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Unconventional Oil and Gas – Global Consequences

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The United States is bucking the global energy trend, with a real prospect of becoming largely independent of fossil fuel imports, while major European consumers, China and India are preparing for increasing dependency. The global energy landscape is changing rapidly and profoundly, with trade flows shifting and security of supply issues re-shaping. At the same time, national energy paths increasingly diverge even within the OECD. Access to unconventional energy gives the United States a global competitive advantage, with far-reaching repercussions for economic and geopolitical structures. Russia – once an indispensable energy power – and the OPEC producers must adapt to a new market situation and enormous uncertainties about how the new world map for energy will fit together.

The 2012 World Energy Outlook (WEO) published by the International Energy Agency (IEA) forecasts incisive change in the global energy landscape. The US energy market has experienced a technological "revolution" driven by hydraulic fracturing (fracking) and advances in horizontal drilling. Fracking allows oil and gas trapped in dense strata to be extracted by injecting a mixture of proppant (frac sand), water and chemicals at high pressure. The ensuing "shale gas revolution" has put the United States on a par with gas giant Russia in natural gas production, and in the coming decade it is even set to match the big oil producers Saudi Arabia and Russia. This could make the United States, which currently imports almost 20 percent of its energy consumption, (almost) self-sufficient.

The US Shale Gas Boom …

Fracking has dramatically improved the energy situation for the United States and caused prices to tumble. Within a few years US gas production has grown by one quarter to 690 billion cubic metres (2011), and imports, especially of liquefied natural gas (LNG), have fallen correspondingly. The price drop is impressive too: one million British thermal units (MBtu) cost $13 in mid-2008 but only about $2 by mid-2012.

Gas is now competitive with coal and finding increasing use in power generation, thus significantly lowering emissions in the US electricity sector. But if the entire production chain is included, the picture is less rosy. The Environmental Protection Agency recently identified the oil and gas industry as the second-largest source of

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greenhouse gases in the United States. At the same time, the rising opportunity costs of renewables could slow their expansion.

There are signs that this initial gas wave may have broken. The spot price at Henry Hub in Louisiana is now below production cost for the mostly small producers. The February 2013 price of about $3/MBtu leaves many wells below the profitability threshold, with production costs ranging between $5 and $8/MBtu. The resulting shift of activity to the oil sector has merely exacerbated the price pressure, because many oil wells produce gas as a marketable by-product. The US gas business is currently undergoing a process of restructuring, with major international oil corporations moving in and very interested in long-term export options. The price at Henry Hub is unlikely to remain below production cost for long.

… and Its Global Dimension

The IEA is already predicting a "global age" for natural gas, which releases much less greenhouse emissions and particulates than oil or coal. But to cover expected demand in 2035, annual production would have to increase on a scale corresponding to roughly three times Russia's. And for that to happen, almost half of global production would have to come from unconventional gas.

Internationally, this raises the question of the replicability of the US boom, both in terms of available quantities and price developments. It must be remembered that the situation in the United States was unique in terms of the political and legal framework, security of investment, availability of equipment and services, existence of a developed gas market, advanced infrastructure, a liquid hub, and proximity to consumers. Exploitation of unconventional reserves is particularly attractive for countries with high domestic demand. China, Argentina and South Africa possess gas reserves comparable to or larger than the United States, while major conventional producers like Russia and Mexico possess considerable potential too. In Europe France, Poland and Ukraine stand out, although exploration in Poland has already proved disappointing and firms have pulled out. The enormous consumption of water, infrastructure deficits and lack of service companies could also put a drag on development, for instance in China. Whether, where and on what scale a shale gas (r)evolution will occur also depends crucially on respective assessments of the environmental risks.

To date the US boom has had only an indirect effect internationally: coal exports have increased and LNG originally intended for the United States has been diverted to international markets. The question now arising is how much US shale gas should be liquefied for export. Here Washington faces a strategic decision. US energy policy has always pursued two fundamental tenets: maximising energy independence (especially with respect to the Persian Gulf) and seeking free energy markets and functioning trade flows. In terms of the second paradigm the fracking revolution represents a real litmus test for Washington.

