Leading the energy mix revolution

Europe's exposure to expensive imports means cheap renewables will be needed to put competitive price pressure on fossil fuel suppliers. Crispian McCredie *and* Ruud Weijermars*, *Alboran Energy Strategy Consultants, highlight the hurdles for Europe in keeping its lead in the global energy transition.*

Changes in the global energy mix are needed for three pressing reasons. Firstly, the world population continues to grow and, despite all the advances of technology, 60% of the world's population remains without electrical power – as they cannot afford the cost. Secondly, the rising cost of primary fossil fuel-based energy supply will hinder long-term economic growth and will depress global gross national product, especially in energy import countries. Thirdly, greenhouse gas emissions are still too high and growth in fossil fuels means carbon dioxide (CO_2) emissions will continue to increase. Together, these three global crises (see **Figure 1**) provide an economic and political minefield for any country, be it rich or poor.

Unfortunately, world demand for fossil fuels still continues to outpace the growth of renewable energy systems.[1] Cheap and green energy alternatives need to grow much faster to replace fossil fuels, which today still account for 82% of the worldwide energy mix, with nuclear contributing just 11% and renewables only 7%. Steering away from an energy crisis is as important as a reversal of the environmental crisis. Lowering the cost of energy supplies (fossil, nuclear and renewables) would help resolve the lingering economic crisis and reduces the risk of future escalation. So, where are we heading?

Europe's energy outlook

Europe has one of the least favourable positions when it comes to conventional fossil fuel endowment.[2] It will face rapidly rising fuel costs over the next decades. Europe's conventional fossil fuel reserves are small relative to the rest of the world. In 2010, worldwide conventional fossil fuel reserves were estimated to last another 46 years for oil, 58 years for gas and 112 years for coal (see **Figure 2**). For Europe, the remaining conventional fossil fuel reserves are forecast to last 10 years for oil, 15 years for gas and 105 years for coal at present production rates.[1] Rising demand means that depletion rates will only accelerate.

Clearly, Europe cannot rely on conventional fossil fuels for its long-term future energy supply. Most European countries will be forced to import more energy by pipeline or ship for oil and gas, and by cable for electrical power. Importing more energy will mean paying high prices as world demand increases and supply is constrained. Europe is already paying high prices for fossil fuel energy imports. For example, wholesale gas prices in continental Europe are twice as high as in the US where both tight gas and shale gas are now abundant.[3] Little downward pressure on EU natural gas prices is to be expected in the coming decades, as natural gas import dependency will rise to 75% by 2030.[4] European Brent Blend already trades at a 25% premium over US West Texas Intermediate (WTI).[5] While both blends have nearly identical compositions, the two cannot easily be arbitraged – WTI from Cushing is difficult to physically export. In any case, worldwide oil and

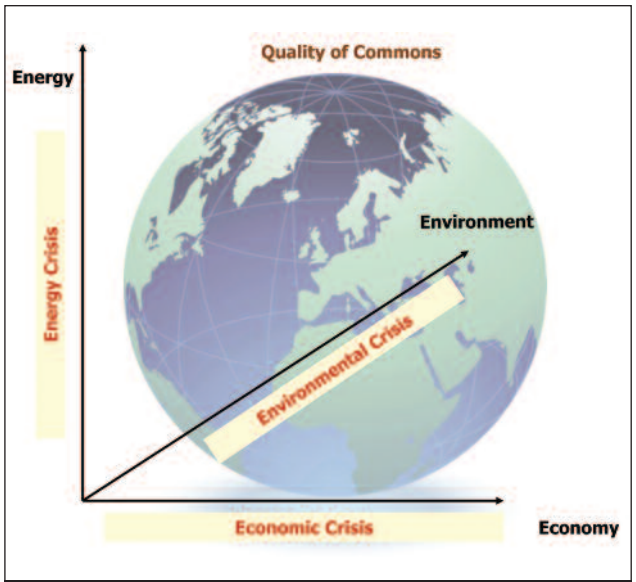

Figure 1: Our society faces three major interrelated crises – energy, economy and environment *Source: Alboran*

