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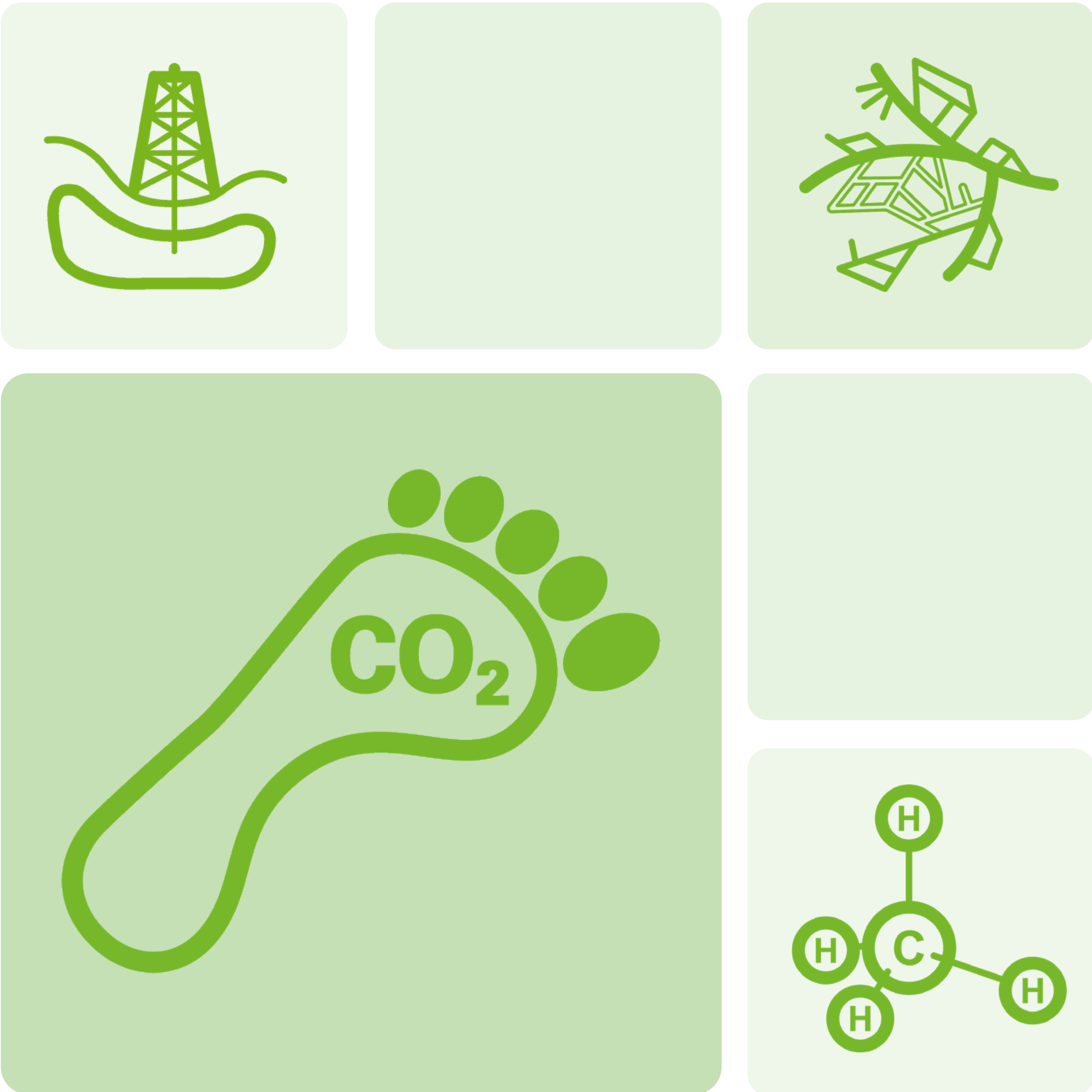
CFNG1.1

Carbon Footprint of Natural Gas 1.1

Management Summary



Imprint

Final Report

CFNG1.1

Carbon Footprint of Natural Gas 1.1

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Carbon Footprint of Natural Gas 1.1

Goal and Key Findings

The goal of this study was to determine the CF of natural gas distributed in Central Europe (CE)[1] or Germany (DE) for the years 2015 to 2018. The analysis comprised the steps natural gas production, -processing, -transport and storage outside as well as inside CE (DE) and the natural gas distribution within CE (DE). Usage of gas was not included.

