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The transformation of global energy markets

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Abstract

Two major shifts in global energy markets have occurred over the past ten years. First, emerging economies now drive growth in global energy consumption and use more than half of all energy produced globally. The growth emphasis has clearly shifted to emerging economies. Second, traditional energy markets have been challenged by the arrival of unconventional hydrocarbons and plentiful liquefied natural gas. Renewable energy sources continue to meet an increasing share of consumption, yet even a few decades from now they will account for less than 20% of overall production. At the same time, access to unconventional oil and gas deposits has driven down production costs, especially in the United States and Canada. This has led to a dramatic drop in natural gas prices in North America even as energy prices have remained high in Europe.

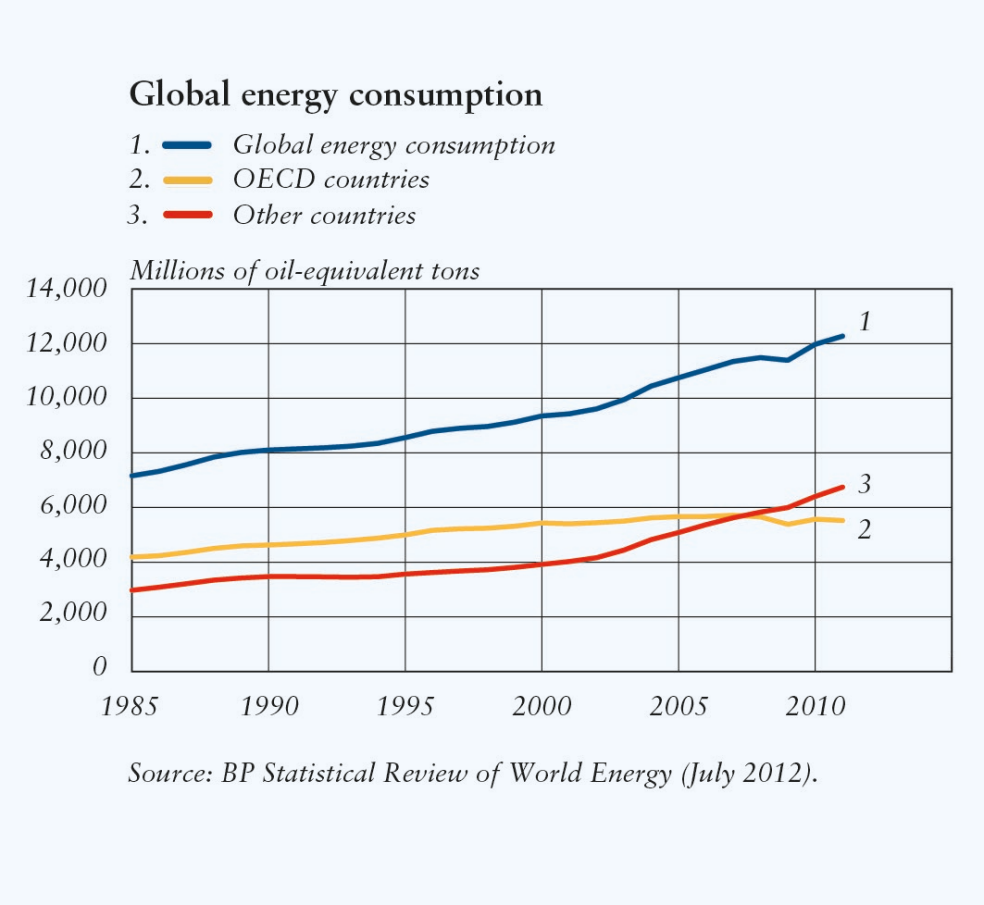
Keywords: energy markets, shale gas, liquefied natural gas (LNG)

[1] The article first appeared in Bank of Finland Bulletin 1/2013.

Asia consumes an ever-increasing share of the world's energy

Although energy consumption in emerging economies has been increasing rapidly for over a decade, the OECD member countries still accounted for over half of the world's energy consumption up to 2007. Today the picture has changed and almost all growth in global energy consumption − as well as increases in fossil fuel use and greenhouse gas emissions – comes from these emerging economies. China's energy consumption doubled from 2002 to 2009, making it the world's biggest energy consumer and number-one source of carbon dioxide emissions.[2] The growth in energy consumption in Asia's emerging economies is supported by urbanisation and rising personal wealth. In addition to the creation of massive infrastructure, rising energy demand is driven by the manufacturing and use of consumer electronics and home appliances. According to the 2012 forecast of the International Energy Agency (IEA), the OECD countries will account for just 35% of global energy consumption in 2035 (Chart 1).

