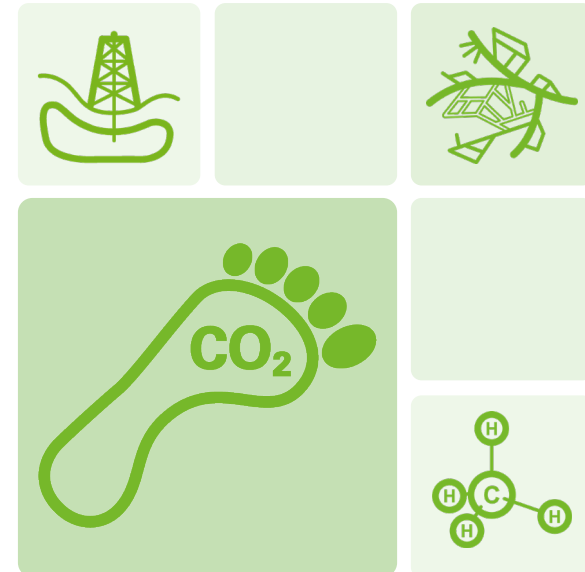


Carbon Footprint Natural Gas 1.1 (CFNG1.1)

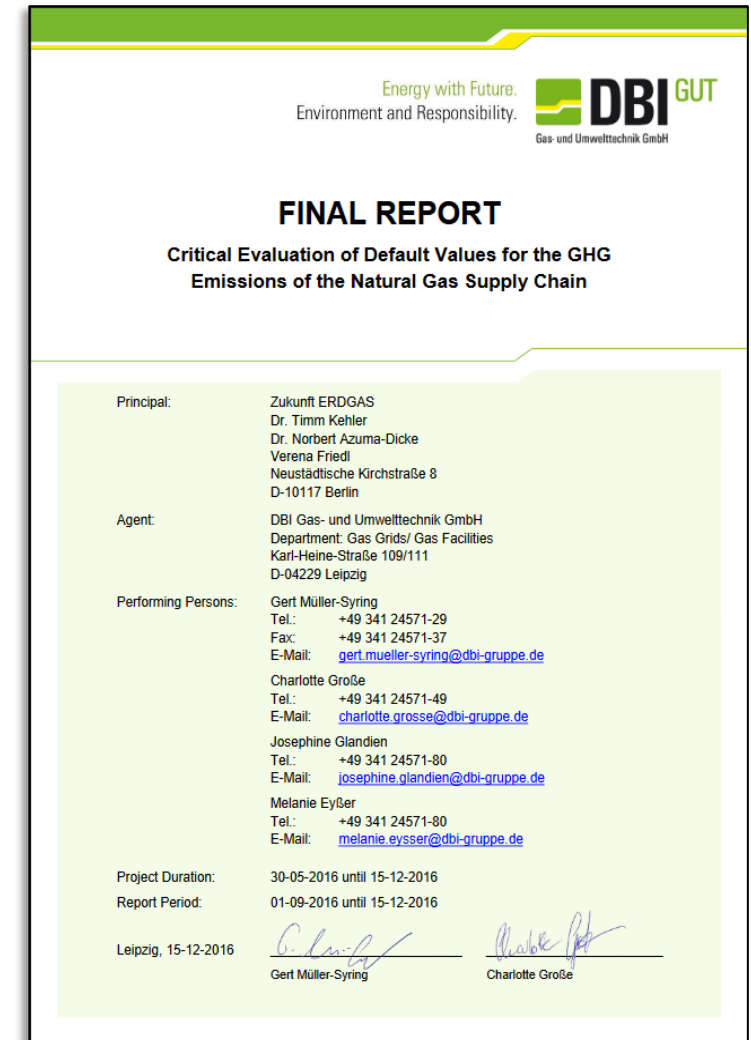
Charlotte Große, Melanie Eyßer, Stefanie Lehmann

