conclusions on natural gas

The following section lists the conclusions of the report.

2.2.1 Proposed regions

Three main regions are proposed for the natural gas transmission system, a Northern, a south-western and a South-Eastern. This is supplemented with a sub-region for Baltic integration and a LNG Forum.



The idea of using regions for ensuring implementation of projects, and other objectives in general, is known from the ERGEG regional initiatives, which have been constructed in order to facilitate the implementation of a common gas market.

However, as these new regions are established in order to deal with security of supply and climate issues, as well as market issues the proposed regions differ slightly from the regions established by ERGEG.

The reasoning for the different regions is listed below:

Northern region:

- Norwegian suppliers will have to choose between gas sale to Western Europe or Eastern Europe.
- New Norwegian fields in the Norwegian Sea and the Barents Sea are located quite easterly and can possibly be coordinated with Russian fields in the Barents Sea. Gas transmission could be offshore via the Norwegian Sea and the North Sea, the Baltic Sea (Nord Stream extension), or onshore via Russia, Latvia, Lithuania, Poland (Amber) or via Finland, Sweden (previously known as Trans Scandinavia).

- Projects like the Mid-Nordic Gas grid could be re-vitalised with positive impact on security of supply in the entire region.
- Many ongoing TEN-E projects cross between the North Sea and the Baltic Sea in order to create diversification of supply, mainly to new member states.
- Depletion of gas fields in the UK, Germany, Denmark and The Netherlands will have to be replaced by gas supply from Norway or Russia. Timing and priority of field developments is an integrated part of the overall planning of new gas infrastructure.
- Major energy companies like Total, StatoilHydro, E.On, Gazprom are share owners and partners in field developments and gas infrastructure in Norway and Russia, and in development of gas infrastructure as Nord Stream.
- Different approaches have been used for approval and planning of projects in the North and Baltic Sea. There is room for learning from best practice.

South-West region:

- Full integration of the Iberian peninsula to the rest of Europe.
- Possibly direct interconnection between France and Italy. Today there is only an indirect link via the non- EU and non-EEA Switzerland. Otherwise the shortest direct connection is via Austria and Germany. This means in reality that there is limited redundancy on the gas supply from Algeria to the EU via the transit countries of Tunisia and Morocco.
- Long-term supply options from Africa as the Trans Sahara pipeline from Nigeria, which would secure the EU a competitive advantage over LNG export where the EU would be in competition with the USA and Asian LNG importing countries.

South-East Region:

- Integration of EU member states, which is partly limited due to lack or reverse flow in existing pipeline systems. This is the background for the Nabucco project and the different proposals for interconnections of Italy to Greece and further to Turkey.
- Long-term gas supply from the Caspian region, which has already been initiated via the South Caspian Pipeline from the Shah Deniz project in Azerbaijan.
- Selection between main supply routes, Nabucco, South Stream and White Stream.
- Long-term gas supply from the Middle East via Syria, Iraq or North Africa.
- Possible connections to Cyprus.
- Integration and development of the western Balkan into the EU system.

Baltic region:

- Integration of Lithuania, Latvia, Estonia and Finland.
- Development and use of gas storage in the region.

- Establishment of a gas exchange to create an import price from Russia on the EU side of the border.

When the interconnections between the four member states and the existing network are established, the sub region should be dissolved.

LNG Forum:

Ramboll does not recommend the creation of a LNG action plan, as there seems to be no scope for such a measure. However, Ramboll recognises the increasingly important role LNG plays in the EU gas market and hence the potential need for a common platform for addressing LNG issues and to ensure that a forum exists for discussing issues such as: Should the EU be able to grant LNG supply facilities in non-EU countries, with the status of priority projects as ensuring adequate supply capacities is a question of cross-border interest in the EU.

Issues and topics discussed in a LNG forum could be:

- Is there scope and need for creation of uniform criteria for implementation of LNG projects with respect to technology, safety, environment and regulation?
- Is there scope for acting in cooperation and thus creating a counterpart towards existing and potentially new supply countries and companies? Can such a counterpart ensure adequate investments in the supply-side by reducing investment risks etc.? Today, this role is played by single companies and member states.
- How to act as counterpart towards the international shipping industry, IMO etc to ensure consistent rules and regulation?
- Can and should the EU help facilitate LNG projects in any way?
- Can the EU promote an efficient and competitive EU LNG market?
- Should the EU play any role in terms of the world market for LNG?
- Should LNG supply facilities by included in the next priority corridors plan?

Further, a LNG forum could ensure cooperation and act as counterpart towards the two main LNG markets i.e. the US LNG market and the Asian LNG market.

2.2.2 Supply/demand balance – impact of depletion of gas production

Gas demand in EU-27 was close to 500 bcm in 2007, but decreased slightly in comparison to the previous year, mainly due to a mild climate, but probably also in response to high prices. EU gas production declined to less than 200 bcm in 2007 with a likely continuous depletion of gas fields. The gab between consumption of production of 300 bcm was covered from import from Russia with 115 bcm, from Norway with 90 bcm and from Algeria with 50 bcm. The remaining 45 bcm was LNG.

New infrastructure as Langeled and Tampen Link pipelines from Norway, BBL pipeline between The Netherlands and the UK and upgrading of capacity of Transmediterranean and Yamal-Europe pipeline has been commissioned in recent years. This means that the average utilisation of import capacity of pipelines and LNG was 72.5 percent for pipelines and 47.5 percent for LNG in 2007.

With demand increase as foreseen in the Primes base scenario to around 575 bcm before reaching a plateau around year 2025, and continuous depletion of EU indigenous production to less than 100 bcm, the import need will increase from the present 300 bcm to 400 bcm in 2015, 430 bcm in 2020 and 480 bcm in 2030.

The Norwegian gas export is expected to increase from present day level of 90 bcm to between 120 and 140 bcm within the next decade. This will hence cover a third of the increase in import increase. Planned LNG plants, when assuming the same utilisation as existing plants, can cover another 40 bcm. Most of the remaining need for import capacity to 2020 can be covered from increased import from projects already under implementation as Nord Stream, 50 bcm, and Medgaz, 8 bcm. Further, projects like Nabucco, SkanLed, South Stream, White Stream and Galsi may contribute with increased import capacity. Overall, this will create a robust import system with flexibility and diversification. With the present high gas prices and focus on emissions there are also strong incentives reduce the fuel gas consumption by adding new transmission capacity.

On the longer term from 2020 to 2030 focus will therefore shift to ensuring availability of gas to fill the import pipelines and LNG import facilities.

2.2.3 Natural gas focus shift to links from sources to EU external borders

The natural gas sector has successful managed to implement a large number of projects within the last years, including PEI projects as well as projects which were not even on the list of projects, like the Langeled pipeline.

However, the case story of Nord Stream pipeline also highlights the difficulties and lack of EU instrument for implementation of large scale projects crossing and influencing many Member States.

Assuming that the Nord Stream project will be implemented, the main conclusions with respect to new natural gas projects is that new projects will mainly be outside the borders of the EU with the objective of getting access to new gas reserves. The problems concerning the progress of the Nabucco pipeline are mainly linked to uncertainty about the sources of gas.

We propose that the revision of the guidelines for trans-European energy networks should include a number of large scale long distance pipelines from the gas sources to the EU. Hereby, the EU is more likely to secure the gas supply than if LNG projects were used in competition with other gas consuming countries.

New gas infrastructure projects would most likely include:

- Barents Sea transportation (in Russia or Norway).
- Caspian Sea to EU pipeline, which could be considered as an extension of the Nabucco.
- Trans Sahara pipeline.
- Qatar, and other Middle East, to Europe either via Turkey or Egypt/Libya.
- Yamal to Europe, including field development infrastructure.

The size of such projects will be challenging and will require a combination of political and physical development of the projects, especially in view of the talks about creating a gas-OPEC.

Project implementation differences between the EU Member States, as seen in the implementation of the Nord Stream and the Nabucco projects, will weaken the EU negotiation power with respect to maturing such major new gas supply schemes.

2.2.4 Interconnectors, integration, de-bottlenecking, easing of market functioning, storage

Apart from import pipelines there is still a need for smaller internal projects in order make the internal EU gas market working. This especially includes the missing links to integrate all member states into the integrated EU system, most important the Small Amber and Balticconnector projects or similar. Further, there is a need for new interconnectors, capacity increase after import points and storage projects to be able to absorb more gas during summer and to supply more gas during winter and hereby increasing the overall utilisation of gas import system. A large number of projects are mentioned in this context Also, there is a need to create larger entry and exit zones in the transmission system for market reasoning and increase of competition.

The overall supply capacity of the integrated gas system is sufficient at present with an almost equal share of gas delivery from indigenous gas production, import pipelines and LNG and gas storage withdrawal during cold weather conditions. During normal weather conditions there is a surplus capacity of approx. 15 percent.

2.2.5 Cold winter and LNG

Analysis shows that in the event of a cold winter in Europe, the role of LNG becomes very important. LNG is at present the only supply source that has sufficient idle capacity to increase supplies in the amount that is required in the event of a very cold winter. Import pipelines are already facing a relative high level of utilisation, limiting their ability to bring extra gas supplies to the EU, in the event of a cold winter. Further, a cold winter in Europe will most likely coincide with a cold winter in Russia, which makes the question whether additional supplies could be imported from Russia doubtful.

Further focus is pointed towards the fact that in the event of two following cold winters, storages may experience difficulties in refilling their stocks during the summer between two cold winters, because the first cold winter will leave gas stocks, at a very low level, requiring additional refilling. This may cause summertime-bottlenecks which could present a problem if we have back to back winters. The cold winter supply problems could arise in the event of two back to back winters in Europe.

2.2.6 Multi-criteria analyses of 30 pipeline projects

A model for comparing the different projects by different criteria has been developed with the possibility to prioritise different aspects like security of supply, market or environment. The model should be used in order to understand the difference between the functioning of the different aspects of projects like market or security of supply issues. However, as no cost comparison and detailed environmental impact assessment is included it can not directly be used for selection of projects. To make such comparison detailed feasibility studies are required.

2.2.7 Proposal for new list of Projects of European Interest

Based on the capacity analyses, multi-criteria analyses and assessment of the project inventory, the following projects are recommended as Projects of European Interest:

Supply lines connecting major gas fields to the integrated EU system or to existing systems already connected to EU system:

- Nabucco – extended to include pipelines to the gas fields (Middle East/Central Asia).
- Barents Sea pipeline (from Norway or Russia or combination).
- White Stream – extended to include pipelines to the gas fields (Middle East/Central Asia).
- Trans-Sahara gas pipeline.
- LNG production plants and pipelines associated with such plants (work on preferred countries to be developed by the proposed LNG Forum).

Supply lines between networks of neighbouring states and EU as direct as possible:

- Nord Stream (it may be anticipated that this project is already under construction and therefore will not need to be included in the new list or projects).
- Amber.
- Galsi.
- South Stream.
- SkanLed/GNE/Norway-Denmark.
- Baltic Interconnection Plan

Interconnectors which integrate member states into the EU gas system

- Small Amber (Lithuania-Poland).
- Balticconnector.

Interconnectors improving the functioning of internal EU gas market:

- IGI and/or TAP.
- UK-Denmark (including a general interconnection of countries around the North Sea).
- Romania-Hungary.
- Spain-France.
- Czech Republic-Belgium (or similar projects connecting east and west Europe)
- BalticPipe (in lack of reverse flow in Yamal-Europe pipeline at the German/Polish border).
- UK-Spain.
- Poland-Slovakia-Hungary.

It is our recommendation that the group of projects should be prioritised as shown with the highest focus on direct access to new gas fields.

2.2.8 Methodological differences between gas and electricity

A sound methodology for electricity lies on the following list of relevant aspects:

- Transmission connects sources (generation), with sinks (demand) in real time with no possibility for storage.
- Transmission planning requires a long term horizon (typically 25-30 years), compatible with projects life cycle. However, the horizon of investments in generation is much lower, usually no more than five years.
- In electricity due to the meshed design of the electricity grid, the physical load flows do not follow the economic transactions.
- Linked to the above issue, each new transmission facility modifies the flow patterns in lines (electrically) near the new project. Therefore it is extremely inaccurate to asses individually the candidate projects.
- Electricity is not traceable; it means there is not a scientific method to identify who is responsible for a particular flow in a line. Consequently it is difficult to allocate efficiently investment and operation costs to users of the system.
- Typical security criteria for transmission systems (for instance N-1) difficulties to the planning process, since demand must be met even when a major facility is not operative.
- Security of supply measurement requires a considerable effort.
- Renewable energy is mostly intermittent. This means that planning should properly consider the intrinsic stochastic nature of some renewable energy sources like hydro and wind.

Therefore, due to the reasons cited above, further requirements need to be set for the electricity sector with the subsequent changes in the methodological approach. This is analyzed in this report with the provision of two alternative models that may be used for the selection criteria.

The gas sector is much more physical than the electricity sector. Main drivers in the gas sector are the location and size of gas fields in and outside the EU together with location of underground gas storage.

Opposite to electricity there is also a huge economics of scale factor in gas pipelines planning. The overall transmission cost for large diameter pipelines is only a fraction of the transportation cost for small pipelines. There is hence a huge benefit of combining projects for more member states to harvest this advantage.

Due to its physical nature with line pack of gas, the time scale of operation of gas system is much longer than for electricity. Advanced real time models are hence not required to the same extend in the gas sector as for the electricity sector.

Demand wise there is a huge difference between gas and electricity. As natural gas is now the preferred fuel for heating in the EU there is a huge seasonal variation in the use of gas. In the electricity sector, there is a limited seasonal variation but large variations within the day between peak hours and night hours. In the gas sector the daily variation is typically absorbed in the pipelines as line pack.

Section I - Legislation

3. Legislation

This section aims to propose legislation that would streamline and shorten authorisation of Projects of European Interest (PEI) according to the intentions of the TEN-E guidelines.

3.1 Challenges

The legal frame governing the establishment of PEI is Decision 1364/2006 of the European Parliament and the Council laying down guidelines for trans-European energy networks and repealing Decision 96/391 and Decision 1229/2003 (the TEN-E guidelines). The Decision defines the scope and the nature of Community Action for the trans-European Energy networks including the criteria for projects of common interest, priority projects and PEI. In this respect article 12 of the Decision addresses competition requiring that.

"When projects are considered, their effects on competition and on security of supply shall be taken into account. Private financing or financing by the economic operators concerned shall be the main source of financing and shall be encouraged. Any competitive distortion between market operators shall be avoided, in accordance with the provisions of the Treaty."

PEI are of cross-border nature per the TEN-E guidelines. TEN-E guidelines stipulates that PEI shall be implemented rapidly (Article 9(1)) and that Member States (MS) shall submit to the Commission an updated and indicative timetable for the completion of those projects, showing the planning and approval process, feasibility and design phase, construction and entry into service of the project. In case of delay of PEI, the Commission is under article 10(1) of the TEN-E guidelines given the power to designate a European Coordinator after consultations with the concerned MS. The task of the coordinator is to improve the European dimension of the project and the cross border dialogue and to contribute to coordination.

Beside these overall guidelines for the establishment of PEI the rest is left to MS. Whether the developer of each corridor is the MS, Energy Companies or other private or public bodies is for the MS to decide. It is also for the effected MS to decide the authorisation process and the criteria for the selection of developers or operators in case more than one is interested in one particular PEI. In this respect, the MS must however comply with EC-legislation on public procurement, on environmental impact assessment and on nature protection.

While it is known to be possible to build cross-border projects within 5 years, this is not the usual case with TEN-E PEI. There are two main reasons for that: one is related to the market conditions, the other is the process of project authorisation, with main challenges related to:

- Political opposition.
- Absence of incentives (e.g. 3rd party/transit countries): 3rd party or transit countries do not benefit directly from a project, and will tend to give a project low priority or be unwilling to authorise a project.
- Institutional hearing: Several authorities and public bodies are involved at different level in each MS. Need of coordinated, integrated approach which could be inspired by the IPPC-Directive (96/61).
- Procedural challenges: The process is imprecise or poorly specified or unnecessarily complicated. Procedures do not match between Member States.
- Absence of scoping: Content of investigations and studies needs to be agreed to ensure a focus on the main issues and challenges of the project, and a common understanding between all interested parties. Absence of scoping increases the risk of changes to investigations and studies required throughout the project.
- Absence of time frame: No time limits on the stages of authorisation or no firm outer time frame.
- Capacity at local administrative level: There is a shortage of skills and competence to manage the authorisation process and no clear will to make a decision.
- National law does not provide for effective authorisation processes.
- Several permit procedures are required based on national legislation relating to planning, environment, nature protection, expropriation.
- Process is extended for local planning and environmental issues.
- SEA context and EIA and SEA overlap.

Project authorisation procedures and environmental regulations in particular are means with a potential to delay and complicate projects. Projects are not given priority or implemented into national regulations and national plans do not exist for TEN-E projects. The priorities and interests varies both at national and local level, and opposition towards projects leads to long authorisation processes, where the environmental regulations and hearing obligations are widely applied.

3.2 Authorisation procedures in Member States

Different approaches to project authorisation are applied in Member States (MS). Procedures are comparable as concerns environmental assessment, national and local permits, and consultation with the public, while the overall planning approval level is subject to different approached, e.g. in terms of number of entities involved in the process and number of examinations of projects at different levels.

As concerns environment and nature assessments there are no essential differences among MS regulations. Environmental Impact Assessment according to the EC Directive 85/337 and assessment according to the Birds and Habitats Directives 79/409 and 92/43 has to be carried out in all MS. The MS have transposed those directives into their national legislation.

As concerns the authorisation procedure, however, the MS apply different approaches following their national regulations. There is no EC directive on the authorisation procedure and MS are not bound to enact concerted procedures.

As concerns policies and planning for energy infrastructure there are no binding regulations in the MS that can be referred to in the authorisation process, with the consequence that PEI may not be taken into consideration by authorities, and a project will have to be justified in a national context in each case. In combination with the fact that there is no obligation related to the procedure and to time limits this is one of the major reasons for delay.

Some countries may well have clear and transparent procedures, while they take time for reasons like absence of national policy for infrastructure and multiple consent regimes.

3.2.1 Case acceleration measures - Germany and the UK

Germany

In Germany environmental law and the planning system is characterised by the federal nature of Germany, with competencies split between the federal and the Länder levels. The federal structure of Germany has been viewed as a hindrance to decision making and delaying reforms in a number of areas.

The complexity in environmental regulation is due to a variety of challenges in the fields of environmental protection, nature conservation, resources management, and coordination with other policies, not only in federal systems. In the case of Germany the complexity may be seen partly as a consequence of inappropriate allocations of competences among the federal and Länder level.

A federal reform was adopted in 2006, changing relationships between federal and Länder competencies. It establishes a clearer separation of power between the federal government and the Länder and reduces the number of laws that the federal government can veto. The federal level has three levels of competence: framework competence where federal and Land laws have to complement each other, concurrent competence where the Länder have the right to adopt laws as long as the federal level has not done so, and exclusive competence where the federal level alone can enact legislation. The areas of framework competence are particularly problematic, as it requires seventeen acts of legislation within Germany: one federal framework law and adoption or amendments in each of the sixteen Land laws. In the area of environmental law competences at federal level are being strengthened through the reform. Existing framework legislation has been changed to concurrent legislation and it would pave the way for the federal government to harmonise and streamline the system of environmental regulation and administration.

The administrative system in federal Germany has developed many institutions and procedures to cope with and compensate for the complexity of environmental policy challenges. The federal government and the Länder have set up a Conference of Ministers of Environment in order to coordinate environmental policy in general. The Conference sets the work programme and supervises the activities of various thematic working groups dealing with the main fields of environmental policy. The working groups play an important role in harmonising approaches among Länder and facilitating cooperation and coordination with the federal government. They also facilitate the involvement of the Länder in EU affairs. One important role of the working groups therefore consists of ensuring harmony in their legal approaches, structures and procedures.

Environmental policy is rich in challenges in the implementation, such as issuing authorisations to projects. The authorisation procedure for infrastructure projects, that are land consuming on the wider area, is the plan approval procedure. Decisions for projects subject to that procedure are discretionary following a weighing up different issues by the competent authority, with time limits for certain steps, but no overall time limit for the completion of the procedure. This is in contrast to authorisation of installations subject to the federal immission control act, where the project is entitled to authorisation if all relevant standards and requirements are met and a time limit for the completion of the procedure (seven months) is stipulated.

Germany has also implemented a range of initiatives starting in the early 1990s to accelerate general planning processes and authorisation procedures for infrastructure projects, following perceived long planning and authorisation procedures of 10 to 20 years.

The initiatives introduced a range of measures that have shortened the overall length of authorisation procedures, in terms of faster procedure management and consultation processes e.g. star procedure where authorities are consulted in parallel, restrictions to legal consequences due to procedural errors, advisory duty for authorities and pre-application meetings if requested, introduction of simplified procedures and of time limits for consultation processes and introduction of preclusion rules for statements and objections submitted by the public and other authorities.

The most recent initiative, in 2006, is the act for acceleration of planning procedures for infrastructure projects, with the federal administration court being first and last level of jurisdiction, changes to time limits for objections from environmental organisation and to the way information is provided to organisations, and hearing meetings made discretionary.

UK

In the UK the Government has introduced a Planning Reform Bill in November 2007. The legislation builds on the proposals set out in a May 2007 Planning White Paper to streamline and improve the planning regime and introduces a new system for nationally significant infrastructure planning, alongside further reforms to the town and country planning system.

It introduces a single consent regime for major infrastructure projects, establishing an infrastructure planning commission to examine and take decisions on applications for nationally significant infrastructure within the framework of national policy.

The UK has made improvements to the planning system during the last decade, but the Planning White Paper proposes further reform to meet increasing challenges. The Planning White Paper identifies a series of areas in need of improvement:

- There is not a clear policy framework for nationally significant infrastructure. The result is that local authorities and others can find it difficult to take account of relevant policy considerations or may adopt an overly cautious approach rather than one that encourages development. Development proposals have to be evaluated from scratch in each individual case and this can delay the process more as debating issues such as need of the project is involved.
- The planning system is too bureaucratic, takes too long and is unpredictable. The authorisation process for major infrastructure projects has been to slow and complicated. Some developments have to get approval under a number of different statutory arrangements, in the planning terminology referred to as 'multiple consent regimes'. This means that there are multiple decision points and multiple decision makers.
- The UK has a provision under the planning regulations for "call-in" by ministers of cases of more than local importance. The use of this measure has grown to an unacceptable level, and it is proposed to consider the type and scale of projects that merit for a "call-in", with a view to reducing the number of "called-in" cases.
- Local decision making may not be the best solution for some projects which are particularly complex, span several local authority areas, or confer national or regional benefits but local disbenefits (the "spillover" effect). Energy transmission projects, while vital to the overall security of supply, may confer no direct local benefits.

The main response of the Planning Reform Bill to the needs that relate particularly to nationally significant infrastructure projects is:

- National policy statements are produced, to ensure that there is a clear policy framework for nationally significant infrastructure which integrates environmental, economic and social objectives.
- Clarify the decision making process, and achieve a clear separation of policy and decision making, by creating an independent commission to take the decisions on nationally significant infrastructure cases within the framework of the relevant national policy statement.
- Give powers to the infrastructure planning commission to grant authorisations necessary to construct a project, including the power to authorise the compulsory purchase of land.

- Provide for improving the way promoters prepare applications; requiring consultation publicly on proposals for development and requiring early engagement with key parties.
- Streamline the development consent procedures by rationalising the different regimes, improving inquire procedures, and imposing statutory timetable on the process.
- Decisions must be taken within a framework that takes account of relevant factors at national, regional, and local level, while local and regional planning bodies are expected to take full account of relevant national policy.
- Improve public participation providing opportunities for public consultation and introduction of a system providing additional funding to public bodies.

The planning system reform aims to make authorisation processes for nationally significant infrastructure projects more efficient. The introduction of national policy statements would provide a strategic context in which to develop schemes and a much clearer framework for their examination. The introduction of an infrastructure planning commission would make the authorisation process more transparent and establish a separation between policy making and taking judicial decisions, and ensuring that the examination and decision phases are more joined up.

3.3 U.S. experience

In 2005 the Energy Policy Act of 2005 was passed in the U.S. as an attempt to combat growing energy problems. The Act created a section of the Federal Power Act that directs the U.S. Department of Energy (DOE) to identify transmission congestion and constraint problems, and determines that resolving an areas electricity problems is a matter of sufficient national importance to warrant the exercise of the DOE's discretion to designate a national interest electric transmission corridor (National Corridor).

The background for the Act was, that the U.S. has seen persistent underinvestment in the power transmission sector, relative to demand growth, since the mid-1980s. Such underinvestment leads to higher electricity prices, dependence on a limited range of generation suppliers, and greater risk of blackouts, that electricity markets are now regional (multi-state) in size and networks must be planned, developed and operated on a regional scale. A lot of new generation capacity will be sited distant from cities, increasing the need for transmission capacity, and that a robust transmission grid is vital to the nation's economic health and welfare.

The provisions of the Act require states to consider adopting policies that direct utilities to develop demand response programs. The DOE is required to publish a national study every three years on transmission congestion and authorised to designate appropriate areas as National Corridors.

A designation would signify that the federal government has concluded, that a transmission congestion problem exists and requires timely solution, and enable the Federal Energy Regulatory Commission (FERC), under certain conditions, to approve siting and construction of transmission facilities within the corridor. Conditions for exercise of siting authority are that the state does not have authority to consider interstate benefits associated with the project, the state has withheld approval of the project for more than a year, or the state has conditioned its approval such that the project would not significantly reduce congestion or be economically feasible.

A designation of a National Corridor is a first step in providing the federal government siting authority that supplements existing state authority. In practice, this means that if an applicant does not receive approval from a state to site a proposed transmission project within a year, FERC may consider whether to issue a permit and to authorise construction of the project.

Only those transmission projects within a National Corridor that would significantly reduce congestion would be eligible for a FERC permit. FERC also does not have the ability to authorise or order construction of transmission lines over state or federal property within the National Corridors, without the consent of the relevant land management agency.

A designation does not determine how the affected area's congestion problem should be resolved, nor does it endorse particular projects or circumvent compliance with any existing federal environmental requirements.

In May 2007, the DOE drafted two National Corridors that were subsequently designated in October 2007: the Mid-Atlantic Area National Corridor and the South-West Area National Corridor.

The designations do not direct the construction of any new transmission facilities, they do not decide whether or where any new transmission facilities should be built, and they do not approve or disapprove the construction of any particular proposed facilities.

In designating the corridors the DOE has not carved out environmentally sensitive lands because the statute does not exclude such lands from the inclusion in a National Corridor. In the event of a siting proceeding, a review would be conducted under the National Environmental Protection Act, which would include realignment analysis to avoid adverse effects on the environment, landowners and local communities. It is attempted to make the corridors broad enough to encompass a range of alternative routes. The DOE proposes to make corridor boundaries coincident with the boundaries of counties, so that boundaries are specific, and readily identifiable.

3.4 Options for improvement

The main challenge in improving the conditions is to streamline the project authorisation process, based on more uniform procedures and criteria while observing the fundamental principles of the EU legislation. There are basically three possible ways of improvement via introduction of new EU regulation in order of effectiveness and extent of the intervention that will be required:

1. **Harmonisation of timetable**. The EU establishes a time limit for the authorisation of each PEI
2. **Harmonisation of procedures and criteria on authorisation of PEI**. The EU adopts common uniform procedures and criteria for the authorisation of PEI and further considers whether to integrate assessments under the EIA-Directive, the SEA-Directive and the Habitat-Directive in this process.
3. **Endorse the power of authorisation of PEI to the Commission**. The Commission will be responsible for the permits under the EIA, SEA, and Habitat-Directives, and the Commission will have the power – subject to conciliation – to decide location of a PEI and in this respect de facto is in power on physical planning.

Based on an assessment of the likelihood of a measure to be effective combined with its chances of being implemented, it would appear that an improvement measure should combine elements of MS obligations to adopt national policy with integration of PEI, MS obligations to implement concerted procedures applying a one-stop approach and with time limits for decisions, and possibly provisions to establish a body given powers, under given circumstances, to grant authorisations necessary to construct a project.

3.5 Analysis of legislation options

The legal frame for any solution to the challenges is the EC Treaty and the legislation powers endorsed to the Community legislator. The subsidiary principle does not prevent intervention, as the priority corridors for energy transmission in the EC and between the EC and third states would justify extensive EC legislation.

The obstacles lie mainly in the principle of institutional autonomy, the principle of implied powers and the Treaty Article 295 on protection of private property.

Within the legislative power of the Community the three legislative options represent basically three different political approaches to the way the Community could respond to common major challenges as related to the need for priority corridors for energy transmission.

While the existing guidelines take a legal approach close to international soft law without clear substantial obligations, the formal harmonisation of timetable represent the first step towards the usual EU approach towards common problems: minimum requirements on certain procedural aspects. The second legislative option represents the principles applied in the internal market harmonisation reflecting that minimum requirements on few procedural aspects have not been able to solve the problems. The third option follows the principles in more advanced internal market legislation in which the Commission has been given the power to authorise certain activities or products. This legislative approach has been applied on the outfacing of ozone depleting substances and lately more comprehensively in the REACH-regulation 1907/2006 on authorisation of industrial chemicals. Because the third option in relation to PEI involves land use and implies that the Commission will have the power to decide project location, it extends beyond what power has until now been transferred to the Commission. This does not mean, however, that the third option is not possible under the Treaty, since such legislative power has been anticipated in the Treaty article 175(2) on physical planning.

The pros and contras of the three legislative options are briefly addressed in the following:

3.5.1 Time limit harmonisation

This first option proposes a binding time frame for authorisations required under EC law. Such time frame restrictions are used in other EC legislation, as e.g. the Regulation on Shipment of Waste. The legal basis for this model should be article 156 and maybe article 95.

The advantages of this model is that it leaves all substantial matters to the Member States only requiring that each PEI is established and in operation before a fixed date, which for each corridor could be decided either by the Council or by the Commission. In this respect this model is the most flexible. There are mainly two weakness of the model. Firstly, that many conflicts are caused by unresolved questions which are addressed under the second and the third option. Secondly, it is doubtful whether the timetable can be enforced efficiently. Sanctions on delay could be implemented as Member State liability for economic loss caused by the delay. It is however doubtful whether such liability sanctions are efficient to ensure compliance. Penalty on Member States does not seem possible beyond what is provided under the Treaty Article 228(2) on penalty payment.

3.5.2 Harmonization on criteria and procedures for authorisation of PEI

The second option follows the well known principles from the internal market harmonisation. The basic model is uniform criteria on authorisation and uniform procedures as known from the Regulation on Shipment of Waste. This is however only the basic part, since the model also intends to integrate existing EC obligations as environmental impact assessment. The legal basis for this model is the Treaty Article 156, 95 and 175(1).

The model has four basic elements:

1. Requirements to cooperation between affected Member States - as stipulated in the TEN–E-Guidelines.

1.1 The Commission designates a number of alternative geographical cross border locations for the PEI.

1.2 The Member States affected by the PEI may designate alternative cross border points for the PEI.

1.3 Final decision of the authorisation of the PEI is left to the competent authorities of the affected Member States. If a common agreement cannot be reached, the Commission is obliged to act as mediator. In case a final agreement is still not reached, decision is taken by commitology procedure with due respect to imperative public need of the affected Member States.

2. Definition of the legal frame for competition on the establishment of each PEI.
2.1 Member States call, within a fixed date, for expressions of interest from parties which are interested in constructing the particular PEI.
2.2 Based on the principles for selection under the public procurement directive, the affected Member States selects the qualified parties which will be asked to present their project within a fixed date.
2.3 The legislation defines the criteria regarding economy, energy supply, technical standards, safety and environmental considerations applying to evaluation of the proposed project.
2.4 Application for the project should only be submitted to one national authority (one-stop approach), leaving it to this authority to ensure that the relevant national public bodies are involved in accordance with national law.

3. Environment.
3.1 The project shall be supplemented by an Environmental Impact Assessment, an assessment of impact on Natura 2000 sites, and on endangered species protected under article 12-16 of the habitats directive. This obligation together with the public hearing (see 3.4) replaces the obligations under the EIA-directive, the SEA-Directive and the Habitats-Directive article 6(3) and 6(4).
3.2 The project shall be supplemented by an assessment on needs of dispensation from national planning legislation and national nature legislation.
3.3 The national authority designated for the PEI obligation is responsible for organising a public hearing based on the environmental impact assessment before any final decision is taken.
3.4 Based on the environmental impact assessment and taking into account the public hearing conditions for the projects are decided for the selected project.
3.5 The legislation defines a timetable covering the period from application to public hearing and final decision.

4. In case of conflict between involved Member States the Commission is obliged to act as mediator. The Commission has no final say.

The advantages of the second option are twofold. Firstly, it establishes a legal frame based on free competition, a high level of environmental protection, transparency and the participation of third parties. Secondly, the simplification of the complex decision process caused partly by different EC legislation, and partly by different national legal schemes, will lead to a faster decision process without jeopardising third party interest. The weakness of this model is that to the extent strong national and/or economic interests interfere in the decision process, the model has no efficient tool to prevent delay – but because the procedure balances the different interest that might not be needed.

3.5.3 Commission power to authorise PEI

The third option will give administrative power to the Commission to authorise priority projects, substituting all national authorisations, based on the Treaty Article 95, 156, 175 (1) and 175(2). Only the expropriation part is left to Member States.

This model will imply that the Commission takes over the tasks and powers of national authorities under existing EC legislation as the EIA and the Habitats Directives. However, the power of the Commission is not in the end restricted to areas on which the Community already has legislated. Based on the urgent need for PEI (security of supply and Kyoto-obligations) and the Treaty article 156 in combination with article 95 on the internal market, and article 175(1) and 175(2), the option will imply that the Commission under certain condition replaces national planning decisions and other permits needed under national law for the PEI with one permit from the Commission covering EC-law as well as all needed permits under national law. Because planning permits are involved the Treaty Article 175(2) will have to be applied.

The benefit of this model is that it could ensure simplification of procedures and shorten the decision process without jeopardising third party interests. The weakness of the model is that it implies transfer of national power to the Commission of a character and on a field not seen before. Hence, this model is likely to cause strong political opposition from Member States.

3.6 Impact analysis of legislation options

Legislation options are considered in the light of a need of efficient and well performing infrastructure that improves cohesion in the EU and increases connection of isolated markets.

The overall objective is eventually to secure the quality of people's lives – via development that meets economic, social and environmental objectives in an integrated and sustainable way.

The immediate objective of a legislation improvement is to streamline and shorten authorisation of projects, while meeting the overall objectives, realising that lengthy authorisation procedures are significant obstacles to infrastructure development. Streamlining and shortening the authorisation period will allow for timely and adequate investments in transmission for natural gas and electricity, which will promote and ensure security of supply, functioning markets and allow for the climate and environmental goals of the EU to be reached as efficiently as possible.

Any legislative improvement would have to provide for effective project development and authorisation time in a way that takes duly account of environmental, safety and social concerns and legal interests of affected citizens.

As discussed earlier, the three legislative legislation options represent three different principles that consider (1) minimum requirements on procedural aspects, (2) principles of market harmonisation with uniform criteria and procedures and (3) advanced internal market legislation with Commission power to authorise projects.

In essence, all 3 options are thought to be economically beneficial on a global level, although to a varying degree. The overall goal of each option is ultimately the same, i.e. to ensure adequate and efficient energy transmission in the EU. However, the outcome and effects may be different in each option, e.g. as decision-making is increasingly centralised in option 3, the projects that are implemented might differ slightly from the projects chosen under e.g. option 2. This is due to potential differences in how the EU and the market evaluate different projects.

All options are expected to be socially beneficial, due to an increase in activity globally and locally, directly via the project activities. Further an efficient level of energy infrastructure is necessary in order to ensure and promote low- and stable energy prices, which directly affects EU energy consumers. Again Local benefits may vary across the EU and for some regions they might be negative.

All 3 options are thought to meet environmental objectives, as they have generally built-in environmental assessment mechanisms subject to EU regulation. This is not basically interfered with in the legislation options. Rationalisation mechanisms are built into the legislation options, to a varying degree, that would basically centralise environmental assessment decision making and carry a scope for uniformity in assessment and decision-making.

There is a downside though, on a local scale, economic as well as social and environmental interests could suffer under a system that plans and decides differently compared to status quo. In a more centralised system, common EU interests versus local or national interests. However, from a global point of view, a harmonised and ultimately a centralised system would provide scope for better decisions seen from a global perspective.

An example of an global/local environmental conflict would be: Investing in large transmission lines, with the purpose of transporting electricity from an offshore wind farm, may entail large environmental benefits on the overall EU level. However, locally the effects may be negative, as such a project could cause damage to the local environment.

The following table gives a qualitative evaluation of economic, social and environmental impacts. The impact is compared to a business-as-usual scenario, where no changes in legislation are implemented.

Table 2 Impacts

Economical	**Social**	**Environmental**
Economical benefits from quicker and in-time implementation of projects Lower implementation costs Economical benefits from increased Security of supply Potential costs from uncoupling of the market	Lower prices – globally More stable energy prices Locally prices could increase	Global environmental benefits Support of EU Climate package and goals of Climate package Local environmental costs

In the following, the impacts are assessed for each of the three options individually.

Option 1

Only minimal economical impact as the effect of this option is limited.

Overall social impacts would be limited as well, as the effect would be limited, thus potential benefits in term of lower energy prices would be limited, presumably non-existing.

Overall environmental effects would also be limited, due to the low effect expected from option 1.

Option 2

Economic impact would be relatively high, as option 2 would promote and help to ensure implementation of the optimal and most efficient solution, ensuring interconnection of energy markets and adequate supply capacity to EU energy markets. Further successful implementation of projects would ensure improved security of supply in the EU.

Overall social benefits would be positive as efficiency gains from energy transmission would promote cheaper energy prices. Locally social benefits could vary, as e.g. interconnection of a high price country with a low price country, could lead to higher prices locally, however on an EU scale effects would be positive.

Overall environmental benefits anticipated to be positive, as investments in energy transmission would cater to optimal utilisation of renewable energy sources as well as enable e.g. the implementation of the climate package.

Option 3

Option 3 has the largest potential for economic benefits due to an effective decision-making process that would allow for timely and adequate interconnection of energy markets as well as supply capacity. Further, economical benefits would incur due to potentially large savings from the extensive expenditure on lengthy and complicated EIA procedures etc. However, option 3 also entails a uncoupling of market mechanisms as decisions are centralised and regulated, that might have a negative overall effect, i.e. increased centralisation and regulation could result in welfare losses due to a uncoupling of the market and subsequent loss of efficiency. Further centralised decision may have a negative effect on national preferences and affect national energy planning in a negative way.

Social impact - as was the case for option 2, only would option 3 allow for even quicker implementation and increased level of investments, which would ensure lower energy prices. Further, locally costs could be higher than was the case for option 2 as legislation becomes more effective.

Overall environmental effects would be positive. However, this would possibly occur at the expense of local environmental interest, as transfer of decision power is transferred to the EU, local environmental interests may be affected. This effect is most dominant for option 3.

Overall the impact and effects on a global scale, increase from option 1 to option 3, i.e. as the level of centralisation is increased the focus on overall EU benefits increases, such as lower and more stable energy prices on average in the EU, overall global environmental benefits are also promoted along with the level of legislative intervention. However, as decision-making along with the increased centralisation in option 3, local effects may become increasingly negative as well as a decoupling of local and global markets may lead to less efficient outcome.

In terms of ensuring timely and adequate energy transmission in the EU, we also need to evaluate the "implementability" of each option i.e. to evaluate which option would be the quickest and easiest to implement and then compare this to the overall impact of each option. The reasoning being, that when deciding upon an option one should take into account such issues as: How quick and how easy can this option be adopted, i.e. choosing an option, which would take a long time to implement is not desirable, even though the option would be very effective once implemented. This is because urgency is very important in terms of securing adequate and efficient energy transmission.

3.6.1 Comparison of options

In Table 3, we rank each option and assign a score to each category economy, social aspects, environment and "implementability". Individual scores are based on the above assessment, where the overall evaluation is transformed into a score ranging from 1 to 5, 5 indicating the highest level of benefits and 1 the lowest.

"Implementability" is rated according to how quickly and easily the legislative option cold be implemented, with 5 indicating a quick and easy implementation process and 1 a slow and difficult process.

The individual scores include evaluation of all impacts as well as efficiency of the impact, e.g. option 2 scores 4 on environment and option 3 only 3, this is based on the assumption that although option 3 has a greater impact globally than option 2, the negative effects from local environmental cost are assessed to outweigh the increased global benefits.

Any assigned score is considered indicative, i.e. the scores have been assigned for the purpose of highlighting and exemplifying the various effects and how each option scores compared to the other options, thus the ranking is not to be considered as a conclusive but only a tool to illustrate any differences between options.

The total score is calculated by adding the scores of the 3 main categories economy, social and environment and multiplying this number with each options individual score for "implementability", e.g. option 1: (1+1+1)x 5 = 15. The idea is to create a multi-criteria analysis that promotes any option, which is effective as well as "implementable".

Table 3 Ranking of options

Legislation option	**Economy**	**Socio**	**Environ-ment**	**Implement-ability**	**Total**
1. Time table	1	1	1	5	**15**
2. Harmonisation of procedures	3	4	4	3	**33**
3. Authorisation power to the EU	5	5	3	1	**13**

Based on the on the above analysis option 2 has the highest overall score, 33. This result is based on a combination of high global economic, social and environmental impact, relative small negative impact locally and a high "implementability" score.

Although option 3, in total, has a slightly higher score than option 2 on economy, social and environment (13 compared to 11), the overall score is limited by the fact that this option would be very difficult implement due to a low "implementability" score.

Option 1 has only a very limited impact economically, socially and environmentally and thus overall receives a fairly low score, although it is the easiest and quickest option to implement.

3.7 Structure of legislation options

The objective of new legislation is to improve the energy related internal market conditions through establishment of clear legal obligations on the authorisation of PEI. PEI involve per definition two or more Member States. Different national legislation on authorisation of energy transmission projects has caused substantial obstacles to the establishment of PEI. To avoid such obstacles neither guidelines nor a simple time limit is believed to be sufficient. There is a need for uniform criteria and procedures on the PEI authorisation to avoid delay and disturbance of free competition and ensure free trade with energy, while observing regulations related to the protection of the environment.

The two options considering harmonisation of procedures and transfer of power to the commission are further developed:

The option with harmonisation of criteria and procedures for authorisation of EIA; leaving final decision to the Member States, but based on harmonised, uniform criteria and procedures on the authorisation of PEI and replacing the obligations under the SEA-Directive, the EIA-Directive and the Habitat-Directive within the procedures of such a new legal scheme for the authorisation of PEI.

The option with Commission power to authorise PEI; considering the absence of legal power of the Commission to interfere with the delays in project authorisations that happen as a consequence of the challenges faced with none coherent permit schemes and many national institutions involved at different levels, the most effective and simple solution would appear to be give the Commission the power to select and authorise PEI and competence related to national planning decisions that are necessary for the project. In such legislation the obligations under the SEA Directive should be considered covered by the selection of PEI and the obligations under the EIA Directive and the Habitat-Directive should be integrated in the decision-making process. Such a transfer of power to the Commission is expected to cause strong reservations from many Member States.

The two options for a new legislation are described more in detail in the following including a draft-legislation frame for each of them.

3.7.1 Harmonisation of procedures and criteria on authorisation of PEI

Legal form: Regulation

Legal Basis: EC Treaty article 95, 156, 175 (1)

Reason for legal basis: the regulation intends to improve internal market on energy by harmonised uniform criteria and administrative procedures for the establishment of PEI. Article 175(1) has been included since the legislation and includes modifications of the procedures under the Directive 85/337 on Environmental Impact Assessment, the Directive 2001/42 on assessment of plans and programmes and the Directive 92/43 on conservation of natural habitats.

Principles

The proposed Regulation builds on the following principles:

Given that PEI are of common Community interest, with high priority, the different national criteria and procedures applied in the authorisation of PEI should be harmonised to uniform criteria and procedures including a timetable to ensure the establishment of PEI within due time. The criteria and procedures must be based on economic efficiency, free competition, environmental concern, transparency and public participation.

The Regulation establishes the obligation of each Member State to ensure the establishment of the PEI decided by the Community within its territory in due time applying the criteria and administrative procedures laid down in this Regulation.

Each Member State designates one competent authority responsible for the final authorisation of the PEI within the Member State.

The Regulation defines the legal frame for competition on the establishment of each PEI. Based on the principles for selection under the public procurement directive 2004/18, the effected Member States select the best qualified parties, which will be asked to present their project within a fixed time limit.

The Regulation defines the criteria regarding economy, energy supply, safety, technical standards and environmental considerations governing which of the proposed projects should be preferred.

Application for the project should only be given to one national authority, leaving it to this authority to ensure that the relevant national public bodies are involved in accordance with national law.

