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Abstract

This paper reviews and compares major long-term scenarios for the European Union's demand, supply and imports of natural gas. The analysis includes scenarios from the IEA, the European Commission and Eurogas, and pays particular attention to the role of climate policy commitments. While the Union's import dependence ratio is set to continue to rise according to all available scenario projections, there is considerable uncertainty about the demand volumes that may unfold. This high level of uncertainty will lead to a number of practical difficulties for EU governments and institutions as well as for the Union's energy companies and their external partners. In a longer-term perspective, the option of consolidating the Union's bargaining power through the creation of a gas purchasing agency is also discussed.

Keywords: Natural gas; energy scenarios; climate policy; demand uncertainty; bargaining power; gas purchasing agency; European Union.

Contents

1 Introduction

The European Union is a major consumer of natural gas, with an annual consumption of around 533 bcm in 2008, or 17% of global consumption. EU production is however quite low, at around 216 bcm in 2008, yielding an import dependence ratio of 60%. This import dependence ratio is generally on an increasing path, for one part due to the ongoing depletion of the EU's reserves, for the other part due to projected increases in gas demand.

On the production side, the EU's proven reserves of natural gas are very limited: 2,770 billion cubic metres (bcm) at the end of 2008, see BP (2009). This is even less than those of Norway (2,908 bcm), let alone those of Russia (43,302 bcm), of Iran (29,610 bcm) or of Qatar (25,465 bcm). The EU's production of indigenous natural gas peaked in the mid-1990s at around 270 bcm per year, experienced a plateau until around 2005, and then started to decline. The IEA projects that production will continue this gradual decline, from 214 bcm in 2007 to 139 bcm per year in 2020 and just 103 bcm per year in 2030, see IEA (2009b: 429).

As concerns consumption, the general expectation in recent years has been that it would continue to increase. Natural gas presents certain advantages. It is cleaner than coal in terms of sulphur and nitrogen oxide emissions (SOx and NOx). It also emits substantially less CO2 per unit of recovered energy than coal. Partly as a result, demand is projected to rise, e.g. to 564 bcm in 2020 and 619 bcm in 2030 according to the IEA's Reference Scenario, see IEA (2009b: 478). The IEA's projections for the EU's gas balance would lead to net imports growing from 312 bcm in 2007 to 425 bcm in 2020 and to 516 bcm in 2030. The corresponding import dependence ratio would grow from 60% in 2008 to 75% in 2020 and 83% in 2030.

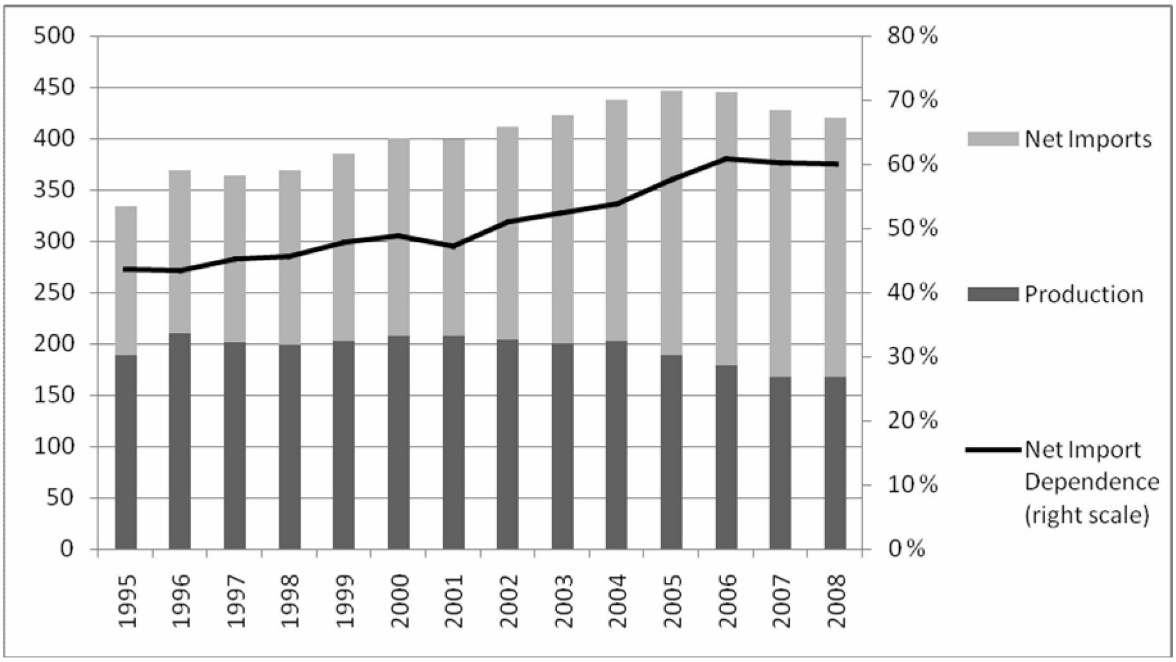
The main component which could lead to a permanent change on the demand side would be a shift in relative costs between energy products. Natural gas is relatively less CO2 intensive than coal (the possible future deployment of CCS technologies notwithstanding) and has gained in attractiveness as a result. On the other hand, natural gas is still a fossil fuel and is much more CO2 intensive than nuclear power or renewable energy sources. The price of CO2 is therefore a key variable which can affect demand for natural gas positively or negatively depending on its level and on economic conditions. The most important determinant in this respect is how much scarcity EU member states agree to impose on the EU ETS when committing to emissions targets.

This paper is structured as follows. Section 2 contains a brief review of stylised facts about the EU's natural gas production, consumption and import patterns, including a brief look at well-known energy scenarios to 2020 and beyond. In Section 3 the demand profiles from available scenarios are compared notably with respect to differences in policy assumptions. In Section 4 the EU's declining production prospects are discussed. Section 5 draws on the findings from the previous sections, leading to a range of values for expected net import demand. The issues of demand uncertainty and rising import dependence are presented in Section 6, laying the ground for a policy-oriented discussion in Section 7 concerning a possible consolidation of the EU's bargaining power through the creation of a gas purchasing agency. Section 8 concludes.

2 Stylised facts

In recent history the EU's annual natural gas production has fluctuated around 200 Mtoe (around 250 bcm GCV). This held true until 2005, when a steady decline started to occur. Demand on the other hand increased substantially, from less than 350 Mtoe in 1995 to almost 450 Mtoe in 2006. As a result, the EU's import dependence ratio rose from around 45% in the mid-1990s to around 60% in 2008, see Figure 1.

Figure 1. Production and net imports 1995-2008 (Mtoe)

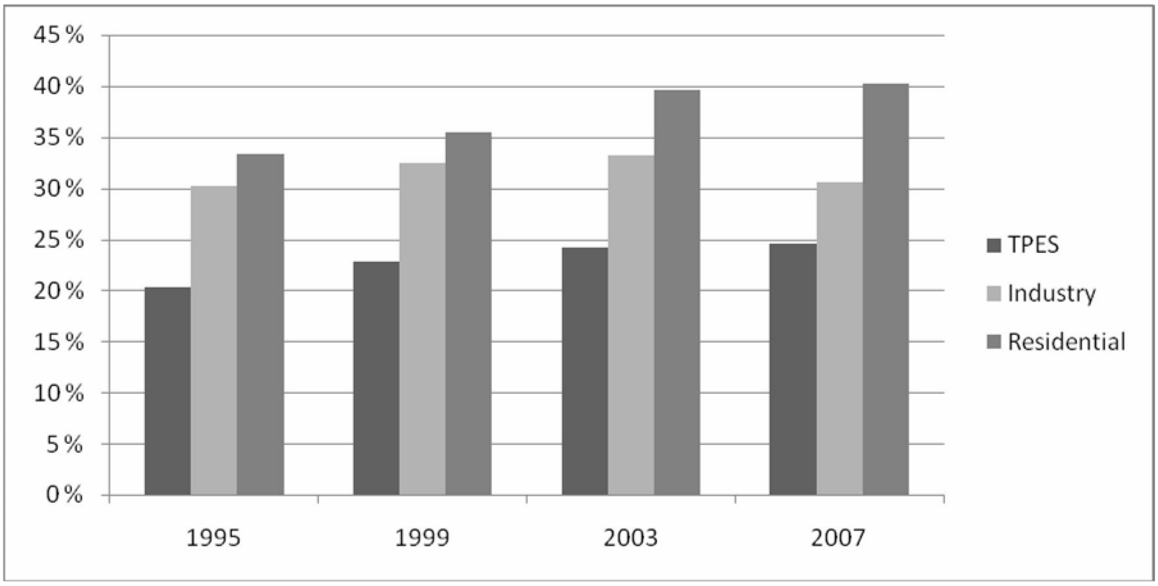


Source: IEA Energy Balances

From 2006 to 2008 there was an absolute fall in demand, primarily as a response to high gas prices, themselves driven by high oil prices. However production was also falling, so net import dependence flattened out rather than fell. As the decline in production is widely projected to continue relentlessly while demand could recover somewhat, net import dependence should continue to rise.