DBI GUT Leipzig

Final presentation

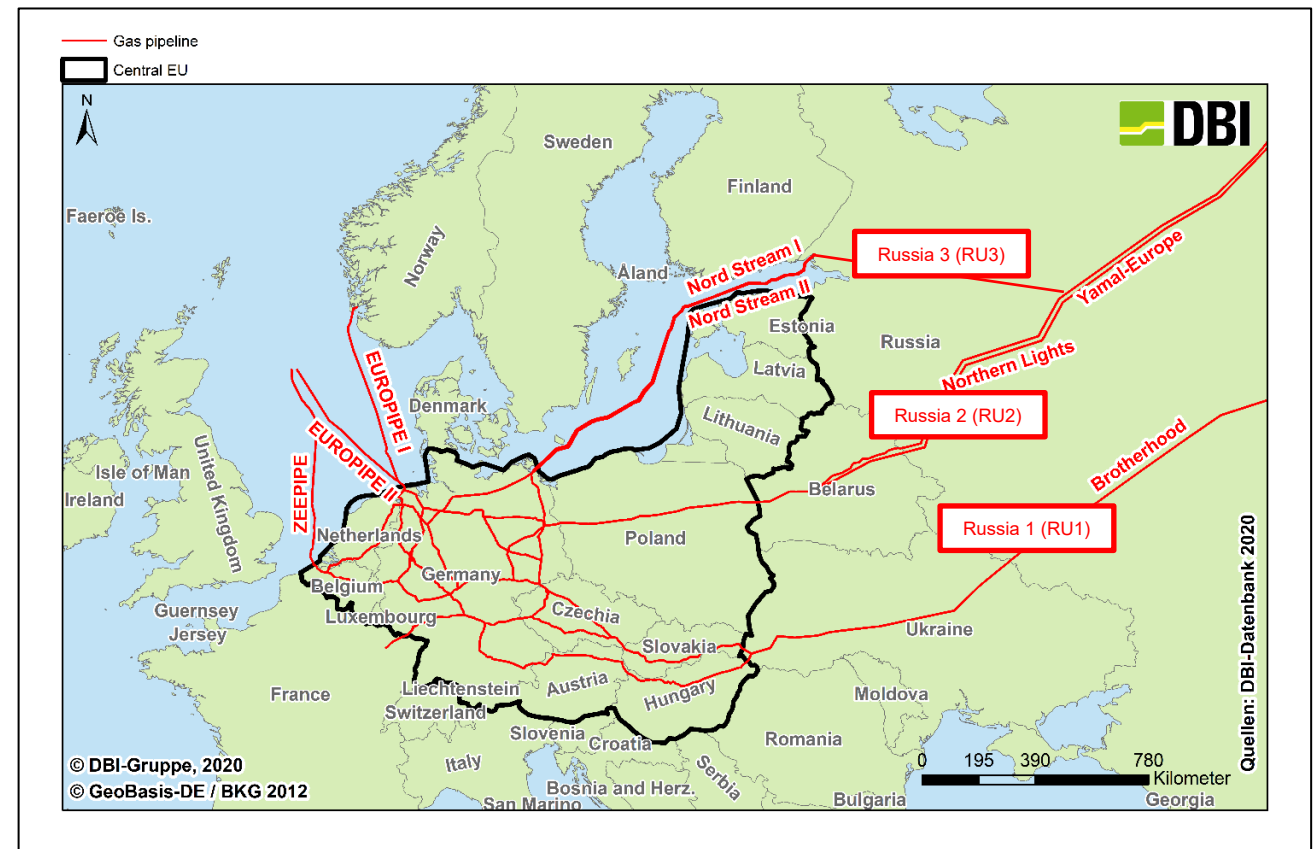


- **Motivation:** Update of the study „Critical Evaluation of Default Values for the GHG Emissions of the Natural Gas Supply Chain“ from 2016, which evaluates the years 2012 - 2014 by using data from 2015 - 2018
- **Goal:** Calculation of the Carbon Footprint (= measure of the impact of greenhouse gases on climate change based on life cycle assessment, expressed as CO₂-equivalents) of natural gas, distributed in Central Europe (CE) or Germany in 2015 – 2018 (DE)
 - In accordance with the standards DIN EN ISO 14040, 14044 and 14067
- The results should be used as solid, scientific basis for the communication with members, stakeholders and the politics of the association for greenhouse gas emissions of natural gas