The procedure under the Regulation replaces the obligations as concerns PEI under the EIA Directive, the SEA Directive and the Habitats Directive and integrates the national planning decisions within the procedure. The competent authority designated for the PEI is responsible for organising a hearing of the public and relevant national and local public bodies.

The Regulation defines the criteria which must be taking into account in selection of the project.

In case of conflict between involved Member States the Commission is obliged to act as mediator.

The procedure will include time limits relating to prequalification, application, public and MS hearing, selection of preferred project, conciliation procedure, consent to project, and land acquisition.

Structure of the draft Regulation

Article 1: Scope and object

This Regulation establishes the uniform criteria and administrative procedures for the approval of the establishment of PEI by the Member States.

Article 2: Definitions

…..

Article 3: Timetable and designation of cross border passage for PEI

3.1 The Commission decides for each PEI the deadline for application by interested parties in accordance with article 5.

3.2 At this decision the Commission must designate between 5 and 10 cross border locations for the PEI.

Article 4: The competent authority

Each Member State must, within one year after this Regulation has been adopted, designate one competent authority, which is responsible for the final authorisation of PEI at the territory of the Member State and has the responsibility of coordination with all relevant national public bodies as well as coordination with competent authorities in other Member States.

Article 5: Call for interested parties

5.1. Within the time limit established by the Commission under article 3.1 the competent authority must call interested parties to submit a basic application for prequalification as developer in accordance with the requirements stipulated in Annex.

5.2 In making the call for interested parties the competent authority may add 3 new cross border locations to those proposed by the Commission under article 3.2.

Article 6: Prequalification

6.1 Prequalification of a maximum of five developers is based on the principles in Annex.

6.2 Within a period of no more than 1 month after prequalification has been finalised, the competent authority decides a date not more than 12 months later, at which the interested parties should present their application for the PEI. The dates must be coordinated with other Member States affected by the PEI.

Article 7: Application for authorisation

7.1. The application must beside technical and economic information as defined in Annex include: (1) Environmental Impact Assessment in accordance with the EIA Directive; (2) an assessment on the impact on all Nature 2000 sites from the proposed project; (3) an assessment whether the proposed project is in accordance with local and regional physical planning and nature protection legislation in the affected Member States, explaining to what extend the proposed project requires new plans, permits or dispensations before it can be approved in the affected Member States.

7.2 The competent authority decides within a period of 3 months whether the applications comply with the requirements of this Regulation.

Article 8: Hearing of the public and national and local bodies
Not later than 3 months after the competent authority has accepted the applications, the competent authority shall organise a public hearing and a hearing of all relevant national public bodies and local authorities on the applications and the environmental impact assessment of each project. The timescale for the public hearing must be coordinated with the competent authorities of the other Member States affected by the PEI.

Article 9: Pre-selection
Based on the public hearing and the interventions from different national and local public bodies and the technical, economic and energy supply criteria stipulated in Annex, the competent authority of each affected Member State makes a pre-selection of which project it will suggest for the PEI.

Article 10: Consultation and final decision
10.1 Based on the pre-selection the competent authorities of the effected Member States starts consultation to agree on a final decision of which developer or developers should be given authorisation for the PEI. In case agreement cannot be reached, the Commission is obliged to act as mediator to reach a common agreement.

10.2 If an agreement cannot be achieved, the final decision of the project/projects and developer/developers is decided by commitology procedure in respect of imperative public interests of the affected Member States.

Article 11: Authorisation
When the project is finally selected, the competent authorities of the effected Member State issue an authorisation of the project. This decision substitutes consent under the EIA Directive and the Habitats Directive article 6(3) and 6(4).

Article 12: Acquisition of land
Within a period of 12 months after the final consent, the Member States must acquire the land for the project. The costs of acquiring the land are paid by the project developer.

Article 13: Third States relation
PEI between the EC and third states follow the same legal scheme to the extent the PEI are placed on the territory of one of the Member States.

3.7.2 Commission empowered to authorise projects

Legal form: Regulation

Legal Basis: EC Treaty article 95, 156, 175 (1), 175 (2)

Reason for legal basis: the objective of the Regulation is to improve internal market on energy by deciding the administrative procedures needed for the establishment of priority corridors for energy transmission. Article 175(1) has been included since the legislation includes modifications of the procedures under the Directive 85/337 on Environmental Impact Assessment, the Directive 2001/42 on assessment of plans and programmes and the Directive 92/43 on conservation of natural habitats. Article 175(2) has been included as the legal basis because the Regulation transmits competence concerning town and country planning and land use to the EC.

Principles

The proposed Regulation builds on the following principles:

Given that PEI are of common Community interest, with high priority, it should be the Commission that has the competence to select and authorise the PEI. The selection should be based on economic efficiency, free competition, environmental concern, transparency and public participation.

The selection and authorisation procedures should be based on procedures for the award of public works contracts laid down in Directive 2004/18 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts combined with the principles on environmental impact assessment and public participation laid down in Directive 85/337 on Environmental Impact Assessment, the Directive 2001/42 on assessment of plans and programmes and the Directive 92/43 on the conservation of natural habitat and wild fauna and flora.

The decision on the project is considered to cover assessment subject to Directive 2001/42 on assessment of plans and programmes (SEA Directive) and otherwise requirements under that Directive do not apply.

The first step in the procedure is a prequalification procedure based on the principles known from the public procurement Directive 2004/18.

The pre-qualified applicants must submit an application before a fixed date. The application must include: (1) Environmental Impact Assessment in accordance with the EIA Directive; (2) an assessment on the impact on all Nature 2000 sites from the proposed project; (3) an assessment whether the proposed project is in accordance with local and regional physical planning and nature protection legislation in the effected Member States explaining to what extend the proposed project requires new plans, permits or dispensations before it can be approved in the effected Member States.

The Commission is responsible for organising a public hearing based on the principles of the EIA directive of the applications for projects within the Member States affected by the project. Member States whose territory is affected must inform the Commission within a period of 6 months if a project will conflict with imperative public planning decisions of the Member State. Based on the public hearing and the interventions of the Member States involved, the Commission selects the preferred project for the priority corridor. If an affected Member State raises objections against the selected project as being in conflict with imperative planning decisions of that Member States, the Commission initiates consultation with the Member States. If an agreement cannot be achieved, the final selection of the project is decided by commitology procedure.

When the project is finally selected, the Commission provides a formal consent of the project within a period of 6 months, laying down conditions for the establishment and operation of the PEI. This decision substitutes consent under the EIA Directive and the Habitats Directive from national authorities as well as any national planning decision.

Within a period of 12 months after the final consent, the Member States must acquire the land for the project. The costs of acquiring the land are paid by the project developer.

As regards PEI between the EC and third states, the Commission is given the mandate to negotiate and conclude framework agreements with third states on establishment of priority corridors from third states. In accordance with the Treaty article 300, the agreement is only binding after having been adopted by the Council.

The implementation of agreements with third states on the territory of the European Community is based on the principles laid down for PEI within the EC.

The procedure will include time limits relating to prequalification, application, public and MS hearing, MS objections, selection of preferred project, conciliation procedure, consent to project, and land acquisition.

Structure of the draft Regulation:

Article 1: Scope and object

This Regulation establishes the uniform procedures and criteria for the authorisation of PEI in accordance with the Decision 1364/2006.

Article 2: Definitions

…..

Article 3: Timetable
The Commission shall for each PEI decide the deadline for application.

Article 4: Prequalification
The Commission call interested economic actors to apply for prequalification, subject to criteria stipulated in Annex.

Article 5: Application for the project
1. The pre-qualified economic operators must within a time limit established by the Commission submit the final application for the proposed PEI.
2. The application must contain a description of the project and include an environmental impact assessment in accordance with EIA Directive 85/337. If the project has an effect on any Special Protected Bird Area designated under article 4 of Directive 79/409 on protection of wild birds or on habitats designated under article 4 of Directive 92/43, the application must include an assessment of the impact in accordance with article 6(3) of the Directive 92/43. If this assessment cannot establish that the project will not have any adverse effect on bird or habitat areas, the application must include an assessment of alternatives in accordance with article 6(3) of Directive 92/43 and inform of proposed compensatory measures.
3. The application must establish to what extend the proposed project requires new plans, permits or dispensations before it can be approved in the affected Member States.

Article 6: Public Hearing and hearing of effected Member States
Subject to control by the Commission whether the applications comply with the requirements laid down in this Regulation, the Commission organises a public hearing in the affected Member States on all the applications regarding the proposed project and its environmental impact. The same information is submitted to the governments of the affected Member States.

Article 7: Member States objections
Each of the Member States whose territory is affected by the PEI must inform the Commission within a period of 6 months if one or more of the submitted projects will conflict with imperative public planning decisions of the Member State.

Article 8: Derogations from Directive 2001/42
In case the application for the project under national law requires that new plans are adopted, the Directive 2001/42 does not apply for these plans, since the overall planning has been considered by the Commission in deciding the priority corridors.

Article 9: Selection of the preferred project
Based on the criteria laid down in Annex the Commission selects the preferred project for the PEI.

Article 10: Conciliation procedure

If one of the affected Member States raises objections as stipulated in Article 7 the Commission initiates consultation with the Member States. If an agreement cannot be achieved, the final selection of the project is decided by commitology procedure.

Article 11: Consent of the project

When the project is finally selected, the Commission shall provide a formal consent of the project within a period of 6 month establishing conditions for the establishment and operation of the PEI. This decision substitutes consent under the EIA Directive and the Habitats Directive from national authorities as well as any national planning decision.

Article 12: Acquiring land for the priority corridor

Within a period of 12 month after the final consent the Member States must acquire the land for the project. The costs for acquiring the private property needed for the project is paid by the developer establishing and operating the permitted project.

Article 13: Priority corridors involving third states

1. As regards priority corridors between the EC and third states, the Commission is given the mandate to negotiate and conclude framework agreements with third states on establishment of PEI. In accordance with the Treaty article 300, the agreement is only binding after having been adopted by the Council.
2. The implementation of agreements with third states on the territory of the European Community is based on the principles laid down for internal priority corridors.

Section II - Natural Gas

The following sections 4 to 12 focuses on the gas part of Task 1-3 in the Terms of reference.

The following subsections are dealt with in terms of natural gas: Selection of regions (section 4), Stakeholder analysis (section 5), Capacity analysis (section 6), Project synopsis (section 7), Role of Norway (section 8) and Selection criteria (section 9 and section 10), the revision of the TEN E guidelines is dealt with in section 11). Further, an additional section on the Gas workshop for the East Baltic Sea Area is also presented (section 12).

4. Selection of suitable gas regions

In the Priority Interconnection Plan the development of coordinated planning at regional level is mentioned as action 3 where the purpose is quoted as: “this framework should provide a platform for undertaking monitoring and analyses on the existing and future developments of networks in each energy area that improves the transmission capacities between Member States on a regional basis. It will facilitate the dialogue between stakeholders with due regard to socio-economic and environmental considerations. It will prepare, fully in line with national planning procedures, regional plans for network developments as well as forecasts for balancing supply and demand (for peak- and base-load). In carrying out its tasks, it will take due account of the opinion of regulators and other relevant forums for electricity and gas (i.e. Florence and Madrid forum, respectively)”.

The European gas network has been established gradually over the last 70 years. Overall, 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 1960's the large gas field Groningen was found in The Netherlands. Large scale gas import from Norway, Russia and Algeria only took over as the main source of gas supply in the 1980's after the two oil crises. In the 1990's gas was introduced and developed in Greece, Portugal and Ireland. After 2000 there have been three main challenges 1. To connect the huge UK gas market to the Continent and the Norwegian gas fields in line with depletion of indigenous gas fields and to integrate the gas systems, 2. To connect and integrate the new member states to the system of the old member states and 3. To create new import channels as import pipelines from North Africa and the Caspian Sea and establishment of new LNG import facilities.

The next challenges, which the EU gas market is facing in the coming years, are amongst others. the following three:

- The increasing dependency on gas imports and uncertainty about availability of sufficient gas reserves in Russia and other main external supply countries.
- The development of a single European gas market, including the completion of the integration of the EU gas network, e.g. in view of the EU enlargement.
- The climate change challenge where natural gas will be a bridging energy until sufficient renewable energy sources will be available.

This calls for the creation of appropriate regions where challenges can be handled within a setting that allows for efficiency and uniformity considering both challenges and solutions within the region.

Only six of the EU member states are not connected to the integrated gas network: Finland, Estonia, Latvia, Lithuania, Malta and Cyprus. In order to create a single European gas market it is considered as a goal in itself to connect at least Continental member states to the integrated systems.

With 27 member states and possibly even more in the future, it is practically difficult to make an overall planning of the TEN-E networks. Also, due to the cost of transmission of gas, there is a clear tendency to use the gas as close to the sources as practically possible, with a few exemptions where gas is supplied over longer distances for security of supply and diversification reasons. It can be foreseen that the 'influence sphere' of gas from different sources will change in the coming decades in line with depletion of the gas fields in the UK, Germany, Denmark and The Netherlands.

4.1 Existing regional initiatives - ERGEG

Gas regions are already a well-known concept in the EU gas market as the approach is already used by the ERGEG Regional Initiatives, where the Gas Regional Initiative (GRI) is operating in three regions. The purpose of the GRI is defined as the following (from energy-regulators.eu): *The overall aim of the Gas Regional Initiative is to push forward, at a practical level, the development of regional gas markets in collaboration with industry, Member States, the European Commission and other stakeholders.*

The GRI is operating with three gas Regional Energy Markets (REMs) North-west, South and South-southeast, the purpose of these REMs is defined as: "*The gas REMs tackle at a regional level barriers to competition, such as the lack of market integration, transparency and balancing issues, highlighted in DG Competition's energy sector inquiry".*

The GRI regions are made up of the following member states:

Table 4 Regional Energy Markets, GRI

North-West	South South-East	South
The Netherlands	Austria	Spain
Belgium	Bulgaria	Portugal
France	Czech Republic	France
Ireland	Greece	
Great Britain	Hungary	
Germany	Italy	
Denmark	Poland	
Sweden	Romania	
Northern Ireland	Slovakia	
Norway (observer)	Slovenia	

The above regions are mainly aimed at tackling market issues and are thus not necessarily optimal for dealing with large-scale transmission such as huge import pipelines that may cross market regions on their way from supplier to consumer.

4.1.1 Baltic Gas Associations

Baltic Gas Association http://www.balticgas.org/ is a privately organised organisation of gas transmission and supply/trade companies around the Baltic Sea. The organisation was established in the late 1990's with the purpose of promoting the use of gas in the region and to exchange information. Norwegian StatoilHydro has also joined the organisation as well as Gazprom from Russia who is also a member of the organisation.

Despite the work of the organisation, very few new gas systems have been finalised in the Baltic Sea Region over the last decade.

4.1.2 Observatoire Méditerranéen de l'Énergie

The Observatoire Méditerranéen de l'Energie (OME) is a non-profit oriented organisation whose main objective is to promote the co-operation between the major energy companies operating in the Mediterranean basin. The Association is a centre of studies and information on energy in the Mediterranean area as well as a pole of reflection and a permanent meeting forum between its members.

The member organisations are energy companies within the EU and external suppliers as e.g. Sonatrach from Algeria.

4.1.3 South-East Europe – energy community treaty – Athens process

The development of new gas infrastructure in South-east Europe has been one of the topics of the energy community treaty which was signed by most countries in the region.

4.1.4 North Sea

In the North Sea there is no formalised organisation, and cooperation takes place among producers and from a project-to-project basis. However, the huge Norwegian transportation system is organised in a common company, Gasled, while the planning of the development of the system takes place in the state-owned Norwegian gas transmission company, Gassco. The consequence of this organisation is a strong centrally planned system.

4.1.5 Is there a need for streamlining of regions?

As described above, there are different existing regional initiatives which are mostly used for informal exchange of information. As there are often competing interests and projects between members of the organisations, it is mostly outside the scope of work for these organisations to prioritise between different projects and corridors.

Also, in line with change in the supply and demand balance, the historical regions may change and there is a need for combining some regions and, in some cases, to focus on particular issues.

4.2 Criteria for regions and sub-regions

The following criteria are proposed for establishing new regions:

- The origin of the main source of gas now and in 2020.
- The origin of a possible secondary source of gas now and in 2020.
- Geographical distance to potential new sources of gas.
- Pooling of gas storage in view of typical weather in order to smoothen peak demand.
- Pooling of LNG use and import.

Creating the appropriate regions should entail creating regions within which challenges and market conditions are relatively similar, as stated above. However, the most important thing, considering the intention of the priority corridors, is to connect supply with demand. Thus the regions should take into account all stakeholders starting at the supply point and ending at the demand point. Therefore when setting up appropriate regions in terms of dealing with gas transmission, the issue of supply and demand is the central balance.

4.2.1 Supply routes

There are roughly speaking four possible main gas pipeline supply/import routes into the EU:

North-western route – through the North Sea

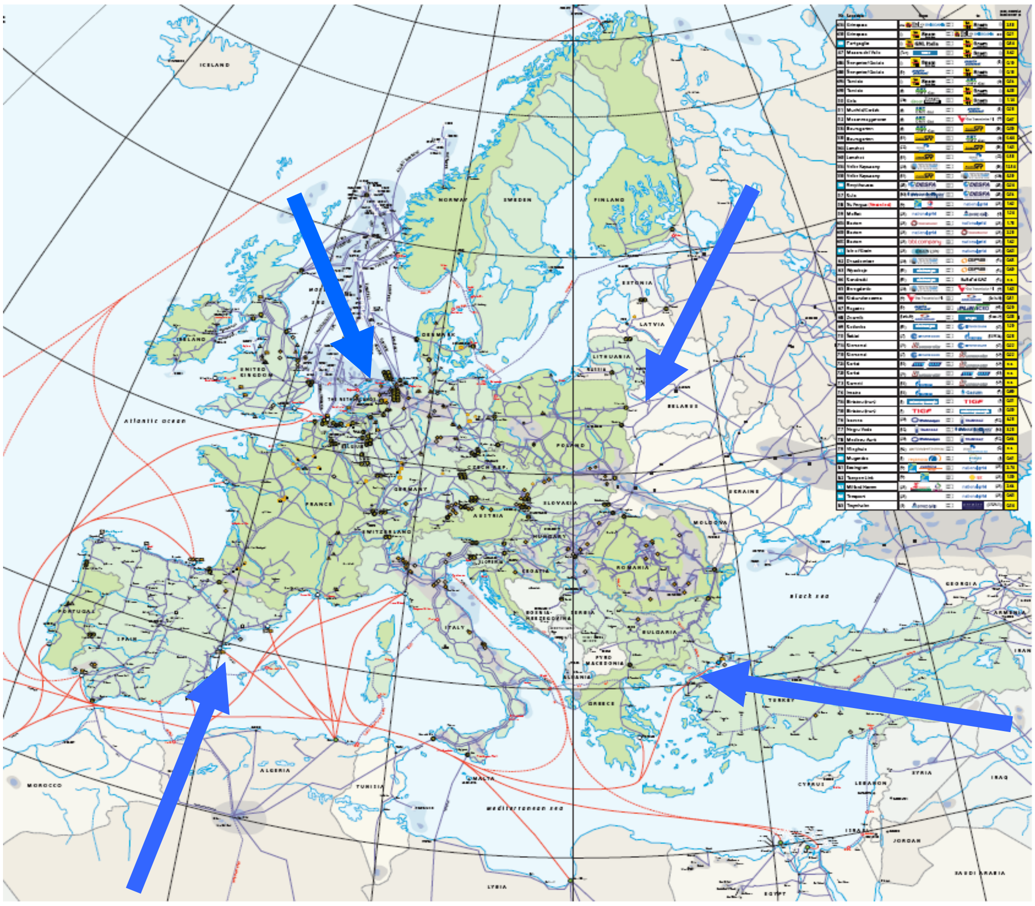
North-eastern route – from Russia

South-western route – through Northern Africa

South-eastern route – through Caucasus/Central Asia/Middle East which could be via Turkey, The Mediterranean Sea, The Black Sea or Ukraine or combinations of these routes.

Depending on the development and agreements between supply countries and companies, some of these corridors could be combined. As an example, gas from the Norwegian and Russian part of the Barents Sea could be transported in the same pipeline. Gas from the Middle East could be transported to the EU via Turkey/the Black Sea or via the Mediterranean Sea.

Figure 1 Main gas import routes to the EU



Source: Underlying map from Gas Transmission Europe (GTE)

Today, the most commonly utilised routes are the north-western, north-eastern and south-western routes as most of the gas imported to the EU comes from Russia, Norway and Algeria. However, in the future it is possible that more gas will come through the south-eastern import route as it holds options to import gas from Russia, Caucasus, Central Asia and the Middle East.

In recent years there has been a clear tendency to push the technological development of pipelines and LNG to ensure direct supply from producer to consumer. Examples of this are the Franpipe, Blue Stream, Medgaz, Galsi, Nord Stream, Langeled and SkanLed. This indicates that the gas producers have experienced some disadvantages of transporting gas via transit countries.

LNG import terminals are, by definition, located at the coasts and will in some cases need new pipeline network to connect to inland markets.

4.2.2 Demand areas

Evaluating demand areas are done in perspective to the supply routes, i.e. where is the gas that is supplied through each import route in general consumed.

Gas from the North Sea is mainly consumed in North-western EU. Gas from Russia goes to North-western, North-eastern part and the South-eastern part of the EU. Gas from Africa is mainly consumed is South-western EU and gas from the Caucasus area and Central Asia is mainly consumed in South-eastern EU. These geographical links between import route and consumption allow for the creation of a set of new regions. A few longer distance supply routes exist such as supply from Norway to Spain or from Russia to France. However, with an integrated network there should be no need for dedicated transportation routes in the future.

4.2.3 Missing links and proposed interconnectors

Some of the interconnectors included in the TEN-E Guidelines are listed below, together with missing links. Missing links are defined as pipeline connections between member states which are not yet connected.

Table 5 Missing Links

	Country 1	Country 2	Inte-grate	Interconnect	Capacity
			Missing links		
Small Amber	Lithuania	Poland	x		
Balticconnector	Estonia	Finland	x		
Baltic Pipe	Poland	Denmark		x	
Baltic Gas Interconnector	Germany	Sweden/Denmark		x	x
SkanLed	Norway	Sweden/Denmark		x	
No Name	Norway	Denmark		x	
UK-Denmark Interconnector	Denmark	UK		x	
No Name	Poland	Slovakia		x	
No Name	Slovakia	Hungary		x	
IGI	Italy	Greece		x	
TAP	Italy	Greece/Albania		x	
Nabucco	Turkey	Bulgaria			x

No Name	Bulgaria	Romania			x
No Name	Romania	Hungary		x	
No Name	Hungary	Austria			x
No Name	France	Spain			x
No Name	France	Italy		x	
No Name	UK	Spain		x	
No Name	UK	France		x	

It can be seen that two interconnectors, the Small Amber project and Balticconnector, are the only projects which will contribute to integrate more member states into the EU integrated gas system. It can be argued that a dedicated sub-region should be introduced to promote these projects in particular.

There are different uses for some of the project names. The Amber project was originally defined as a small interconnection between Poland and Lithuania, mainly with the purpose of enhancing security of gas supply and diversification of gas supply to Lithuania. Later on the name has been used for a large scale transportation scheme of Russian gas to Germany via Latvia, Lithuania and Poland. The report distinguishes between the two projects by referring to the interconnector between Lithuania and Poland by the name Small Amber, while the large supply project is referred to as Amber.

4.2.4 Reverse flow restrictions limits the operation of internal gas market

Despite the introduction of directive on the internal gas markets and rules for access to the transmission systems, there are still a number of restrictions on reverse flow in main pipeline systems, which hinder the functioning of the markets. The restrictions also jeopardize the security of gas supply for a number of member states.

Some examples of the main restrictions on reverse flow are:

- Yamal-Europe pipeline (Europolgaz) prevents gas flow from Germany to Poland.
- Botas to Bulgargaz prevents flow from Turkey to Bulgaria.
- Spain to France.
- Hungary to Austria.
- The Gassco transportation system prevents use of the system for transportation of gas from the Continent to UK.
- Denmark-The Netherlands prevents the flow from the Netherlands to Denmark.
- BBL pipeline prevents flow from UK to the Netherlands.

Contrary to this there are a large number of border crossings open for reverse flow. This includes the crossings between Germany and the Netherlands, the UK-Belgium interconnector, Denmark to Germany (Deudan), Czech Republic to Germany and more recently also the border between Lithuania and Latvia has also been opened for flow in both directions.

In most cases the opening of the pipelines in reverse flow would not physically change the flow direction during normal operations. However, in emergency situations there would physically be reverse flow.

The consequence of lack of reverse flow is the need for duplication of pipeline and compressor investments, waste of energy for compressors and uncertainty about investment decisions, which in many cases postponed investment decisions.

As an example, the Nabucco pipeline could reduce the pipeline investment with approx. 500 km, if the existing gas network from Romania and Bulgaria to Turkey could be used in reverse flow mode. Another example is the gas supply to Poland which is the main background for the need for north-south pipelines to Poland.

The investments required for opening of pipelines for reverse flow are in general limited and includes mostly alterations to metering stations and in some cases also compressor stations.

It is strongly recommended that the problems with reverse flow should be solved within a very short time span (one to two years) to create a clear background for decisions about new pipeline, storage and LNG projects.

4.2.5 Increase of internal capacity and supply to new areas

In some cases there are restrictions of the internal gas transmission capacity and need for new systems to supply areas which are not yet supplied with gas.

In the 1990´ies the development of the internal gas networks constituted a major part of new investments, most notably in Greece, Spain, Portugal and Ireland. At present the only major parts of EU not yet connected to the gas systems are:

- Sweden (Mid and Northern including Stockholm, the only Capital on the EU mainland not connected).
- Finland (Northern part).
- The Mediterranean islands, including the two Member States, Cyprus and Malta.

Connection of these parts of the EU to gas is mainly a national issue as the impact on other EU member states is very limited.

There are still some bottlenecks in the systems depending on the actual flow situation. By establishing a new gas storage project, there may be a need to strengthen the pipeline systems to and from these facilities. Also, for security of supply reasons there may be a need to invest in new pipelines.

A number of potential new projects are described in chapter 6, based on information from TSO´s.

4.3 Proposed regions – conclusion and description

The proposed regions are listed in Table 6.

Table 6 Proposed regions for priority corridors

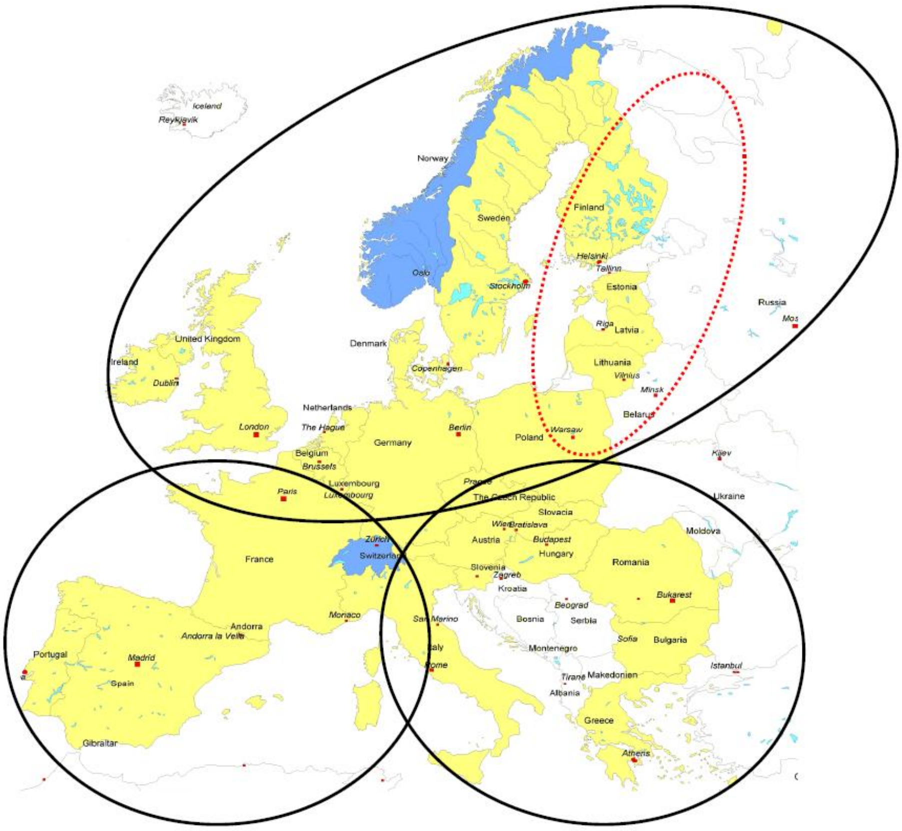
North	South-East	South-West	Sub region Baltic integration	LNG forum
The Netherlands	Austria	Spain	Finland	Spain
Belgium	Bulgaria	Portugal	Estonia	France
Ireland	Czech Republic	France	Latvia	Belgium
UK	Greece	Italy	Lithuania	UK
Germany	Hungary	(Switzerland)	Poland	Italy
Denmark	Italy			Greece
Sweden	Romania			Portugal
Luxembourg	Slovakia			(New LNG countries should be included, when LNG projects are initiated)
Finland	Slovenia			The Forum should be an open forum
Poland	Germany			
Lithuania	Cyprus			
Latvia	(Turkey)			
Estonia	(Croatia)			
Czech Republic				
France				
(Norway)				

France, Italy, Germany and the Czech Republic are included in more regions to act as bridges between the three main regions:

- France: North to South-west
- Italy: South-west to South-east
- Czech Republic and Germany: South-east to North

The listed regions imply one major change compared to the REMs and that is the creation of one large North region that includes both North-western and North-Eastern EU. Norway should be considered a part of the North region. Figure 2 shows an indication of the suggested regions.

Figure 2 Indicative display of proposed regions



4.3.1 Northern region

It is proposed to include all countries around the Baltic Sea and the North Sea into one region. The main reasons are:

- Norwegian suppliers will have to choose between gas sale to Western Europe or Eastern Europe.
- New Norwegian fields in the Norwegian Sea and the Barents Sea are located quite easterly and can possibly be coordinated with Russian fields in the Barents Sea. Gas transmission could be offshore via the Norwegian Sea and the North Sea, the Baltic Sea (Nord Stream extension), or onshore via Russia, Latvia, Lithuania, Poland (Amber) or via Finland, Sweden (previously known as Trans Scandinavia).
- Projects like the Mid-Nordic Gas grid could be re-vitalised with positive impact on security of supply in the entire region.
- Many ongoing TEN-E projects cross between the North Sea and the Baltic Sea in order to create diversification of supply, mainly to new member states.
- Depletion of gas fields in the UK, Germany, Denmark and The Netherlands will have to be replaced by gas supply from Norway or Russia. Timing and priority of

field developments is an integrated part of the overall planning of new gas infrastructure.

- Interconnection of the pipeline system around the North Sea could contribute to a better functioning market in view of depletion of gas fields and uneven development of gas storage, which could be onshore or in depleted offshore gas fields.
- New member states wish to diversify gas supply mainly by investing in North Sea field developments and import via existing networks supplemented by new interconnectors bridging between the North sea and Baltic Sea area.
- Stockholm is the only Capital of main land EU which is not supplied by natural gas and not connected to a gas transmission network. Further, Mid and Northern Sweden and Northern Finland could be connected to the gas systems in combination with Norway.
- Major energy companies like Total, StatoilHydro, E.On, Gazprom are share owners and partners in field developments and gas infrastructure in Norway and Russia and in development of gas infrastructure as Nord Stream.
- Different approaches have been used for approval and planning of projects in the North and Baltic Sea. There is room for learning from best practice.

4.3.2 South-West region

The south-West region is mainly supplied from Algeria and other Northern African countries via the existing Transmediterranen, Green Stream and Maghreb-Europe pipelines and LNG and the Medgaz project being implemented Further gas is supplied from Russia, Norway and The Netherlands to France and Italy which are included in more regions and as such will be the bridging countries to neighbouring regions.

The main reasoning behind the region is the following elements:

- Full integration of the Iberian peninsula to the rest of Europe by increasing the internal capacity between Spain and France.
- Possibly direct interconnection between France and Italy. Today there is only an indirect link via the non- EU and non-EEA Switzerland. Otherwise the shortest direct connection is via Austria and Germany. This means in reality that there is limited redundancy on the gas supply from Algeria to the EU via the transit countries of Tunisia and Morocco.
- Long-term supply options from Africa as the Trans Sahara pipeline from Nigeria which would secure the EU a competitive advantage over LNG export where the EU would be in competition with the USA and Asian LNG importing countries.
- Integration of LNG plants.
- Integration of underground gas storage.

A bridging element from the South-West region to the Northern Region could theoretically be a direct link between the UK and France or even Spain. Hereby, the heat driven demand could be smoothened.

4.3.3 South-East region

The south-East region has been very much in focus during the last decade due to the break-up of Yugoslavia and the Soviet Union and the vicinity of the region to the huge gas reserves around the Caspian Sea and in the Middle East. This opens for the possibility of import via the south-eastern corridor on a long-term perspective.

The reasoning behind the region is the following elements:

- Integration of EU member states, which is partly limited due to lack or reverse flow in existing pipeline systems. This is the background for the Nabucco project and the different proposals for interconnections of Italy to Greece and further to Turkey.
- Long-term gas supply from the Caspian region, which has already been initiated via the South Caspian Pipeline from the Shah Deniz project in Azerbaijan.
- Selection between main supply routes, Nabucco, South Stream and White Stream.
- Long-term gas supply from the Middle East via Syria, Iraq or North Africa.
- Interconnection between Greece and Italy to smoothen demand and increase transmission through the region
- Possible connections to Cyprus.
- Integration and development of the western Balkan into the EU system.

4.3.4 Sub region for Baltic integration

The four member states, Finland, Estonia, Latvia and Lithuania, are the only continental member status not integrated into the integrated EU network. In order to create a fully functioning EU internal market, it is considered as an objective in itself to ensure such integration. This shall also be seen in view of the discussion about the Nord Stream which could reduce the security of gas supply to non-integrated member states in case of insufficient availability of gas from Russia.

The reasoning behind the region is the following elements:

- Integration of Lithuania, Latvia, Estonia and Finland by new interconnectors.
- Development and use of gas storage in the region.
- Establishment of a gas exchange to create an import price from Russia on the EU side of the border.

When the interconnections between the four member states and the existing network are established, the sub region should be dissolved.

4.3.5 LNG Forum

The question of whether a special institution or action plan for LNG should be established because of the special characteristics and issues that apply for LNG is discussed in the following.

Ramboll supports the idea of a creating special forum for Member States and others involved in LNG projects. The reasoning behind creating an LNG forum is due to the unique characteristics of LNG. Unlike Pipeline projects, which mainly affect the gas markets within the proposed regions, we have that LNG to a much wider degree affects gas markets across regions and thus a forum that allows for coordination at an EU level, rather than at a regional level, may be required. Further, as the LNG market is a global market, special issues and considerations may apply to LNG.

However, a forum for LNG should not be mistaken for a common EU action plan for LNG. There is no apparent scope or need to create a common action plan for LNG. This is due to several factors first of all, as is shown in section 5.4.4, LNG projects are planned all over the EU, and in fact capacity is expected to double in the coming years, thus there seem no apparent reason for why investments in LNG projects need to receive special attention or support in the form of a EU LNG action plan. Further, as LNG terminals are not subject to the problems in connection with cross-border issues, legislative measures such as those proposed in: section 1 – Legislation, are not relevant for such projects. There is also no real scope for an action plan or additional action via a revision of the TEN-E guidelines as any problems concerning implementation of LNG projects are mainly due to national issues within the individual member states and not due to difficulties arising from cross-border issues.

However, as LNG plays a vital role in terms of EU gas supply, security of supply and competition, and will do so increasingly in the future, and because LNG projects transcends national borders and integrates world markets, there might be scope for a LNG forum, which could serve as a platform for raising concerns, sharing information and evaluating LNG from an EU perspective.

The recent upswing for LNG in the EU is a complex issue, but some of the more evident reasons are that, LNG can provide alternative supplies for countries, that are heavily dependent on a single or few suppliers (Diversification). Secondly LNG allows for gas supplies from isolated, distanced or remote sources, and thirdly, because LNG projects may bypass implementation problems, which are occurring due to cross-border issues, LNG terminals may have an obvious attraction in terms of being a trouble-shooter for regions or countries, which have difficulties in agreeing on a specific project or solution.

If the large number of LNG projects in the EU, are a result of missing coordination and cooperation within the EU, then a LNG forum could play a vital role in terms of addressing such issues and coordinating between the regions, LNG project owners and governments.

An example of a case were cross-border pipeline projects have failed is the Baltic region. The failure in integrating the region and in ensuring additional supply sources seems an obvious reason, among others, for why several countries in the region at the moment are all evaluating and looking into the option of investing in LNG terminals.

The purpose of having an LNG forum would, in accordance with the above, be to ensure that governments, LNG importers, shippers and traders of LNG have a forum, which allows them to discuss any topics or issues concerning LNG. Further the forum could serve as a bridge between, on one side, the regions and pipeline projects (the TEN-E projects) and, on the other, the LNG projects.

Further the LNG forum could deal with questions that affect both LNG interests and at the same time affect the EU gas market. An example of such an issue could be: Should the EU include LNG supply projects outside of the EU in the list of prioritised projects? Seen as the promotion of supply capacity is in line with the overall recommendations in this report, this could be a viable solution. Further, although LNG import terminals do not entail cross-border issues per se, LNG liquefaction plants could be perceived as such and could thus be considered relevant in terms of prioritising projects.

Issues and topics discussed in a LNG forum could be:

- Is there scope and need for creation of uniform criteria for implementation of LNG projects with respect to technology, safety, environment and regulation?
- Is there scope for acting in cooperation and thus creating a counterpart towards existing and potentially new supply countries and companies? Can such a counterpart ensure adequate investments in the supply-side by reducing investment risks etc.? Today, this role is played by single companies and member states.
- How to act as counterpart towards the international shipping industry, IMO etc to ensure consistent rules and regulation?
- Can and should the EU help facilitate LNG projects in any way?
- Can the EU promote an efficient and competitive EU LNG market?
- Should the EU play any role in terms of the world market for LNG?
- Should LNG supply facilities by included in the next priority corridors plan?

Further, a LNG forum could ensure cooperation and act as counterpart towards the two main LNG markets i.e. the US LNG market and the Asian LNG market.

Thus, in conclusion, Ramboll does not recommend the creation of a LNG action plan, as there seems to be no scope for such a measure. However, Ramboll recognises the increasingly important role LNG plays in the EU gas market and hence the potential need for a common platform for addressing LNG issues and to ensure that a forum exists for discussing issues such as: Should the EU be able to grant LNG supply facilities in non-EU countries, with the status of priority projects as ensuring adequate supply capacities is a question of cross-border interest in the EU.

4.3.6 Comparing the regions – why are they so different?

The proposed regions are quite different in size and number of Member States. The largest region, the Northern, includes more than half of the EU population and more than half of the gas consumption. The reason to have this as one region is partly due to geography and market development. As there is no possibility for gas supply by pipeline from the West, gas has to travel far to come from the North and East in line with depletion of gas production within the region. This creates need for pipeline connections which may be coordinated or competing.

The South-West region is the smallest with respect to number of member states. It is characterized by the Iberian Peninsula which does not receive gas from Russia. Hereby, the peninsula is very much depending on gas supply from one source, Algeria, and the region has been created with the dedicated purpose of bridging this to France and Italy in order to create back-up possibilities.

The South-East region is characterized by a large number of member states with relatively small gas consumption. It will also be the region with potential for new members in line with enlargement of the EU. The purpose of the region will be to fully integrate the new member states with the old ones and to establish new import routes from the Caspian Sea and balance this supply option with North Africa and Russia. Supply from Norway has little impact in the region.

5. Gas stakeholders

In order to provide for a better planning and subsequent quicker implementation of priority projects, it is necessary to conduct a stakeholder analysis to first of all identify and consequently assess the influence of the different stakeholder groups with an interest in the project.

As stated in the invitation to tender "…. strong opposition from local and regional communities, unjustified use of veto powers, and large number of entities responsible for the granting of permission represent major obstacles". Hence, it is imperative that stakeholders are identified and also consulted at the very early stages of the project, in order to facilitate a smooth and hopefully swift implementation process.

The primary objective of the stakeholder analysis is thus to identify and compile relevant information on those persons and organisations that have an interest or stake in a given project/policy. This information can be used to provide input for other analyses; to develop action plans to increase support for a project; and to guide a participatory, consensus-building process.

Four major attributes are important for Stakeholder Analysis: the stakeholders' position on the project, the level of influence (power) they hold, the level of interest they have in the specific project, and the group/coalition to which they belong or can reasonably be associated with. The level of influence depends on the quantity and type of resources, and power the stakeholder can marshal to promote its position on the project. The level of interest or salience is the priority and importance the stakeholder attaches to the project. Broadly, these attributes signal the capability the stakeholder has to block or promote projects, join with others to form a coalition of support or opposition, and lead the direction/discussion of the project.

The following section will, on the basis of Ramboll's in-house information on the Nord Stream project, provide a generic list of the main stakeholder groups coupled with a description of their function and influence at the different stages of the project life cycle.

5.1 Project Life Cycle

Prior to categorising the different stakeholders, the project life cycle for a gas pipeline must be defined as each stakeholder group will influence the project at different stages of the project.

The below figure illustrates the project life cycle for a gas pipeline project.

Figure 3 Project Life Cycle – Gas Pipeline Project

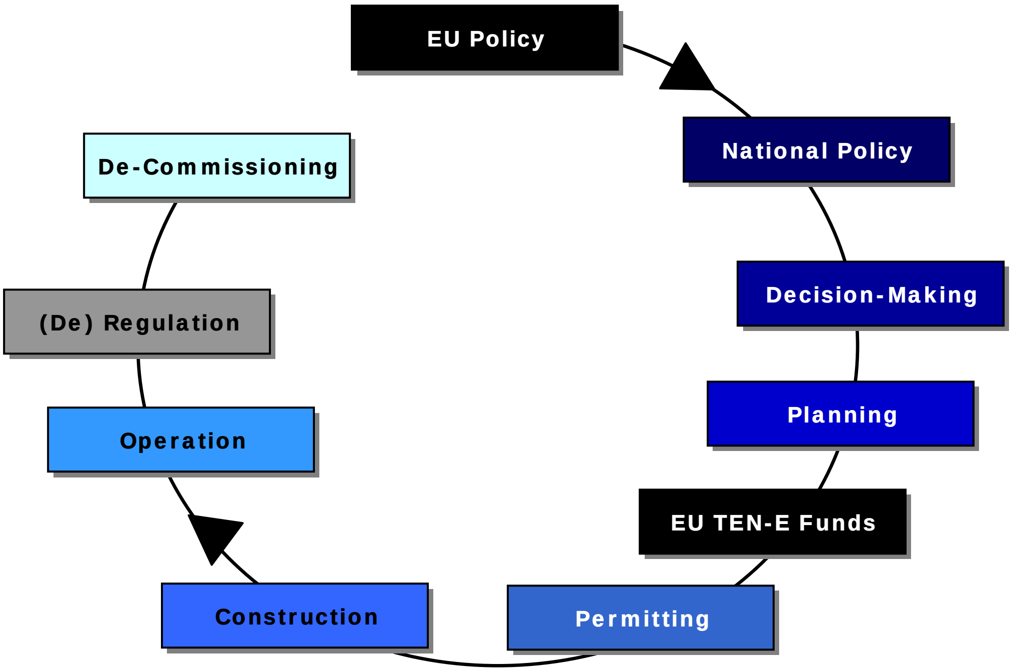


Table 7 below lists the main issues to be addressed and the different tasks involved for each stage of the project life cycle presented above.

Table 7 Description of the Project Life Cycle

Stage	Tasks	Issues
EU Policy	• Devise policy or strategy for energy supply at EU level • Select projects of EU priority	• Security of EU energy supply • Regional employment
National Policy	• Devise policy or strategy for energy supply at national level • Select projects of national priority	• Security of energy supply • Local/national employment • Spin-offs from project at landfall sites • Growth in domestic industry from greater and cheaper energy sources
Decision-Making	• "Go or " No-Go"	• Stakeholder Opposition – "not-in-my-backyard attitude" • Financing Structure
Planning	• Devise project plan • Conduct feasibility studies • Conduct SEA • Undertake risk analyses • Undertake surveys (geotechnical, archaeological)	• Applying for TEN-E funds (only available once a year) • SEA responsibility – Developer's or the EU's?
Permitting	• Obtain permits • Conduct EIAs • Hold public hearings	• Idiosyncratic requirements from country to country within the EU re. permit applications and EIAs • Lengthy and inconsistent process times for applications
Construction	• Construct pipeline • Monitor environmental impacts	
Operation	• Operate pipeline	
(De) Regulation	• Regulate or de-regulate gas transmission systems	
De-Commissioning	• De-commission pipeline	

5.2 Categorisation of Stakeholders

Table 8 below provides a list of generic stakeholders grouped according to their function and/or affiliation, i.e. supra-nationals, associations, regulators, authorities, public/private enterprises and others.

