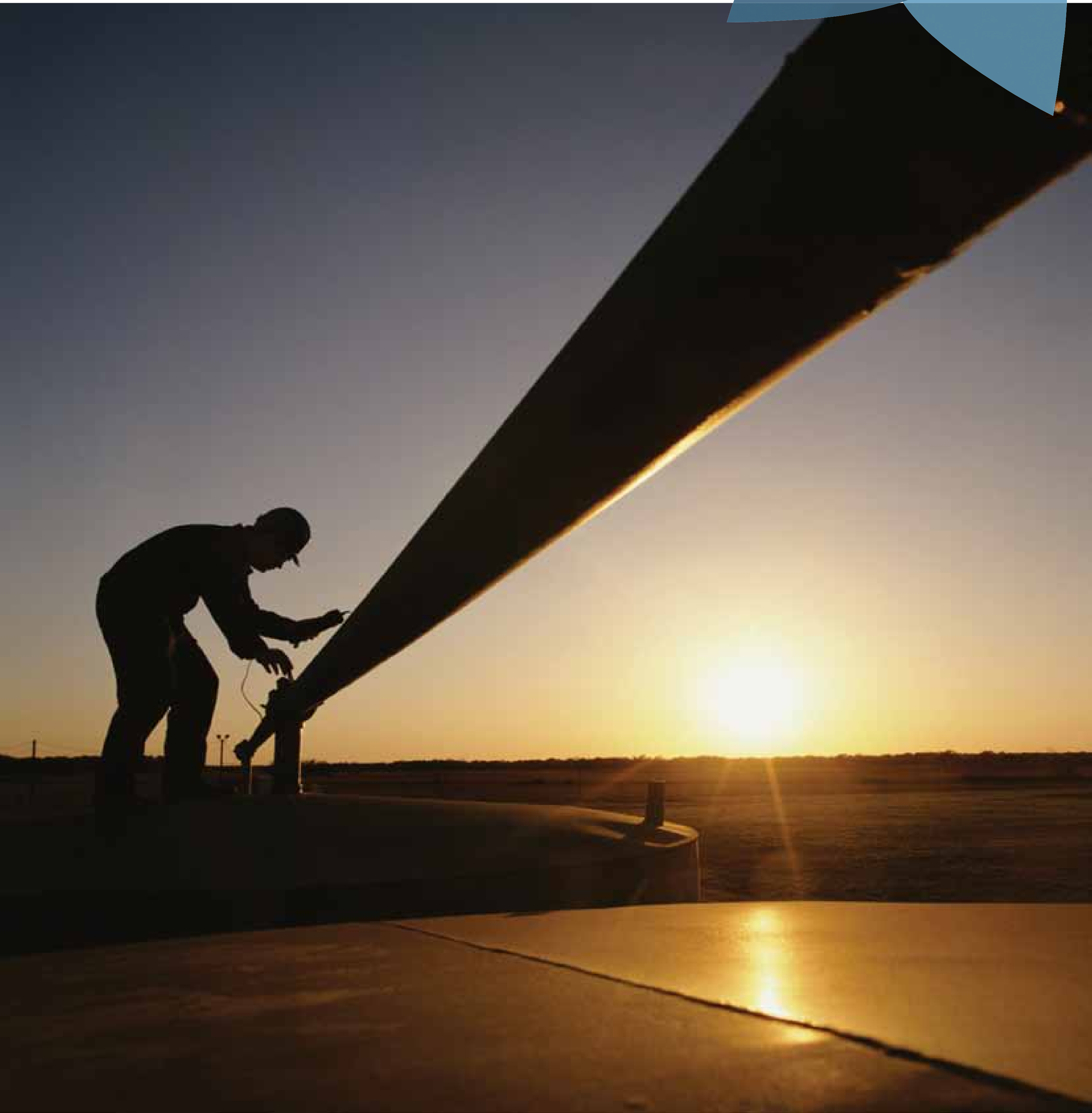
The Future Role of Natural Gas

A Position Paper by the European Gas Advocacy Forum



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Overview

Europe's ability to meet the climate challenge while remaining economically competitive depends on a deeper understanding of the energy supply options available. The aim of this joint position paper is to highlight that the outlook for natural gas is characterised by abundance, affordability and environmental attractiveness.

About the Forum

The European Gas Advocacy Forum is composed of: Centrica, Eni, E.ON Ruhrgas, Gazprom Export, GDF SUEZ, Qatar Petroleum, Shell and Statoil. This informal group of experienced players in the European gas industry was established in 2010 to increase – at all levels of society – understanding of the environmental, economic and energy security benefits of natural gas.

xyntéo

Xyntéo, an advisory firm which specialises in low-carbon growth, has served as an independent, third-party advisor and facilitator in the process.
www.xynteo.com

All referenced web pages last accessed 11 May 2011.

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HIGHLIGHTS

NATURAL GAS IS ABUNDANT

Globally, estimates point to more than 250 years of recoverable natural gas resources at current consumption levels. New pipelines, new inter-connections and expanding LNG infrastructure, along with a revolution in the exploitation of unconventional resources, have transformed supply realities. For Europe – situated within a 5,000-kilometre radius of 80% of proven worldwide gas reserves – the outcome has been a surge in natural gas supplies and a diversification of natural gas suppliers. Europe nevertheless needs to foster an environment that stimulates the longer-term availability of global gas resources.


Electrabel/BECKERS Raf

NATURAL GAS POWER PLANTS ARE A COST-COMPETITIVE ALTERNATIVE

Combined-cycle natural gas power plants have lower full costs than the other generation alternatives for mid-merit and peak operations. Depending on assumptions for future fuel and carbon prices, natural gas powered plants could also have lower full costs than coal for base-load generation. In addition, combined-cycle natural gas power plants are also much less capital investment intensive. Coal plants and nuclear plants require, respectively, two-to-three and four-to-five times as much capital per megawatt as natural gas plants. Natural gas plants are also typically faster to build, with a shorter, more straightforward permitting process.


Siemens press picture

NATURAL GAS IN POWER GENERATION OFFERS SIGNIFICANT EMISSIONS REDUCTIONS

Replacing old coal plants with new natural gas-fired plants could lower emissions of carbon dioxide by 60-70% per kilowatt-hour generated – taking into account the entire life cycle, from exploration and extraction right through to decommissioning and disposal. Even the most modern coal plants can emit twice the amount of CO_2-equivalents per kilowatt-hour as natural gas combined-cycle power plants. Furthermore, the US National Research Council estimates that the cost of environmental damages unrelated to climate change from natural gas power plants is 95% lower per kilowatt-hour than the cost of those caused by coal plants.


Electrabel/BECKERS Raf

NATURAL GAS HAS AN IMPORTANT ROLE TO PLAY IN DECARBONISING THE ENERGY MIX

- In the short term, fuel switching from other fossil fuels to natural gas can deliver a substantial decrease in CO_2 emissions in both power generation and other sectors.
- In the medium term, combining investments in natural gas plants with investments in renewable energy could ensure a secure supply of energy with reduced CO_2 emissions – even when the wind is not blowing or the sun is not shining. Because natural gas powered plants can start up or shut down within minutes, they can serve as a flexible complement to intermittent renewable energy sources. Up to 2030 Europe's required CO_2 mitigation can be reached with existing technologies. We therefore have until then to demonstrate the social acceptability and maturity of carbon capture and storage (CCS) technology.

– In the long term, CCS could enable natural gas to play an important part in the energy mix in a decarbonised 2050. After 2030, CCS could be retrofitted to natural gas power plants to achieve near-zero emissions.