Natural gas plays a relatively important role in the energy product mix of the European Union, and this role has generally increased, for both total primary energy supply (TPES) as well as for final consumption in the residential sector, see Figure 2. The share in industrial final consumption has however fallen back somewhat more recently.

Figure 2. Share of natural gas in the energy product mix: 1995 - 2007



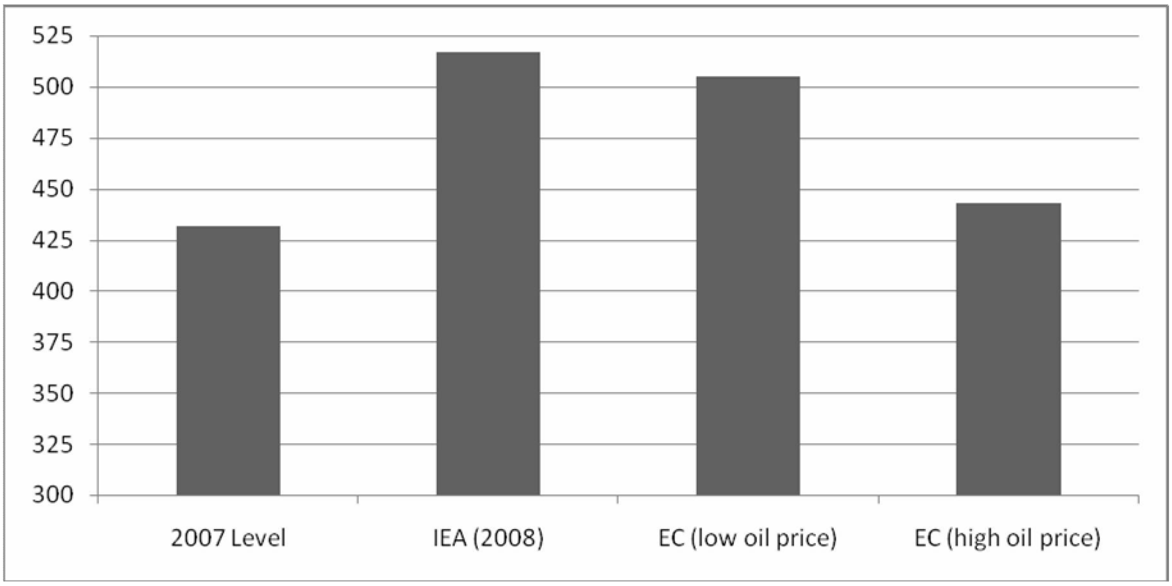
Source: IEA Energy Balances

3 A comparison of mid- to long-term demand projections

The two most important long-term scenarios that can shed light on the future path of EU demand for natural gas are DG TREN's projections prepared in the context of the EU's Second Strategic Energy Review, and the IEA's World Energy Outlook 2009 scenarios. The IEA's scenarios include projections up to 2030, while those from DG TREN go only to 2020.

The most significant policy package at the EU level which is incorporated (or superseded) by the scenarios is the EU's New Energy Policy, also referred to as the 20-20-20 Package. The New Energy Policy foresees that, by the year 2020, the EU should achieve a 20% cut in greenhouse gas emissions as compared to 1990 levels, a 20% improvement in energy efficiency, and a share of renewable energy in the energy mix of 20%. The New Energy Policy (NEP) was endorsed by the European Parliament as well as by the European Council (i.e. the Member States) in December 2008. Taken together these commitments should lead to lower consumption of fossil fuels already by 2020, assuming that the targets are met in part or in full. However while both EC (2008b) and IEA (2009b) take the NEP into account they differ quite markedly in their projections for natural gas demand. EC (2008b) reports both a baseline without the NEP and results for the NEP. For the former, a sensible comparison would be with the 2008 version of the IEA's Reference Scenario reported in IEA (2008), since at that time the IEA did not assume that the NEP would necessarily be approved. The projected effect of the NEP can then be looked into by comparing the Reference Scenario and the 450 Scenario from IEA (2009b) and the NEP scenarios from EC (2008b). We start with presenting the baseline scenarios without the NEP, see Figure 3. The scale is cut at 300 Mtoe to improve readability.

Figure 3. Baseline for gas demand in 2020 without the New Energy Policy (Mtoe)



Source: IEA (2008), EC (2008b)

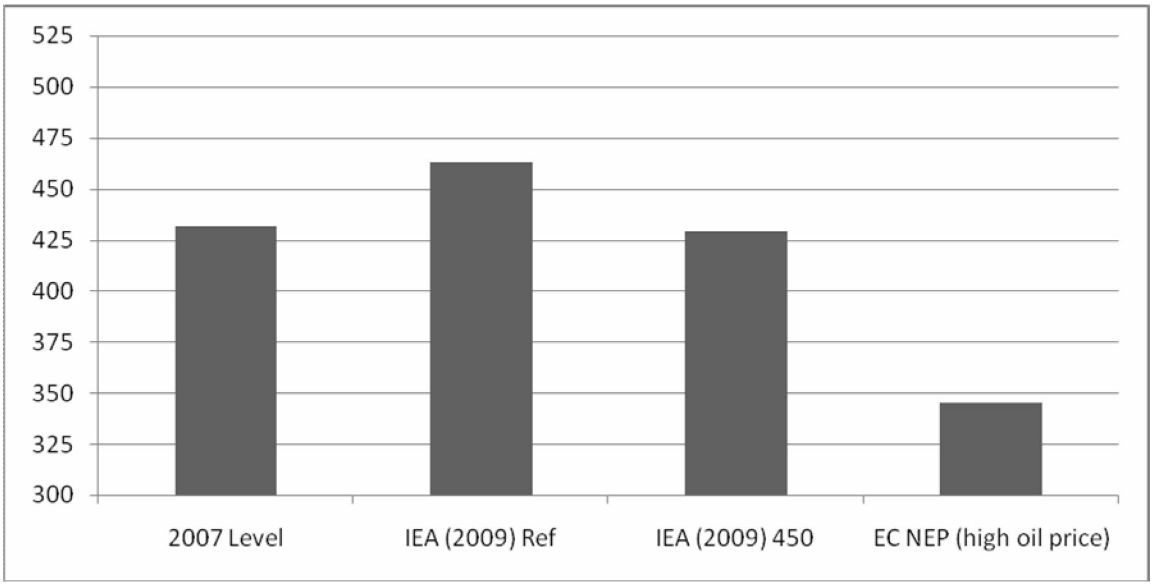
EC (2008b) provide a scenario with low oil prices and another with high oil prices. Those scenarios were based on data up to 2005, and took the average oil price from that year and, in the case of the low price scenario, assumed that the price would slowly increase to 61.1 US Dollars per barrel (USD/bbl) in 2005 prices, roughly 84 USD/bbl given the assumptions on inflation used in EC (2008b). For the high oil price scenario the assumption was a rise to 100.1 USD/bl in 2005 prices, or 138 USD/bbl in nominal terms, see EC (2008b: 59). IEA (2008) is based on a single oil price path which is somewhat higher, averaging 100 USD/bbl over 2008-2015 in 2007 prices, then rising linearly to over 120 USD/bbl at 2007 prices by 2030, see IEA (2008: 59). For the 2020 horizon this would imply, roughly speaking, reaching 105 USD/bbl at 2007 prices. Overall, the oil price assumption in IEA (2008) is similar but slightly higher than the 'high oil price' assumption in EC (2008b). On the other hand, the scenarios are comparable from the point of view of total energy-related CO2 emissions. The baseline with high oil prices in EC (2008b) leads to a reduction of 2.3% by 2020 as compared to the 1990 level, and the Reference Scenario in IEA (2008) leads to exactly the same reduction, see IEA (2008: 521), namely 3949 Mt CO2 in 2020. We will therefore assume that the IEA (2008) Reference Scenario is directly comparable to the high oil price scenario from EC (2008b).

