

Press Release

## **Pöyry Study: Coal-fired power plants are climate-friendlier as backups for the energy turnaround than open-cycle gas turbines**

- **In principle, natural is less carbon intensive than hard coal. If, however, the direct and indirect emissions (including production and transport) of power generation using natural gas and hard coal are considered from a holistic viewpoint, there is a significant change in the difference between the emissions of these two fossil energy sources.**
- **When running at full load, power plants using open-cycle gas turbines and hard coal prove to be almost identical. Fluctuating load in renewable energies more and more frequently restrict these power plants to partial load operation. Pöyry has calculated the indirect emissions in this case for the first time. The results show that the total greenhouse gas emissions from open-cycle gas turbine power plants can be as much as 76% higher than those from hard coal-fired power plants.**
- **Efficient combined cycle gas fired plants are built in the current market conditions – if at all – in connection with the need for heating.**

Hamburg, 14 June 2016 – The flexibility of thermal power plants, especially when running at partial load, will gain enormously in importance in future so that power supply in Germany can be assured over the course of the energy turnaround and the fluctuation in generation rates of renewables can be compensated. Even today, hard coal-fired power plants, thanks to their high flexibility, provide the major share of the load balance for fluctuating renewable energies.

A recent study by the highly respected consulting company Pöyry Management Consulting took a close look at the direct and indirect greenhouse gas emissions caused by power generation from hard coal-fired and gas-fired power plants. The observations included the partial load operation that is especially important for compensating the feed-in fluctuations from renewable energies. Within the scope of the analysis, comprehensive international studies on the emissions in production and transport of hard coal and natural gas were compared and assessed. When these indirect greenhouse gas emissions are added to those from power generation in the power plants, it turns out (taking into account the mix of coal and gas procurement for Germany in 2014) that the direct greenhouse gas emissions of power generation from open-cycle gas turbines are up to 76% higher than for modern coal-fired power plants during a partial load operation scenario. The difference in greenhouse gas emissions between modern hard coal-fired power

plants and combined cycle power plants without heat extraction declined from 36% during full load operation to 30% in partial load operation.

So if the greenhouse gas emissions that result during the production and transport of the two energy sources are included, partial load power generation in modern coal-fired power plants for compensation of the variances in the feed-in volume of renewable energies and the fluctuating demand for power for the present German power plants is the significantly climate-friendlier alternative to open-cycle gas turbines. The latter can also go online on short notice for load balancing, but in partial load operation they suffer substantial losses of efficiency that result in disadvantages for the climate balance. Even if only the direct emissions, excluding production and transport of the fuel, are taken into account, an open-cycle gas turbine plant in partial load operation emits up to 29% more greenhouse gases than a hard coal-fired power plant.

“In the current discussions about the best bridge technology on the road to the energy turnaround, natural gas is currently the energy source of choice among politicians and society because of the pretended better CO<sub>2</sub> balance. The results of the Pöyry study impressively illustrate, however, that the assumptions previously made are wrong. The indirect emissions that are created during production and transport of the various energy sources must also be taken into account, especially if the worldwide climate targets are to be achieved. In this holistic assessment, and especially during partial load operation, hard coal performs significantly better than the pretended climate-friendlier natural gas,” commented Dr Wolfgang Cieslik, CEO of the Verein der Kohlenimporteure e.V. (VDKi).

### **Methane – the primary component of natural gas – is even more harmful than the “climate killer” CO<sub>2</sub>**

In addition to the CO<sub>2</sub> emissions, the Pöyry analysis also considers the emission of the greenhouse gas methane that is emitted during the production, transport and processing of both shale gas and the conventionally produced natural gas. Observed over a period of 100 years, methane’s greenhouse potential is 28 times greater than that of CO<sub>2</sub>. Since the need for action has been regarded as very high and urgent since the world climate conference in Paris, Pöyry used an observation period of 20 years as the basis for the calculation of the CO<sub>2</sub> equivalent. The greenhouse potential for methane then soars to 84 times than that of CO<sub>2</sub>.

The primary components for the emission balance of power generation are therefore the direct combustion process (CO<sub>2</sub>), the energy expenditure for the transport (CO<sub>2</sub>) and the release of methane during production and from leakage. The concentration in the atmosphere of the powerful greenhouse gas methane has risen sharply since 2006. The respected Karlsruhe Institute of Technology (KIT) was recently able to prove that the production of oil and natural gas, especially in the USA, is responsible for this rise. Leakage from a large gas storage facility in Aliso Canyon, California, when 77,000 metric tonnes of methane escaped into the atmosphere, called public

attention to the relevance of this greenhouse gas and its greater impact by far than CO<sub>2</sub> at the beginning of this year.

“Because of the feed-in priority of renewable energy sources, the fossil fuel-fired power plants will more and more be given the task of compensating the generation fluctuations and grid stabilisation. As a result, they operate more and more frequently at partial load,” according to Roland Lorenz, energy expert and managing director of Pöyry Management Consulting. “The study results from Pöyry indicate that in this load range hard coal-fired power plants are the climate-friendlier alternative to open-cycle gas turbines.” The efficient combined cycle power plants produce power in immediate relationship to the production of heat (e.g. for district heating grids) and are consequently unable to respond to feed-in fluctuations as flexibly as required for the energy turnaround. On the current energy market, they are built almost exclusively in response to heat demand, not for compensation of load peaks. Only open-cycle gas turbines without an associated steam process can be used fully flexibly for a transition phase until the expansion targets for wind and photovoltaic power plants have been reached and a solution to the storage problem has been found, but in terms of efficiency and consequently of greenhouse gas emissions, they are worse than modern hard coal-fired power plants. “If hard coal-fired power plants really should be shouldered out of the market in favour of natural gas for political reasons, the energy suppliers will have to make massive investments in the expansion of gas turbines to create a flexible power plant reserve. In view of the significantly worse emission values documented in the Pöyry study, this would amount to a royal bungling of energy and climate policies,” noted Cieslik. In addition, because of current market conditions and regulatory requirements – in the unanimous opinion of experts – no modern combined cycle power plants will be built or go online for the first time in the foreseeable future.

