

The way forward after COP21: why natural gas is the key to a low-carbon world

In December 2015, at the UN climate summit in Paris, representatives from 195 nations agreed restricting the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C. Although the summit participants didn't set concrete emission reduction targets, they are resolved to reach a turning point on emissions fast. They have pledged to define new targets for reducing CO₂ emissions every five years, facilitating progress towards a lower-carbon world.

This process will stimulate permanent debate on the future energy mix. The key question is *how* the targets can be met most efficiently and fairly. Renewable energies alone will not be enough to safeguard economic growth and prosperity in the transition to a lower-carbon world, especially not in developing and emerging nations. Even the most ambitious (2 degrees) scenario from the International Energy Agency (IEA) estimates a 60% contribution of fossil fuels in 2040, down from 80% today.

A focus on affordable climate protection

The Paris Climate Agreement underlines the importance of the affordability of climate protection for individual national economies. A transition to a low-carbon global economy based on renewables alone would be very costly, again particularly in developing nations whose growing populations have a legitimate claim to economic growth.

Against this backdrop, what matters aside from efforts to increase the use of renewable energies, is improving the carbon footprint of conventional energy sources sustainably and cost-efficiently. Natural gas is the ideal fossil fuel for doing so: natural gas is best-suited to facilitate climate protection quickly and affordably, for in terms of carbon content, it delivers more energy than the other fossil fuels and when burned emits about 50 percent less CO₂ per kilowatt hour (kWh) than coal and lignite.

Flexible and efficient in the relevant fields

Natural gas has other crucial advantages which are making it increasingly popular as a source of energy: no other fossil fuel is as flexible, efficient and suitable for a diverse range of applications as natural gas. Thanks to its sophisticated, versatile and low-cost technology, it can easily replace CO₂-heavy alternatives and unlock carbon reduction potential across a wide variety of applications. The use of gas will contribute to a better air quality in comparison with all other fossil fuels:

- In the electricity market natural gas is a key energy source, thanks to its low CO₂ emissions, for ensuring a turnaround in climate change together with renewable energies. Capital costs for gas-fired power plants are substantially less than for coal plants, making them more suitable to be operated in combination with power generation by wind and sun. Moreover gas-fired power stations can be turned on and off much more quickly than other power plants and are therefore ideal to compensate for fluctuations in supply resulting from variable renewables generation.

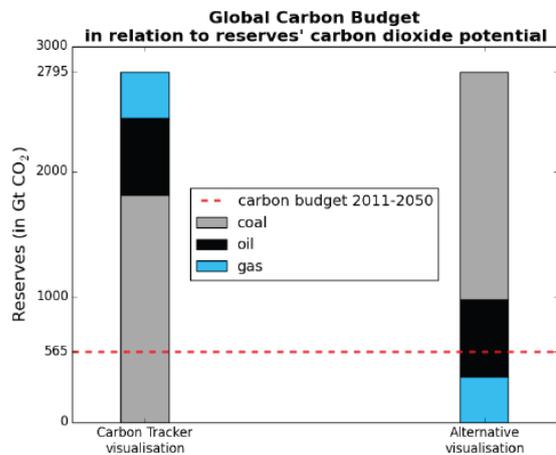
- Heat and electricity can be produced simultaneously both in the residential sector and in industry by means of innovative combined heat and power plants and fuel cells. These represent a highly efficient use of natural gas and lead to substantial savings on CO₂ emissions.
- Worldwide, a large proportion of final energy is used for heating and cooling. Gas can be used in a great many proven and affordable technologies in almost all heating and cooling applications, often in combination with renewable energies. An example is the combination of gas-fired boilers with solar thermal power in households, which can also be used in commercial applications. In the residential sector significant CO₂ reductions can be realized immediately with the use of cheap and modern gas technology which is readily available.
- In the transport and maritime sector, natural gas is a very environmentally friendly alternative to oil. It reduces CO₂ emissions by around 24 percent compared to oil, produces almost no particulate matter and is cost-competitive. Thus, natural gas not only enables a rapid reduction of CO₂ emissions in the transport and maritime sector, it also improves air quality in towns and cities, and on the seas and oceans. For example LNG is beneficial in heavy transport and maritime while CNG has its advantages in private transportation..
- Gas can serve as a very efficient storage medium for s electricity from renewable energy. Power from wind and solar farms can be converted into synthetic methane and transported through the existing gas infrastructure ('power-to-gas'), alleviating the need for electricity grid expansion and costly batteries while improving system stability and energy security in the process. Power-to-gas will become increasingly attractive in a world where the share of renewable energies will be constantly growing. After all, synthetic gas is a non-intermittent renewable; consequently it has a higher value compared to renewables which cannot be adapted to demand.
- The existing gas infrastructure also helps to facilitate the build-up of renewables' share in energy production by supplying transport and storage of renewable gas. Renewable gas not only includes synthetic methane but also bio methane.