NATURAL GAS HAS ADVANTAGES BEYOND POWER GENERATION

In heating, industry and city transport, natural gas is an environmentally sound alternative to other fossil fuels. Fuel substitution and replacing old appliances with gas-based heating technologies are fast and cost-effective ways of reducing both CO_2 and other emissions; these same technologies are a good match for integrating renewable energies (like solar heating or biogas) over time. More and more cities around the world are taking advantage of natural gas's twin benefits in public transportation: dramatically improved air quality and a smaller urban carbon footprint.

NATURAL GAS SUPPORTS EUROPEAN ECONOMIC DEVELOPMENT AND COMPETITIVENESS

Compared to the European Climate Foundation's pathway to a 2050 European energy mix featuring 60% renewables ("Roadmap 2050: A practical guide to a prosperous, low-carbon Europe"), an "optimised" pathway could secure, in total power cost savings, an estimated €500 billion up to 2030. While it might be possible to avoid €300-400 billion in capital expenditure between 2030 and 2050, the total power system cost over this same period could be roughly equal or slightly better relative to the ECF pathway referred to above.

For Europe, natural gas is thus not only an abundantly available energy source, but one that used in combination with a growing and innovative renewable industry meets agreed reduction ambitions in an economically superior manner.

Mandating the exact technologies and energy sources to be used to decarbonise the European economy, rather than setting clear end-goals and levelling the playing field, risks hamstringing innovation. And innovation, along with a flexible and robust energy system, is a prerequisite of Europe's future competitiveness.

FOREWORD

The European Gas Advocacy Forum appreciates the scale of the challenge in limiting global warming to 2˚C. This will require halving global CO_2-equivalent emissions by 2050 (compared to 1990 levels); for the EU and other developed countries, this means an 80% cut by 2050.

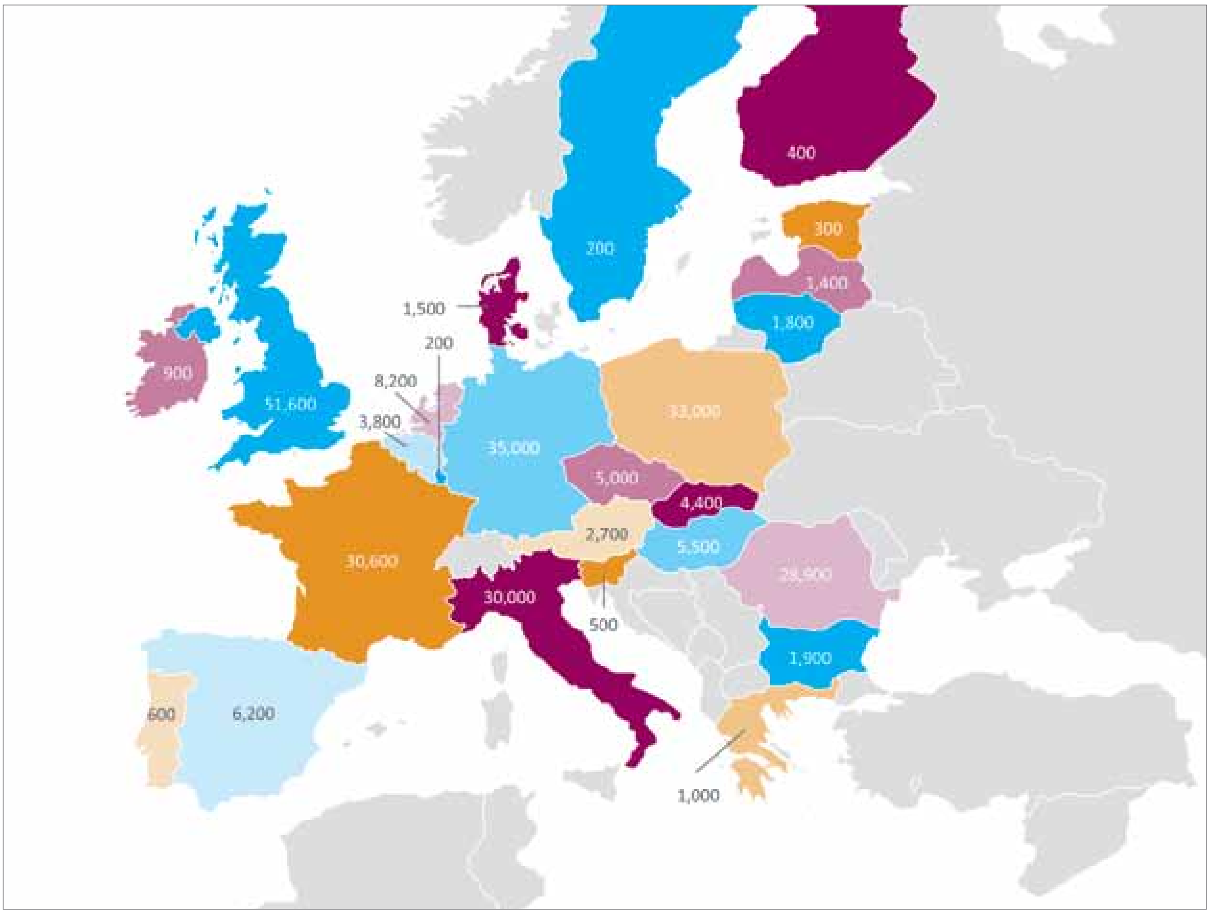
It is our belief that we can reach these targets faster and more cost-effectively if natural gas plays a significant part in the energy mix not only in the short to medium term (from now until 2030), but also over the longer term (towards 2050) when deployed in tandem with CCS. Given its advantages in terms of both cost and carbon, an energy pathway emphasising natural gas could support European competitiveness while increasing chances of meeting climate targets.

However, in some of the emission mitigation pathways currently being promoted, natural gas is being phased out of the energy mix and overtaken by coal combined with CCS and nuclear and renewable energy. Renewable energy will undoubtedly play a pivotal role in the future energy mix; its share is bound to grow in any lower-carbon scenario. Using more natural gas instead of coal would enable renewable energy to be developed more efficiently. This is mainly because natural gas plants can provide the operational flexibility needed to balance intermittent renewable energy in an economical way.

As we evaluate emissions reduction pathways it is vital that natural gas's potential contribution is fully recognised: a greater role for natural gas in the European energy supply of tomorrow has the potential to deliver the same level of sustainability more economically.

European Gas Advocacy Forum
May 2011

The European natural gas industry employs large numbers

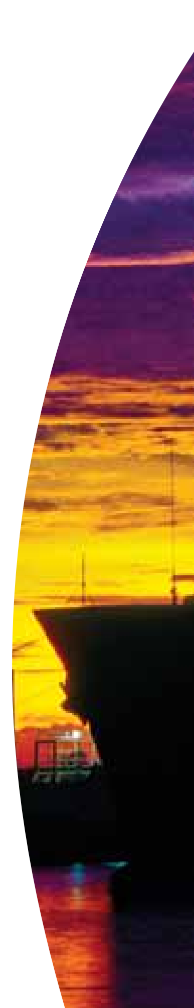


More than 250,000 people in the EU contribute to the European economy through their jobs in the natural gas industry. Natural gas has played an important role in Europe for decades. From 1990 to the present, the share of natural gas in the European energy mix has grown from 18% to 25% (2008). Today Europe consumes roughly 500 billion cubic metres per year – equivalent to 15% of the global natural gas market.

The overall increase in European use of natural gas has been mirrored in power generation, where the share of natural gas increased from 8% in 1990 to 20% in 2008 – at the expense of coal, oil and (to a lesser extent) nuclear energy. The replacement of oil- and coal-fired plants with natural gas-fired plants has reduced CO_2 emissions from power generation by 8% between 1990 and 2008 – despite the fact that the power generation segment grew by 14% over the same period.