The key findings are:

- The specific methane emissions decreased in all considered production countries[2]. Since proportionally more gas was imported from Russia, which has higher specific methane emissions than Norwegian or Dutch gas, methane emissions in the CE region have remained more or less stable[3].
- At the same time, CO_2 emissions have increased, mainly due to increased energy consumption for gas extraction and gas transport to CE.
- Thus, between 2015 and 2018 the carbon footprint has increased but is still slightly below the value calculated for 2014 in the previous study[4].

Background and Motivation

The study was commissioned by Zukunft GAS as an update of the study “Critical Evaluation of Default Values for the GHG Emissions of the Natural Gas Supply Chain” published in 2016 [2], hereinafter referred to as “previous study”. Its findings will be used as a sound scientific basis in the communication with the association´s members, stakeholders, and politics about greenhouse gas emissions of natural gas.

Research Approach

This study collected reliable and up-to-date data on the life cycle greenhouse gas emissions released during the different stages of the natural gas value chain (Figure 1) for the years 2015 to 2018. It was conducted in accordance with DIN EN ISO 14040, 14044 and 14067 regarding data quality, completeness, and consistency. The study is prepared to be critically reviewed by independent third parties.

1 The region “CE” comprises: Austria, Belgium, Czech Republic, Estonia, Germany, Hungary, Latvia, Lithuania, Luxemburg, the Netherlands, Poland, Slovakia [1].

2 The methane emissions of natural gas distributed in CE decreased by the following percentages in 2018 compared to 2015: Germany: 3.5 %, The Netherlands: 1.3 %, Norway: 1.1 %, Russia: 6.3 %.

3 The methane emissions of natural gas distributed in CE decreased by 0.7 % in 2018 compared to 2015.

4 “Previous study” refers to the study “Critical Evaluation of Default Values for the GHG Emissions of the Natural Gas Supply Chain” published in 2016. [2]

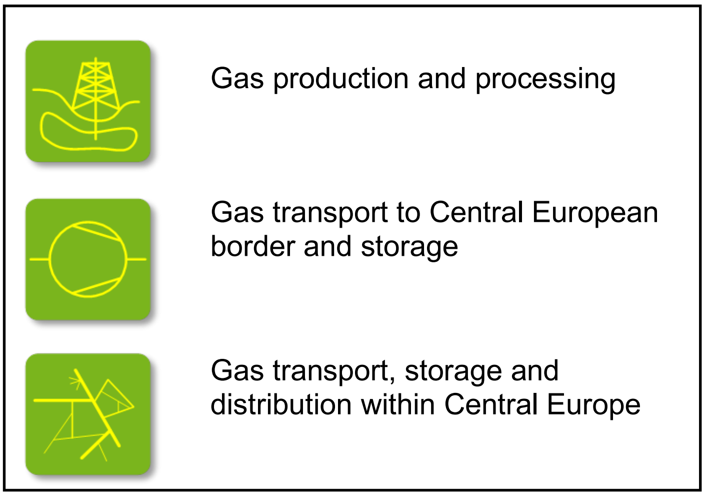

Figure 1: Product System, own illustration based on [3]

