TRANS-EUROPEAN
ENERGY NETWORKS

TEN-E priority projects

Directorate-General
for Energy and Transport

EUROPEAN
COMMISSION

The European Commission's Directorate-General for Energy and Transport develops and implements European Union policy in these closely linked areas. The 2000 Green Paper entitled 'Towards a European strategy for the security of energy supply' analysed Europe's structural weaknesses in this field: energy consumption is rising, while the EU is becoming increasingly dependent on external sources of energy. At the same time, to respect its commitments under the Kyoto Protocol, the EU must reduce its production of greenhouse gases. The Green Paper proposes a strategy to reduce energy consumption in Europe, through improved energy efficiency and market integration as well as to increase the use of renewable energy sources. Improving the trans-European energy networks is a crucial element in the overall strategy for improving the efficiency of Europe's energy systems, increasing security and flexibility of energy supply and transmission networks, and supporting economic and social development across the Union.

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Energising Europe's infrastructure

Reliable energy supplies are vital for European consumers, whether for industrial, domestic or transport uses, and are an essential element in a well-functioning society. The wide-ranging energy demands in Europe make energy infrastructure critical for the development of energy markets and the economy as a whole. The trans-European energy networks are integral to the European Union's overall energy policy objectives, including reinforcing security of supply, increasing competitiveness and protecting the environment. The internal market – based on free movement of goods, people, services and capital – is fundamental to the EU, and upgrading our energy networks is a prerequisite to an effective European energy market.

Currently, about one-quarter of European energy consumption is based on natural gas. Recent predictions suggest that gas demand in the EU will more than double by 2030, and meeting this demand will require significant increases in gas-import capacity.

I also hope that we shall be able to contribute to a reduction in carbon dioxide emissions through a move from energy consumption of other fossil fuels to the greater use of the cleaner natural gas.

As we rely on third countries for a huge part of our supply – and this share is growing – new transit routes, for natural gas in particular, are needed. These will allow us to diversify supplies, and so reduce our dependence on individual third countries. We shall therefore be working closely with our neighbouring countries to facilitate this and to include these links in the trans-European energy networks.

Electricity generation on the other hand has to be precisely matched with demand at any given time, and transmission capacity (the weakest point in the system) must be sufficient for peak demand or there is a risk of large-scale blackout. Recent experiences have shown that increases in generation capacity to meet growing demand have to be matched by upgraded transmission capacity. Electricity networks have developed on the basis of centralised generation and national, monopoly provision and significant bottlenecks – including natural barriers such as mountains and sea – limit the interconnections between Member States.

A single European energy market requires that energy networks cross national boundaries freely. Successful opening of the internal energy market, with the associated benefits of increased competitiveness for European consumers, requires a major increase in interconnections between national networks.

The trans-European energy networks programme identifies the missing links and the bottlenecks on the network and we have identified priority routes that are in need of upgrading. It is likely though that the new infrastructure required will take 5 to 10 years from planning to entry into service and with EU enlargement bringing in 10 new Member States, we have already taken steps to ensure that these countries will be fully connected to the trans-European energy networks and our proposal of December 2003 includes additional priority projects to ensure that these new Member States are fully implicated in EU energy policies.

This brochure presents the projects identified as priorities by the EU institutions, showing the ambitious goals we have set ourselves. We must reach them, or European citizens will face a future with much less dependable energy supplies.

Loyola de Palacio
Vice-President of the European Commission,
responsible for energy and transport

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Developing adequate and flexible energy networks for Europe

European society and industry are dependent more than ever on the availability of energy supplies and on the good functioning of energy transmission networks. Our standards of living, our healthcare and our jobs – evermore so in the knowledge-based economy – are all fundamentally reliant on reliable energy supplies. The power cuts and electricity blackouts which occurred in several parts of Europe in 2003 demonstrate the need to strengthen energy networks in Europe, to establish sufficient generation capacity, and most importantly to provide alternative transmission routes so that isolated incidents on the networks are less likely to have devastating consequences on a larger scale.

Serving the European energy market

The development of an integrated European internal energy market means that supplies of electricity and natural gas should be better matched to demand across Europe, but a crucial element for this internal market to function efficiently is the availability of secure, reliable networks to transport energy supplies to the load centres. Today, Europe's energy networks are the legacy of national systems, built for the needs of individual countries. In many cases, relatively short connections across frontiers are needed to open up alternative energy supply routes. In other cases, in particular in countries which are sited on major transit routes, existing infrastructure needs to be upgraded to carry larger loads. Upgrades are often needed to allow the possibility of backflow (i.e. two-way transmission) in existing one-way connections, increasing the flexibility of the network.

Electricity cannot be stored easily, and so, in contrast to natural gas or crude oil, it is not a primary energy source but an energy carrier. The electricity transmission system in use throughout western and central Europe (UCTE) forms a synchronous system, with all elements tied together by electromagnetic links. The extension of this basic synchronous system to the countries of eastern Europe, which operate different technical standards, constitutes a major task.

Connecting renewable sources

The European Union needs to increase the proportion of energy use from renewable sources, in order to respect its Kyoto Protocol commitments. But renewable energy sources are often found in remote locations, far from traditional power stations and consumption centres. Renewable sources need to be connected to electricity transmission networks, not just within individual Member States, but on a more global scale to permit the efficient trading of electricity from renewable sources on the internal energy market.

Reinforcing security of supply

In 2000, the Commission adopted a Green Paper entitled 'Towards a European strategy for the security of energy supply'. This analysis showed that the Union will become increasingly dependent on energy sources in third countries, even if more energy-saving measures are introduced. In this context, the trans-European energy networks will play a significant role in increasing efficiency of energy systems, in developing additional supply routes from third countries and in increasing the proportion of energy from renewable sources within the EU as part of the strategy to respond to the challenge of climate change.

Improving security of energy supply from outside the Union requires existing links to be upgraded in many cases, but the EU also needs to develop additional and alternative routes for supplies from both existing and new third-country partners, notably to fulfil rapidly-increasing demands for natural gas. The development of alternative routes will reduce our dependence on individual countries for energy supplies, increase flexibility, and develop competition in the internal energy market. For these reasons, the trans-European networks are as concerned with links to and from third countries as they are with links within the EU and with the new Member States.

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Agreeing policy guidelines in the European Union

The first set of guidelines for trans-European energy networks was adopted by the Council and European Parliament in June 1996. They have been amended three times, most substantially in June 2003 ([1]), to reflect the development of the internal market for electricity and gas supplies. In particular, these new guidelines set out priority projects – which are described in detail throughout this brochure – which have been identified as the most important for security of supply or for the competitive operation of the internal energy market.

Integrating the new Member States

In December 2003 ([2]), the Commission proposed to update the lists of priority projects – which have first call on EU funds – to take account of the new frontiers of the EU following the May 2004 enlargement. In fact, in some cases the new Member States are already connected to EU networks. For example, Poland and the Czech Republic are already exporting electricity to Germany and Italy, but the connections used have limited capacity and are saturated most of the time. In other cases, notably that of the Baltic States, connections with existing or new EU Member States need to be built.

Investing in the future

The projects described in this brochure – which are only those on the priority axes – demonstrate the scale of investment needed to realise the full trans-European energy networks. Funding may be available from the EU for the networks, but mainly for preparatory measures, such as feasibility studies and pre-construction development. Building and maintaining the networks must be the preserve of energy transmission companies. The scale of commitment required is large, reaching EUR 28 billion for the priority energy network projects to be constructed in the period 2007–13, but as this brochure aims to demonstrate, in the medium and longer term, there are significant benefits to be gained from completing these projects.

1) Decision No 1229/2003/EC of the European Parliament and of the Council of 26 June 2003 laying down a series of guidelines for trans-European energy networks and repealing Decision No 1254/96/EC, OJ L 176, 15.7.2003, pp.11–28.

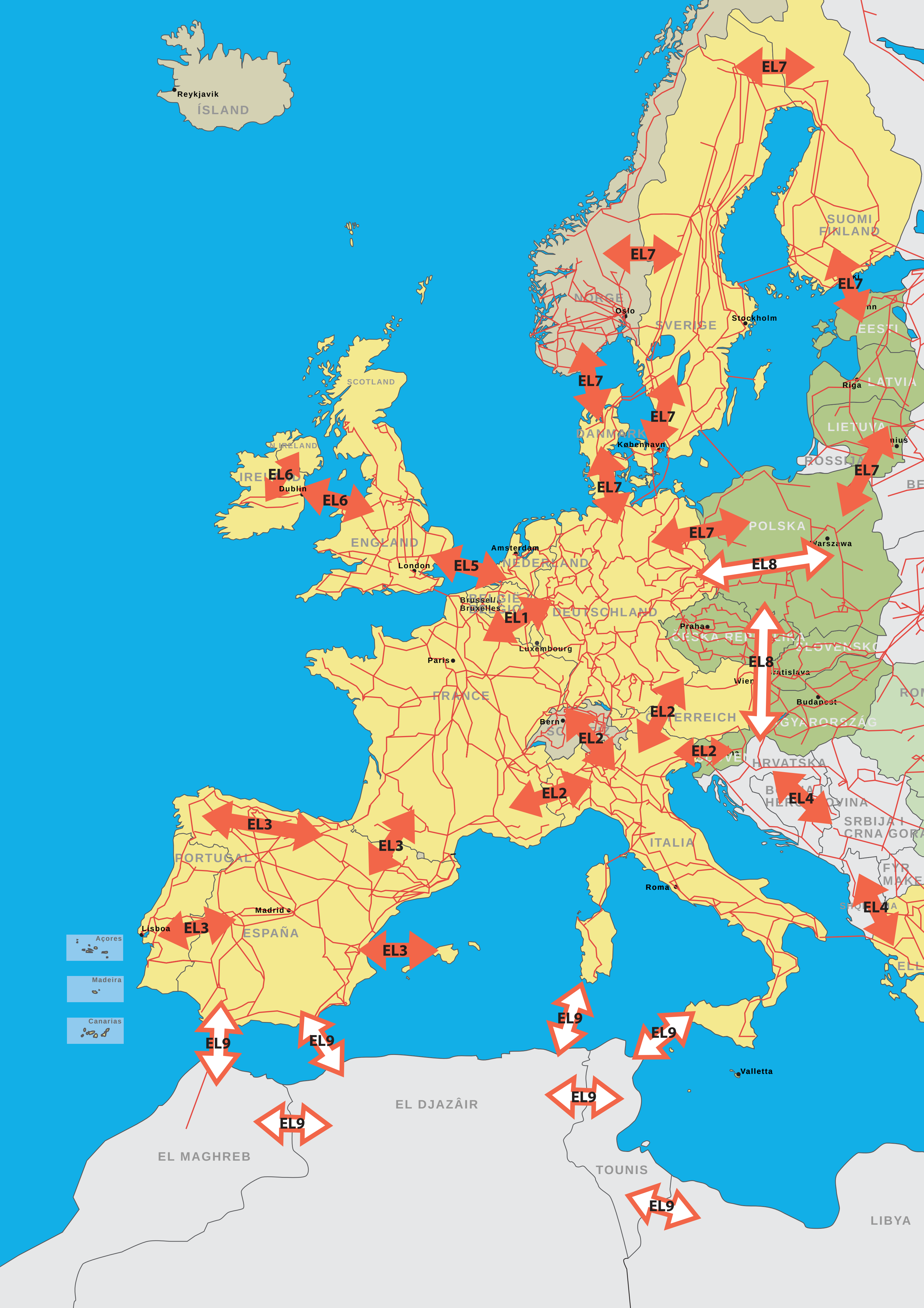
2) Proposal for a decision of the European Parliament and of the Council laying down guidelines for trans-European energy networks and repealing Decision Nos 96/391/EC and 1229/2003/EC, COM(2003) 742 final, 10.12.2003.