Natural gas is also used for many purposes beyond power: in residential and commercial contexts for heating and cooking, in industrial applications and as a transportation fuel. Its attractiveness is illustrated by its rapid climb in the European energy mix – from zero to today's 25% share over just 50 years.

Sources:
"Statistics 2008", Eurogas, available from: www.eurogas.org/uploaded/Eurogas%20Annual%20Report%202008-2009_%20statistics.pdf
"Statisticl Review of World Energy", BP, June 2011, available from: www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481
"World Energy Outlook 2010", Paris: OECD/International Energy Agency, 2010, p.618-640

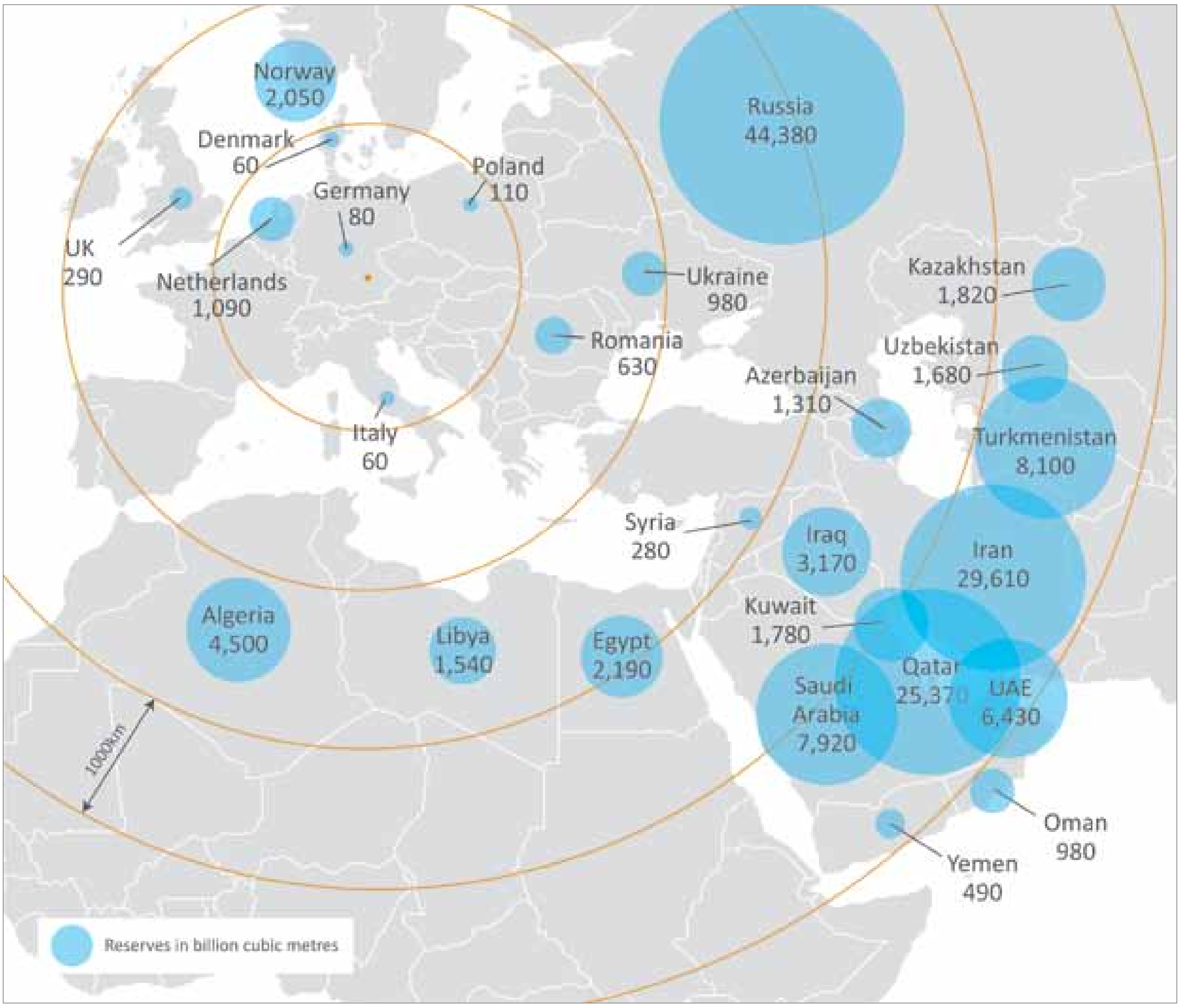


section one

THE CHANGING SUPPLY PICTURE

AMONG some stakeholders, natural gas seems to have gained a reputation as a less reliable source of energy, vulnerable to political uncertainty. Whatever merit this line of thinking might have had in the past, the supply outlook for Europe is now fully transformed, the principal reasons being: the global growth of liquefied natural gas (LNG) infrastructure; the proliferation of new pipeline systems into Europe; more inter-connections within the existing grid; the recent shale gas revolution in the US; and the prospects for increased recoverable unconventional reserves in other parts of the world, including Europe.

80% of the world's proven natural gas reserves are located within a 5,000-kilometre radius of the EU

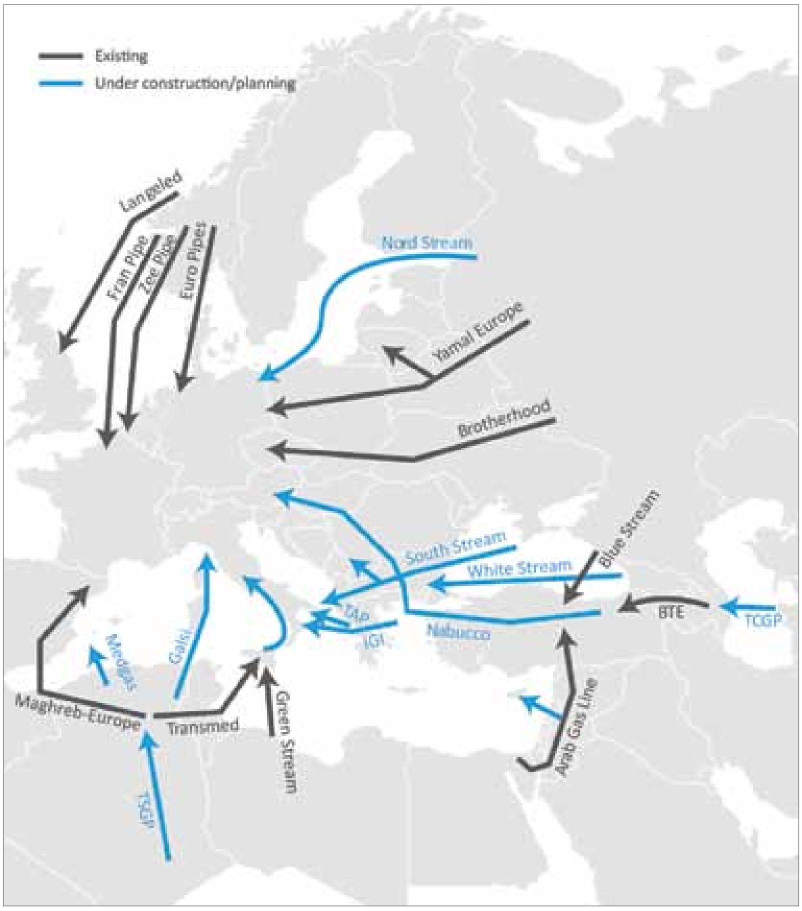


Source: "Statistical Review of World Energy", BP, June 2010
Unconventional not-yet-proven reserves are not included in this illustration.

