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Phasing out coal and phasing in renewables – Good or bad news for arctic gas producers?

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ABSTRACT

This paper examines to what extent downscaling of global coal based electricity generation encourages gas demand and affects regional activity in gas production, with emphasis on the arctic regions. In our reference scenario up to 2050 we take into consideration that renewables is set to increase its contribution to global electricity production over time, while coal will contribute less. We find that a policy scenario with further phasing out of coal and phasing in of renewables in line with the 2 °C scenario for the power sector up to 2050, will lead to reduced arctic gas production compared to the reference scenario, although total worldwide electricity production doubles over the same period. However, even in a situation with less resources in the Arctic, future investments in new reserves in the region are still profitable in our 2 °C policy scenario, as total arctic gas production is marginally higher in 2050 than today.

1. Introduction

Coal has been running the wheels and warming the homes for centuries. Unfortunately, it has also warmed the globe and changed its climate (IPCC, 2013). When mitigating climate change, coal stands out as a major target due to its high emissions of CO_2 per unit thermal energy. Coal also generates high emissions of health damaging air pollution and causes tragic mine and traffic accidents (Sovacool, 2008).

Coal and gas are substitutes in power generation, hence, the future role of gas is closely linked to the future role of coal. Both fuels are subject to climate policy, but gas has the advantage of being less CO_2 emission intensive and less of a burden on local air pollution and health. In a green transition gas is regarded as a low carbon alternative. This study investigates how a low carbon policy in line with the 2 °C scenario will affect the gas market and in particular the supply from arctic regions, where the cost of extraction is relatively high for many gas fields compared to more temperate regions.

Coal covers almost 30% of global primary energy demand and plays a particularly important role in electricity production. In 2012 coal generated 41% of global electricity, however, its share is falling. Gas is the only fossil feedstock that is on the rise (IEA, 2014a).

In 2012 coal use was the source of 44% of global CO_2 emissions (IEA, 2014a). According to the Global Carbon Project (2016) the world must limit accumulated future emissions to 860 $GtCO_2$ to ensure, with 66% probability, that the global mean temperature increase stays within 2 °C. If the 2013 emission level of CO_2 from energy use persists, the carbon budget will be consumed within 24 years. With a 1.5 °C ambition there is hardly room for future use of fossil energy (Oil Change International, 2016). Hence, some argue that also gas resources have to be left in the ground and that it is least costly to leave high cost resources unused (McGlade and Ekins, 2015; Oil Change International, 2016).

A decade of new climate research culminating in the IPCC 5th assessment report has changed the sense of urgency and lifted the issue of climate mitigation to a higher political level. This was demonstrated at the COP21 meeting in Paris where a new climate agreement was made based on pledges from 196 nations in December 2015. It adds to the urgency that carbon capture and storage (CCS) has turned out less promising for the next decades than earlier expected. IEA (2014a) expects CCS to start being deployed from around 2020, but only 3% of coal fired power plants are expected to be equipped with CCS by 2040. Coal with CCS will raise the cost of electricity by 40–75% (IEA, 2014a). However, emissions reductions become more feasible as the costs of solar and wind power have been falling rapidly over the last few years (IEA, 2016). The coal future seems bleak considering that coal power is also facing strict and costly regulation of air pollutants in major coal burning countries.

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USA and China are the two largest economies and the two largest coal users in the world. At a summit meeting in 2014 President Barack Obama and President Xi Jinping gave statements pledging to reduce CO_2 emissions substantially towards 2030. Obama pledged a 26–28% reduction from the 2005 emission level, whereas Xi pledged to cap CO_2 emissions by 2030 at the latest.

In August 2015 the Obama administration implemented the Clean Power Plan, estimated to reduce CO_2 emissions to 32% below 2005 level by 2030 (EPA, 2015a). The plan introduces a cap on CO_2 emission intensity in power production at state level. Total benefits of the Clean Power Plan are estimated to be in the range of USD 55 billion to USD 93 billion per year in 2030 (EPA, 2016), far above the costs. Health benefits through reductions in particle emissions and other local pollutants are estimated to yield 60% of the plan's gross benefits (Fowlie et al., 2014).

Meanwhile, the energy market in the USA is already in transition as natural gas has become available. The electricity consumption in USA is expected to grow only marginally by 0.1% per year on average towards 2040 (IEA, 2015) and the move towards low carbon energy is further supported by the Mercury and Air Toxics Standards (EPA, 2015b), which particularly will increase the costs of coal based electricity. Finally, switching from coal to gas power is convenient as it creates a market for domestic shale gas and has substantial advantages regarding health damage.

President Donald Trump has taken formal steps to repeal the Clean Power Act. However, even if the Clean Power Plan and the Mercury and Toxic Standards were removed under Trump, the risk of facing high cost regulations after his presidency might discourage investment in new coal power capacity, considering the competitiveness of natural gas and renewable energy.