Table 8 Presentation of Main Stakeholder Groups for Gas Projects

Stakeholder Group	**Definition of Stakeholder Group**	**List of Possible Stakeholders (Examples)**
Supra-Nationals	An international organisation, or union, whereby member states transcend national boundaries or interests to share in the decision-making and vote on issues pertaining to the wider grouping	• United Nations (UNECE) • NATO • IEA • OECD • EU (EC, European Regulators' Group for Electricity and Gas (ERGEG))
Asso-ciations	An organised body of people/entities who have an interest, activity, or purpose in common	• International Gas Union (IGU) • European Energy Forum • Gas Infrastructure Europe (GIE) • European Association for the Streamlining of Energy Exchange (EASEE) • European Transmission System Operators (ETSO) • The International Association of Oil & Gas producers (OGP) • Eurogas • Marcogaz
Regulator	A body or agency, which ensures compliance with laws, regulations, and established rules	• EU (ERGEG, CEER) • National (Energy agencies etc.)
Autho-rities	A public agency or corporation with administrative powers in a specified field	• Legal authorities • Ministries of Environment and Climate • Ministries of Transport and Energy • Ministries of Trade and Industry • Ministries of Economy • Ministries of Foreign Affairs • Financial institutions in Member States and Candidate Countries • Donors (EIB, EBRD, EU etc.) • Governmental Institutions/Regional Authorities
Public/ Private Enter-prises		• Transmission System Operators (TSO) • Distribution System Operators (DSO) • Gas Producers
Others		• NGOs (environmentalists) • Non-profit organisations (Euro Gas) • Local Communities/Municipalities/ Residents • Research Institutes • Crossed Parties • End users/consumers • Private Persons

Table 9 below links the different stages of the project life cycle with the different stakeholder groups presented in Table 8 above. The table also briefly describes the function of each stakeholder group at the different stages.

Table 9 Description of Stakeholder Group Function at each Project Stage

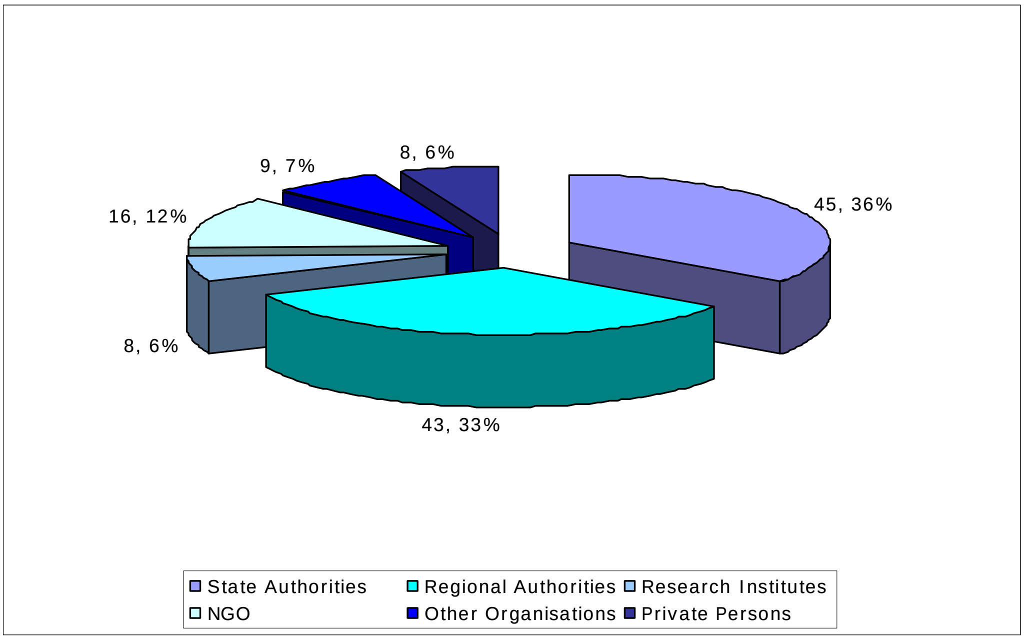
Stage	Stakeholder Group	Stakeholder Function
Policy	• Supranational • Authorities • Regulators • Associations	• Provide policy guidelines • Implement policy guidelines • Supervise the implementation of the policy • Make proposals
Decision-Making	• Supranational • Authorities • Public/Private Enterprises	• Decide on projects of priority • Approve projects of priority • Invest/fund projects of priority
Planning	• Supranational • Public/Private Enterprises	• Provide funds for SEA, feasibility studies etc. • Conduct feasibility studies etc.
Permitting	• Public/Private Enterprises • Authorities • Others	• Prepare and submit permit applications • Grant permits • Voice stakeholder concerns
Construction	• Public/Private Enterprises • Authorities • Others	• Construct pipeline or other • Monitor construction and ensure compliance to agreed procedure etc. • Ensure stakeholder concerns are considered and catered for during construction
Operation	• Regulators • Public/Private Enterprises	• Supervise the operation of the pipeline • Operate the pipeline
(De) regulation	• Authorities • Regulators • Public/Private Enterprises	• Approve (de) regulation of pipeline • (De) regulate pipeline • Propose deregulation of pipeline / oppose regulation of pipeline
De-Commissioning	• Authorities • Public/Private Enterprises	• Approve and monitor de-commissioning of pipeline • De-commission pipeline

5.2.1 Nord Stream Case Study – Stakeholder Analysis

To get a better understanding of the difficulties inherent in implementing a gas pipeline project and to get an insight into the wide array of stakeholders involved in the central permitting process information on stakeholder comments from the Nord Stream project is used to illustrate and delineate the distribution of power between the different stakeholder groups.

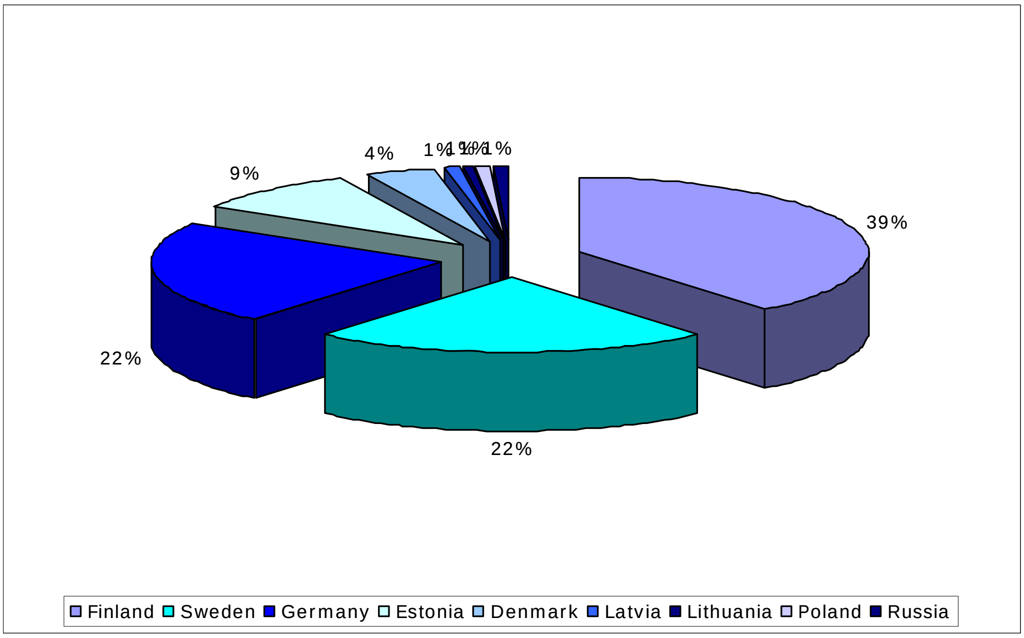
As stated in the enclosed Nord Stream case study (see annexes), during the Espoo notification period Nord Stream AG received 129 statements from stakeholders. Twothirds of the comments came from authorities and government institutions, whilst approximately 10 percent came from non-governmental organisations (see Figure 4 Distribution of Comments Received by Stakeholder Group, Nord Stream Project and the annexes). Fewer than 10 comments in total were submitted by private persons.

Figure 4 Distribution of Comments Received by Stakeholder Group, Nord Stream Project



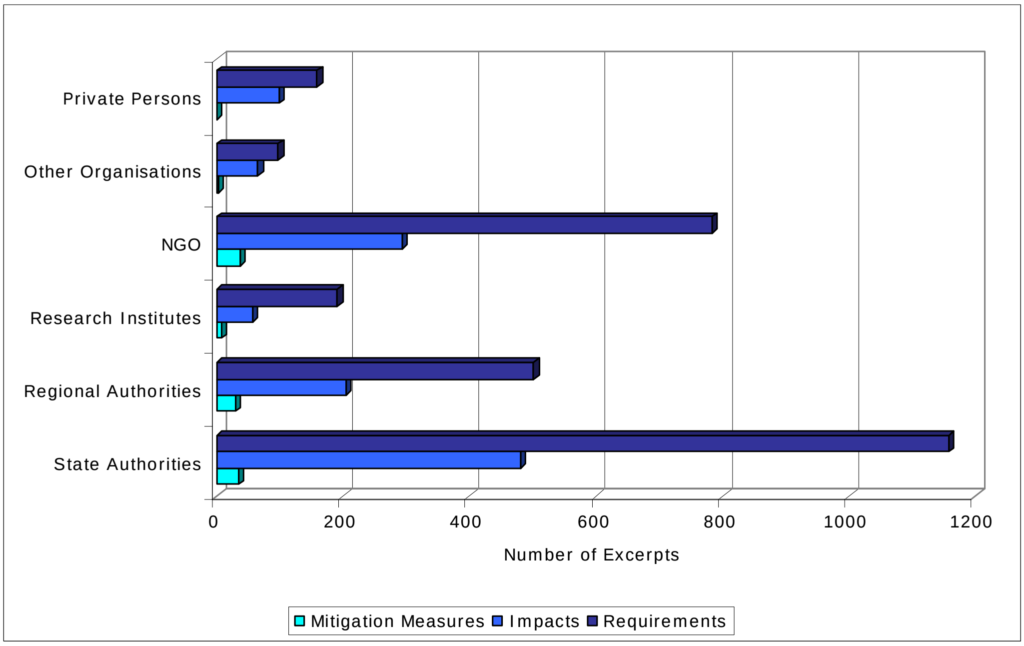
As evident from Figure 5, great discrepancies exist between the countries in terms of stakeholder comments submitted. Both Finnish and Swedish stakeholders have been relatively vocal despite their respective countries only functioning as transit countries. However, for Finland the issues of supply bases based in the country to be used for construction of the pipeline as well as the anticipated large amount of corrective works to be carried out due to a very uneven seabed merit additional comments as compared to the other two transit countries, Denmark and Sweden.

Figure 5 Distribution of Comments Received by Country, Nord Stream Project



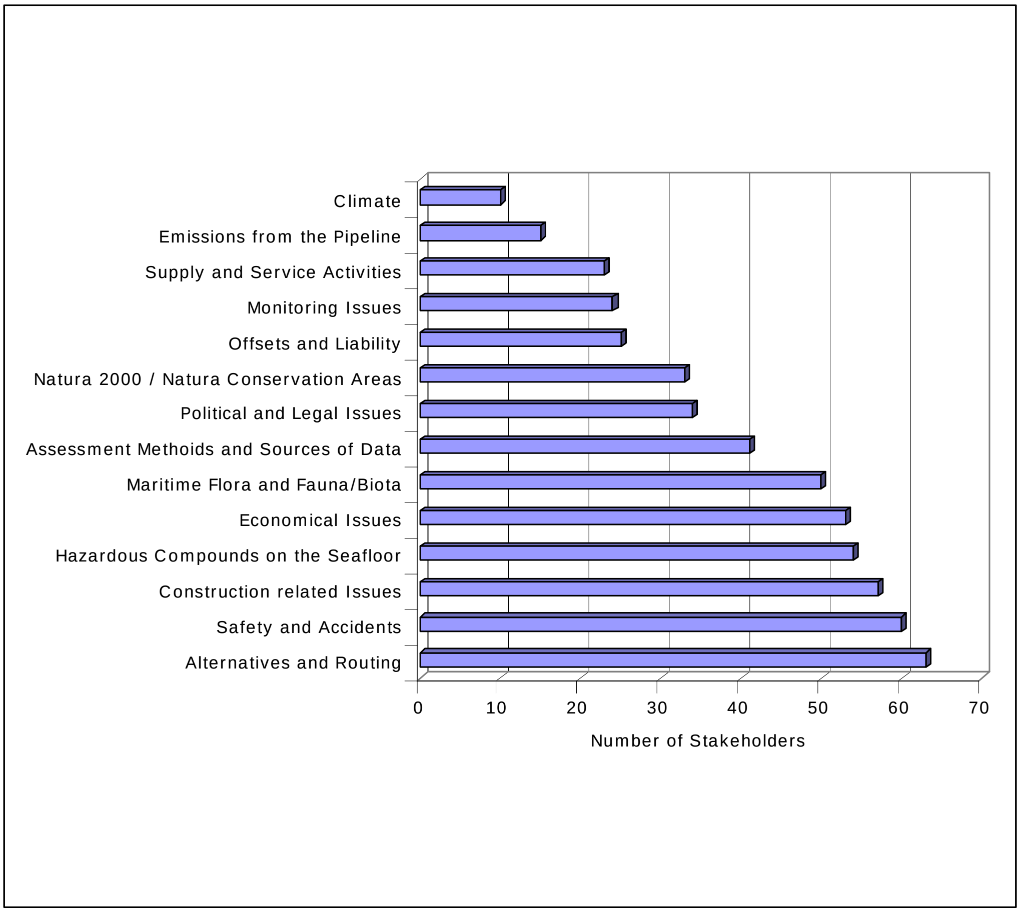
As stated above state and regional authorities have provided the greatest proportion of comments, however, as evident from Figure 6 Excerpts of Comments by Stakeholder Group, Nord Stream Project, NGOs have stated a great number of requirements which the developer, Nord Stream AG, must address when constructing and operating the pipeline. Even though the NGOs do not have direct political power to reject a project, their mere presence as well as their ability to influence decision-makers through lobbying and the media do validate added attention in the planning and permitting process.

Figure 6 Excerpts of Comments by Stakeholder Group, Nord Stream Project



When it comes to specific issues addressed by the various stakeholders, routing, safety and construction top the list (see Figure 7 Number of Stakeholders Dealing with Selected Issues). This great emphasis on alternatives and routing indicates that stakeholders should be consulted at the earliest possible stage, preferably at the planning stage if not before. This also suggests that undertaking a SEA should be mandatory and it should be done at the planning stage in order to avoid lengthy and to some extent unnecessary discussions regarding alternatives and routing at the permitting stage.

Figure 7 Number of Stakeholders Dealing with Selected Issues



5.3 Sub-conclusion – Stakeholder Map

The stakeholder maps (see Figures 1.7-1.9), produced for three most critical stages of the project life cycle, provide a visual overview of the power and interest distribution of the different stakeholders involved.

As evident from the preceding analysis, authorities constitute the main obstacle to implementing projects already designated priorities of European interest, since the authorities involved in granting the permit applications have little interest in the project, but unlimited power when it comes to granting survey, construction and operation permits.

Finally, as explained above in connection with the Nord Stream case study, NGOs and local communities are important stakeholders, who irrespective of their level of power, are highly involved in the project and therefore should be kept informed about project impacts.

Figure 8 Stakeholder Map – Planning Stage

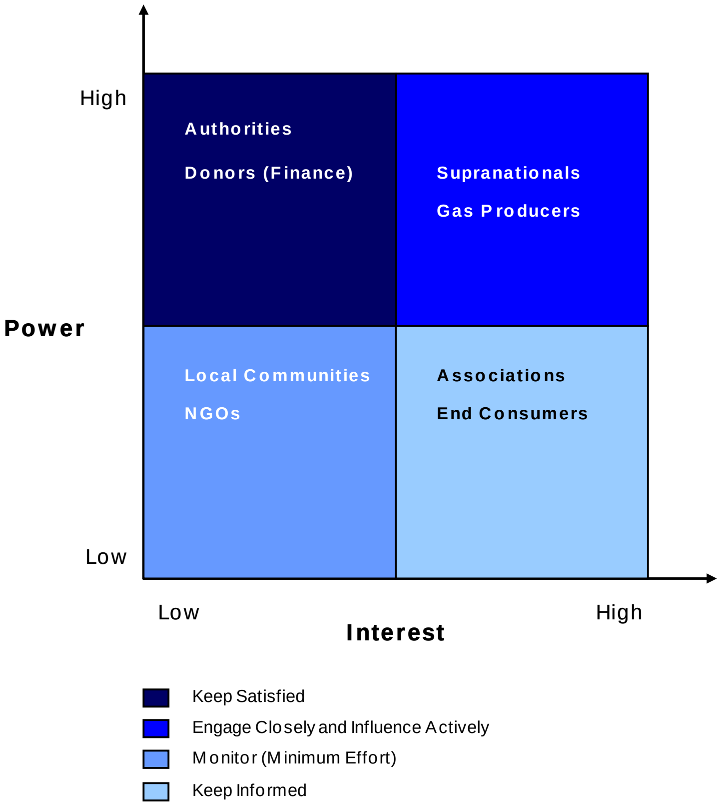


Figure 9 Stakeholder Map – Permitting Stage

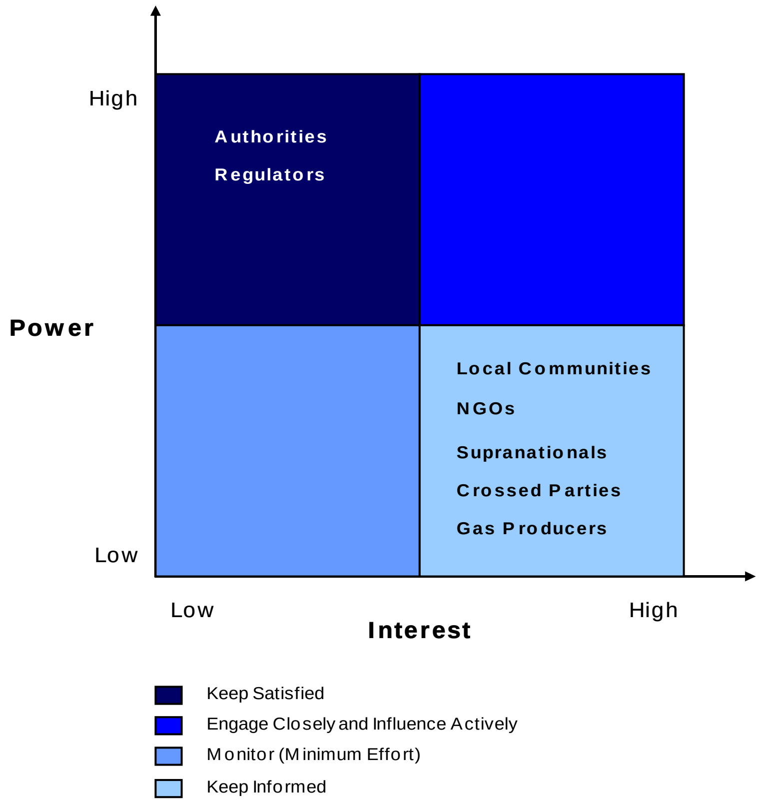
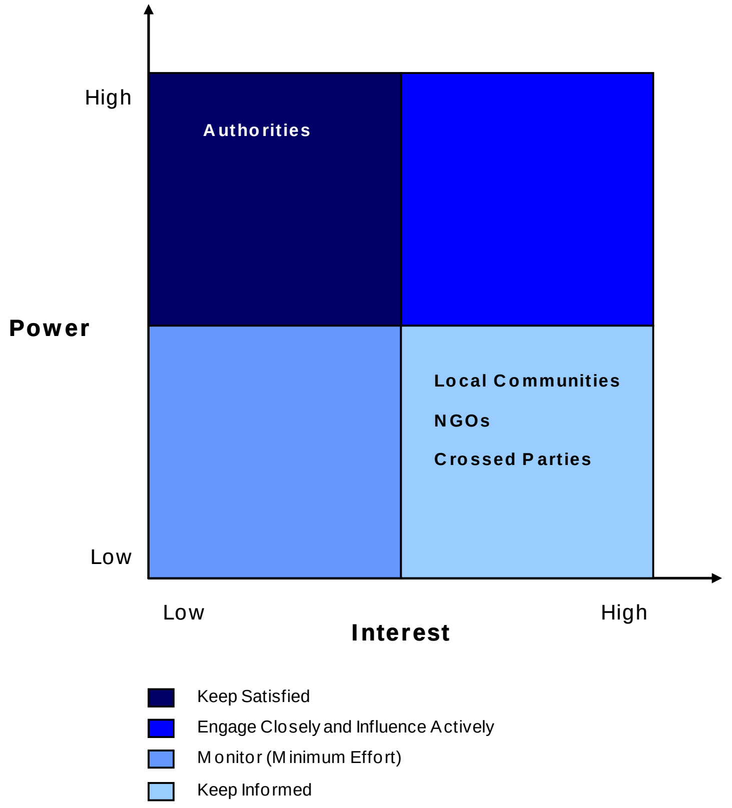


Figure 10 Stakeholder Map – Construction Stage



6. Gas network capacities

The following section analyses the EU natural gas capacity situation, supply and demand, and assesses what areas and issues will be the most important in the future considering natural gas transmission and new capacity and thus what should be the focus point of the revision of the TEN-E guidelines.

The first section looks into capacity before we take a look at supply and demand issues.

6.1 Capacity is a combination of different operational modes

Evaluation of the capacity of the EU gas system is a complex and not deterministic exercise. This is because the use of capacity in one part of the system will reflect the capacity in other part. As the most recent years have shown, the capacity is also a function of development in the transit countries.

In this report we will look into different aspect of capacity evaluation:

- Peak winter day – in the coldest winter day in 20 years. This is corresponding to the exercise carried out in GTE winter outlook. The cold winter will be a combination of supply from production, import, storage withdrawal minus the export.

- Cold winter – accumulated use of gas in a one in 20 year cold winter. In this evaluation the focus will be on the combined production, import from pipeline and LNG and storage withdrawal minus the export from the integrated EU system.

- The summer situation and the ability of the gas system to absorb gas into storage and to the consumers, most notably power plants. At the same time in order to ensure full utilisation of the long distance supply pipelines and gas production facilities. This could be called the need for “summer pipelines”

- Energy efficient gas transmission. With increased focus on availability of gas it is worrying that the EU transmission system uses up to 5 percent of the produced gas for transmission because the system has been designed for optimal use with many compressors along the routes. By adding more pipeline capacity, the energy use could be reduced considerable, which in itself could justify projects of European interest.

- Lack of interconnectors, integration and restriction on reverse flow is a capacity constraint in itself. This will be identified.

The assessment of capacity will be based on the 2008 system combined with known extension of the system and the demand forecast in the Primes data in order to assess the need for new pipelines, storage and other supply system.

6.1.1 Indigenous production capacity

The indigenous production capacity measured in peak day supply, and the production in the winter season and in the summer season is taken from Eurostat data based on historical data supplemented with information from GTE capacity map.

Some member states have the possibility to increase production in case of need for high production. During the last cold winter in Europe in 1996, it was seen that the production in The Netherlands could be increased to meet high demand.

Some production fields are able to inject gas and hereby act as natural gas storage facilities.

After the turn of the millennium there has been a decline in the EU indigenous gas production. This has in particular hurt the peak production capacity due to the lower deliverability of partly depleted gas fields.

According to GTE winter outlook the indigenous production capacity in 2007 was around 830 mcm/day.

6.1.2 Import and export capacity – pipelines and LNG

The integrated EU gas system is a major importer of natural gas from connections to several neighbouring countries as outlined in the table below. Further there is some export from the EU systems to Turkey, Switzerland, Croatia, Serbia, Bosnia-Herzegovina, FYROM and Russia (Kaliningrad).

The import capacity varies depending on the operational mode of the EU and neighbouring systems. In some cases bottle necks are created at situation with low demand.

The export and import capacity is taken from GTE capacity map information with addition of known projects.

According to GIE the import by pipeline and LNG capacity in 2007 was around 1300 mcm/day.

6.1.3 Storage supply capacity

Storage plants daily capacity depends on the pressure in the storage. This means that the maximum daily delivery rate is highest at full storage, typically in the start of the winter. This is why the most severe supply situation may not always be at the coldest day of the winter. A late cold spell may be worse than cold weather around New Year.

The yearly withdrawal from gas storage is limited to the requirement of minimum pressure in the storage in order not to damage the storages. In extreme situations it is possible to lower the pressure in exchange for some permanent reduction in capacity.

According to GTE winter outlook the storage capacity in 2007 was around 1050 mcm/day.

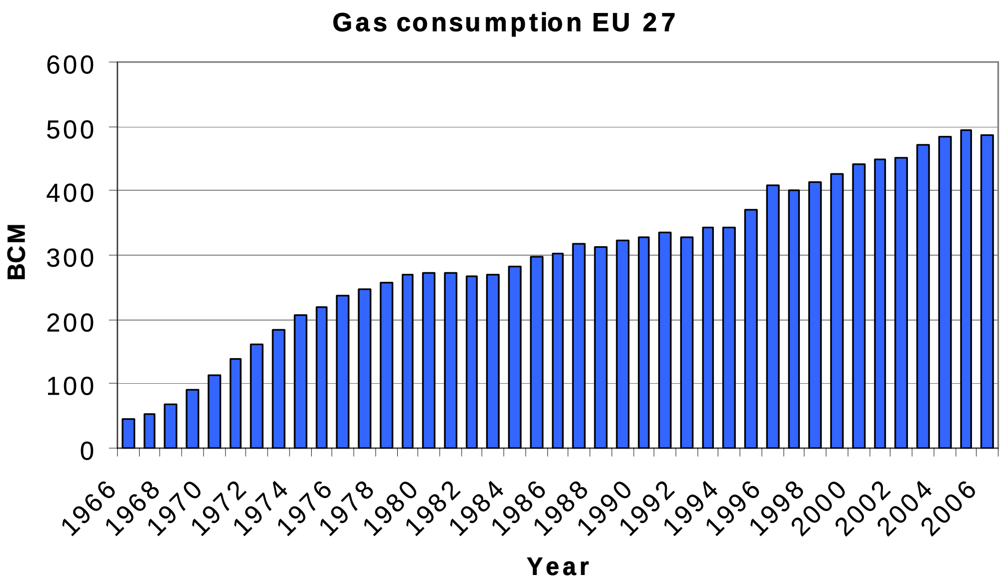
Total storage withdrawal capacity is listed as approximately 1400 mcm/day when totalling withdrawal capacities from all storages are summed[1]. This difference is most likely due to two factors. First of all, storage withdrawal capacity depends on the pressure in the storages i.e. full withdrawal capacity is only available when the storages are filled. Further the transmission system may impose additional restrictions e.g. in Denmark the two storages each are listed as having 8 bcm of withdrawal capacity, however not at the same time due to restrictions imposed by the transmission system.

6.2 Gas consumption

In the next section we analyse the demand for natural gas and issues of volumes of gas.

Gas consumption in Europe has been increasing over the last four decades and today total gas consumption in EU27 amounts to approximately 500 bcm per year. In 2007 there was a minor decrease in consumption but the overall trend in EU gas consumption is quite clear when looking at gas consumption in Figure 11.

Figure 11 Gas consumption in the EU27 (bcm)[2]



Source: BP.com/statisticalreview

[1] Source: GSE excluding LNG peak shaving facilities

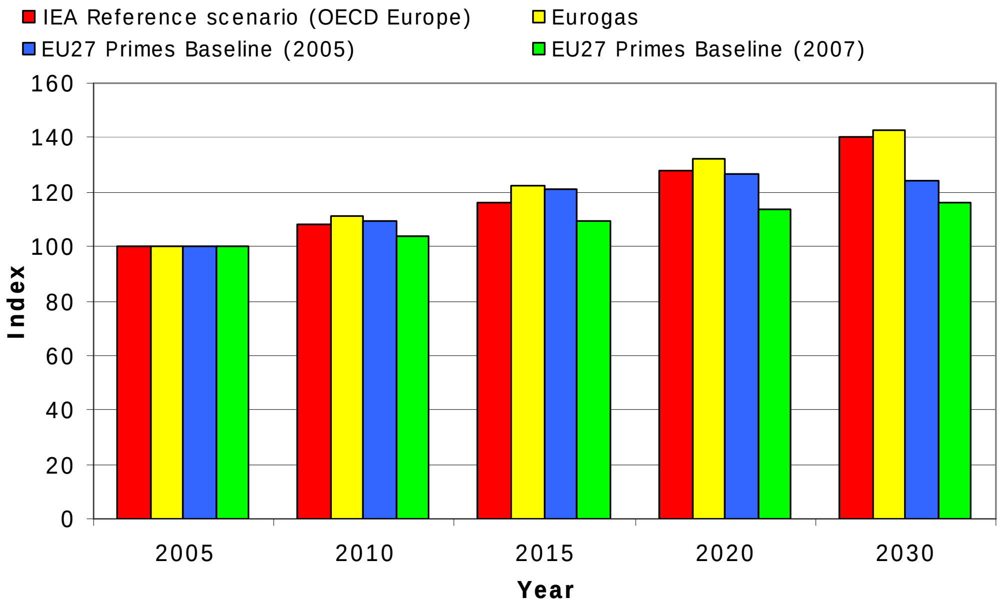
[2] Data excludes Estonia, Latvia and Lithuania prior to 1985 and Slovenia prior to 1991.

Overall, consumption and the development in consumption are essential in terms of analysing and evaluating the level of gas transmission capacities, we therefore look at the expected development of the EU natural gas consumption.

6.2.1 Demand forecasts

Demand projections have a high level of uncertainty. This uncertainty is displayed in the below estimations on how gas demand in Europe will develop until 2030. Predictions vary from an increase in gas consumption of 16% to 43% in the 4 baseline scenarios shown in Figure 12.

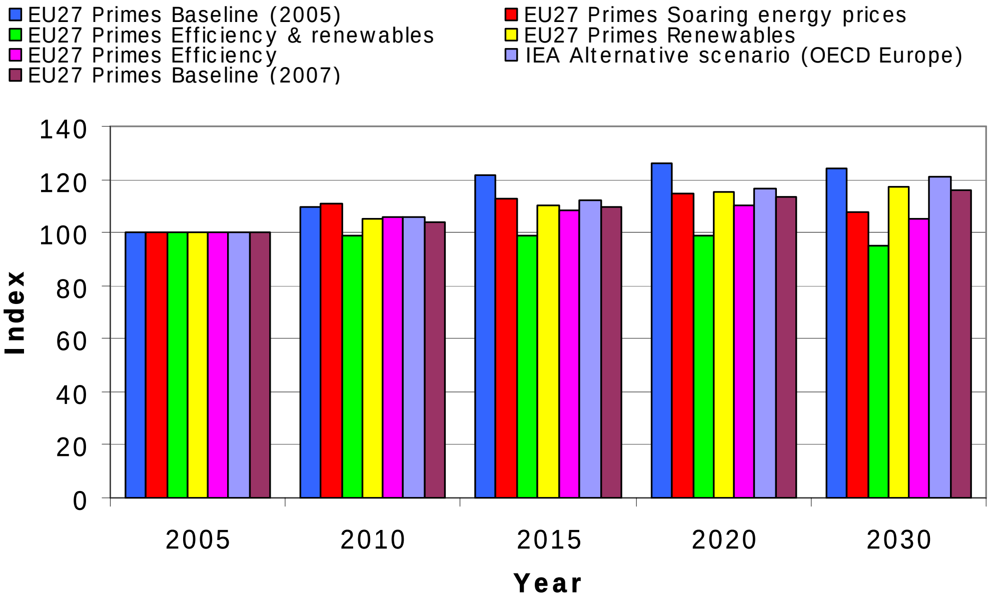
Figure 12 Development of natural gas demand in the EU, Baseline scenarios



Source: IEA, Eurogas and European Energy and transport (PRIMES)

Taking into account the issue of climate change, security of supply and rising oil prices makes the estimation of future demand even more difficult. Figure 13 shows how various scenarios may affect the demand for natural gas. The alternative scenarios vary in gas development from a slight drop of around 5% to an increase of 21%.

Figure 13 Development of natural gas demand in the EU, Alternative scenarios



Source: IEA and European Energy and transport (PRIMES)

Although there is a lot of uncertainty involved in estimating the future natural gas demand in Europe, one thing is certain, the need to increase import capacity in the EU is evident. Future indigenous production in the EU is expected to fall from around 209 bcm in 2005 to around 94 bcm in 2030[3]. This implies that natural gas net import will rise from around 285 bcm in 2005 to 479 bcm in 2030[4], which is an increase of almost 70% in imports. Even in the scenario that predicts the lowest increase in imports i.e. the high efficiency and renewable scenario, natural gas imports will rise by approximately more than 80 bcm per year.

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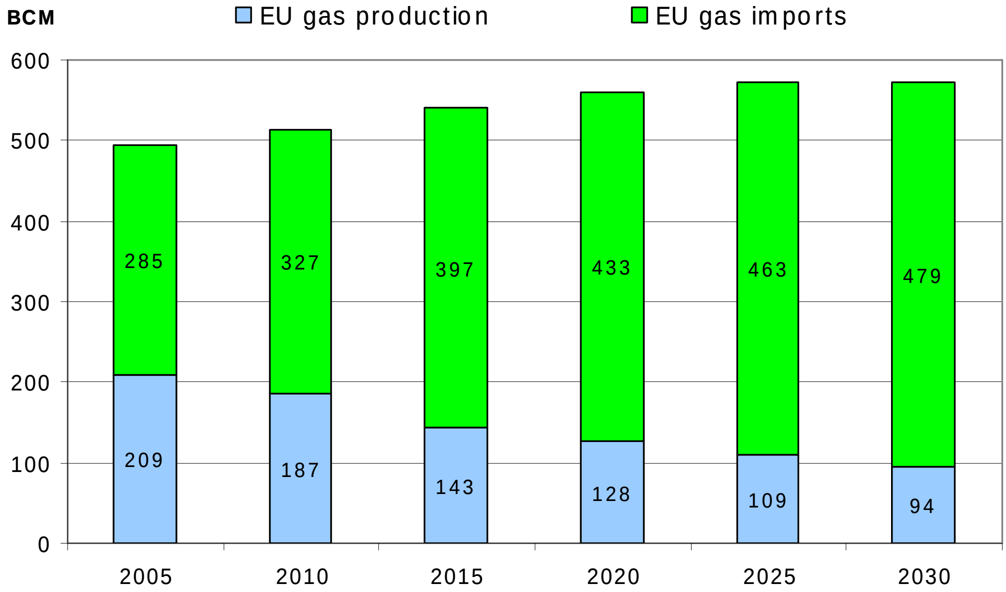
[3] Source European Energy and transport trends to 2030, 2007 update, baseline scenario

[4] In the EU27 baseline scenario

Figure 14 EU gas production and imports estimations



Source: European Energy and transport trends to 2030, 2007 update

This increase in import dependency will require additional investments in import capacity no matter what the future brings, whereas the requirements in terms of internal interconnection in Europe is less certain.

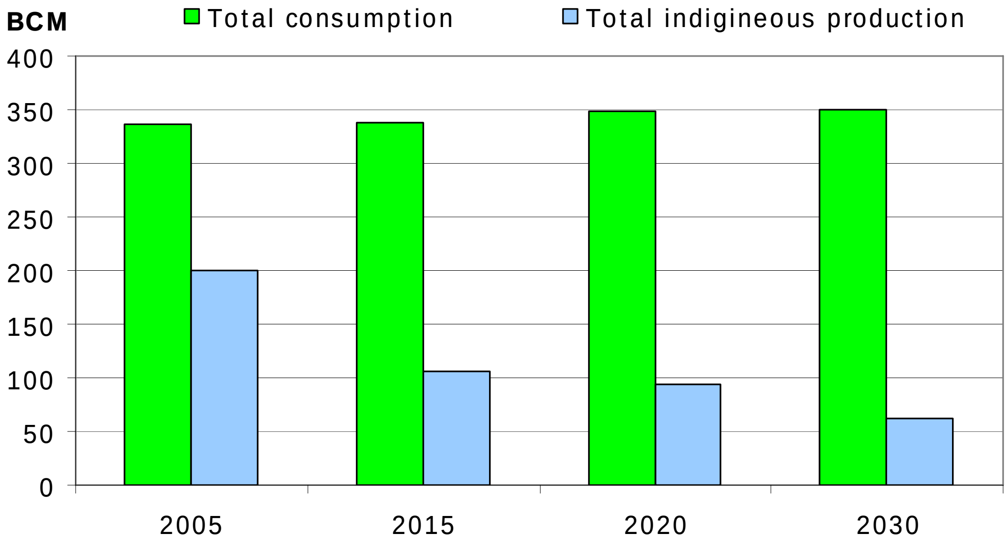
6.2.2 Production and consumption within regions

As seen in the previous chapter the gas supply situation in Europe is changing significantly over the next 10 to 30 years. Europe is facing a depletion of reserves and a decline in indigenous production. Figure 18 EU gas reserves, shows the level and development in the EU27 gas reserves. EU indigenous gas reserves have fallen by approximately 20% over the last 10 years. In 2006 they were 3100 bcm, which is approximately equivalent of 6 years of consumption in the EU.

When looking at Figure 15 it becomes evident that indigenous production is decreasing rapidly in the North region market, where the UK, Netherlands and Germany make up the lion share of indigenous production i.e. and around 93% of total indigenous production. The total indigenous production and consumption profile in the North region can be seen in Figure 15. This drastic decline in indigenous production combined with a slight increase in consumption will especially in the North region require that alternative supplies are made available. According to the PRIMES baseline 2007, the decline in indigenous production in the North region will amount to 140 bcm less indigenous production in 2030 compared to 2005. The planned Nord Stream project will be able to cover for 50 bcm annually, so potentially there is still a need to secure around 85 bcm in the region[5].

[5] Evaluated against the PRIMES 2007 baseline scenario

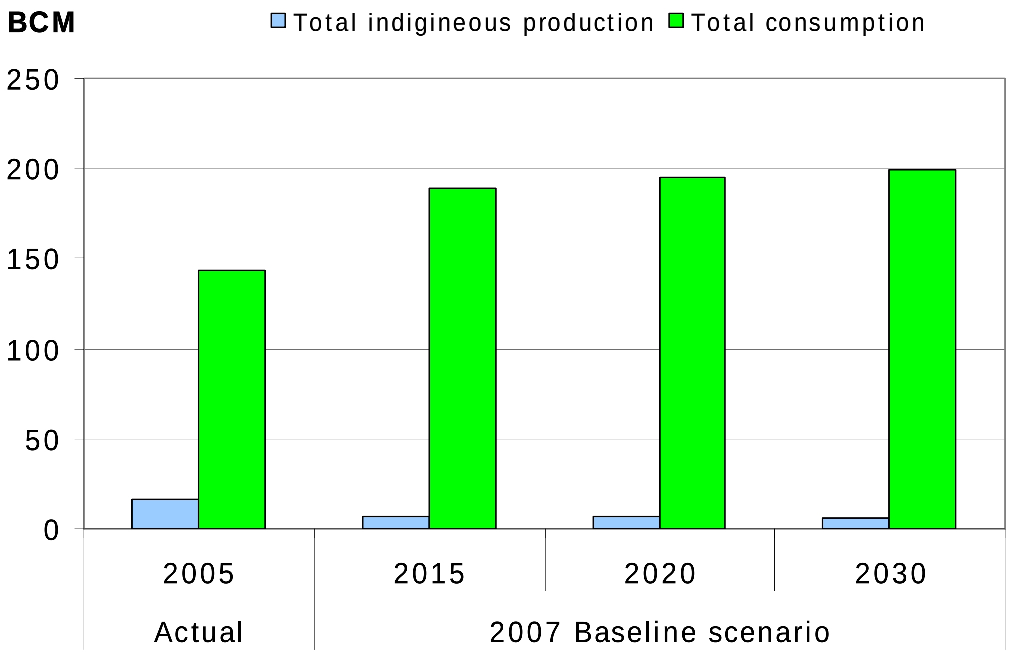
Figure 15 Gas consumption and production in the North region



Source: PRIMES 2007 baseline scenario

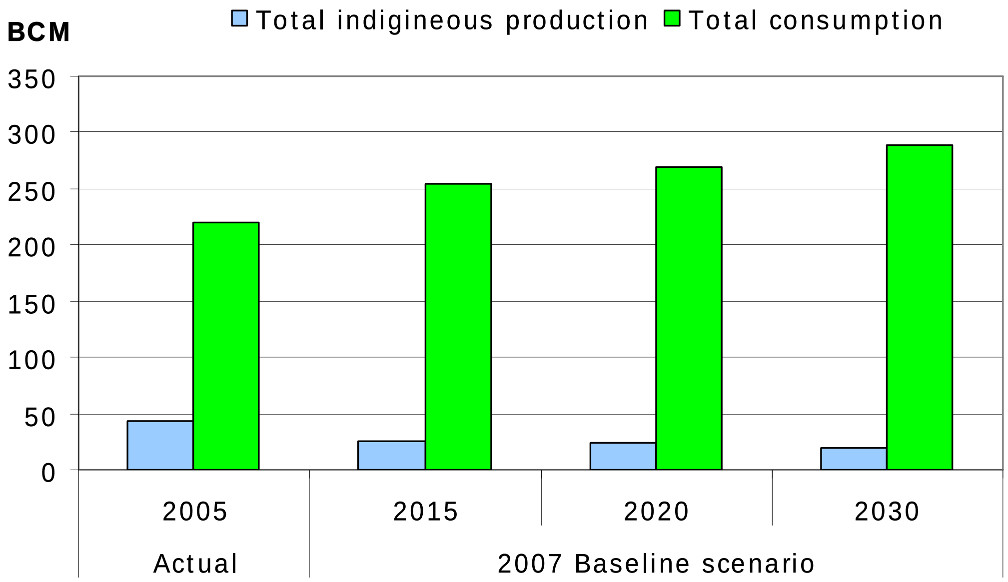
The South-East and South-West regions are characterized by a consumption driven demand for import capacity, rather than a decrease in indigenous production. The consumption profiles of each region can be seen in Figure 16 and Figure 17.

Figure 16 Gas consumption and production in the South-West region



Source: PRIMES 2007 baseline scenario

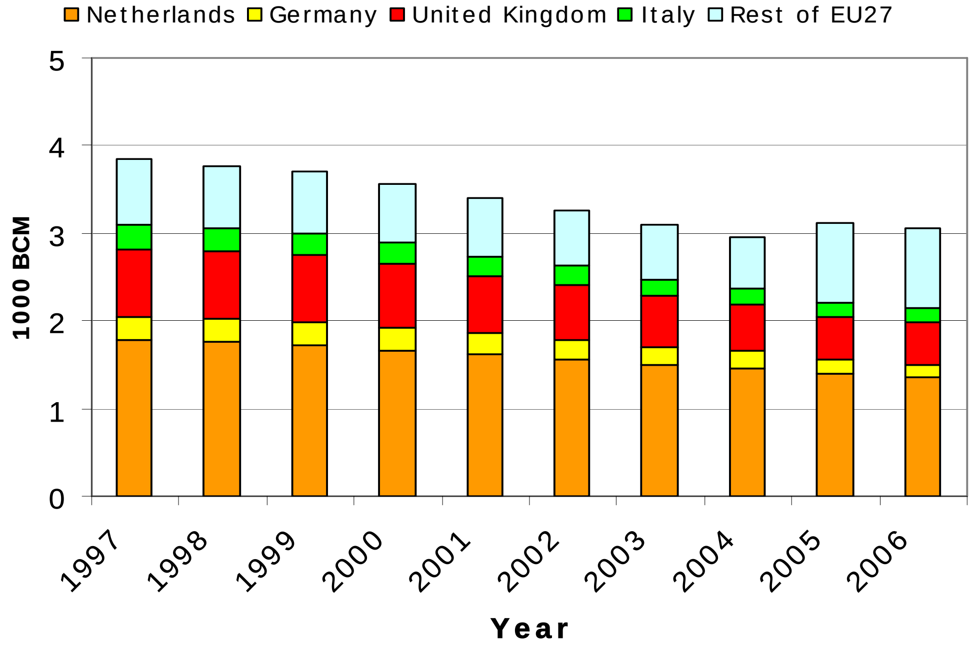
Figure 17 Gas consumption and production in the South-East region



Source: PRIMES 2007 baseline scenario

From Figure 18 it can be seen how total EU gas reserves are currently around 3100 bcm equivalent of around 6 years of consumption at 2007 levels.