Priority axes for energy networks

A number of axes where priority should be given to upgrading/extension projects have been identified and agreed by the European Union's institutions. These are key transmission routes which need to be strengthened to ensure that the internal market for energy functions efficiently and/or to ensure secure supplies of energy to the Union from third countries. Projects which meet the criteria of 'projects of common interest' (see pages 38–41) and fall on one of these priority axes receive priority for the grant of financial aid under the trans-European networks budget.

The list of priority axes needs to be extended to take account of the new situation brought about by EU enlargement in May 2004. The 10 new Member States need to be effectively connected to the internal energy market. Furthermore, links with neighbouring countries need to be reassessed for the Union's new post-enlargement frontiers. As a result, the Commission proposed, in December 2003, two additional priority axes for electricity networks and one additional priority axis for gas networks, together with appropriate extensions of the existing axes.

On the following pages, the agreed as well as proposed priority axes are shown on maps of the European electricity and natural gas networks respectively. The main body of the brochure provides detailed information on the priority projects corresponding to each of the priority electricity and gas axes.



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Electricity networks – axes for priority projects

Electricity priority projects already agreed:

EL 1	France–Belgium–Netherlands–Germany
EL 2	Borders of Italy with France, Austria, Slovenia and Switzerland
EL 3	France–Spain–Portugal
EL 4	Greece–Balkan countries–UCTE System
EL 5	United Kingdom–continental and northern Europe
EL 6	Ireland–United Kingdom
EL 7	Denmark–Germany–Baltic Ring

Proposed additional electricity priority projects:

EL 8	Germany–Poland–Czech Republic–Slovakia–Austria–Hungary–Slovenia
EL 9	Mediterranean Member States – Mediterranean electricity ring

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NORGE
Oslo
SVERIGE
Stockholm
SUOMI
FINLAND
Helsinki
Tallinn
EESTI
Riga
SCOTLAND
IRELAND
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ENGLAND
London
DEUTSCHLAND
Berlin
POLSKA
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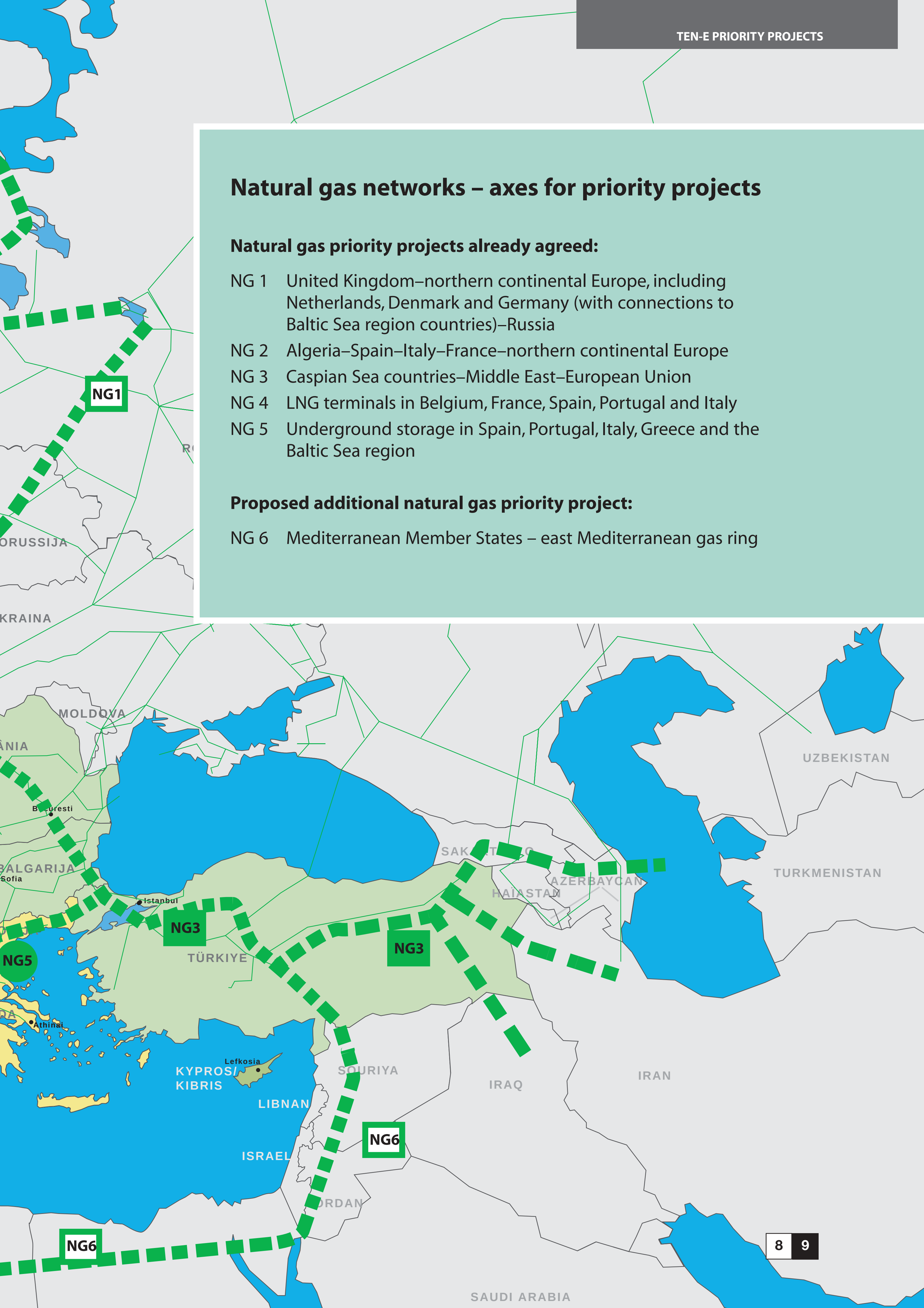


Natural gas networks – axes for priority projects

Natural gas priority projects already agreed:

NG 1 United Kingdom–northern continental Europe, including Netherlands, Denmark and Germany (with connections to Baltic Sea region countries)–Russia

NG 2 Algeria–Spain–Italy–France–northern continental Europe

NG 3 Caspian Sea countries–Middle East–European Union

NG 4 LNG terminals in Belgium, France, Spain, Portugal and Italy

NG 5 Underground storage in Spain, Portugal, Italy, Greece and the Baltic Sea region

Proposed additional natural gas priority project:

NG 6 Mediterranean Member States – east Mediterranean gas ring

Electricity network reinforcement in France–Belgium–Netherlands–Germany

The Benelux region suffers from serious congestion in electricity flows, with high flows occasionally causing problems in the network. This project will reinforce connections in Benelux, improving service in the region and allowing easier electricity transit, thereby improving electricity transmission across the European system.

What is the project?

The project focuses on upgrading the capacity and efficiency of trans-border electricity connections between Belgium and France, and Belgium and the Netherlands. This will help address the general shortfall in electricity capacity in the Benelux region – the Netherlands and Belgium are net importers of electricity from their neighbours – and make it easier to import electricity from renewable sources. Also of crucial importance is the transit capacity through Belgium, ensuring sufficient capacity to move energy from France to the Netherlands and eventually further to Germany.

What are the objectives?

This project has two overarching goals. The first objective is to strengthen and consolidate an important section of the integrated European power transmission grid. This involves developing and enhancing electricity connections between Member States, which will in turn improve the efficiency and reliability of Europe's electricity networks.

The second objective is to support the smooth functioning of the internal market and to make renewable energy more widely available. Germany, Denmark and the Netherlands have been successful in boosting their investment in wind energy. However, in order for such 'green electricity' to prove feasible and efficient, it needs to be hooked up to the distribution grid, which will, in turn, require additional transmission capacity.

What are the main elements?

Upgrading Franco-Belgian cross-border capacity:
Belgian and French operators ELIA and RTE plan to expand cross-border flows by 2 400 MW. By late 2005, they will have added a second circuit of a transmission line between Avelin (FR) and Avelgem (BE). For 2009, an additional connection between Moulaine (FR) and Aubange (BE) is under consideration. The overhead line is ready on the Belgian side but has yet to be constructed on the French side. Upgrading the line between Chooz and Monceau in Belgium will have a significant positive effect on the cross-border capacity.

Local upgrades in the Netherlands and Germany will involve the construction of 380 kV substations in Borssele (NL), and in Conneforde (DE) alongside the existing 150/380 kV configuration. The new capacity will help resolve transmission bottlenecks between the Netherlands, Belgium and Germany.

EL 1: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR
Trans-border connection France–Belgium				
Chooz (FR)–Jamiolle Monceau (BE)	22	Upgrading existing overhead 225/150 kV line	2005	13
Avelin (FR)–Avelgem (BE)	43	Upgrading an existing 400kV line with a second circuit	2005	20
Moulaine (FR)–Aubange (BE)	25	New 400kV line, the Belgian part already exists	Projected for 2009	20
Upgrades in the Netherlands and in Germany				
Borssele substation (NL)	n.a.	Upgrading	2008	
Conneforde substation (DE)	n.a.	Work completed	2003	

Interconnections at the borders of Italy with France, Austria, Slovenia and Switzerland

This project will increase electricity interconnectivity between Italy and the neighbouring countries of France, Austria, Slovenia and Switzerland, including important and sensitive Alpine crossings.

What is the project?

The projects focus on upgrading the capacity and efficiency of trans-border electricity connections between Italy and its neighbours. Italy imports a significant share of its electricity consumption, but its network capacity needs to be upgraded to make this sustainable. The major blackout in September 2003 demonstrated the delicate balance between import needs and transmission capacity.

What are the objectives?

This multi-faceted project has three main goals. The first is to reinforce and consolidate an integrated European power transmission grid. This entails developing and improving electricity connections between Member States so as to increase the efficiency and reliability of Europe's electricity networks.

The second objective is to develop electricity links between existing and new European Union Member States, such as Slovenia. Widening the European network in this way will contribute to enhancing interoperability, and improve the operational reliability and efficiency of the grid.

The third objective is to explore environmentally friendly solutions based on novel technology by utilising existing or future rail and road tunnels through the Alps for electricity transmission.

What are the main elements?

The French connection: The first project plans to improve the connection between France and Italy. The phase shifter installations at Rondissone (IT) and at La Praz (FR) electricity substations have already contributed to the increase of capacity in this area.

New Italy–Switzerland trans-border connection: A new double-circuit 64 km transmission line from San Fiorano (IT) to Robbia (CH) will add 2 500 MW to the gross capacity passing between the two countries. A second connection between Milan (IT) and Switzerland connecting Bovisio–Turbigo–Airolo–Chamoson has been studied. Reinforcing the existing connection between Corduno (CH) and Morbegno (IT) is another potential alternative.

New interconnection between Italy and Austria: Several alternatives are under consideration to increase capacity between Austria and Italy. Upgrading the existing Lienz (AT)–Cordignano (IT) link has been under consideration for some time. In parallel, a feasibility study for the integration of electricity transportation into the planned Brenner Pass rail tunnel between the two countries is pending.