In spite of the similarities mentioned there is a relatively large difference in terms of projected primary demand for natural gas. IEA (2008) projects a level of 517 Mtoe in

2020, whereas EC (2008b) projects a level of 443 Mtoe, or 14.3% less. Given that the oil price and emissions assumptions are very similar, the difference must lie elsewhere and could be due to differing model calibrations and underlying structures. EC (2008b) is unfortunately not very explicit about the energy product mix for major types of users (i.e. power generation, residential sector, industry), making a more detailed comparison of demand patterns with IEA (2008) rather difficult. However one indicator that can be looked into concerns installed power generation capacity for which both publications provide some detail. EC (2008b: 48) projects relatively strong growth in gas-fired capacity for the baseline high oil prices scenario. The latter would grow from 181 GW in 2005 to 273 GW in 2020. IEA (2008: 521) on the other hand foresees growth from 164 GW in 2006 to 198 GW in 2020, a smaller growth rate (21% vs. 51%), but also (strangely) from a lower base although the latter is one year later than the one used in EC (2008b: 48). Focusing only on the growth rates, it is remarkable that IEA (2008) projects much lower growth in gas-fired capacity, and yet projects higher total primary demand. The difference between the IEA (2008) and EC (2008b) scenarios should therefore lie primarily in final consumption, mainly industrial and residential consumption.

We now turn to the projections that do take the NEP into account, while bearing in mind the differences in the baselines used by each scenario owner, which for total primary demand of natural gas is around 14.3%. Given the oil price assumptions, the appropriate comparison is between the Reference Scenario and the 450 Scenario from IEA (2009b) on the one hand and the high oil prices NEP scenario from EC (2008b) on the other hand. The projections for total primary demand of natural gas are shown in Figure 4. In this case the differences are much larger than in the comparison of the baseline scenarios. If one assumes that the 450 Scenario from IEA (2009b) is comparable to the NEP high oil price scenario from EC (2008b), then there is still a difference of almost 20% between the scenarios, with IEA (2009b) projecting 429 Mtoe and EC (2008b) projecting 345 Mtoe. The difference is much larger if one takes the Reference Scenario from IEA (2009b). Several factors could account for this. First, IEA (2009b) does not explicitly test the NEP as compared to its baseline. Instead IEA (2009b) is an update on IEA (2008) which incorporates the NEP but also more up-to-date assumptions and data about global economic and energy market conditions. In EC (2008b) there is of course no update between the baseline and policy scenarios, and it is based on slightly older data sets. In another sense however, EC (2008b) is a more proper policy evaluation exercise, since other factors are held constant.

Figure 4. Scenarios for gas demand in 2020 with the New Energy Policy (Mtoe)



Source: IEA (2009b), EC (2008b)

3.1 The role of the total emissions target

The next issue is the extent to which the Reference Scenario in IEA (2009b) assumes that the targets defined by NEP will be met. Although it is stated that the new policy is taken into account, see IEA (2009b: 56), the projection for the EU's (energy-related) CO2 emissions is that it would reach a total of 3553 million tonnes of CO2 (Mt CO2), see IEA (2009b: 633). The level in 1990 (the reference year for the Kyoto Protocol) was 4042 Mt CO2; therefore the Reference Scenario projects a reduction of 12.1%. On the other hand, the 450 Scenario imposes a 20% reduction, not with respect to the 1990 level, but with respect to the 2007 level, see IEA (2009b: 334), therefore reaching 3109 Mt CO2 as compared to 3886 Mt CO2 in 2007. That target represents a reduction of 23.1% compared to the 1990 level.

As concerns the NEP scenarios in EC (2008b), the total emissions target is of course met (it was the goal of the exercise). However in the high oil price version which we choose to use the total emissions level goes slightly beyond the target as well, reaching 77.5% of the 1990 levels with respect to energy-related CO2 emissions, i.e. a fall of 22.5%. In other terms, the NEP high oil prices scenario and the IEA's 450 scenario should be directly comparable with respect to the emissions constraint. What this also implies is that the Reference Scenario in IEA (2009b) assumes that the targets fall far short of being met although they have been committed to. In particular, see IEA (2009b: 633), the Reference Scenario projects that the reduction in emissions from power generation would be only 16.2% as compared to the 1990 level, while the biggest failure would come from final consumption, with a reduction of only 10.4% see Table 1.

Table 1. Energy-related CO2 emissions in the IEA 2009 Reference Scenario

Mt CO2	**1990**	**2007**	**2020**	**Change 1990-2020 (%)**
TOTAL	**4042**	**3886**	**3553**	**-12.1**
Coal	1737	1269	1002	-42.3
Oil	1647	1624	1487	-9.7
Gas	659	992	1064	61.5
Power generation	**1492**	**1450**	**1250**	**-16.2**
Coal	1171	1039	834	-28.8
Oil	195	86	39	-80.0
Gas	127	326	376	196.1
Total Final Consumption	**2379**	**2251**	**2131**	**-10.4**
Coal	529	198	141	-73.3
Oil	1336	1420	1332	-0.3
Gas	513	633	657	28.1
Memo: oil in transport	*749*	*954*	*929*	*24.0*
TFC without oil in transport	*1630*	*1297*	*1202*	*-26.3*
Total without oil in transport	***3293***	***2932***	***2624***	***-20.3***

Source: IEA (2009b: 633)

The main problem comes from emissions from transportation. While the latter would fall compared to the 2007 level, it would still be 24% higher than the 1990 level. On the other hand, emissions from total final consumption without the contribution of oil products in transportation fall by 26.3% from 1990 levels and, most clearly, total emissions excluding oil products in transportation fall by 20.3% as compared to the 1990 level. In other terms, the way in which IEA (2009b) takes the NEP into consideration is to assume that the EU succeeds in meeting the target with the concrete policy instruments that it has, in particular the EU ETS, but that emissions from transportation will continue to evolve unconstrained since no binding emissions ceiling has been defined and, relatedly, no policy instrument is yet in effect which can guarantee a specific quantitative outcome.

However this insight still does not clarify why the IEA’s 450 Scenario leads to comparatively lower demand for natural gas which is essentially unaffected by developments in transportation. Part of the answer may have to do with the two other targets defined by the NEP, namely a 20% energy efficiency improvement, and reaching a share of 20% for renewable energy.

3.2 The role of the renewable energy and energy efficiency targets

The NEP's renewable energy target is defined not in terms of primary energy demand (gross inland consumption in Eurostat terminology), but in terms of *gross final consumption*. The latter is a hybrid category, defined in Directive 2009/28/EC (Art. 2, par. f) as:

'the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission'.

In other terms, gross final consumption includes total final consumption in IEA terminology, as well as items of non-final consumption in the transformation sector, namely own use of electricity and heat and losses in distribution and transmission. It is not possible to ascertain this exact value based on published versions of the scenarios under discussion. However the constraint is imposed in EC (2008b) for the model simulations, see EC (2008b: 62). For the comparison between IEA (2009b) and EC (2008b) the only option therefore is to look at primary energy demand, see Table 2. The total levels and shares being almost identical between the NEP scenario from EC (2008b) and the IEA's 450 Scenario, it must be concluded that the difference in primary demand for natural gas is not explained by a smaller role of renewable energy sources in the IEA scenarios. It also implies that the IEA's 450 Scenario imposes the renewable energy target, while the Reference Scenario does not.