During the trough of 2012 gas prices in the United States were about one fifth of European levels and one eighth of Japanese. Such low energy costs create competitive advantages for US industry and are seen as a prop for reindustrialisation, strengthening the dollar and significantly reducing America's trade deficit. Exporting gas would narrow that price gap (even if the level in the United States would probably remain below other markets). Exports promise benefits for the entire national economy but particular sectors would suffer. This political discussion has only just begun in Washington.

So far the US boom has actually tended to reinforce the three-way division of the global gas markets between North America, the European/Asian continental market, and the Asia-Pacific region (which, with the major consumers Japan, South Korea and China, absorbs two thirds of globally traded

LNG). The gas glut that affected the European market in 2009, partly caused by a recession-driven fall in demand, put the system of long-term oil-indexed gas contracts under pressure and gave a boost to the spot market alternative propagated by the European Union. Europe (still) uses a hybrid long-term (oil-indexed) contract and spot price model, while the Pacific LNG market pays high security premiums on long-term oil-indexed gas contracts. The United States and Canada are together self-sufficient and possess a real spot market gas-to-gas price (Henry Hub).

The first US exports are due to leave in 2014/2015 via Cherniere's Sabine Pass Terminal in Louisiana, which is to date the only export terminal with all the necessary permits. The target market is the lucrative Pacific region. There is as yet little reason to expect any rapid fall in international gas prices to result. Even if the price formula were to be orientated on Henry Hub, the costs of liquefaction, transport, regasification, etc. mean that liquefied US shale gas is not competitive everywhere. About twenty applications are pending for new export terminals with a total annual capacity of about 285 billion cubic metres, but the approval process is long, expensive and unpredictable. For a stronger, flexible global gas market, however, it is essential that US shale gas be exported in significant quantities, as the major conventional producers Russia and Qatar have an interest in securing their market shares and preserving the price level through market fragmentation.

In recent months Russian gas giant Gazprom has come under increasing pressure at home, with major projects subject to repeated postponements (first and foremost the development of the Shtokman Field in the Barents Sea). That is an indicator of difficult circumstances, but also bad news for future supply. Russia's regional strategy might continue to prosper, with the concept of pipeline markets and expanding existing market shares in Europe paying off. There is certainly a case for Russia and Europe remaining highly dependent on one another at least in the medium term.

To summarise: Unconventional gas has the potential to drive diversification and contribute to gas market globalisation, but this is by no means a foregone conclusion. It is also conceivable that unconventional gas will experience (short-term) local/regional booms and create local bubbles, thus bringing down prices only in regional markets, thereby contributing to fragmented gas markets. Much depends on political decisions and visions concerning the role of natural gas in the future energy mix.

American Oil Bonanza

An oil bonanza is now set to follow the shale gas boom. US oil production reached its highest level for twenty years in February 2013, with about seven million barrels per day. Oil imports have decreased from 60 percent of US consumption in 2005 to 40 percent today, and are forecast to fall to one third. Today the United States draws only 22 percent of its oil imports from the Persian Gulf region. Canadian oil sands, US light tight oil extracted by fracking, and natural gas condensates could make North America self-sufficient. America's fortunate supply situation becomes even clearer if the heavy crudes of the Venezuelan Orinoco Basin and Brazil's deep ocean reserves are taken into account.

Since mid-2010 the price of benchmark West Texas Intermediate (WTI) has fallen continuously relative to North Sea Brent crude, by up to $20 per barrel. This underlines how relaxed the North American oil market has remained despite the turmoil in the Arab world. The major trading hub for WTI, Cushing, Oklahoma, is even witnessing a certain supply surplus because of the growing influx of unconventional oil from Canada and the United States. Cushing is also a transport bottleneck, with existing infrastructure laid out principally for the opposite direction of flow, namely, to transport oil products north from the coast of the Gulf of Mexico. And the major refin-

eries on the Gulf coast are still set up to process heavy sour foreign crude. If the United States really intends to become independent of imported crude and use its own light tight oil, expensive modifications will be required in the processing chain. But the various domestic qualities certainly could successively substitute imports. The price gap between WTI and Brent already gives US refineries a clear advantage, making the country the biggest exporter of oil *products*.