Time for a change of perspective

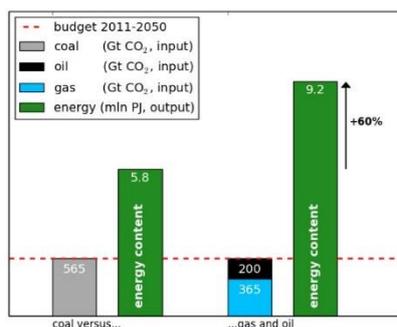
In order to limit global warming to a maximum of 2 degrees by 2050, the IEA's current "450 Scenario" (its most ambitious scenario) says that no more than 565 gigatons (Gt) of CO₂ should be emitted between now and 2050. Current annual emissions equal some 35.7 gigatons.

Since it is clear that our energy requirements cannot be met solely by renewables, and fossil fuels must continue to play an important role for decades to come, *it becomes absolutely vital to reduce emissions from fossil fuel use as quickly as possible.* All major energy scenarios from independent organizations come to the conclusion that this can best be achieved by replacing coal – and to some extent oil – by natural gas on as large a scale as possible. To understand the implications of this change, it is time to change our perspective on the fossil fuel mix. The 'carbon budget', as defined by the IEA, is limited, but the way in which it is distributed makes a big difference. Since natural gas is the most efficient of the fossil fuels and has by far the lowest CO₂ content, it makes sense to spend the budget first of all on gas and only then on oil and coal, in so far as practically possible. In other words, *gas should take on the leading role in the fossil fuel mix as soon as possible.*

To visualize what this means, consider the way in which the carbon budget is illustrated in graph form by the NGO Carbon Tracker – and what happens when the perspective is changed and gas becomes leading:



Source: [Why energy per carbon matters](#), page 8



Source: Why carbon matters, page 10

The traditional view on the global carbon budget so far was that coal would take up the largest share until 2050. However, if we change the perspective as demonstrated above, the following key conclusions can be drawn:

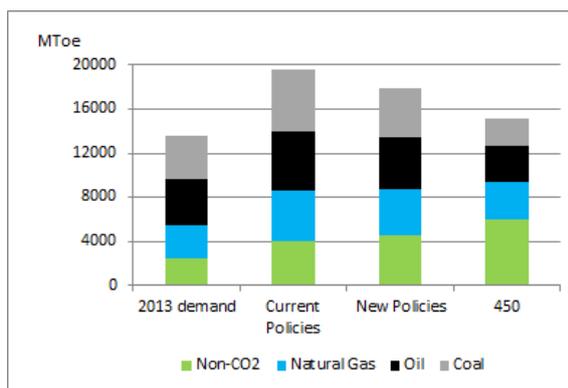
- Even by using all known gas reserves the remaining carbon budget between now and 2050 would even leave room for other fossil fuels.
- If we look at the energy content per carbon unit emitted, another important advantage of gas becomes apparent: if gas substituted coal and oil in their respective appliances, it would be possible to use more energy while staying within the carbon budget, as shown in the second graph above.

Without CO₂ sequestration technologies, the continued use of coal would use up the global carbon budget much faster, and with lower yields of energy per ton of CO₂ emitted. Especially for developing countries, such a path forward would severely limit opportunities for economic growth and welfare. The sooner a strategy of low-carbon and high-energy-yield fuels is adapted, the steeper the growth path which can be achieved. The energy system of the future will see a much higher and continuously rising share of renewable energies. The system should be supplemented with more natural-gas-based technologies sooner rather than later.

In other words, gas not only helps reduce greenhouse gas emissions, it also improves the global energy yield.

A world without coal

It is noteworthy that even the IEA's 450 scenario allows for a substantial use of coal in 2040. This can be seen in the graph below, which illustrates various scenarios (the 450 scenario is on the far right):



The continued use of coal, as depicted in this graph, has several implications for this scenario. For example, the 450 scenario has to assume 150% growth of nuclear power, 70% growth in biomass and a 9-fold increase of renewables by 2040 (compared to 2013) to stay within the carbon budget. However, if coal were to be replaced by natural gas a very different picture would emerge, with less CO₂ emissions and less strain on alternative energy supplies.

Conclusion

Natural gas delivers significantly more energy than coal per ton of CO₂ emitted. As the cleanest and most flexible of the fossil fuels, natural gas has the potential to make rapid and affordable CO₂ savings worldwide. It can be integrated into all parts of the global energy system cost-effectively and in combination with renewable energy and improves air quality. That makes gas a central agent of the climate turnaround in the energy sector, ensuring the most rapid implementation of carbon reduction goals at the lowest cost, while taking into account the legitimate economic interests of the global population.