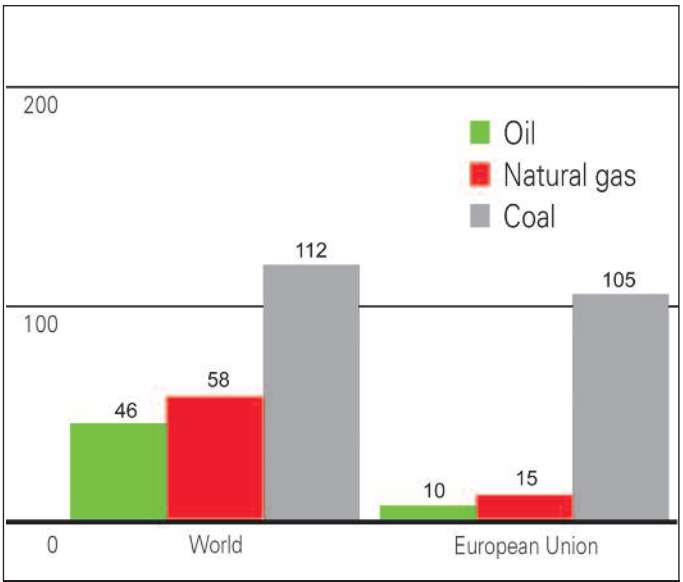

Figure 2: Reserve to production ratios (R/P) at end-2010 indicate time to depletion (in years) for the world and Europe *Source: See Ref 1*

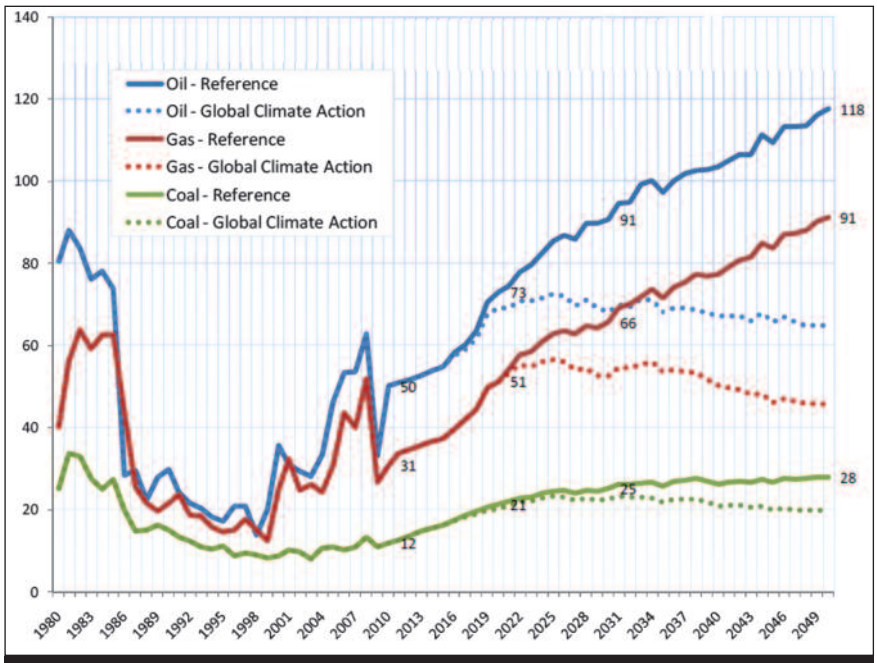

Figure 3: Fossil fuel prices for Europe in two scenarios modelled by E3MLab. Prices are in constant 2008 €/boe *Source: See Ref 6*

gas prices are expected to increase further over the next few decades as growth in demand outpaces reserve replacement.

Scenarios for Europe

Future fossil fuel prices for Europe are modelled in the Prometheus model, the European Commission's (EC) energy-economy-environment system model (E3M), developed at the E3MLab of the National Technical University of Athens.[6] **Figure 3** shows that fossil fuel prices will continue to rise over the next four decades, unless downward price pressure is imposed by global climate action. The baseline trajectories for the EU-27 price of oil, gas and coal assumes a conventional development of the world energy system. World coal prices are still relatively low, but have risen since mid-2000 in response to rising world demand. **Figure 3** further shows how the switching to renewables in the global climate action scenario can provide downward pressure on fossil fuel prices. Clearly, Europe needs to work harder on replacing expensive energy imports with renewables to realise the anticipated price leverage on fossil fuel imports. Switching to renewable sources requires heavy upfront investments to accelerate the energy transition, but fossil fuels cannot be phased out all at once.[7]

The risk of short-term visioning by EU governments under the present financial stress has increased. The rescinding of subsidies on renewables as government allocated subsidy budgets are cut or exhausted, and delays in the costly roll out of both domestic and

European-wide smart grids does not bode well for the future affordability of energy prices. Aside from subsidies, carbon taxation could force coal-fired power producers to invest in green technology. Even so, the cost of coal can only be expected to rise, as any carbon emission penalties imposed on coal-fired power stations will be passed on to consumers. Meanwhile, Europe's least able countries will continue to burn coal for baseload power production, as it is indigenous and they cannot afford the cost of imported gas. Developing cheaper renewables able to provide baseload power production will remain crucial to assisting Europe's economic competitiveness in the long run.

