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The Global Energy Markets in a Strong Change

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The fossil energy markets are in a rapid change due to rising use of non-conventional resources of crude oil and natural gas especially in the US. In Europe the Polish production is expected to start in the next few years, although environmental concerns delay the beginning. This new production prompted by strongly risen crude oil prices, is increasing oil production markedly. The "end of oil" is moving further.

The strong global economic growth and increase in industrial production has led to very rapid rise in demand for and production of fossil energy. The energy-intensive growth in emerging economies and particularly in China has played a key role in this process. Fossil fuels are non-renewables and concerns about the adequacy of, e.g., oil have risen. Already in the 1970s it was argued that with the current rate of production at that time, oil would end in 30 years. Similarly, in recent years, the peak of the global oil production is estimated to already peaked or to be close to peak. Both implications base on the assumption that oil reserves are constant as they are not renewable. This is naturally true in geological sense. However, these total oil resources are unknown and the available estimates are a function of current state of knowledge in the field of geology. These estimates are changing in time as different analytic

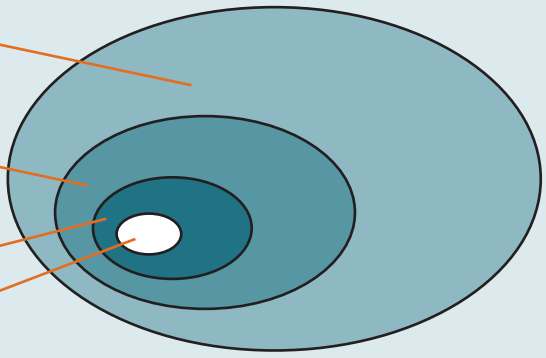
1 A simplified representation of the resource envelope

Resource in Place
Resource endowment. Lots of uncertainty, but we can never get beyond this ultimate number.

Technically Recoverable Resource
This is the number that is being assessed. Lots of uncertainty, but experience has shown this number generally grows over time.

Economically Recoverable Resource
This will grow with decreasing costs and rising prices, but is bound by technology.

Proved Reserves
Connected and ready to produce.



Source: Jaffe et al. (2011).

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centres base their opinion on improving information and knowledge.

The reserves used in these calculations are, however, usually proven reserves, which are estimates of technically and economically accessible reserves at prices at the certain time with a "reasonable" certainty. Based on them, the end of gas and coal would take place on similar basis in 63 and 112 years, respectively. However, higher prices and technological advances raise the size of proven reserves. The oil has not ended, but its adequacy in years has actually increased since 1970s. Last year, proven crude oil reserves (including gas condensate and natural gas liquids (NGLs)) covered oil production for over 40 years, although oil demand, which diminishes the reserves of this non-renewable commodity, has almost doubled since 1970. High oil prices and technological advances in production have made part of the uneconomical resources economical, i.e., "proven", like strong metal prices have changed many mineral deposits to ores. High oil and gas prices as well attempts to reduce CO2 emissions for environmental reasons provide a strong incentive to develop alternative fuels, energy sources and technical advances in both production and use, which will lengthen the adequacy of these non-renewable resources and eventually make them unnecessary.

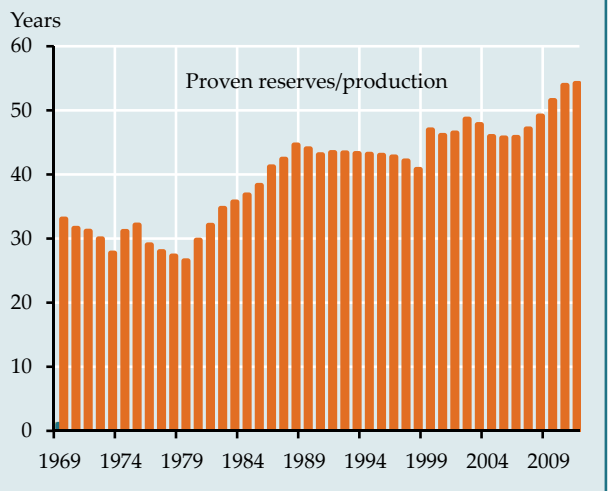
Shale gas and shale oil shape the energy markets

In the US, production of both gas and oil has risen rapidly with strong impacts on the local markets. Shale oil included, the US oil production turned to a strong rise in 2008. The logistics of oil supply was not prepared for increasing supply of shale oil from inlands in Canada and in the US, which has changed the small price premium of the US WTI oil to a discount of almost 20 dollars. These bottlenecks will be resolved in time, but the IEA estimates that the US will hit a new record oil production within five years. These developments do not come without costs. Production techniques are not environment friendly and the opposition both production and improving logistics (Keystone Project) is high.