Figure 18 EU gas reserves (1000 bcm)



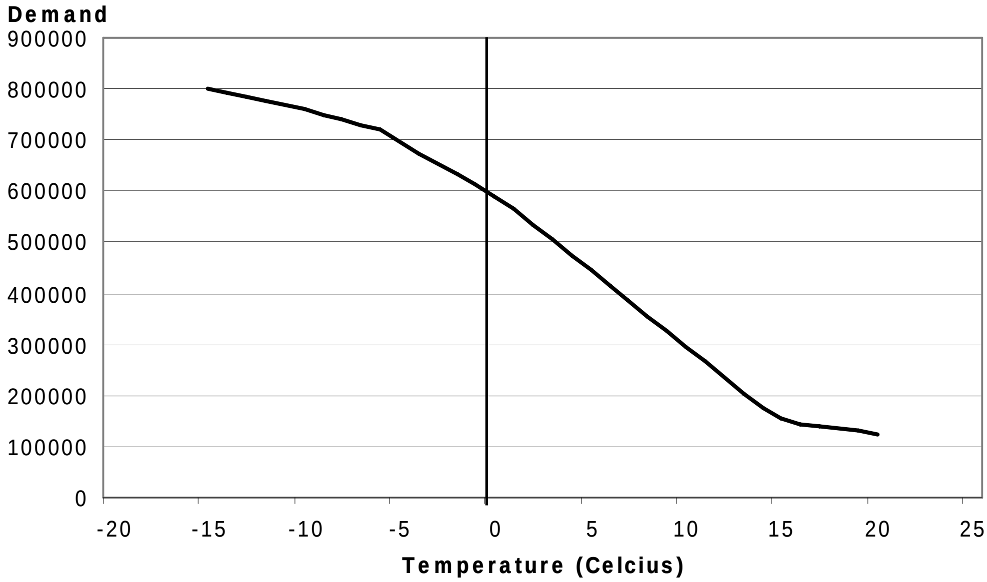
Source: BP.com/statisticalreview

In the following section we take a closer look at tae available capacities in the EU import system.

6.3 Demand in normal and cold years

Gas demand is very depending on temperature since as a lot of gas is used for heating or power production which is also most often highest during winter time. The typical dependency of gas demand as function of temperature is shown in the figure below.

Figure 19 Natural gas consumption and temperature dependency (illustrative)



It can be seen that the heating demand only starts below temperature of around 16 C. At very cold temperatures, there is a tendency to saturation of the gas market, which is due to consumer's appliances running at full capacity and due to cost concerns.

According to GTE, the demand during a normal year in 2007 was 2500 mcm/day, while the demand in extreme years would be 3000 mcm/day.

Before we take a look at the actual capacities in the EU we take a look at how gas consumption is expected to develop, as this is crucial in terms of evaluating the need for capacity investments in the future.

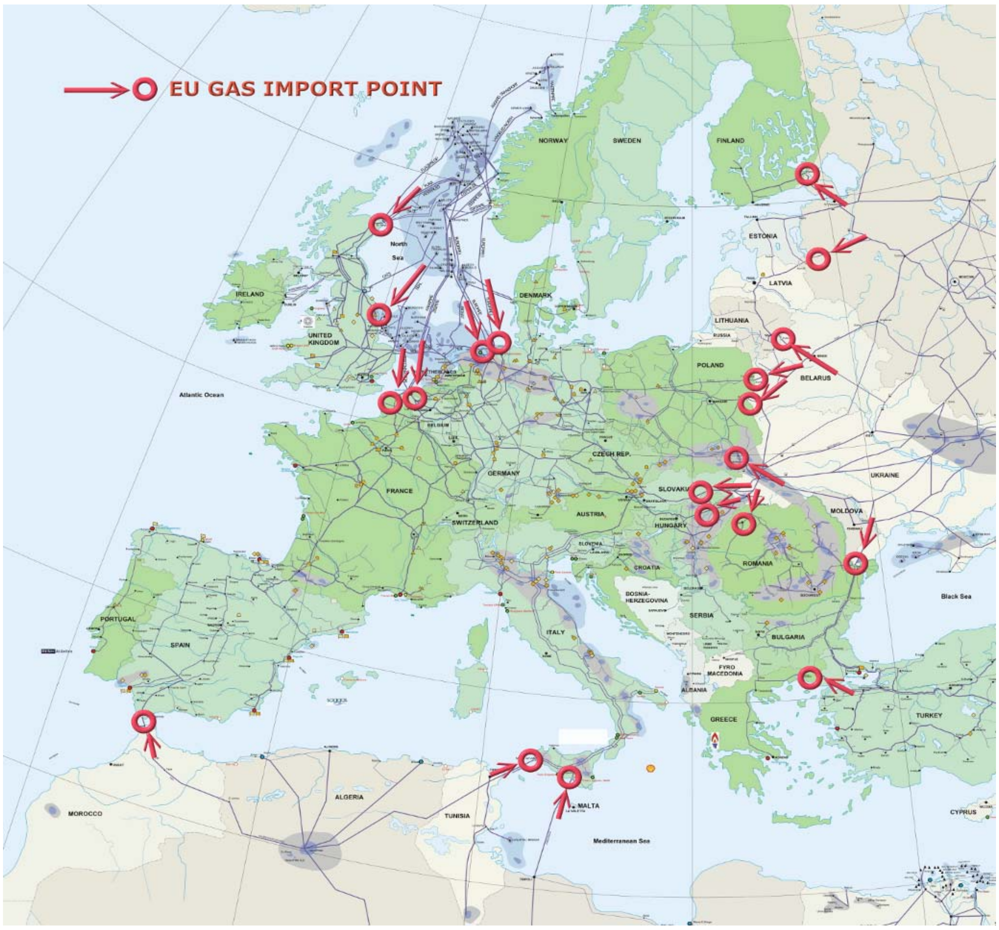
For further analysis on the impact on demand of gas and storage in a cold year see section 6.6.

6.4 Capacity Analysis of EU-27 gas import gas

This section outlines the existing and future import gas infrastructure in EU-27. The analysis entails the following subsections. Figure 20 below shows all the import gas pipelines into EU and the annual capacity at each import point.[6]

[6] Source: Gas infrastructere Europe (GIE)

Figure 20 Gas pipeline import, entry points into EU



Source: Ramboll based on GIE map data

Data on each import point has been summarized in Table 10. Based on these figures, daily and yearly maximum flow rates are estimated. The data on each source country is compared with the actual import volumes[7] from each respective country in 2007 where after the utilization rate is calculated. In the present context, utilization rate is the percentage of utilized capacity of the existing total maximum capacity available for the entire year. [8]

[7] Source: BP yearly statistical review

[8] See annexes for a more detailed description of Table 10

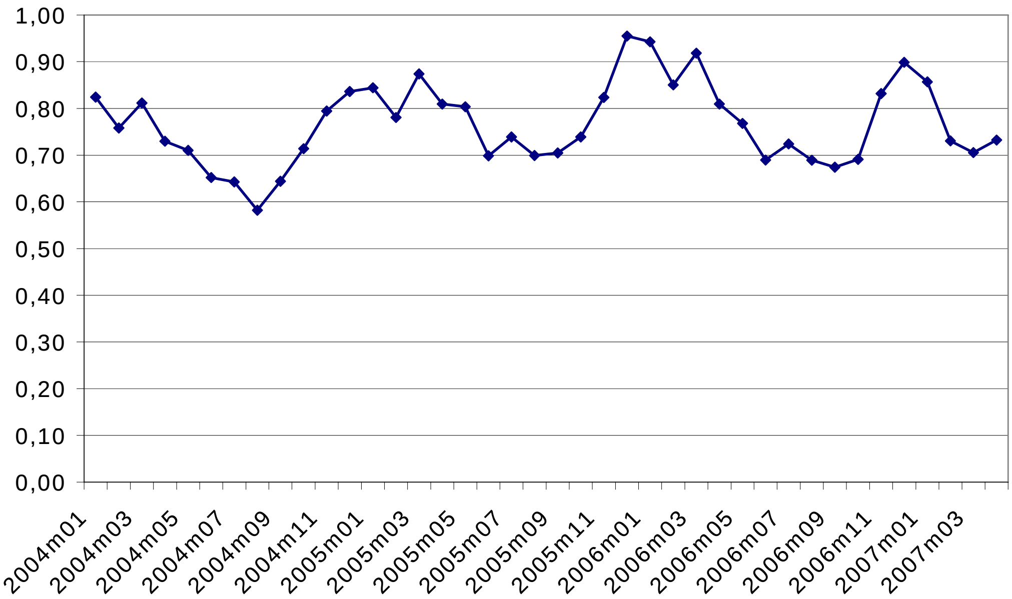
Table 10 Existing import pipelines and respective capacities (2007) [9]

Export country	to/via	Max. flow rate mil Nm3/hour	Max. flow rate mil Nm3/day	Max. yearly flow rate bcm	Total Max. yearly flow rate bcm	Total imports from the each source country bcm	Utilization rate
Russia	Slovakia (Via Ukraine)	12.33	295.92	108.01	224.9	155.6	69.2%
Russia	Lithuania (Via Belarus)	1.20	28.80	10.51			
Russia	Hungary (via Ukraine)	1.63	39.12	14.28			
Russia	Finland (Imatra)	0.80	19.20	7.01			
Russia	Latvia (Korneti)	0.15	3.50	1.28			
Russia	Poland (Wysokoje)	0.60	14.40	5.26			
Ukraine	Poland (Drozdowicze)	0.65	15.60	5.69			
Russia	Poland (Via Belarus)	3.57	85.70	31.30			
Ukraine	Romania (Isaccea)	4.28	102.72	37.49			
Ukraine	Romania (Mediesu Aurit))	0.46	11.04	4.03			
Algeria	Spain (via Morocco)	1.27	30.48	11.13	11.1	32.7	76.4%
Algeria	Italy (Via Tunisia)	3.62	86.88	31.71	31.7		
Libya	Italy (Gela)	1.14	27.36	9.99	9.99	9.2	92.1%
Norway	Belgium (Zeebrugge)	1.67	40.08	14.63	14.6	86.1	75.8%
Norway	Germany (Emden NPT)	3.30	79.20	28.91	43.9		
Norway	Germany (Emden NPT1)						
Norway	Netherlands (Emden NPT)						
Norway	Netherlands (Emden EPT1)						
Norway	Germany (Emden EPT)						
Norway	Germany (Emden EPT1)						
Norway	Germany (Dornum/NETRA)	1.71	41.04	14.98			
Norway	France (Dunkerque)	2.12	50.88	18.57	18.6		
Norway	United Kingdom (St.Fergus Vesterled)	1.42	34.08	12.44	36.4		
Norway	United Kingdom (Easington)	2.74	65.76	24.00			
		44.66	**1071.8**	**391.2**	**391.2**	**283.6**	**72.5%**

[9] This data includes transit gas

As it can be noticed from Table 10 total import capacity is 391 bcm per year, however only 284 bcm were actually imported[10]. This gives us an average utilization rate for pipelines of 72% with 70% from Russia and 75.8% for import pipelines from Norway. Thus there is a relative large import potential in these pipelines, which perhaps could be utilised by building more storage capacity in the EU. In order to utilise the available capacity in the existing pipelines – the capacity that is available is mainly available in the summer months. The below figure shows monthly utilisations rates of gas import pipelines in the EU.

Figure 21 Monthly Utilisation rates[11]



Source: Ramboll own calculations

The above figure illustrates how imports follow the seasonal consumption pattern of low consumption in the summer and a high level of consumption during the winter. This can be due to flexibility in import contracts which allow importers to buy more gas during winter or it can be due to summertime bottlenecks in the system, further described in section 6.10.1.

6.4.1 Assessment of future supply-demand situation

In order to assess the future supply-demand situation a supply and demand analysis is carried out. According to European Commission's latest Trends to 2030 baseline scenario, net gas imports are projected to be at 433 bcm in 2020 and 479 bcm in 2030. This is a significant increase when compared with the current import figures.

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[10] The table does not include the Turkey-Greece interconnection as this pipeline was only inaugurated on 18 November 2007 and thus there exist no data on imports in 2007. The capacity of the pipeline is 7 bcm although an expansion is planned for 2012,

[11] Utilisation rates are including LNG imports which makes the overall utilisation rates a bit higher than they actually are – around 0.02 higher on average

In order to accommodate the additional demand for gas, there needs to be adequate import infrastructure in place. Currently, EU-27 imports through pipelines and LNG terminals.

In the following we create a possible investment scenario that would fulfil the investment requirements faced by the EU in relation to the expected gas import requirements. However first we need to evaluate LNG imports in order to evaluate the total import investment situation in the EU.

6.4.2 Current LNG terminal capacities

In Table 11 LNG terminals' maximum capacities are taken and the data is compared with the actual import figures, and utilization rates are calculated accordingly. It can be observed from the table that average utilization rates are below 50%. The largest LNG importer Spain has a utilization rate of around 45%. Where as it is much lower in the case of the UK. However, here current maximum capacities are compared with the actual imports in 2007. During this period some of the facilities capacities have been extended, hence the projected figures can be lower than the actual numbers, which in turn means that the actual utilization rates could be higher.

Table 11 Current LNG terminals and respective capacities

LNG Nr. / Location	Recei-ving Country	Max. yearly flow rate	Total Max. yearly flow rate	LNG Import (2007 figures)	Utili-sation rate
Zeebrugge LNG	Belgium	8.41	8.4	3.2	37.7%
Fos Tonkin	France	6.57	18.3	13.0	70.8%
Montoir de Bretagne	France	11.74			
Barcelona	Spain	14.45	54.4	24.2	44.5%
Cartagena	Spain	10.51			
Huelva	Spain	11.83			
Bilbao	Spain	7.01			
Sagunto	Spain	7.01			
Mugardos	Spain	3.59			
Sines	Portugal	5.96	6.0	2.3	38.8%
Panigaglia	Italy	4.73	4.7	2.4	51.4%
Revythoussa	Greece	2.10	2.1	0.8	38.5%
Isle of Grain	UK	5.52	5.5	1.5	26.5%
Milford Haven	UK				
Total		**99.43**	**99.4**	**47.3**	**47.6%**

Source: GIE, LNG capacity database

6.4.3 Total capacity

We thus have that total import capacity in the EU is 391.2 bcm per year from pipelines and additional import capacity from LNG is 99.4 bcm per year. However unless the existing import pipelines and LNG terminals are operated with higher utilisation rates the actual capacity they provide is 283.6 bcm plus 47.3 bcm.

In order to properly assess the import situation we further need to evaluate import projects that are already planned for. We begin by looking at planned investments in LNG terminals.

6.4.4 Planned new / extension LNG capacities

Based on the GIE data the following projects and respective capacities are listed in Table 12.

Table 12 New/extended LNG terminals (bcm)

<table>
<tr><th>LNG Location</th><th>Receiving Country</th><th>Max. yearly flow rate</th><th>Total Max. yearly flow rate</th></tr>
<tr><td>Zeebrugge LNG</td><td>Belgium</td><td>0.59</td><td>0.59</td></tr>
<tr><td>Fos Cvaou</td><td>France</td><td>8.25</td><td>8.25</td></tr>
<tr><td>Barcelona</td><td>Spain</td><td>2.65</td><td rowspan="7">20.52</td></tr>
<tr><td>Cartagena</td><td>Spain</td><td>1.29</td></tr>
<tr><td>Bilbao</td><td>Spain</td><td>3.49</td></tr>
<tr><td>Sagunto</td><td>Spain</td><td>3.49</td></tr>
<tr><td>Musel</td><td>Spain</td><td>7.00</td></tr>
<tr><td>Arinaga</td><td>Spain</td><td>1.30</td></tr>
<tr><td>Arico-Granadilla</td><td>Spain</td><td>1.30</td></tr>
<tr><td>Adriatic</td><td>Italy</td><td>7.60</td><td rowspan="2">23.6</td></tr>
<tr><td>Brindisi</td><td>Italy</td><td>16.00</td></tr>
<tr><td>Isle of Grain</td><td>UK</td><td>7.48</td><td rowspan="2">29.03</td></tr>
<tr><td>Milford Haven</td><td>UK</td><td>21.55</td></tr>
<tr><td>Total</td><td></td><td>82.0</td><td>82.0</td></tr>
</table>

Source: GIE, LNG capacity database

Considering the fact that most of the projects listed above are either under construction or at a mature planning stage[12], it is presumed that all these projects will be materialised. Assuming that these new facilities will also reach utilisation ration of 47.6 these new LNG projects can be expected to provide an additional import capacity of 39.0 bcm. (47.6% of 82.0 bcm).

However, it should be noted that LNG imports are constrained by the fact that there is lacking production capacity i.e. demand is increasing more than supply. Further LNG also has the disadvantage of having to compete with other parts of the world for LNG shipments.[13]

Even assuming that all the LNG projects listed above in Table 12 and assuming an utilisation rate of 47.6%, this additional capacity will not be sufficient to meet the

[12] GIE LNG capacity database
[13] For more on LNG see the annexes.

complete import demands and hence rest of the gas demand would have to be supplied through import pipelines.

Therefore, in order to project plausible future developments, we create an investment scenario that would accommodate the investments required in order to secure sufficient import capacity in the future. The investment scenario is created in order to give an example of what is needed when. The investments that are included are only an example and the actual investments that will be realised could be another mix of projects than the one in our example.

The below table shows a list of possible import projects that could be built in order to close the future supply/demand gap in the EU. The list is a mix of existing projects and projects proposed by Rambøll.

Table 13 Future/planned import pipeline projects

Name of the Project	Source country	Additional capacity expected per year (in bcm)
Nord Stream	Russia	50.00
Amber	Russia	50.00
Skanled	Norway	8.00
Galsi	Algeria	8.00
Trans-Sahara	Nigeria	30.00
Medgaz	Algeria	8.00
Nabucco	Azerbaijan	31.00
South Stream	Russia	31.00
White Stream	Azerbaijan	32.00
Qatar pipeline	Qatar	30.00
Barents pipeline	Russia	30.00
Yamal – Europe	Russia	33.00
Total		**351.00**

Source: various project homepages and Ramboll inhouse knowledge

As indicated in the table maximum yearly capacities of these projects range from 3 bcm to 50 bcm per year.

As was noted earlier the total import demand in 2020 and 2030 is expected to reach the level of 433 bcm in 2020 and 479 in 2030. This requires total import capacity investments in the amount of 433 – (283.6 + 47.3) bcm i.e. future demand minus pipeline capacity and LNG capacity = 102.1 bcm before 2020 and additionally 46 bcm of investments in import capacity before 2030.

Assuming that LNG capacity is increased by 39 bcm per year, we have that additional investments in the amount of 60 bcm before 2020 and another 46 bcm by 2030. The below table shows an example of how this can be achieved.

Table 14 Investment scenario (bcm)

Name of the Project[14]	Source country	Max. yearly flow rate	Total Max. yearly flow rate 2020	Total Max. yearly flow rate 2030	Exp. natural gas imports 2020	Exp. natural gas imports 2030
Nord Stream	Russia	50	50	50	**433**	**479**
Amber	Russia	50				
Skanled	Norway	8	8	8		
Galsi	Algeria	8	8	8		
Trans-Sahara	Nigeria	30				
Medgaz	Algeria	8	8	8		
Nabucco	Azerbaijan	31				
South Stream	Russia	31				
White Stream	Azerbaijan	32				
Qatar pipeline	Qatar	30		30		
Barents pipe	Russia	30		30		
Yamal-Europe	Russia	33				
Total		**351**	**74.0**	**134.0**	**433**	**479**

In the above scenario the new Pipeline projects Nord Stream, Skanled, Galsi and Medgaz are expected to be implemented by 2020 (yellow highlight). Additionally a Qatar pipeline and a Barents Sea pipe (green highlight) are constructed within 2030. Table 15 below show the supply-demand balance in case these investments are realised.

Table 15 Supply demand calculations (bcm)

year	**2020**	**2030**
Total required additional capacity	102.0	148.0
Export	21.0	21.0
Total capacity required	123.0	169.0
Capacity covered through new pipelines	74.0	134.0
Capacity covered through new or extension of LNG	39.0	39.0
Supply-demand	**-10.0**	**4.0**

It can be seen that if these 6 investments are realised then there is just insufficient import capacity to supply the gas demand in the EU by approximately 10 bcm in 2020 and a surplus in capacity by 4 bcm in 2030, if the investments in the above scenario are made. The next section evaluates the level of investment required in the High renewables scenario.

[14] Source: Ramboll internal data

6.4.5 Combined High renewables and efficiency scenario

In this section, demand estimates for combined high renewables and efficiency scenario are considered and similar calculation is made with different investment scenarios. According to this scenario, because of higher efficiency the demand for the import gas will be comparatively lower i.e. 363 bcm in 2020 as opposed to 432 bcm in an earlier case.

Table 16 Combined high renewables and efficiency scenario 1 (bcm)

Name of the Project	Source country	Max. yearly flow rate bcm	Total Max. yearly flow rate bcm (by 2020)	Total Max. yearly flow rate bcm (by 2030)	Expected natural gas imports in 2020 (in bcm)	Expected natural gas imports in 2030 (in bcm)
Nord stream	Russia	50			363	368
Amber	Russia	50				
Skanled	Norway	8	8	8		
Galsi	Algeria	15				
Trans-Sahara	Nigeria	30				
Medgaz	Algeria	8	8	8		
Nabucco	Azerbaijan	31				
South Stream	Russia	31				
White Stream	Azerbaijan	8				
Qatar pipeline	Qatar	30				
Barents pipeline	Russia	30				
Yamal-Europe	Russia	33				
Total		**340**	**16**	**16**	**363**	**368**

In the high renewable scenarios pipeline projects highlighted in yellow are expected to be implemented. Expected net imports are only 363 bcm and only 32.2 bcm more than the current levels.

Table 17 Supply demand calculations (bcm)

year	2020	2030
Total required additional capacity	32.2	36.6
Export	21.1	21.1
Total capacity required	53.3	57.7
Capacity covered through new pipelines	16.0	16.0
Capacity covered through new or extension of LNG	39.0	39.0
Supply-demand balance	**1.8**	**-2.6**

This means that only fewer new pipelines are required. As illustrated in above scenarios two more new projects until 2030 will approximately be needed to cover the decline in indigenous production in 2020 as well as in 2030.

6.4.6 High level of demand uncertainty

It should be noted that the above calculations are very sensitive to gas demand forecasts. If gas demand increases by more than what is foreseen in the 2007 baseline scenario or the High renewables scenario examined in the above analysis, then this will entail import investments on a one-to-one basis i.e. if natural gas demand increases by 50 bcm more than expected in the baseline 2007 scenario then all this gas will have to be supplied via increased imports which entail additional investments of 50 bcm of annual import capacity equivalent of a Nord Stream size import project.

Because indigenous production is fixed, all uncertainties regarding consumption will be transferred directly to uncertainty in terms of investments in imports. Therefore the above calculation should be evaluated considering this large level of uncertainty.

6.4.7 Capacity analysis summary

The following conclusions can be summarized from the capacity analysis performed.

- It is observed that most of the import pipelines have a utilization of around 70%. An alternative to building additional pipeline import capacity could be to build storages and increase imports from existing import routes. I.e. assuming that low summer utilisation rates are caused by EU internal bottlenecks.
- Increased imports can also be achieved by increasing the very low utilisation rates associated with EU LNG imports. This could call for increased focus on LNG supplies i.e. LNG production capacity.
- To meet future import demands there needs to be additional import capacity of approximately 120 bcm per year in 2020 and another 46 bcm in 2030 (2007 baseline scenario) in which case as shown in the analysis only a few major new pipelines have to be built.
- Uncertainty in terms of future gas consumption is likely to affect import capacity needed on a one-to-one relationship.

In the next section we take a closer look at what the reasoning is behind some of the pipelines listed in Table 13. Further the above capacity analysis is expanded in terms of analysing volumes

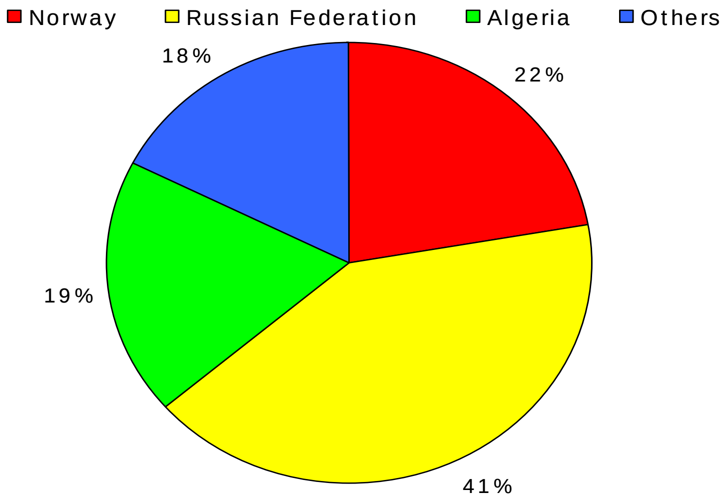
6.5 Volume analysis

At a current consumption level of around 500 bcm/year. The total indigenous EU27 reserves are more than inadequate to secure gas supplies in the future. Total reserves are falling and would only cover demand for 5-6 years, if the EU was to rely solely in indigenous reserves. The following sections expand on the above capacity analysis by including a volume analysis.

6.5.1 Import possibilities

A large part of total consumption is thus imported in to the EU from 3 main regions/countries i.e. Norway, Russia and Northern Africa. The import mix can be seen in Figure 22. Russia and the Middle East hold substantial gas reserves, it is noteworthy that the Middle East constitutes for as many gas reserves as Russia, Norway and Africa in total.

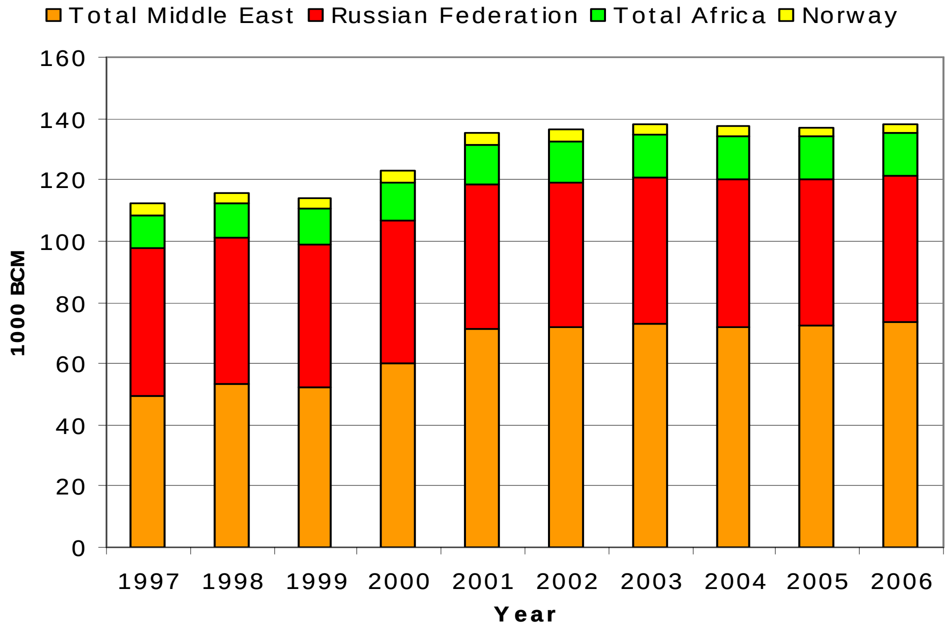
Figure 22 Total EU natural gas imports of net gas imports 2005



Source: Eurostat

Figure 23 EU import countries/Regions and the Middle East gas reserves show the gas reserves of the present main gas suppliers to the EU. Gas reserves in the Middle East are almost as large as the total reserves in the 3 other main gas suppliers in 2006. Gas reserves in the Middle East were 73500 bcm and in Norway 2890 bcm, Russian federation 47650 bcm and Africa 14180 bcm.

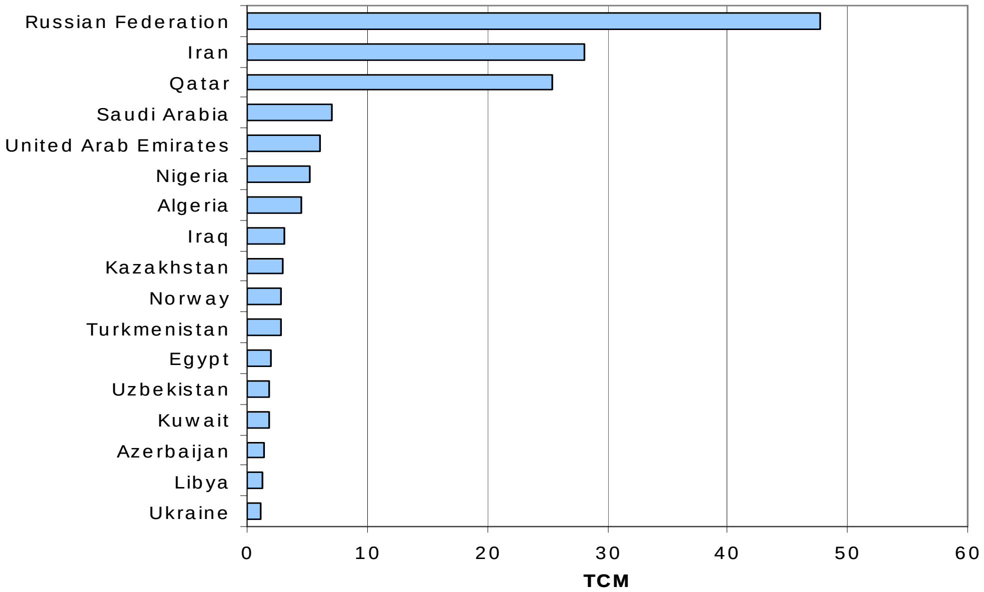
Figure 23 EU import countries/Regions and the Middle East gas reserves



Source: BP annual statistics 2007

When looking at gas reserves of possible interest to the EU two things are essential 1. Gas reserves within pipeline distance and 2. Gas reserves with LNG capacity. Figure 24 looks at various reserves which are all within pipeline distance.

Figure 24 Gas reserves 2006 within Pipeline distance of the EU



Source: BP.com/statisticalreview

Figure 24 shows that gas reserves within pipeline distance are plentiful. With an average annual consumption of around 500 bcm Russia alone would be able to supply the EU for more than 90 years.

6.5.2 Investment requirements in the future

The capacity analysis performed in section 6.4 focussed on import capacities. However, increased consumption and decrease of indigenous production will also require investments in e.g. storage capacity and interconnection. Table 18 shows the results of the TEN Energy – Invest report[15] which analysed the overall investment needs in Europe based on the Primes scenarios.

An apparent conclusion to be made when evaluating the results attained in the TEN Energy – Invest report, is that the need for investments in interconnection compared to total investments are very small for all scenarios. Further results show that investments in all scenarios except the soaring oil and gas price scenario are substantial when it comes to the need for investments in new import capacity.

Table 18 summarises the expected total investments presented in the previous sections

EU 30: Expected investments B EUR 2005-2013: New import capacity	TSO internal Investment	Storage	Intercon-nectors etc.	Ongoing Projects	Import Pipelines & LNG	Total Investment
Baseline Scenario	24	10	3	1	10	48
12% renewables in 2010	23	7	3	1	9	43
Energy efficiency	21	5	3	1	7	37
Efficiency case with high renewables	20	4	3	1	6	34
Soaring oil and gas price scenario	18	4	3	1	0	26
EU 30: Expected investments B EUR 2014-2023: New import capacity	TSO internal Investment	Storage	Intercon-nectors etc.	Ongoing Projects	Import Pipelines & LNG	Total Investment
Baseline Scenario	24	12	3	0	13	52
12% renewables in 2010	23	10	3	0	12	48
Energy efficiency	21	6	3	0	8	38
Efficiency case with high renewables	20	5	3	0	8	36
Soaring oil and gas price scenario	18	1	3	0	3	25
EU 30: Expected investments B EUR TOTAL: New import capacity	TSO internal Investment	Storage	Intercon-nectors etc.	Ongoing Projects	Import Pipelines & LNG	Total Investment
Baseline Scenario	48	22	6	1	23	100
12% renewables in 2010	46	17	6	1	21	91
Energy efficiency	42	11	6	1	15	75
Efficiency case with high renewables	40	9	6	1	14	70
Soaring oil and gas price scenario	36	5	6	1	3	51

Source: T E N-Energy- I n v e s t: Study on Energy Infrastructure Costs and Investments (2005)

[15] T E N-Energy- I n v e s t: Study on Energy Infrastructure Costs and Investments between 1996 and 2013 (medium-term) and further to 2023 (long-term) on the Trans-European Energy Network and its Connection to Neighbouring Regions

The above table shows that expected investments in interconnection are rather limited for all scenarios analysed, some possible missing links in terms of natural gas interconnection in the EU are identified below. (These projects are however often spin-off projects from large import projects, such as the Romania-Hungary interconnector which would be a spin-off project of the Nabucco pipeline)

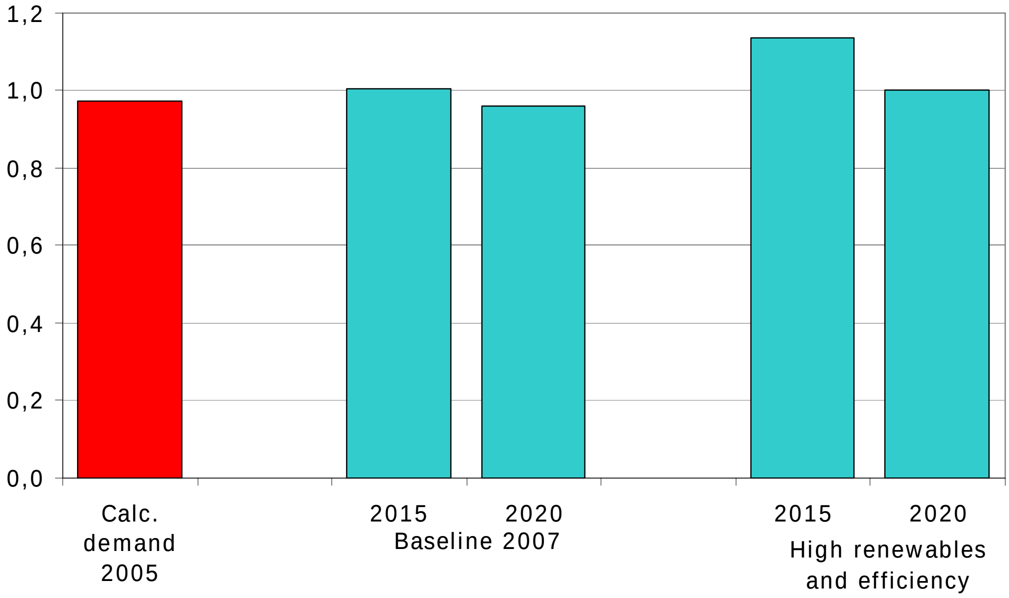
- Poland – Lithuania: Small Amber pipeline
- Finland – Estonia: Balticconnector
- Norway-Sweden-Denmark: SkanLed or North Sea
- Romania-Hungary: Nabucco
- Greece-Italy: IGI or TAP
- Poland-Denmark: Baltic Pipe
- Germany-Sweden/Denmark: BGI

6.5.3 Storage volume capacity

Storage demand in the EU is set to grow quite significantly over the next years, as the EU becomes more dependent on imports which are less flexible compared to indigenous production and thus more storage is required in order to be able to supply enough flexibility.

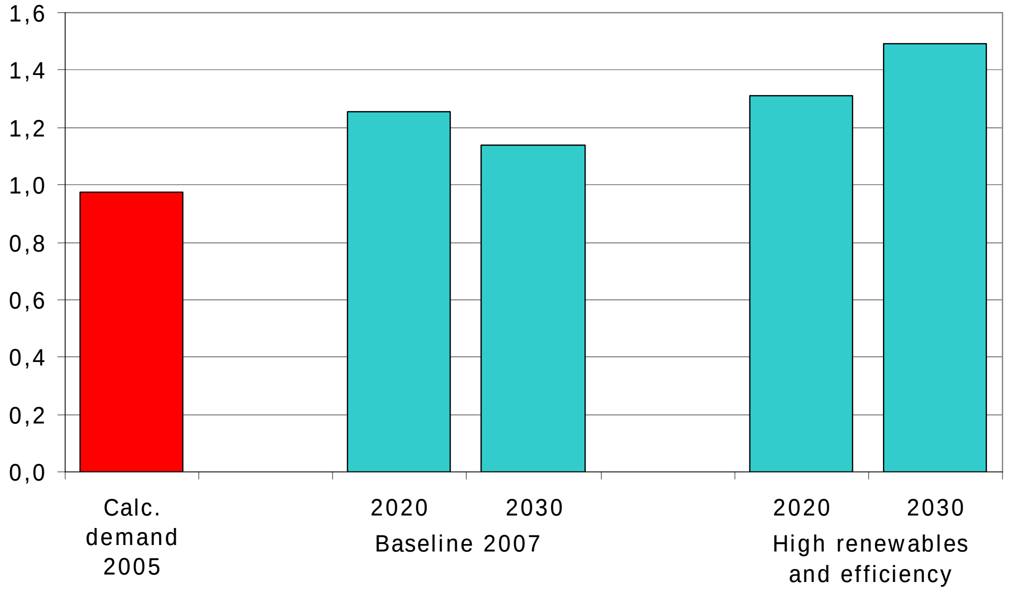
Figure 25 shows the supply demand ratio for gas storage under the assumption that only the investment projects listed by Gas Storage Europe, that are either under construction or committed to take place within 2015 will actually be constructed. This can be regarded as a somewhat conservative measure, the total of investments taking place in the EU is in this scenario 15.3 bcm of storage capacity. It can be seen from the figure that in 2005, total demand was a bit higher than supply as the supply/demand ratio was below 1. This will however improve when using the 2007 baseline PRIMES scenario gas demand for 2015.

Figure 25 Gas storage demand compared to gas storage supply (Committed and under construction 2015) (red = situation today, turquoise = calculated future situation)



Source: Ramboll own calculation based on Ramboll gas storage demand model (preliminary results)

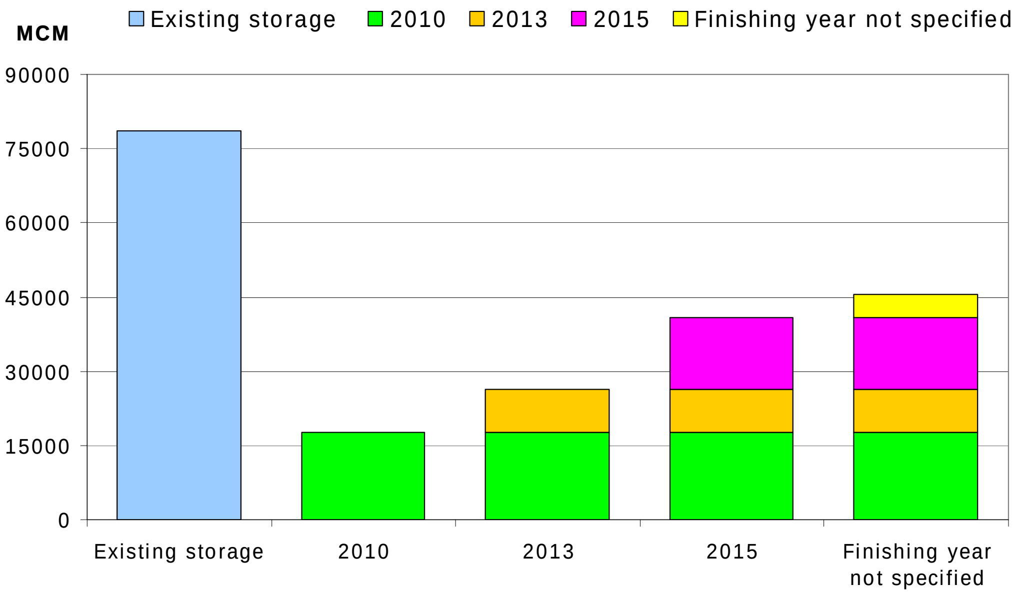
Figure 26 Gas storage demand versus supply, EU total – all planned investments (red = situation today, turquoise = calculated future situation)



Source: Ramboll own calculation based on Ramboll gas storage demand model (preliminary results)

Investment requirements in storage are substantial for several of the analysed scenarios in Table 18. However substantial storage investments are already being planned, see Figure 27. A total of around 45 bcm of new storage capacity is planned although only approximately a third of these investments are actually under construction or committed.

Figure 27 Planned storage investment capacity in the EU (volume)



Source: Gas Storage Europe, January 2008 update (GSE)

Preliminary results on future storage demand and supply[16] indicate that the market is just able to provide sufficient storage capacity. Thus, it would seem that storage projects are not in a position where they require a lot of additional support in terms of status as prioritised projects. However, analysing the effects of a cold winter, see next section 6.6, shows that there could be insufficient storage capacity if a very cold winter was to hit Europe. Further, it is important to highlight that a significant increase in storage capacity is crucial in terms of securing sufficient flexibility in the market when indigenous production decreases.

6.6 Cold winter analysis

This section analyses the capability of the gas market to provide the necessary gas supply, during an exceptionally cold winter, which we will define as the winter measured in number of heating degree days with a probability of 5 percent of occurring (20 year winter) If the EU experiences an extraordinarily cold winter then the market will require additional gas in order to accommodate for this increase in demand, which will mainly be for direct heating use but also for additional power production. The increase in demand during a cold winter can in principal be accommodated by increasing any of the three existing supply alternatives indigenous production, imports and supply from storages. However, as gas imports pipelines are often utilised close to 100% during winter months, imports are most likely not able to increase supplies during the winter months. Also, recent experience has shown that cold weather in EU will probably also coincide with cold weather in Russia, Belarus and Ukraine which may tend to even decrease in winter supply. Indigenous

[16] Study on natural gas storage in the EU made by Ramboll to be handed in August 2008.

production may be increased but as indigenous production is decreasing overall in the EU the share of demand that can be meet by an increase in indigenous production is also decreasing, this entails that the role of storages are possibly becoming increasingly important for supplying additional gas during very cold winters and therefore the importance of having adequate storage capacity is increasing. Only The Netherlands, which has a politically decided limit over gas production, holds the potential for significant increase in production. This section analyses the impact on storage demand in the event of a very cold winter.

6.6.1 Demand in a cold winter

From Figure 11 it can be seen that gas consumption shows a clear increasing trend but some years seem to stand out e.g. 1996 which cold winter.

Actual data on how much gas consumption increases in cold years on an EU level is not available thus the approach used in this report is based on data from 1996 which was a cold winter and further the gas consumption data that year shows a high increase besides the overall trend in gas consumption. Estimates of the increase in gas consumption in 1996 indicate an increase of approximately 6% not contributable to the overall trend of growth in gas consumption. The analysis performed is however based on an increase in consumption of 8% to cover for any uncertainties regarding gas demand in a cold year. Further the potential increase in indigenous production has been estimated to be approximately 7.5% this is based on the actual increase in indigenous production in 1996.

Swing consumption is kept fixed at the same level. This may at first seem questionable, as it could be expected that in a cold winter consumption would only increase in winter time thus we would expect swing ratios to increase. However in order to allow for an objective sensitivity analysis we assume that swing ratios are constant. This assumption is actually in line with data from the cold winter in 1996. However we have to keep in mind that the results attained from the analysis are based on this assumption and thus result could underestimate the actual demand for storage in a cold winter.

6.6.2 Results from the cold winter analysis

Results have been attained using preliminary results from Ramboll's storage demand model[17]. As can be seen from that a very cold year increasing gas demand by 8% would result in a total extra storage demand of 6.6 bcm in 2005 compared to a normal year. This figure increases to 7.6 bcm in 2015, 7.9 bcm in 2020 and 8.7 bcm in 2030. It is also noticeable that the figure it relatively constant when evaluating in all years 2015, 2020 and 2030.

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[17] Final results will be published in the Ramboll: Study on Natural Gas Storage in the EU, to be published in the Fall of 2008

Table 19 Increase in gas storage demand in a cold winter, bcm

	2005	2015				2020				2030			
	Increase in demand (cold winter)	**Demand (normal)**	**Cold year**	**Increase in demand (cold winter)**	**Increase in %**	**Demand (normal)**	**Cold year**	**Increase in demand (cold winter)**	**Increase in %**	**Demand (normal)**	**Cold year**	**Increase in demand (cold winter)**	**Increase in %**
Total	**6.6**	**93.4**	**101**	**7.6**	**8.1**	**97.9**	**105.8**	**7.9**	**8.1**	**108.1**	**116.8**	**8.7**	**8.1**

Source: Ramboll Storage demand model preliminary results

Further analysis has shown that a 1% increase in consumption due to a very cold winter entails a 1% increase in gas storage demand.[18]

6.6.3 Increase in import utilisation

Increasing consumption in a year with a very cold winter will have implications not only on the demand for storage but on overall supply of gas. For arguments sake we look at what an increase in 8% of annual consumption would imply for the utilisation of the gas import pipelines. As was shown previously we had an utilisation rate of 72.5%. If we had to import all 8% then this would approximately entail that we import 40 bcm of additional gas. This would imply that the overall utilisation rate of the import pipelines would have to be increased from 72.5% to approximately 82.5%. Thus cold winter demand may be accommodated by increasing utilisation rates were the above example shows a 10%-point increase in utilisation rate is equivalent of additional 40 bcm, this is when evaluating on a yearly basis though.