New line to Slovenia: A new 90 km connection between Udine (IT) and Okroglo (SI) will bring an additional gross capacity of 2 500 MW, possibly supported by a phase shifter installation.

Additional transmission capacity in Member States needs to be constructed to further support cross-border transmission. This includes the lines Südburgenland–Kainachtal and Tauern–St Peter in the eastern part of Austria, lines in the western part (Tyrol) as well as lines in Italy and Slovenia.

EL 2: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Trans-border connection France–Italy				
New interconnection France–Italy	80-180	Several alternatives, including using tunnels under study	No confirmed dates yet	(0.90)
Upgrades in Italy				
Five lines	220	400 kV lines	2006	75
Trans-border connection Italy–Switzerland				
San Fiorano (IT)–Robbia (CH)	114	Upgrade with second circuit under construction, 400 kV	2004	25 (0.25)
Chamoson (CH)–Turbigo (IT)	253	New 400 kV connection	2015	281
Trans-border connection Italy–Austria				
Lienz (AT)–Soverzene (IT)–Cordignano (IT)	154	Upgrade of an existing 220 kV line to 400 kV and construction of new 400 kV line	Projected for 2008	75 (0.35)
Interconnection via new Brenner Pass Tunnel	65	Rail transport and energy transmission, 400 kV	Feasibility study: 2003–05	Study: 1.9
Upgrades in Eastern Austria				
Two lines	245	Upgrade from 220 kV to 400 kV	2010	436
Upgrades in Western Austria (Tyrol)				
Two lines	250	Upgrade from 220 kV to 400 kV	> 2010	
Trans-border connection Italy–Slovenia				
Redipuglia (IT)–Okroglo (SI)	130	Upgraded/new 400 kV connection	2009	30
Increasing interconnector capacity	n.a.	FACTS installation in Divaca substation	2004	40
Bericevo (SI)–Krsko (SI)	80	New 400 kV line	2006	34

Electricity network reinforcement in France–Spain–Portugal

This project will increase electricity interconnection capacities between Spain and France and between Spain and Portugal, with a special focus on efforts to make the Iberian Peninsula's power grid more flexible, as the current infrastructure places severe restrictions on electricity flow. A further important element is the grid development in island regions.

What is the project?

Within this project studies are being undertaken of a range of alternative routes to expand the capacity and enhance the efficiency of trans-border electricity connections between France and Spain, and Spain and Portugal.

What are the objectives?

The first objective is to improve the reliability of the Iberian and French systems taking advantage of their complementarity. The second goal is to bring closer to fruition a consolidated and integrated European power transmission grid to serve the internal market and increase the EU's energy efficiency. The European Commission holds that a reasonable level of electricity interconnection should equate to 10 % of installed Member State capacity.

What are the main elements?

France–Spain: France and Spain have agreed to add some 1 200 MW of additional capacity by 2006 to the current 1 400 MW with the objective of reaching 4 000 MW in the future. Towards that end, a number of feasibility studies are exploring various alternatives for transporting extra wattage across the eastern, central and western Pyrenees.

Iberian Peninsula: The Spanish and Portuguese governments signed an agreement in 2001 to develop a common Iberian power market. A new east-west interconnection between Sines (PT) and Balboa (ES) is under construction as well as an upgrade for the connection between Aldeadavilla (ES) and Recarei (PT). In addition, the north-south connection in Portugal will also be strengthened (Valdigem–Viseu–Anadia).

A study has been launched to analyse connections between the Balearic Islands and the Spanish network.

EL 3: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Trans-border connection France–Spain				
New interconnection across Pyrenees		Study		(0.9)
Sentmenat (ES)–Baixas (FR)	211	New 400 kV line	2006–07	130 (0.62)
Peñalba (ES)–Salas (ES)	125	New 400 kV line	2006	
Itxaso (ES)–Gueñes (ES)	120	New 400 kV line	2007	
Trans-border connection Portugal–Spain				
Sines (PT)–Balboa (ES)	193	New 400 kV line	2004	36 (0.54)
Recarei(PT)–Valdigem (PT)–Douro (PT)–Aldeadavila (ES)	165	New 400 kV line/upgrades	2007/2010	32
Valdigem (PT)–Viseu (PT)–Anadia (PT)	120	New line 400 kV (north-south connection)	2006	29 (1.20)
Pereiros (PT)–Santarém (PT)	125	Upgrade/new 220 kV line	2004	26
Pego (PT)–Batalha (PT)	75	New line 400 kV	2005	22 (0.35)
Connections between Balearic Islands and the Spanish peninsular network				
Barcelona/Valencia (ES)–Mallorca (ES)	200	High voltage submarine cable, study of the marine route	Start of study: June 2003	(0.86)

Electricity network reinforcement in Greece–Balkan countries–UCTE system

This project will develop an electricity infrastructure to improve the link between Greece and the Union for the Coordination of Transmission of Electricity (UCTE) system, a European 'power highway' connecting 23 countries and providing 450 million people with electricity.

What is the project?

This project seeks to set in motion a European-level strategy to create modern and efficient energy infrastructure networks in south-east Europe. This is with a view to ensuring that the region's power generation system can meet each country's demand.

Possible areas for investment highlighted by the strategy include: very high tension lines, substations and large-scale combined heat and power (CHP). Priority goes to connecting the electricity grids of the region with the UCTE network and filling in the missing links in the high tension transmission networks between national grids.

What are the objectives?

The first goal of this multidimensional project is to move one step nearer to an integrated European power transmission grid to serve the electricity needs of Europeans, the requirements of the internal market and boost the EU's energy efficiency.

The second objective is to put in place electricity connections between the European Union, its Balkan neighbours and candidate countries, particularly Bulgaria and Turkey. This will partly entail hooking up the UCTE with the CENTREL network (which links the Czech Republic, Hungary, Poland and Slovakia).

What are the main elements?

Linking Greece with the Balkans: Several schemes are under consideration to hook Greece up with its Balkan neighbours, including Albania, Bulgaria, and the Former Yugoslav Republic of Macedonia. Four contracts have already been awarded to help integrate the Greek and Balkan grids. A key action in this area is the upgrading to 400 kV of an existing 150 kV connection between Greece and Serbia and Montenegro.

Future actions in south-east Europe: The Athens Forum has identified four strategic links that need to be made in order to connect the electricity networks of the region with those of the EU. These include reconnecting the Ernestinovo and Mostar lines connecting four former Yugoslav republics and connecting Podgorica (CS) with Elbasan (AL), Tirana (AL) with Skopje (MK) and Pécs (HU) with Ernestinovo (HR) and with Sombor (CS). Further important new links are between Chervena Mogila (BG) and Štip (MK), Nis (CS) and Skopje (MK) and between Maritsa (BG) and Filippi (GR).

Connecting Greece and Turkey: This project is studying the feasibility of a new 400 kV electricity line between Greece and Turkey.

EL 4: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Trans-border connections in the Balkans				
Pécs (HU)–Ernestinovo (HR)/ Sombor (CS)	185	New lines 400 kV	After 2010	35
Mraclin (HR)–Jajce (BA)	198	New line 400 kV	2004	12
Tumbri (HR)–Banja Luka (BA)	200	New line 400 kV	After 2010	
Sremska Mitrovica (CS)–Ugljevic (BA)	70	New line 400 kV	After 2010	
Podgorica (CS)–Elbasan (AL)	202	New line 400 kV	2007	31
Tirana (AL)–Skopje (MK)–Nis (CS)	356	New line 400 kV	After 2010	64
Štip (MK)–Cheverna Mogila (BG)	150	New line 400 kV	2007	40
Zlatitsa (BG)–Plovdiv (BG)	149	New line 400 kV	2006	25
Trans-border connection Greece–Bulgaria and Bulgaria–Turkey				
Filippi (GR)–Maritsa (BG)	201	New 400 kV line	After 2010	30
Trans-border connection Greece–Turkey				
Filippi (GR)–Hamidabat (TR)	270	New line 400 kV	2006	50 (0.35)

Electricity network reinforcement Ireland–United Kingdom–continental Europe and northern Europe

These projects will set up or increase electricity interconnection capacities between the United Kingdom and continental and northern Europe. On the other side, connections between the UK and the Republic of Ireland will be improved.

What is the project?

This project focuses on new underwater cables for connecting the United Kingdom electricity grid with its European neighbours. The UK currently has a 2 000 MW DC link to France, and AC links to the Republic of Ireland and the Isle of Man. The links to France and Ireland are both small relative to the size of the systems involved. Furthermore the UK is internally divided into two AC grid systems which cover Great Britain and Northern Ireland respectively. These AC systems are connected by a 500 MW DC link. New links across the Irish Sea to Wales, together with upgraded capacity within Ireland will bring the island of Ireland into the overall European grid.

What are the objectives?

This multidimensional project aims to help create a fully integrated European power transmission grid to serve the electricity needs of European citizens and firms, increase the EU's energy efficiency and competition in the power generation and distribution markets.

The project will also further integrate the Union for the Coordination of Transmission of Electricity (UCTE) system – which connects 23 countries and provides 450 million people with electricity – with the British system, comprising the supply systems of England, Wales and Scotland, and the Irish system, comprising the supply systems of Northern Ireland and the Republic of Ireland.

What are the main elements?

UK–Netherlands sub-sea interconnector (BritNed): BritNed is intended to provide transmission capacity between the UK and UCTE systems to enable the competitive trade of electricity within the single market. Due to be in operation by 2007/08, this DC cable will be about 250 km long and is expected to carry 1 000–1 320 MW of electricity.

Ireland–Wales link: The project would involve a high-voltage direct current link between the electricity transmission systems in Ireland and Wales. The Irish government has recently expressed its support for the development of a double 500 MW link.

Reinforcing Irish links: A feasibility study to investigate options for increasing interconnector capacity between the Republic of Ireland and Northern Ireland is in progress. Both 275 kV and 110 kV options are being considered.

Connections in Ireland: Plans are on the way to improve connections in the north-west of Ireland. A 220 kV line between Flagford and Srananagh is under construction. Studies are also under way with regard to improving connections in the north-east of Ireland, between Dublin and the border with Northern Ireland.

EL 5: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Britain–Netherlands Interconnector: BritNed				
Holland–south-east England	250	Development of a single HVDC circuit. Capacity of 1 000–1 320MW	2007–08	300–400 (4.55)

EL 6: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Interconnector Ireland–UK (Wales)				
Ireland–Wales East–West Interlink	100–180	Development of one or two HVDC circuits. Each circuit is to have a capacity of up to 500MW.	2008–09	400 (2.35)
Republic of Ireland–Northern Ireland Interconnections				
Northern Ireland–Republic of Ireland		Increased interconnection capacity, feasibility study in progress		(1.54)
Northern Ireland–Republic of Ireland		Preparatory and technical study of dynamic stability of interconnection	Start date of study: July 2003	(0.30)
Connections in Ireland				
Ireland		Reinforcement of the network in the north-east of Ireland		(1.0)
Flagford–Sranangh	108	Improving connections	2005	(1.24)

Electricity network reinforcement in Denmark–Germany–Baltic Ring

This project will increase electricity interconnection capacities – including the possible integration of offshore wind energy – among the countries around the Baltic Sea.

What is the project?

The aim of this project is to strengthen connections in the Baltic region, including with several of the new EU Member States. Currently three separate transmission networks converge on the Baltic: NORDEL to the north, UCTE and CENTREL to the south, and IPS/UPS in the former Soviet Union countries to the east. The Baltic electricity ring has already made significant studies towards integrating the three networks, and further increases in capacity will create more flexible transmission options throughout the region.