Table 2. Role of renewable energy in primary energy demand by scenario (Mtoe)

	Total demand	**Renewable energy**	**Share**
EC NEP (high oil price)	1672	274	16.4%
IEA (2009) 450	1668	267	16.0%
IEA (2009) Reference	1723	241	14.0%

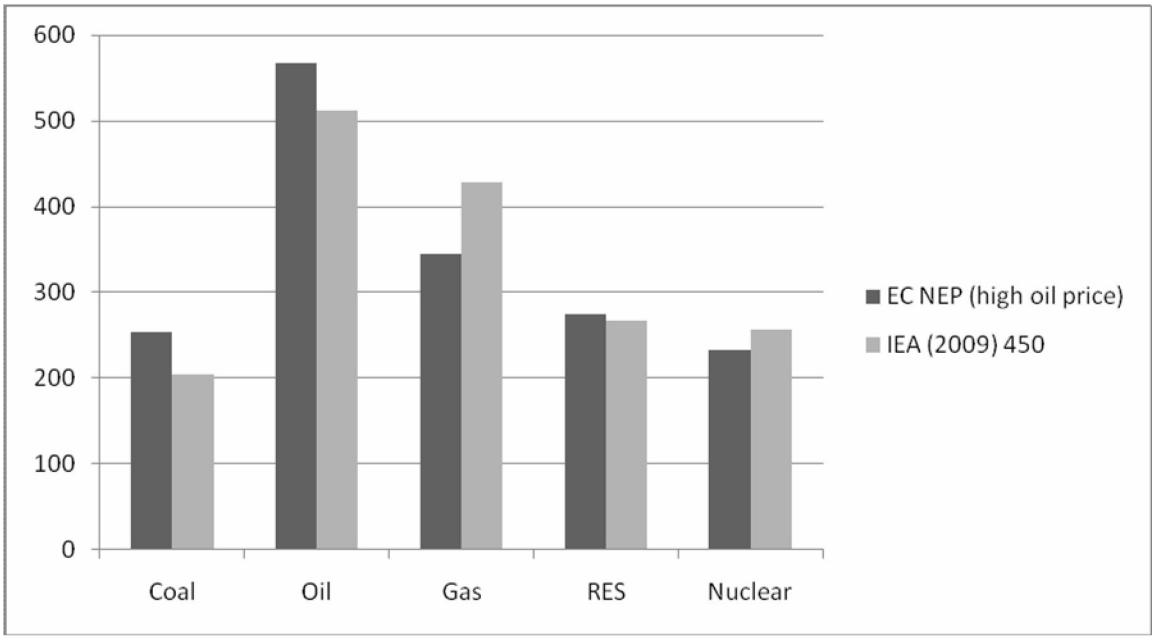
Source: IEA (2009b: 336), EC (2008b: 65).

Concerning energy efficiency, EC (2008b) indicates that the target does not need to be met in order to ensure both the total emissions target and the renewable energy target. The energy efficiency is a more problematic target from a policy viewpoint as it is defined for the 2020 horizon as compared to a baseline for 2020. In practice the comparison may be made with the baseline scenarios from EC (2008b), but setting a policy target based on a counter-factual evaluation is impractical to begin with. In any case, taking the NEP high oil price scenario from EC (2008b), one finds that energy intensity of GDP falls by one third from 2005 to 2020, but that the gap with respect to the business as usual scenario (with a low oil price) for 2020 is 15% (of which roughly 2 percentage points is due to the higher oil price). This suggests that the energy efficiency target is not properly defined, and is partly redundant with the emissions target. So while several important policy instruments are in place to improve energy efficiency, e.g. on the energy performance of buildings, or changes in product regulation such as for light bulbs, the actual target is not clearly defined and is not quantified in a manner which is practical for economic agents, or indeed for monitoring purposes since the 2020 baseline changes every time the same energy model is updated with new assumptions (not to mention differences between models). Conversely, as soon as a fixed point would be set, e.g. the baseline estimation for 2020 from EC (2008b) with one of the two oil price paths, then one would have a standard policy target that is useable. It remains to be seen whether new legislation will clarify this.

3.3 A different energy product mix

Total primary energy demand levels are almost identical between the NEP high oil price scenario and the IEA's 450 Scenario as shown in Table 2. The oil price assumption is similar, the total emissions level is essentially the same, and the share of renewable energy in primary demand is virtually identical. The question remains why there is a comparatively large gap in primary demand for natural gas, and since total primary demand is the same, the difference is in the energy product mix, see Figure 5.

Figure 5. Energy mix in the IEA 450 and EU NEP scenarios (Mtoe)



Source: IEA (2009b: 336), EC (2008b: 65).

The lower level for gas in EC (2008b) is almost fully compensated by correspondingly higher levels for coal and for oil. This seems odd, because natural gas is less CO2 intensive than coal and since the total level of energy-related emissions is the same, it is not clear how both scenarios can be consistent unless quite different CO2 intensities result from, say, different assumptions about technologies. Beneath the surface however the scenarios are more similar than at first sight and the differences can be identified with a more detailed breakdown. Table 3 shows the implicit breakdown for final demand. There is a difference of 38 Mtoe in terms of gas consumption, and a difference of 22 Mtoe in terms of coal use. As an aside and for purposes of clarity, IEA (2009b) does not assume a growth of natural gas use in transportation: it should stay at a symbolic level of around 2 Mtoe, while the role of electricity should roughly double to 13 Mtoe. The latter is not immediately clear from IEA (2009b: 336) but is implicit bearing in mind that natural gas is used as a feedstock in the petrochemical industry (around 15 Mtoe in 2007).

Table 3. Final consumption in the EC NEP and IEA 450 scenarios (Mtoe)

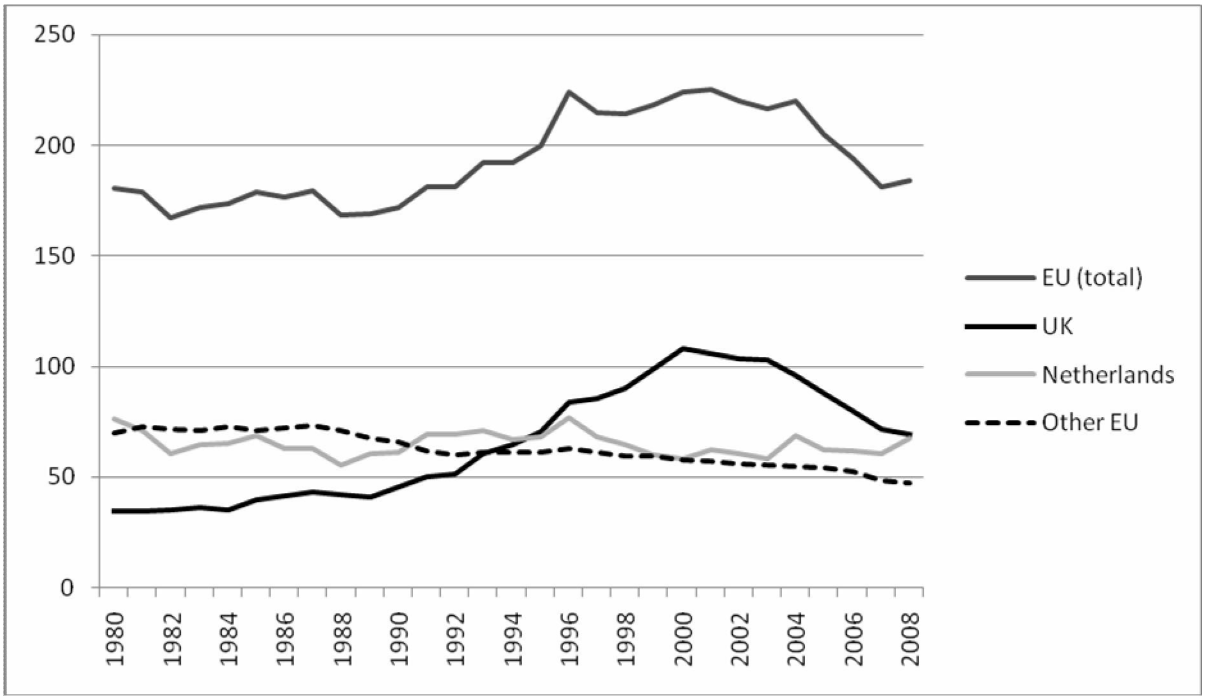
Final demand by product	**EC NEP (high oil price)**	**IEA 450 Scenario**
Oil	433	459
Gas	235	273
Coal	50	28
Electricity	260	267
Heat	41	62
Biofuels	38	25
Other renewable energy	84	87
Total	*1140*	*1201*

