Time for Europe to face oil and gas supply realities

The peaking of Europe's oil and gas production is undisputed but the current EU 2020 energy conservation policy does not address this decline. Ruud Weijermars[1] highlights the emerging fossil fuel supply gap which demands formulation of a new EU energy strategy.

Perhaps for too long, concerns about switching to renewable energy, greenhouse gas (GHG) mitigation, and energy conservation have dominated the EU's energy agenda (European Commission, 2010). The 20–20–20 target for 2020 has been: 20% reduction in energy consumption below 'projected' levels, 20% of primary energy use should come from renewable sources, and GHG emissions should be reduced by 20%, taking 1990 as the reference year. But there are other threats to Europe's future energy supply in need of attention too.

The strong focus on 20–20–20 targets arguably has diminished the EU's vigilance about the strategic security of its fossil energy supply. Traditional oil and natural gas still account for a hefty 60% of Europe's primary energy demand (OECD/IEA, 2010a). Recent unrest in the MENA countries has reminded us that importing some 50% of its natural gas and 70% of its oil makes Europe rather vulnerable to price hikes and supply interruptions. This study examines the historic data for oil and gas production in Europe, as well as forward projections for consumption. Strategy options are recommended to improve the security of Europe's future oil and gas supply.

Gas production drops

Natural gas dependency has risen rapidly in Europe over the past few decades (OECD/IEA, 2010b): the gas share in the energy mix has grown from less than 10% in 1970 to over 25% in 2010. The rest of Europe's primary energy comes from oil (35%), coal (16%), nuclear energy (14%), and renewable sources (10%).

Europe had substantial natural gas reserves when indigenous production started back in the 1960s (Weijermars & Madsen, 2011; Weijermars et al., 2011), but has chosen to consume its indigenous gas supplies at a fast pace. Gas production peaked in 2004 (Figure 1), and Europe now faces a steep decline of its indigenous gas production. Much of the production decline is due to the depletion of gas fields in the Netherlands and in the UK. By 2030, 'old' Europe's indigenous gas production will have dwindled to half the 2004 peak supply rate.

Gas imports rising

The decline of indigenous gas production means Europe will increasingly depend on gas imports (Figure 2). Today's 50% dependency on gas imports is as follows: two-thirds of the gas imports come via pipelines from Russia, Algeria, Libya, Iran, and Azerbajan. The remaining one-third comes in as LNG shipments from liquefaction factories in Algeria, Qatar, Nigeria, Trinidad, and Egypt.

As the gap between demand and indigenous production continues to widen, Europe must continually secure new gas contracts. The growing gap between indigenous supply and demand is referred to here as the 'growing import lens' (Figure 2). By 2030 some three-quarters of EU's gas needs will have to be met by gas imports.

Securing ever more gas imports at affordable prices may not be easy. Global gas demand is seen to rise by 44% in 2035 (OECD/IEA, 2010a). Asia too needs more gas in the future as the world economy recovers and Asia's indigenous production itself is even lower than European output (OECD/IEA, 2010b). Natural gas prices are therefore set to rise for Europe: the Continental European 2011 gas deliveries under long-term contract (oil-indexed) already trade at nearly *three times* the concurrent US Henry Hub reference price (McCredie

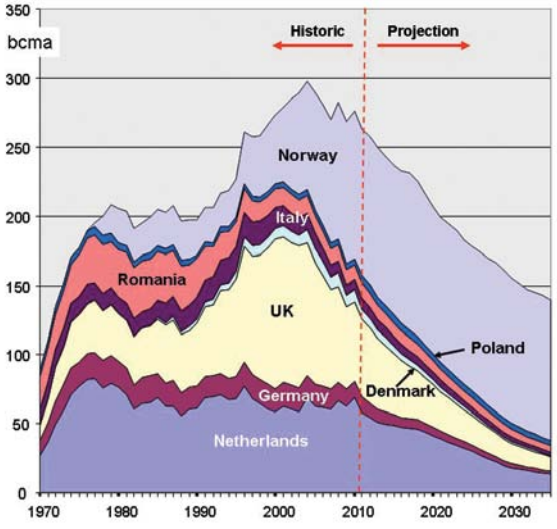

Figure 1 *Europe's indigenous gas supply peaked in 2004 and now decline has set in [Source: Alboran Research, BP Yearbook, 2010, and IHS CERA, 2010].*