If we assume that imports could be raised by approximately 2.5%-points during winter months then this would entail an additional import of gas of approximately 0.82 bcm per month. Thus the potential of utilisation increased import during cold winters in rather limited.

It is important to realise that a cold winter does not only increase the demand for gas in the winter time and thus the demand for storage. It also increases demand during summer time because gas storages will need additional refilling compared to a normal year. Thus in the summer following a very cold winter we may experience

[18] Based on a fixed level of 7.5% increase in indigenous production

summer bottle necks because of lacking injection capacity into storages. This could become an issue if we have two following cold winters i.e. we might have a shortage of supply in winter number two because of a summer bottleneck in the system.

6.6.4 Cold winter and LNG

As was show previously the utilisation rate of LNG in the EU is compared to pipeline utilisation ratios very low. Only around 50% of total capacity was utilised in 2007 and massive investments in LNG are planned increasing the importance of LNG as a supply source in the EU considerably.

The low utilisation ratio of LNG combined with the flexibility in LNG supplies i.e. LNG transporters can be redirected towards the highest priced markets. Thus if the EU is hit by a very cold winter then LNG imports could potentially cover the increase in demand because overall there is spare capacity.

If the utilisation ration of LNG terminals was increased to the level of pipelines then this would entail an increase in imports of approximately 25 bcm annually based on the import capacity that is available today. Keeping in mind, that investments in LNG might raise total LNG capacity in the EU by 80%.

Thus LNG could potentially be a very important player in terms of Security of Supply for cold winters and overall in terms of providing the EU gas market with flexibility. LNG would, however, only be viable as a measure against cold winters to the extent that there is spare LNG import capacity availible during winter, which is not necessarily the case.

However, it is important to notice that increasing the utilisation rate is not a simple quick fix, because although there is spare capacity on a yearly level, there may still be capacity restraints on a daily/weekly or monthly basis, thus increasing the utilisation rate may entail increasing supplies on a yearly basis, but may not be viable for peak demand or winter demand if the available capacity is only available in summer. To increase the overall level of supply from LNG, additional investments in storage capacity may be required. Increased storage capacity would allow LNG terminals to import more gas, because the utilisation rate could be increased by increasing imports when there is idle capacity and the gas could then be stored for when the gas is needed. The economic rationale is that if the supply of storage increases then this would lead to a decrease in the price of storage, ceteris paribus. Lower storage costs could make it optimal for LNG importers to increase LNG imports during summer, when the gas price is lower, and then store the gas until winter, instead of importing gas during winter, when the gas is more expensive. Economically we have that if the price of gas in the winter is higher than the price of gas in the summer plus the costs of storage, then LNG importers will choose import more during winter, if however the costs of storage are decreased then LNG importers might shift some of their imports to the summer this would lower the utilisation rate in winter time and increase the potential of LNG to be a safeguard against very cold winters.

6.7 Conclusion cold winter

When evaluating gas storage demand and supply in the light of a cold winter, we see that the demand for storage increases in the event of a cold winter. A cold winter will require more storage capacity in order to supply the additional gas demand. Today (2005) will require 6.6 bcm more storage capacity in the event of a cold winter this figure will increase by approximately 30% to 8.7 bcm in 2030. However, the increase in storage needed for cold winter supply is in line with the overall demand for storage, which is also set to increase by approximately 30%.It is important to consider that a growing gas demand, and a decreasing indigenous production, also raises the demand for capacity in cold years.

Analysis showed that imports via pipeline could not cover for the increased demand, caused by a cold winter as utilisation rates are relatively high. Further, because main imports via pipeline come from Russia, the question arises whether Russia would even be able to increase its exports to the EU in a cold winter as cold weather in the EU coincides with cold weather in Russia. Thus it is questionable whether Russia would be able to supply more gas even in the case that there was capacity available. However, LNG showed potential in terms of providing additional gas supplies during a cold winter in the EU. Further the planned increase in LNG could increase the possibility to import gas via LNG during cold winters. It was, however, also noted that determining the absolute level of security of supply that could be provided by increasing the utilisation rate of LNG depended on daily/weekly/monthly analysis of utilisation rates, in order to evaluate the specific potential of LNG. Further, to benefit fully from the available LNG capacity, increased investments in storage capacity might be needed.

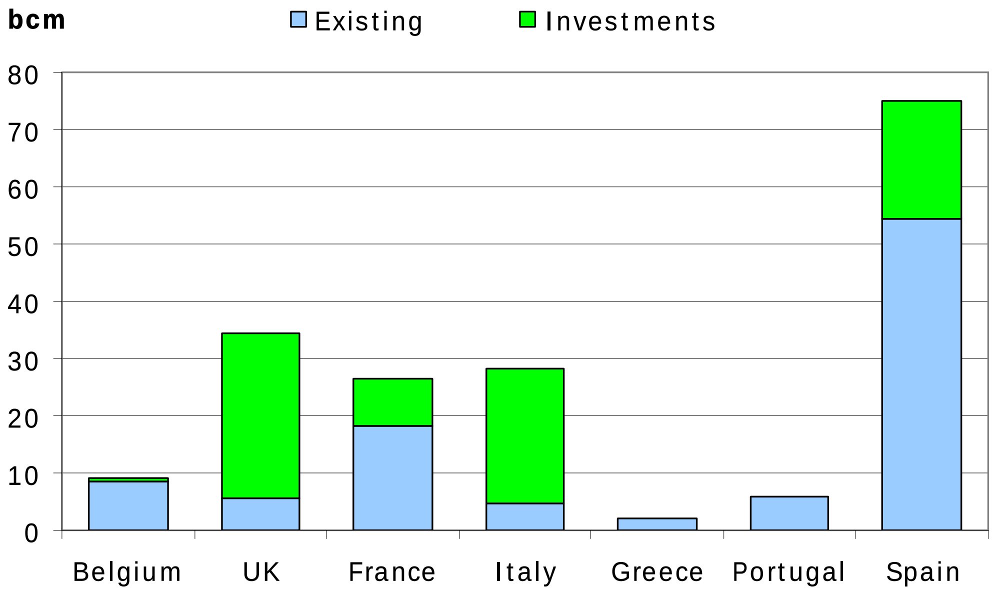
The following sections takes a closer look at the LNG situation in the EU as section 6.4 showed, there is a lot of investments going on in terms of LNG terminals, however it also seems as if the utilisation rate of LNG terminals is significantly lower than that of pipelines.

6.7.1 LNG Capacity

Presently (2008), there are 14 importing LNG plants in the EU, with a total annual import capacity of 100 bcm, additional 9 facilities are under construction and/or are included in mandatory planning. Capacities are not known for all the planned investments, but known investments in new capacity and expansion of existing facilities will increase total capacity by more than 40%[19]. LNG import capacity is however distributed unevenly across the EU with a few countries having the majority of available capacity, shown in Figure 28.

[19] Source: Gas LNG Europe (GLE)

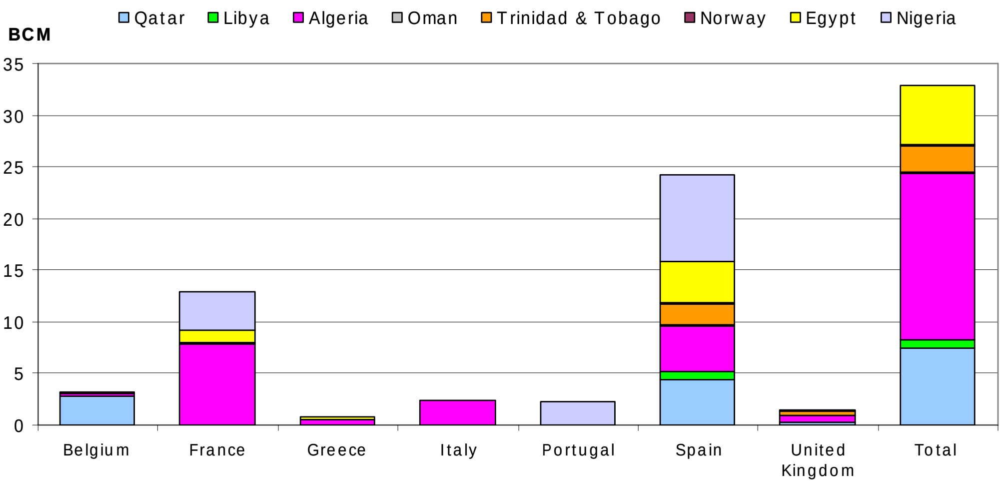
Figure 28 LNG capacity in the EU, existing and investments



Source: Gas LNG Europe (GLE)

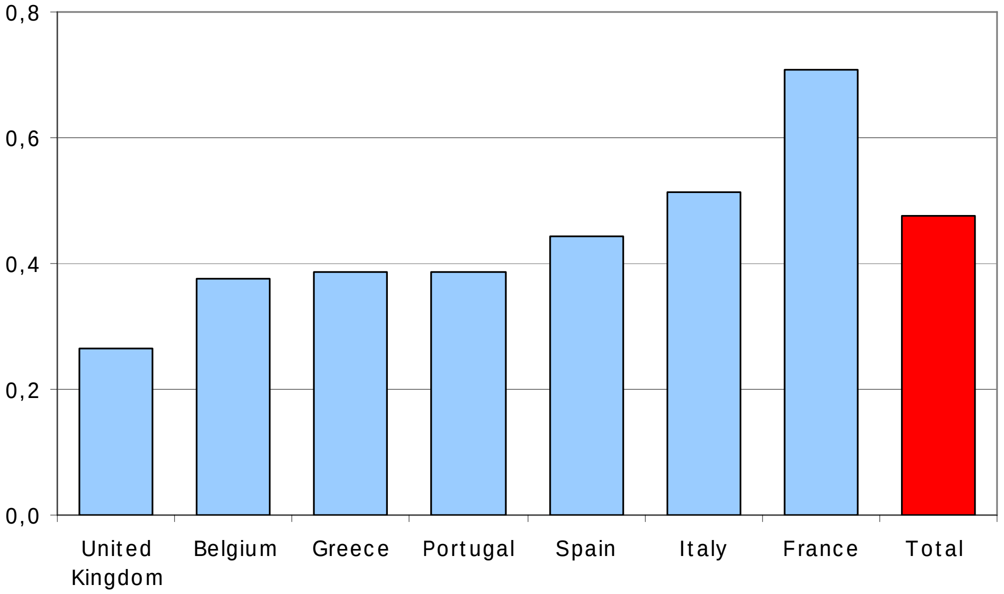
Further a wide range of different LNG terminals have been proposed all over the EU. GLE have more than 20 projects listed as being under study or proposed. This could potentially bring the total amount of LNG terminal up to more than 40 in the future i.e. triple the total amount of LNG terminals in the EU. It is however questionable whether a substantial increase in LNG import capacity would also be to able find adequate suppliers. In Figure 29 actual trade movements in 2007 concerning LNG can be seen, it shows that around 50 bcm of LNG were imported into the EU that year, approximately 10% of total gas consumption. However, with LNG import capacities of more than 100 bcm, this equals only a utilisation-factor of around 0.5 i.e. only around half of the actual capacity was realised. Figure 30 shows the various utilisation factors in the EU in 2007 for LNG terminals.

Figure 29 LNG trade movements in the EU 2007



Source: BP Statistical Review of World Energy 2008

Figure 30 Utilisation rates for LNG import capacities in 2007

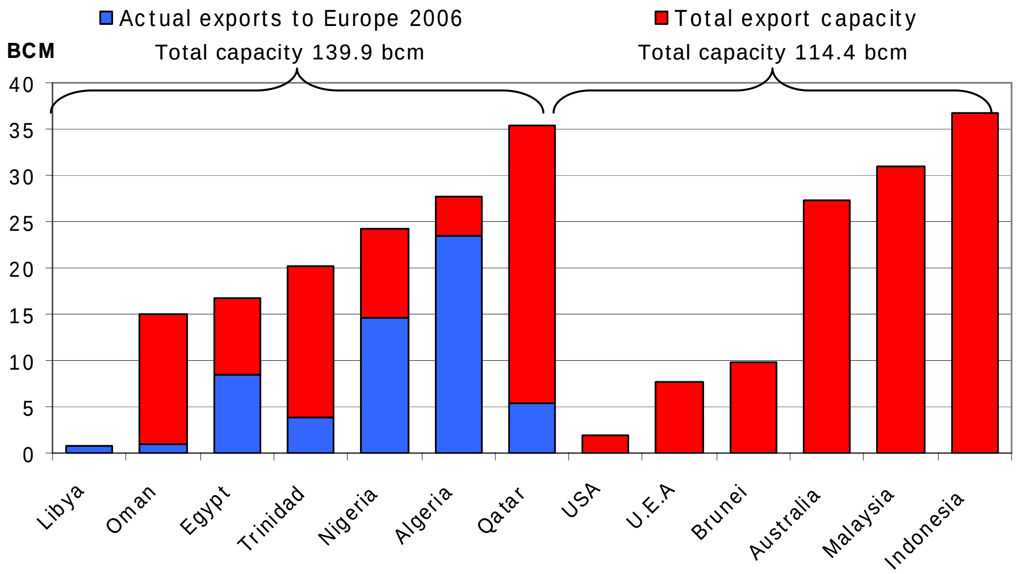


Source: Gas LNG Europe (GLE) and BP Statistical Review of World Energy 2008

With utilisation factors as low as 0.5, the role of LNG as a way to secure gas imports becomes questionable i.e. even if new LNG capacity is being build in the EU, then the question of whether there will be actual LNG supplies available for a massive increase in LNG capacity is imposing itself and is highly relevant.

A total import of around 50 bcm in 2007 is equivalent to what the Nord Stream pipeline would be able to deliver by itself once it would be up and running. Further when looking at the total LNG production capacity in the world, it becomes rather questionable whether a massive investment in LNG import capacity in the EU is able to find adequate LNG supplies, Figure 31 shows that mainly Qatar, Oman and Trinidad have capacities that could be redirected towards Europe, however those countries are currently exporting to the US and the Asian markets. Thus the actual additional share of gas imports that the EU may rely in the future to come from LNG is rather limited.

Figure 31 World LNG exporting capacities



Source: IEA: Natural gas information 2007

6.7.2 Capacity constraints

The EU needs to focus on additional import capacity. In the future this will require additional investments in import pipelines as future gas supplies are bound to come from outside the EU. Not only in a scenario with increasing gas demand will the EU require additional gas import capacity, but even in a scenario that will limit gas demand there will still be an increased demand for gas imports as indigenous production with the EU is rapidly declining. Further it is questionable what role LNG is able to play in the future, considering the relative low capacities available and especially the low rate of actual utilisation of the existing terminals.

6.7.3 Pipelines versus LNG

LNG terminals are becoming increasingly popular amongst gas importing countries. This is due to a lot of factors e.g. diversification of supply and the fact that LNG terminals do not face difficult international or cross-border authorisation in addition to environmental problems that pipelines often struggle with because they often have to cross through other countries.

The problem with LNG is, however, that supplies are more costly and due to the nature of LNG, LNG is also subject to international competition. This means that in principle LNG can go to the highest bidder all over the world. Natural gas from a pipeline from Russia to the EU is however not subject to the same level of competition as supplies ill end up somewhere in Europe since the gas cannot go anywhere else.

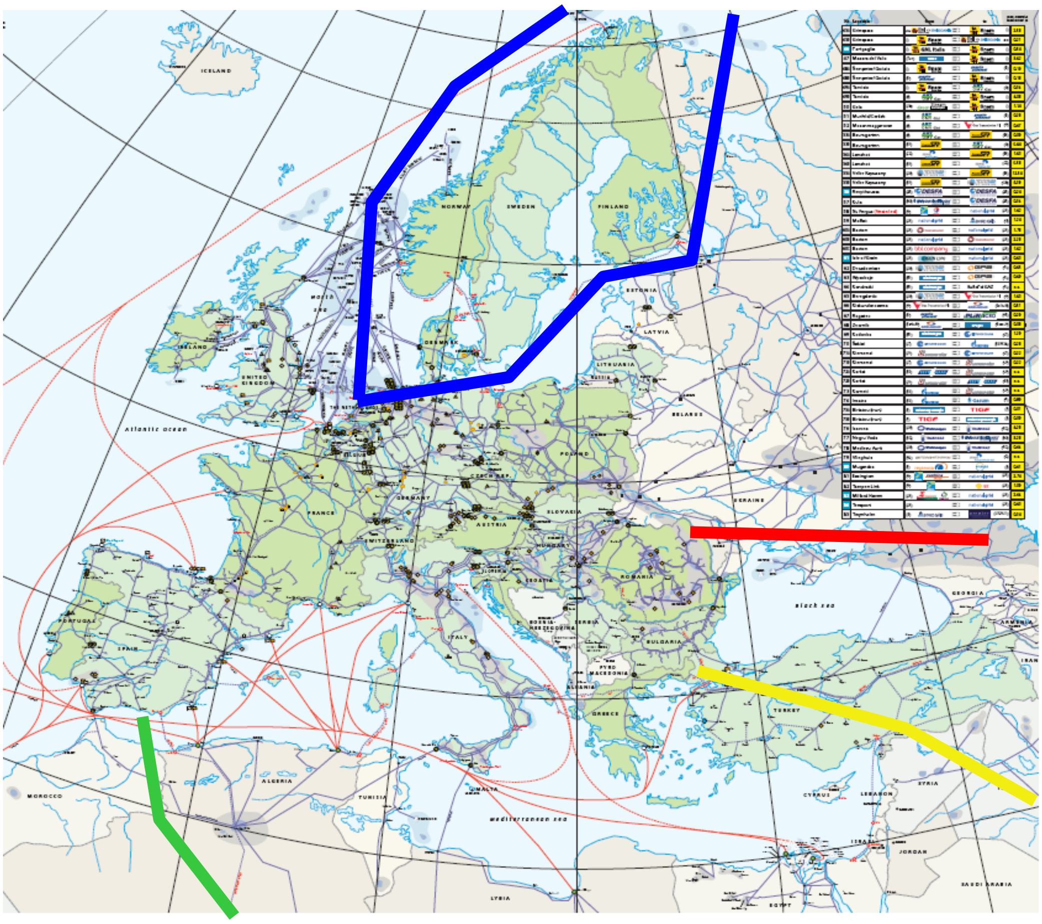
This means that building a pipeline from somewhere like Qatar or Nigeria would offer gas suppliers an additional option i.e. to send their gas via pipeline to Europe. Transportation is once the pipeline is constructed much cheaper compared to LNG and pipelines will thus likely have and edge competitively speaking compared to LNG. Thus if Nigeria or Qatar would have the option to send gas cheaply to Europe this could give Europe a competitive edge compared to LNG destinations, theoretically speaking. This would not change the supply situation in the short run but would perhaps convey Qatar or Nigeria to produce natural gas not intended for LNG. Section 6.8 will look further into possible pipeline options.

6.8 Next priority generation

When evaluating where future imports to the EU could come from considerations regarding distance (costs), gas reserves (supplies) and diversification of supply (Security of Supply) are all most relevant parameters.

The above analysis showed that possible countries/regions with large reserves that are within Pipeline distances are Qatar, Nigeria, Norway, the Russian federation and the central Asian countries Azerbaijan, Turkmenistan, Uzbekistan and Kazakhstan. These potential import routes form 4 main corridors that may be of interest to EU, The four corridors are shown in Figure 32.

Figure 32 New import routes to the EU



Source: Map is taken from Gas Transmission Europe (corridors added)

As can be seen in Figure 32, the suggested main new possible routes are:

Blue Corridor – Barents Sea to Northern Europe

Red Corridor – central Asia to South-eastern Europe

Yellow Corridor – Middle East to South-eastern Europe

Green Corridor - Africa to South-western Europe

6.8.1 Barents Sea to integrated European Network:

Two main suppliers are found in the Barents Sea, Russia and Norway

- Norway Barents Sea to Mid Norway
- Shtokman to Nord Stream

The gas reserves in the Barents Sea are large estimates say that the Barents Sea has around 10.000 bcm of gas reserves of which more than 3.000 are found in the

Russian field Shtokman. The Shtokman field is scheduled to start production in 2013 with an annual supply of 23-24 bcm plus LNG deliveries in 2014. Shtokman is scheduled to supply the Nord Stream pipeline with gas. Apart from the Russians also Norway has some considerable gas reserves in the Barents Sea. The Snohvit project which extracts natural gas from three sub sea gas fields in the Norwegian part of the Barents Sea containing a total of around 300 bcm of gas reserves has just recently come online and is now producing LNG for the US and EU market.[20] However, a pipeline that would connect the Norwegian Barents Sea reserves to the North sea pipeline system would increase security of supplies and reduce the LNG competition factor.

6.8.2 Qatar to South East Europe:

Qatar has the second largest gas reserves in the world, around 25.000 bcm. Only around 5 bcm of Qatar's production of around 25 bcm in 2006 was shipped to the EU (mainly Spain) in form of LNG. This leaves room for a potential increase in supplies to EU from a source that has plenty of reserves and which would increase the diversification of supply to Europe considerably.

The idea of building a pipeline connection from the Middle East to the European gas grid has already been analysed to some extent in the Nabucco project. The Nabucco pipeline, which is still very much in the study phase, has had several different supply concepts, where one of them could be to supply gas from the Qatar.

6.8.3 Central Asia to Europe

Within relative short distance to the EU borders a wide range of potential gas suppliers can be found in Central Asia within the vicinity of Europe and the EU. These countries like Azerbaijan, Georgia, Armenia, Kazakhstan and Turkmenistan offer yet another option for new import routes. Possible routes could be:

- Trans Caspian
    - Azerbaijan
    - Georgia/Armenia
    - Turkey
- Via Russia
    - Kazakhstan
    - Ukraine
    - Black Sea (South Stream)
- Turkey via Iran

[20] Source: http://www.hydrocarbons-technology.com/projects/snohvit/

6.8.4 Trans-Sahara pipeline

The trans Sahara pipeline project has constituted a new possible source of gas imports for the EU for some years now, the 4.300 km long project would connect the more than 5.000 bcm of proven gas reserves[21] in Nigeria with the EU gas market improving diversification of supplies and security of supply in the EU significantly.

6.8.5 Missing links – major schemes or Wildcards

Possible projects that are not mentioned above could be:

- South Stream (Russia-Bulgaria-Serbia-EU)
- White Stream (Turkmenistan-Ukraine-EU)
- France-Italy
- France-UK

6.8.6 Conclusion

The main conclusion on the analysis is that the EU should focus on import routes and specifically that gas imports in the future could come from further away. The EU should broaden the existing focus on gas imports and look towards options that can increase diversification on secure gas supplies in the long term. Therefore the TEN-E guidelines should on the gas side focus on the links between the EU and various third-party gas import possibilities.

6.9 Peak daily capacity assessment

In the following the balance between natural gas capacities and demand for natural gas in the EU is evaluated. We begin by analysing Peak Day demand and supply – normal and extreme years

The GTE winter outlook report for 2007, results shown in Table 20, gave the following picture[22].

Table 20 EU capacity – demand balance

	GWh/d	**Million cubic meters of gas[23]**
Total capacity import and LNG	14634	1318
Total capacity – Indigenous production	9255	834
Total capacity storage	11702	1054
Total	35591	3206
Total Demand market (normal conditions)	27419	2470
Total Demand market (exceptional conditions)	32803	2955

Source: GTE winter outlook report for 2007

[21] Source: BP.com
[22] Source: GTE Winter Outlook 2007
[23] Convergence factor from GWh to mcm used 11.1

The capacity constraint in the peak day situation is mainly a question about delivering capacity from gas storage. It will in most cases be too expensive to solve the capacity constraints by other measures, like increased import capacity, thus for peak day capacity constraints it is relevant to analyse to capacity restraint and solve any capacity constraint by increasing the storage withdrawal capacity.

6.10 Cold winters and yearly balance

The capacity during a cold winter and the yearly balance is determined from the indigenous production capacity, plus import from pipelines and LNG, minus export, plus storage volume available for the market.

The table below show the peak demand for winter and summer and the capacities for indigenous production, storage withdrawals and imports from pipelines and LNG.

Table 21 Winter peak capacity analysis bcm/day

	Winter		**Summer**	
	2007 Max. capacity	**2007 Limited capacity**	**2007 Max. capacity**	**2007 Limited capacity**
Pipeline	1.09	1.09	1.09	1.09
LNG	0.28	0.28	0.28	0.28
Indigenous production	0.83	0.83	0.83	0.83
Storage	1.40	1.05	1.40	1.05
Total supply	3.60	3.25	-	-
Total supply – not including storage			2.22	2.22
Consumption average peak[24]	2.36	2.36	1.37	1.37
Consumption peak daily (normal)[25]	2.47	2.47	-	-
Consumption peak daily (exceptional)[26]	2.96	2.96	-	-

By analysing the above table it can be seen that total supply capacity is well above the peak demand in the winter time. Supply capacity minus peak demand is ranging from 0.29 BCM in 2007 limited capacity compared to exceptional peak daily consumption and the difference is as much as 0.64 BCM when comparing compared against maximum storage capacity. Further in a normal cold month the total system has between 0.81 and 1.26 bcm of spare supply capacity available per day. This is more than adequate in the event of a supply interruption, based on the total pipeline import, which is only 1.09 bcm per day.

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[24] Average peak demand is calculated by looking at the maximum demand on a monthly basis in the period 2005-2007 and dividing the figure by 30 days. This is done for winter months and summer months.

[25] Source: GTE Winter outlook

[26] Source: GTE Winter outlook

During summer daily supply is more than adequate to cover the peak demand in fact indigenous production and full LNG utilisation would be able to cover for all demand in a peak situation.

6.10.1 Summer situation – absorption of gas from import

In some cases there are capacity constraints in the pipeline system during the summer period as there is less demand along the import pipelines during the summer time. In some cases this has been compensated with establishment of large gas storage facilities close to the import points.

Also, the capacity of pipeline systems is less during the summer situation due to the higher temperatures, which means less power for the compressor stations and larger volume of gas at higher temperature.

The lack of capacity during the summer, results is less use of the production facilities and the external pipeline or LNG systems.

Some of the systems with import restrictions are:

- Transmediterranean pipeline system from Algeria via Tunisia.
- Green Stream.
- Maghreb-Europe.
- Norwegian and Danish systems.

Some of the proposed new gas systems which could be justified to solve the summer capacity are:

- Looping of pipelines in Italy, Spain and Denmark. This could also be establishment of new compressor stations.
- New gas storage close to import facilities or along the external part of such systems. This could be storage facilities in Northern Germany, Poland and the UK.
- Increase of injection capacity of gas storage.

6.10.2 Integration, interconnectors and internal connections

In order to establish an EU gas market, it is necessary to be able to balance supply and demand, taking into account normal differences due to temperature and economic development. Further, for security of supply and establishing competition, is based on the possibility for connecting suppliers and consumers.

Four continental member states: Finland, Estonia, Latvia and Lithuania are not connected to the integrated EU network. Even if the day-to-day capacity is plentiful to these member states, there is no possibility for diversification. In order to connect these member states it will be necessary to establish the following two projects:

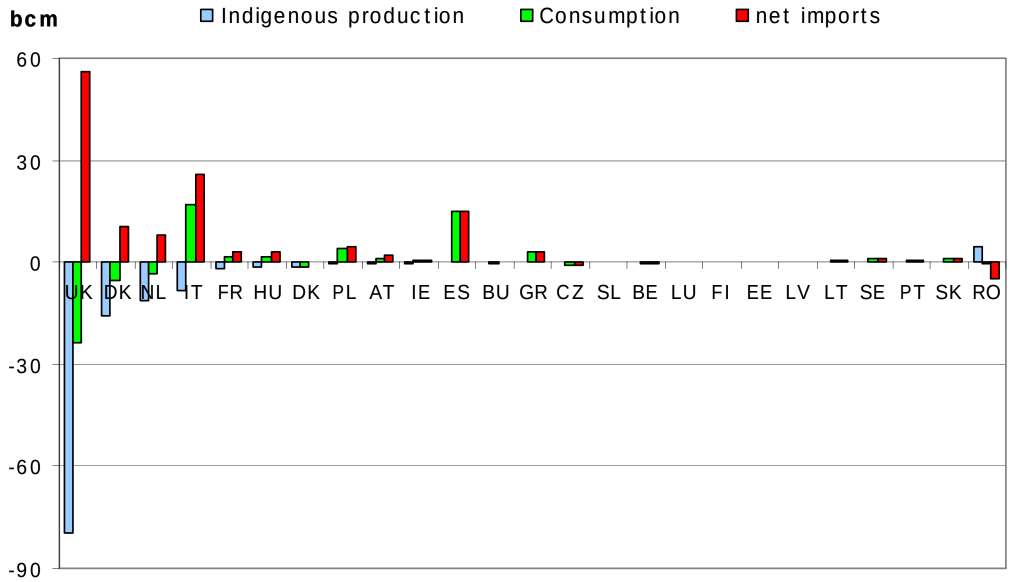
- Lithuania-Poland (Small Amber)
- Finland-Estonia (Balticconnector)

6.10.3 Depletion of gas fields in the UK, Germany and Denmark creates a need for new interconnectors

The most notable change in the EU gas market at present time, is the depletion of gas fields in the UK. This will result in a need for increase of import capacity of up to 60 bcm per year. Even more notably the maximum daily delivery capacity will have to be increased, as the gas fields have so far been used as swing producers.

From the chart below it can be seen that also Germany, Italy, Poland, Spain and Denmark will need more import capacity and interconnections.

Figure 33 Changes in production, consumption and net imports 2005-2020 baseline scenario



Source: European Energy and transport trends to 2030, 2007 update

6.10.4 Simplification of market operation

The entry-exit system has been chosen for almost all member state for access to gas transportation. This may, in some cases, lead to complicated transactions due to internal bottlenecks in the system, and hereby a need to break up the system in a large number of zones or exit points with different tariffs. In order to ease the functioning of the gas market, some additional investment will be necessary to simplify the system.

One example is the investment in the French gas transmission system with the purpose of reducing the number of zones from five to three. Further to physical investment there has been and will be a need for investment in new IT systems in order to ease market functioning.

6.11 Energy efficiency of gas transmission system

A large part of the EU gas system was established at a time with low gas prices and less concern about availability of gas and climate change. This resulted in a system with compressors located at distances down to 150 km on major import pipelines. As the efficiency of the gas turbines which powers the compressors, are typically around 30 percent, it is assessed that up to 5 percent of the gas is used between the gas field and the consumer for moving the gas in the transmission system. Use of LNG will further increase this percentage.

New projects could be justified by energy improvement. This could in turn create extra robustness of the system as compressor could be kept on stand-by mode in case of disruption of the system. Some of the systems which could be justified for energy savings reasons are:

- New major import pipelines, like Nord Stream, looping of existing systems.
- Pipelines instead of LNG supply.
- Reverse flow of pipelines to avoid gas flowing in opposite direction.

It is estimated that at least two major new import pipelines could be justified to reduce the energy consumption along the transmission systems.

7. Synopsis of projects

In the following a synopsis of projects planned by TSO´s is presented and other relevant players in the gas market. Some projects abandoned by the original promoter are included, as they are still found to be justified, possibly by adapting the business plan for other conditions. Finally, Ramboll has added some ideas for new projects for consideration.

Table 22 Natural gas projects except storage

Supply pipelines outside EU	Supply pipelines connecting to EU	Interconnectors and internal strengthening	Storage projects [27]	LNG projects
Yamal-Vyborg	Nord Stream	Small Amber		Tenerife (Spain)
Norland-North Sea	Galsi	Balticconnector		Las Palmas (Spain)
Trans Sahara	Gas Network Expansion	BalticPipe		Madeira (Portugal)
Trans Caspian	Nabucco	Baltic Gas Interconnector		Cyprus
Barents Sea-Norwegian Sea	SkanLed	UK-Denmark interconnector		Crete (Greece)
Barents Sea-Scandinavia	Mid Nordic Gas Pipeline	IGI		Verdon-sur-Mer(France)
				Cartegena (Spain)
	Amber	TAP		
	Norway-Denmark	France-Spain		Monfalcona (Italy)
		France-Italy		Muggia (Italy)
		Germany-Poland reverse flow		South Adriatic Coast (Italy)
		Czech Republic-Belgium		Taranto (Italy)
				Gioia Tauro (Italy)
		Italy - North-South		
		Italy - North East		Sicily (Italy)
		Italy - Po Valley		Livorno (Italy)
		Poland - North West development		Rosignano (Italy)
		Hungary-Romania		
		The Netherlands Round about		Swinousije (Poland)
		Belgium East-West		Tallin (Estonia)
		Poland-Slovakia-Hungary		
		UK-Spain		

[27] See annexes

7.1 Project synopsis – short description of selected projects

The following section gives a brief introduction and description of natural gas projects within the EU.

Murmansk-Vyborg and Yamal-Vyborg

Gas supply from the giant gas fields in Yamal and Sthockmann in the Barents Sea are vital for gas supply to the EU. As part of the Nord Stream project onshore pipeline in Russia from Gryazovetz to Vyborg. Further, pipeline is planned for the first stage of Sthockmann development with a pipeline from Murmansk to Vyborg. In order to bring the new fields into full capacity, there will be a need for more pipelines.

Haltenbanken / Norland-North Sea

Most new gas fields in Norway are located in the Haltenbanken area or even further to the north in the Norland area. Gassco, the state owned Norwegian system operator, is analysing different options in connections with new gas finds like the Frøy field.

Barents Sea-Norwegian Sea / Scandinavia

From the Barents Sea to the EU there are different options for connection to the EU system. The first pipeline solution will be the Sthockmann pipeline and the Snøhvit LNG terminal. If high prices continue on gas there may be an option to establish direct new pipelines which could be via Russia, offshore Norway or via Scandinavia.

Trans Sahara

Trans Sahara pipeline could bring gas from Nigeria via Niger to Algeria, and then via the existing or new network to EU. The advantage would be to bring a new player into the EU supply market and to compete with LNG transportation to USA and Asia.

Trans Caspian
Trans Caspian gas pipeline could bring gas from the Central Asia to Azerbaijan, and further via Georgia to Turkey, or the White Stream to EU.

Qatar / Middle East – EU
Several options exist for possible pipeline projects from the Middle East to Europe. As the most reserves are available in Qatar, with a small population, this is used as the basis for a possible network. Such network could be via Iraq, Saudi Arabia, Egypt and other countries. There is a need to develop new schemes for such project.

Nord Stream
The Nord Stream project from Russia to Germany is under implementation. First pipeline is expected on line in 2011 and the second in 2013. Capacity of the system will be 50 bcm/year.

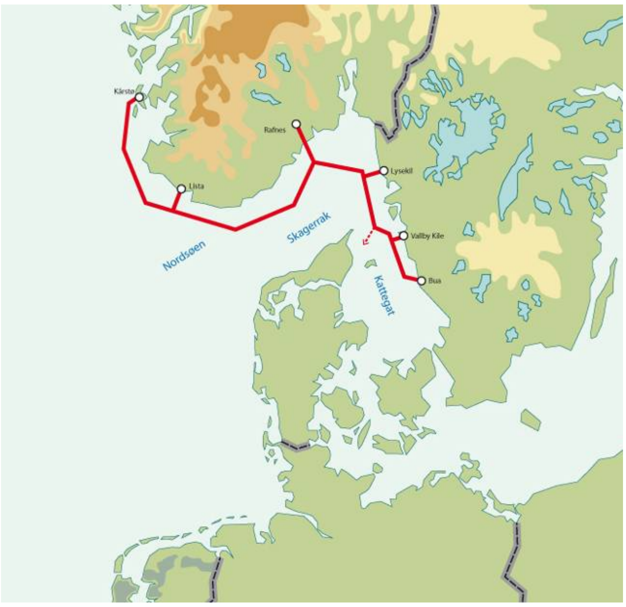
Galsi
The Galsi project from Algeria via Sardinia to the Italian mainland is in the planning phase and is waiting for investment decision. A possible branch could be to the French Island Corse, and hereby creating the first direct pipeline connection between Italy and France.

Gas Network Expansion, Norway
The GNE project had as objective to increase gas production from the Troll field, and included a new major pipeline to the European Continent or to the UK. However, the Norwegian state decided not to go forward with the project at present, in order to maximise oil production instead. The project could relatively fast be revitalised.

Nabucco
The Nabucco project from Georgia, Iran and Syria via Turkey to the EU member states of Bulgaria, Romania, Hungary and further via a new pipeline to Germany, is the most advanced project in South-East Europe. The main concern about the project is the access to gas supply.

SkanLed

The SkanLed pipeline will connect Norway with Sweden and Denmark, and may be used for supply of gas to Poland via these countries. The system may be in operation in 2012 with a relatively small capacity.



Mid Nordic Gas Pipeline

The Mid Nordic Gas Pipeline was a project with the intention to bring gas from mid Norway via Sweden to the western part of Finland, with possible future connection to Estonia via the Balticconnector.

Amber and Small Amber

The Amber project was originally developed as a small interconnection between Lithuania and Poland known as the Small Amber. Later, a larger scheme involving import of gas from Russia via Latvia has been developed. No firm description of the project exists and there is no sponsor behind the project at present, and the project is mostly a political initiative. There is a need to appoint a company to be responsible for developing and maturing the project.

Norway-Denmark/The Netherlands
A direct connection between Norway and Denmark offshore has been analysed for the last 30 years, but has so far not materialized because new Danish gas finds have made in unnecessary. As the Danish and The Netherlands system has been connected, a pipeline from the Norwegian fields to Denmark could also supply gas to this member state. In line with depletion of the Danish gas fields, such connection could be established and the fields may be used as intermediate storage of gas.

Balticconnector
Balticconnector is a pipeline between Finland and Estonia, with the purpose of connecting Finland to the gas storage in Latvia. In line with establishing of other pipelines, like the Amber pipeline, the project can be used for import of gas to Finland. The promoter behind, is the Finnish system operator Gasum. The planning work is in progress, and survey and basic design has been carried out. The pipeline could become operational from 2013.

Baltic Pipe
Baltic Pipe is a pipeline between Denmark and Poland. Such connection has been launched several times, but has so far not been build. In 2007 the polish gas company PGNIG took initiative to re-launch the project to use it for import of its gas from the Skarv field in Norway via SkanLed further to the Baltic Pipe. The planning work is ongoing.

Baltic Gas Interconnector
Baltic Gas Interconnector is a pipeline between Germany and Sweden/Denmark. The purpose has been to bring new gas supply to Sweden, which so far is only supplied via a single pipeline from Denmark and therefore has the poorest security of gas supply in the EU. The project was sponsored by a number of gas supply companies headed by E.On Sweden. The project is dormant after receiving most approvals from authorities.

UK-Denmark interconnector
UK-Denmark interconnector is one of the projects analysed in order to create more competition in the North Sea area. However, the project was overtaken by the pipeline from Denmark to The Netherlands. An UK-Denmark interconnection could still be valuable to create competition in line with depletion of gas fields in the two countries.

IGI
The Italy Greece Interconnector will connect the two EU member states directly and hereby create a east-west connection. This will for the first time open for import of Caspian gas to Italy. The connection between Turkey and Greece was completed recently, as a precondition for the project. Promoter for the project is Edison and DEPA, who has formed the company IGI-Poseidon.

TAP
The TAP project is an interconnector between Albania and Italy with gas delivered from Greece. The offshore part of the pipeline is shorter than for the IGI. The main difference between IGI and TAP is that TAP will cross a non EU country, Albania. On the other side there is a large untapped gas market in Albania. The operators behind TAP are EGl of Switzerland and StatoilHydro from Norway, who will supply gas from their interest in Shah Deniz field in Azerbaijan.

France-Spain
France and Spain have been connected via a small gas pipeline in the Western part of the border for many years as part of the Troll deal back from the 1980´ies. Further, an even smaller connection has been made for local use. There is only some capacity from North to South of 6 MCM/day, which is insignificant compared to the overall balance in the two countries. In order to merge the gas markets on the Iberian Peninsula and Southern France, there is a need for a much larger connection. Such connections have been planned previously as part of the Magreb-Europe pipeline in the 1990´ies, but France withdrew from this project. The obvious solution would be to connect the pipelines around Barcelona and Artere du Midi in France. A 36” pipeline is included in Enagas strategic plan.

France-Italy
France and Italy is not directly connected with pipelines. Therefore there is only indirect connection via Switzerland or via Austria and Germany. There are some natural constraints in establishing the connection due to the terrain. However, it seems that there could be considerable market and security of supply advantages of establishing a connection. No plans have been identified.

Germany-Poland reverse flow in Europol pipeline
The gas export from Poland to Germany via the Europol pipeline is up to 30 bcm/year, or more than twice the gas consumption in Poland. The security of supply concern in Poland is hence caused by the lack of possibility of reverse flow in this pipeline, which could bring gas from the North Sea to Poland in case of disruption of gas supply from Russia or Ukraine. Such reverse flow could be contractually or physical. Technically there will probably be a very small investment needed to solve this important bottleneck in the European gas system, which is still dividing the old and new member states. After the 2004 supply disruption of gas via Belarus, there were some initiatives, headed by the EU, to establish reverse flow, but so far the problem has not been solved. Instead, costly new pipelines bringing gas from respectively Germany and Denmark to Poland are being planned.

Czech Republic-Belgium
A new gas pipeline connecting the Czech and Belgium border is planned by RWE in Germany. The pipeline would in general increase the possibility to move Russian gas further to the West.

Italy – North-South
New North-South connections in Italy is planned in order to increase the import capacity from Algeria, and from other sources, connected to the southern part of

Italy. The capacity of the present import is a.o. limited during the summer time, when there is limited off take along the pipeline, because there is no suitable geological formation for underground gas storage.

Italy – North East
Strengthening of the Italian system in the North Eastern part of the country is planned. This will increase the capacity for import via Austria from Russia.

Italy – Po Valley
A new pipeline along the Po Valley is planned to increase capacity and possibly also to replacing some pipelines which are among the oldest in Europe. The pipeline may contribute to create more competition between gas from different sources.

Poland – North West development
Poland is one of the least developed gas countries in the EU. This is because of the reliance on coal in the power and heat sector. The Polish TSO Gaz-System is amongst others planning new pipeline to the North-Western part of the country. Such a pipeline could be used for connection to the Baltic Pipe for export and import.

Hungary-Romania
A new decision to establish the connection between Szeged (HU) – Arad (RO) was made in July 2008. The TSOs of Hungary and Romania, FGSZ Ltd. and Transgaz are behind the project.

The Netherlands Roundabout
A number of fortifications in the gas system in The Netherland can be used for strengthening the transit possibility via The Netherland, the so-called "gas roundabout". The TSO Gas Transport Services is planning the system increase, which to a large degree is due to the need for transit to the UK via the BBL pipeline.

Belgium East-West
In Belgium a new pipeline from East to West will be established to increase the transit capacity to the Belgium-UK interconnector. This project is also linked to depletion of gas fields in the UK. The TSO Fluxys is behind the project.

Poland-Slovakia-Hungary
The rationale for this pipeline is to create an integrated market. The pipeline is only needed because some of the main transmission pipelines through the three member states are not open for reverse flow. This implies that there is uncertainty about the economic justification of the project, because if those pipelines were to be opened up for reverse flow, then the business case for the Poland-Slovakia-Hungary interconnector might decrease significantly.

Baltic Interconnection Plan
The Baltic Interconnection Plan is a combination of the projects Small Amber and the Balticconnector plus a LNG terminal in the Baltic region. The Baltic Interconnection Plan combines increased security of supply via the LNG terminal which allows the Baltic countries to diversify the supplies as well as lower their dependency on a

singly supplier, with the integration into the EU gas market by connecting Poland and Lithuania and Finland to Estonia.

UK-Spain

This is a wild card, which has not been suggested by any TSO. However, such bypass pipeline could create connection between different markets with different import sources and different climatic conditions and hereby also difference in peak demand.

8. Norway – the key to EU gas supply in the short run

Norway is becoming one of the main suppliers of gas to the EU. In 2007 the production increased to 90 bcm, which makes Norway the fourth largest gas producer globally after Russia, USA, Canada and Iran. As there is only very small consumption in Norway, it becomes the world's third largest gas exporter with around 85 bcm in 2007 after Russia and Canada. Norway has overtaken Algeria with respect to gas production. Almost all gas export from Norway goes to the EU. Only a small part of the LNG produces at the recently commissioned Snöhvit plant, is exported to the USA.

8.1 Reserves and resources in Norway

There are good possibilities for increase of the gas production in Norway. The official forecast from Fact Sheet 2008 is shown in the table below with an indication of increase of gas export to a level between 125 and 140 bcm.