Source: DBI GUT, 2021

- Focus of the analysis is the **region Central Europe or Germany** and their relevant supplier countries (**The Netherlands, Norway, Russia**)
- **Product System:**
 - Gas production/processing
 - Transport and storage outside and inside CE/DE
 - Distribution in CE/DE
- For LNG (as part of the supply structure) no new data is collected, but the state of the NGVA study from 2017 is used



Source: DBI GUT, 2021

- The CF is calculated with a professional **life-cycle-assessment-software** (GaBi from Thinkstep/Sphera)
- An import route (CF from natural gas, which is produced in Norway and distributed in CE) is inserted in the GaBi model to show, which **differences are given through a different model**. The difference is **< 5 %**, which is due to different data for electricity mixes and some default values (e.g. emission factor of gas CHP)
- Considered product: **Natural gas distributed in Central Europe or Germany**
- Functional unit: 1 GJ (NCV) natural gas, distributed in Central Europe or Germany
- Impact assessment of climate change in accordance with DIN EN ISO 14067 with global warming potential over 100 years with help of the values that are used for the UNFCCC reporting (4th Assessment Report of IPCC, e.g. $GWP_{100} CH_4=25$)

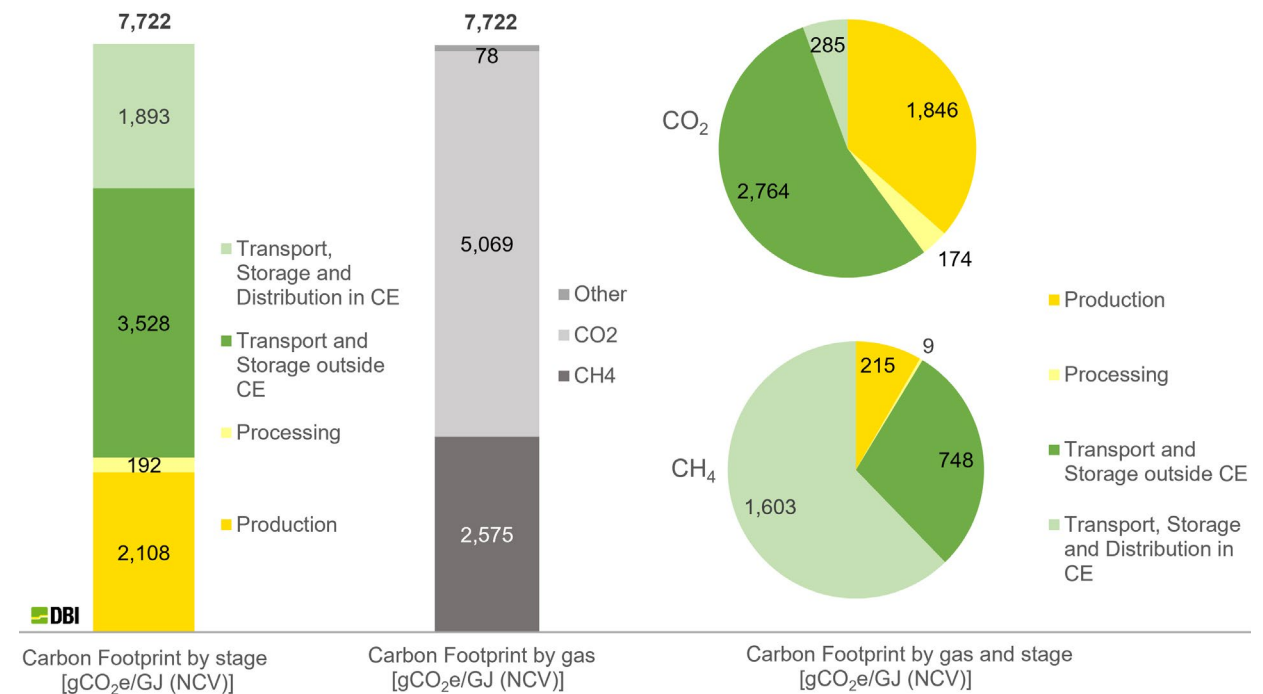
- Data collection focused on the natural gas production countries Norway and Russia, which have a huge impact on the results
- Furthermore, update of statistical data about the Netherlands and Germany
- Additional data collected from the Ukrainian operator TSOUA about the Ukrainian transport grid