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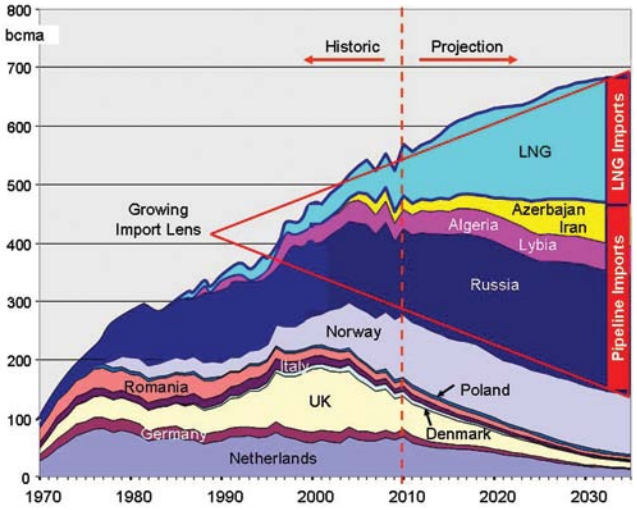

Figure 2 *More gas imports (pipeline and LNG) must help to fill the growing 'import lens' between Europe's gas demand and its dwindling indigenous gas production [Source: Alboran Research, BP Yearbook, 2010, and IHS CERA, 2010].*

and Weijermars, 2011; Weijermars and McCredie, 2011).

Europe has taken some advantage from sustained cheap LNG spot gas supplies over the past two years. Hopes that LNG will remain in ample supply at cheap rates are now fading. LNG regasification terminals have been built at an aggressive pace in the US, Europe, and Asia. The world's LNG receiving capacity now exceeds three times the global supply capacity (Rogers, 2010). If all LNG receiving stations wanted to secure full capacity, it would be impossible because only one-third can be at capacity at anyone time. The global LNG mismatch is likely to persist over at least the coming decade.

Oil production peaked

Europe uses some 14 million barrels of oil per day, a consumption pattern that has been more or less steady over the past 40 years (within a 10% variation band). What has changed, though, is the proportion of indigenous oil production versus imports. The first oil crisis of 1973 jump-started offshore oil production in the North Sea Basin. Indigenous production grew significantly and accounted for nearly half of Europe's oil supply by the late 1990s (Figure 3). Production peaked around the turn of the century, due to depletion of the North Sea Basin. Production decline for the UK and Norwegian Continental Shelves is now accelerating.

Although European oil consumption is projected to contract over the coming decades (OECD/IEA, 2010a), indigenous oil production is dropping faster than consumption declines. The conclusion is that the dependency on oil imports will grow, unless new indigenous resources are tapped. Currently oil imports come into Europe half via pipelines and half by oil tankers. Pipeline oil comes in from Russia, Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan. Oil tankers source their cargoes from the Middle East and other world markets.

Nearly all of EU's indigenous oil production comes from the North Sea Basin (Figure 3) and the ongoing production decline for the UK is endemic for the other North Sea producers (e.g., Norway, Denmark, Germany, and the Netherlands). By 2030 the EU oil production may have dropped below 2 Mbbls/day: oil imports will then account for well over 85% of consumption.

UK double peaking

The past field development record of the UK North Sea Basin has been strongly affected by oil price shocks and technology breakthroughs. As in all E&P operations, early exploration success also provided the basis for the North Sea play. The actual profitability of the subsequent oil extraction process was primarily controlled by: (1) the quality of the reservoirs in the geological subsurface, (2) the precision, effectiveness, and cost of oil recovery technology, and (3) the prevailing oil price.

Figure 4 illustrates the typical double-humpback of the UK's overall production profile. This profile resulted from a series of interconnected price shocks and technology develop-