What are the objectives?

The integrated European internal electricity market means that cross-border interconnections need to be strengthened, especially with the countries which have just joined the European Union. As well as improving reliability, it will also bring new transmission capacity to connect offshore wind farms means to major networks.

Secondly, electricity connections with third countries, particularly those which are now at the borders of the enlarged EU, will be strengthened. This strengthening should improve the inter-operability and reliability of the region's electricity grids.

What are the main elements?

Denmark–Scandinavia interconnections: Comprising an undersea cable across the Skagerak to Norway of 225 km length and the refurbishment of the old Konti-Skan 1 cable to Sweden. Furthermore, a high voltage DC cable is planned to connect Fyn and Sjælland in Denmark.

Norway–Netherlands interconnector (NorNed): Operators are analysing the benefits of a new 600 MW undersea cable between Norway and the Netherlands. Two-way exports – towards the market with the highest spot price – will provide socioeconomic interaction between the Norwegian hydro-dominated system and the Dutch thermal/wind-dominated system.

Mid-Norway–mid-Sweden: The need for a new 400 kV AC line from Klæbu (NO) to Järpströmmen (SE) is being studied. The aim is to strengthen the weak connection between mid-Norway and mid-Sweden needed for the fast growing industrial load in mid-Norway. The existing line between Nea (NO) and Järpströmmen (SE) will be refurbished with a new 400 kV line.

Denmark–Germany interconnector: Operators are studying the possibilities of converting the existing 220 kV aerial connection from Kassø (DK) to Flensburg (DE) to 400 kV and extending it to Hamburg.

EL 7: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR (EU support from TEN-E)
Germany–Denmark–Norway–Sweden interconnector				
Skagerak 4 (DK)–(NO)	225	Additional capacity HVDC cable: 600 MW	2008	245
V. Hassing (DK)–Trige (DK)	114	Under construction	2004	166
Fyn (DK)–Sjaelland (DK)	56	HVDC cable	After 2010	135
Konti Skan 1 (DK–SE)	148	Refurbishment of old Konti-Skan 1 cable Capacity: 110 MW	2005	40
Tjele (DK)–Hamburg (DE)	393	New/upgraded 400 kV line	2010	110 (0.15)
Klæbu (NO)–Nea (NO)–Jærpstrømmen (SE)	175	Upgrade to 420 kV line and new 420 kV line	After 2008	53
Feda (NO)–Eemshaven (NL)	578	HVDC cable 600 MW	After 2008	500
Germany–Poland interconnector				
Neuenhagen (DE)–Vierraden (DE)–Krajnik (PL)	150	Upgrade 220 kV line to 400 kV line	After 2010	100
Third Germany–Poland connection: Plewiska (PL)–Preilack (DE)	200	New 400 kV line	After 2008	260
Plewiska (PL)–Patnow (PL)	84	Upgraded/new 400 kV lines or double-voltage lines	2007	40
Patnow (PL)–Grudziadz (PL)	170	Upgraded/new 400 kV lines or double-voltage lines	2010	80
Dunowo (PL)–Zydowo (PL)–Krzewina (PL)–Plewiska (PL)	250	Upgraded/new 400 kV lines or double-voltage lines	2012	155
Poland–Lithuania interconnection				
Elk (PL)–Alytus (LT)	154	New 400 kV line with Back-to-Back, capacity 1,000 MW	After 2008	434
Narew (PL)–Elk (PL)–Matki (PL)	303	New 400 kV lines, upgrading of Elk substation	After 2008	
Kryonis (LT)–Alytus (LT)	53	Increasing capacity	After 2008	
Finland–Estonia interconnector–Estlink				
Harku (EE)–Espoo (FI)	80	2 HVDC submarine cables Capacity: 315 MW	2008	100 (0.67)
Sweden–Finland interconnection				
Dannebo/Gråska (SE)–Rauma (FI)	200	New submarine HVDC cable		200

Germany–Poland interconnector: The Polish network has been connected to the UCTE system (connecting 23 countries) since 1995. This project aims at upgrading the existing connections to 400 kV and opening a third 400 kV link between Poland and Germany. Upgrades within the Polish grid are also necessary.

Poland–Lithuania interconnector: This 400 kV aerial link will form a bridge between the UCTE and IPS/UPS (former Soviet Union countries) systems. With the planned decommissioning of the first section of the Ignalina nuclear power plant in 2005, Lithuania needs to increase its cross-border capacity. This project has to be considered in relation to prior development of networks and interconnections on the western border of Poland including upgrades within the Polish grid.

Finland–Estonia interconnector (Estlink): This 315 MW undersea cable, together with converter stations at both ends, will provide a link between the Nordic and IPS/UPS systems. In particular, it will allow exports of electricity from the Baltic States to the Nordic markets.

Sweden–Finland interconnection: The need for a new HVDC cable between Sweden and Finland is under study. The aim is to increase transmission capacity by upgrading the existing Fennoskan HVDC link to bipolar connection.

Network reinforcement in southern Sweden: To get the real benefit out of the interconnectors, network reinforcements are necessary.

Network reinforcement in Germany: Networks need to be reinforced, especially due to increased wind power production (the lines Krümmel-Görries and Halle-Schweinfurt are under consideration).

Reinforcing connections in central Europe

The electricity market in the new EU Member States of central Europe is developing rapidly and a number of new connections are required to develop stronger links between the networks of these countries and those of Germany, Austria and Italy.

What is the project?

The Czech Republic, Hungary, Poland, Slovakia and Slovenia have all been integrated into the UCTE system since 1995, enabling trade in electricity, especially exports to Germany and Italy. But many connections are now saturated, so increased capacity is needed. Furthermore, as consumption patterns are changing, the existing infrastructure needs to be adapted and upgraded to allow more flexible operation.

What are the objectives?

Spare electricity capacity is available in central European countries, and needed in Italy and other EU Member States. The difficult Alpine terrain means that capacity in Austria is limited and also needs to be upgraded. This project comprises a range of new or upgraded links to increase transmission capacity within and between the five new Member States in the region. In addition, connections between them and Austria, Germany and Italy would also be upgraded. The intention is to enable some of this additional capacity to be used to allow operators in the southern countries to benefit from new wind-power generation capacity in northern Germany.

EL 8: Route	Distance (km)	Type of work and technical information	In operation	Estimated cost in million EUR
Germany–Poland: east-west interconnector				
Hagenwerder (DE)–Mikulowa (PL) (location not yet decided)		Phase shift transformers (requires a further feasibility study)	After 2010	
Ostrow (PL)–Trebaczew (PL)/ Rogowiec (PL)	114	Upgrades/new 400 kV lines	2007	60
Ostrow (PL)–Plewiska (PL)	145	Upgrades/new 400 kV lines	2006	100
Poland–Slovakia–Hungary–Slovenia: north–south interconnector				
Krasikov (CZ)–H. Zivotice (CZ)	78	New 400 kV line	2010	20
C. Stred (CZ)–Bezdecin (CZ)	70	New 400 kV line	2009	20
Byczyna (PL)–Varin (SK)	156	400kV double circuit	After 2010	100
Tarnow (PL)–Krosno (PL)	75	New 400 kV line	2005	25
Héviz (HU)–Cirkovce (SI)	80	New 400 kV line	2008	50
Szombathely (HU)–Hévíz (HU)		400 kV line	After 2011	
Sándorfalva (HU)–Békéscsaba (HU)	92	New 400 kV line	2004	33
Paks (HU)–Pécs (HU)	82	400 kV double circuit	2005	30
Györ (HU)–Szombathely (HU)	90	New 400 kV line	2007	32
Sajóivánka (HU)–Rimavska Sobota (SK)	56	400 kV tie line	2006	20
Moldava (SK)–Sajoivanka (HU)	71	New 400 kV lines	2010	60
Medzibrod (SK)–L. Mara (SK)	35	New 400 kV lines	2010	29
Lemesany (SK)–V. Moldava (SK)	36	New 400 kV lines	2010	32
Lemesany (SK)–V. Kapusany (SK)	80	New 400 kV lines	After 2010	46
Gabcikovo (SK)–Velky Dur (SK)	85	Internal new 400 kV tie line	2011	51
V. Kapusany (SK)–UA Border	13	New 400 kV lines	After 2010	5
Austria–Czech Republic/Hungary and Hungary–Romania interconnector				
Dürnrohr (AT)–Slavetice (CZ)	94	Adding a second circuit to an existing 400 kV line	2007	50
Wien (AT)–Györ (HU)	64	Adding a second circuit to an existing 400 kV line	2010	30
Békéscsaba (HU)–Oradea (RO) or Arad (RO)	103/115	New 400 kV line	After 2010	93

What are the main elements?

Germany–Poland: This east-west interconnector includes the upgrade and construction of a number of links within Poland to ease bottlenecks, possibly including the construction of a phase-shift transformer on the Germany–Poland border.

Poland–Slovakia–Hungary–Slovenia: the north-south interconnector is made up of a series of new 400 kV lines which will increase transmission capacity along the routes from Poland to the south, improving security as well as increasing the flexibility of the transmission network.

Austria–Czech Republic/Hungary: These upgrades of the existing 400 kV connections will reduce the risk of the relatively isolated Austrian internal network becoming overloaded.

Hungary–Romania: This new connection will increase flexibility within the region and provide additional transmission capacity towards the Balkan region.

Mediterranean Member States – Mediterranean electricity ring

This project will set up or boost electricity interconnection capacities between the EU's Mediterranean Member States and several of the Union's Mediterranean partners, namely, Morocco, Algeria, Tunisia, Libya, Egypt, Turkey, and other Middle Eastern countries.

What is the project?

This set of 13 projects seeks to ensure full interconnection between the European Union and its neighbours around the Mediterranean Sea.

What are the objectives?

The first aim of this project cluster is to secure electricity supplies – by developing and diversifying energy sources and forging close cross-border cooperation – both within the Union and in partner countries.

The second objective is to promote the competitiveness of the energy industry ahead of the creation, by 2010, of a Euro-Med free-trade area.

The third goal is to improve environmental protection by ensuring safe and clean transportation of power across borders, boosting energy efficiency and promoting the use of renewable energy sources.

What are the main elements?

Morocco–Spain: Reinforcing the interconnection between the Moroccan and Spanish grids with a second link via the Straits of Gibraltar.

Morocco–Algeria: Adding two 400 kV lines – one in 2003 and the other in 2005 – between Algeria and Morocco.

Algeria–Tunisia: A fifth line carrying 400 kV is currently under construction between Algeria and Tunisia.

Algeria–Spain: A 2 000 MW connection between Algeria and Spain is currently in the pre-feasibility stage.

Algeria–Italy: A 400–500 kV link between Algeria and Italy is at the pre-feasibility stage.

Tunisia–Libya: Once completed, this link between Tunisia and Libya will not only serve the two countries, but will facilitate power transfers between the eastern and western Mediterranean.

Tunisia–Italy: This proposed project could shift up to 500 kV between Italy and Tunisia by 2010.

Libya–Egypt: This project seeks to reinforce the existing interconnection between Egypt and Libya.

Egypt–Jordan: This project proposes to reinforce the existing 300 MW submarine link between Egypt and Jordan.

Jordan–Syria: A second stage of the Jordan–Syria link is expected to be commissioned by 2010.

Lebanon–Syria: A new double circuit 400 kV link will supplement the existing 230 kV connection.