Unconventional hydrocarbons: the beginning of a brave new world?

The existence of large amounts of hydrocarbons situated in layers of sedimentary rock has been known for many years. However, horizontal drilling and hydraulic fracturing have made the extraction of these deposits commercially viable only recently. Among the small number of countries it is the US that has been most successful in benefiting from shale gas and oil. Among other countries, South Africa, China and Argentina are expected to follow suit by using the US technology of extraction. The US production success was due to the combination of the following factors: large domestic gas market, extensive land-based oil and gas exploration and production industry, developed pipeline infrastructure, high-level technical know-how and accommodative legal regulations.

2 The adequacy of oil – "End of oil" is moving further, 1969–2011



Sources: BP, ETLA.

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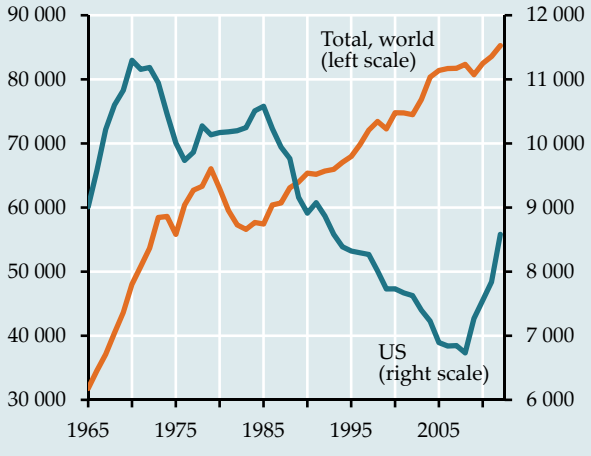
3 World oil production 1965–2012, 1000 b/d



Sources: BP, EIA, ETLA.

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In the US the relative weight of shale gas in total gas consumption grew from 1 per cent in 2000 to 30 per cent in 2012. As a consequence of this the US is now more or less self-sufficient, whereas in 2007 it was still the world's largest importer of natural gas.

As a result of the increase in the production of shale oil (Texas and North Dakota are the are the largest oil-producing states), US oil imports dropped from more than 13 million barrels per day in mid-2007 to less than 8 million bbl./d at the end of 2011. For the first time in 60 years, the US is net exporter of refined oil products. UBS forecasts that total US oil production will go up from just over 9 million bbl./d now to above 12 million bbl./d in 2020. As a result, US oil imports should fall by at least 1 m b/d by 2020 from about 9 m b/d now.

According to the World Energy Outlook 2012 by the International Energy Agency, the US may overtake Saudi Arabia as the world's largest producer of oil and natural gas liquids such as ethane by 2020. Other forecasts say that US overtake is expected as early as 2017. Anyway, in both cases a shift will take place in the global supply of oil from politically unstable regions such as the Middle East to a well-established market economy. Thereby geopolitical risks will decrease.

A closer look reveals also some risks

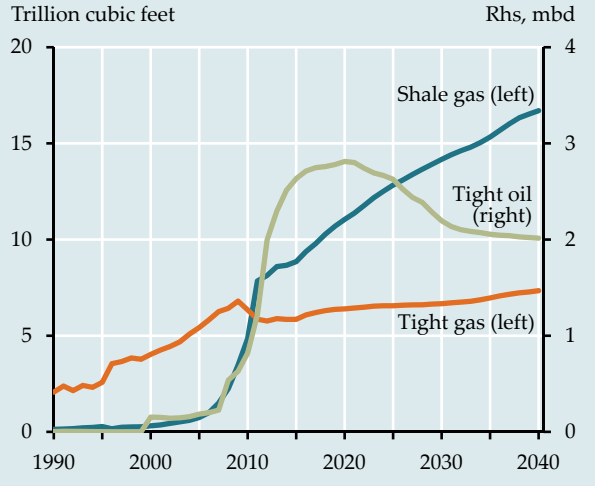
Nevertheless, the realisation of these projections is subject to several preconditions. First, the extraction of shale oil is commercially viable if the oil price remains above $70 per barrel. Break-even prices for shale oil are in the range of $44–$68 per barrel. A significant threat to shale oil production is a prolonged slump of the world economy or a surge of oil extraction elsewhere (e.g. if Iraq would be able to realise its enormous potential of oil reserves or Saudi Arabia would raise its output substantially) as a result of which oil prices would decline to the break-even prices of shale oil. It is smaller and mid-sized producers rather than international oil companies that are involved in the shale oil business. These companies are not rich in cash, and they are forced to scale back their investments if prices decrease and their cash flows turn under pressure.