Country	Production	Processing	Transport to CE	Transmission in CE	Distribution in CE
Austria					
Belarus					
Belgium					
Czech Republic					
Germany					
Estonia					
Latvia					
Lithuania					
Luxembourg					
Hungary					
The Netherlands					
Norway					
Poland					
Russia					
Slovakia					
UK					
Ukraine					
	Updated data available and used for this study				
	No updated data available - data from the previous study was used				
	Process step not existing				

Source: DBI GUT, 2021

- Carbon Footprint of natural gas distributed in Central Europe in 2018: **7,722 gCO₂e/GJ (NCV)** or **28 gCO₂e/kWh (NCV)**
- Regarding greenhouse gases, CO₂ has the largest share of the result (approx. 65%), followed by CH₄ (approx. 33%)
- Regarding process steps, transport and storage outside CE have the largest share (approx. 45%) of the result, followed by the production (approx. 27%)

Carbon Footprint of Natural Gas distributed in Central Europe (2018)



Source: DBI GUT, 2021

- Carbon Footprint of natural gas distributed in **Central Europe:**

	2015	2016	2017	2018
Production	2,014	1,906	1,975	2,108
Processing	242	234	224	192
Transport and Storage outside CE	2,581	2,895	3,246	3,528
Transport, Storage and Distribution in CE	1,907	1,871	1,854	1,893
Total [gCO ₂ e/GJ]	6,745	6,906	7,298	7,722
Total [gCO ₂ e/kWh]	24	25	26	28