Chart 1. Global energy consumption



Global energy efficiency has constantly increased. The IEA predicts that energy intensity (energy consumption in relation to global GDP) will decline about 2% a year.[3] Despite gains in energy efficiency, global energy consumption in 2035 will be about 40% higher than in 2010. Renewable

[2] BP (2012).

[3] The greatest reductions in energy intensity will occur in China, India and Russia; the world's first, third and fourth largest energy consumers, respectively.

energy sources (biomass, hydropower, wind, solar, etc.) are expected to play a much larger role, especially in electrical power generation, but their overall contribution to satisfying energy demand will remain small. The share of fossil fuels in world primary energy consumption will fall from around 80% at present to about 75% in 2035, while the share of renewables in the primary energy mix will increase from 13% to 18% in 2035. Nuclear power will account for most of the remainder.

Oil is currently the world's top energy source, satisfying about a third of the world's energy demand. Although reliance on petroleum products by industry and in electrical power generation should diminish, their use in transportation will increase demand overall. Demand for oil and coal in particular, may even decline in the OECD countries as they shift to increased use of natural gas and renewable energy sources. The high growth in emerging economies, however, will demand both increased use of renewable energy sources and increased use of fossil fuels (oil, coal and natural gas).

International trade flows have shifted rapidly. China became a net importer of oil as recently as 1993, yet it was the world's second-largest oil importer and the largest importer of petroleum products by 2010. China and India together account for over half of the world's coal production, and yet both are important buyers of coal on the world market. India, in particular, is expected to step up its coal imports in coming years. By international standards, India's domestic coal production is extremely inefficient and unable to keep pace with rising domestic demand.[4] The share of natural gas in energy consumption outside the OECD countries and countries of the former Soviet Union has been small, but gas consumption could grow rapidly in the coming years.

Europe and North America will continue to be major markets in the future, but the growth of Asian energy consumption will shift the bulk of energy trade flows from the Atlantic to the Pacific Ocean, and will increase the importance of the South China Sea in global energy trade. Currently, about a third of the world's crude oil supplies, and about half of the world's liquefied natural gas (LNG) supplies, move through the Strait of Malacca and the South China Sea.[5] Energy companies owned by the Chinese, Koreans and Indians are increasingly influential operators in producer countries of the Mideast, Africa and Central Asia, as well as in international trade. Rising demand in China and other emerging economies also bears a direct impact on world prices of energy commodities.[6]

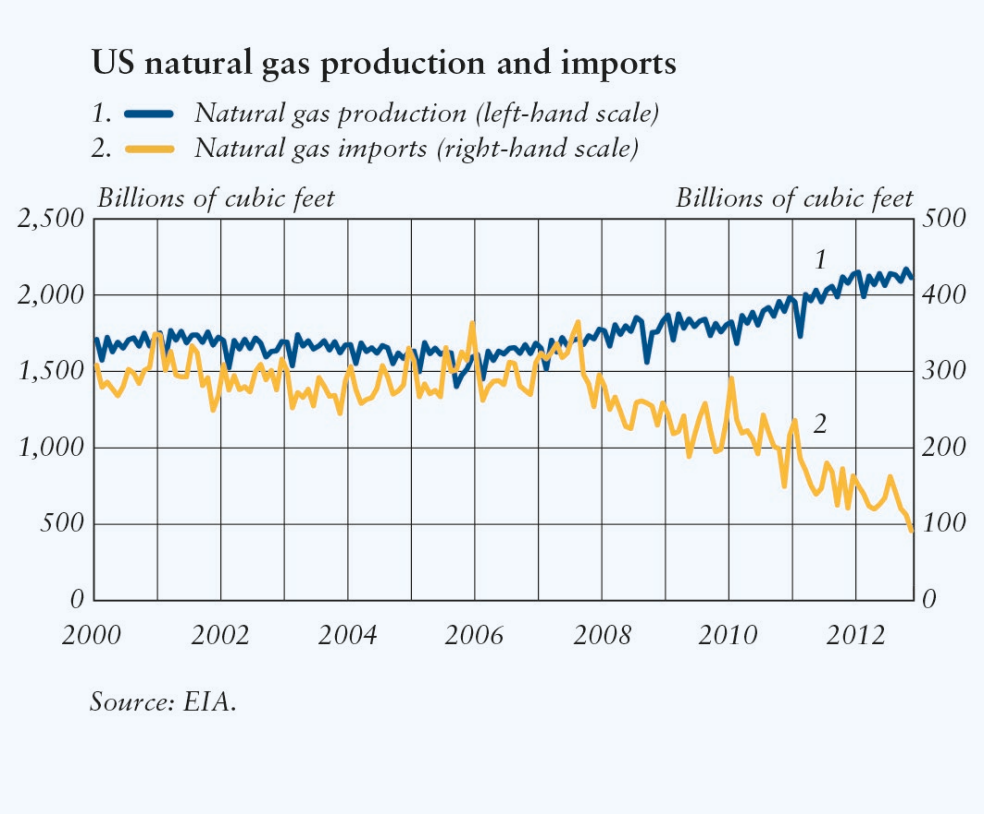
Deposits once thought intractable now drive boom in US oil and gas production