Syria–Turkey: This project, which has been delayed since 1997, seeks to lay a 400 kV connection between Syria and Turkey.

Turkey–Greece: A 400 kV line between Greece and Turkey is due to be ready by the end of 2006.


Existing electricity network
Priority project (line)
Priority project (location of line to be determined)
IRELAND
UNITED KINGDOM
NEDERLAND
BELGIE / BELGIQUE
DEUTSCHLAND
POLSKA
BELORUSSIJA
ČESKÁ REPUBLIKA
SLOVENSKO
MOLDAVIA
ROMÂNIA
ÖSTERREICH
MAGYARORSZÁG
SCHWEIZ
SLOVENIJA
HRVATSKA
BOSNA I HERCEGOVINA
SRBIJA I CRNA GORA
BALGARIJA
FRANCE
PORTUGAL
ESPAÑA
Açores
Madeira
Canarias
Estrecho
Melloussa
ITALIA
SHQIPERIA
FYR MAKEDONIJA
ELLADA
TÜRKIYE
KIBRIS
SOURIYA
LIBNAN
ISRAEL
JORDAN
SAUDI A
MALTA
EL DJAZÂIR
TOUNIS
EL MAGHREB
LIBYA
EGYPT

Gas pipeline connecting the United Kingdom–northern continental Europe–Russia

Homes and industry in north-west Europe and the UK could be running on Russian gas upon completion of a new gas pipeline.

What is the project?

Installing a new pipeline to deliver Russian gas to the United Kingdom and northern central Europe – including Germany, Denmark, Sweden and the Netherlands (with a proposed branch to Belgium) – this project should improve the interoperability of the networks in the areas concerned while guaranteeing supply.

The envisaged pipeline is divided into two main sections: the northern European line, which brings Russian gas either across the Baltic Sea or overland alongside the existing Yamal–Europe pipeline. From this backbone, there might be additional branches to the Nordic States as well as to the Baltic States.

What are the objectives?

First, the goal is to secure gas supply in Europe by creating a new route option for importing Russian gas, increasing capacity from the present 20 BCM/y to 30 BCM/y – the total volume of Russian gas imports to Europe will then exceed 130 BCM/y – and improving links between major gas sources. This pipeline could, in its first stage, transport gas from the Nadym-Pur-Taz gas-producing region to north-west Europe, and later also from fields in the Barents Sea (Schtokmanov field) north-east of Murmansk. Existing gas lines from Russia cross Belarus along the 'Northern Lights' and 'Yamal 1' gas pipelines.

This project is Russian utility Gazprom's biggest investment for the next decade and is an important political priority, especially in light of the EU-Russian energy dialogue. The option of a new pipeline across the Baltic Sea also diversifies Russian gas supply routes to the EU, while simplifying gas transfer and reducing the number of countries crossed.

Another objective is to improve the internal market for gas, with the possibility of a major increase in reverse flow from the continent to the United Kingdom (from 8.5 BCM/y at present to 24–29 BCM/y when the interconnector compression project has been completed and the new NL–UK Balgzand-Bacton (BBL) pipeline is in place).

What are the main elements?

Russian inland stretch of 570 km from Gryazovetz to Viborg, with one of seven compressor stations built in Portovaya bay near Viborg.

Baltic Sea stretch of 1 200 km from Portovaya to the north-east German coast, i.e. the Greifswald (DE) area, or to the Danish coast.

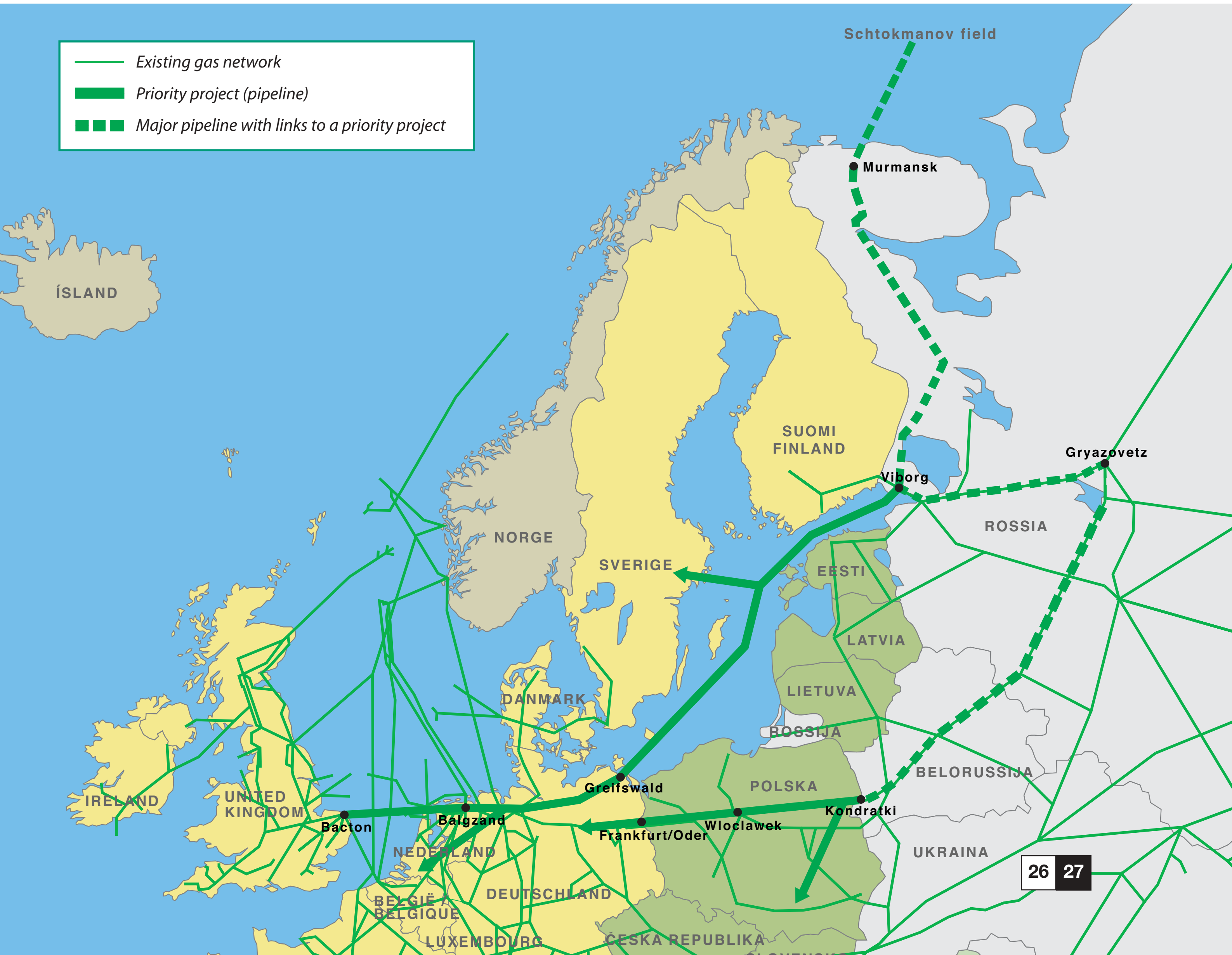
Land stretch of some 630 km from the Greifswald area via Bunde/Oude Statenzijl to Balgzand (NL).

North Sea stretch of some 230 km from Balgzand (NL) or, with the Denmark option, from Den Helder (NL) to Bacton (UK).

On-shore option: a Yamal-Europe line, with a total length of approximately 4 000 km and a new stretch of about 680 km from Belarus across Poland to Frankfurt an der Oder (DE) and Berlin and on to the Netherlands.

Another project of common interest is the Baltic gas interconnector connecting the markets in northern Germany, eastern Denmark and southern Sweden. The gas pipeline will include approximately 200 km of sea sections, as well as land sections in Germany and Sweden.

NG 1: Route	Distance (km)	Type of work	Technical information	Status and timetable	Estimated cost in million EUR (EU support from TEN-E)
(I) Within Russia: Gryazovetz–Viborg	570	New pipeline onshore	Additional capacity to St. Petersburg region: 1.6 BCM/y	Field survey and land appropriation start: Jan. 2003	1 800
(II) Viborg (RU)–Greifswald area (DE)	1 200	New pipeline offshore in Baltic Sea	Capacity 10 BCM/y	Construction starts: 2006–08	2 400
		Study	Technical, environmental and commercial analysis	Study completed: Dec. 2005	10 (3.0)
(III) Greifswald area (DE)–Balgzand (NL)	ca 630	New pipeline onshore		Construction starts: 2004 Operational from 2007/8	1 500
(IV)(a) Balgzand (NL) to Bacton (UK)	ca 230	New pipeline	Capacity 8–13 BCM/y Increasing reverse flow from 8.5 to 24–29 BCM/y	Construction: 2004–06. Operational from 2006/07	500
(IV)(b) Offshore DK to UK	200–250	New pipeline	Possibly landing in Bacton (UK)	Study completed: March 2002	375–475 6.7 study
Total axis from Russia across Baltic Sea to UK	570 outside EU ca 2 060 inside EU			Operational from 2013	1 800 outside EU 4 400 inside EU
Alternative route Yamal Europe II Kondratki–Wloclawek–Frankfurt an der Oder	680	Second line across Poland	Additional capacity: 32 BCM/y	In operation: 2008–10	1 520



Gas pipeline connecting Algeria–Spain–Italy–France–northern continental Europe

Europe's search for new sources of energy takes it, among other directions, across the Mediterranean, where new gas pipelines will link the Maghreb with the European continent.

What is the project?

With the construction of new gas pipelines linking Algeria with France and beyond, this project is tapping into valuable sources of energy for European industry. Four separate routes with varying lengths of offshore lines would transport gas from North Africa to Spain or Italy and beyond.

What are the objectives?

First, the goal is to secure the gas supply in Europe by increasing import capacity for Algerian gas through Spain, Italy, France and other EU countries. These new pipelines will help diversify supply routes to Europe.

Second, the plan is to improve the gas market by better connecting imported sources with Europe's internal network linking Spain and Italy with France and northern Europe.

With the four supply routes in place, overall gas capacity from Algeria to Europe would be increased by around 31 BCM/y.

What are the main elements?

Algeria–Morocco–Spain–France

Gas passes inland (860 km) from the Hassi R'Mel (DZ) fields to Tangier (MA), crosses the 40 km Strait to Tarifa (ES) and reaches Córdoba (ES), Madrid (ES), and Lacq (FR): capacity 6–7 BCM/y via Gibraltar crossing (new line due to be ready in 2005). The Spain–France connection will be increased by 3–4 BCM/y in 2005, and in future new capacity (up to 6 BCM/y more) can be added without a new line.

Algeria–Spain–France

From Hassi R'Mel, the gas goes to the coast at Beni-Saf (550 km), then offshore to Almeria (ES) along the Medgaz project (200 km), then passes inland to the Spanish-French border near Gerona (ES) and Perpignan (FR) and to the north of France: capacity 8–10 BCM/y, construction 2005–06, a planned upgrade will double this capacity in 2010.

Algeria–Sardinia–Corsica–France–Italy

A line from Skikda to El Kala (DZ) on the Algerian coast (640 km), on to Cagliari (310 km) and up the Sardinian coast to Porto Torres or Olbia (220 km), then to either Montalto di Castro (220 km) or Castiglione della Pescaia on the Italian mainland: the objective is to transport 10 BCM/y of gas directly to Italy. A branch pipeline supplies Corsica.