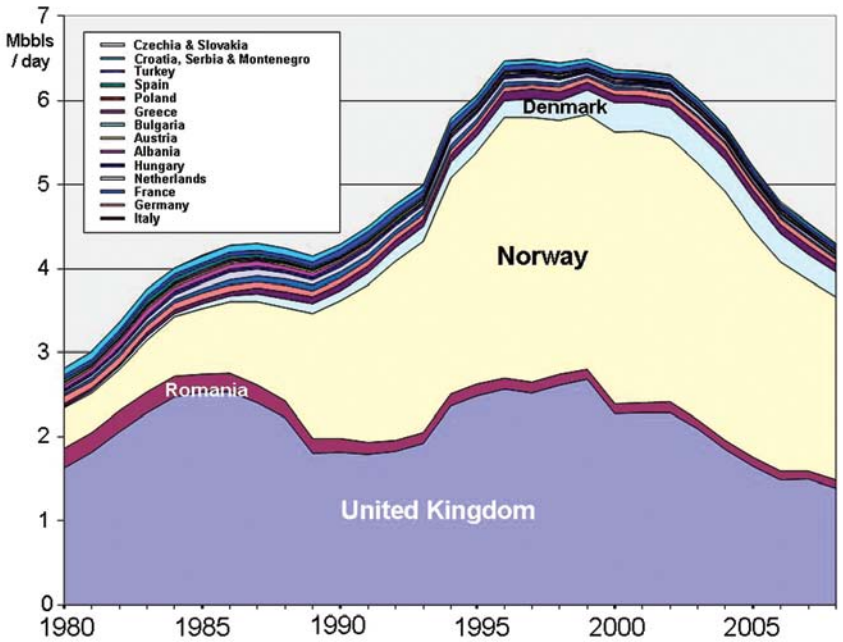

Figure 3 *European oil production has peaked and has been declining since 2000. UK oil production is dropping and so is the output of all other European oil producers [Source: Alboran Research and BP Yearbook, 2010].*

ments. When oil prices rose sharply in the aftermath of the first oil crisis of 1973, offshore drilling – already in progress in the Gulf of Mexico – became profitable for the North Sea Basin. The early production high was lifted even higher by the second oil crisis of 1979 (in the wake of the Iranian revolution). The first steep production decline of 1987 occurred when the oil price dropped below $20/bbl, and rendered most UK fields sub-economic. A leap in affordable seismic processing capacity (3D and 4D seismics) improved exploration accuracy and production effectiveness throughout the 1990s, and thus enabled the second high for the UK's North Sea Basin development. In spite of the high oil prices over the past decade, decline set in after year 2000.

For any particular oil play, the information on subsurface quality is better understood over time and becomes a given as E&P operations mature. Smaller and smaller fields are tied into the evacuation infrastructure until the creaming curve is completed and all economic oil is recovered. That the North Sea Basin has now entered its final depletion phase seems a likely conclusion. If correct, neither oil price hikes nor technology can do much to raise North Sea production levels for a third time – as long as we look at conventional oil extraction only.

IEA renewable scenarios

The decline of Europe's indigenous oil and gas production has been overshadowed by the EU focus on its 2020 energy policy agenda (dedicated to renewable sources, GHG reduction, and energy conservation). The IEA has also focused on renewables in its authoritative energy scenarios and strategies to 2050 (OECD/IEA, 2010c). The fossil fuels' stake in the world's primary energy mix has been steeply downscaled in the IEAs most radical scenario: global gas consumption will be suppressed to 12% below the 2007 reference level, and oil supply will be 27% lower (coal at -36%). These scenarios were calculated in IEAs 2010 energy technology perspectives to specifically advise OECD ministers on the cost of executing detailed future energy scenarios for GHG abatement to keep emissions at 2000 levels and meet Kyoto targets. The total annual cost was calculated in 2010 to amount to $1.1 trillion (equivalent to Italy's

Strategy options for improving the security of Europe's oil and gas supply

What can Europe do to improve the security of its future oil & gas supplies? A list of recommended strategy options follows from the above oil and gas production analysis.

A. Gas security

1. Increase gas storage capacity. This capacity now stands at less than a two months consumption buffer if all other gas supplies were halted. Assuming indigenous production would continue and only the external supply is faltering, EU storage supplies could last for nearly 4 months, but only three months for winter periods when consumption peaks. By 2030 some three-quarters of EU's gas need will be covered by gas imports. For such an increased dependency, the strategic gas storage capacity must grow significantly to hedge Europe against future price shocks and gas supply shortages.

2. Diversify gas supply sources. Australia and South Africa are both gearing up to develop their massive shale gas resources at marginal cost. Europe might consider securing early delivery contracts to facilitate the business case for building LNG liquefaction installations in these potential supply countries.

3. Develop unconventional gas resources. North America has no net gas imports because the half of its total gas supply that was lost to decline of conventional fields has been wholly replaced by supply from its own unconventional sources (shale gas, tight gas, and coal bed methane). Europe is far behind in developing its unconventional gas resources. Europe should get started, first of all by initiating research to ensure environmental concerns are properly addressed. Economic fundamentals also must improve through the use of better and more cost-effective technology solutions.

B. Oil Security

1. Increase oil storage capacity. European strategic oil stock now stands at three months worth of the prior year's net imports, as required by a March 2001 agreement signed by all 28 IEA members. As decline of its indigenous oil production continues, EU oil storage capacity must expand. Enhanced strategic storage capacity can be used for contango speculation and hedges Europe against future price shocks and oil supply shortages.