The explosion in global demand in the past decade coincided with peaking of production in mature production areas developed in the 1970s (eg Russia, the US and Europe). The new potential oil and gas fields were known to be in increasingly challenging locations, but the relatively low oil prices in the 1980s and 1990s did not encourage large and uncertain investments. It was only when global demand took off and prices of crude oil and natural gas shot up that companies got serious about exploring production possibilities in extreme conditions such as the Arctic continental shelf (Russia, Alaska) and in the deep Atlantic (Brazil). Interest also turned to unconventional gas and oil reserves, especially in North America. Exploiting these less accessible hydrocarbons was understood to require patience, deep pockets and an ability to take on risk.

[4] IEA Coal (2012).
[5] EIA (2012).
[6] Simola (2012).

The technology, new skill sets and support services needed to extract unconventional oil and gas have evolved far faster than predicted. Lower production costs have made it attractive to develop many unconventional hydrocarbon deposits and has led to an oil and gas boom in the United States. Using new methods, substantial amounts of natural gas are now beginning to be extracted from vast shale formations. After 2006, US natural gas production began to rise – and rise much faster than earlier imagined. During 2007–2012, US gas production increased over 25% and caused a noticeable decline in gas imports (Chart 2). Just ten years ago, US gas imports were expected to continue to rise rapidly, so gas producers in eg Qatar and Russia were planning gas export terminals specifically to serve a growing US gas market. Now suddenly the US is self-sufficient in natural gas and it may become a net gas exporter. Over the last five years, natural gas originally destined for the North American market has had to be diverted to the European and Japanese markets.