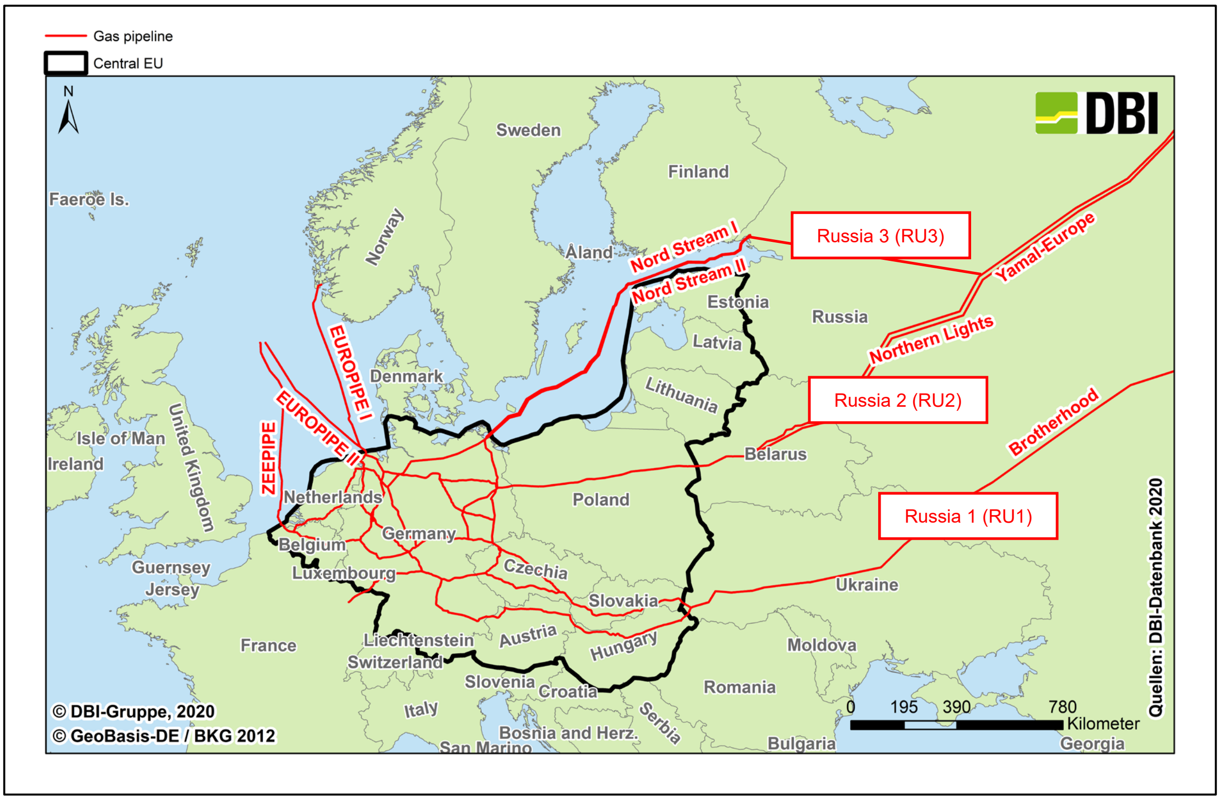

Figure 2: System “Natural gas Distributed in CE”, own illustration based on [4]

Only data with a significant impact on the resulting carbon footprint were collected. Certain input data, such as those for some countries within Central Europe (e.g. Austria or Poland) or for the value chain of LNG, were used in the form as provided in the literature. It is expected that further adjustment of these data would lead to a higher precision of the carbon footprint results.

The impacts of all greenhouse gases were assessed using the Global warming potential values from the IPCC 4th Assessment Report over 100 years, which are currently the basis for national greenhouse gas inventories. The Life Cycle Assessment software GaBi from Sphera was used for the modelling.

Results

The following main results were identified:

- The Carbon Footprint of natural gas distributed in Central Europe was calculated to be **7,722 gCO2e/GJ (NCV) or 28 gCO2e/kWh (NCV)** in 2018.
- The Carbon Footprint of natural gas distributed in Germany was calculated to be **6,592 gCO2e/GJ (NCV) or 24 gCO2e/kWh (NCV) in** 2018, which is lower than the Carbon Footprint of natural gas distributed in Central Europe. This is mainly due to the different natural gas supply structures.
- **Methane losses amount to 0.5 % (0.3 %)** related to the gas distributed in CE (DE) in 2018[5].