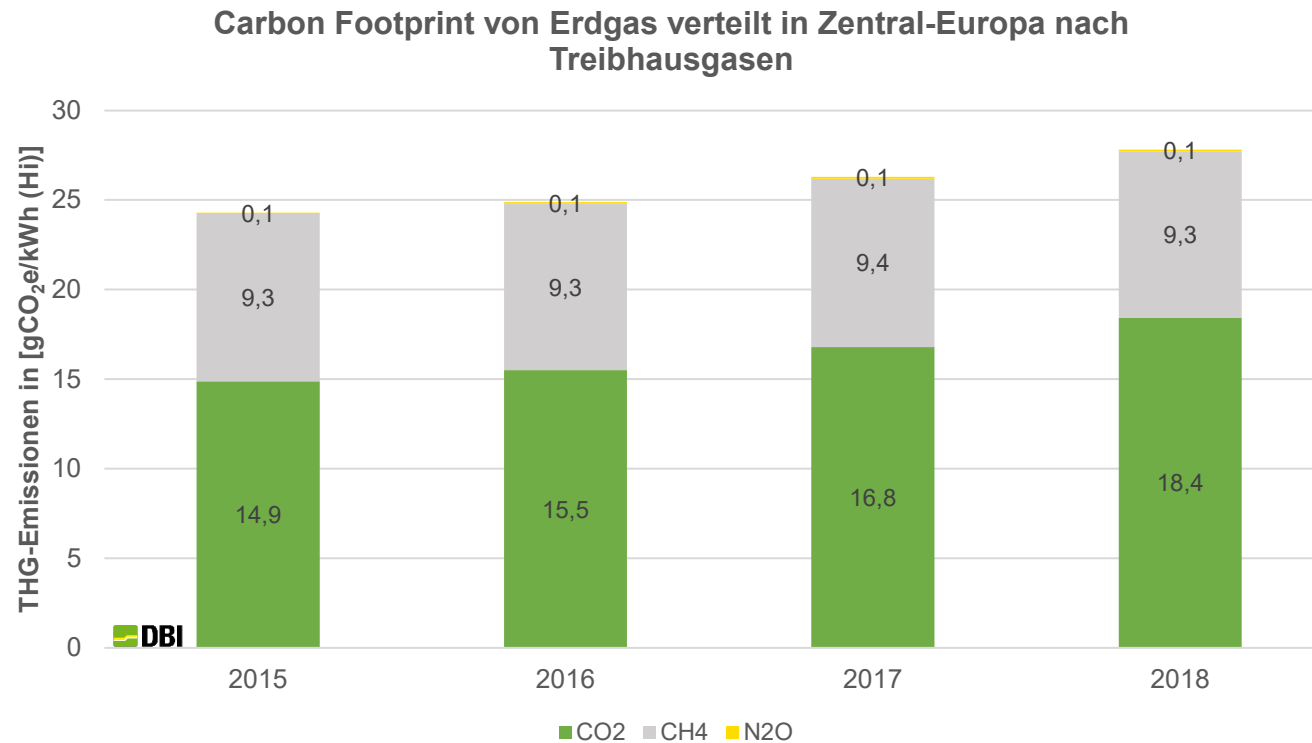
Source: DBI GUT, 2021

- Carbon Footprint of natural gas distributed in **Germany:**

	2015	2016	2017	2018
Production	1,621	1,572	1,619	1,623
Processing	289	296	260	239
Transport and Storage outside GER	2,710	3,137	3,607	3,853