In calculating the values, the origin of the fossil energy sources is crucial for the amount of the indirect emissions because the transport route plays a decisive role. In Germany, the German natural gas and gas from the next-door Netherlands have lower indirect emissions than natural gas from more distant regions such as Norway and Russia or liquefied gas from the USA or Middle East. However, natural gas reserves in this country are dwindling fast. “This means that a growing use of natural gas in the future will depend more and more on supply areas and production methods that have a substantially worse climate balance. They include liquefied natural gas (LNG) or natural gas produced by fracking as well. All of these factors must be taken into consideration for future concepts of energy policies,” demanded Cieslik.

**VDKi calls for an objective appraisal of the energy source hard coal during the assessment of the most appropriate bridge technology for the transition to the post-fossil fuel age**

The study results underscore the political pressure for action in this sector. Power generation using hard coal is at least as suitable as power generation using natural

gas to function as an especially flexible bridge technology until the expansion targets for wind farms and photovoltaic parks are reached and the storage problem has been solved. “In April of this year, only five of the eight nuclear power plants still in operation were online because of technical issues. Then there is the fluctuating feed-in of renewable energies that repeatedly challenges anew supply security. In this situation, it is above all the existing thermal power plants, especially the German hard coal-fired power plants, that secure the flexibility required for permanent load compensation because of the economic advantages. Even if gas prices are competitive, many combined cycle gas fired plants cannot take on responsibility for this task because they generate heat at the same time and cannot offer flexibility in the required scope. New construction of open-cycle gas turbines as replacements for existing hard coal-fired power plants would be a gigantic annihilation of capital without the least benefit for climate protection,” said Cieslik.

As the study results show, modern hard coal-fired power plants operate with significantly lower emissions than open-cycle gas turbines, especially at flexible partial load. Yet public perception is different. Politicians repeatedly refer to the presumably lower emissions from power generation using natural gas. But only direct emissions are taken into consideration during the debate about greenhouse gases, and the degrees of efficiency of highly efficient combined cycle power plants with power-heat extraction are used as a generalised basis. But it is important to make a distinction here according to what load operation is required and what technology must be used for this purpose. The emission advantage of hard coal-fired power plants in partial load operation is obviously ignored.

All existing energy sources should be utilised economically so that the power supply in Germany (without rising emission values) and the required flexibility in the mode of operation of the thermal power plants can be secured in the middle term. Moreover, fair competition among the fossil energy sources must be guaranteed so that consumers are protected from any further price increases. The declining natural gas reserves in Germany and the Netherlands play a decisive role here. “The gas industry positions itself as climate-friendly in the current discussion about the reduction of greenhouse gases and the realisation of the energy turnaround. But the debates on greenhouse gases all around the energy industry generally consider only the direct emissions. Indirect emissions from production and transport are largely left out of the equation. That is why the VDKi calls for political decision-makers to put aside any preconceptions and re-evaluate and rethink their attitude to the energy source hard coal in the light of the holistic assessment found in this new study,” concluded Cieslik.

#### **About the study**

*The study “Comparison of Greenhouse Gas Emissions from Coal- and Gas-fired Power Plants” conducted by Pöyry Management Consulting compares the greenhouse gas emissions resulting from fuel production to power generation as caused by natural gas- and*

*hard coal-fired power plants. The comparison of the direct and indirect greenhouse gas emissions during the generation of power in natural gas- and hard coal-fired power plants was conducted on the basis of an analysis of literature sources and the consultancy's own calculations. Previous studies were analysed (in part on the basis of country-specific information) to determine the emissions during production of natural gas and hard coal.*

*Sufficient information regarding the emissions during transport was available only for natural gas. Previous studies did not contain any valid data for hard coal-fired power plants, so the firm's own analyses had to be used for hard coal transport. The emissions caused by power generation in gas-fired power plants, open-cycle gas turbines and modern coal-fired power plants were calculated on the basis of average degrees of efficiency made available by the VDKi and specific emission values. Research in the literature made use of publicly available sources (per January 2016), appraised with respect to the German mix of natural gas and steam coal in 2014. In addition, studies focusing on the market in the USA were included in the analysis for unconventional production (shale gas) and LNG transport. The outlook in scenario form was based on the future change in the natural gas mix for Germany (without consideration of economic realisation and probability of occurrence).*

#### **About the Verein der Kohlenimporteure e.V. (VDKi)**

*The Verein der Kohlenimporteure e.V. [Coal Importer Association] (VDKi) is the lobby organisation for the hard coal import market in Germany. Its German and European members come from the sectors power, industry, trade and logistics. The Association currently has 70 members who consume about 80% of the German requirements for hard coal of approximately 58 million tonnes in their facilities. Imported coal covers more than 90% of Germany's coal requirements. The VDKi represents the overwhelming share of the hard coal market (German and imported hard coal) in Germany, a financial volume in the billions. The VDKi regularly examines the significance of the global hard coal markets for the European and German import hard coal markets, describes prospects for future import development and regularly publishes statistics about German hard coal imports and prices. Additional information is available at [www.verein-kohlenimporteure.de](http://www.verein-kohlenimporteure.de).*

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