Second, environmental concerns against hydraulic fracturing are significant. This extraction technology may cause earthquakes; the chemicals injected in the earth to extract the hydrocarbons may spoil the water reserves, etc. Therefore, political opposition is gaining in strength against the exploitation of shale hydrocarbon reserves.

Third, the appropriate market structure that would ensure stable supply of shale oil and gas without exerting a negative impact on renewable energy policies is still missing.

Although the technology is present, the past successes are remarkable and future production trends are promising, the shale hydrocarbon "revolution" is not as straightforward as it looks at first glance, it is burdened by significant risks.

4 US unconventional gas and oil production



Source: EIA (2013)

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A case of Poland: failed revolution or still a chance?

Shale gas boom burst out in Poland at the beginning of 2011 after the release of the initial assessment of world shale gas resources (actually, for selected basins in 32 countries) by the US Energy Information Administration (EIA). Poland has been recognized as one of potential leaders in this field, with technically recoverable shale gas resources estimated at an enormous 5.3 trillion cubic meters (tcm) – over 30 times more as compared with existing proved natural gas reserves in the country. Poland's resources have been assessed as the largest in Europe, sufficient to cover domestic gas consumption

for more than 300 years, and hence able both to revolutionize the energy balance of the country, easing its dependence on domestic coal and natural gas imports from Russia, and to change the gas outlook in Europe by potentially large shale gas deliveries from Poland to other countries of the region in the not so distant future.

However, enthusiasm towards shale gas in Poland has began to gradually wane due to the impact of a series of disappointing news regarding the resource base and regulatory environment in the country and in the EU.

A year after the EIA release the Polish Geological Institute (PGI) in cooperation with the US Geological Survey reduced the initial figure of 5.3 tcm to less than the tenth (i.e. only 3 times the natural gas reserves) – the most probable level of shale gas reserves has been calculated in the range of 346–768 billion cubic meters with the maximum level put at 1.9 tcm.

Next estimates of the PGI are to be published in early 2014 after more detailed information has been obtained from exploratory drilling. Although over 110 shale gas exploration concessions have been granted to international and Polish companies and the concession areas cover 20 per cent of Poland's territory (stretching along a wide belt from the northern coast through the centre with Warsaw towards eastern border), the exploration is still at early stage. The number of wells reached 42 in March this year, and even with drilling of more than 300 new wells planned by 2021 it would still represent only a small fraction of over 100,000 wells drilled in the US. So far the results of exploration have been mixed. A number of companies reported shale gas flow, but its rates often proved discouraging and no "sweet spot" has been found yet. In addition shale gas deposits are located substantially deeper in Poland than in the US, which raises exploration costs, although production still seems economically viable under current prices at the international gas market. Another problem arises from the lack of proper regulatory framework that would encourage gas investors (and guarantee interest of the budget) as the respective government bill remains under discussion.

A major threat for shale gas prospects in Poland could emerge from strict EU regulations concerning environmental issues. The ban on shale gas production has been implemented by some EU member states including France, the Czech Republic, Bulgaria and Romania and the dangers connected with shale gas (especially for water supply) are seriously considered by the European institutions.

According to recent announcements of companies engaged in shale gas exploration in Poland, its commercial production could begin in 2015–2016 and the level of production would be counted in millions of cubic meters already in 2017. Though hopes that Poland would replicate the US shale gas revolution are at present much smaller than two years ago, the prospects still look promising. The key risk for the shale gas production in Poland as elsewhere is, in addition to environmental regulation, the price of natural gas.

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