Transport, Storage and Distribution in GER	932	874	857	877
Total [gCO ₂ e/GJ]	5,552	5,879	6,343	6,592
Total [gCO ₂ e/kWh]	20	21	23	24

Source: DBI GUT, 2021

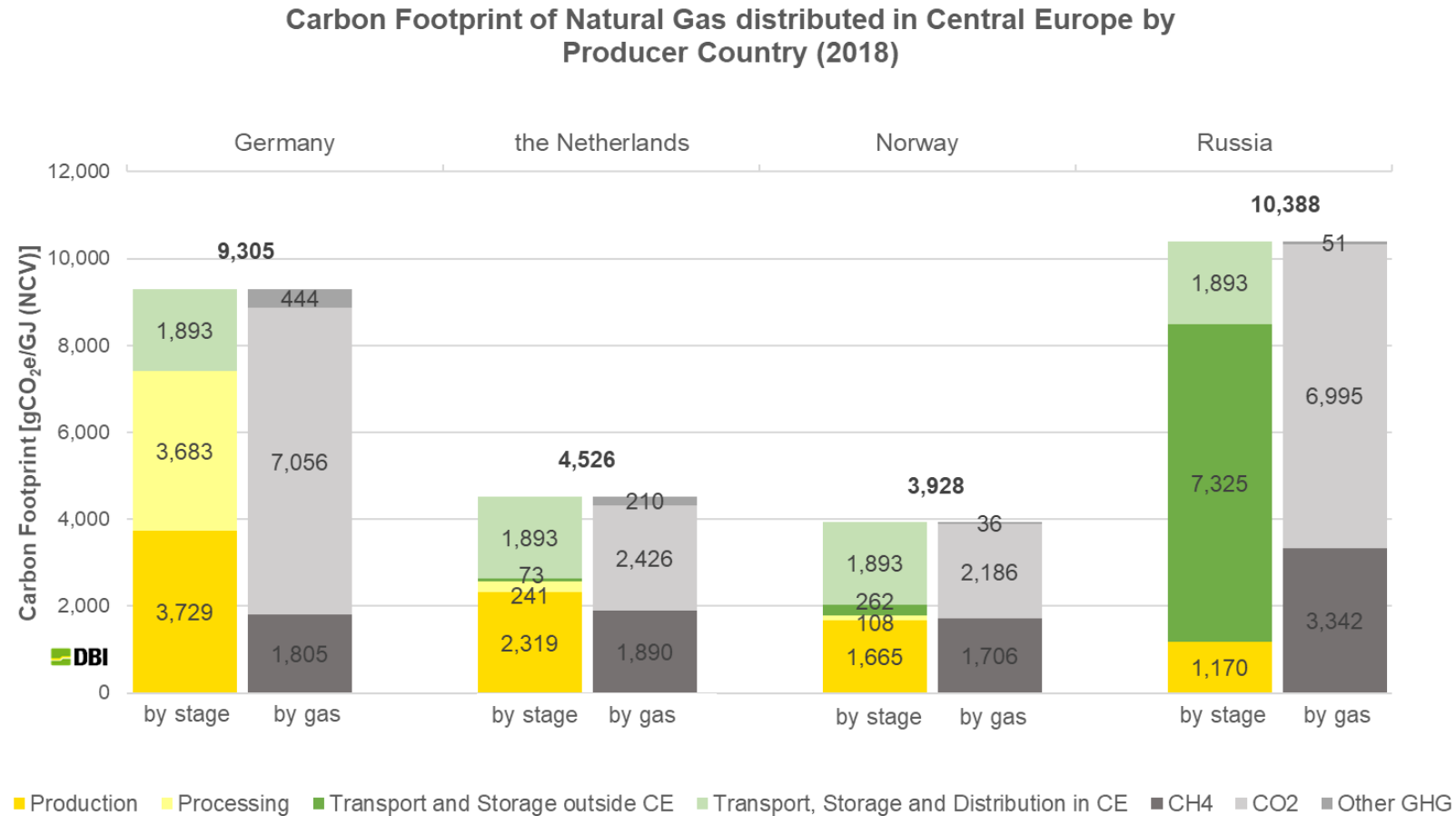
- Carbon Footprint of natural gas distributed in Central Europe **divided into Greenhouse Gases in gCO₂e/kWh (NCV)**