Concerning power generation, unfortunately EC (2008b) does not provide the breakdown between fossil fuels, reporting only a total amount of generated electricity in TWh. However IEA (2009b: 336) does provide that breakdown for the 450 Scenario, and given some experience with energy balances one can make somewhat plausible guesses about the underlying energy product mix in generation that was left unspecified in EC (2008b). Those would suggest that the rest of the difference for gas between the scenarios is indeed in power generation and is explained mostly by a relatively higher use of coal, as both scenarios foresee strong (and similar) expansion in renewable energy sources in power generation, as well as very similar total levels of electricity generation and consumption. For purposes of clarity it should however be said that both scenarios project a strong absolute fall in coal consumption from present levels, but the question is how much. As a result of these consideration, one is left (still) with a 20% difference in gas demand in 2020 that is hard to explain. There is no prima facie reason to doubt the underpinnings of either scenario. On a more positive note, the comparison of the two IEA scenarios clearly demonstrates the importance of meeting (or not meeting) the renewable energy target. That target yields a difference in natural gas demand of 34 Mtoe, while the (unresolved) difference between the IEA's 450 Scenario and the NEP high oil price scenario is 84 Mtoe. One possible interpretation could however be that energy security considerations influenced the formulation of some assumptions for EC (2008b), e.g. to test within the PRIMES energy model that was used whether a constraint on natural gas in primary energy demand could be accommodated while endangering neither economic growth nor climate policy commitments.

4 The EU's natural gas production profile

The EU's natural gas production is primarily located offshore in the North Sea, with the Netherland and the UK as traditionally large producers by European standards. Romania is another relatively important producer, though it is on a clear path of decline as well. The largest ongoing shift in recent years is the decline of UK production, see Figure 6.

Figure 6. Production history of the EU, the UK and the Netherlands (bcm per year)

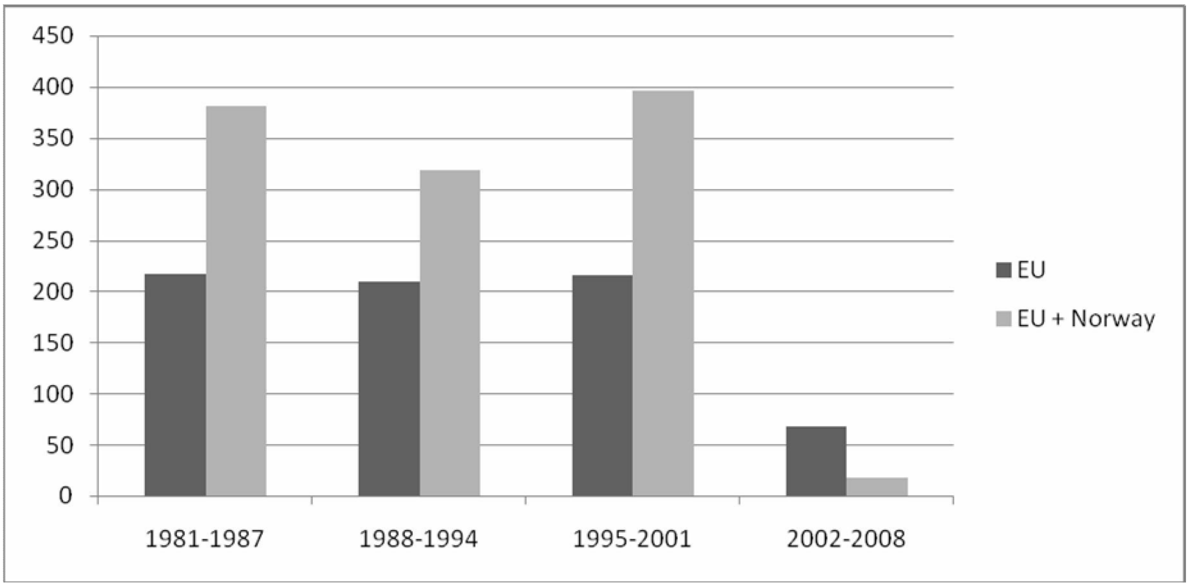


Source: BP (2009)

Note: totals differ from IEA statistics due to differences in methodology

Proven reserves estimates change every year due to production, due to geological assessments or re-assessments (upward or downward reappraisals for known reservoirs, discoveries of new reservoirs), and due to estimates of the expected profitability of future extraction (depending on extraction costs and technologies, and on expected gas prices). As a result, it is possible to reconstruct historical time series of reserves adjustments that are not due to physical withdrawals (i.e. production) from the reservoirs. On a country level this gives a broad-brush picture. Annual adjustments can be quite different from one year to another, but if one looks at averages over several years a clear picture emerges, see Figure 7. From 1981 to 2001, average reserves adjustments were around 210 bcm per year for the EU and between 300 and 400 bcm per year for the EU plus Norway. Over 2002-2008 that level collapsed to around 65 bcm per year for the EU, and even less for the EU plus Norway (because Norway had negative reserves adjustments on average). Such low levels over a 7 year period, particularly given higher oil prices and higher demand in European markets, suggest that European production is entering a period of terminal (and potentially relatively quick) decline, at least as far as conventional natural gas is concerned.

Figure 7. Average annual reserves adjustment: EU and EU plus Norway (bcm per year)

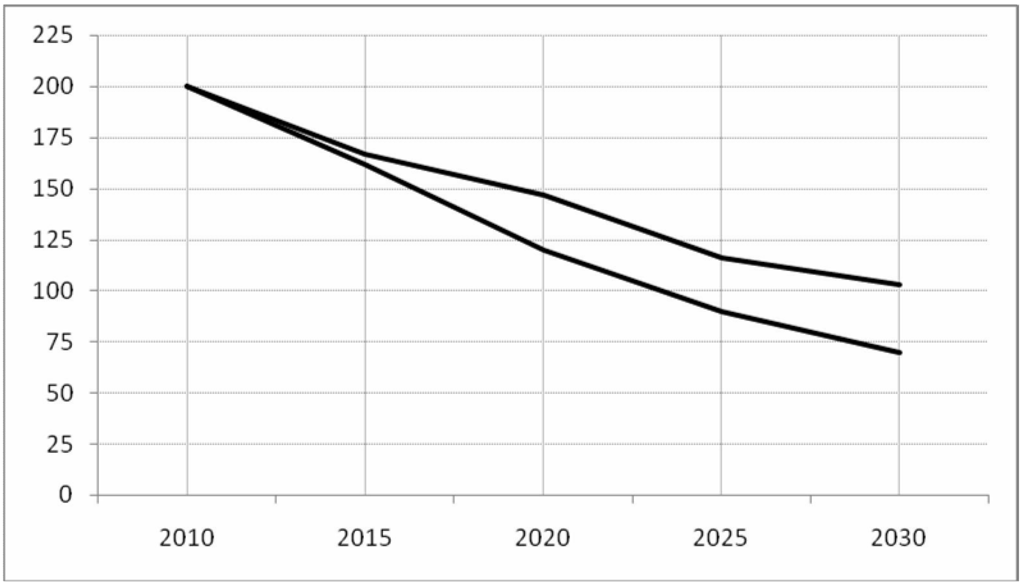


Note: Annual change in proven reserves net of production, calculated using BP (2009) reserves history and production data. EU = Denmark, Germany, Italy, Netherlands, Poland, Romania, UK.

Another exercise is to compare cumulative production to-date with estimates of remaining total potential, the latter including not only proven reserves, but also potentially viable remaining resources. Available data for the European Union, see BGR (2009: 47), suggests that 9.07 trillion cubic metres (tcm) have been produced to-date (up to the end of 2007) as compared to a total initial resource base of 16.17 tcm, i.e. more than half. Around 7.08 tcm remain, of which 3.35 are classified as proven reserves. The data refers to conventional natural gas only. Concerning non-conventional resources, the position of the EU is slightly better, with a total of around 29 tcm in Western Europe, see IEA (2009b: 397), of which 10 tcm is tight gas, 4 tcm is coalbed methane (CBM), and 14 tcm is shale gas. There are therefore two separate questions to be addressed. One is how the decline of the remaining conventional resources will play out, and the other is the extent to which non-conventional resources may be tapped into and with what production profile.