The worldwide reserve-to-production ratio of proven reserves of natural gas is estimated to be roughly 60 years. But proven reserves represent only a small proportion of total resources. Economically recoverable resources are estimated to amount to around 800 trillion cubic metres, the equivalent of more than 250 years' supply at current consumption rates. Natural gas from unconventional sources – such as shale gas, tight sand gas and coal-bed methane – is thought to represent at least half of that; unconventional gas is, furthermore, more widely dispersed geographically.[1]

LNG developments are making supply from remote areas more economically viable and encouraging more intra-regional gas trade – a significant step towards a more global and liquid gas market. The growth in pipeline trade has connected the CIS and North Africa to Europe, thus reinforcing European supply security. [2]

Natural gas infrastructure developments are increasing import capacities



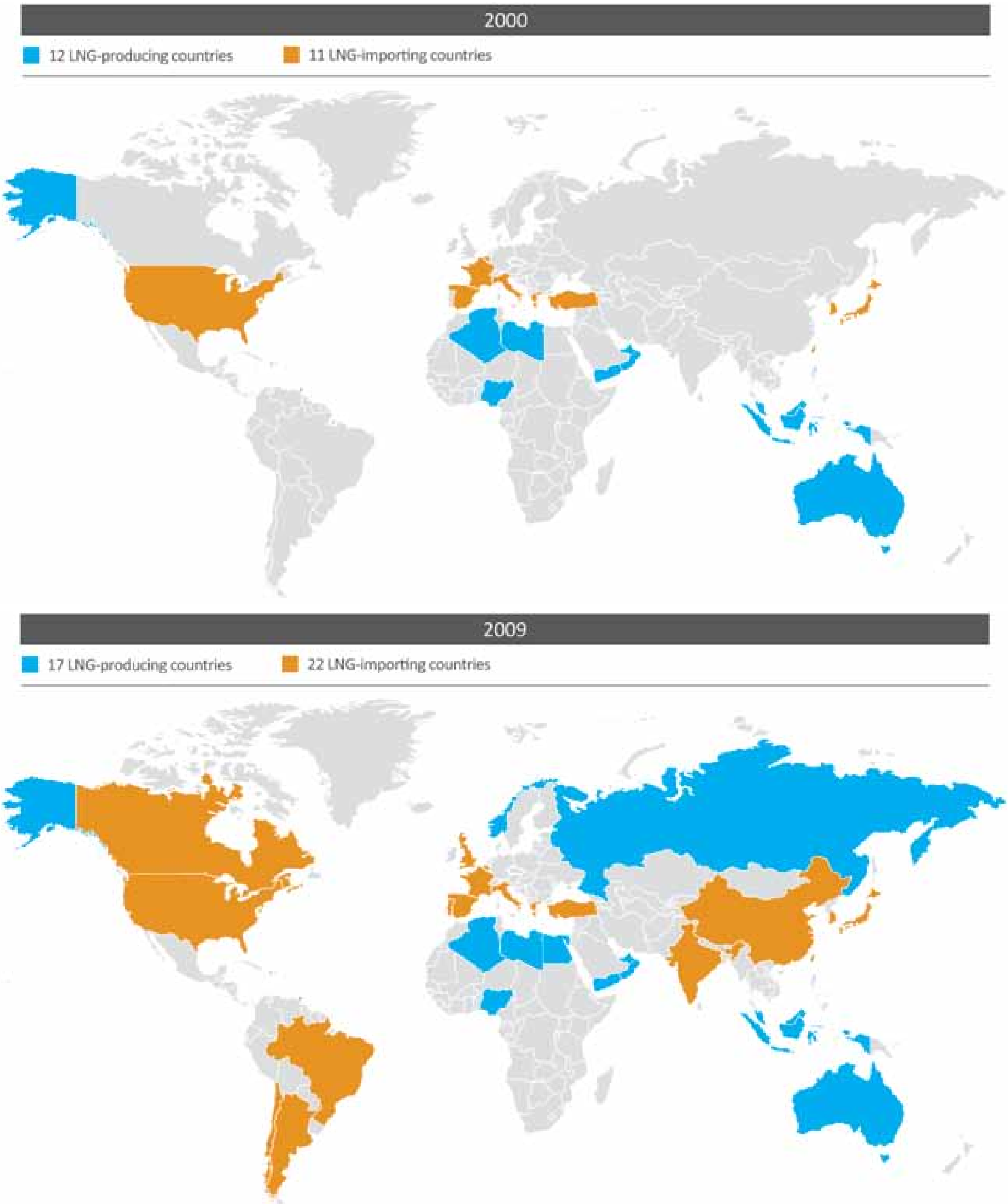
Source: Auer, J. and Nguyen, T-L., "Gas Glut Reaches Europe", Deutsche Bank Research, Reports on European Integration, EU Monitor 75, 8 July 2010

Pipeline growth is enhancing security of supply

1 "World Energy Outlook 2010", p. 187

2 Auer, J. and Nguyen, T-L., "Gas Glut Reaches Europe", Deutsche Bank Research, Reports on European Integration, EU Monitor 75, 8 July 2010

The LNG market has seen remarkable growth between 2000 and 2009



Source: "The LNG Industry 2000" and "The LNG Industry 2009", *Groupe International des Importateurs de Gaz Naturel Liquefiée* (The International Group of LNG Importers). The updated report is available from: www.giignl.org/fr/home-page/lng-industry/

In just nine years the number of LNG-producing countries has grown from 12 to 17, while the number of importing countries has doubled, from 11 to 22. This growth is helping to create a more global and liquid natural gas market

In the US, technological innovation has revolutionised the production of unconventional (particularly shale) gas. As a result of its shale boom, the US's role as an LNG importer is likely to be much diminished, thus freeing up LNG supply for Europe and other markets.

Unconventional gas resources in other parts of the world, notably in Eastern Europe and China, may also bolster European supply security in coming decades. Current estimates suggest that European shale gas resources could meet approximately 30 years of the EU's natural gas needs (at current consumption levels).[3] The European shale gas industry is still working through the early stages of the learning curve. As it moves forward, the industry is confronting a number of issues – including ensuring that production processes, from water management to drilling technology, support the development of a sustainable European shale gas industry.

Also contributing to Europe's supply security is the increase in gas storage capacity: roughly 70 billion cubic metres of storage under construction or planned, on top of the 80 billion cubic metres in operation today.[4]

To benefit fully from these positive gas supply developments, Europe needs to promote an investment climate that stimulates the long-term attractiveness of the European market for natural gas producers.

3 "World Energy Outlook 2009", Paris: OECD/International Energy Agency, 2009, p. 397
4 "Analysis following the update of the GSE Investment Database", Gas Infrastructure Europe, February 2010, available from: www.gie.eu/maps_data/GSE/database/index.html