Source: DBI GUT, 2021

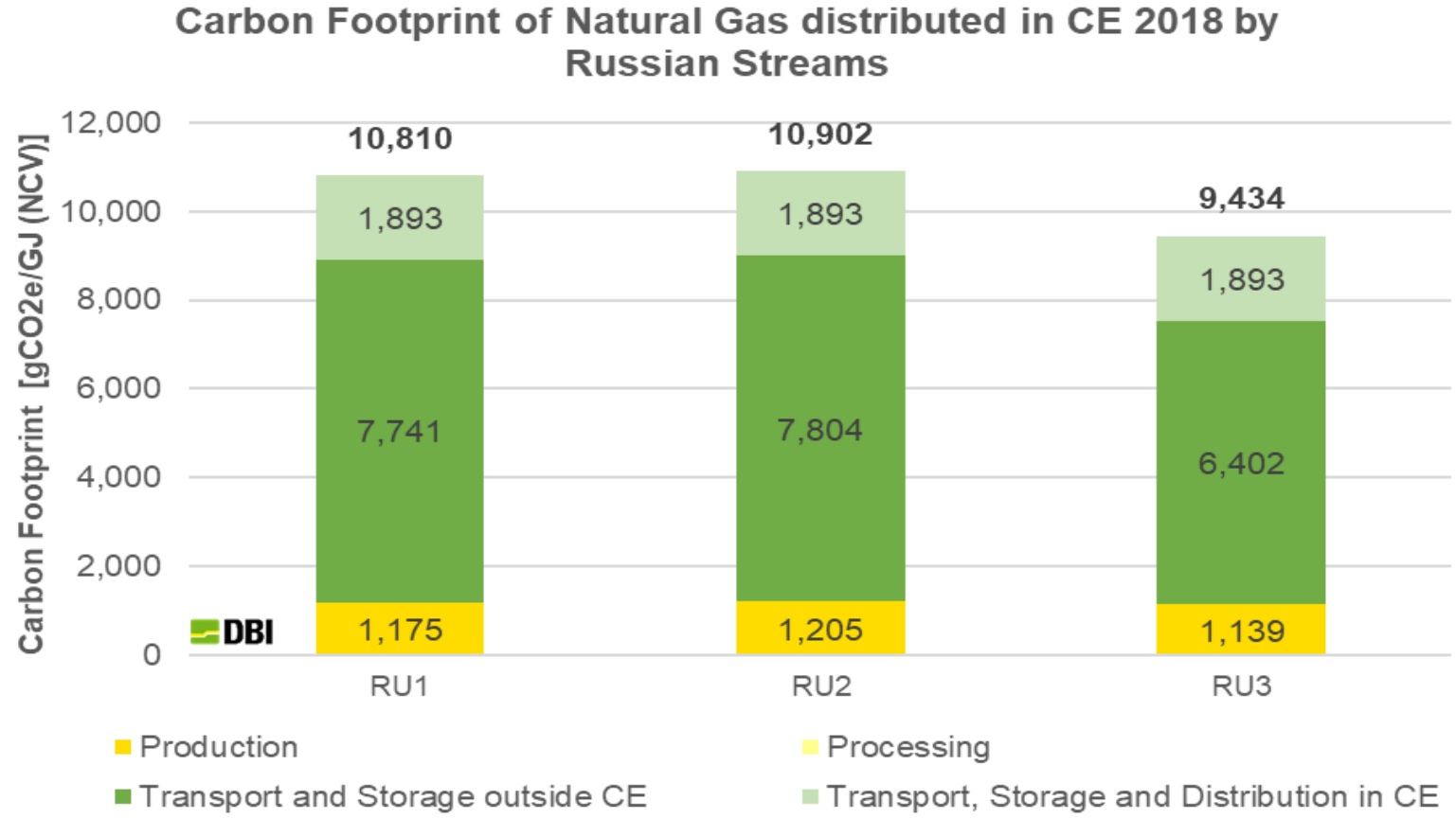
- Methane losses** amount to **0.5 % (0.3 %)** related to the gas distributed in CE (DE) in 2018.