2. Reduce oil consumption. The reduction of European oil consumption may continue, but is in part linked to an increase in gas consumption. Gas is a cheaper fuel source as it is traded at a calorific discount relative to oil and burns cleaner – hence the European preference for gas. Its oil supply sources are already diversified and options for further diversification of traditional import sources seem limited.

3. Develop unconventional oil resources. The US has stopped the decline in its domestic oil production by applying the unconventional gas techniques of horizontal drilling and hydraulic fracturing to extract more oil. Europe too should explore its own success in reversing the decline of its indigenous oil production.

current GDP or 1.1% of global GDP each year) from now until 2050. The undiscounted sum of over $46 trillion is needed (above the baseline cost for 2050 world energy supply) to establish a cleaner global energy mix by a combination of shifts in primary energy sources as well as innovations in energy technology.

Reality is that, today, Europe only produces 30% of its own oil and 50% of its own gas – and imports are growing rapidly for both fuels. By 2035, oil and gas imports will account for respectively 90% and 80% of EU's anticipated consumption of these fossil fuels. Although IEA scenarios are authoritative, they remain scenarios and there is little reason to believe that the fossil fuel consumption outlook for Europe of IHS CERA (2010) and BP (2010, 2011), integrated in the projections analyzed here, are far off. In fact, IEA's 2010 World Energy Outlook projects global gas demand to have risen by 44% in 2035 (OECD/IEA, 2010a). Relying on renewable energy sources alone, therefore, is no option. The technology and cost-effectiveness required to generate from renewable sources the huge amounts of energy consumed by the future world requires more time to develop and mature (Kramer and Haigh, 2009).

Putting unconventionals on the agenda

For Europe to become less dependent on fossil fuel implies the need for both a coherent energy strategy and a research agenda. The accelerated development not only of renewable resources but also of unconventional oil and gas resources is required. Rising oil and gas prices can be alleviated by enhancing indigenous production , a challenge that has yet to be embraced by the European oil and gas industry. The US has demonstrated that independent petroleum producers can contribute to stopping the decline of the country's domestic oil and gas production by advancing techniques for horizontal drilling and hydraulic fracturing to extract oil and gas.

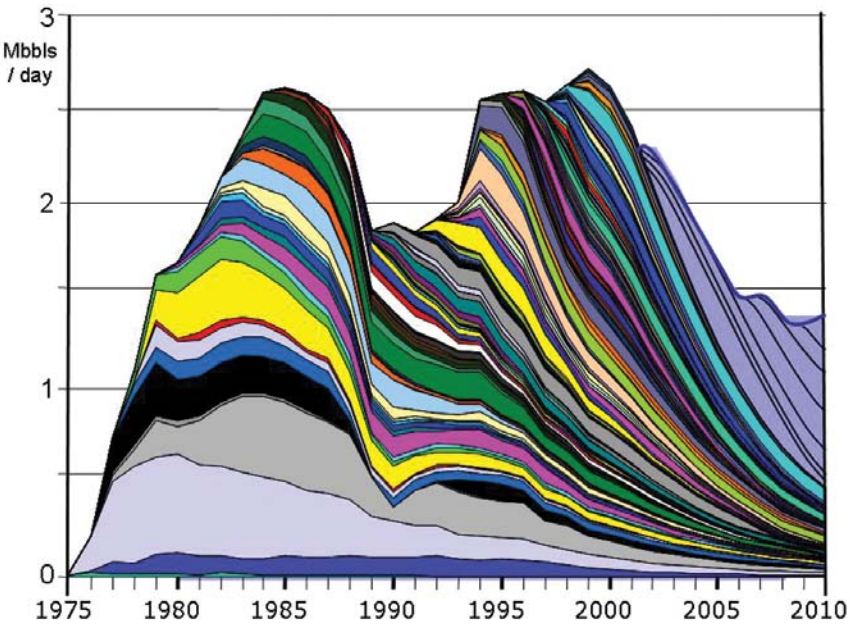

Figure 4 *Stacked production profiles for UK show double peaking resulting from oil price shocks and drops, as well as technology breakthroughs [Source: Alboran Research and DECC, 2010].*

US achievements were preceded and accompanied by dedicated research programmes under governance of the US Department of Energy.

A similar path could be copied in Europe, while avoiding past mistakes and applying lessons learned. Further innovation of unconventional extraction technology should be stimulated now in Europe through advanced R&D incentives. Recommendations for improving the security of Europe's future oil and gas supply are illustrated in the accompanying section. These are the issues that a new EU energy policy must urgently address.

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