The gas reserves and resources in Norway can be divided into reserves and resources as shown in the table below.

Table 23 Gas reserves and resources in Norway

Project category	Total	North Sea	Norwegian Sea	Barents Sea
Produced	1232	1135	97	0
Remaining reserves	2313	1479	673	160
Contingent resources in field	166	98	60	9
Contingent resources in discoveries	405	139	242	23
Potential from improved recovery	77	0	0	0
Undiscovered	1875	500	825	550
Total	6068	3351	1897	742
Not yet produced	4836	2216	1800	742

With the present production of 90 bcm there are hence resources for more than 50 years. Even with the forecasted increase of up to 140 bcm there are resources for more than 35 years in Norway.

This indicates that there is a possibility for increase of production to a higher level than predicted by the Norwegian authorities. In 2007 the authorities rejected a plan for development of increased production from the Troll field, the so-called Gas Network Extension project. This was due to the prioritisation of oil production.

In this aspect the Norwegian oil and gas policy may in some cases be in conflict with the interest of EU. In the fact sheet the policy is condensed as follows: "The approval of the authorities is required in all stages of the petroleum activities, in connection with exploration drilling, plans for development and operation and decommissioning plans for fields. In this system, the oil companies create the necessary technical solutions to recover the resources, while the Norwegian authorities ensure that these solutions concur with the goal of maximising the values for the Norwegian society as a whole."

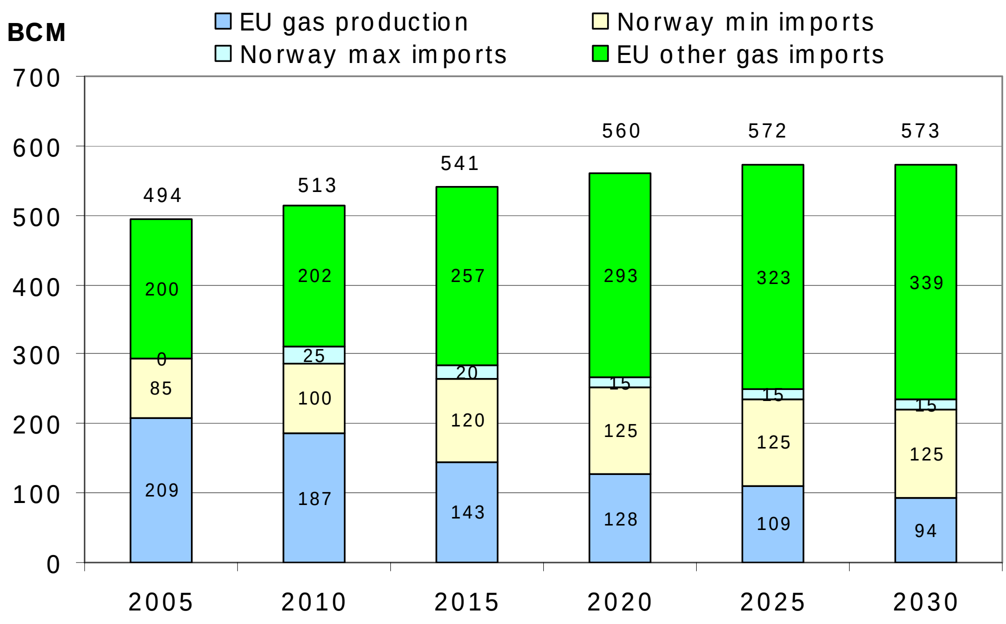
The need for securing gas supply from other countries than Norway will hence very much depend on the chosen policy with respect to how fast the gas resources shall be produced. One positive example is the Ormen Lange field which came in production only a decade after discovery. This decision may coincide with the economic situation in the late 1990´ies with low oil prices and need for generation of income to the Norwegian state. At present, with very high oil and gas prices there may be some more reluctance for developing gas fields. Firstly with lack of engineering and manufacturing capacity it is likely that oil fields which are less labour intensive will be given first priority. Secondly, there may be some degree of saturation and no need for extra income to the Norwegian state. In such a situation the Norwegian oil and gas companies may prioritize participation in outside Norway as seen with StatoilHydro´s engagement in Russia (Sthockmann), Azerbaijan (Shah Deniz) and Iran (South Pars). It may also be in the interest of the Norwegian State, to seek close cooperation with other gas producing countries, most notably Russia, Algeria, Iran, Azerbijan and Qatar.

The decision about developing the gas production infrastructure in Norway will have huge impact on the need for other gas transmission systems. During the last year the Langeled pipeline with a daily capacity of 70 MCM/day and the Tampen link with a capacity of 25 MCM/day has been taken into operation, both to the UK system. These two connections alone will be able to deliver a third of the yearly UK gas consumption.

8.1.1 EU and Norway

Figure 34 Gas consumption and production including Norway shows the Gas consumption and production in the EU when Norway is included.

Figure 34 Gas consumption and production including Norway



At present the only planned gas links from Norway to the EU is the SkanLed project.

9. Selection of projects of European interest

The aim of this section is to construct a set of selection criteria that will enable the commission to identify future projects of European interest. The selection mechanism should ensure that only projects that will have significant impact on the gas flows and natural gas trading, the project should be realistic, have a positive robust European added value and all parties involved should be in agreement.

From the term of reference:

> For the sake of ensuring the effectiveness of such declaration, the Commission considers that future identification of projects of European Interest should be subject to strict conditions. It should only be granted to projects with significant impact on power flows and on trading in the region concerned; where the planning and authorisation phase appears to be clear and realistic; where there is a positive and robust European added value; and where all parties involved are in agreement.

Before analysing what the selection criteria should entail in order to ensure that the proper projects are selected in the future, an evaluation of the latest revision of the TEN-E guidelines is performed.

9.1 Status of existing selection criteria

The latest revision of the TEN-E guidelines, Decision No 1364/2006/EC article 7, sets out the existing criteria to be used in order to select priority projects, as follows:

The criteria used for selection of links are that projects must be in line with sustainable development and meet the following criteria:[28]

a) They shall have a significant impact on increasing competition in the internal market and/or
b) They shall strengthen security of energy supply in the EU and/or
c) They shall result in an increase in the use of renewable energies.

In order to attain status of a priority project, the project must fulfil one or more of the above criteria. These criteria definitions are rather general and therefore in line with practically any cross-border natural gas project.

Based on the above selection criteria, the EU has identified 10 gas infrastructural projects that are considered being priority projects. The status of these natural gas priority projects is shown below.

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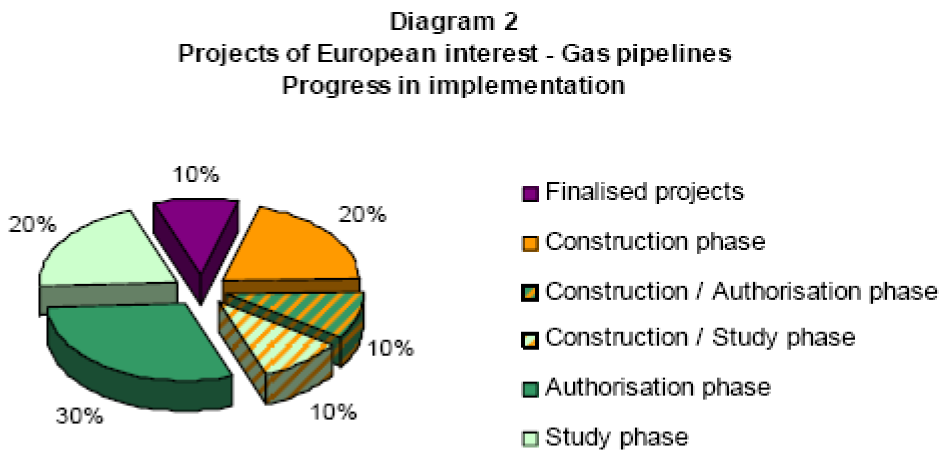
[28] Emphasis is put on cross-border projects

Figure 35 Projects of European interest – gas pipelines – progress in implementation



Source: European Commission – DG Energy and Transport

Although only 10% i.e. one project has been finalised, around half of the projects are under construction. The corridors that were identified in the latest revision of the priority corridor plan, here named as corridors 1-4 were:

Gas connections between Great Britain – northern continental Europe-Russia (corridor 1)

- The North European Gas Pipeline (NEGP) (Nord Stream).
- The Yamal II project.
- The Baltic gas Interconnector (BGI).
- The increasing transmission capacity on the Germany-Belgium-Great Britain axis.

Northwest Africa-South-West Europe (Corridor 2)

- The pipeline between Algeria-Spain-France and continental Europe.
- The GALSI pipeline linking Algeria to Italy via Sardinia, and with a branch to France via Corsica.
- The TRANSMED II pipeline between Algeria-Tunisia and Italy via Sicily.

South East Europe – (Caspian Sea countries/Middle East) (Corridor 3)

- The Turkey-Greece Interconnector (TGI).
- The gas Interconnector Greece-Italy (IGI).

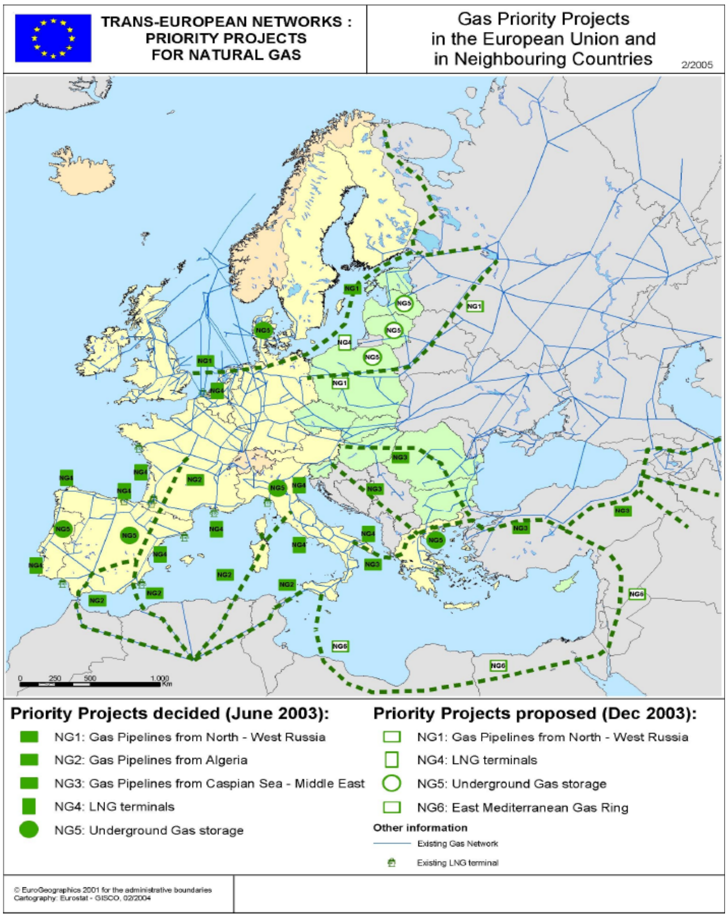
- The Nabucco gas pipeline between the Caspian and Middle East gas fields-Turkey-Bulgaria-Romania-Hungary and Austria.

South-East Mediterranean Member States and (Northeast Africa / Middle East) (Corridor 4)

- The Greenstream pipeline between Libya and Italy via Sicily.

Figure 36 shows the latest TEN–E guidelines Priority corridors for natural gas:

Figure 36 TEN-E priority projects for natural gas



Source: European Commission – DG Energy and Transport

9.1.1 Realised gas transmission projects in recent years

The rather extensive list of natural gas projects that have been realized in Europe in recent years further give evidence to the fact that realisation of natural gas projects may not be quite as difficult and complex as may be the case with electricity projects.

In recent years the following projects have been constructed in Europe:

- Langeled – from Ormen Lange to UK.
- BBL pipeline – from The Netherlands to UK.
- UK-Belgium interconnector – new compressors.
- Yamal-Europe – new compressors in Poland.
- Turkey-Greece.
- Libya-Italy – Green Stream.
- South Caucasus Pipeline.
- Iran-Turkey.

The following projects are under construction:

- Medgaz from Algeria to Spain.
- Nord Stream from Russia to Germany.
- Belgium-UK interconnector – further capacity increase.

It is evident from the above, that the activity level regarding investments in natural gas transmission projects has been relatively high. Further, the success rate of the prioritized projects has also been rather high. This indicates that at least in terms of natural gas projects the priority corridors and TEN-E guidelines have been rather successful.

The successful investments above and the conclusions on capacity made in section 6, indicate that when evaluating the next wave of priority corridors perhaps a new and different set of criteria could be relevant. It is however important to analyse the developments facing the EU in terms of Energy specifically security of supply, climate change and renewables, and market developments.

9.2 Updating the criteria

The reasoning of having prioritised projects is to ensure, that projects that are highly beneficial as well as required in terms of a well-functioning gas market are implemented.

However, with the development of the European gas markets, the definition of what is a beneficial or a required project, may change along with the developments in the energy sector, which again are influenced by a number of economical and political factors.

The following section gives an overview of the latest developments and priorities within EU energy policy and strategy, which may affect the natural gas market and thus possibly also the projects that are beneficial and relevant for being granted status of being a prioritized project. The main issues that are analyzed are security of supply, climate change and renewables, market development and a section that describes some of the more practical and economical issues regarding selection criteria.

9.3 The security of supply situation

The issue of Security of supply was discussed extensively in section 6. In terms of selection criteria, it is important that the TEN-E Guidelines have focus on projects that are able to improve the security of supply situation in the EU. Import pipelines are often relatively large projects involving a lot of member states, as well as a wide list of different stakeholders thus considering the overall importance of improving the security of supply situation with the difficulties that large pipeline projects often face. It is most logical that the selection criteria aim at granting priority to these projects.

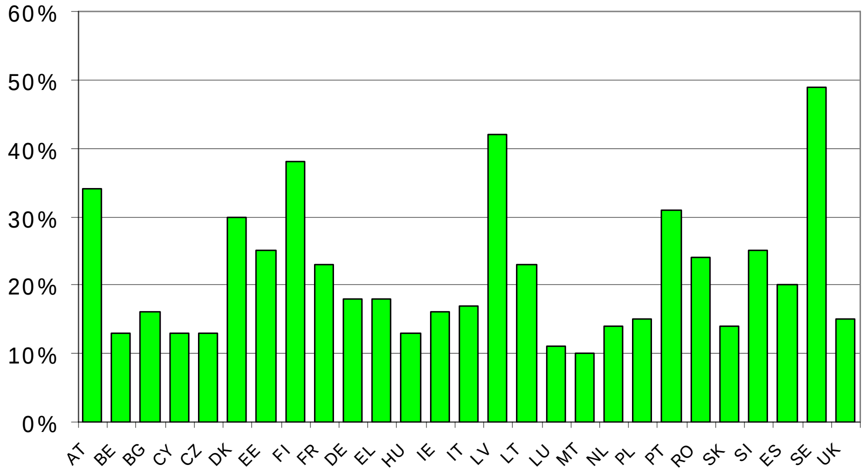
9.4 Climate change end the climate package

The last couple of years have brought on some major new developments in the EU energy market and policy. The focus on climate change has increased significantly worldwide and in the EU. There is internationally a growing consensus that the emission of greenhouse gasses is causing for temperatures to rise – therefore the EU has put forward a proposal for a policy on the reduction of greenhouse gases and an increase in renewable energy in order to prevent temperatures to rise. The proposal is also known as the climate package and has set a goal of attaining a 20% reduction in greenhouse gasses and a 20% share of renewable energy in the EU by 2020.

9.4.1 Increasing amounts of renewable energy

The Energy climate package introducers a set of targets for the share of renewable energy in each member state, these targets differ from country to country based on the different potentials existing in each country.[29] Figure 37 shows the individual targets presented by the Commission 23 January, 2008.

Figure 37 Share of renewables in final energy demand by 2020



[29] Both economically and practically

In order to achieve these targets it is crucial that the transmission systems in the various member states are capable of handling large amounts of renewable energy where especially large amounts of wind penetration will put pressure on the existing transmission nets in EU.

It is imperative that a lack of sufficient transmission capacity does not stifle the target of reaching the EU goal of 20% reduction in greenhouse gasses and 20% share of renewable energy, thus the revised set of selection criteria must take into account these new requirements caused by the renewable targets set out by the EU.

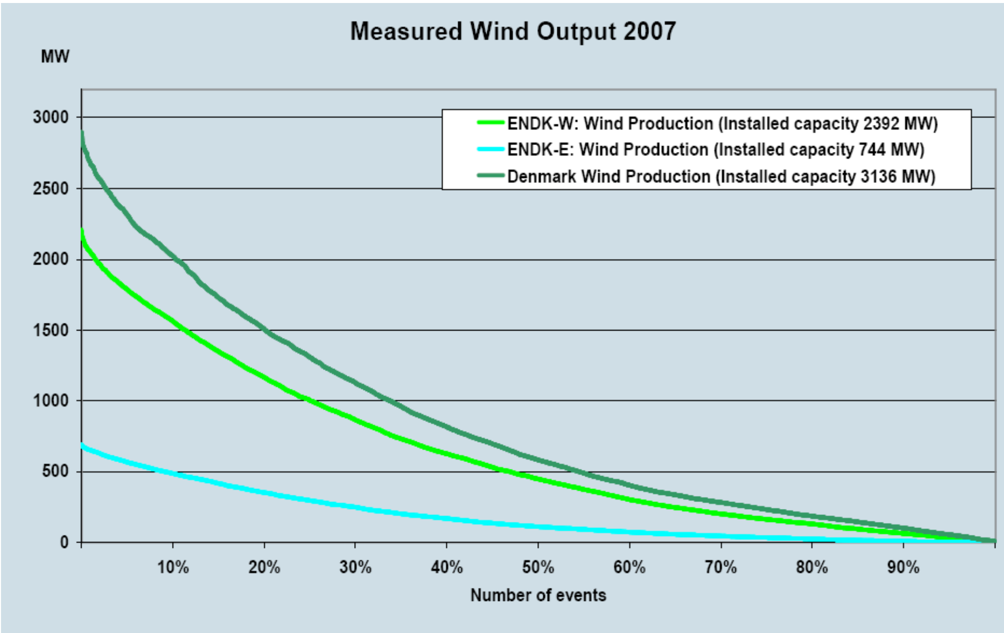
The status of being a priority project, should thus be granted to those projects that play an instrumental role in the creation of the new EU energy market and which is in line with requirements caused by the climate package 2020 in 20.

9.4.2 The impact of using renewable energy

Transmission capacity requirements in the future, on the gas side, are in general more affected by the challenges posed by security of supply i.e. the increasing levels of demand and decreasing levels of indigenous production, than by the requirements raised by the energy package and targets for renewable energy.

However, one aspect of an increased level of renewable energy that may have impact on the infrastructural requirements in natural gas i.e. the need for natural gas storage. Because of the intermittency of e.g. wind- and solar power, an increased amount of renewable energy will increase the need for alternative generation capacity for when production from wind and solar power is low. Figure 38 shows the level of wind generation in the Danish system:

Figure 38 Measured wind output 2007 in Denmark



Source: Energinet.dk

It can be seen that with a total installed wind capacity of 3136 MW[30] the output was below 700 MW for 50% of the time, thus actual production varies from practically non-existent to almost 3000 MW of capacity. This not only puts pressure on the electricity transmission and the system operator, it also requires generation capacity that can make up for the "missing" generation, when the wind is not blowing. Gas-fired generation could be applied in those situations, natural gas generation is very well suited for this due to its flexible production ability, i.e. you can turn gas-fired generation on and off, Further, gas-fired generation capacity has relatively low capital costs but high operational costs, which makes gas-fired generation optimal in situation where generation is not predictable and stable.

Turning gas-fired generation on and off to the whims of the wind, will increase the demand put on the gas infrastructure system, especially the demand for storage will increase if gas-fired electricity generation is to be used to counter the intermittency of high levels of e.g. wind. Thus in regions with high levels of wind power and gas-fired generation, it is important that the gas infrastructure system is flexible enough to cope with varying gas demand. This will require large investments in natural gas flexibility measures such as natural gas storage.

Alternatively the missing production can be imported from countries and regions with large thermal generation capacity, excess renewable production or large reserves of hydro capacity.

However, as stated in chapter 6, gas storage investments are already taking place in relative large scale within the EU. However, developments regarding natural gas storage should be monitored in case the investment climate changes or if planned investments are not completed.

Flexibility in terms of power production can also be achieved through imports of electricity, the next section looks further into this.

9.4.3 Gas-fired generation and electricity transmission

When renewable electricity production is low, due to calm wind conditions or cloudy weather, power can either be purchased from neighbouring countries or regions that have excess production of power or large reserves of hydro that can be accessed at will. Alternative electricity can be generated domestically by e.g. natural gas-fired power plants that are able to switch on and off in accordance with changing weather conditions as noted in chapter 9.4.2. Natural gas-fired electricity generation can thus be utilized as a substitute for electricity transmission capacity i.e. specifically as a substitute for insufficient import capacity due to either missing connections or bottlenecks in the system.

This could potentially delay investments in electricity transmission i.e. if there are large amounts of available gas-fired electricity generation available then the

[30] Total generation capacity including wind is around 13.000 MW in Denmark, Source Eurelectric

incentive for investing in transmission capacity could be lower. Thus, in regions with large amounts of available gas-fired electricity generation and increasing amounts of renewable generation capacity, in the form of intermittent energy sources like wind or solar power, there needs to be a strong focus on regional cross-border transmission projects in order not to risk supporting projects that may not be optimal when analysed using a wider outlook.

In effect this could imply that priority should be given to cross-border electricity transmission rather than natural gas transmission or storage projects that are supposed to support the gas-fired electricity sector of a country or region. Section 9.4.4 provides an example of this.

9.4.4 UK-Norway or UK-Netherlands

The UK has a high level of gas-fired power generation and the penetration of renewables in the form of wind power is also increasing rapidly. In the UK around 1/3 of all generation capacity is gas-fired combined cycle generation capacity. Thus the UK has two options, in line with the above made argument, in order to supply adequate electricity when domestic renewable generation is low. This can be achieved by either using their gas-fired generation or by importing electricity from e.g. Norway which has large quantities of hydro power. Imports from Norway are, however, not possible because no such link exists at the moment between these two markets and securing the supply balancing of supply and demand using gas-fired generation would require investments in Gas storages.

Which project should be granted status of priority?

The interconnector to Norway raises utility in both Norway and the UK because Norway is able to import cheap wind generated electricity when there is excess production in the UK. The gas storage only improves utility in the UK[31]. Which project is the optimal is not necessarily obvious, but building the “wrong” project may render the other project economically non-viable, simply because there may not be “room” for both to operate profitably. Thus it is important that the selection criteria applied, evaluates the projects within the appropriate socio-economic scope i.e. not only does the proper socio-economic scope include what countries should be included in the analysis, but projects should also be evaluated against all possible alternatives i.e. gas projects should when appropriate be evaluated against all other relevant projects from all sectors. In the UK-Norway example this meant to evaluate the gas storage projects against the power transmission project.

In conclusion evaluation of projects should be done keeping the broad picture in mind i.e. any cross-effects from one sector to another should be evaluated.

9.5 Market development

In order to make sure that the Single European gas market has the best possible conditions to grow and evolve, the infrastructure of the gas market needs to be in

[31] The effects of importing gas from e.g. Norway are not considered here

the best possible shape i.e. there should be adequate and transparent access to transmission capacity, as well as adequate supplies of gas. To aid this process it is important that priority projects are developed in line with the developments that are taking place in the EU natural gas market. Thus the infrastructure in the gas market should support increased market integration, increased competition, TPA, unbundling, open season procedures etc. These are all issues that will affect how the natural gas market “works” and with the continuing development of these issues the infrastructure needs to be able to properly support the idea of the internal market for natural gas. Therefore projects that are awarded status of priority should also support and aid the further integration of markets and the overall development of the internal market for natural gas.

This means that projects that create connection between markets that are not interconnected as well as pipelines that eliminate serious bottlenecks should receive priority above projects that do not. An example of where increased capacity and interconnection has had a large impact on markets is the interconnector between the UK and The Netherland i.e. the BBL pipeline was introduced into a market, giving shippers alternatives to the UK-Belgium interconnector.

9.6 Practical and economical issues

Alongside political issues such as Security of Supply Climate changes and renewables and market integration there is a range of issues that are of a more technical and methodological nature. These issues may also be relevant to consider when analysing and defining a new set of selection criteria. Section 9.6 will take a closer look at those issues.

9.6.1 Priority projects and benefits

The first issue in the category of practical and economical issues deals with the aspect of priority status and priority benefits. The idea is that if projects granted with the status of being priority projects are also presented with some considerable legislative and practical benefits and instruments that will allow them to shorten the implementation considerably. Then the selection mechanism needs to restrict the number of projects. The notion is that if too many projects are granted too many benefits, then this will devaluate the value of those benefits and may thus risk that those projects of utmost importance are not implemented in due time.

Further, if benefits are to be tailored to specifically allow a quicker implementation time then it is important that the projects selected can also actually benefit from the advantages that derive from being granted status as a priority project. I.e. if the problem with the lengthy implementation time of projects is due to administrative delays and postponement of the decision-making process that stem from having cross-border projects, then the status of prioritised projects should only be granted to cross-border projects. This implies that projects such as gas storages and LNG terminal, which are of national characteristics, should not be able to receive the status of being a priority project.

The above issue perhaps call for a criterion somewhat along the line of: In order for a project to be granted status of priority project, the project should be able to fully benefit from the priority programme.

9.6.2 Project size and economics of scale

When considering gas projects one additional factor is of utmost importance, in terms of economics this factor is project size. Investments in natural gas transmission are subject to large economics of scale i.e. a doubling of capacity only increases cost by approximately 40%. This entails that large pipelines are relatively cheap, but especially private investors may wish to invest in smaller capacities because this will enable them to increase prices. Economically there is a divergence in what is commercially optimal and what is socio-economic optimal. Further large socio-economic favourable projects are not always favourable seen from a commercial viewpoint, because such projects by nature require very large investments and both risk as well as the level of uncertainty are often very high. Thus commercial projects are often biased towards smaller projects and it is therefore economically optimal for the EU to subsidize larger projects in order to assure that also large (socio-economic optimal) projects are build.

The issue of economics of scale is further in line with the three main issues (Security of supply, climate change and renewables as well as market integration) concerning priority projects. In short the rationale is:

- Security of supply – large projects bring large volumes of gas to the market thus large projects will increase capacity by more and thus raise security of supply more.
- Market – large projects allow for cheaper transportation of the gas due to economics of scale in natural gas pipelines.
- Climate change – increasing security of supply and reducing transportation costs provides a stronger case for gas-fired electricity generation which if it replaces coal-fired generation will reduce CO2 emissions.

The issue of economics of scale and thus the consequence of favouring large projects does however have one potential downfall, the next section deals with the conflict of economics of scale and authorisation procedures.

9.6.3 Economics of scale and authorisation procedures

Because of the nature of natural gas infrastructure there are huge possible benefits in big projects due to economics of scale as noted in section 9.6.2. There is however one major problem in large infrastructural projects and that is that the time before the project is in operation and time used for authorisation and environmental analysis, is often very lengthy and the process very time-consuming. Thus, it may be appealing for investors to choose the investment that has the least obstacles to face and has the quickest/easiest/least risky authorisation phase, which from the socio economic point of view is not optimal.

Thus, larger projects should be preferred above smaller projects. The set of selection criteria should therefore be very careful and not automatically reward projects that promise a fast implementation time, because this could bias projects towards becoming smaller and smaller, because it is a lot quicker to implement small projects that only have a few stakeholders compared to a large project.

9.6.4 Criteria flexibility

It is crucial to define a flexible system of selection criteria that will allow the definition of the right priority projects related to the specific target. If the aim of the projects is to achieve an immediate increase of security of supply in the region, then e.g. cost-benefit may be less important and should not be allowed to abolish the project. Further if a project has the potential of pushing the technological boundary i.e. raising the bar for what is possible in the future, then this should be given positive consideration.

Thus, when evaluating whether a project should be granted the status of being a priority project or not, one needs to evaluate not only whether the specific project is in line with the overall selection criteria, but also whether the project is able to live up to the objectives it sets out to answer e.g. if it is of high-priority to implement a project very fast in order to achieve a certain time-related goal, then it might be valuable to give this overall goal increased weight when evaluating whether the project is priority corridor material.

9.7 Large projects define smaller projects

Because it is not all projects planned that will be realised, it is very difficult to predict what projects in terms of interconnection etc. that will be relevant in the future. Therefore selecting smaller projects which could be called spin-off projects would be very difficult and the timing would probably be off i.e. you do not invest in interconnection before you know where the gas will come from and hence know what the demand for interconnection is.

Projects that are recognised as spin-off projects to large import priority projects could get an automatic priority project approval if there “mother” project is a priority project.

9.8 Proposal of selection criteria

The above chapters from chapter 9.4 to chapter 9.7 described a long range of issues that should be taken into consideration when creating a set of selection criteria. The essence of these discussions has been boiled down to the following:

9.8.1 Security of supply

This section sums up the security of supply issues discussed and creates a set of criteria based on the issue of security of supply:

- Projects that provide the EU market with capacity from new fields and thus increase diversification of supply should be granted priority.

- Projects that are able to supply large quantities i.e. projects that connect Europe with large fields are preferred over projects that connect Europe with relatively smaller fields.
- Projects that ensure that more gas reserves are going to Europe.
- Assuming that there are 4 main supply routes of gas North west (North Sea), North east (Russia), South west (North Africa) and South east (Middle East and Kazakhstan etc.), projects that increase the balance of supply between those corridors should have priority. No projects should allow Europe to become too dependent on any one of those corridors by any of those corridors supplying more than 50% of natural gas demand in Europe.
- Strategic storage projects that increase security of supply significantly i.e. storages sites of a certain capacity that may minimize negative effects of a supply disruption should have priority.
- Larger projects are preferred because of significant economics of scale within natural gas projects, both in terms of economics as well as in terms of authorisation processes.

9.8.2 Climate change and renewables

This section sums up the climate change and renewables issues discussed and creates a set of criteria based on the issue of climate and renewables:

- A project that enables the system to utilize more renewable energy should have priority.
- A project that allows for the faster construction of renewable energy generation should have priority.
- A project that is necessary for increasing the penetration of renewable energy in a country or region is of priority.
- A project that will have a positive direct or indirect affect on reducing emissions.
- A project should not have any negative effect on other sectors.

9.8.3 Market development

This section sums up the market issues discussed and creates a set of criteria based on the issue of market integration and development:

- A project that increases cross-border capacity.
- A project that allows a more efficient utilization of the existing infrastructure.
- Projects that remove bottlenecks in the system.
- Projects that increase competition with existing transmission lines without rendering the existing infrastructure useless.
- Projects should be economically viable and feasible.
- Projects that enable new trading and transmission between countries or regions.
- Projects that provide increased flexibility.
- Projects that provide increased interconnection which may lead to equalizing of gas prices between regions.
- Projects that score positively with regard s to the issues of TPA, unbundling, transparency, open season etc.

9.8.4 General issues

This section sums up the general issues discussed and creates a set of criteria based on the general issues:

- Proper socio-economic scope should be applied when evaluating the economical viability of a project. This is especially true for natural gas projects because of the large economics of scale involved in natural gas projects. Projects should be able to account why they have chosen routing and capacity they have.
- Projects should be evaluated against all other options i.e. any possible cross sector effects should be evaluated.
- Projects that allow for gas to flow in both directions should have priority.
- Priority should be granted projects that seek to push technical limits and barriers.
- Priority should be given projects that connect supply with consumption areas.
- Projects should be evaluated with the appropriate amount of flexibility within the selection criteria.

9.9 Conclusions and recommendations

It is the recommendation that the selection criteria on the gas side are made more specific compared to the relatively soft measures applied at the moment. The mechanism recommended is what can be described as a twofold mechanism in that projects should either fulfil the specific import requirements identified in section 6 and thus should be located on one of the suggested four priority axis's proposed in section 6. If the project does not affect the issue of securing supply via one of the suggested import routes. then the project should be carefully evaluated against the criteria listed in section 9.8.

10. Multi-criteria analysis

The purpose of developing a multi-criteria analysis tool is twofold. First, it allows for identifying what projects are in line with the overall priorities for energy of the European Commission, both actual and possible projects. Secondly it identifies and visualises the different parameters and aspects of the projects and can thus be used as a basis for a more in-depth evaluation of projects.

Further by creating a tool that allows for quantifying the different projects it becomes possible to evaluate the benefits and costs of two competing projects on a much more objective basis than otherwise possible. Eventually, the decision between project should be based on full cost-benefit analyses, as the present model does to a very limited extend, include investment and operational cost.

The model looks upon the project from the society point of view. Private investors may have a different point of view, as the model does not include assessment of land acquisition, taxes and regulation of transmission tariffs along with similar redistribution of income. This will in particular make a difference between on- and offshore projects.

Several selection criteria were proposed in the preceding section. The selection criteria were focused around 4 categories: security of supply, market, climate and environment, and general administrative and economic parameters. These four categories will form the basis of the analysis tool.

Creating a tool that allows for an objective evaluation of different natural gas infrastructure projects and a comparison of the various projects is far from straight forward and any model created will to some extent be guilty in terms of simplifying the issue.[32]

The biggest challenge is to identify parameters that describe the projects in terms of the four categories. These parameters should give a clear indication of the benefits and possible disadvantages or shortcomings of each analysed project. However, in order to properly compare these parameters in an objective manner, they should also be quantifiable. Thus the selection of parameters will necessarily have to entail some compromises in terms of choosing between what the best parameters are and which ones can be quantified.

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[32] The difficulty of such a task are to some extent illustrated by the present TEN-E questionnaire which in many cases does not allow for the administrator to compare different projects and evaluate the potential impact on security of supply, market, climate and environment and economics each project makes.

Thus, comparing the characteristics of the different projects will only be an approximation and will be made more difficult due to the fact that parameters must be quantifiable. Therefore, it is important to realise that the multiple selection criteria model should only be used as a tool of guidance in the TEN-E selection process.

10.1 The model

Choosing a project at the expense of another project may not always be straightforward. In evaluating projects, one needs to take many different parameters into account. It can thus be helpful to have a general tool that can be used to evaluate how projects perform relatively to each other, over a range of different parameters. Such an analysis requires following setup:

- Definition of the categories of comparison, and a choice of parameters describing these areas.
- Quantification of the parameters of interest.
- Transparent comparison of categories.

We defined five categories, supply, market, environment, general issues, and at last a parameter indicating the likelihood of the initiation of the project. Under each of these categories we chose the variables that describe this area.

It may not always be possible to directly compare different parameters. As an example under the supply category we define among other things parameters indicating:

- How much can possibly be supplied
- Is the gas supplied in competition with other gas importing countries?

The first parameter is easily quantifiable. The second parameter is quantified by letting the variable take on a value of 1 if the answer is yes, and 0 if the answer is no. In determining, based on the two parameters which project is the best we cannot merely add up the two variables and pick the highest value. We can go about this problem by normalizing each variable by the largest value obtained. As an example this means that the project with the largest supply will attain the value 1, while the others all will attain values lower than 1 but larger than 0. Hence the projects are measured relatively to the project that obtains the largest value. This normalization procedure makes us capable of adding the various scenarios such that a value for the entire category can be obtained.

The normalization procedure is used for all parameters and all categories. This ensures that the projects are relatively comparable to each other. The highest ranking project will thus be the project that does well in most categories. We furthermore chose to apply a weighting system on the normalized scores. The weights are subjective and can be modified to reflect the preferences of policy makers with different agendas.

In the following we present parameters which we fulfil the criteria proposed in the preceding section as well as are quantifiable.

10.2 Variables

In the following each parameter included in the selection criteria model is presented. The bullet points illustrated as either + or ÷ indicates whether the parameter enters positively or negatively in the model.

10.3 Security of supply

Supplier country

+ Number of countries supplying gas. The more countries supplying gas, the more diversified the European supply becomes.

+ Connection to new fields. Indicates if the project connects the European gas network to new fields. Connection to new fields is desirable as it enhances diversification.

÷ Supplier risk: The more unstable a supplier country is, the riskier supplies from such country. The risk of the supplier country is instrumented by the yearly listing of country risks supplied by the "fund for peace" [33]. The risk index is independent and takes a range of country specific categories into account. It is assumed that the higher a country ranks on this risk-list the higher is the probability of a supply disruption in that country.

+ The size (in bcm) of the supplying field.

+ The size (in bcm) of the supplier countries' reserves. Reserve data was obtained from BP annual statistics.

+ The capacity of the project. Instrumented by the annual supply of gas (in bcm) that a project can carry.

Transit

÷ Transit risk: The more countries a pipeline has to pass the higher the risk. The risk of transit countries is instrumented by a "country risk index" which is provided by the "fund for peace".

[33] http://www.fundforpeace.org

- + Furthermore, projects that replace pipelines in risky countries are also rewarded according to how risky the country is. Again the “fund for peace” ranking is used.

- ÷ Offshore risk. The longer and deeper the pipeline is, the more time reparation of the pipeline will take. Thus long and deep offshore pipelines enter negatively into the model. Offshore pipelines generally counter the offshore risk by building two pipelines.

Receiving countries

- + Number of countries which receive new import possibilities. The more countries the better diversification possibilities.

- + Indigenous production. As most countries in the EU face declining indigenous production there is a demand for larger flexibility, a reward is therefore given to interconnectors that involve countries with high indigenous production. Indigenous production figures have been obtained from Eurostat.

- ÷ Another type of inflexibility arises in the storage capacity compared to consumption of natural gas. Thus, the smaller this ratio is, the more the project is rewarded. Storage data for each EU country was obtained from “Gas Storage Europe”, while consumption data originates from Eurostat.

Supplier competition

- + Instrumented by the distance from the field to EU border. Depending on the policy maker’s preferences, distance may influence negatively or positively in the evaluation of a project. Positive since the resources close to the EU borders could be regarded as “certain” while supply from sources far away is obtained in competition with other gas consuming regions. Negatively if projects that secures fast supplies are prioritized more. For the present the weights used implies that distance enters positively in the model.

- + As a continuation of the preceding discussion of resource competition, we also chose to reward projects that secure gas that alternatively could have been imported to other gas consuming regions such as USA, Japan, India, and China.

Others

- + Storage possibilities along the supply route are rewarded as this could enhance security of supply.

- + The possibilities of adding more compressor stations along the supply route. Compressing the gas could allow for larger capacity.

- Supply to a specific region. Depending on the preferences of the policymaker supply to one region could be prioritized.

10.4 Market development

Technical specifications

- Dual direction of pipelines. Allows for more cross-border trade.

Regulatory framework

- Third party access.

Impact of gas in involved countries

- Projects may have different impact depending on which country they supply. For example 10bcm extra in Portugal have larger consequences for the market than 10bcm in Germany. Quantifying this is done by introducing the ratio: (Added gas)/(Total consumption of gas). The higher this ratio is the larger the impact of the gas would be. Total natural gas consumption is obtained from Eurostat.

- New gas. If the gas is coming from new sources it would be more likely to create competition than if it came from old sources.

- Differences in winter temperature: This variable measures the differences in winter temperature between two interconnected countries. The larger the differences are, the larger the differences consumption pattern will be. Thus the scope for cross border trades becomes larger which strengthens the market.

10.5 Climate and environment

Degree of abundance of gas

- This parameter measures the amount of gas added to the end countries relative to their total energy consumption. A high value here indicates that a lot of gas is flowing into the country relative to how much energy is being used. High ratios would then, everything else being equal, imply a greater probability of replacing either coal or oil with gas, and thus the impact on environment will improve.

Replacement of other energy sources

+ The variable above measured the probability of gas substituting coal and oil. Here we measure how big the potential is. This is quantified by the fuel composition in each country. Thus how much does the affected countries use of coal and oil. Quantifying this variable was done by using BP annual statistics of fuel consumption

Close to existing corridors

+ If a pipeline is already in place, the environmental assessment and approval might be quicker and the re would be no negative environmental impact on new areas - land or sea.

Terrain

÷ Projects situated in demanding areas of Europe might be more prone to failure than other projects. Thus, if the project crosses mountainous geography, it is penalized.

10.6 General issues

+ Is the project innovative and does it challenge technical boundaries?

÷ Start-date of the project. Start-date is important since the challenges in the gas sector are very present, dealing with the situation now is better than dealing it in 10-15 years. The start-date could also measure the seriousness of the project.

+ Economies of scale. Size of pipeline – diameter and pressure. The larger the better.

÷ Distance between compressors. The larger the distance the less opportunity there is for increasing flexibility by upgrading compressors.

÷ "Implementability". The model takes into account the issue of "implementability" i.e. if the projects are very difficult to realise in reality, then the projects is awarded a negative score. This is in light with the overall goal of making sure that projects are implemented within a period of maximally 5 years. The model evaluates this issue by giving a negative score for number of countries involved.

10.7 Weights

We have chosen the following overall weight scale for the selection model. All 4 major categories are weighted on a 10 point scale with 10 being the most important and 1 being the least important category. Each subcategory within these 4 major categories is also weighted on this scale.

In general the weights must be chosen such that they mirror the policy makers' preferences. To obtain the fairest comparison possible each category is normalized by the project with the largest value within that category. This entail that the result of the model will only be relative, i.e. it can only say something about how the analysed projects perform compared to each other. This procedure is repeated for each major category, and facilitates a comparison between different projects. As the weights are subjectively chosen the ranking of the projects may vary according to which type of policy maker is doing the evaluation. To get an overview of how the projects will vary, we demonstrate how the ranking would vary if three different preference profiles are assumed. In the following, we show the outcome of the multiple selection criteria model for policy makers with one of the following categories as their top priority: security of supply, market, and climate. Applying different weights also gives an indication of the robustness of the projects, i.e. a good project should preferably have a high score no matter what the policy makers' preferences are.

10.8 Selection of projects

30 projects have been picked out for comparison based on the project synopsis and capacity analysis made in sections. Further a combination of projects has also been included e.g. the Baltic Interconnection Plan[34]. The individual projects are described in section 7. The projects evaluated are the following:

Table 24 Alphabetical list of projects evaluated in the Multi-criteria analysis

Project name
Amber
Baltic Gas Interconnector
Baltic Interconnection Plan
Baltic Pipe
Balticconnector
Balticconnector + LNG
Barents sea - Scandinavia
CZ-Belgium
France-Italy
France Spain
Galsi
GNE
IGI
Medgaz
Mid Nordic
Nabucco
Nord Stream
Norway-Denmark
Poland-Hungary
Qatar pipeline

[34] See section on Gas workshop for more in the Baltic Interconnection Plan

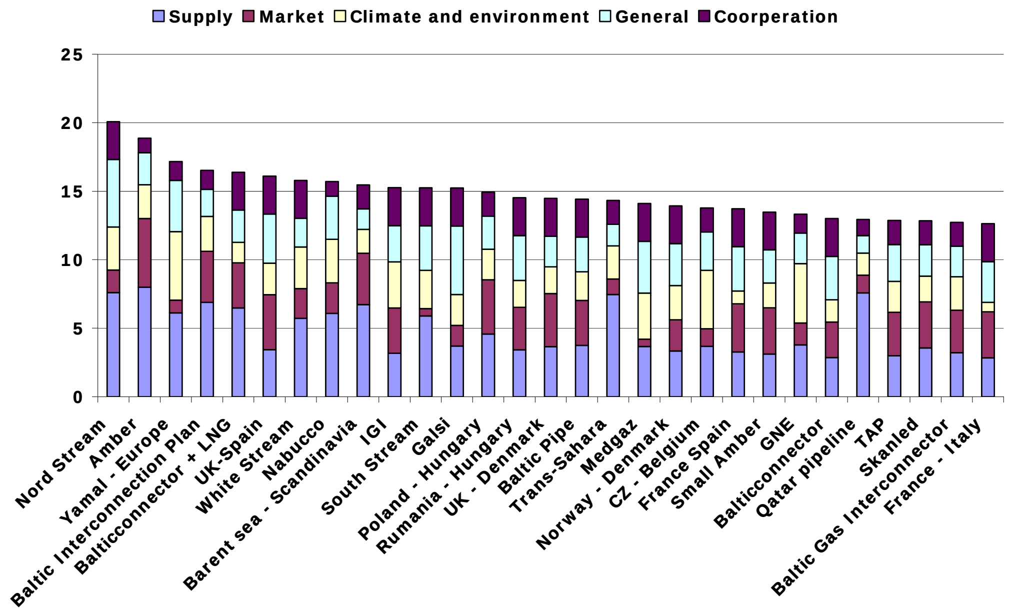
Rumania-Hungary
Skanled
Small Amber
South Stream
TAP
Trans-Sahara
UK-Denmark
UK-Spain
White Stream
Yamal – Europe

In the following we analyse the outcome of these projects in terms of three policymakers with different preferences. The first policymaker analysed values security of supply the highest.