section two

A COST-EFFECTIVE PATHWAY TO A GREENER ENERGY MIX IN ALL MARKET SEGMENTS

Electrabel/DE BARSE Rudy

Wind turbines and a combined-cycle gas turbine station in Herdersbrug, Belgium

Power Generation

The potential of natural gas as a substitute for other fossil fuels

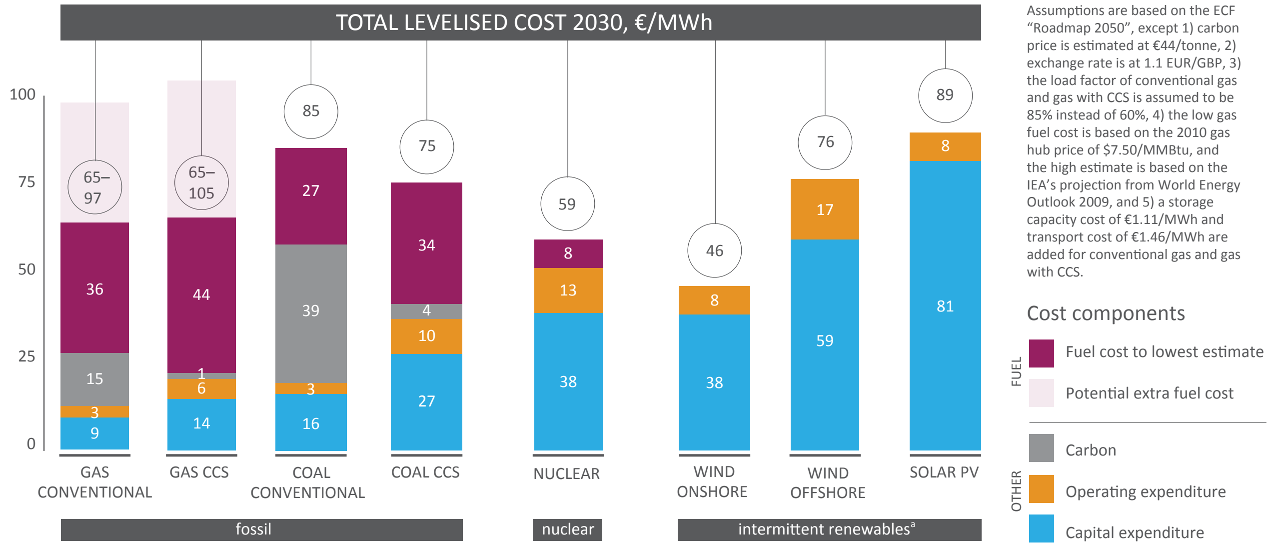
Power generation showcases natural gas's potential economic and environmental strengths. First of all, combined-cycle natural gas power plants are much less capital investment intensive. Current estimates of capital requirements suggest that gas plants are, respectively, two-to-three and four-to-five times less capital intensive per megawatt than coal and nuclear plants. Offshore wind requires four-to-ten times more capital per megawatt; solar PV more than three times.[5]

Over the lifetime of a power plant, natural gas combined-cycle plants are an economically competitive option for new base-load power generation

In addition, gas power plants typically have lower full costs than the other generation alternatives for mid-merit and peak operations. Depending on assumptions for future fuel and carbon prices, natural gas powered plants may also have lower full costs than coal for base-load generation. A recent study commissioned by the UK's Department of Energy & Climate Change (DECC) investigated the levelised cost of electricity generation for various technologies (cost per kilowatt-hour generated over the lifetime of a power plant). Recognising the uncertainty in estimating cost data over the next 20 to 30 years, the study found that combined-cycle gas plants result in both lower capital expenditure and lower total levelised costs. Gas prices would have to exceed the DECC's high-end scenario for combined-cycle gas plants to lose their cost advantage.[6]

The European Gas Advocacy Forum has estimated the levelised cost of electricity generation technologies for new-builds in 2030, based on the set of assumptions used in the European Climate Foundation's "Roadmap 2050" study and a range of natural gas prices. In 2030, gas technologies, with or without CCS, could still be a viable option even when a cost for carbon (assumed at €44/tonne) is factored in (see graph below).

In 2030, new natural gas plants could still be one of the most competitive power generation options



Source: "Roadmap 2050: a practical guide to a prosperous, low-carbon Europe", European Climate Foundation, Volume I, 2010, available from: www.roadmap2050.eu.

a Load factors for these intermittent technologies are usually below 40% pa (this depends on the energy profile, but typically around 30-40% for wind and <20% for solar PV). A like-for-like comparison with the other base-load technologies would enatail adding the cost of back-up generation.

5 "UK Electricity Generation Costs Update", Mott MacDonald, 2010, and "Roadmap 2050: a practical guide to a prosperous, low-carbon Europe", European Climate Foundation, Volume I, 2010, p 34, available from: www.roadmap2050.eu

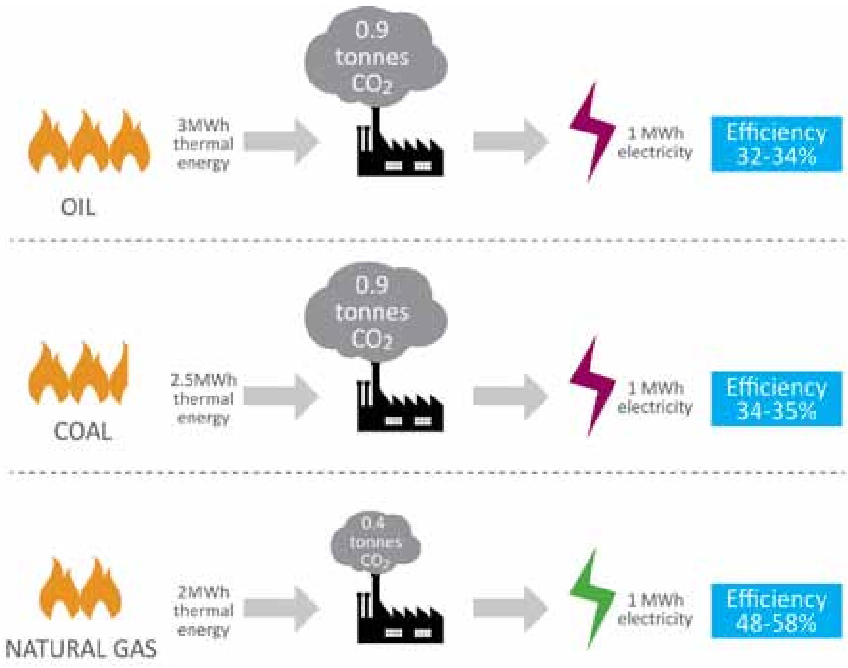
6 "UK Electricity Generation Costs Update", Mott MacDonald, June 2010

Natural gas plants are also quicker to build, taking 20 to 30 months as opposed to the 40 to 50 months required for a coal power plant and 60 to 80 months for a nuclear plant.[7] In addition, the permitting process is shorter and more straightforward compared with other energy sources.

Combined-cycle gas plants emit half as much CO_2 per kilowatt-hour as modern supercritical coal plants, and up to 80% less CO_2 than old steam turbine coal plants,[8] of which there are still many hundreds left in the world, including in Europe. Many of these could be decommissioned over the next five to 15 years and replaced.[9] This represents an important opportunity: by increasing utilisation of existing gas-fired plants (currently at just 60% in Europe) and by replacing old coal-fired plants with new gas-fired ones, Europe can move faster and more cheaply towards its CO_2 reduction targets. This would yield other environmental and economic advantages as well: the US National Research Council estimates that the cost of non-climate-related environmental damages (unrelated to greenhouse gas emissions, but associated with SO_2, NO_x and particulate matter emissions) generated by natural gas power plants is 95% lower per kilowatt-hour than those caused by coal plants.[10]

Natural gas plants are more efficient, require less fuel input for the same amount of electricity generated and are less CO_2 intensive

Natural gas power plants have better environmental performance than coal and oil plants



Source: "Natural Gas, part of an efficient sustainable energy future", GasUnie, February 2010. Data from Gas Terra

7 Kehlhofer, R. et al., "Combined Cycle Gas & Steam Turbine Power Plants", 3rd edition, Oklahoma: PennWell Corporation, 2009, p.28
8 Weisser, D., "A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies", Planning and Economics Studies Section/International Atomic Energy Agency, 2007. Present lignite (brown coal) plants emit 1100-1700 g CO_2/kWh. Present coal plants emit 800-1000 g CO_2/kWh. Future and advanced coal plants will emit 750-850 g CO_2/kWh. Advanced natural gas plants will emit 400 g CO_2/kWh (existing natural gas plants emit 440-780 g CO_2/kWh). All numbers represent emissions over the entire life cycle.
9 Speech by Malcolm Brinded, Executive Director, Upstream International, Royal Dutch Shell, "Natural gas: a vital part of Europe's energy future", April 2010, available from: www.shell.com/home/content/media/speeches_and_webcasts/archive/2010/brinded_paris_22042010.html
10 "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use", US National Research Council, Washington DC: National Academies Press, 2010, p.6-8. Based on mean figures (substantial variation between power plants).