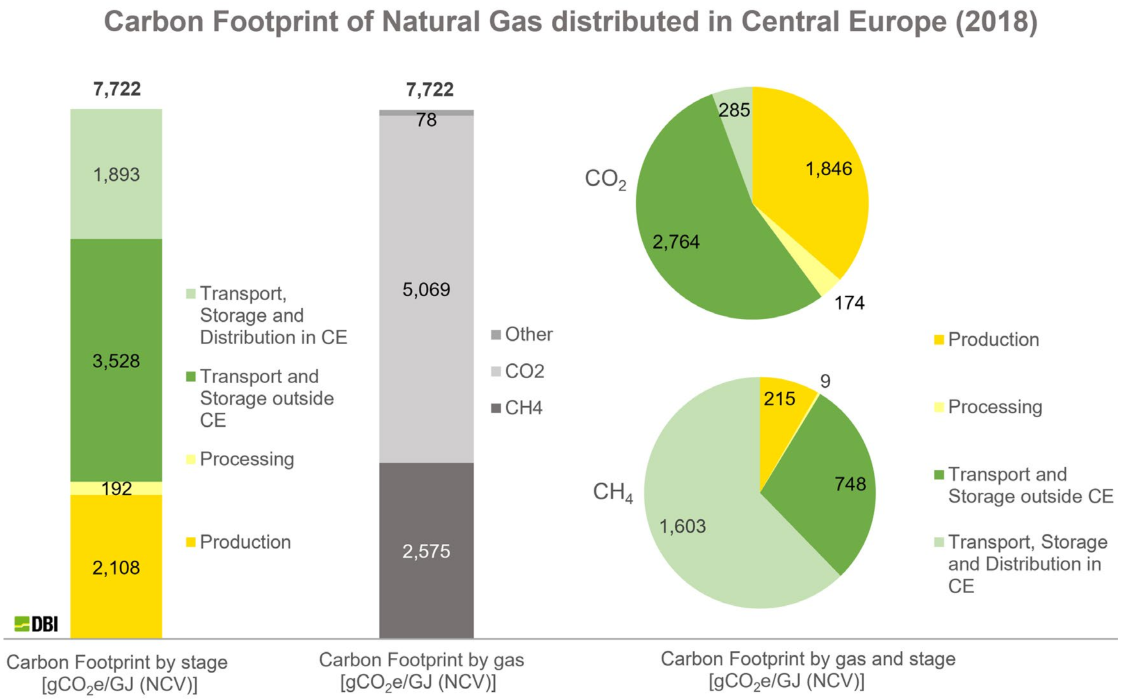

Figure 3: Breakdown of the Carbon Footprint of Natural Gas Distributed in CE by Stage and Greenhouse Gas in 2018

The previous study showed that the inclusion of current best available data instead of assumptions or literature values leads to a significant reduction of the results. This was also found in this study. Compared to the previous study, data updates were made, in particular for Norway and Ukraine.

The calculated Carbon Footprint increased between 2015 and 2018. This is mainly due to the increasing share of natural gas from Russia with its long transport distances, but also because of increasing Carbon Footprints of the individual producer countries (e.g. Germany and the Netherlands show an increase in energy intensity of their gas production over the years).

Nevertheless, methane emissions have decreased in all countries and production steps, which is probably a result of measures to reduce methane emissions. Norway and Russia, for example, have tax systems for methane emissions that led to emission reductions. At the same time, however, energy demand has increased, leading to higher CO_2 emissions.

[5] Calculated based on the mass of CH_4 in relation to the mass of a GJ of distributed gas.

Conclusions and Recommendations

Significant uncertainties are associated with the diffuse sources of methane emissions. There are many elements which cause emissions and not every element can realistically be part of measurements. To some extent these uncertainties are unavoidable.

There are some data gaps that lead to the use of literature data, assumptions, and limitations. The following gaps should be closed in future studies to obtain more accurate results:

- Drilling for gas production
- Energy consumption of gas storage
- Biogas injection plants
- Energy consumption for the distribution of natural gas (e.g. for preheating)

Much of the data used has been provided by the operators, but it is not yet publicly available. The public availability and transparency of the data have a strong influence on study results (as shown in the previous study). It can therefore have a direct impact on decision-making processes at European level, as it cannot always be assumed that representatives of the natural gas industry are in studies that estimate the carbon footprint associated with the value chain of natural gas.

The industry should continue its present course of increasing transparency, so that measures to reduce emissions (e.g. the application of new technologies and new materials for pipeline construction) can be considered when determining the Carbon Footprint. In addition, industry and authorities should work more closely together to enable the inclusion of industry data in public databases such as national inventories on greenhouse gas emissions (NIR), thus enabling the use of industry data for studies not accompanied by industry partners.

The results of this study should be used for communication with relevant stakeholders (e.g. energy policy, European Commission) in order to promote the collection and harmonization of up-to-date data on greenhouse gas emissions of natural gas over the whole life cycle.

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