10.9 Policy maker with a high preference for security of supply issues

In this setting most weight is being placed on security of supply. In the figures below we illustrate how each projects score in each of the main categories as well as how the project performs on an overall level.[35]

Figure 39 Security of Supply



By inspecting the security of supply results, it becomes evident that there is a very clear tendency for larger projects to do very well with regards to security of supply. The security of supply policy maker will favour large supply projects compared to

[35] Graphs showing each category in detail can be found in the annexes

smaller ones and to interconnectors, which do not increase the import capacity of the EU. Further it can be seen how combined projects like the Baltic Interconnection Plan and the Balticconnector plus LNG, receive a very high ranking, because they provide the Baltic region with new supplies i.e. diversification as well as bringing increased interconnection to the area.

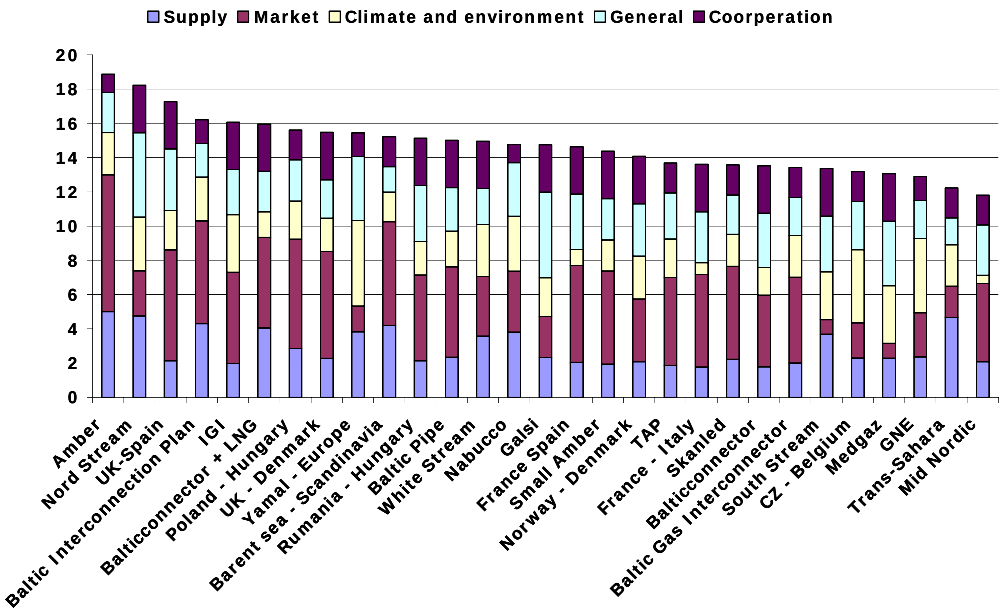
Figure 39 shows how the large projects like Nord Stream, Amber, Yamal-Europe, Baltic Interconnection Plan and Balticconnector plus LNG are favoured over smaller projects. This outcome is in line with the overall recommendation in the gas capacity analysis performed in section 5.

It should be kept in mind that although large projects are favoured over smaller projects in the model, small projects may still have a large impact on security of supply within a smaller area or a single country and thus still have a large impact on security of supply within that country or area. This goes for projects like e.g. Skanled, Baltic Pipe and Galsi who because of the bias towards larger projects should not only be evaluated and compared to all projects, but should also be evaluated against projects of a similar size and if possible against projects with the same rationale.

10.10 Policy maker with a high preference for market issues

The following section looks at how the projects are ranked when they are evaluated using a strong preference for market issues. [36]

Figure 40 Market



[36] Graphs showing each category in detail can be found in the annexes

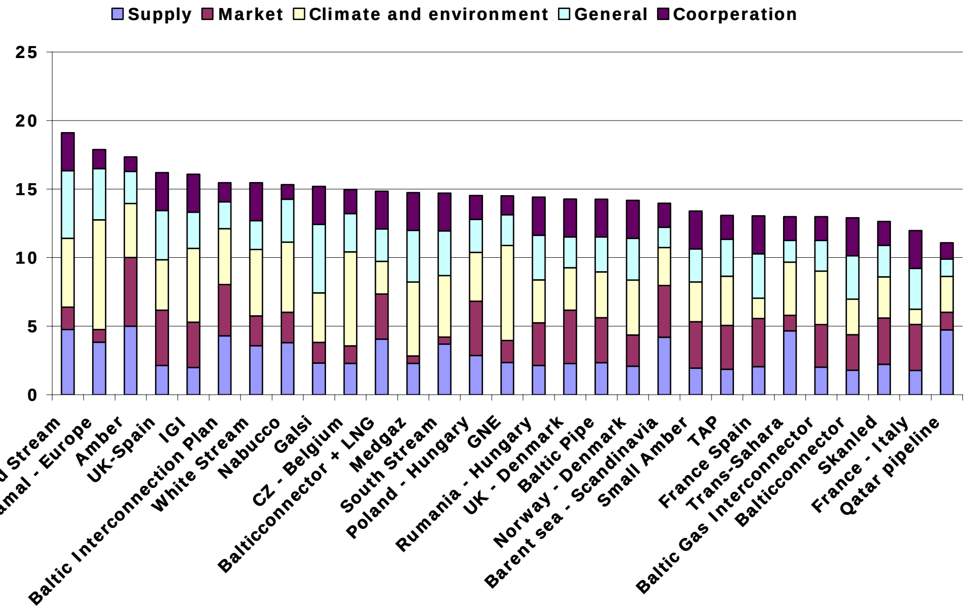
The market illustration shows that although the emphasis is now put on market issues, it is still to a large extent the same projects that score high. The top five of projects are Amber, Nord Stream, UK – Spain, Baltic Interconnection Plan and IGI. The UK – Spain pipeline and IGI are both new to the top five and several of the smaller interconnectors also improve their position when focussing on the market issues. Two such projects are Baltic Pipe and Skanled who both improve their ranking compared to the security of supply policy maker. The increased ranking of projects like UK – Denmark, UK – Spain and Baltic Pipe indicate that from a market perspective, it is a good idea to support interconnectors that create new connections between countries that are not connected today. The UK –Spain projects benefits from the differences in temperature, which means a large potential for trade exists between these two countries.

When analysed from a market perspective, the position of the Amber pipeline is improved somewhat compared to the Nord Stream pipeline. This is because the Amber project scores high on market issues such as TPA, dual pipeline flow and connection of not already integrated networks, which e.g. the Nord Stream project does not benefit from.

10.11 Policy maker with a high preference for climate and environmental issues

If the policy maker has the highest preference for environmental issues, then we attain the following result from running the model.[37]

Figure 41 Climate and environment



[37] Graphs showing each category in detail can be found in the annexes

We have that the top five to a large extent consist of the usual suspects i.e. Nord Stream, Yamal-Europe, Amber, UK – Spain and IGI. From a climate point of view the Yamal – Europe pipeline has a relative advantage because it benefits from the fact that it would not entail environmental impacts on new areas, land or sea, as there already exists a pipeline.

10.12 Conclusion

The above analysis shows that no matter whether the listed projects are evaluated based on a security of supply point of view, a market point of view or from a climate/environmental point of view the focus should be on large projects or alternatively a combination of projects such as the Baltic Interconnection Plan, as these projects are best able to fulfil all of the different preferences.

One should not put too much focus on smaller differences in the above scores, because smaller differences will not be significant in this type of model. However, apart from the result that large projects are preferable, the results can also be used to compare strengths and weaknesses of the projects e.g. comparing Nord Stream to Amber. Nord Stream is relatively better when seen from a security of supply point view as well as from an environmental perspective. However, analysing it from a market point of view the Amber pipeline is relatively better, due the fact that Amber interconnects the Baltic Region the rest of the EU gas market.

Table 25 below shows how the top 5 ranking based on each scenario is.

Table 25 Top 5 ranking of projects per scenario

No./Scenario	Security of supply	Market	Climate and environment
1	Nord Stream	Amber	Nord Stream
2	Amber	Nord Stream	Yamal-Europe
3	Yamal-Europe	UK-Spain	Amber
4	Baltic Interconnection Plan	Baltic Interconnection Plan	UK-Spain
5	Balticconnector + LNG	IGI	IGI

Further it is noticeable that no project stands out in a negative way, i.e. none of the evaluated projects perform much worse than the others. Actually, if we look at the spread from the number 6 ranked project to the project that ranks number 30, it is almost the same as the spread from the number 1 ranking project to the project ranking number 6. This indicates that the lowest scoring project does not perform a lot worse when compared to the 6th best project than the 6th best project is worse relatively to the best project. The spreads are listed below in Table 26.

Table 26 Relative project scores

Scenario	Security of supply	Market	Climate and environment
Project 1 / project 6	1.25	1.18	1.24
Project 6 / project 30	1.42	1.47	1.49

It should be remembered that projects that score lowest in some or maybe all the scenarios are not necessarily bad projects, but could be projects that just have a small impact on the overall EU level. This is illustrated by the Balticconnector project and the Baltic Interconnection Plan. Evaluated independently the Balticconnector scores in the low half of all the evaluated projects in the analysis, however, when it is combined with the Small Amber project and a LNG terminal (Baltic Interconnection Plan), then the combined project scores in the top 5 or 6 for all the scenarios evaluated i.e. security of supply, market and climate.

11. Revision of the TEN-E guidelines

This section sums up and evaluates the conclusions and recommendations put forward regarding natural gas in terms of revising the TEN-E guidelines. The section refers to task three in the terms of reference. The section does not include recommendations on the legislative part presented in section 3.

Based on the analysis of stakeholder analysis, suitable regions, capacity analysis and selection criteria the revision of the TEN-E guidelines should on the gas side entail the following revisions:

11.1.1 Suitable regions

A set of new regions are proposed to be implemented in the TEN-E guidelines these new regions are created in line with the main task of gas transmission which is to connect supply and demand within an region. Further a sub-region has been constructed to ensure that the Baltic countries and Finland are integrated into the EU gas transmission network.

The regions proposed have been created in order to accommodate the challenges facing the European gas sector in the forthcoming years. The main challenges are:

- The increasing dependency on gas imports and uncertainty about availability of sufficient gas reserves in Russia and other main external supply countries.
- The development of a single European gas market, including the completion of the integration of the EU gas network, a.o. in view of the EU enlargement.
- The climate change challenge where natural gas will be a bridging energy until sufficient renewable energy sources will be available.

The introduction of the suggested regions will help to ensure that the gas market is able to handle the above challenges by facilitating the appropriate platform for cooperation and analysis required in order to ensure the optimal investment and decision climate.

11.1.2 Priority corridors / axis

In order to ensure that the projects selected are in line with the requirements and challenges facing the EU gas market in the future, a new set of energy corridors are introduced. These new corridors are introduced in order to direct focus on the issue of increased dependency for the EU in terms of gas imports. To deal with this the revised corridors are proposed to transcend the EU borders and thus direct focus from within the EU, towards the relationship between the EU and the countries that present potential import possibilities now and in the future.

The following corridors are proposed:

Blue Corridor – Barents Sea to Northern Europe

Red Corridor – central Asia to South-eastern Europe

Yellow Corridor – Middle East to South-eastern Europe

Green Corridor – Africa to South-western Europe

The recommendation is thus to broaden the scope of the Guidelines to also entail gas supply routes.

11.1.3 Revision of multi-criteria analysis

For the process of selecting projects eligible for status of priority two mechanisms are proposed. One is the axis approach where projects that are situated on the proposed axis should be granted priority, and the other is a multi-criteria selection mechanism entailing the criteria presented in section 9 and 10.

The multi criteria analysis performed in section 10 gives further support to the fact that focus in terms of what projects should be granted status of being a project of European interest, should be larger import projects. Projects were evaluated from three perspectives: security of supply, market and climate and environment, the outcome was the following:

Table 27 Top 5 ranking of projects

No./Scenario	Security of supply	Market	Climate and environment
1	Nord Stream	Amber	Nord Stream
2	Amber	Nord Stream	Yamal-Europe
3	Yamal-Europe	UK-Spain	Amber
4	Baltic Interconnection Plan	Baltic Interconnection Plan	UK-Spain
5	Balticconnector + LNG	IGI	IGI

7(8) different projects made it into the top 5, however, the analysis also showed that the distance between the highest scoring and lowest scoring projects was relatively small. Further projects should also be evaluated against “equal” projects in terms of purpose and size. Analysis also showed that a combination of projects, such as the Baltic Interconnection Plan, could elevate a project from scoring relatively low into becoming a top 5 project. This underlines the fact that natural gas transmission projects should be evaluated considering carefully other projects as well as alternatives.

11.1.4 Revision of selection criteria

Generally, only the very best projects should be granted status of priority in terms of allowing the “benefits” suggested in the chapter 3 on legislation to be efficient and to ensure that benefits of the legislative procedure are maximized and costs are minimized.

Further with limited resources in terms financing priority projects should not spread those resources too much as the proposed axis' will require relatively extensive studies compared to smaller projects.

11.1.5 Revision of projects

The following projects/axis should be included in the revision of the TEN-E guidelines:

Based on the capacity analyses, multi-criteria analyses and assessment of the project inventory, the following projects are recommended as Projects of European Interest:

Supply lines connecting major gas fields to the integrated EU system or to existing systems already connected to EU system:

- Nabucco – extended to include pipelines to the gas fields (Middle East/Central Asia).
- Barents Sea pipeline (from Norway or Russia or combination).
- White Stream – extended to include pipelines to the gas fields (Middle East/Central Asia).
- Trans-Sahara gas pipeline.
- LNG production plants and pipelines associated with such plants (work on preferred countries to be developed by the proposed LNG Forum).

Supply lines between networks of neighbouring states and EU as direct as possible:

- Nord Stream (it may anticipated that this project is already under construction and therefore will not need to be included in the new list or projects).
- Amber.
- Galsi.
- South Stream.
- SkanLed/GNE/Norway-Denmark.
- Baltic Interconnection Plan

Interconnectors which integrate member states into the EU gas system

- Small Amber (Lithuania-Poland).
- Balticconnector.

Interconnectors improving the functioning of internal EU gas market:

- IGI and/or TAP.
- UK-Denmark (including a general interconnection of countries around North Sea).
- Romania-Hungary.
- Spain-France.
- Czech Republic – Belgium (or similar projects connecting east and west Europe).

- BalticPipe (in lack of reverse flow in Yamal-Europe pipeline at German/Polish border).
- UK – Spain.

It is our recommendation that the group of projects should be prioritised as shown with highest focus on direct access to new gas fields.

11.2 Priority corridors and the "third package"

The so-called "third package", which has been proposed in reference to amending the Directive 2003/55/EC, entails several issues that could have an affect on the issues covered in this report. This section evaluates how the third package corresponds to this report.

The package deals with the following issues:

- Unbundling of supply and production activities.
- Enhanced powers and independence of national regulators.
- An agency for cooperation of energy regulators.
- Efficient cooperation between TSO's.
- Improvement of market conditions.
- Cooperation to reinforce Security of supply.

11.2.1 Investment climate and market transparency

Overall the proposals made in the "third package" should improve the investment climate for infrastructure. This is attained by putting emphasis on the issue of unbundling, which will help ensure that investors will not benefit from investing in too little capacity as can be the case when the investing part is both a producer as well as a supplier.

Further by extending the transparency requirements in terms of information regarding gas stocks, forecast of demand and supply, network balancing costs and trading costs e.g. ensuring information on prices, it will be easier for investors to assess the need and profitability of new investments.

Also the proposed streamlining of the exemption legislation will increase transparency and reduce uncertainty regarding gas infrastructure investments.

11.2.2 Stakeholder cooperation

Two new platforms for stakeholder cooperation are addressed in the Third package, one for TSO's and one for national regulators called the Agency. An increased level of cooperation in the form of an "Agency" for cooperation between regulators as well as increased independence and enhanced powers for the regulators with the purpose of e.g. monitoring and reviewing the cooperation between TSO's. The creation of an Agency would fill the regulatory void that exists at the moment, in terms of cross border issues.

Further it is intended for the Agency to deal with exemption issues regarding projects of European interest, this would ensure that regulation in terms of projects of European interest would be granted the best overall regulating scheme.

11.2.3 Third package conclusion

The Third package is overall in line with the recommendations and the goals of the suggestions put forward by this report. However, how big the impact of the third package would be in terms of securing the necessary and optimal investments in the natural gas sector will depend on how exactly the third package will be adopted.

12. Gas workshop: Natural Gas in the East Baltic Sea Area

September 5th, 2008, a gas workshop was held involving stakeholders from the East Baltic Sea area. The intention of the gas workshop was to test whether a regional forum, where problems could be discussed and voiced, information could be shared and contacts could be made, would be beneficial in terms of facilitating the implementation of projects in the region.

The workshop was a big success in the sense that all project owners in the region were present as well as different stakeholders such as government official and industry representatives.

The following projects were presented by the project owners

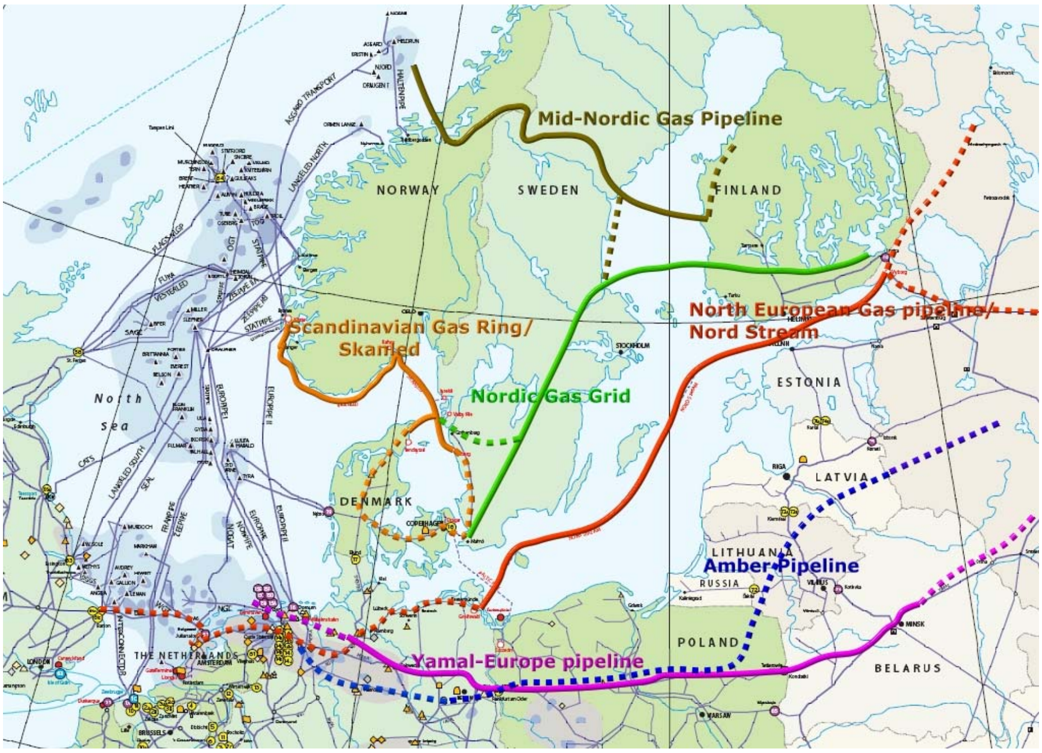
- Balticconnector (Gasum)
- Nord Stream (Nord Stream)
- Amber (various alternatives) (Ministry of Economy, Lithuania)
- Yamal-Europe (PGNIG and Gaz-System)
- Baltic Pipe (PGNIG and Gaz-System)
- LNG and storage (PGNIG and Gaz-System)

12.1 Brief natural gas history of the East Baltic Sea region

A large number of different projects have been analysed and studied over the past 20 years or more, but no projects have yet been implemented. This lack of new projects is in vast contrast with the rest of the EU, which has seen a number of gas projects realised and this despite the fact that the need for projects in the region, due to the fact that Finland, Estonia, Latvia and Lithuania are not an integrated part of the EU gas market, which implies that they have no diversification of supply, i.e. they only have one supplier of gas, i.e. Russia and no market integration with the rest of the EU.

Thus despite the lack of market integration and despite a lack of supply diversification no project in the East Baltic Sea Region has been implemented. There has however, been no lack of ideas for projects as Figure 42 shows.

Figure 42 Various projects in the Baltic region



Source: GIE map for background plus Ramboll

A number of possible explanations as to why this lack of implementation of projects in the region was identified from the gas workshop.

12.2 Problems identified

Talks with stakeholders revealed that communication and coordination between the different stakeholders in the region was almost completely absent. This despite the fact that a lot of the projects are obviously mutually beneficial, e.g. The business case for the Balticconnector and the small Amber pipeline, would from a European perspective as well as an individual perspective most likely increase the rating of both the projects considerably. (See section 10 for more)

Further, there seemed to be uncertainty as to what projects were planned and what projects were progressing in the region. There was also uncertainty as to what the specific details of the projects were, e.g. whether the Amber project was an interconnector between Lithuania and Poland (Small Amber), or an import projects bringing gas from Russia through the Baltic States through Poland and Germany.

The industry raised concerns because of regulatory uncertainty, an unrealistic tariff setting as well as an overall uncertainty of gas demand.

The Amber project had no clear anchoring in the industry, and it was unclear which stakeholders would be responsible for its development. The Lithuanian Government has recently launched a pre-feasibility study and applied for TEN-E support for a larger feasibility study.

Lack of reverse flow from Germany to Poland is also a major factor when analysing the security of supply in the Baltic region. Allowing for reversed flow in the Yamal – Europe pipeline would, in the short run allow Poland to diversify their supply and in the long run, further strengthen the diversification in the entire region, if the Small Amber and Balticconnector where built. Thus, allowing for reversed flow between Germany and Poland could improve the business case for Small Amber and the Balticconnector.[38]

The debate revealed a need for combining projects into a larger scheme to allow mutual benefits.

12.3 Combination of projects

Analysis using the multi criteria analysis tool, showed that combination of projects could improve the rating of the different projects.

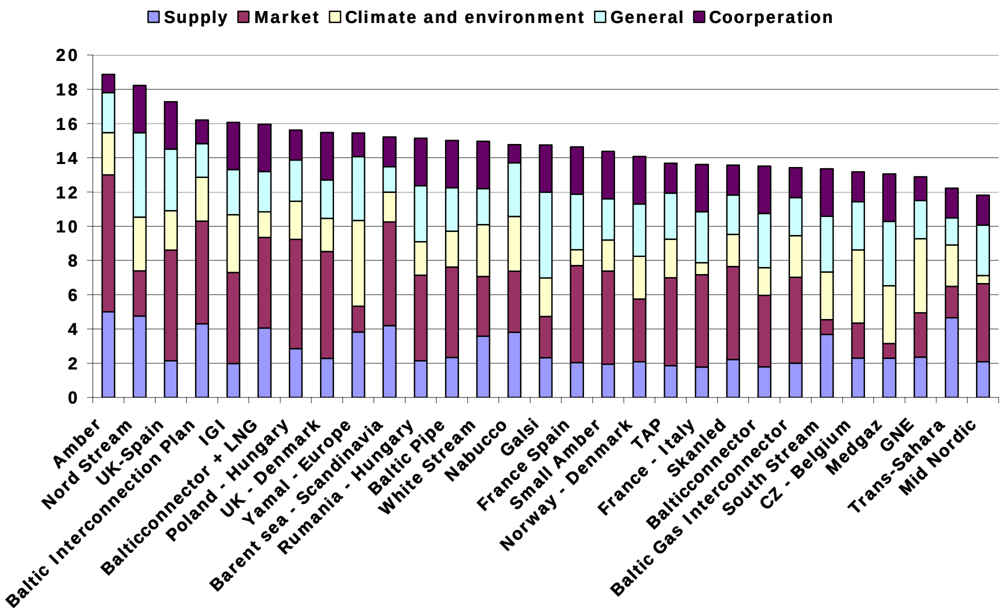
The Multi-criteria analysis showed that if the Small Amber, i.e. the connection between Lithuania and Poland, was combined with the Balticconnector and a LNG project in the region, then the rating in the multi-criteria analysis would improve considerably. Evaluated individually, both projects scored in the lower half for all scenarios. However, combining them and including diversification of supply in the form of a LNG terminal in the region, i.e. the Baltic Interconnection Plan transformed the rating of those projects and put the Baltic Interconnection Plan amongst the top 5 European Projects, when evaluated in terms of security of supply and market. The Baltic Interconnection Plan scored 6th highest in the climate and environmental scenario.

Further, a combination of the Balticconnector and a LNG terminal was evaluated. Results showed that the rating of the Balticconnector was improved considerably by including LNG. This is in line with the overall developments presented by Gasum at the workshop, whose presentation revealed that an LNG terminal was being considered in Finland.

As can be seen from the multi criteria analysis ranking shown in Figure 43 the Baltic Interconnection Plan as well as the “Balticconnector + LNG projects”, score as relatively 4 an 6 overall (market scenario), whereas the Small Amber project and The Balticconnector project score 17 and 22.

[38] For more on reverse flow see section 4.2.4

Figure 43 Multi-criteria analysis of the Baltic Interconnection Plan (market)



This underlines the importance of creating a common setup for the Baltic region e.g. the creation of a Baltic Interconnection Plan.

12.4 Next steps

As the problems identified above indicate there is a significant need for increased communication, coordination and information sharing in the region. A solution to the problem could be the creation of the before-mentioned Baltic Interconnection Plan, in combination with an administrative body that can ensure that lines of communication are in place and that information is shared. The role of this administrative body would also be to ensure momentum throughout the process of implementing the Baltic Interconnection Plan.

The setup of such an administrative body could be created in various ways. A Baltic Region coordinator could be appointed as has been the case with the European Coordinators:

- High voltage connection France-Spain (Mr. Mario Monti)
- Off-shore wind connections in the Baltic and North Sea areas (Mr. Adamowitsch)
- Nabucco gas connection project (Mr. van Aartsen)
- Power connection between Germany, Poland and Lithuania (Mr. Mielczarski)

Another solution could be to create a small company which job it would be to ensure momentum is kept, act as a political catalyst and link between stakeholders in the region and the European Commission. Further, the responsible company could provide the stakeholders in the region with sparring and additional analysis capacity as well as help coordinate and facilitate the process of implementing a Baltic Interconnection Plan in a quick and efficient way.

Section IV – Monitoring

The following section deals with the issue of monitoring of energy infrastructure projects in the EU. The monitoring tool presented here is not a fully developed tool, but what can be called a basis tool, which can be further developed in cooperation with stakeholders and potential users. The tool can easily be adjusted to fit any specific requirements that may present themselves and then be implemented on the DG TREN website or any other platform.

13. Monitoring tool

The project monitoring tool has been developed in order to allow stakeholders, politicians, and consumers etc. a possibility to follow the overall development of gas and electricity projects, as well as the individual progress of specific projects.

The tool is created focussing on the following issues:

- Geographical oversight of all projects.
- Easy access to information.
- One point entry to all relevant information.
- Comparability of different projects.
- Easy to update.
- No nonsense information i.e. basic information on capacity and progress is provided but more detailed information is available by a click on the mouse.

13.1 Application of the monitoring tool

The project monitoring tool is developed with the objective to keep track of proposed and planned projects in EU. Current version of tool is a basic template which presents an overview how such a tool can work.

13.1.1 How should one use it?

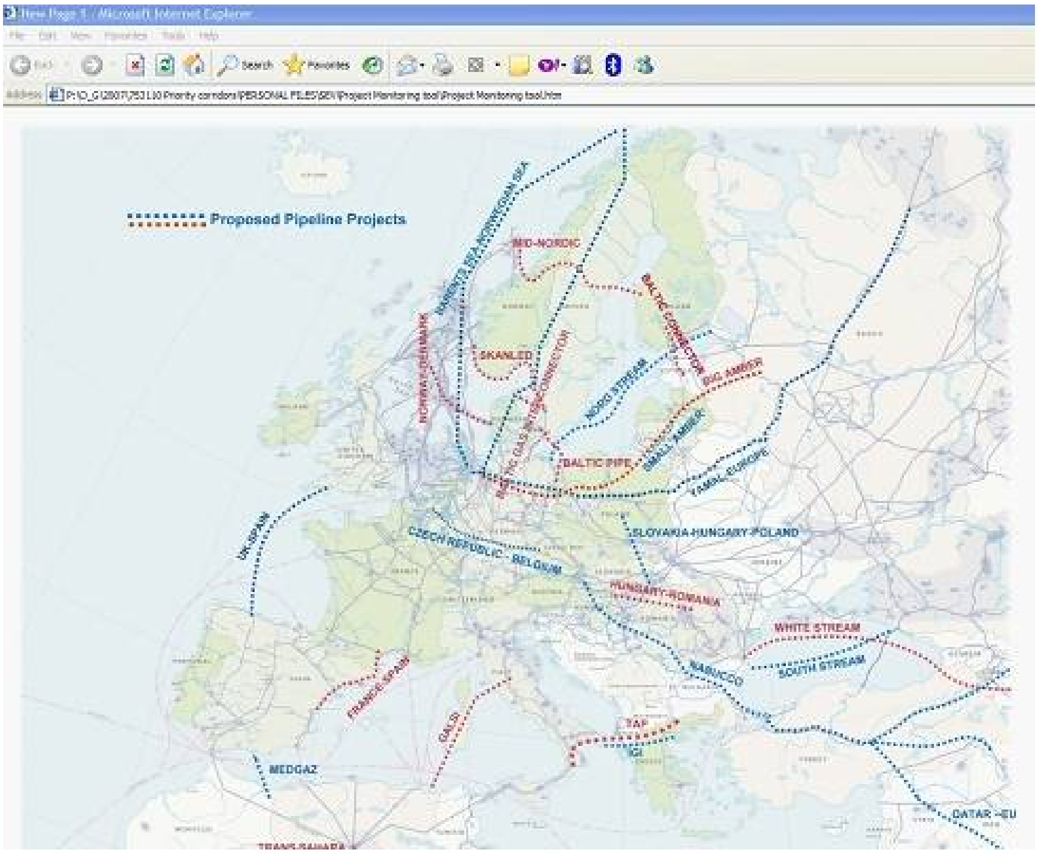
In the following, a short manual is presented on how to use the tool. The monitoring tool shown in the manual is the tool for Natural gas projects. However, the monitoring tool for electricity projects is used in the exact same way.

Step 1: Click on the enclosed file "Project Monitoring tool for Gas.htm".[39]

Step 2: A window as shown in Figure 44 will appear. This window will contain all the proposed projects.

[39] For electricity tool click "Project Monitoring tool for Electricity.htm"

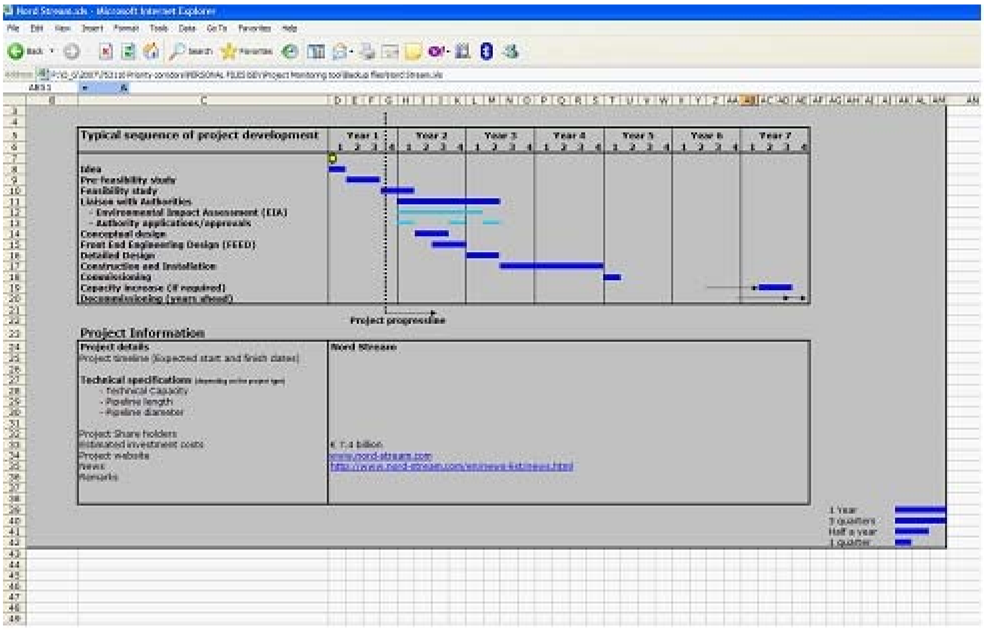
Figure 44 Map showing the various natural gas projects



Step 3: Move the cursor to the specific project that you wish to track. When you move the cursor close the project title, the cursor pointer will change into an *"index finger pointer"* indicating a link. Then, click on the link.

Step 4: An excel sheet, see Figure 45, showing project schedule and indicating the project progress will appear. This sheet also contains additional information about that particular project such as technical details, project related websites, news, etc.

Figure 45 Project Information Sheet

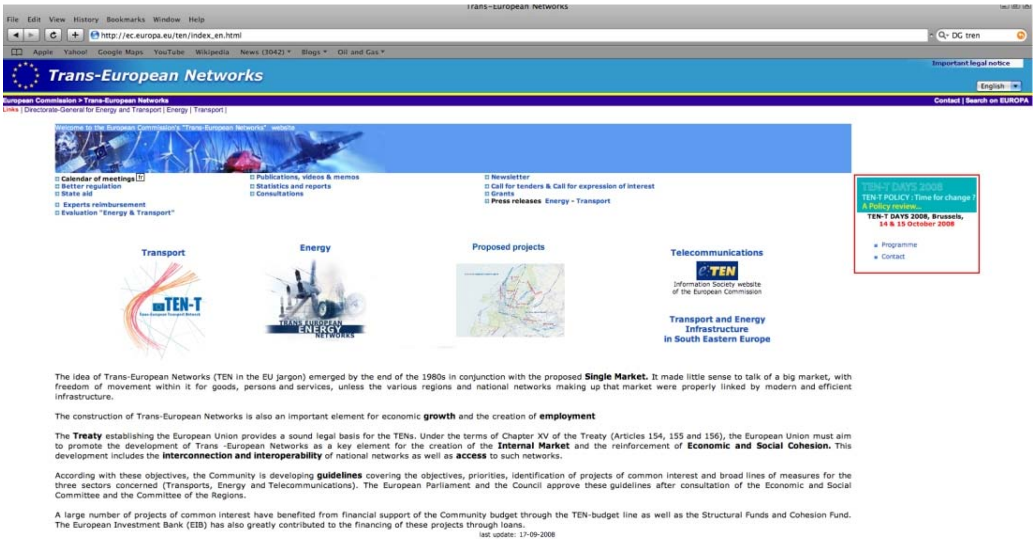


The project progress line indicating the sequence of the project development presents an updated status of the project.

13.1.2 Implementation of the project monitoring tool e.g. on the DG TREN website

The Project monitoring tool can be made available from any webpage, e.g. the trans-European Networks website, see Figure 46. A small picture showing “Proposed Projects” can be posted on the webpage. If a user clicks on the proposed projects map, then the sequence of steps explained earlier will follow. This would enable all stakeholders, politicians, interest groups etc. to keep track of future projects.

Figure 46 DG TREN Website



Source: Screenshot DG TREN Website

13.1.3 Additional features that can be added to the project monitoring tool

The existing monitoring tool can be automated further by adding some more features and web based applications. Further, a user-based standardised project monitoring tool can be made for all the projects e.g. having a zoom function on the map. When a user clicks on the map, zooming in and out on map will enable the user to see more information about a specific project.

13.2 Gas project phases

The project monitoring tool uses a uniform approach to categorise the phases of the various projects in order to allow for comparability between the different projects. We have defined the following phases for a TEN-E project:

- Idea.
- Pre-feasibility study.
- Feasibility study.
- Conceptual design.
- Front End Engineering Design (FEED).
- Detailed Design/Authority applications.
- Construction.
- Commissioning.
- Capacity increase.

13.2.1 Idea

The starting point of a project is the idea to establish a new energy project. This is most often initiated by one stakeholder in the business and further consolidated with partners who have an interest in the project.

Contrary to other businesses there are few professional project developers in the energy transmission business as the commercial value of the idea as such is limited and can not be traded. It might be beneficial to give some incentives for project developers.

13.2.2 Pre-feasibility study

The next phase in project development is to carry out pre-feasibility study, which is often a desk study based on available information and rough market data. Most often the study is carried out by the stakeholders who originally developed the idea. The budget for a pre-feasibility study may be approx. 0.1 MEUR

13.2.3 Feasibility study

The purpose of the feasibility study is to justify the technical-economical viability of a project and decide the main parameters. Further a business plan for project development will typically be included. The work may include physical surveys, detailed market studies etc. The budget for a feasibility study may be from ½ MEUR to 20 MEUR depending on the size and maturity of the project.

13.2.4 Conceptual design

The purpose of the conceptual design is to freeze main technical and economic parameters as a basis for investment decision. This could be the first step of the life of a dedicated project company with its own organisation. Typically a project organisation is developed with a combination of in-house and external experts. The budget for a conceptual design may be from 2 MEUR to 50 MEUR.

13.2.5 FEED – Front end engineering design

FEED is used to mature projects to a level of tending for construction if so-called EPC contracts are used. The work will include fairly detailed design, although not to a level of construction. The level of a FEED may be from 5 to 100 MEUR.

13.2.6 Detailed Design / Authority applications

The detailed design and authority applications are the most comprehensive preparatory areas of work. The work will include detailed design to a level ready for construction as well as detailed environmental impact assessments and authority applications. Further, activities can include financing of the projects. The budget for a detailed design and authority application may be from 10 to 500 MEUR

13.2.7 Construction

Construction including procurement involves the physical implementation of the projects. This is the most comprehensive part of a project implementation and will involve a large work force on site and on manufacturer's sites. The budget may vary from typically 200 MEU to 10 BEUR for very large projects, e.g. Nord Stream.

13.2.8 Commissioning

The commission phase it the handing over from investment to operations. It typically includes tests and a slow increase of production. Often a number of adjustments have to be made to ensure optimal operation. Money wise it is a relatively small activity, but experience has shown that time wise it is important.

13.2.9 Capacity increase

After the start-up operation, there may be possibility for increasing capacity. For pipelines, this could include new compressor stations. This phase can be treated an expansion or as a part of the original project.

13.3 Stakeholder responsibility

Projects that have been granted Priority status should be responsible for providing information to be used by the monitoring tool. Whether it should be the individual stakeholders who should be responsible for updating the individual project information sheets, or if the should notify the publisher of the monitoring tool whenever they have changes in projects progress or information, is optional.

It is proposed that the information required for the monitoring tool is made mandatory for TEN E projects. Projects that are not TEN E projects could however have an interest in also being part of the overall map. Such projects could simply make the same information required by the Priority projects available and then be shown on the overall map. The map could indicate what projects are listed as Priority projects and which are not by using a colour code or it could say so in the information sheet.

Annexes - Natural Gas

1. Case Study: Nord Stream Gas Pipeline Project

In connection with developing a methodology for a better planning and quicker implementation of priority projects of European interest, this section provides a brief description of the permitting process for the Nord Stream gas pipeline project.

The Nord Stream project has been selected as a case study due to its cross-border status requiring permits in five different countries, four of them EU Member States, and Ramboll's direct involvement in the project providing first-hand knowledge of the different obstacles inherent in the current national permitting procedures.

Even though construction and operation of the pipeline require permits in all five countries, this case study will only provide detailed information on the permitting process and obstacles encountered for the three Scandinavian countries (Finland, Sweden and Denmark) as these are the responsibility of Ramboll. Russia and Germany fall outside the scope of Ramboll's work and information is therefore limited.

1.1 Project Description

To accommodate the future demand for gas in Europe as well as to ensure stability and reliability in Russian natural gas exports, the North European Gas Pipeline (NEGP) Project, now referred to as the Nord Stream gas pipeline project, was launched in the late 1990s as a joint venture initially between JSC Gazprom (51%), BASF AG (24.5%) and E.ON AG (24.5%).

In December 2000, Nord Stream became a priority project in the European Trans-European Energy Network (TEN-E) on the basis of ensuring diversification in supply sources and routes as well as meeting the European Community's demand for natural gas.

The planned offshore gas pipeline system will transport gas from Vyborg in Russia through the Gulf of Finland and the Baltic Sea to a landfall area at Greifswald in Germany. In addition to Russia and Germany, the pipeline will go through the Territorial Waters and/or Exclusive Economic Zones[40] (EEZ) of Finland, Sweden and Denmark, and run close to the EEZ of Estonia, Latvia, Lithuania, and Poland, see Figure 47.

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[40] An Exclusive Economic Zone (EEZ) is an area beyond and adjacent to a state's territorial waters, under which the rights and jurisdiction of the coastal state and the rights and freedoms of other states are governed by the relevant provisions of the 3rd UN Convention on the Law of the Sea (1982). An EEZ stretches out for 200 nautical miles from the coast, unless the countries agree otherwise.

Figure 47 Route of the Nord Stream Pipeline

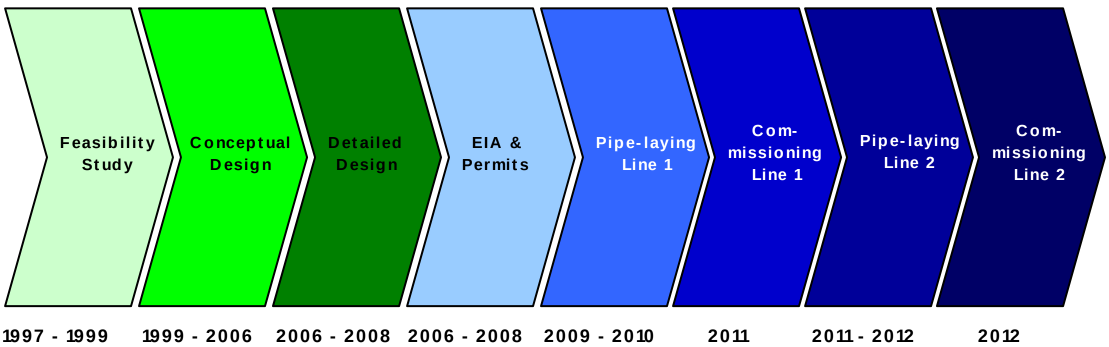
The system, comprising two parallel 48" (1,219mm in diameter) pipelines, will have a total capacity of 50 billion SM^3/Year.

The two pipelines will be installed on the sea bottom with a distance of approx. 50 meters. The sea bottom corridor directly affected by the pipelines, including the trench zone, will be approx. 100 – 150m wide. The total width of the affected corridor on the sea bottom following pipeline installation, including impacts from anchors used by the lay vessels, will be approx. 1,600m.

The transmission system is planned to be commissioned in 2010, initially with one single pipeline with an annual transmission capacity of approx. 27.5 bcm.

The project envisages laying a second pipeline, which will be taken into operation in 2012 and doubling the transmission capacity to approx. 50 bcm. Figure 48 below shows the time schedule for the development of the Nord Stream project, from planning to commissioning.

Figure 48 Time Schedule, Nord Stream Gas Pipeline Project



1.2 Regulatory Aspects

According to national legislations, an Environmental Impact Assessment (EIA) must be conducted to identify and assess environmental effects, compare alternatives, make plans for environmental management and design mitigation measures for any construction project.

Additionally, as a cross-border project Nord Stream is subject to international conventions, such as the Espoo Convention[41] on transboundary impacts and the International Co-operation for the Protection of the Marine Environment of the Baltic Sea governed by the Helsinki Commission[42].

1.2.1 Espoo Convention

The Espoo Convention on Environmental Impact Assessment in a Trans-boundary Context stipulates the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

Article 3 of the Espoo Convention states that "for a proposed activity that is likely to cause a significant adverse trans-boundary impact, the Party of origin shall, for the purposes of ensuring adequate and effective consultations under Article 5, notify any Party which it considers may be an affected Party as early as possible and no later than when informing its own public about that proposed activity. The Parties of Origin under the Espoo Convention for the Nord Stream project are Russia, Finland, Sweden, Denmark and Germany. Affected Parties include Estonia, Latvia, Lithuania and Poland.

Table 28 below provides a brief overview of the Espoo process.

Table 28 Espoo process

Parties of Origin notify all Affected Parties about the project by submitting a Project Information Document[43] (PID)
⇩
The Affected Parties circulate the PID among the relevant authorities in their

[41] The Espoo Convention was opened for signature in Espoo (Finland) on 25 February 1991 and came into force on 10 September 1997. 30 countries have signed the agreement. http://www.unece.org/env/eia/welcome.html

[42] The Helsinki Commission, or HELCOM, works to protect the marine environment of the Baltic Sea from all sources of pollution through intergovernmental co-operation between Denmark, Estonia, the European Community, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. http://www.helcom.fi/

[43] The Project Information Document describes the technical background and possible environmental impacts of Nord Stream project.

respective country and may conduct public consultations.
Whether public consultations shall take place is decided by the individual country in accordance with national legislation and procedures.