Chart 2. US natural gas production and imports

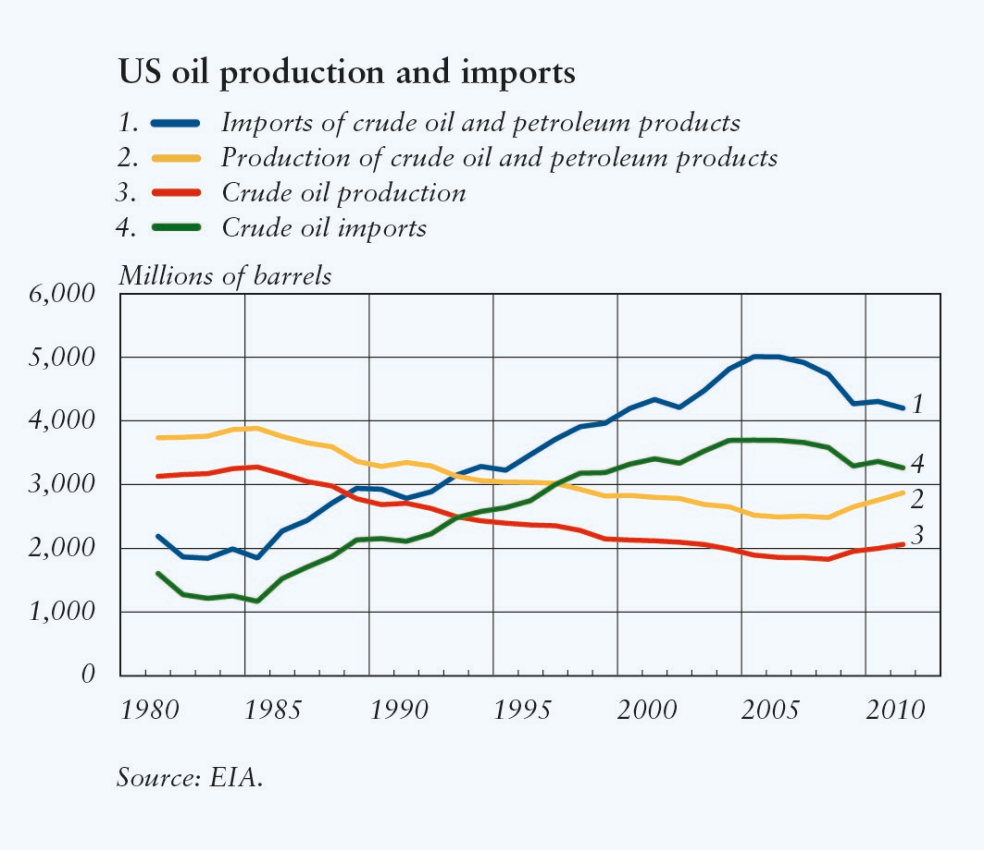


The technology developed to extract shale gas has been repurposed for use in oil production, and production from unconventional oil deposits once considered unprofitable has increased. The result is an impressive rise in domestic production in the US that reversed decades of decline in the US crude oil production in 2008. US production of oil and petroleum products exceeded 1993 levels in 2012 (Chart 3).[7] The latest IEA forecast sees US oil production climbing 40% a year through 2017, which would make the US one of the world's biggest oil producers.[8] At the same time, US reliance on imported oil has fallen both due to the recent financial downturn and increased domestic production. US dependence on imports is likely to keep falling, so the domestic production in the

[7] EIA figures available up to November 2012.
[8] IEA Oil (2012).

near future could be sufficient to cover about half of total US oil consumption. The US Energy Information Administration (EIA) expects net fuel imports to the US to fall by about 20% by 2025.[9] This, together with net gas exports, should reduce the US trade deficit over the next ten years by about 0.5 percentage points of GDP.

Chart 3. US oil production and imports



Because the United States still is one of the world's largest crude oil and natural gas consumers, growth in its domestic gas and oil production has significant global impacts. Growth in gas production has driven gas prices in the US to record lows, which, in turn, has boosted the use of gas, especially in electrical power generation. Many US power plants have shifted from coal to cleaner natural gas, leading to a sharp decline in coal consumption in 2011–2012. This, in turn, has led coal producers to seek out export markets, which has driven down market prices especially in Europe. Unlike the US, gas prices have remained high in Europe, making coal, the environmentally less friendly fuel, an attractive option for power plants. The collapse in coal prices has in some cases made running gas-fired power plants unprofitable.

The low price of natural gas in the US has also helped keep the price of electricity fairly stable, even as electrical power rates in Europe have soared over the past decade. In 2011, the price for gas paid by industrial users in the US was about a third of that paid by their European counterparts; US electricity rates were about half of the European average (Charts 4 and 5).[10] This situation has created increased challenges for Europe's industrial competitiveness, especially in energy-intensive industries such as metals refining and chemicals. In Germany, in particular, many

[9] EIA (2013).
[10] Comparable figures are not yet available for 2012, but the difference is unlikely to have changed much.

companies have publicly stated that they are considering transferring production to the US to take advantage of cheaper energy supplies.