- Carbon Footprint of natural gas distributed in CE 2018, allocated **by producer country, lifecycle phase and GHG**



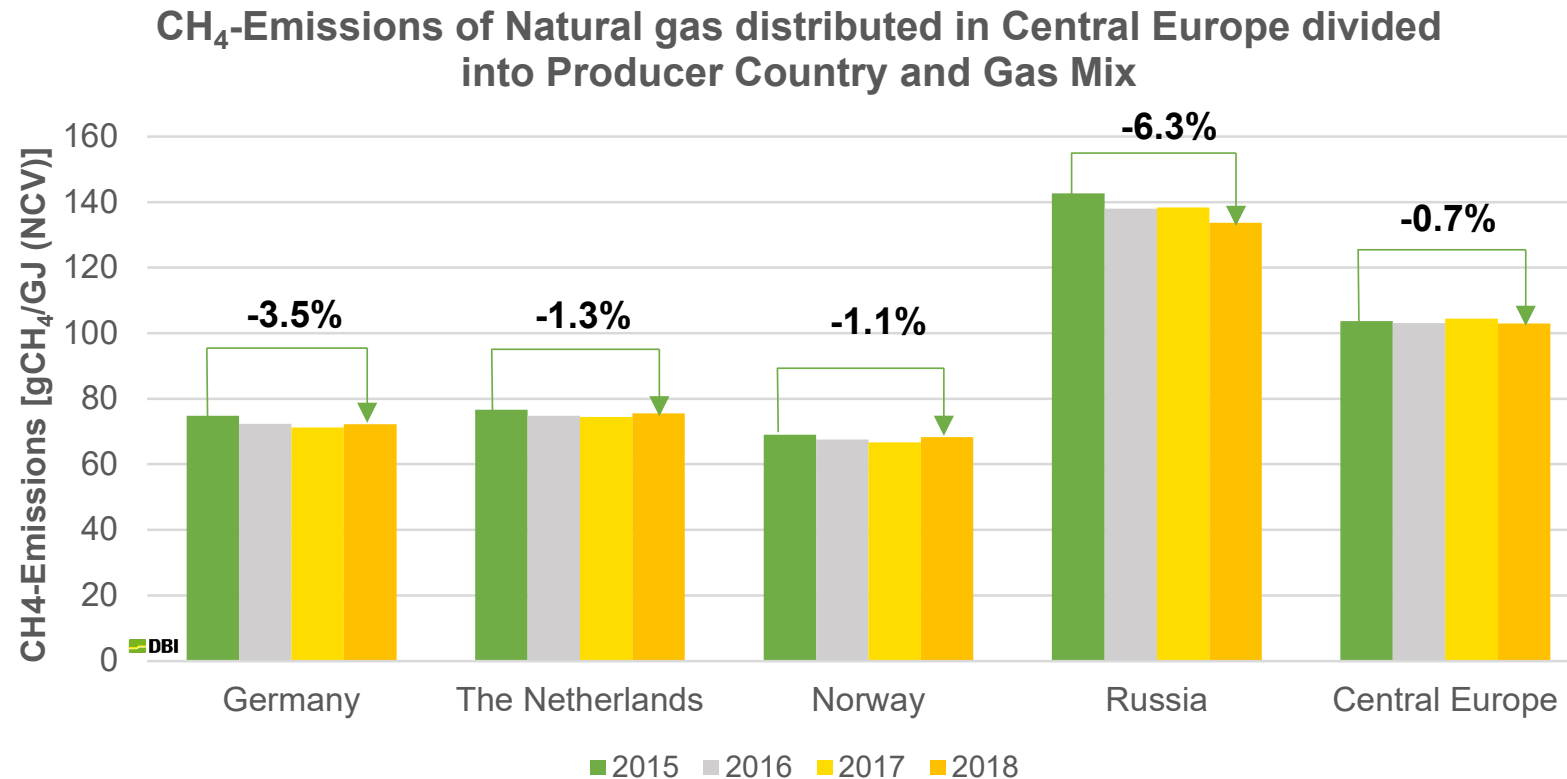
Source: DBI GUT, 2021

- Differences between **Russian Streams**: the CF of the Northern Corridor (with Nord Stream as offshore pipeline) is about 13 % lower than the CF of the two other Russian corridors



Source: DBI GUT, 2021

- The **methane emissions** of natural gas distributed in Central Europe **decreased slightly** in all considered producing countries **between 2015 and 2018**



Source: DBI GUT, 2021

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

- The calculated Carbon Footprint of natural gas distributed in **Central Europe** in 2018 is: **7,722 gCO₂e/GJ (NCV)** or **28 gCO₂e/kWh (NCV)**.
- The calculated Carbon Footprint of natural gas distributed in **Germany** in 2018 is: **6,592 gCO₂e/GJ (NCV)** or **24 gCO₂e/kWh (NCV)**.
- The difference between the two regions is caused by **different supply structures** and also by divergent parameters for energy demand and gas losses during transport, storage and distribution in Central Europe or Germany.
- **Methane losses amount to 0.5 % (0.3 %)** related to the gas distributed in CE (DE) in 2018.

- **The specific methane emissions decreased in all considered production countries.** 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.**
- At the same time **CO₂-Emissions increased** due to higher energy demand of the gas production in several countries
- The **Carbon Footprint increased from 2015 to 2018 by approx. 14% in CE and approx. 19% in DE**, but it is **slightly lower than the 2014 CF calculated in the previous study** (7,939 gCO₂e/GJ (NCV) or 29 gCO₂e/kWh (NCV) regarding CE and 7,050 gCO₂e/GJ (NCV) or 25 gCO₂e/kWh (NCV) regarding DE).
- In comparison with the previous study, **data is updated** (especially for Norway and Ukraine), but there are still data gaps, and assumptions were made that should be addressed in future studies (e.g. drilling).

Thank you very much for your attention!

Your contact person

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- Carbon Footprint of natural gas distributed in Central Europe and produced in Germany, the Netherlands, Norway or Russia in 2018:

	Germany	The Netherlands	Norway	Russia
Production	3,729	2,319	1,665	1,170
Processing	3,683	241	108	0
Transport and Storage outside CE	0	73	262	7,325
Transport, Storage and Distribution in CE	1,893	1,893	1,893	1,893
Total [gCO₂e/GJ]	9,305	4,526	3,928	10,388
Total [gCO₂e/kWh]	33	16	14	37