A recent report by KPMG and A F Consult has suggested that the UK could save £34bn on energy bills – and still meet 2020 carbon targets – by reducing expenditure on wind power and replacing the projected power shortfall with gas and nuclear-powered plants.[8] The renewables sector has reputed many of the report's assumptions on wind power generating capacity and also makes the point of the impossibility of completing the government's proposed nuclear construction programme by 2020. As with the rest of Europe, gas remains the fuel of choice for cleaner power production.

Reality check for Europe

Previously, the gas transition has helped to displace the use of polluting coal in Germany, the Netherlands and the UK to combat acid rain in Scandinavia. Natural gas in these countries now accounts for 25%, 40% and 45% of primary energy consumption. However, Russian pipeline gas imports are already among the most expensive gas deliveries in the global gas market.[4] The global competition to secure more LNG shipments at affordable prices is equally fierce and will remain so for decades to come. Consequently, future use of gas in Europe can only be sustained if gas remains affordable and competitive relative to alternative energy sources. However, as cross-border pipeline trades increase and the number of LNG importers grows, Europe must expect to pay higher prices for its future gas imports.

What can we learn from the world's most successful energy transitions? The green energy transition has worked best in some of the least densely populated nations.[9] New Zealand's primary 2010 energy mix was nearly 37% renewables through a combination of geothermal and hydropower. Norway is Europe's leader in renewables, with 44% renewable energy (mostly from hydropower dams), even though it possesses Europe's largest gas reserves. Hydropower is substantial in the energy mixes of Sweden, Austria and Switzerland (between 10% and 13% of their primary energy mix). Sweden and Finland have a considerable biomass component in their primary energy mixes (nearly 20%), but few countries share the benefit of these densely forested regions. Denmark is Europe's leader for wind power, which accounts for 20% of primary energy supply.

What all these leaders in green energy have in common is that their population is smaller than 10mn inhabitants, combined with a relatively low population density per acre. Nonetheless, 80mn Germans have made a remarkable energy switch and their energy mix already comprises nearly 10% renewable, through mostly photovoltaic energy in spite of Germany's unfavourable northern latitude.

What energy transition progress will the politicians make in the next 50 years? The European nuclear debate continues to swing backwards and forwards, depending on world events. Whilst undoubtedly a major source of base power production and low greenhouse gas emissions, major issues remain about construction, decommissioning and the reprocessing of spent fuel. The nuclear debate will continue despite the closing of German nuclear plants by 2020 and the future decommissioning of France's ageing plants, which currently account for 40% of the country's primary energy supply and 80% of power supply. Such actions will lead to a shortfall in the ability to provide electrical baseload without the use of gas.

Europe will have to compete with Asian market buyers of LNG as well as eastern flowing Russian pipeline gas and rising domestic consumption. Shale gas is unlikely to provide a quick solution. Even in the most optimistic trend projections, by 2030, only 10% of Europe's gas supply could be coming from the domestic unconventional resources of coal bed methane (CBM) and shale gas.[10] European juries are still out on the environmental impact and economics of shale gas.

Time is of the essence

Even as Europe struggles to reach its 2020 energy targets – a 20% cut in emissions of greenhouse gases by 2020, compared with 1990 levels; a 20% increase in the share of renewables in the energy mix; and a 20% cut in energy consumption – the world's emerging economies are hungry for more energy. Will there be the time and the financial resources to accelerate the energy transition before the extinction of fossil fuels? Based on BP statistics, world oil and gas reserves produced with current technology will only last another 50 years. That provides a timeframe horizon to have completed a substantial switch to cleaner, affordable and sustainable energy technologies.

While the economics of many of today's alternative energy sources are not yet competitive enough to phase out fossil fuels, Europe will be forced soon to accelerate the required switch to renewables. Climate change must be halted and the European carbon footprint reduced, before the demise of free eco-services further undermines the GDP of future generations. And despite all the advances of technology for the energy transition, 60% of the world's population will remain without electrical power, as they still cannot afford it.

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