In China there is a strong political pressure on the government to improve local air quality. To control the smog problem, the State Council required the emissions from all coal-fired power plants to comply with emissions standards for gas turbines by 2020 (State Council, 2015), with hastened deadlines for existing plants in the Eastern region by 2017 and the Central region by 2018. Already in January 2015 the government announced a cap on investments in new coal-fired power plants in the Eastern provinces (National Energy Bureau, 2015) and a five year moratorium on new coal-fired plants in the coal rich province of Shanxi (Shanxi Provincial Government, 2015). The logical consequence of these regulations would be a phase out of coal for power production and a switch to gas powered and renewable energy sources. Details on implementation will be decided on in the further elaboration of the 13th Four Year Plan 2016–2020.

Hence, the two largest coal users and emitters of CO_2 have both clean air and low carbon policies in the pipeline and the Paris agreement left a clear message that most other countries will make efforts to reduce emissions, not least the EU pledging to reduce CO_2 emissions by 40% by 2030.

These events make prospects of stranded assets, in terms of wasted investment in production capital and associate loss of profit, in coal mining and coal fired power production emerge as a real risk to private and public investors (Carbon Tracker Initiative, 2014). A Citigroup analysis warns that the 2 °C target might involve stranded assets of USD 100 trillion by 2050 (Citigroup, 2015). The risk of stranded assets has also started to worry central banks. In 2015 the Bank of England Governor Mark Carney warned investors that “the vast majority of reserves are unburnable” if the 2 °C target shall be reached (The Guardian, 2015a). Hence, for climate reasons we might face a situation similar to a sharp decline in reserves. The significance of reserves in company value was illustrated for oil when Shell restated its reserves in 2004. The 20% reduction of oil reserves led to a 10% reduction in the share price and £3 billion in company value over night (Carbon Tracker Initiative, 2011).

Further, there is a trend towards low or no carbon finance among large private investors. There is a fast growing interest in Green Bonds, issued with a label to finance sustainable investments, largely in renewable energy, environmental friendly infrastructure and energy efficiency (Climate Bonds Initiative, 2016). A trend among investors to divest in coal and keep coal out of their future portfolios has also taken off during the last few years. In the wake of the UN Climate Summit in New York 2014 the Rockefeller Brothers Fund pledged to keep coal and tar sand out of their endowments. Further breakthrough occurred when the Norwegian Parliament decided to divest the Norwegian Government Pension Fund Global with USD 900bn in coal by 2020 at the latest (The Guardian, 2015b) and the French global insurance company AXA with assets of € 1200bn pledged to divest in coal (Bloomberg, 2015). Bank of America Merrill Lynch was the first large bank to divest in coal in early 2015, followed by Citigroup's pledge to end finance of coal mining in general, going further from their earlier decision to quit lending to mountain top removal mining (Financial Times, 2015).

As demonstrated already by the swift transition from coal to gas in the USA after the phase in of shale gas, transitions can be rapid and change the energy pattern of regions substantially when alternatives are available. These shifts in energy patterns might also have marked regional implications, and one of these is the potential impacts on the role of the Arctic in global gas supply.

This study looks at how a greener power market might affect the future gas market, with focus on the arctic supply. The Arctic is above all rich in natural gas as 70% of undiscovered petroleum resources in the region are gas. With around one fourth of global undiscovered gas resources, the Arctic has attracted attention as a last large frontier of gas outside the Middle East and North African regions (MENA). However, gas production in some arctic regions is facing harsh weather conditions, high costs and long lead times, at least when production moves to more remote offshore areas. Further, there will be continued competition with US lower 48 and other regional production as shale gas is increasing, in addition to huge conventional gas reserves in the Middle East coming on stream, above all in Iran and Qatar.

For the present study we first develop an updated reference scenario based on the New Policy Scenario (NPS) of IEA (2014a) and identify the path of future arctic gas supply to 2050. Second, we assess the effects of gradually phasing out coal and phasing in renewables for electricity production broadly in line with the 2 °C scenario for the power sector of IEA (2014a). However, in our 2 °C policy scenario coal is not totally phased out prior to 2050, while renewables are on the rise.

In an earlier study of arctic petroleum extraction towards 2050 (Lindholt and Glomsrød, 2012), the future coal scenarios were largely based on expectations in the late 2000s, as e.g. IEA (2008). Current predictions for coal demand in 2020 are already 20% below predictions in IEA (2008).

This paper analyses the competition between coal, renewables and natural gas for electricity production under a more stringent policy towards coal. The particular strength of our approach is that supply of natural gas is modelled with plausible costs and reserves estimates, enabling an assessment of the economic potential for gas supply from the Arctic. Gas and coal represent David versus Goliat among the fossil fuels in a transition to low carbon electricity. Given the long term perspective underlying investments in petroleum, the study provides useful insights into the economic potential of the two in light of climate policy.

Various studies have looked at consequences of climate policies on the mix in energy demand at a regional scale. von Hirschlausen (2016) applies various models to analyze effects on natural gas production in Europe and its neighbouring regions of the development to a lower carbon Europe. To the best of our knowledge, we are the first to analyze how the competition between gas, coal and renewables in the power sector on a global scale can affect the regional gas production in the Arctic.

This paper is organized in the following way: In Section 2 we describe the FRISBEE model of the global energy markets. Section 3 describes the scenarios, while Section 4 concludes.