An alternative route is also being considered for this pipeline, crossing from Porto Torres, but then over to Corsica (25 km), across the island (200 km) to Bastia and over the 200 km offshore stretch to Piombino (IT) (north of Castiglione della Pescaia) or to Nice (FR). Studies for these options will be ready in 2004.

Algeria–Tunisia–Italy

From Hassi R'Mel, the gas goes to the Tunisian coast (about 800 km), then offshore (160 km) to Mazzara-Lippone (IT) and is distributed via the Italian system. The project consists of the Algerian–Tunisian pipeline upgrading and the compression unit repowering: additional capacity 6.5 BCM/y, the planned upgrade should be in operation in 2006.

NG 2: Route	Distance (km)	Type of work	Technical information	Status and timetable	Estimated in million EUR (EU support from TEN-E)
(I)(a) From Algeria to Tangier (MA)	860	Upgrade			
(I)(b) Across the Strait of Gibraltar	40	New pipeline	Capacity 9 BCM/y	Construction delayed sine die	ca 150 EIB loan
(I)(c) Pipelines in Spain		Upgrade			
(I)(d) Arnedo (ES)–Lacq (FR)	ca 100	Interconnection Spain–France	Increasing capacity to 4.5 BCM/y	Operational: 2007	
(I)(e) Arcangues (FR)–Irun (ES) Atlantic Route Spain–France	28	Link between LNG terminal and underground storage in two Member States	Upgrade of capacity to 3 BCM/y New pipeline; 1st phase for 0.5 BCM/y	Construction: 2005 1st phase operational in 2006	20.8 (1.0)
(II)(a) Within Algeria to Beni-Saf (coast)	550	Upgrade			
(II)(b) Beni-Saf (DZ)–Almeria (ES)	200	New offshore pipeline in deep waters	Capacity 8–10 BCM/y	Construction: 2005–06 Operational from 2007 (later link to the Almeria–France pipeline)	600–800 EIB loan 20 for study
(II)(c) Almeria (ES)–France	ca. 900	New pipeline		Linked to the construction of the French line up to other EU countries	
(III)(a) Within Algeria to El Kala (coast)	640	Upgrade (50 km new)			
(III)(b) El Kala–Italy and France	750	New pipeline	Capacity 10 BCM/y		ca 2 000–3 000 12.3 for study
(IV)(a) Algeria–Tunisian coast	800	Upgrade		In operation: 2006	
(IV)(b) Cape Bon (TN)–Mazzara-Lippone (IT)	ca. 160	Pipeline and compressor upgrade	Capacity 6.5 BCM/y		
Total axis within EU Morocco–ES–FR Algeria–ES–FR Algeria–Italy Algeria–Tunisia–Italy	 1 050 (+40 sea) – Atlantic route 900 (+200 sea) – Mediterranean route 750 – Sardinia route 160 – Sicily route		Total capacity: ca. 31 BCM/y		

Caspian Sea countries–Middle East–European Union

Improved links in the south-eastern EU will open up new possibilities for importing natural gas from the Caspian Sea region through Turkey, Bulgaria, Hungary, Romania, and Austria and through Turkey, Greece and Italy.

What is the project?

A new and upgraded pipeline network is planned from the rich gas fields of the Caspian Sea region to the EU, crossing Turkey and ending in Greece, Italy and Austria.

In the Caspian area, upgraded and new lines will bring gas from Iraq, Iran, Azerbaijan and possibly Turkmenistan into the East-West pipeline system, which crosses Turkey. Upgrading the links from Turkey to Greece and from Greece to Italy and, also from Turkey across the Balkans to Austria, will allow this major import source to be fully connected to the EU network.

What are the objectives?

First, the aim is to secure the gas supply in Europe by establishing import capacity from the Caspian Sea countries to Europe, diversifying gas supply and offsetting future shortages.

Second, the plan is to improve the internal European gas market – with the priority on Greece, Italy and Austria – by better connecting import sources with Europe's internal network.

What are the main elements?

Supply from the Caspian Sea region: Baku–Tbilisi–Erzurum pipeline

The gas source lies in the Shak-Deniz field. The gas will flow from Baku (AZ) to Tbilisi (GE), then in Georgia through existing pipelines and onward through a new pipeline to Erzurum in Turkey with a total length of 925 km. This would connect with the existing eastern Anatolya line in Turkey, which also has an envisaged inflow from Iraq and an existing pipeline from Iran.

Interconnector Turkey–Greece

Increasing the line size and adding compressors should more than double the capacity via this route from 3.6 BCM/y to 10 BCM/y. A new Turkish section of 200 km, including the Canakkale Strait crossing to Ipsala/Kipi will be constructed. The Greek section will be extended with an 85 km link from Kipi (TR) to Komotini (GR) and boosted with a new compressor station.

Interconnector Greece–Italy

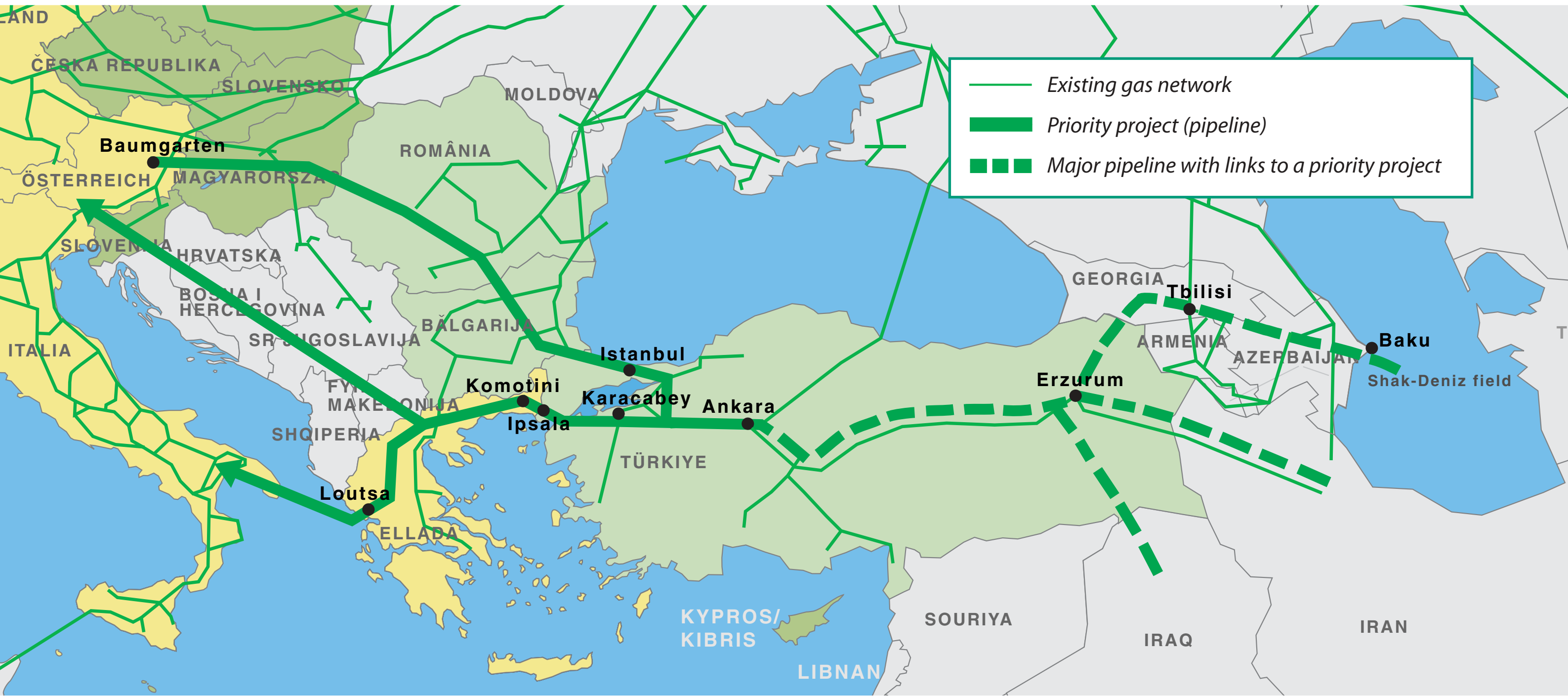
While Greece and several Balkan countries are interested in receiving gas (capacity 3.6 BCM/y) via southern Italy and the Ionian Sea from the EU network, Caspian gas will be transported in the opposite direction. An offshore line (224 km) from Italy's Puglia region across to Loutsa in north-west Greece would be complemented with compressors and on-shore lines on both sides.

Balkan routes to central Europe

The **'Nabucco pipeline'** with a total length of around 3 400 km, would start at the Georgian–Turkish or Iranian–Turkish border and cross Turkey, Bulgaria, Romania and Hungary to end in Austria at the central European gas hub in Baumgarten. Connections would take it on to the German–Austrian and Italian–Austrian borders. In fact, most of the gas would be transported further from Baumgarten. A gradual increase in volume transported from 2009/10 is planned, with a total increase of up to 25–30 BCM/y by 2020 foreseen.

A second route, the **'Orient express pipeline'** foresees upgrading links and the construction of new pipelines from Turkey across northern Greece and up the western Balkans to Slovenia and Austria.

NG3: Route	Distance (km)	Type of work	Technical information	Status and timetable	Estimated cost in million EUR (EU support from TEN-E)
Gas from Caspian Sea through Turkey	ca. 1 500	Upgrade			
Interconnector Turkey–Greece Turkish Section Greek Section	285 ca. 200 ca. 85	New pipeline New pipeline New pipeline	Capacity up to 10 BCM/y	Operational 2006	280 140 140
Interconnector IT–GR Offshore connection in deep water Onshore stretch in Greece	504 224 280	New pipeline New pipeline New pipeline	Capacity phase 1: 2 BCM/y Capacity phase 4: 8 BCM/y	Phase 1: Construction: 2005–08 Operational: 2008 Feasibility study: 2003–05	560 EU 72 1 240 2.0 study (1.0)
Eastern Balkans: Nabucco pipeline TR–BG–RO–HU–AT	3 400	New pipeline	Capacity up to 30 BCM/year	Comprehensive feasibility and market analysis in 2004 Construction: 2005–2008 Operational: 2009	3.4 (1.70) 4 400
Western Balkans TR–GR–Balkans–SI–AT	ca. 1 400	New pipeline			
South-east European gas interconnection (a) Turkey to Italy through Greece (b) Turkey to Austria through Bulgaria, Romania and Hungary (c) Turkey to Austria through Greece, western Balkans and Slovenia			7.6 (up to 22) BCM/y up to 30 BCM/y Possibly 10 BCM/y		ca. 4 000 ca. 4 400



Liquefied natural gas terminals in Belgium, France, Spain, Portugal, Italy, (Poland, Greece and Cyprus)

Liquefied natural gas has been a safe way of handling gas for many years. Plans to build new storage terminals will boost Europe's supply of this important resource.

What is the project?

The aim is to improve the liquefied natural gas (LNG) supply in five EU countries: Belgium, France, Spain, Portugal, and Italy. The proposed revision of the guidelines suggests to also include Poland, Greece and Cyprus. This will entail studying the logistics and implementing the new capacities to transport, receive, store and convert LNG.

Typically, natural gas is liquefied at -162 ºC (at atmospheric pressure).

What are the objectives?

The project's main aim is to diversify and secure the overall supply of LNG in five target countries, while improving competition between the world's gas suppliers. Another aim is to help create a single European gas market, to stimulate the internal market and upgrade the transmission grids.

