

Looking into the future ...

... to see what an increase in renewable energy means for gas

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Venue: Mandarin Oriental, Emerald



Patron



Host



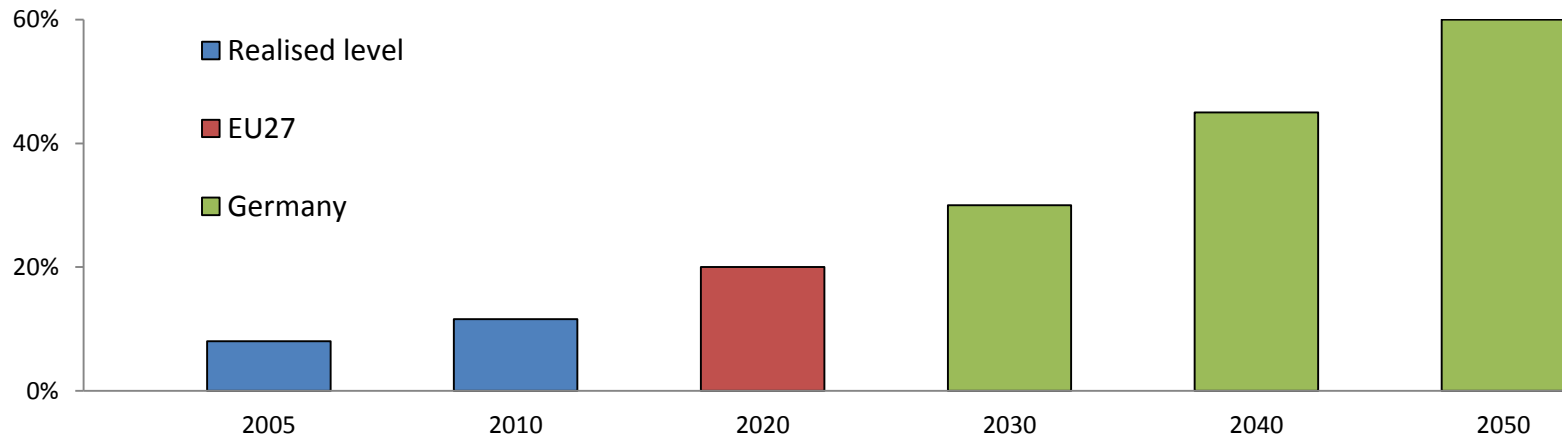
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Increase of renewable energy

Question is not if, but how much and how soon

Renewable energy targets
as percentage of final energy consumption



- Renewable energy will be a game changer: the only question is when

Modeling the future

One perfectly interconnected electricity grid



Assumptions
model:

6 EU countries

2030 - 2035

Copperplate

Sun, wind and
biomass

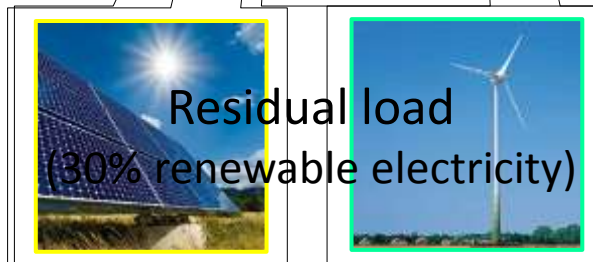
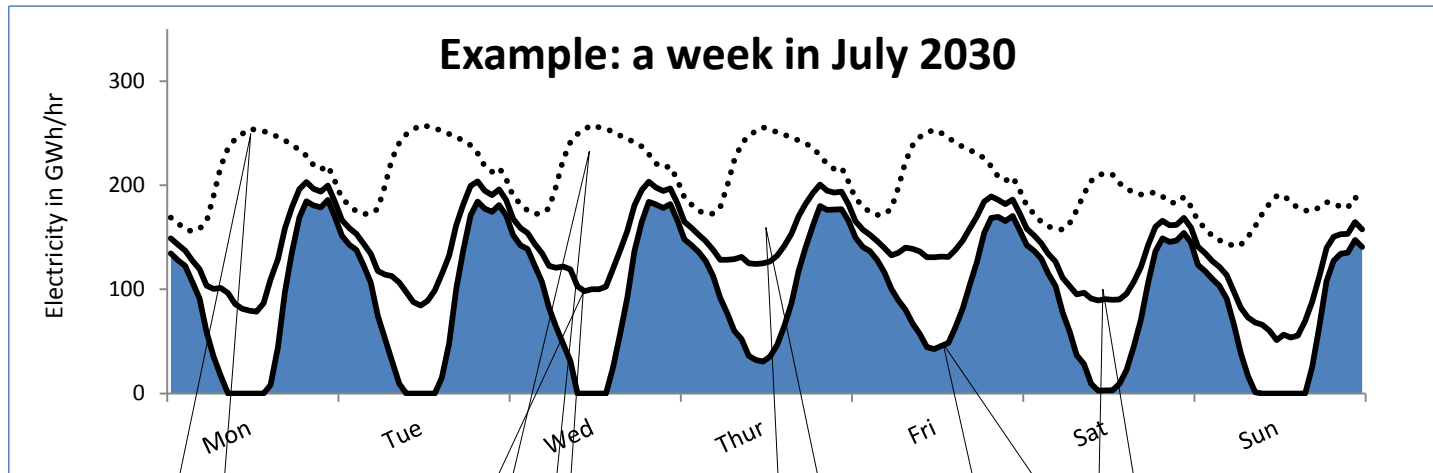
Gas and coal
power plants

State of the art
power plants
(Greenfield approach)

Economic perspective

Fossil fuels act as back-up

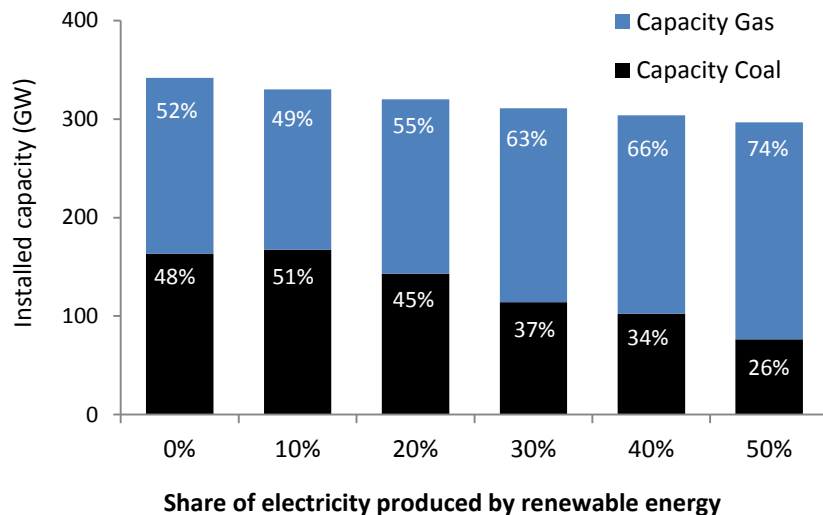
More renewable energy leads to a more spiky residual load