The IEA believes that the chicken/egg problem of exploitation and export infrastructure will decide whether further reserves in North America will be tapped soon. Canada is already seeking export options in the Pacific region, to market its oil sands outside North America. But in the United States crude oil exports, with few exceptions, are essentially prohibited by law.

Global Oil Market: Business as Usual?

While a superficial reading of the WEO data may give rise to great optimism, the truth is less rosy. The report focuses only on the geological and technological availability of fossil fuels, and its dominant scenario is based on assumptions of energy efficiency action that far exceed the measures already decided worldwide. That might almost appear naive, for despite widespread recognition of the benefits of this "no-regrets option", too little is actually happening. Even the United States can only become self-sufficient if it further reduces fuel consumption. Moreover, the WEO scenarios exclude geopolitical and economic risks. Developments on the energy markets tend to be cyclical, often non-linear and sometimes volatile, due to technological innovations, substitution effects and (predetermined) break points.

The oil and gas sectors are generally susceptible to the so-called pork cycle. When prices are rising investment increases to expand capacity. But it takes time before the resource comes onto the market, because of long lead times for exploration, exploitation and infrastructure expansion. So there is a delay before supply increases, which then often occurs very strongly. This causes the price to fall and production and investment are scaled back again. Furthermore, the oil market is highly politicised and both fragmented and opaque along the entire supply chain, which increases the risks and difficulty of investment decisions. Unconventional production can introduce additional volatilities that complicate and increase the cost of adaptation strategies for both producers and consumers. The markets need prices that are low enough to stimulate demand but high enough to incentivise production expansion.

Even in the "new oil world" prices can be expected to be structurally high. Whether one considers deep-sea oil, Arctic permafrost fields, or oil shale, oil sands and heavy crude, the costs of exploiting unconventional deposits lie at the upper range of marginal costs for conventional fields, or even above. And as before, the considerable quality differences between different types of crude place limits on substitutability. What is traded here is not the (final) product, but a global commodity, a raw material that is sold on and processed in a long, complex and dynamic chain with widely varying profit margins. "New oil" differs not only in the geology of the deposits, but also in energy content, refining needs and profitability. This means that the markets are highly dynamic, specialised and opportunity-seeking. With a broader spectrum of deposits and extraction techniques in play, it becomes more difficult to predict what quantities can be profitably extracted, processed and sold.

Fracking is redrawing the world energy map outside North America too. Additional production takes pressure out of the markets and ensures a diversified supply from stable OECD countries outside the energy-rich ellipse of Russia, the Caspian and the Persian Gulf. What this means is a shift of risk from geopolitical uncertainty to ecological danger. Investigations into ecological

"footprints" and greenhouse gas emissions are only just beginning, but is it already apparent that the environmental and climate consequences are even graver than with conventional reserves. Attitudes to fracking risks vary widely, even within Europe. Poland and Ukraine are forging ahead, while France has imposed a moratorium. Political and legal frameworks are thus decisive for the development of supply and regional distribution, restricting or expanding extraction and trade. This encourages fragmentation in energy markets and systems.

How Do OPEC and Co. (Re)Act?

The political upheavals in the Arab world illustrate the geopolitical risks to which the global oil and gas sector is exposed, as the region remains the backbone of the global energy supply. How traditional producers adapt to the new market situation will thus be of enormous importance. Three years ago IEA chief economist Fatih Birol announced that satisfying the expected demand for oil in 2030 would require the discovery of "four Saudi Arabias". The WEO now proposes that the gap will be filled by unconventional reserves and Iraq, with the latter to make the strongest contribution to total growth in global oil supply (45 percent). Iraqi oil production is to increase from three million barrels per day today to six million by 2020 and eight million by 2035. Otherwise, the report says, the oil markets will be heading for difficult times. According to the IEA, the Iraqi energy sector needs more than $25 billion every year this decade. In view of the country's political instability that is a huge sum, especially given that just $9 billion were invested in 2011.