This will involve developing terminals for receiving LNG, converting it back into gas, and for transporting it – through better gas links and national grids – to end users. Several projects are underway to achieve this.

NG 4: Port	Type of work	Technical information Storage capacity	Technical information Output capacity	Status and timetable	Estimated cost in million EUR
Zeebrugge (BE)	Extending the LNG receiving capacity	210 000 m^3	Additional capacity 10 BCM/y	Study completed: April 2004 Operational in 2007	ca. 100
Le Verdon-sur-Mer (FR)	New terminal	160 000 m^3		Projected: 2005	
Fos-sur-Mer (FR)	Extending the LNG receiving capacity	construction of a second terminal	8.2 BCM/y	Study completed: Sep 2002 Operational in 2006	300–430
Bilbao (ES)	New terminal	300 000 m^3	5.3 BCM/y	In operation from 2003	280
Mugardos (Galicia) (ES)	New terminal	300 000 m^3	2.1 BCM/y	Projected: 2004 with possible operation in 2007 or later	320
Huelva (ES)	Extending existing terminal	170 000 m^3 increased to 470 000 m^3	Up to 8.6 BCM/y	Several phases	
Cartagena (ES)	Extending existing terminal	165 000 m^3 increased to 450 000 m^3	Up to 7 BCM/y	Several phases	
Sagunto (Valencia) (ES)	Port enlargement new terminal	300 000 m^3	5 BCM/y	Projected: 2004 with possible operation in 2007	
Barcelona (ES)	Extending existing terminal	240 000 m^3 increased to 540 000 m^3	Up to 12 BCM/y	Several phases	
Las Palmas de Gran Canaria (ES) and Santa Cruz de Tenerife (ES)	New terminal New terminal	150 000 m^3 each	1.0 BCM/y	Construction projected until 2006 Possible operation 2007 for Gran Canaria and 2008 for Tenerife	
Sines (PT)	New terminal	210 000 m^3	2.4 BCM/y	Under construction	237
Madeira (PT)	New terminal				
Tuscany region (IT)	New terminal	160 000 m^3	3 BCM/y 10 BCM/y	After 2004 After 2006 Authorisation	300
North Adriatic coast (IT)	New terminal offshore/onshore	250 000 m^3	4 BCM/y 9 BCM/y	Projected: 2006 Projected: 2006 Authorisation	600
Brindisi (IT)	New terminal		4–8.2 BCM/y	Projected 2005 and planned to be operational in 2006	330
Various additional sites in Italy are being studied on the northern Adriatic Coast, Ionian Coast and Ligurian Coast				Projected: 2006	500–650

What are the main elements?

A range of sites in Belgium, France, Spain, Italy, Portugal, Poland, Greece and Cyprus some with existing terminals, others without, are being studied for new LNG reception and storage facilities. If all these facilities are completed to their full planned capacity, output to the European distribution networks could be increased by as much as 75 BCM per year.

Underground storage in Spain, Portugal, Italy, Greece and the Baltic Sea region

Storing gas underground is a simple and effective solution – indeed natural oil and gas reservoirs, created by geological structures, demonstrate the potential. By utilising underground storage a balance is kept between supply and peak seasonal demand. Nevertheless before gas can be pumped into a natural reservoir, extensive geological studies need to be carried out.

What is the project?

This project supports the establishment of underground gas storage reservoirs in several countries using the three available technologies, namely (i) aquifer traps (replacing water with gas), (ii) creating cavities in salt beds and (iii) reusing depleted gas and oil fields. Given the high costs of the geological surveys required and the long-term nature of the return on investment (filling the reservoirs with gas takes time and money is only generated once the gas flows out again to be used), the construction of underground storage requires significant time and commitment.

What are the objectives?

With Europe relying more and more on gas from external sources, the European Commission is concerned that adequate stocks need to be built up to ensure supplies in times of disruption. Gas stocks need to be assured for at least 60 days of normal use, while oil stocks are required for 90 days' consumption. As well as increasing storage capacity, these reservoirs will contribute to improving the internal market for gas, increasing the possibilities for transfer between Member States.

What are the main elements?

Suitable sites, which are/have been the subject of feasibility studies and/or on-site surveys or drillings, are shown on the map with corresponding data displayed in the table. It should be noted that for Portugal and Greece the envisaged sites will be the first to be established in these countries.

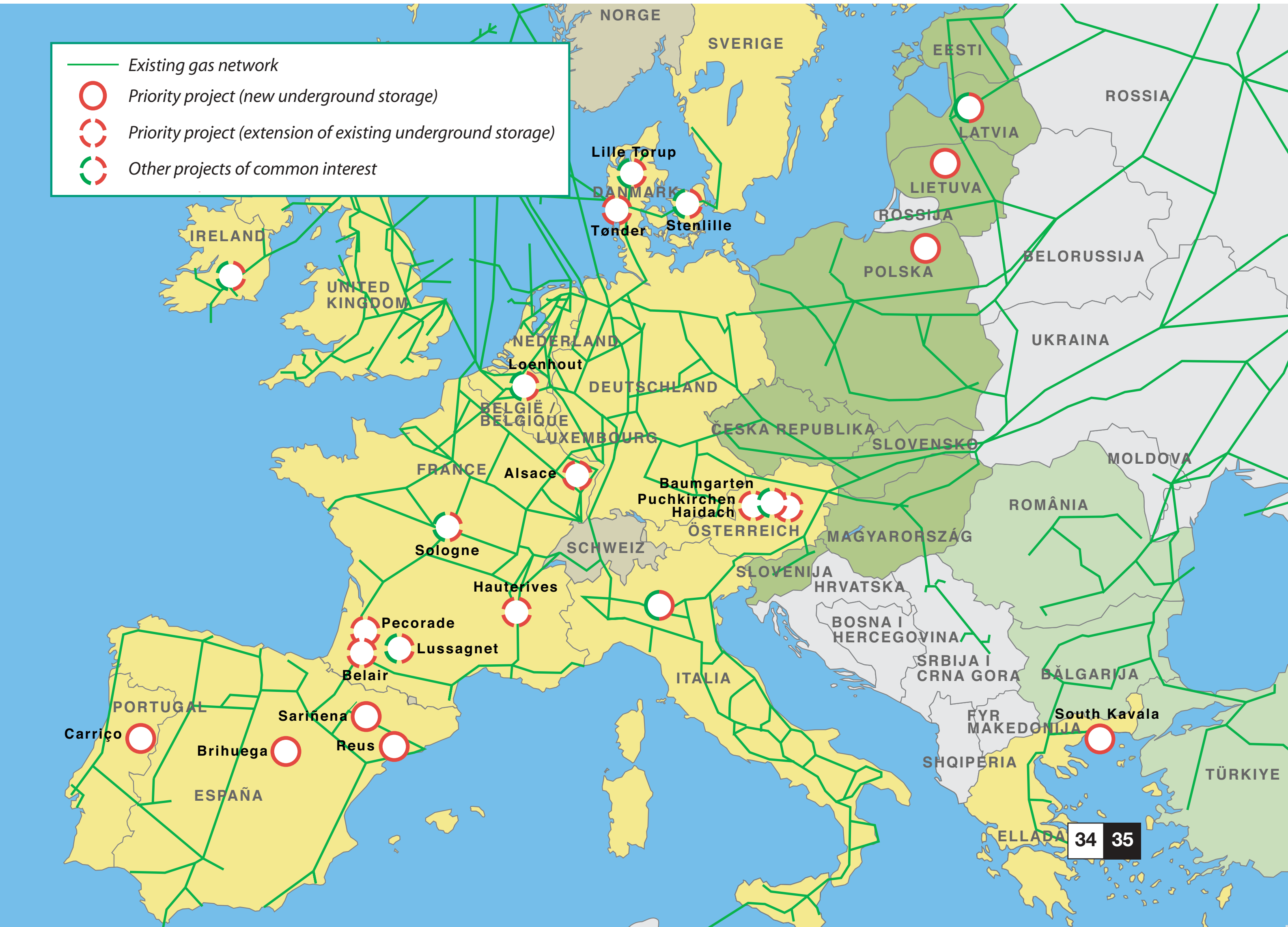
Other projects of common interest, in addition to those on the priority axis, are displayed by broken circles on the map and related data are given in the table.

The countries with maximum working storage volume are Germany (46 storage facilities) with 19 BCM, Italy (10 storage facilities) with 17 BCM and France (16 storage facilities) with 11 BCM. In the context of the trans-European energy networks' priorities, France and Germany are considered to have made sufficient progress on underground storage. However, Italy and several other countries (Spain, Portugal, Greece, Poland, Latvia and Lithuania) require additional storage capacities for the development of their gas markets and the present level of their storage capacities.

NG 5: Underground Storage	Type of work	Technical information Geological storage	Technical information Storage capacity	Status and timetable For technical study	Estimated study cost in million EUR (EU support from TEN-E)
South Kavala (GR)	New storage facility	Conversion of an offshore depleted oil field	1.1 BCM		
Italy	***Developing underground gas storage facilities***				
Rivara Canton Alfosine and Bordolano		 Aquifer storage Aquifer storage	3 BCM 1.5 BCM 1.5 BCM		 75* 120*
Spain	***Developing underground gas storage facilities***				
On north-south axis in Spain Sarinena Brihuega	New storage facility	 Aquifer storage Aquifer storage	 1 BCM 1 BCM	Completion of study Further studies required Further studies required	 7.5 (3.8) 25.8 (12.9)
On Mediterranean axis in Spain–Reus	New storage facility	Aquifer storage	1 BCM	Further studies required	8.6 (4.3)
Portugal	***Developing underground gas storage facilities***				
Carriço (PT)	New storage facility				
Baltic Sea Region	***Developing underground gas storage facilities***				
Lithuania	New storage facility		1.6 BCM	In operation: 2010	160*

Table continued on next page

** Estimated total cost of project*



LIST OF OTHER PROJECTS OF COMMON INTEREST

NG 5: Underground Storage	Type of work	Technical information Geological storage	Technical information Storage capacity	Status and timetable For technical study	Estimated study cost in million EUR (EU support from TEN-E)
Hauterives (Rhone Valley) (FR)	New storage facility	Developing saline cavities		Completion of study: April 2004	5.4 (1.45)
Belair and Bastennes-Gaujacq (near Pau)–south-west France	New storage facility	Developing saline cavities	180 MCM 10 MCM/day	Completion of study: June 2005	8.5 (3.30)
Sologne (FR)	New storage facility	Aquifer storage		Completion of study: Dec 2010	18.5 (2.2)
Lussagnet (FR)	Extension of existing site	Aquifer storage	Up to 3.5 BCM	Completion of study: Dec 2003	3.45 (1.5)
Pecorade (FR)	New storage facility	Conversion of a depleted oil field	1 BCM	Completion of study: June 2005	11.0 (4.3)
Alsace region (FR)	New storage facility	Developing saline cavities	700 MCM	Completion of study: June 2005	7.5 (3.4)
Loenhout (BE)	Extension of existing site	Aquifer storage	0.9–1.1 BCM	Completion of study: 1999	6.5 (3.25)
Stenlille (DK)	Extension of existing site	Aquifer storage	3–7 BCM	Completion of study: 2001(further study required)	8.6 (4.3)
Tønder (DK)	New storage facility	Aquifer storage	1 BCM	Completion of study: 1997	3.0 (1.5)
Puchkirchen (AT)	Extension of existing site	Aquifer storage	1.1 BCM	Study completed, expansion phase I finished	5.8 (2.9)
Baumgarten (AT)	Conversion of gas field	Aquifer storage	1 BCM	Study completed: 1998	0.65 (0.33)
Haidach (AT)	Conversion of gas field	Aquifer storage	2 BCM	Completion of study Dec. 2002, phased construction up to 2010, first phase until 2004	2.4 (0.74)
Ireland	Developing underground gas storage facilities				

Mediterranean Member States – east Mediterranean gas ring

Libya and Egypt both have major gas reserves, but there are limited connections both to Europe and to their Mediterranean neighbours. Creating a network of gas lines will open up new supply routes and ensure greater security of energy supply.