Concerning the decline of conventional production, various estimated production paths have been estimated. While some uncertainty prevails, successive European Commission publications show repeated downward revisions in recent years, see e.g. Karbuz and Castellano (2009) for a review. The more general path of decline is based on standard production profiles for a sum of fields when most or all of them have passed their production peaks with certainty. Additionally, production profiles depend on market conditions, since higher demand and prices incentivise the extraction of slightly higher proportions of remaining resources by reservoir and encourage a greater use of techniques such as enhanced recovery, e.g. using CO2 injection. The latter is illustrated by the more recent and slightly divergent production profiles estimated in IEA (2009b) and EC (2008b). The resulting range of values is illustrated in Figure 8, which displays the minimum and maximum production values for available future years from IEA (2009b) and EC (2008b), as well as the OME scenario from Karbuz and Castellano (2009). The latter remains a slightly more pessimistic scenario that the more recent estimates from the IEA for every year except 2015.

Figure 8. Selected gas production volume ranges 2010-2030 (bcm per year)



Source: IEA (2009b), EC (2008b), Karbuz and Castellano (2009)

Concerning non-conventional gas, IEA (2009b) expects a moderate contribution by 2030 of around 15 bcm per year. The latter is included in the IEA estimates which represent the upper bound for 2025-2030. Similar estimates are however not included in the lower bound which is driven by the estimate from Karbuz and Castellano (2009), the latter being based on estimates of decline rates of conventional European fields. For 2020 the EC (2008b) estimates are in Mtoe and were converted using an assumed average calorific content of 36,500 TJ/bcm in GCV terms, based on average calorific contents for Dutch, British and Romanian natural gas. That implies a conversion factor of 1.275 from Mtoe data in NCV terms to bcm data in GCV terms and yields a range of 127-147 bcm, the same range marked out by Karbuz and Castellano (2009) as shown in Figure 8. It should be noted that the lowest value from EC (2008b), namely 127 bcm, corresponds to the NEP high oil price scenario. The IEA projects a more narrow range, 139 bcm for the Reference Scenario and 132 bcm with the 450 Scenario for 2020, with the gap widening to more than 20 bcm per year for 2030. Again, production is projected to be lower if climate policies are more ambitious, and lower as well if the oil price is higher. Both phenomena occur in the model simulations through price mechanisms which affect demand.

In spite of the high level of media attention with respect to non-conventional gas (which is a decisive factor in the case of the United States), the expectations so far for European production are very low. More favourable developments cannot be ruled out, but it is unlikely that non-conventional gas will make any meaningful difference before 2020-2025.

5 The outlook for net import demand

The assumptions made for this Section are that the EU's emissions target and the EU's renewable energy target are both met in full by 2020, while on the other hand the energy efficiency target is ignored. This leaves either the NEP high oil price scenario from EC (2008b) or the 450 Scenario from IEA (2009b) as candidates for projecting demand. As discussed earlier, there is no clear prima facie case for favouring one scenario over the other. As a result, primary demand in 2020 is in a range of 345-429 Mtoe (NCV). As concerns indigenous production of natural gas, the highest and lowest levels from EC (2008b) are taken. Implicitly, the higher value implies that some additional policy would be put in place to increase incentive for faster extraction of conventional resources or an earlier recourse to non-conventional resources, or some combination of the two, while the low level would be consistent with a market-based approach based on the disincentive for higher production due to higher carbon prices and lower demand due to a higher share of renewable energy. The range taken is therefore 100-115 Mtoe (NCV).

As a consequence, net import demand in 2020 should be in a range of 230-329 Mtoe (NCV). This compares to a 2007 level of (approximately) 264 Mtoe (NCV). The latter estimate is based on a total demand level of 432 Mtoe (NCV) and a domestic EU supply level of 214 bcm (GCV), which is approximately equivalent to 168 Mtoe (NCV).

In other terms, it seems possible that net imports could fall as compared to the 2007 level by as much as 13%, but they could also rise by as much as 25%. This range, as stated, assumes a full adherence to the renewable energy target, an outcome which is not certain to occur. Higher net import values are therefore also possible. It is however extremely unlikely that net imports could be lower than 230 Mtoe in 2020.

According to IEA (2009a), the EU's total (gross) imports of natural gas in 2008 were 331.2 bcm (GCV), or 278 Mtoe (NCV). Of that total, at least[2] 133.9 bcm, or 40.4%, came from the Former Soviet Union (essentially Russia, plus some smaller volumes notionally from Central Asian states). In net calorific terms the corresponding volume was 108.2 Mtoe (NCV), or 38.9%. The simplest exercise for looking at potential imports from the Former Soviet Union (FSU) is to assume fixed proportions in net calorific

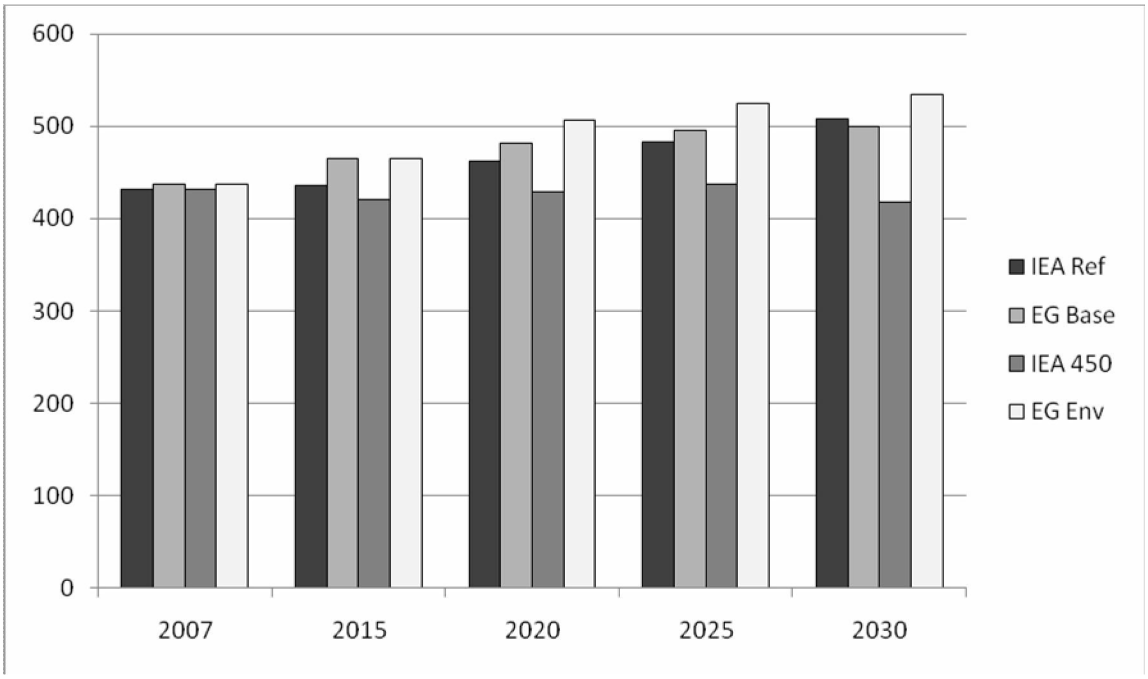
[2] An additional 20.9 bcm were imported into the EU from 'unspecified sources' in 2008 according to IEA (2009a). Some of that volume could be from the Former Soviet Union.

terms. Given net imports in a range of 230 to 329 Mtoe (NCV), net imports from the FSU would then be in a range of 89.5 to 128.0 Mtoe (NCV). Applying average Russian calorific content values leads to a range of 110.8 to 158.5 bcm (GCV). This compares to the (gross) volume of 133.9 bcm cited above.

This range seems wide already, but the uncertainty is higher still if one assumes that the share of FSU gas in the EU's total imports can change. Moreover, the upper bound of the range would be higher if one assumes that the EU's targets are not met in full, or if one assumes that other assumptions used for the IEA's 450 Scenario are not verified, e.g. stronger economic growth, smaller improvements in end-use efficiency.