For the OPEC countries especially, but also for Russia, the new market situation diminishes the value of their oil and gas reserves – depending, naturally, on the course of the unconventional revolution. Ultimately supply and demand will decide what yield can be derived from deposits. For OPEC the importance of production quotas and discipline will increase in coming years, but most of all it will have to seek a sensitive balance of interests between Saudi Arabia, Iran and Iraq, where world market shares are concerned. That adds tinder to an already incendiary regional situation. Russia will also be paying close attention to changing market shares. Worse still, the state budgets of all these countries depend on high oil prices, while the fracking revolution hits them at a politically vulnerable moment. So it is not only the exploitation strategy that is called into question, but the very politics of generating affluence and securing power. In future, moreover, rising energy demand will lead the Arab world to consume a large proportion of its own energy.

Awareness of these questions could also function as an incentive to modernise and open up to joint ventures. But growing insecurity could equally lead to the development of new reserves being put on hold. This in turn would have negative long-term effects on global supply and spare production capacity. According to the IEA, dependency on OPEC will rise again from 2020, with its share of the global oil supply increasing from 42 percent today to 50 percent in 2035.

Demand Pull and Substitution Effects

In view of the still fragile state of the world economy it is almost superfluous to point out that the development of global demand is one of the grave insecurity factors that make forecasting the future energy world akin to fortune-telling. Interactions between individual types of energy, their markets and their prices are also likely to increase: international oil corporations are increasingly moving into the gas business; coal covered almost half the increase in global energy demand during the past decade; and global electricity demand is rising almost twice as fast as overall energy consumption. Finally, the biggest growth

in demand for oil comes from goods transport in Asia, and road freight could overtake car fuel consumption. If natural gas were to find increasing use in the electricity and transport sectors, substitution effects vis-à-vis coal and oil would be a game changer. Effects on prices of these energy sources would be profound and almost unpredictable. And even more pressing: Is the supply side ready for such leaps?

More than 90 percent of the expected growth in energy demand in the next two decades will come from the non-OECD world. China is already the world's largest energy consumer, and any change in its energy mix has enormous consequences for the global energy balance. Underlining this point, even though oil currently supplies only 19 percent of China's energy demand (Germany: 34 percent), it is already the world's second-largest consumer. Natural gas comprises only about 4 percent of China's energy mix, but this still amounts to about 130 billion cubic metres per year. By 2035 Chinese natural gas demand is forecast to increase to 545 billion cubic metres. Coal still represents 70 percent of China's energy mix, but its experience with smog could spur further action to reduce local air pollution.

After China, India and the rising economies of Southeast Asia are the new major consumers, and the realignment of trade flows from the Persian Gulf is already in full swing. Far more than half of all oil and gas exports from the Persian Gulf already go to China and the Pacific region. China's energy strategy builds on diversification of energy types, source countries and transport routes, tapping domestic reserves but increasingly also penetrating "Western spheres of influence" to secure supplies. Conflicts over oil and gas reserves in the South China Sea are growing increasingly volatile. The extent to which China trusts the international markets to guarantee supply, and the extent to which they deliver, will be decisive factors.

Geopolitical Implications

The US self-sufficiency narrative will increasingly influence its foreign and security policy. Ultimately, however, it is hard to imagine the United States ditching the Carter Doctrine, withdrawing from the Persian Gulf and waiting to see how China, India or Russia fill the vacuum. Its close partnership with Israel and worries about regional stability will tie the United States to the Gulf long after the current crises have blown over. Gulf oil is also crucial for price-setting and oil is priced in US dollars. Nonetheless, America's foreign policy and security options grow as dependency on OPEC and the Arab world diminishes. Economically too, the United States profits from a reduction in imbalances. Its budget deficit is successively alleviated by the resultant improvement in its trade balance, while China is forced to spend more on energy. In future Washington will find it easier to call for sanctions against energy-rich countries in the region. In any case the United States can be expected to demand greater responsibility and burden-sharing of its European and Pacific partners.

