Carbon Footprints of Fossil Fuels for Power Generation
– Comparison of the carbon footprint of pipeline gas from Russia and Norway with those of LNG, shale gas and coal –

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Round Table on Coal
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Full chain of natural gas, hard coal and lignite use

**Natural gas**
- Extraction
- Processing
- Transport
- Distribution + Storage
- Conversion into power

**Hard coal**
- Extraction
- Inland transport
- Ship
- Inland transport
- Conversion into power

**Lignite**
- Extraction
- Inland transport
- Conversion into power
Basic assumptions for comparison

- Account taken of emissions due to consumption and leakage along the supply chain for natural gas, hard coal and lignite
- Inclusion of carbon dioxide and methane
- Period under review: 100 years and, alternatively, 20 years (GWP*)
- Extraction method, origin and type / length of transport route
- Power-plant technology – specifically efficiency in 2030
- Study of plants without CCS and, alternatively, with CCS

Comprehensive approach on the basis of existing literature

* GWP = Global Warming Potential according to IPCC (2007), i.e. for methane: factor 25 for 100 years and factor 72 for 20 years.
Total emissions without CCS
Climate period under review: 100 years; forecast for 2030
Combustion in German power plants

Sources: GEMIS database (Ökoinstitut); *: according to Howarth et al. (2011) and Jiang et al. (2011).
IHS CERA (2011; no quantifications made) assumes there are no differences in the emissions resulting from shale gas and natural gas.
Total emissions without CCS
Climate period under review: 20 years; forecast for 2030
Combustion in German power plants

- GEMIS database (Ökoinstitut); *: according to Howarth et al. (2011) and Jiang et al. (2011).
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Worldwide power generation, 2009 to 2035, in TWh (New Policies Scenario)

2009: 20,043 TWh
- Renewables: 20%
- Nuclear energy: 13%
- Fossil fuels: 67%

2020: 27,881 TWh
- Renewables: 24%
- Nuclear energy: 13%
- Fossil fuels: 63%

2035: 36,250 TWh
- Renewables: 31%
- Nuclear energy: 13%
- Fossil fuels: 56%

Total emissions with CCS
Climate period under review: 100 years; forecast for 2030
Combustion in German power plants

Sources: GEMIS database (Ökoinstitut); *: according to Howarth et al. (2011) and Jiang et al. (2011). IHS CERA (2011; no quantifications made) assumes there are no differences in the emissions resulting from shale gas and natural gas.
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Upshot for climate relevance of natural gas and coal

> If the entire chain is included, the climate relevance approximates – although gas has an advantage (where no CCS is used).

> To achieve climate targets, CCS is indispensable in the future.

> If power is generated with CCS, coal has no disadvantage over gas.

> In power plants with CCS, coal does better than shale gas (according to Howarth et al. 2011).

It is not substitution of energy sources that is key to climate protection but new technologies, increase in efficiency, and CCS.
THANK YOU FOR YOUR ATTENTION