How far the uncertainty goes can be illustrated by looking at the recent projections from Eurogas, which is the main representative body of the European gas industry. The latter are presented alongside both IEA scenarios in Figure 9. Naturally, the Eurogas projections should be interpreted with caution as they originate from an industrial lobbying group. It is generally true that industry federations choose to publish slightly over-optimistic assessments of their own prospects, unless there is a political case for doing the opposite (e.g. as a scare tactic concerning jobs or tax revenues). In the case of the gas industry there is no clear reason for doing the latter at this point in time. If anything, relatively less gas demand would be welcomed by many politicians from an energy security viewpoint. It is therefore more likely that an upward bias, rather than a downward bias, may have entered the Eurogas scenarios.

Figure 9. Comparison of Eurogas and IEA scenarios for EU demand to 2030 (Mtoe)



Source: IEA (2009b), Eurogas (2010)

The other reason for scepticism with respect to the Eurogas scenarios is methodological. The Reference scenario of the IEA (IEA Ref in Figure 9) and the Base Case scenario of Eurogas (EG Base in Figure 9) yield somewhat similar results, though Eurogas foresees demand growth occurring faster up to 2025 than does the IEA. However that outcome seems unlikely, given the rather mild oil price assumption that is used for the Eurogas scenarios, namely rising no higher than 70 USD/barrel in real terms (presumably 2009 prices) by 2015 and no higher than 100 USD/barrel (in real terms) by 2030. Also, Eurogas (2010) lists a number of assumptions that are rather vague, notably that: 'new gas supplies [are] not prevented from reaching market', and that there is a 'continuation and further development of energy policies and measures in place'. The latter is particularly problematic given that Eurogas (2010) does not address in much detail the future outlook for the EU's overall energy mix. In particular it is not clear what assumption is made in Eurogas (2010) concerning the role of renewable energy sources. The analysis of the IEA scenarios presented in Section 3.2 revealed that the EU's renewable energy target is an important factor for determining the potential future role of natural gas.

The biggest problem with the Eurogas scenarios concerns the 'environmental' case. The corresponding scenario from Eurogas (EG Env in Figure 9) foresees *higher* demand than in the corresponding baseline scenario (EG Base), a result which seems hard to believe. On closer inspection, see Eurogas (2010: 3), one notices that the ‘environmental’ scenario of Eurogas relies on assumptions that are not connected to environmental policy commitments. In particular, Eurogas chooses to assume that economic growth will be higher than in the ‘Base Case’, though why such an assumption carries the label ‘environmental’ is unclear. That assumption naturally leads to higher demand ceteris paribus. Moreover the scenario assumes that while CO_2 (EUA) prices would be higher, they would not however exceed 50 €/t CO_2 over the projection period. This is particularly relevant.

According to IEA estimates of long-run marginal costs of electricity generation, see IEA (2009b: 382), there is a ‘goldilocks’ range for CO_2 prices which would be particularly favourable to natural gas. If EUA prices remain in a range of roughly 30 to 50 €/t CO_2 in the medium-run, then natural gas would be more attractive than coal for power generation (even with CCS, let alone without it), while onshore wind power would remain relatively less attractive. Unless nuclear power is allowed to substantially expand, and/or unless a higher share of renewable energy is mandated through additional targets, it would then be easy for natural gas to take the lion’s share of new generation capacity in a near- to mid-term perspective. The latter reasoning cannot have escaped the attention of Eurogas and its members. As a result, the key for the gas industry is to make sure that emissions targets do not go much beyond the 20% cut already committed to for 2020, and that subsequent emissions targets are relatively subdued so that EUA prices do not rise too strongly. Additionally, the gas industry will want to ensure that no mandated share for renewable energy is imposed. The latter would be achieved if targets are not enforced, or not binding, or not made at all. Beyond 2020 there is not, as yet, a clear policy commitment. Finally, the natural gas industry will be hoping that nuclear energy is not strongly promoted either. Bringing these factors together, it is interesting to note that Eurogas (2010) foresees EUA prices not exceeding 50 €/t CO_2 by 2030, and is somewhat vague on both renewable energy and nuclear power. Those three factors combined are however the key to determining the future of natural gas demand in its most important segment, namely power generation.

6 Uncertainty of demand and import dependence

The projected results arising from the EU's New Energy Policy, particularly as published in EC (2008a), represented a substantial break from earlier scenarios and expectations when it was published in November 2008. Gazprom was the first actor to react, through a statement made by Alexander Medvedev on 18 November 2008, which concluded that: *'Under the conditions of political and economic uncertainty Gazprom's stake on long-term contracts with "take-or-pay" clauses for the European market has paid off in full'*, see Gazprom (2008).

The gas industry reacted with marked scepticism (and quite possibly alarm) at the prospective effects of the EU's environmental policies. The come-back, in a sense, is to argue that natural gas is 'green' and that it is part of the solution for a *lower*-carbon future, see Eurogas (2010:11), as opposed to notions of *low*-carbon or *zero*-carbon solutions. Political rhetoric aside, the EU in a general sense and the gas industry in particular face a serious problem of uncertainty of demand. If one were to take both the Eurogas (2010) scenarios and the EC (2008b) scenarios at face-value, one would conclude that demand could be as low as 345 Mtoe or as high as 507 Mtoe already by 2020. This translates into substantial uncertainty concerning the EU's future import needs and is most unfortunate, for both policy-makers and the industry, as well as for the EU's main external suppliers. Many projects, upstream, midstream and downstream, depend on having a reasonably narrow projection range for future demand.

The potential impact of a potentially much lower demand path was discussed in Christie (2009), Umbach (2010) and Brower (2009). Umbach (2010) drew the logical consequences from the potentially lower net import demand profile by noting that it would be in the interest of EU gas companies to avoid signing up to 'too much gas' from Russia, given the existence of take-or-pay clauses, 'or they need to renegotiate those contracts with more flexibility enshrined', see Umbach (2010: 1238). Gazprom's recourse to take-or-pay clauses (a practice adopted by other suppliers as well) raises the question of the concept of 'security of demand' as typically expressed by the gas industry. The main argument in favour of that concept has to do with the high capital costs that must be provided up-front for the development of new upstream resources. Whether the commercial interest in a stable future demand profile justifies take-or-pay clauses from the broader perspective of social returns is however a different matter, and one which would certainly merit independent analysis.

Whatever demand path materialises, the available scenarios all point to a rising import dependence ratio. This is illustrated in Table 4 which presents the import dependence of the European Union that result from the IEA and Eurogas scenarios.

Table 4. Import dependence ratios in the IEA and Eurogas scenarios

	IEA Ref	**EG Base**	**IEA 450**	**EG Env**
2007	59%	59%	59%	59%
2015	69%	70%	69%	70%
2020	76%	79%	75%	80%
2025	81%	85%	81%	86%
2030	84%	89%	85%	89%

Source: IEA (2009b), Eurogas (2010), own calculations.

The pattern that emerges is very clear. The EU's import dependence ratio, which was already relatively high at just under 60% in 2007, will rise according to all four scenarios to at least 84% and perhaps to as much as 89% by 2030. Over the next two decades the EU's external suppliers will therefore, collectively speaking, find themselves in a stronger bargaining position than today. EU countries and companies on the other hand will, again collectively speaking, find themselves in a relatively weaker bargaining position than today. Indeed, while substantial volumes have already been contracted from external suppliers, in some cases even beyond 2030, a number of long-term supply contracts will be due for renegotiation, extension or increases in volumes over the coming years, while the search for new resources inside the Union and beyond will have to continue.

7 Consolidation versus fragmentation of bargaining power

Natural gas from outside the European Union is purchased mostly through long-term supply contracts that incorporate take-or-pay clauses and price indexation clauses based on the principle of 'replacement value'. The latter is advantageous for the gas industry as a whole (including EU importers), since downstream demand remains high and relatively stable. Consumers face stable *relative* gas prices and have little incentive to substitute in favour of potentially competing products. In parallel, the ongoing liberalisation of the EU internal market for gas is leading to an expansion of spot market trading volumes, thus leading to tensions between the prices set out in long-term contracts and spot prices. These tensions are particularly vivid in periods of short-run slumps in demand, e.g. as due to the 2009 recession, thus leading to a 'gas glut'. Short-term fluctuations notwithstanding, EU actors should consider what type of market structure best suits their interests.