Chart 4. Electricity prices for industry in the United States and Europe

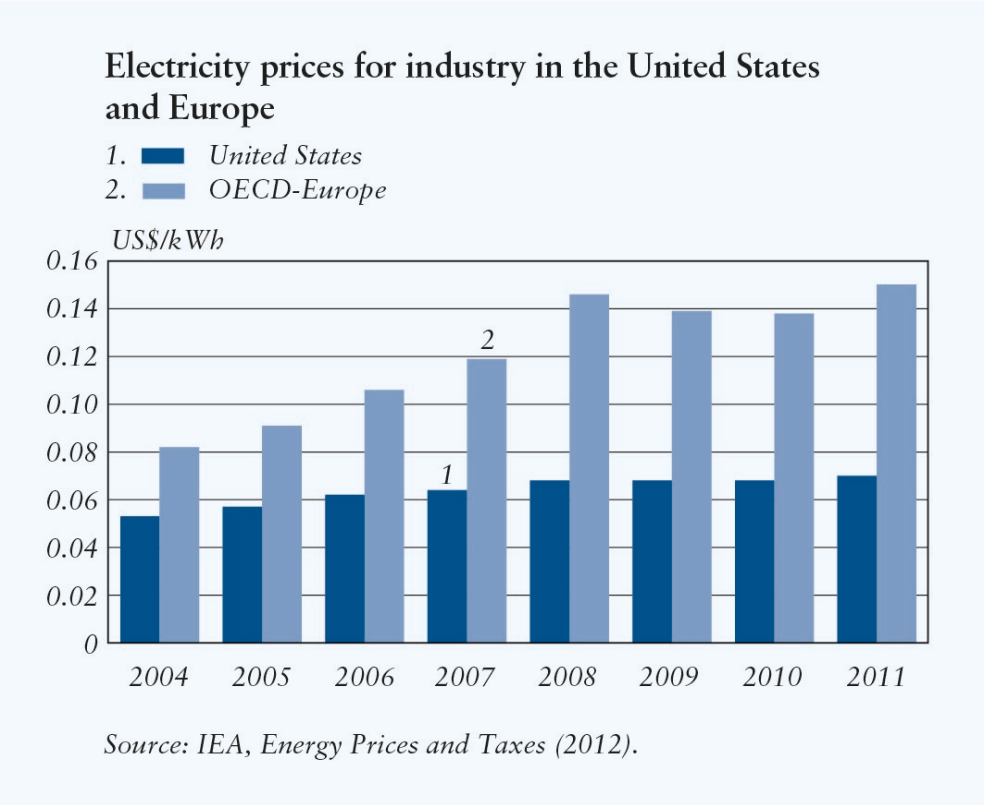
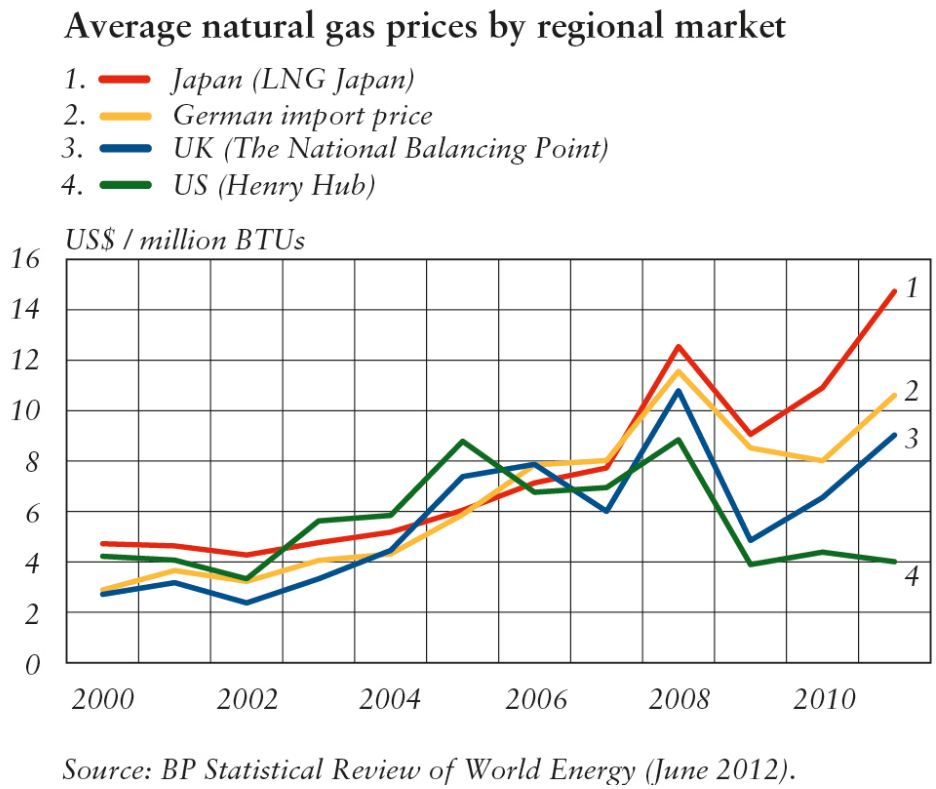


Chart 5. Average natural gas prices by regional market



Source: BP Statistical Review of World Energy (June 2012).