While a gas-based pathway could meet the EU's required 2030 emissions reductions with existing technologies, the longer-term (2030-2050) role of natural gas powered plants would depend on the removal of CO_2 from flue gases using technologies such as CCS. Retrofitting CCS to gas powered plants instead of coal plants will cost less per kilowatt-hour generated, not least because there is substantially less CO_2 to capture and store.[11]

Europe has thus almost two decades to earn social acceptability and demonstrate the technical and commercial maturity of CCS.

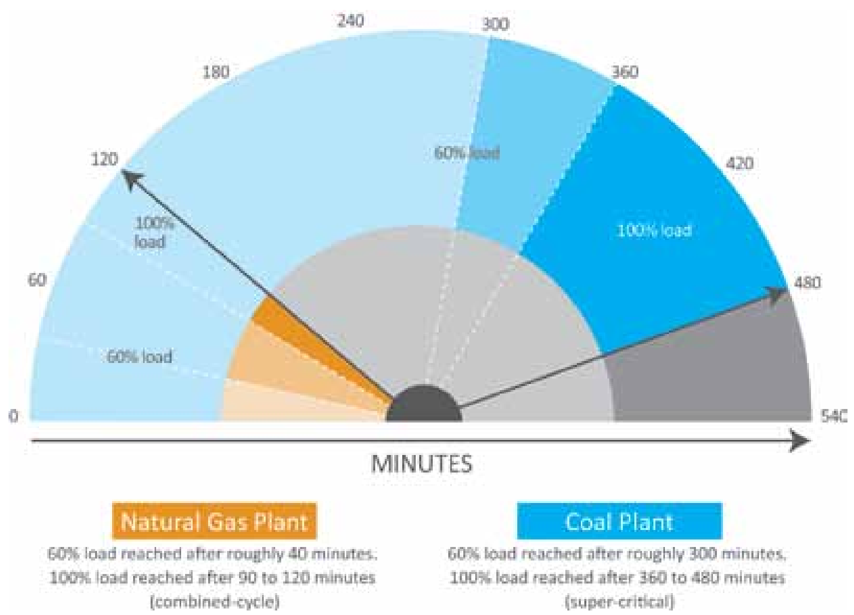
Natural gas – a good match with renewables

Renewable energy is an indisputable part of Europe's energy future. The question is at what scale and according to what timeframe the deployment of renewables should take place. Exploiting the advantages of natural gas through fuel switching could open up a more optimal investment pathway for the power sector. The fuel-switching phase could then be used as a window in which to master the learning curve of both renewable energy and keystone technologies like CCS, while demonstrating economic viability and broadening acceptability among stakeholders.

Up until 2030 fuel switching to natural gas coupled with energy efficiency measures could meet the projected increase in demand while achieving required emissions cuts. Efforts to drive efficiency will need to continue through 2030, after which it would be logical and economical to start deploying natural gas plants away from base-load to providing flexible power to balance intermittent renewable energy sources. Gas turbines are well-suited to this function: they can be turned on and off within minutes.

Natural gas plants, quicker to start up and shut down than coal plants, are a good complement to intermittent renewable energy technologies

Natural gas plants can reach 100% load after just 90 minutes – coal plants take four times as long



Source: "Natural Gas: Technologies for the Future", Eurogas, available from: www.eurogas.org/Fiche_5_OK.pdf

11 "UK Electricity Generation Costs Update", Mott MacDonald, 2010

Employing natural gas as a complement to renewable energy has major advantages. First of all, it means that renewables investment can be phased in, with the greater share of investments taking place when the necessary technologies are more mature. This implies not only reduced overall investment requirements but also lower subsidies – an overriding consideration in today's world of constrained national budgets. Also, more mature technologies are likely to be more efficient. Secondly, a robust network of natural gas plants could satisfy the inherent flexibility needs of an energy mix reliant on renewable energy sources. Compared with a large-scale, mandated deployment of renewable energy, the natural gas scenario described above would require less investment in overcapacity to achieve the same supply security.

Natural gas thus offers an efficient and competitive investment strategy to meet the intermittency challenges of renewable energy.

Other uses of gas – a major part of Europe's energy consumption

There are several other major applications of natural gas in Europe, together representing roughly two thirds of European gas demand.[12]

The residential and commercial market

The use of natural gas for residential purposes (ie, heating and cooking) comprises 37% of natural gas demand in Europe – the largest application.[13] Gas consumption has increased steadily in this sector in line with the expansion of local infrastructure; in 2005, more than 80 million homes in the EU were supplied with gas.[14]

Most of the natural gas consumed in Europe is used for residential purposes.

There are signs of a competing trend towards greater electrification, including a growth in the installation of heat pumps. From an efficiency perspective, the advance of heat pumps has been a very important development. However, electrification may not in all cases represent the optimal allocation of financial and environmental capital, when one takes into consideration the current electricity generation mix, inherent losses in the generation and transmission of electricity, and the economic benefits of making use of the existing natural gas distribution network. In a recent study of the UK market, many natural gas-based heating solutions performed better in terms of carbon

12 "World Energy Outlook 2009", p. 477
13 "Natural Gas Demand and Supply: Long Term Outlook to 2030", Eurogas, available from: www.eurogas.org/uploaded/Eurogas%20long%20term%20outlook%20to%202030%20-%20final.pdf
14 As above

abatement cost (cost per tonne of CO_2 removed) than electricity-based ground-source heat pumps.[15] Electrification also has significant infrastructural implications – the required investment in new power transmission lines and electricity distribution grids needs to be accounted for environmentally and economically.

Particularly in areas where electrification is less viable, natural gas-based technologies can help by integrating renewable energies (like solar heat or biogas) into the residential and commercial market segment. Substituting other fossil fuels and old heating appliances with cleaner, gas-based technologies is a fast and cost-effective way of reducing CO_2 emissions in the shorter term.[16] Other natural gas options, such as condensing boilers and small-scale combined heat and power, represent technical and economical improvements over many heating systems today. Fuel cell technology may become another viable application in the future.

Over the longer term, biogas and bio-methane could play a larger role in decarbonising residential heating. The advantages of bio-methane include its compatibility with existing infrastructure and high-density urban housing stock, particularly as the latter is proving a challenging environment for retrofitting ground-source heat pumps.[17] In some European countries there is also considerable scope for increasing the use of biogas and bio-methane in the shorter term.