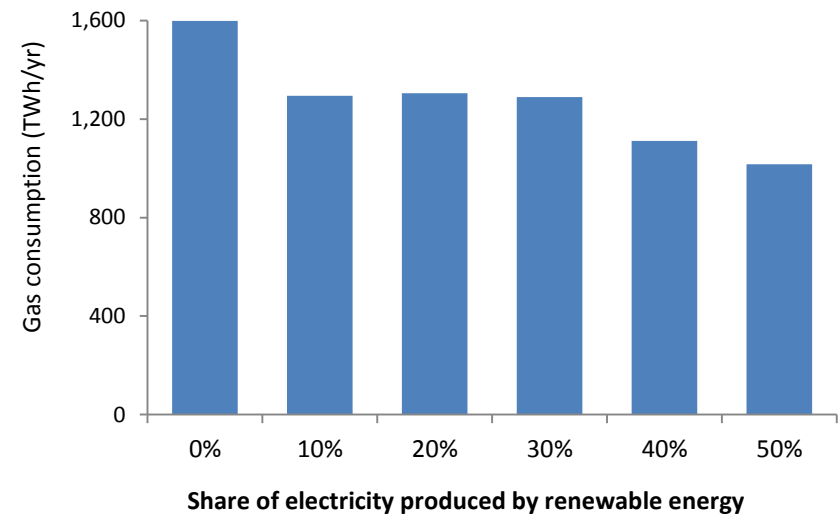
Impact on natural gas

More gas fired capacity ... but less gas consumption

**Cost minimising power mix
Installed capacity**





**Cost minimising power mix
Gas consumption**



- More gas fired capacity needed
- Cost structure is the main driver (gas has relatively low CAPEX and high OPEX)
- Less gas consumption, mainly if renewable energy increases above 30%
- Sensitivity analysis on CO₂ price, CAPEX and flexibility resulted in similar conclusions

Thank you!

- Acknowledgements to Mayke Nijboer and Roland van Straaten
- For any further information please contact Joost Wempe (joost.wempe@gasterra.nl)



The Impact of Renewable Energy on Natural Gas Consumption for Power Generation

Why Natural Gas is Essential for Accommodating Renewable Energy¹
J. Wempe (GasTerra B.V.), M.S. Nijboer (GasTerra B.V.), R. van Straaten

Background

Over the past years the share of electricity generated from renewable sources has increased significantly and, supported by EU legislation, is expected to increase further in the coming years. When setting the 20/20/20 target of having 20% reduction in carbon emissions, 20% of energy from renewable sources and 20% reduction in energy usage, the EU made clear it takes combating carbon emissions seriously (European Commission 2011). On top of that, in the G8 meeting in L'Aquila in July 2009 Europe agreed to a target of 50% emission reduction in 2050 (compared to 1990 levels) if global action would be taken (United Nations Environment Programme 2011).

In order for the EU to reach these targets, an increase in electricity from renewable sources will be essential. This will lead to a reduction of electricity demand from conventional thermal power plants (e.g. coal fired, natural gas fired power plants or nuclear power plants). The power sector is an important natural gas consumer. On a global level the power sector is by far the largest gas consumer with about 39% of total gas consumption in 2008 and rising to 40% in 2035. Over the period 2000 to 2010 90% of the new build electricity output in OECD countries was gas-fired (International Energy Agency 2011, 23; 101).

The majority of electricity from renewable sources is by nature variable in production - wind turbines depend on the availability of wind, and solar PV on sunlight. Therefore, an increase in renewable electricity production will also increase the fluctuations in demand from thermal power plants. Thermal power plants will need to act as a back-up for renewable energy by producing the electricity not delivered by renewable energy. It can be expected that with increasing levels of renewable energy, the production profile of thermal plants will become more volatile. Natural gas fired power plants are considered to be the most flexible type of power plants, and therefore an increase in renewable electricity production could lead to an increase in demand for gas fired power plant.

Based on a simulation model, this paper investigates what the impact of an increase in renewable energy will be on the conventional thermal power generation mix, with a focus on the natural gas demand from the power sector. This is done by simulating the future electricity market for a five year period (period 2026 - 2030) for six Northwest European countries² with varying levels of electricity from renewable sources. The model determines by which types of power plants the fluctuating demand can be generated and calculates and minimises overall cost for the conventional electricity generation such that all electricity demand is fulfilled.

¹ This paper is a revised and short version of the thesis The optimal power mix: cost efficiently accommodating renewable energy. For a more elaborate information the authors would like to refer to this document.
² Belgium, Denmark, France, Germany, The Netherlands and United Kingdom.

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