What is the project?

A network of pipelines will bring gas from Egypt and Libya to Italy and to southern Europe. Furthermore, the Arab gas pipeline will bring Egyptian gas to countries in the eastern Mediterranean, including Jordan, Syria, Lebanon, and eventually to Cyprus and Turkey. Egypt will become a major export country for LNG in the coming years.

What are the objectives?

The Euro-Mediterranean Energy Forum envisages the establishment of competitive energy markets throughout the region, with a view to free trade across both EU Member States and the Mediterranean partner States. These gas lines will play a vital role in ensuring security of energy supply, and in improving flexibility and competitiveness in the gas-supply industry.

What are the main elements?

Libya–Italy: 600 km pipeline, with 520 km of underwater pipeline, with a capacity of 8 BCM per year. Gas is expected to start flowing in 2005, with half committed for supply within Italy. Further shares are expected to go to France and other countries beyond Italy.

Egypt–Libya–Spain: In the longer term, natural gas supplied by pipelines from Egypt could be channelled along this route to southern Europe. It is noted that Egypt will ship a significant part of the gas in the form of LNG.

Arab gas pipeline from Egypt: With a capacity of 10 BCM, this pipeline built in six phases will eventually take gas from Egypt through Jordan and Syria to Lebanon, Turkey and Cyprus. Initial phases reaching Jordan and on towards the Syrian border are already operational.

Projects of common interest

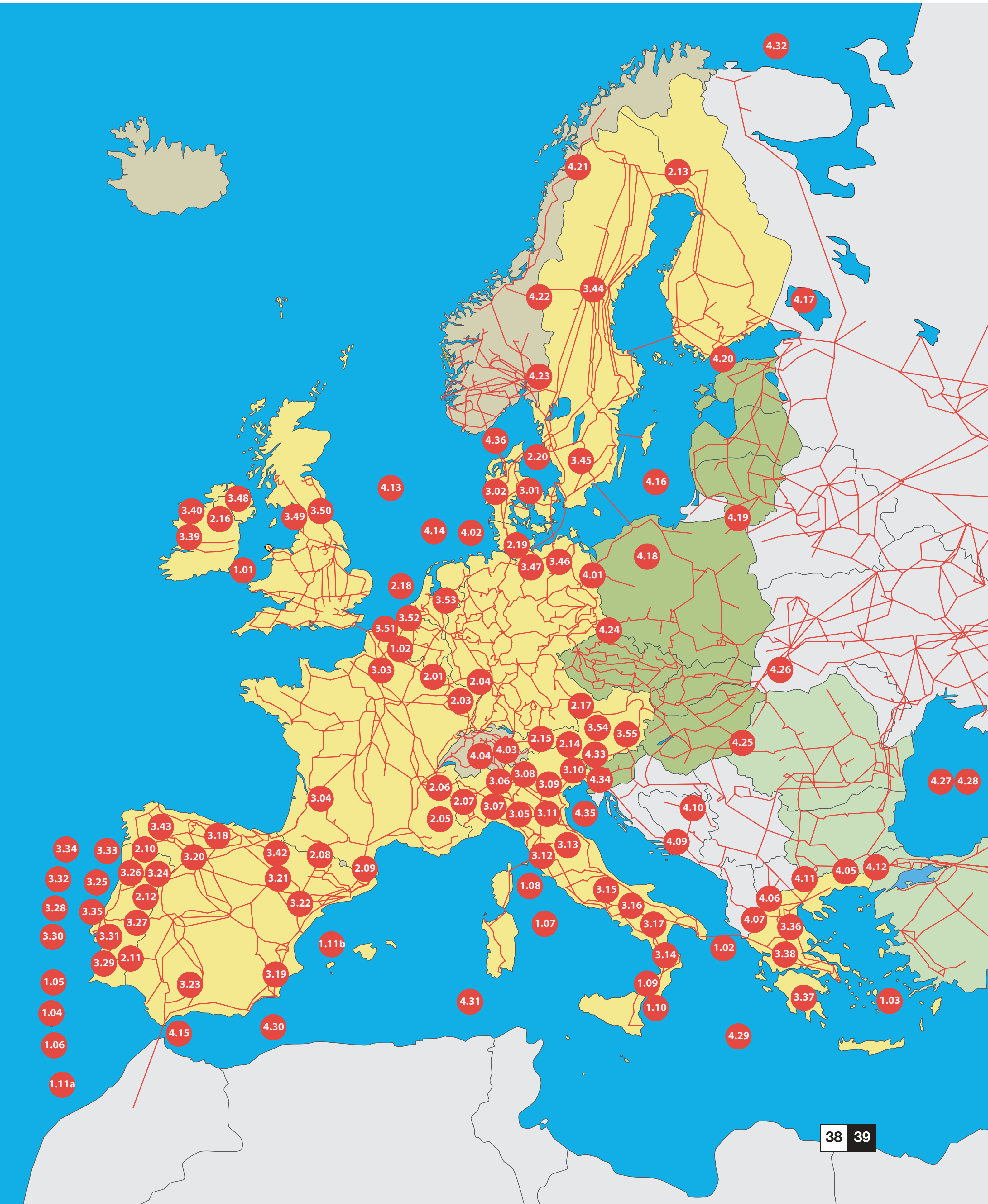
Eligibility for TEN-E financial support

To be eligible for support from the EU under the trans-European networks budget, energy network projects must fulfil the criteria set out in the June 2003 guidelines, and be included in the list of projects of common interest agreed by the EU institutions and reproduced in Annex III of the guidelines (Decision No 1229/2003/EC of 26 June 2003).

On the maps shown below, each project is represented, in a schematic way, by a circle and a number.
The numbering follows that of Annex III.

Electricity networks

The projects of common interest for electricity networks aim at developing connections needed for the efficient functioning of the internal energy market. Such connections may be between the Member States, including relevant sections within Member States, or may connect with non-Member States – in particular, countries which are candidates for EU accession. These connections should ensure the reliability and dependability of the operation of electricity networks. Furthermore, they may support the connection of renewable energy sources or the connection of isolated regions.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Horizontal actions for electricity and natural gas networks

In order to meet the European Union's targets, individual projects are complemented by horizontal actions. These actions improve the functioning of the interconnected electricity and gas networks within the internal energy market, and – in the case of gas – in transit countries. They are:

- identifying bottlenecks and missing links, especially in cross-border sectors,
- developing solutions for electricity and natural gas flow management in order to deal with the problems of congestion,
- adapting forecasting and operating methods for electricity and natural gas networks, required for the functioning of the internal energy market.

Natural gas networks

Gas projects aim at developing connections which meet the needs of the internal market or strengthen the security of supply, including the connection of existing distinct gas networks and isolated regions. This can include developing capacities for receiving liquefied natural gas (LNG) and for storage of natural gas, needed to meet demand and control gas-supply systems, as well as to diversify sources and supply routes. The development of gas-transport capacity (gas-supply pipelines) is essential to meet demand and diversify supplies from internal and external sources, and diversify supply routes.


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Financing the trans-European energy networks

Current estimates by the Commission suggest that the total investment needed to realise the projects on the priority axes (including those being proposed by the Commission but not yet adopted by Council and Parliament) would amount to EUR 28 billion in the period 2007–13. Of this, around two-thirds is required inside the EU and the remainder on sections outside.

The trans-European networks budget line

In comparison, this figure amounts to about one third of the total annual EU budget, and over 35 times the total annual budget available for trans-European networks – which covers transport and telecommunications networks in addition to energy. It is clear that the EU contribution to this investment can only be minor, especially in the competitive energy sector where investment costs may be recovered from customers. However, the Commission aims to gain a leverage effect from the small sums it is able to invest.

The trans-European energy networks budget is relatively small and its use is as a catalyst for investment, and as an initiator of studies and other preparatory activities, rather than to support the actual construction of projects. In the period 1996–2001, for example, a total of 140 actions in 53 projects received assistance totalling EUR 123 million, with 56 % going to natural gas projects and the remainder to electricity projects.

As a general rule therefore, financing the construction of these projects should be the responsibility of the network operators, who will after all receive the proceeds from their operation. Operators are expected to invest their own funds or raise capital from the markets to realise these projects. However, for a limited number of cross-border sections, EU funding can provide a catalyst to facilitate the investments. Moreover, given that many of the sections outside the EU are in regions considered to be high-risk investments, insurance against the political risks is a necessary condition for gaining loans for such projects. EU funds may be used to cover this type of insurance in the future.

Structural Funds

Besides specific funding from the trans-European networks budget, other Community instruments may also contribute to support infrastructure developments. In particular, projects in regions which are eligible under the Structural Funds (in particular, Greece, Ireland, Portugal, Spain) have attracted grants from these sources, which are aimed at bringing disadvantaged regions closer to average EU standards. In the period 1996–2000, around EUR 2 billion (two thousand million) in grants from the Structural Funds went to trans-European energy networks projects.

The Structural Funds can also be expected to make a significant contribution to energy network projects in the new Member States in the coming years. In previous years, the preparatory phases of some energy network projects in the candidate countries have received some support from the Phare programme, which supports economic transition in the central and east European countries. Trans-European energy network projects in other non-member countries may receive similar support from related programmes, such as Tacis (Russia and the former Soviet Union countries), CARDS (south-east Europe), and MEDA (Mediterranean partner countries).

The European Investment Bank (EIB)

The European Investment Bank, which is the EU's main financing institution, is able to lend money for infrastructure projects of this nature. In fact, trans-European networks projects – in transport and energy – are one of the EIB's key priorities for investment. The EIB borrows money on capital markets, benefiting from its status as an EU institution to gain low interest rates, and lends it for long-term projects in the EU and in partner countries. In 1996–2000, the EIB provided loans totalling EUR 3 billion towards trans-European energy networks projects.

The European Investment Fund (EIF), a public-private partnership in which the EIB, the EU and a number of banks in the Member States hold shares, can provide loan guarantees to assist in obtaining finance for major projects. Often the scale of such infrastructure projects and the attendant risks may make it difficult for operators to raise the funds necessary on the open market. Loan guarantees from the EIF can make the difference for such operations.

Further information

- For further information on the trans-European energy networks, please visit: http://europa.eu.int/comm/energy/ten-e/en/index.html
- The Green Paper entitled 'Towards a European strategy for the security of energy supply', together with related documents may be downloaded from: http://europa.eu.int/comm/energy_transport/en/lpi_lv_en1.html
- Information on EU policies relating to the gas market is at: http://europa.eu.int/comm/energy/gas/index_en.htm
- Information on EU policies on the electricity market can be found at: http://europa.eu.int/comm/energy/electricity/index_en.htm
- Statistics on European energy may be accessed from: http://europa.eu.int/comm/dgs/energy_transport/figures/index_en.htm

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