⇩

The Affected Parties respond to the Parties of Origin with a request to participate in the EIA and/or to be kept informed of the results.
The Parties of Origin then make provisions for including the Affected Parties in the transboundary EIA (Espoo EIA).

⇩

The Espoo EIA is submitted to the relevant authorities and any comments are reported back to the developer to be incorporated into a revised EIA and if requested additional mitigation measures are introduced.

1.2.2 National EIA Documentation

As stated above and according to the “European Union (EU) COUNCIL DIRECTIVE 97/11/EC of 3 March 1997 amending DIRECTIVE 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment”, an EIA is a pre-requisite for granting permits to construct a gas pipeline.

The EIA procedure ensures that environmental consequences of projects are identified and assessed before authorisation is given. The public can give its opinion and all results are taken into account in the authorisation procedure of the project. Hence, the EIA is an interactive process at the planning and design stage of the project, since it entails broad public consultations and coordination with official bodies of the Baltic Sea region countries which are in any way going to be affected by the Nord Stream project.

Four of the five countries directly implicated in the Nord Stream project are EU Member States having implemented the above mentioned EU EIA Directive in their national legislation.

Albeit a common overall framework following the implementation of the EU EIA Directive into national law ideally aligning community interest and thus facilitating analogous procedures and process of EIA documentation both Germany and Finland impose detailed and idiosyncratic procedures and formats. Sweden and Denmark are more flexible with Denmark accepting the Espoo EIA as the National EIA documentation.

1.2.3 National Permitting Legislation

As an offshore project Nord Stream is subject to the UN Convention on the Law of the Sea[44] (UNCLOS) – an international agreement on regulating the exploitation of the oceans.

The Convention states the rights of the coastal state over the sea adjacent to its shores. The UNCLOS also states the obligation of each coastal state to protect the marine environment.

Finland, Sweden, Denmark, Germany and Russia have ratified the UNCLOS and have implemented the necessary legislation for the territorial sea[45], the continental shelf[46] and the EEZ[47].

A brief overview of the key permitting legislation for construction of the Nord Stream pipeline is listed in Table 29 below.

Table 29 Overview of Key Legislation related to Permitting

State	Legislation in EEZ
Russia	Permits for construction and operation according to: • *The Act for Inside Sea Areas, Territorial Sea and Nearest Sea Water of the Russian Federation* • *The Act for the Exclusive Economic Zone of the Russian Federation* • *The Continental Shelf Act*
Finland	Permit for construction according to: • *The Water Act* Government Decision according to: • *The Law on the Finnish EEZ*

[44] http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm
[45] The territorial sea is the seabed and the waters up to 12 nautical miles from the baseline (roughly speaking the coast).
[46] The continental shelf comprises of the seabed and the subsoil of the submarine areas, and extends throughout the natural prolongation of its land territory to the outer edge of the continental margin or to a distance of 200 nautical miles from the baseline (roughly speaking the coast).
[47] The exclusive economic zone extends up to 200 nautical miles from the baseline (roughly from the coast) and comprises the subsoil, the seabed and the waters above.

Sweden	Permit to construct the pipeline: • *Act on the Continental Shelf*
Denmark	Permit to construct and operate a pipeline according to: • *Act on Continental Shelf as specified in Administrative Order on Pipeline Installation on the Danish Continental Shelf for Transport of Hydrocarbons*
Germany	Permit for construction in territorial water: • *Federal Energy Trade Law* Permit for construction in EEZ: • *Federal Mining Law*

1.3 Permitting Process

Nord Stream AG started its permitting process on 14 November 2006, when the company submitted the PID on the planned pipeline through the Baltic Sea to the responsible environmental authorities in Denmark, Finland, Germany, Russia, and Sweden in accordance with the Espoo Convention.

Since November 2006, the company has been in active and continuous dialogue with the environmental authorities and the public in the Baltic Sea region countries. A series of public presentations and consultations have been conducted aimed at explaining the economic, technical and environmental aspects of the project as well as answering questions and concerns of the public.

Until date, the company has received 129 comments from private and public bodies in the Baltic Sea countries (Denmark 5, Estonia 12, Finland 50, Germany 29, Latvia 1, Lithuania 1, Poland 1, Russia 1, and Sweden 29) which focus on the impact on the seabed and commercial fisheries as well as on dumped and residual munitions. These comments are to be analysed and incorporated into the final EIA report required under the Espoo Convention.

As illustrated in Table 30 below the permitting process, i.e. from the time the affected parties have been notified about the project to the permits have been issued, can take anywhere between 2-3 years.

Table 30 Generic Permitting Schedule

Step	**Explanation**	**Duration**
Notification	*PID submitted to relevant authorities*	
Screening	*Consultation with authorised bodies and the public about the project*	12 months

Scoping	*Defining the scope of the EIA programme, i.e. what information is to be included (geographical coverage, level of detail etc.)*	
Environmental Survey	*Environmental studies conducted for selected areas/issues, such as* • *Protected natural areas* • *Sites of chemical and explosive munitions dump sites* • *Water protection areas* • *Tourism and recreation sites* • *Spawning and fishing areas* • *Intensive shipping areas*	
EIA Submitted		
Authority Comments and Adjustment	*Authority review of EIA and requests for additional information to be included*	3 months
Public Consultation	*Consultation with the public about the content of the EIA*	3 months
Review and Assessment of Comments	*Incorporation of comments and supply of additional information if requested*	2 months
Final Approval of EIA	*Amended EIA re-submitted for final approval by the relevant authorities*	1 months
Permit Applications Submitted	*Technical permit application prepared and submitted*	
Authority Permit Preparation	*Authority review of technical permit applications*	3 – 8 months
Permit Issued	*Permit granted or declined*	

As evident from above Tables, the permitting process, EIA scope and time schedule for Denmark, Sweden and Finland vary somewhat.

In order to construct and operate an offshore pipeline within the Finnish EEZ, two permits must be obtained: A permit according to the EEZ Law and a permit according to Water Act. The former relates to installing and operating a pipeline, the latter to constructing a pipeline. The latter must be supplemented by an EIA.

The Finnish legislation stipulates time limits for processing of the permit applications by the relevant authorities – six months for the EEZ Law and eight months for the Water Act.

The main issue in Finland is whether the two applications can be submitted and subsequently reviewed in parallel or if they will be examined sequentially thereby extending the timeframe from eight to 14 months in total.

In Sweden a permit to construct and operate an offshore pipeline is obtained according to the Act on the Continental Shelf. Sweden has implemented the Espoo Convention in its national environmental legislation. However, no referral has been made to the Continental Shelf Act pertaining to the laying of pipelines on the Swedish continental shelf outside Swedish national territory. Thus, there is formally no requirement under Swedish law to establish an EIA for the application on laying the pipelines on the continental shelf.

Contrary to Finland Sweden has no regulation limiting the processing time for the authorities.

In Denmark the granting of permits is a two-step process the first relating to obtaining a permit to construct the pipeline the second to operate the pipeline once constructed. Similar to Sweden there is no regulation limiting the processing time, but given the authorities' large experience in offshore pipelines from the North Sea processing time is usually between three to four months.

As stated above, no national EIA for Denmark is required.

Both Russia and Germany have imposed time limits on the authorities for processing permit applications.

Table 31 Danish Permitting Process

Steps	Task	2006				2007				2008				2009				2010				2011				2012			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Notification – PID Submitted																												
2a	International Consultation (Espoo)																												
2b	Public Consultation (Planned Activity)																												
3	Espoo EIA – Draft Submitted																												
4	Authority Comments on Espoo EIA Draft																												
5a	Permit Application Submitted (Construction)																												
5b	Espoo EIA – Final Submitted																												
6	Authority Review for Completeness																												
7	International Consultation (Espoo)																												
8	Submission of Additional Info (Final EIA)																												
9	Authority Permit Preparation (3 months)																												
10	Permit Issued/Granted																												
11	Construction																												
12	Permit Application Submitted (Operation)																												
13	Authority Permit Preparation (1 month)																												
14	Permit Issued/Granted																												
15	Operation																												

Table 32 Swedish Permitting Process

Steps	Task	2006				2007				2008				2009				2010				2011				2012			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Notification – PID Submitted																												
2a	International Consultation (Espoo)																												
2b	Public Consultation (Planned Activity)																												
3	Espoo EIA – Draft Submitted																												
4	Authority Comments on Espoo EIA Draft																												
5	Permit Application and National EIA Documentation Submitted (Pipeline)																												
6	Authority Review for Completeness – Permit Application and National EIA																												
7	Submission of Additional Info (National EIA)																												
8	Espoo EIA – Final Submitted																												
9	International Consultation (Espoo)																												
10	Submission of Additional Info (Final Espoo EIA)																												
11	Authority Permit Preparation (8½ months)																												
12	Permit Issued/Granted																												
13	Construction																												
14	Operation																												

Planned/Anticipated Review Period

Table 33 Finnish Permitting Process (Parallel Submission of Permit Applications)

Steps	Task	2006				2007				2008				2009				2010				2011				2012			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Notification – PID Submitted																												
2a	International Consultation (Espoo)																												
2b	Public Consultation (Planned Activity)																												
3	Espoo EIA – Draft Submitted																												
4	Authority Comments on Espoo EIA Draft																												
5	National EIA – Draft Submitted																												
6	Authority Review – National EIA Draft																												
7a	National EIA – Final Submitted																												
7b	Espoo EIA – Final Submitted																												
8	Authority Review – National EIA Final																												
9	Public Consultation (National EIA)																												
	International Consultation (Espoo EIA)																												
	Authority Statement Preparation (National and Espoo EIA) (3 months)																												
	Authority Statement Issued																												
8a	Permit Application Submitted (EEZ Law)																												
8b	Permit Application Submitted (Water Act)																												
	Authority Permit Preparation – EEZ Law (6 months)																												
	Authority Permit Preparation – Water Act (8 months)																												
	Permit Issued/Granted (EEZ Law)																												
	Permit Issued/Granted (EEZ Law)																												
	Construction																												
	Operation																												

1.4 Obstacles Encountered

Overall, the international and national political agendas have proved to be the main problem to overcome coupled with inexperienced and unprepared national authorities.

As stated above Nord Stream received EU priority status in year 2000, but even six years later, when the permitting process commenced the affected countries still had not accepted the EU's decision and no national planning had been done to ease the permitting process. This is reflected in insufficient or outdated legislation in place.

In Finland, the EEZ legislation is new and Nord Stream is the first project to apply for a permit according to this law.

In Sweden, a permit for an offshore project is, as stated above, done according to the Act on the Continental Shelf. However, this Act does not require the inclusion of an EIA, whereby Sweden is dependant on the Espoo EIA to provide the necessary information.

However, the Espoo EIA is legally only to provide information on transboundary impacts not a complete EIA for the entire project. But since Denmark has agreed to have the Espoo EIA substitute a national EIA, the country requires a more complete Espoo EIA than traditionally envisaged.

Even after having agreed to a complete Espoo EIA differences remain between the affected countries as to the content and level of detail. Germany wants a very detailed and technical Espoo EIA since the project passes through Natura 2000 areas. Finland, on the contrary, is more concerned about the public perception and thus wants an easily readable Espoo EIA which is not too technical and detailed, but contains all relevant and important information.

2. List of stakeholders providing comments on Nord Stream

Table 34 Stakeholders providing comments on the Nord Stream Project, listed according to stakeholder group

Country	State Authorities	Regional Authorities	Research Institutes	NGOs	Other Organisations	Private Persons
Denmark	Danish Energy Agency Danish Maritime Authority Danish Ministry of the Environment Heritage Agency of Denmark The Royal Danish Admin. of Navigation and Hydrography	Bornholms Regionskommune				
Estonia	Ministry of Foreign Affairs Ministry of the Environment Ministry of Economic Affairs		Commission for Natura Conservation of the Estonian Academy of Sciences Stockholm Environment		Estonian Fund for Nature	Ants Erm Mihkel Veiderma

	and Comm. Ministry of Economy Ministry of Social Affairs Estonian Rescue Board Dept. of Crisis Regulation Maritime Admin.		Institute – Tallinn Centre Tallinn Uni. of Technology			
Finland	Finnish Forest Authority Finnish Maritime Admin. Ministry of Agriculture and Forestry Ministry of the Environment Ministry of Foreign Affairs Ministry of Trade	Cities of Espoo, Hanko, Hamina, Helsinki, Kaarina, Kotka, Loviisa and Parainen Employment and Regional Development Centre for Uusimaa and South-West Finland Government of Åland Municipal	Finnish Environment Institute Finnish Institute of Maritime Research	Finnish Association for Nature Conservation Finnish WWF ProKarelia	Community of Ingå Hamina Town Council The Finnish Professional Fishing Association	

	and Industry Ministry of Transport and Communications Geological Survey of Finland Metsähallitus National Board of Antiquities Safety Technology Authority	Executive Board of Virolahti Regional Council of Eastern Uusimaa Regional Council of ItÄ-Uusimaa Regional Council of Kymenlaakso Regional Council of South-West Finland South-East and South-West Finland Regional Environment Centres Southern Finland Regional Environment Centre State Provincial Offices of Southern and Western Finland				

Germany	Federal Agency for Nature Conservation Military Admin. The Federal Environment Agency Waterways and Shipping Directorate North	Administrative District of Eastern West Pommerania Ministry of the Economy, Labour and Toursim of Mecklenburg-Western Pomerania State Angling Association Mecklenburg-Western State Bureau for Central Police Functions and Technology, Fire-Safety and Civil Defense, Mecklenburg-Western Pomerania State Bureau for Culture Preservation of Historical Monuments and Artefacts Mecklenburg-	Federal Fisheries Research Institute	WWF Germany	AWE GmbH Baltic Sea Resort of Binz Deutsche Telekom AG	

		Western Pomerania State Bureau for the Environment and Nature, Rostock State Bureau for the Environment and Nature Stralsund State Bureau for the Environment and Nature Uckermünde State Forestry Admin. Mecklenburg Western Pomerania				
Latvia	Latvijas Republikas Vides Ministrija					
Lithuania	Ministry of the Environment					

Poland	Ministry of the Environment					
Sweden	Ministry of Environment Ministry of Energy, Enterprise and Communications National Board of Housing, Building and Planning Geological Survey of Sweden Swedish Armed Forces Swedish Board of Fisheries Swedish Coast Guard Swedish Emergency Management Agency Swedish Energy	County Admin. Board of Blekinge County Admin. Board of Gotland County Admin. Board of Kalmar County Admin. Board of Skåne County Admin. Board of Stockholm Gotland District Council Bleking Environmental Federation Kristianstad District Council Mörbilånga District Council	FOI Swedish Defence Research Agency Gotland University Swedish Meterorological and Hydrographic Institute Swedish University of Agricultural Sciences		Gotland Fishing Association Swedish Fishermen's Federation Swedish Gas Association The Swedish Green Party Väröhus Foundation	Gunnel Bergstroem

	Agency Swedish Environmental Protection Agency Swedish Marine Admin. Swedish Maritime Admin. Swedish National Heritage Board Swedish Rescue Service Agency	Municipality of Trelleborg Oskarshamn District County Provincial Admin. Board, Gotland Province Pronvicial Admin. Board, Kalmar Province Provincial Admin. Board, Södermanland Province Provincial Admin. Board, Stockholm Province				

3. Storage investments

Table 35 storage investment

Project	Country
Schonkirchen Tief	AUSTRIA
Haidach	AUSTRIA
Haidach	AUSTRIA
Loenhout	BELGIUM
Poederlee	BELGIUM
Chiren	BULGARIA
Not specified	CZECH REPUBLIC
Stenlille	DENMARK
Stenlille	DENMARK
Céré La Ronde/Soings	FRANCE
Céré La Ronde/Soings	FRANCE
Etrez/Manosque	FRANCE
Etrez/Manosque	FRANCE
Hauterives	FRANCE
Ile-de-France Nord/Gournay	FRANCE
Ile-de-France Nord/Gournay	FRANCE
Alsace Sud	FRANCE
Trois Fontaines	FRANCE
Izaute/Lussagnet	FRANCE
Pécorade	FRANCE
Etzel	GERMANY
Etzel	GERMANY
Anzing	GERMANY
Wielen	GERMANY
Berhringen	GERMANY
Peckensen Phase 2	GERMANY
Peckensen Phase 3	GERMANY
Kiel-Ronne	GERMANY
Epe	GERMANY
Epe 2A	GERMANY
Huntorf	GERMANY
Nuentermoor	GERMANY
Ruedersdorf	GERMANY
Reckrod	GERMANY
Empelde	GERMANY
Epe	GERMANY
Xanten	GERMANY
Wolfersberg	GERMANY
Frankenhal	GERMANY
Epe	GERMANY
Bernburg	GERMANY
Jemgum	GERMANY
Reckrod-Walf	GERMANY
Szoereg	HUNGARY

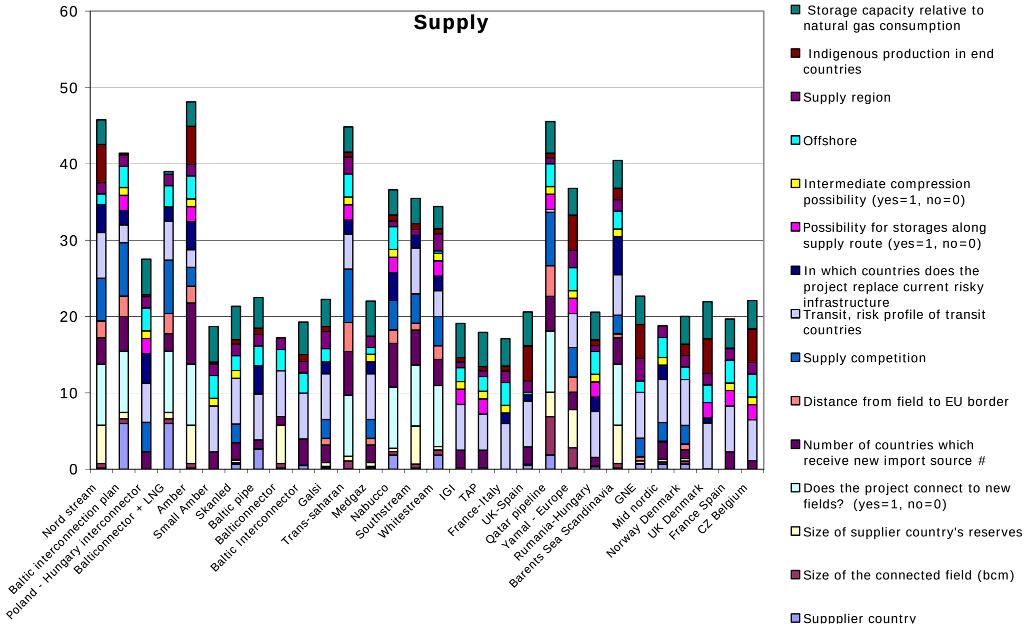
Zsana	HUNGARY
Cellino & Collato	ITALY
Cotignola & San Potito	ITALY
Not specified	ITALY
Cugno Le Macine	ITALY
Cornegliano	ITALY
Bordolano	ITALY
Caleppio-Merlino	ITALY
Cignone	ITALY
Cortemaggiore Pool C	ITALY
Fiume Treste BCC1	ITALY
Fiume Treste C2	ITALY
Fiume Treste DEE0	ITALY
Ripalta	ITALY
Sergnano	ITALY
Incukalns	LATVIA
Not specified	LITHUANIA
Bergermeer	NETHERLANDS
Zuidwending	NETHERLANDS
Zuidwending	NETHERLANDS
Bonikowo	POLAND
Daszewo	POLAND
Kosakowo	POLAND
Mogilno	POLAND
Strachocina	POLAND
Wierzchowice	POLAND
Carrico	PORTUGAL
Nades-Prod-Seleus	ROMANIA
Roman-Margineni	ROMANIA
Tirgu-Mures	ROMANIA
Banatski Dvor	SERBIA
Barcelona	SPAIN
Huelva	SPAIN
Cartagena	SPAIN
Bilbao	SPAIN
Sagunto	SPAIN
Musel (Gijon)	SPAIN
Ferrol	SPAIN
Gran Canaria	SPAIN
Tenerife	SPAIN
Castor	SPAIN
Gaviota	SPAIN
Marismas	SPAIN
Poseidon	SPAIN
Yela	SPAIN
Las Barreras	SPAIN
El Ruedo	SPAIN
Fleetwood	UK
Bains	UK
British Salt	UK

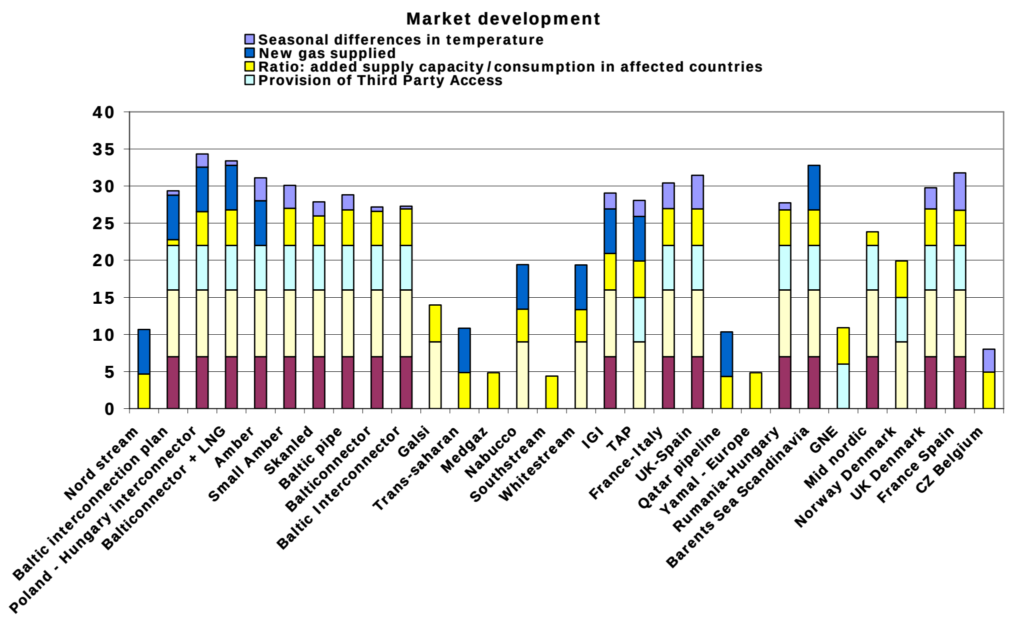
Hewett	UK
Hole House phase 2	UK
Isle of Portland	UK
Holform (formerly Byley)	UK
Whitehill Farm	UK
Stublach	UK
Humbly Grove	UK
Albury Phase 1	UK
Albury Phase 2	UK
Welton / Scampton North	UK
Bletchingley	UK
Esmond / Gordon	UK
Aldbrough phase 1	UK
Aldbrough phase 2	UK
Gateway	UK
Caythorpe	UK
Saltfleetby	UK

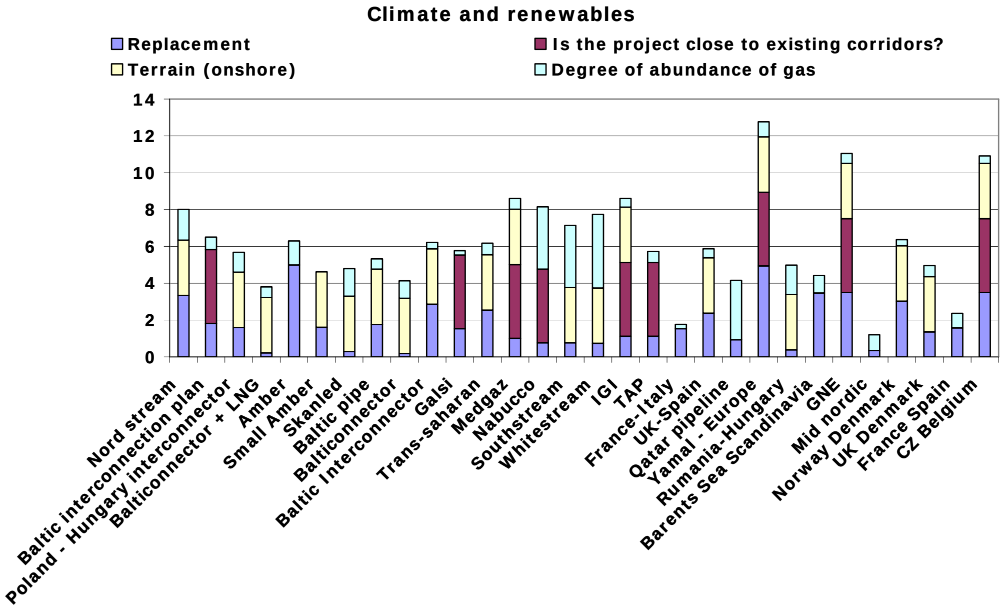
Source: GSE investment database

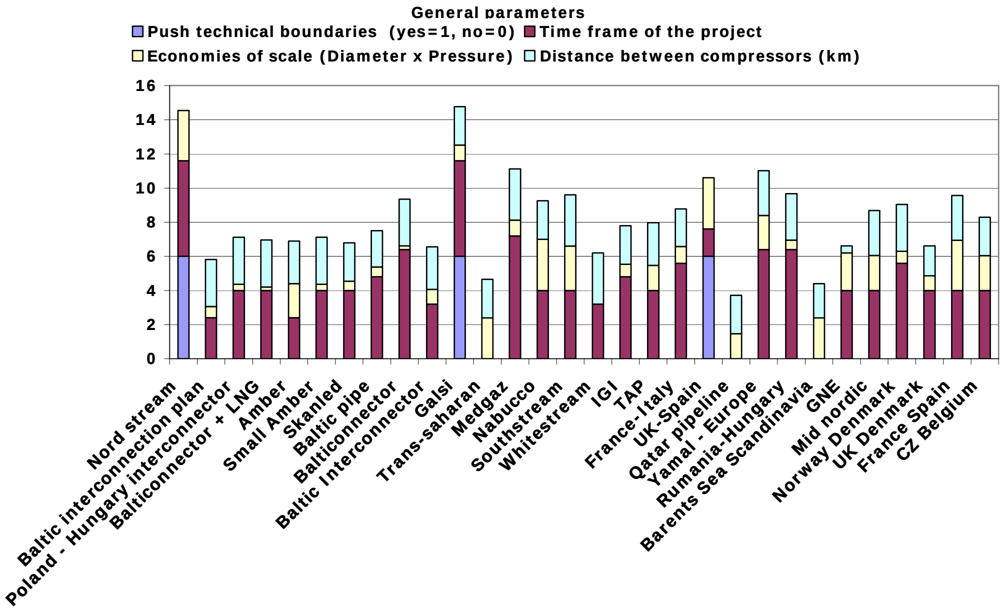
4. Multi criteria analysis diagrams

4.1 Security of supply scenario

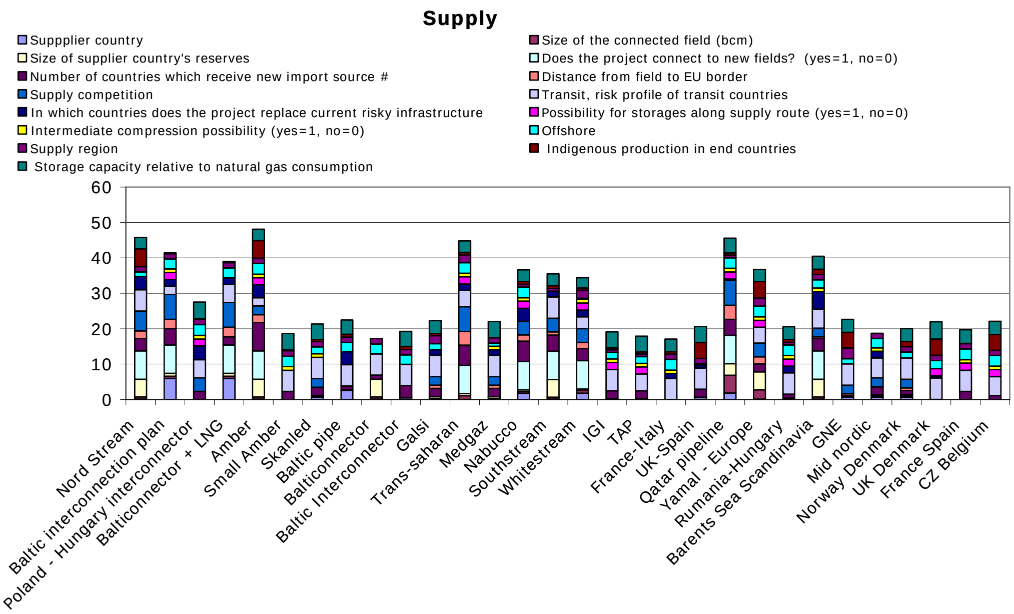


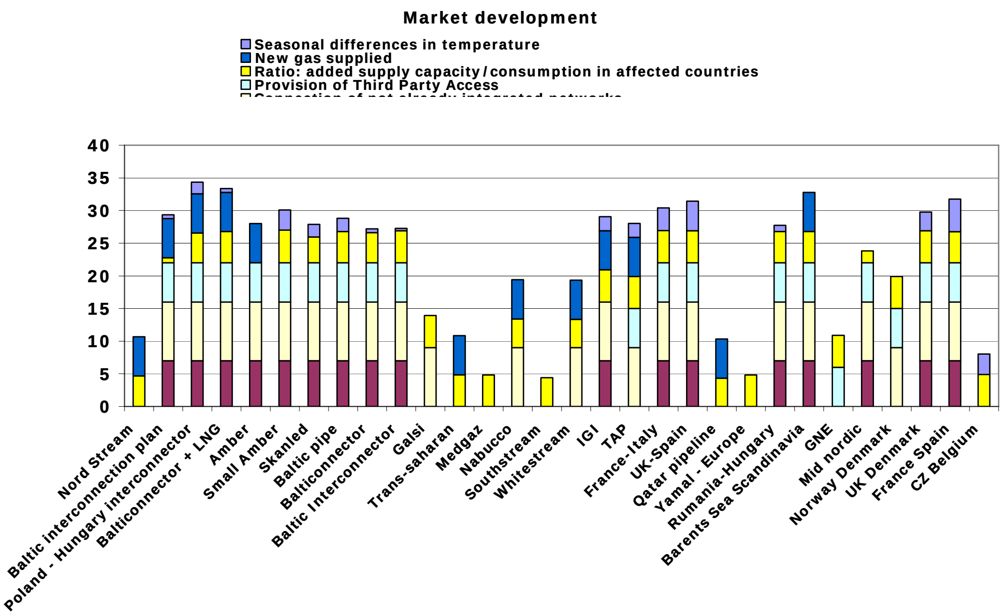


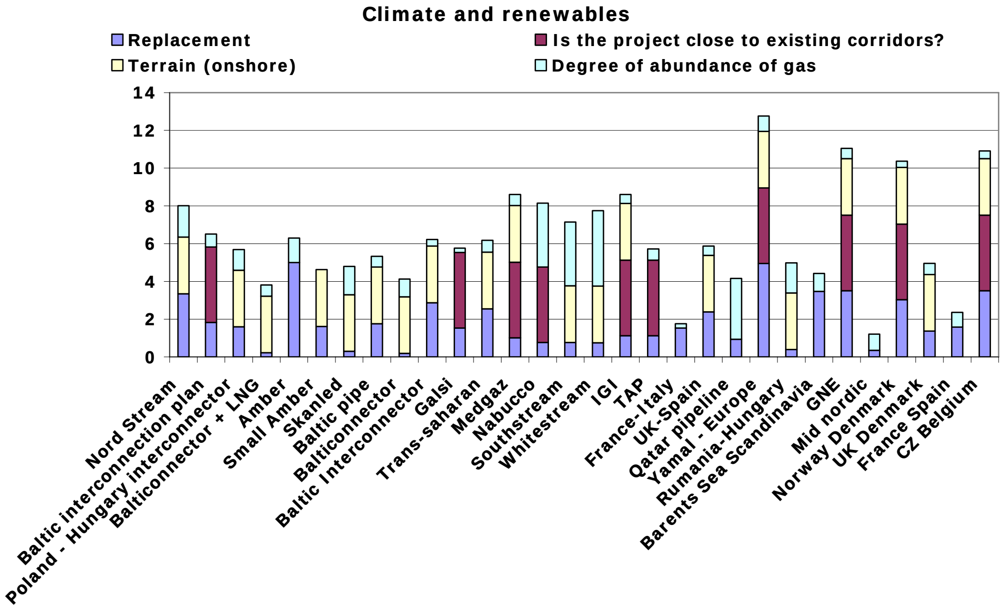

Climate and renewables
Replacement
Is the project close to existing corridors?
Terrain (onshore)
Degree of abundance of gas
0
2
4
6
8
10
12
14
Nord stream
Baltic interconnection plan
Poland - Hungary interconnector
Balticonnector + LNG
Amber
Small Amber
Skanled
Baltic pipe
Balticonnector
Baltic Interconnector
Galsi
Trans-saharan
Medgaz
Nabucco
Southstream
Whitestream
IGI
TAP
France-Italy
UK-Spain
Qatar pipeline
Yamal - Europe
Rumania-Hungary
Barents Sea Scandinavia
GNE
Mid nordic
Norway Denmark
UK Denmark
France Spain
CZ Belgium


General parameters
Push technical boundaries (yes=1, no=0)
Time frame of the project
Economies of scale (Diameter x Pressure)
Distance between compressors (km)
0
2
4
6
8
10
12
14
16
Nord stream
Baltic interconnection plan
Poland - Hungary interconnector
Balticonnector + LNG
Amber
Small Amber
Skanled
Baltic pipe
Balticonnector
Baltic Interconnector
Galsi
Trans-saharan
Medgaz
Nabucco
Southstream
Whitestream
IGI
TAP
France-Italy
UK-Spain
Qatar pipeline
Yamal - Europe
Rumania-Hungary
Barents Sea Scandinavia
GNE
Mid nordic
Norway Denmark
UK Denmark
France Spain
CZ Belgium

4.2 Market scenario






Climate and renewables
Replacement
Is the project close to existing corridors?
Terrain (onshore)
Degree of abundance of gas
Nord Stream
Baltic interconnection plan
Poland - Hungary interconnector
Balticonnector + LNG
Amber
Small Amber
Skanled
Baltic pipe
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Barents Sea Scandinavia
GNE
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UK Denmark
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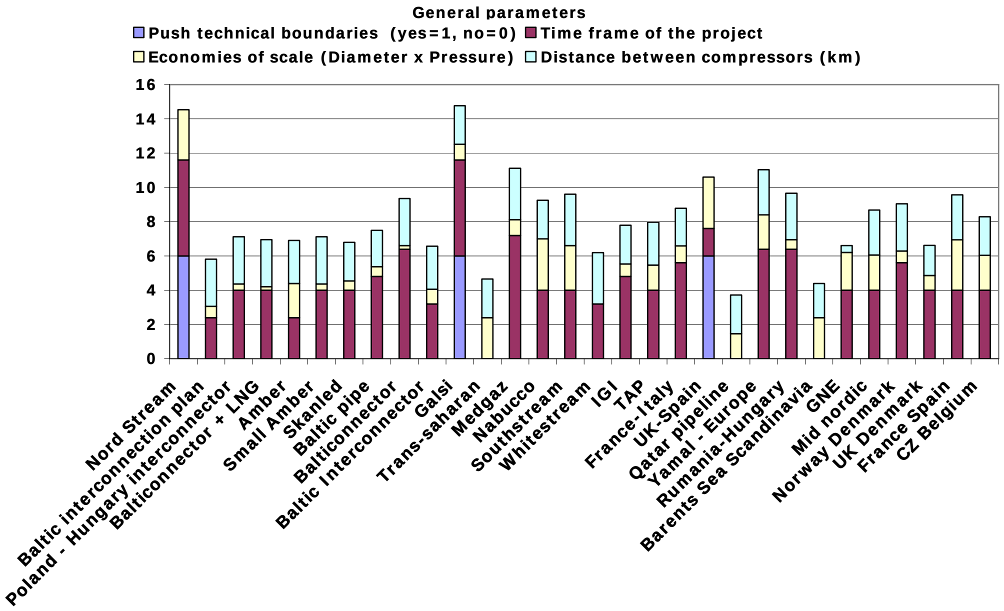
General parameters
Push technical boundaries (yes=1, no=0)
Time frame of the project
Economies of scale (Diameter x Pressure)
Distance between compressors (km)
Nord Stream
Baltic interconnection plan
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France-Italy
UK-Spain
Qatar pipeline
Yamal - Europe
Rumania-Hungary
Barents Sea Scandinavia
GNE
Mid nordic
Norway Denmark
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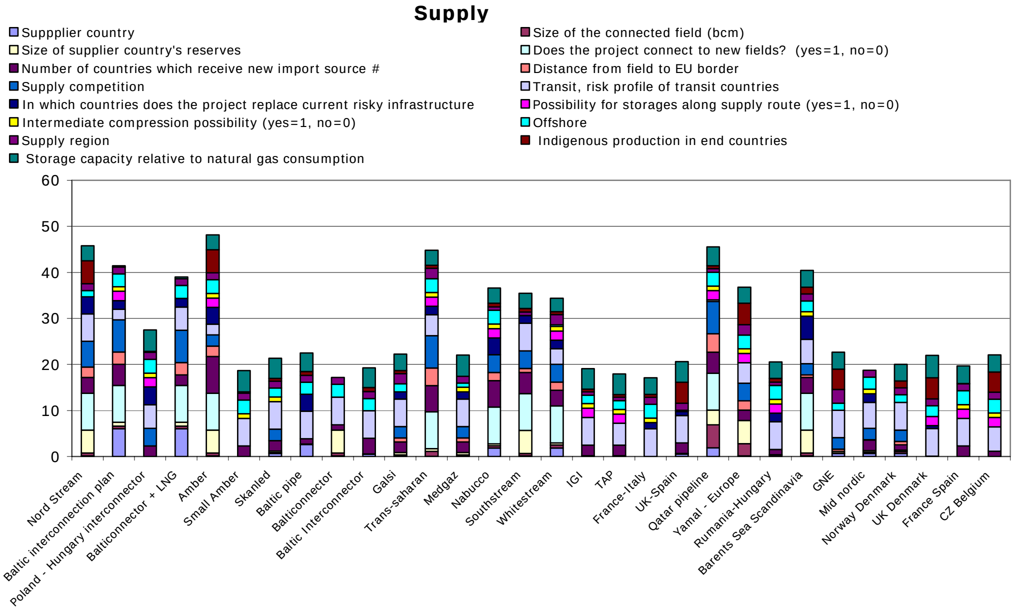
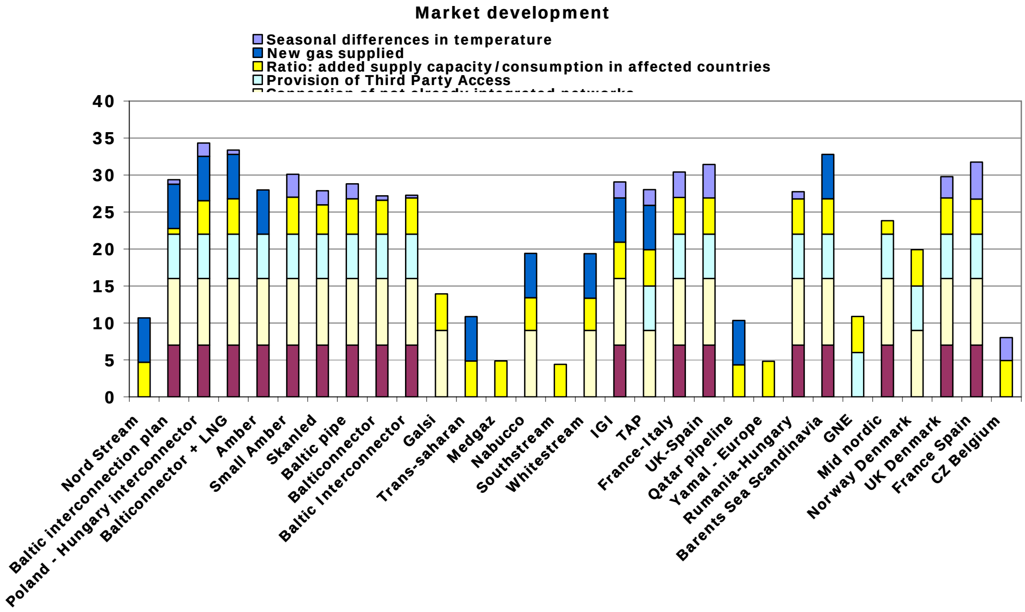
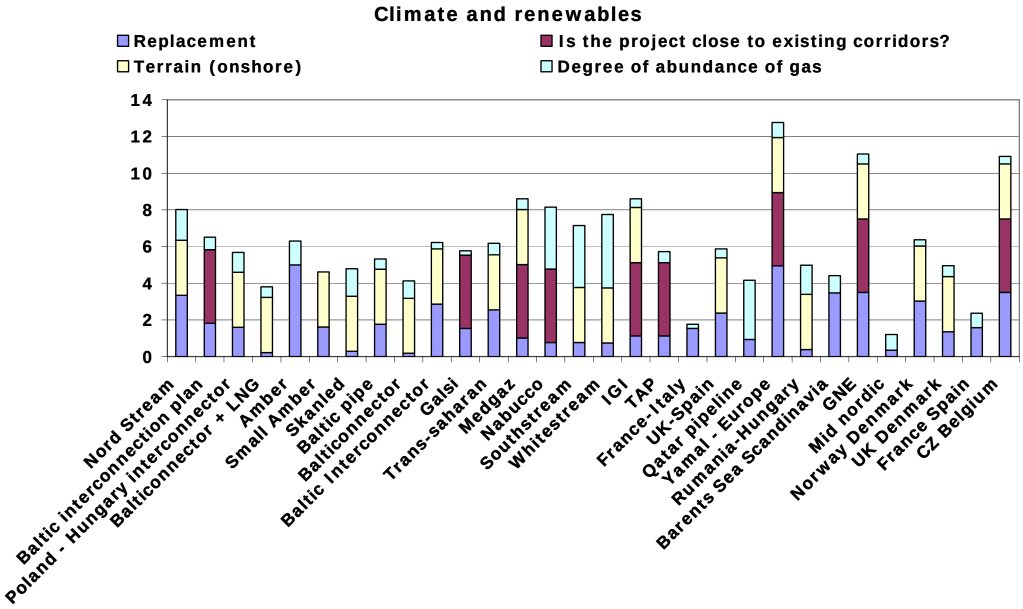
CZ Belgium

4.3 Climate and environment






Climate and renewables
Replacement
Is the project close to existing corridors?
Terrain (onshore)
Degree of abundance of gas
0
2
4
6
8
10
12
14
Nord Stream
Baltic interconnection plan
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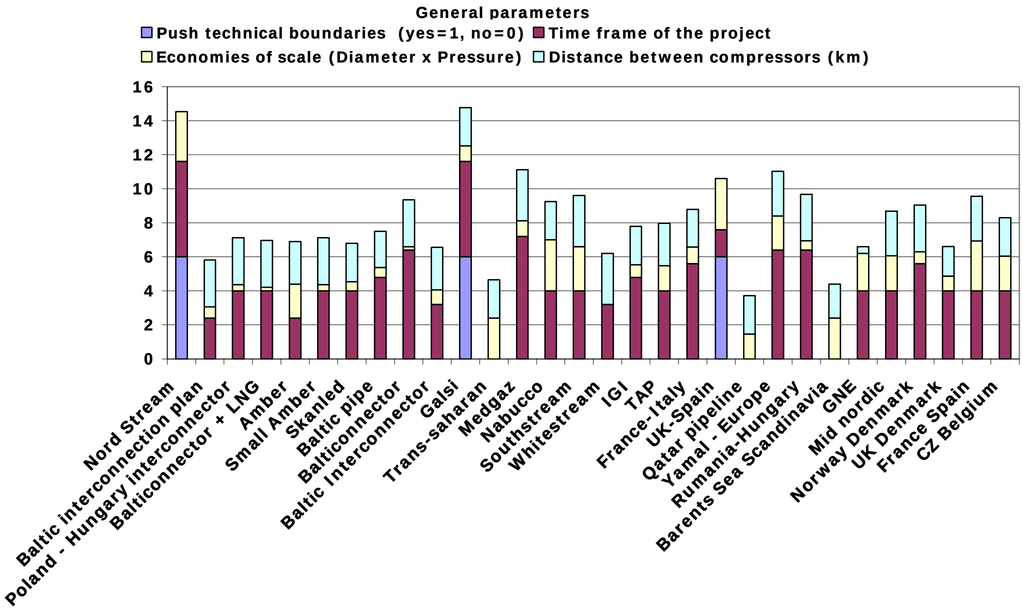
General parameters
Push technical boundaries (yes=1, no=0)
Time frame of the project
Economies of scale (Diameter x Pressure)
Distance between compressors (km)
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Norway Denmark
UK Denmark
France Spain
CZ Belgium