In 2002, Delhi's law-makers forced its auto rickshaw fleet to switch to CNG, halving local air pollution while vehicle numbers doubled.[20]

Industrial applications

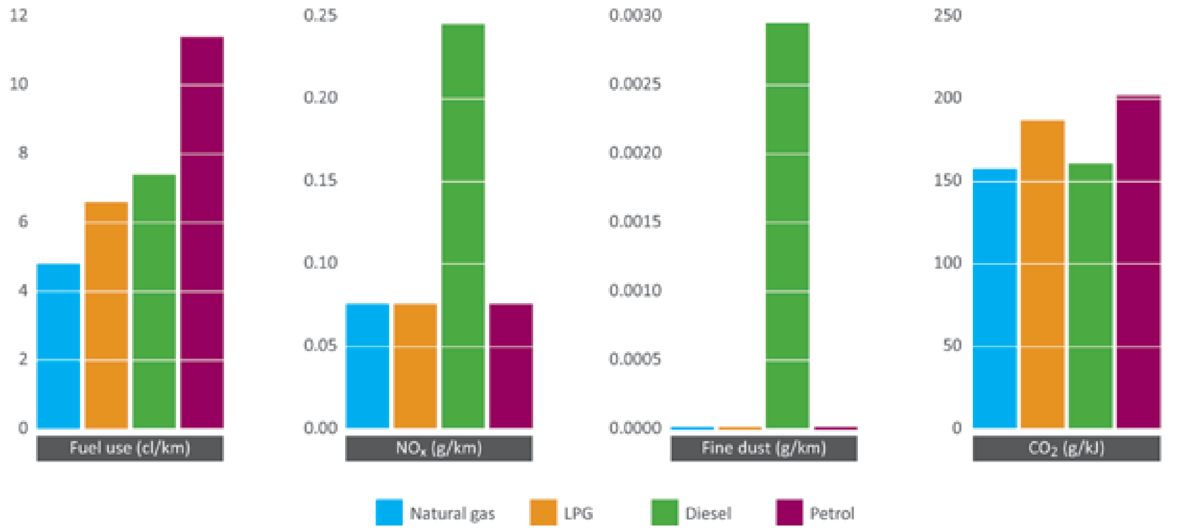
In industry, natural gas typically competes against coal, oil products and electricity, first and foremost as a source of process heat. In Europe this sector represents 26% of natural gas demand. Natural gas currently accounts for roughly 30% of industrial final energy consumption.[18] Natural gas is also used by industry for non-energy purposes, mainly as a feedstock for the manufacture of fertilisers and petrochemical products. Due to its chemical properties and higher efficiency, natural gas will normally be the preferred choice over coal and oil. However, the fuel price remains a decisive factor in determining gas market share.[19]

15 "Gas: At the centre of a low carbon future", Pöyry, a review for Oil & Gas UK, September 2010
16 As above
17 "Impact Assessment of the Renewable Heat Incentive scheme for consultation in January 2010", UK Department of Energy & Climate Change, February 2010, available at:
www.decc.gov.uk/assets/decc/Consultations/RHI/1_20100201105915_e_@@_ImpactAssessmentforRHIConsultation.pdf
18 World Energy Outlook 2010, p. 638
19 World Energy Outlook 2009, p. 382
20 "Cummins Westport Natural Gas Engines Attract Purchase Orders in India", Natural Gas Vehicles Global News, 24 March 2010, available from: www.ngvglobal.com/cummins-westport-natural-gas-engines-att%20ract-purchase-orders-in-india-0324

The transport sector

Natural gas is gaining ground as a transport fuel, since natural gas-fuelled vehicles emit less CO_2 and particulate matter while also consuming less fuel per kilometre. (Also, the fuel itself typically costs significantly less per litre.)

Natural gas is a cleaner transport fuel



Source: "Natural gas, part of an efficient sustainable energy future", Gasunie, February 2010. Data from CROB (Coalitie Rijden Op Biogas/Coalition Driving on Biogas), Netherlands

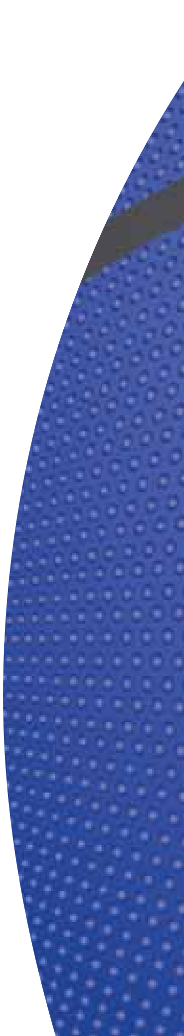
From 1998 to 2009 the world natural gas vehicle fleet increased ten-fold, reaching more than 11 million vehicles worldwide. The Italian market ranks first in Europe with vehicles running on compressed natural gas (CNG) representing roughly 1.7% of the national fleet in 2010; CNG models available in Italy increased from eight to 20 between 2006 and 2009. A major challenge to take-up of CNG vehicles has been the worry that the fuel tank would cramp passenger and storage space. But in modern vehicles the CNG tanks are installed within the vehicle structure, thus addressing this concern.

While we wait for large-scale electrified transportation options to become a reality, natural gas is available – now. Natural gas provides a highly competitive and easy-to-implement solution to secure rapid CO_2 emissions reductions and significant air quality improvements across Europe. In the longer term, bio-methane could help secure further emissions reductions in the transport sector.

Natural gas could also play a pivotal role in the transition to lower-carbon shipping, in particular short-sea shipping.[21] LNG's compatibility with ship engines has already been demonstrated, and significant innovation in this area is ongoing. DNV predicts that, by 2020, the majority of ship owners will order ships that can operate on LNG. The environmental benefits could be dramatic. According to DNV, an LNG-powered crude oil tanker would use 25% less energy and emit 34% less CO_2, more than 80% less NO_x and 95% less SO_x and particulate matter than a conventionally-fuelled vessel.[22]

In transport natural gas vehicles can significantly improve air quality due to natural gas's lower emissions

21 "Leadership through Rough Seas", Xyntéo, 2009, p.29, available from: http://xynteo.com/uploads/LeadershipThroughRoughSeas.pdf
22 "A major step towards the new environmental era for tanker shipping", DNV press release, 6 December 2010, available from: www.dnv.com/press_area/press_releases/2010/amajorsteptowardsthenewenvironmentaleraf ortankershipping.asp



section three

SUPPORTING THE EU'S COMPETITIVENESS WHILE MEETING EMISSIONS TARGETS

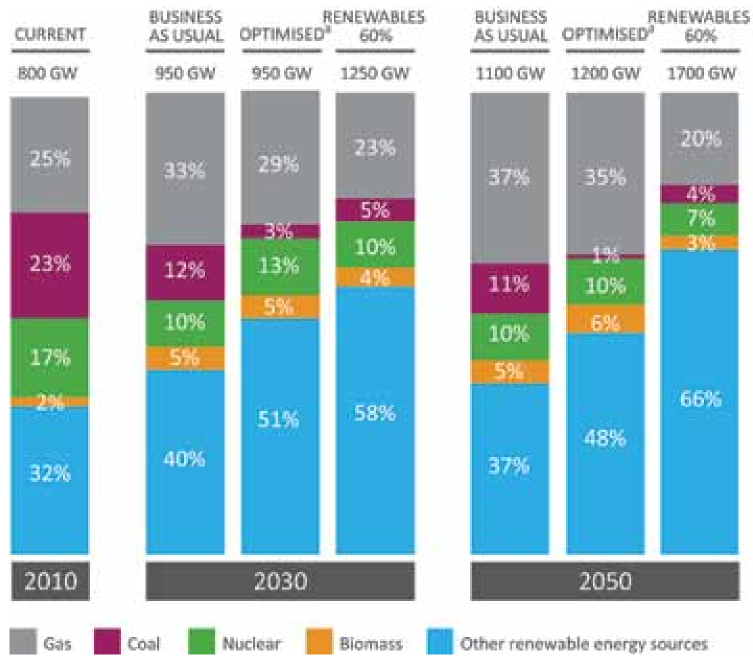
IN 2010 the European Climate Foundation published its seminal report – "Roadmap 2050" – which investigates whether a CO_2 reduction of 80% by 2050 is possible in the following four sectors: power, industry, buildings and transport.[23]

The analysis confirms that these reductions are indeed feasible. Achieving the reductions would require significant efficiency improvements and a high percentage of alternative resources like renewable energy for power generation, heat pumps for buildings and batteries, and plug-in hybrids, biofuels and hydrogen for transport. The study did not take into account financial constraints within the utility sector, limits to government subsidies or insufficient social acceptability of new technologies that result in additional cost burdens for households.