The European Commission is committed to increasing economic efficiency in the internal energy market by fostering competition between EU gas companies, thus ensuring that end users can choose between competing suppliers. The Commission's view is that liberalisation in the internal market leads to higher economic efficiency. While this may be accurate, the challenge of external relations with foreign monopolistic suppliers remains unsolved. As a matter of fact, liberalisation in the internal market, if pursued in isolation, could lead to further fragmentation of bargaining power in relations with external suppliers. A more promising approach would therefore be to continue to foster competition in the internal market (transmission, distribution and supply), but to consolidate bargaining power in the context of extra-EU relations.

From the perspective of security of supply, the Union will be more vulnerable to political leverage on the part of external suppliers if its import dependence is higher, since the relative importance of the external suppliers for the maintenance of the Union's economic prosperity will be correspondingly greater. In commercial terms, EU companies seeking to secure additional imports will have to negotiate from a position of greater weakness with respect to external suppliers given declining production portfolios in terms of home country production and in terms of a stagnation or fall in controlling stakes in foreign gas fields.

This prospect should be a matter of serious concern for public policy. Potentially unfavourable developments in terms of energy prices or supply disruptions (as well as concessions that may have to be made to prevent such developments) may adversely impact consumers and governments in the EU at large. The EU gas industry has a vested interest in seeing its own market expand. In the presence of low and declining domestic production, the industry finds it in its interest to go along with rising imports, since the only alternative would be less gas demand altogether. In other terms, while an expanding EU gas market (higher demand) leads to higher private returns for the industry, the risks and costs in case of adverse developments would affect society at large. This combination, namely privatisation of gains versus socialisation of losses, is not acceptable from a public policy viewpoint. It is therefore necessary for actors outside of the gas industry to take the lead in thinking through and developing instruments of public policy at the Member State and/or Union levels which may be conducive to alleviating the risks and costs of high and rising import dependence.

Besides further interventions with respect to energy and climate policy targets and instruments, one idea which is currently making its way into the policy debate is to set up gas purchasing consortia or, in a more developed version, an EU gas purchasing agency. The latter idea was presented by this author at two energy security seminars in the course of 2008, see Christie (2008a), Christie (2008b), and was subsequently discussed in Auverlot *et al.* (2010), a report from a unit of the Office of the French Prime Minister, and Andoura *et al.* (2010), with the endorsement of Jacques Delors. Exemptions from EU competition law are foreseen in the Treaty on the Functioning of the European Union (TFEU). The necessary legislation already exists for the creation of either ad hoc gas purchasing consortia of EU companies (Articles 101 (3) and 103, TFEU) or a fully-fledged gas purchasing agency (Articles 101 (3), 106 and 107, TFEU).

Such developments would of course require the approval of the European Council (the Member State governments). Moreover, and this issue is left open for further analysis, the economic and strategic impact of such a change in EU legislation requires deeper analysis. No such analysis has yet been made, at least not in the public domain. One preliminary thought is that the analysis would have to consider the strategic response of the EU’s external suppliers, e.g. the possible formation of a cartel out of the Gas Exporting Countries Forum (GECF). A cartel on the OPEC model would make most sense if the entire EU market were driven by spot pricing. If long-term supply contracts survive as a major feature of EU imports, then the purchasing agency’s role would be to ensure more favourable terms from future and, potentially, existing supply contracts.

8 Conclusions

The European Union faces two important challenges with respect to its external gas relations. The first is that its demand profile is highly uncertain even in the relatively near-term, with substantial differences in projected import demand from published scenarios for 2020 (and beyond). The second, mostly unrelated to the first, is its rapidly increasing import dependence ratio.

The first challenge is related to the Union's energy and climate policies. First, the extent to which commitments to increase the share of renewable energy will be met will affect natural gas demand. Second, the evolution of carbon prices will affect the relative costs of different forms of power generation. Natural gas is particularly favoured by moderate EUA prices, i.e. high enough for gas to edge out coal, but low enough for gas to remain competitive with respect to wind energy. The timing and depth of new commitments to reducing emissions in the context of the EU ETS will therefore have a crucial impact on natural gas demand, as will any strong change in nuclear energy policy.

According to a range of recently published scenarios, the Union's import dependence ratio will be in a range of 84% to 89% by 2030 as compared to 59% in 2007. This increase in import dependence heralds a phase of decreasing bargaining power for the EU in its interactions with external suppliers. Higher levels of dependence also lead to potential risks and potential costs affecting not only the EU gas industry, but EU consumers and governments as a whole. One way to address this challenge is to consolidate the Union's bargaining power with respect to external suppliers through the creation of gas purchasing consortia, or through the creation of a fully-fledged EU gas purchasing agency. Both options are feasible using existing EU legislation and may therefore be proposed by the Commission and submitted for approval to the European Council. Further analysis on the economic and strategic implications of carrying out either option would be very welcome in the near future.

References

Auverlot, Dominique, Hervé Pouliquen and Christian Stoffaës (2010). “La sécurité gazière de l’Europe: De la dépendance à l’interdépendance”. Centre d’Analyse Stratégique. March 2010.

Andoura, Sami, Leigh Hancher and Marc Van der Woude (2010). “Towards a European Energy Community: A Policy Proposal”. Notre Europe. March 2010.

BGR (2009). Energierohstoffe 2009. Reserven, Ressourcen, Verfürgbarkeit. Tabellen. Bundesanstalt für Geowissenschaften und Rohstoffe (BGR): Hannover.

Brower, Derek (2009). The EU’s big gas climb-down. *Petroleum Economist*, Vol. 76, No. 8, pp. 4-5.

Christie, Edward H. (2009). European security of gas supply: a new way forward. in: Liuhto, Kari (Ed.) (2009). The EU-Russia gas connection: pipes, politics and problems. *Electronic Publications of Pan-European Institute, 8/2009, Turku School of Economics, pp. 3-22*.

Christie, Edward H. (2008a). “European Energy Security after the 2008 South Ossetia War”. *Presentation. NATO-EAPC Seminar: ‘Energy security through development of cooperation’. Yerevan, 2-3 October 2008*.

Christie, Edward H. (2008b). “EU-Russia Energy Relations: Russian strategies and ideas for EU responses”. *Presentation. Conference of the 20th Anniversary of the Pan-European Institute at the Turku School of Economics: ‘Energy challenges in Northern Europe’. Turku, 27-28 November 2008*.

De Jong, Jacques, Jean-Michel Glachant, Manfred Hafner and Robert Grant (ed) (2010). “A smart EU energy policy – final report”. CIEP, LdP-EUI, FEEM and Wilton Park. April 2010.

EC (2008a). An EU Energy Security and Solidarity Action Plan. *Communication from the Commission, COM(2008) 781 final*. European Commission: Brussels.

EC (2008b). Europe's current and future energy position: demand – resources – investments. *Commission staff working document, SEC(2008) 2871 VOLUME I.* European Commission: Brussels.

Eurogas (2010). Long Term Outlook for Gas Demand and Supply 2007-2030. *Online publication.* Eurogas: Brussels.

Gazprom (2008). New Initiatives of the European Union and Export of Russian Gas – Gazprom’s Vision. Presentation by Alexander Medvedev, Gazprom Deputy Management Committee Chairman, VI International Forum “Russian Gas – 2008”, Moscow.

Holz, Franziska, Christian von Hirschhausen and Claudia Kemfert (2009). “Perspectives of the European Natural Gas Markets Until 2025.” The Energy Journal 30 (Special Issue): 137-150.

IEA (2009a). Natural Gas Information 2009. Paris: OECD/IEA.

IEA (2009b). World Energy Outlook 2009. Paris: OECD/IEA.

IEA (2008). World Energy Outlook 2008. Paris: OECD/IEA.

Karbuz, Sohbet and Bruno Castellano (2009). The Role of Supply-Demand Forecasts and Scenarios in Long-term EU Natural Gas Insecurity. *OME Discussion Paper, Observatoire Mediteranneen de l’Energie.*

Umbach, Frank (2010). “Global energy security and the implications for the EU.” Energy Policy 38 (3): 1229-1240.

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