At the same time, the gas and oil boom in the US is anticipated to create thousands of new jobs in the energy sector and other industries. While cheap energy may have helped revive American industry and encouraged new capital investment, the impact should not be exaggerated. The rebirth of the energy sector largely affects closely related branches such as chemicals and metals, and the employment effects are limited. The American Chemistry Council estimated in 2012 that only about 10% of the then 12 million unemployed persons in the US would benefit from the energy boom and that the impacts on industrial competitiveness would increase level of the US GDP by slightly more than 1% over the long term.[11]

How these changes affect Europe and Finland

United States natural gas imports contracted during 2006–2011, while global production capacity for liquefied natural gas doubled. As significant amounts of LNG became available, spot trade volumes increased and prices fell in several trading hubs.[12] LNG represented less than 10% of the global gas trade in 2003 and over 25% in 2011.[13] At the same time, oil prices on the world market rebounded rapidly to pre-crisis levels last seen in 2008, which, in turn, caused European and Asian oil-indexed gas prices to go up. LNG, which was once considered the expensive alternative form of gas, began to look quite attractive to many European energy companies. In 2005, there were nine LNG import terminals in Europe. There are 19 today in eight EU countries and more are planned.[14]

[11] American Chemistry Council (2012).
[12] Spot and short-term LNG trade is defined as LNG traded under contracts with a duration of 4 years or less.
[13] IGU (2012).
[14] GIIGNL (2012).

In 2000, about 5% of gas imports to the EU zone were supplied as LNG. That share rose to about 15% in 2005 and about 25% in 2011.

The increased availability of LNG and short-term supply contracts increased demands from European customers for modification of the terms of their traditional long-term supply contracts. So far, Norway's Statoil has been much more accommodating about new pricing principles than Russia's Gazprom or Algeria's Sonatrach. Gazprom's inflexibility on modifying terms of its gas supply contracts has be widely criticised and even contributed to Gazprom's loss of market share in recent years. Even with these problems, Gazprom remains the top supplier of natural gas to the EU countries.[15]

LNG has yet to appear on the Finnish market for the simple reason that Finland does not have a LNG import terminal. At the moment, all of Finland's natural gas supplies come from Russia, as does 90% of its crude oil and 80% of its coal. Gasum, the company that manages Finland's gas market, is planning an LNG regasification terminal to be built in Turku and Inkoo or Porvoo. Environmental impact assessment studies have been initiated for both sites. There is also a plan to build LNG terminal to Tornio, which would serve industries in northern Finland and Sweden.

In autumn 2009, the European Commission and the EU parliament approved the Third Energy Package aimed at reforming and opening up the gas and electricity sectors in the EU. The goal of this package of legislative proposals is to increase competition and trade across national borders, separate (unbundle) energy distribution from energy production, as well as improve energy security of EU member states through the construction of trunk transmission pipelines and grids. To support these goals, EU's Baltic Energy Market Interconnector Plan (BEMIP) project may co-finance construction of an LNG import terminal in Lithuania, Latvia, Estonia or Finland, along with construction of trunk pipelines connecting all the BEMIP countries. Given that the EU support will be available only for one large project, the member countries must first agree on the best location for the LNG terminal. The Finnish market by itself is too small to support a very large terminal.

The availability of LNG on the Finnish market would increase security of supply and introduce gas pricing that more closely tracks price formation in European trading hubs. In the future natural gas may travel under the Baltic seabed from east to west via the Nord Stream gas pipeline, while on the surface of the Baltic Sea LNG tankers will sail from west to east to deliver their cargoes.

The reduction in the production costs of unconventional oil and gas has opened new opportunities to increase energy production elsewhere than in the traditional oil and gas producing countries. Given that domestic production will meet a larger share of US oil demand than previously thought, the significance of emerging Asian economies as export destinations will increase. Natural gas is increasingly becoming a globally traded commodity that can be readily shipped to distant destinations in liquid form. This implies that, gas pricing on European regional markets is moving towards market-based pricing. At the same time, the shift in focus to growing energy demand in Asia's rising economies will alter global trade flows and erase the relative dominance of the OECD member countries. Shifts in global supply and demand will become more apparent in European energy prices in the future.

[15] Simola, Solanko and Korhonen (2013).

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