The European Gas Advocacy Forum therefore commissioned an independent analysis that used the same model to identify the lowest total cost pathway to achieve the 80% CO_2 reduction by 2050. The work undertaken investigates developments required within the power, industry, building and transport sectors, with an emphasis on the power sector. The analysis identified three "optimised" pathways, which first implements the lowest cost and most reliable measures for CO_2 reduction until 2030, and then, towards 2050, adopts an optimised mix of low-carbon technologies. The three optimised pathways are based on different assumptions with respect to fuel price and societal sensitivity to new nuclear power.

This optimised scenario represents a balanced capacity mix between the business-as-usual scenario, on the one hand, and the 60% renewables scenario on the other

Scenarios for Europe's power capacity mix in 2030 and 2050



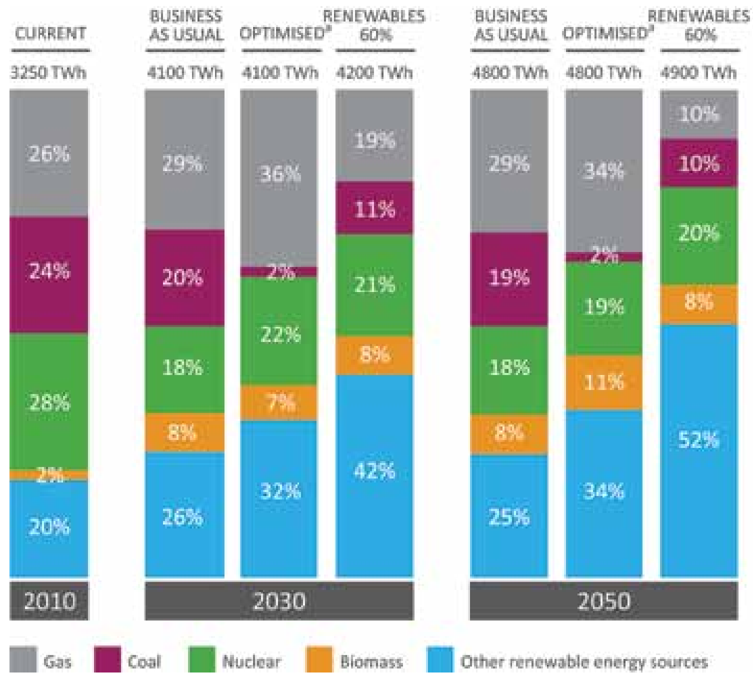
Source: "Making the Green Journey Work – Optimised pathways to reach 2050 abatement targets with lower costs and improved feasibility", European Gas Advocacy Forum, February 2011.

a The energy mix in the optimised pathway shown results from a scenario in which gas prices are kept at 2010 levels ($7.5/MMBtu) and there are constraints on the development of nuclear energy. In a scenario where gas prices increased to the IEA forecasted high level along with no constraints on nuclear, nuclear would gain a higher share at the expense of natural gas in the optimised pathway. This would only marginally change the economic results.

23 "Roadmap 2050: a practical guide to a prosperous, low-carbon Europe", European Climate Foundation, volume 1, 2010, available from: www.roadmap2050.eu

This 375-megawatt Siemens gas turbine, in use since December 2007 at the Irsching power plant near Ingolstadt, Germany, is a record-breaker. In association with a steam turbine, it can reach efficiencies of over 60% and satisfy the power needs of more than 3 million residents.

Scenarios for Europe's power production mix in 2030 and 2050



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Because renewable energy technologies rely on intermittent energy sources, production stemming from this capacity will be lower than actual capacity installed. The optimised pathway is much more renewables-intensive than the business-as-usual pathway (at the expense of coal), but less renewables- and coal-intensive than the European Climate Foundation's 60% renewables pathway

Summary of "Making the Green Journey Work"[a]

Below are highlights from "Making the Green Jouney Work", independent analysis commissioned by the European Gas Advocacy Forum. The analysis has identified three “optimised” pathways Europe could adopt to achieve the required 80% CO_2 reduction by 2050, at a lower total cost relative to the pathways identified by the European Climate Foundation.

- The three optimised pathways would reduce CO_2 emissions every year, reaching the EU’s 80% reduction target in 2050. In the earlier years the emissions reductions would be achieved largely through a higher utilisation of gas plants and a lower utilisation of more polluting technologies.
- Up to 2030 the total system cost (capital expenditure, operational expenditure and fuel cost) for the power sector could be approximately €500 billion lower than in the European Climate Foundation’s 60% renewables scenario, and €0-50 billion lower than the business-as-usual case (based on the International Energy Agency’s projections). The optimised pathways require €450-550 billion less in capital expenditure than the ECF 60% renewables scenario.
- Compared to the ECF 60% renewables scenario, the EGAF optimised pathways could save Europe up to an estimated €900 billion in capital expenditure in the power sector from 2010 to 2050. The optimised pathways could require roughly €300-400 billion more investment capital than the clearly unsustainable business-as-usual pathway.[b]
- A large share of non-intermittent generation would make the power system robust. This would ease reliance on complex, demanding international collaboration, for example to build and manage additional international power transmission lines. Gas demand would be roughly equal to today’s levels, while supply capacity would increase. The overall security of the energy system would be improved.
- In industry the EGAF optimised pathways assume that CCS implementation starts ten years later (ie, from 2030) than that envisioned by ECF.
- In the buildings sector heat pump penetration reaches 50-70% by 2050 in the optimised pathways, compared to ECF’s 90%. Biomass/biogas is assumed to occupy a 10-25% share of heat demand. Resistance heating could gain up to a 20% share where heat pumps and biomass/biogas options are not attractive. Conventional natural gas boilers could address any remaining heat demand.
- The transport sector would be powered by a mix of electricity including hybrid technologies, as well as by hydrogen, biofuels and conventional fuels (in particular for larger vehicles).
- The optimised pathways would be less reliant on technologies still in the early stages of the learning curve, transmission build-out and solving societal dilemmas. Because they would rely on mature and dispatchable technologies the optimised pathways would be relatively easy to implement.

The optimised pathways could deliver substantial cost savings as well as the 2050 emissions reduction target (estimates for power sector only)[a]

While both the optimised pathway and the 60% renewables pathway meet Europe´s 2050 reduction ambitions, the optimised pathway is likely to have significant cost advantages. The business-as-usual scenario is clearly unsustainable over the long term.

Source: “Making the Green Journey Work – Optimised pathways to reach 2050 abatement targets with lower costs and improved feasibility”, European Gas Advocacy Forum, February 2011.

a These are highlights. For the full analysis, go to www.statoil.com/no/NewsAndMedia/News/2011/Downloads/Making_Green_Journey_Work_web.pdf

b For the 2030-2050 period estimates naturally carry more uncertainty than those for the period before 2030

c The optimised pathway shown reflects a scenario in which gas prices are kept at 2010 levels ($7.5/MMBtu) and where there are constraints on the development of nuclear energy.

Closing remarks

The European Gas Advocacy Forum believes that these results underline the need for the European policy debate to give greater consideration to the role of natural gas in a lower-carbon energy mix. Achieving the crucial decarbonisation targets will generate a significant cost burden for European economies. It is therefore important to identify and pursue capital efficient energy pathways in order to minimise costs for Europe's financially constrained economies. Prescribing the exact technologies to be implemented in the pursuit of agreed targets will drive costs up and curb innovation in other, more efficient technologies, making Europe less competitive.

The energy pathway of the future is still uncertain. But from what we do know today, a short- and medium-term energy pathway which harvests natural gas's CO_2 and cost benefits will give Europe the flexibility as well as the economically competitive energy supply envelope it needs over the longer term. Natural gas could thus offer a no-regret pathway for Europe as we set out to meet our vital climate ambitions and targets in the short term, through to 2030 and beyond 2050.

The Future Role of Natural Gas
a joint position paper by the European Gas Advocacy Forum

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