Developments in the energy world amplify geopolitical processes that are already under way, especially the shift of US strategic and economic interests to the Pacific. The Strait of Hormuz and the Strait of Malacca are crucial to Japan and South Korea, both close partners of the United States, but also vital to China's energy supply. Like the United States, China is expanding its military capacity in the region. The dilemma is two-edged: China depends on free passage, as do Japan and South Korea, but the fear of a blockade of these vital seaways runs deep in all three.

Europe must do much more to prepare itself for energy flows to shift from the Atlantic to the Pacific. In terms of availability and pricing, Europe "encounters" China increasingly directly in the Caspian and Central Asian regions, as well as in Russia. Europe should be prepared for a regional contraction of its energy trading relations and quantitative shortages, even

if these need not automatically occur. Finally, Europe could be forced to seek and secure its energy supply in its own broader region: North and West Africa, new gas discoveries in the Mediterranean, and the Caspian, Russia and Norway. Here it is problematic that Russo-European relations resemble a power struggle that both sides believe they are losing. That is a growing burden; the same applies to the lack of progress in the (sustainable) energy partnership and envisaged Energy Community with North Africa.

At a point where the European Union needs to bundle its forces in the global market, European fragmentation instead intensifies. It is by no means certain that internal market integration will continue to advance. In the oil and gas markets of the new energy world, Europe will operate from a position characterised by declining relative market share. European demand is stagnating, with imports rising slightly as a consequence of falling domestic production. Unresolved questions surrounding the future energy mix and climate and energy targets for 2020 and thereafter exacerbate the uncertainty of demand, detracting from Europe's attractiveness vis-à-vis the emerging economies. The refinery sector supplies a prime example of processing capacities emigrating to Asia. Here influence is lost along with profit margins and jobs, because large parts of the supply chain now lie outside European jurisdiction.

Conclusions

The emerging fragmented energy world amplifies the contours of a multipolar world. National energy paths diverge, energy mixes become more heterogeneous. Germany places its faith in the "energy transition" and conversion to a more sustainable energy system, America in the shale gas revolution, while Russia and others adhere to a conventional energy path. Singular and particular development paths may promote exclusive access and use strategies that might result in growing fragmentation of the energy world order. It is questionable whether this will make the global energy system more resilient to supply crises. Multilateral initiatives to shape energy relations are certainly hampered by such widely scattered interests, exacerbating huge existing uncertainties. Internationally, trust in markets and unhindered trade flows must be strengthened. The new times demand increased international cooperation and dialogue.

In terms of security of supply – as well as for ecological and climate mitigation reasons – it would be fatal to interpret the IEA figures as promising a sustained relaxation on the oil and gas markets. Unconventional fuels are no solution for global energy problems. At best they offer a viable bridge for conversion of the energy system, at worst they perpetuate existing use paths. Comparatively clean natural gas could acquire a transitional function and overtake oil. Repercussions on pricing structures will be decisive, but almost impossible to predict, as long as gas trade is still highly pipeline-dominated, only partially global and with limited flexibility. Also with respect to global warming, there will be a need to review very closely the reductions in greenhouse gas emissions achieved by substitution of oil/coal with gas *consumption*, and put them into perspective of simple geographical relocation of coal consumption and the "climate footprint" incurred by exploration and extraction of shale gas, coalbed methane, etc. The transition to a sustainable energy system remains a must from the perspective of climate protection *and* of security of supply.

It does not help that the boom in unconventional production increases the opportunity costs of the energy transition on both sides of the Atlantic. Simply examining a snapshot of the various energy costs falls short, and tends to obscure negative repercussions for environment, climate and future cost curves of individual energy types. Politics will sooner or later have to accept a trade-off between perceived short-

term cost advantages and plausible long-term benefits. With respect to unconventional energy sources, knowledge about ecological footprints, greenhouse emissions and technological risks is urgently needed.

In the face of these great uncertainties, Europe should maintain clear (climate) targets and a stable framework. Carbon pricing is the key to the energy transition. Flexibility in the European energy system represents the second response to uncertainty. That includes diversification and broad use of domestic energy sources, and could – after prior consideration of all ecological risks and effects on climate along the whole production and consumption chain – involve shale gas.

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