



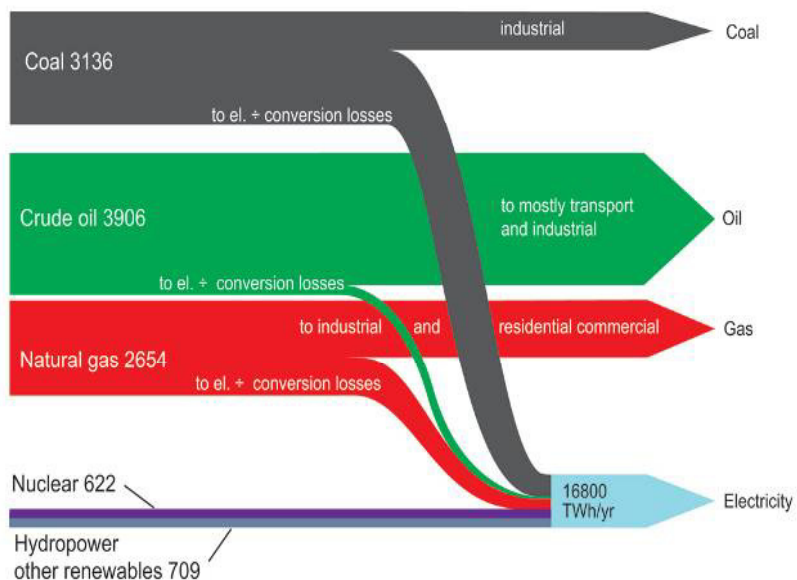
PGC A, WOC 1, WOC 2, WOC 3 and WOC 5
The Gas Industry Response to Climate Change
Presentation of the CO₂ Mitigation
Project

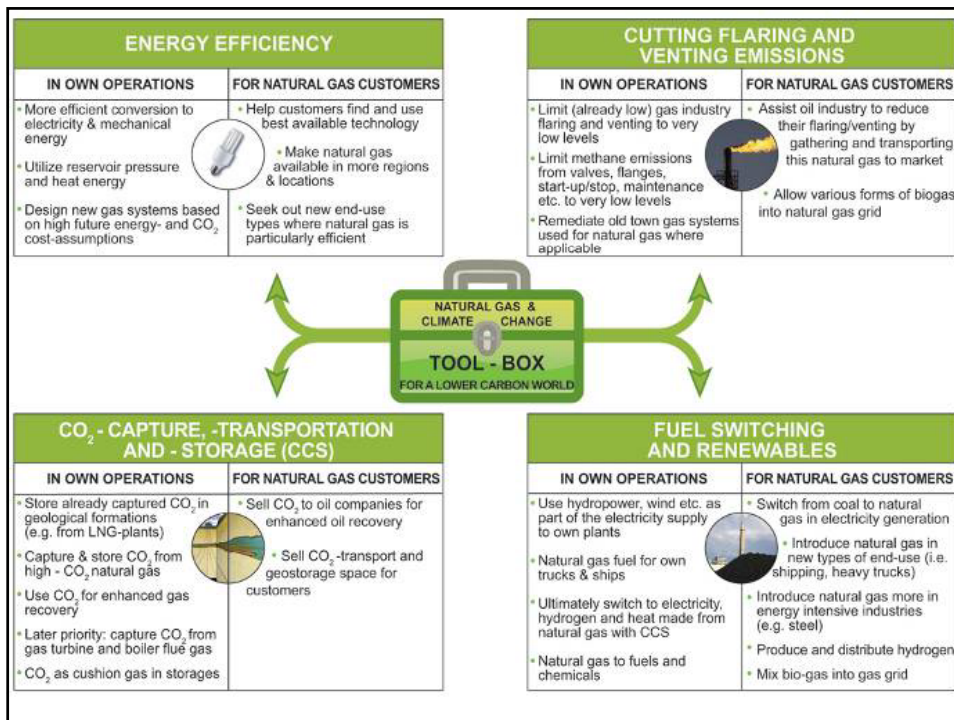
by

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Natural Gas - Unlocking the Low Carbon Future

Simplified Global Energy Flows 2007 - The role of natural gas
(million tonnes of oil equivalent per year)





24th World Gas Conference
ARGENTINA | 2009
5-9 October

The Global Energy Challenge:
Reviewing the Strategies
for Natural Gas

Natural gas - low in carbon, high in hydrogen

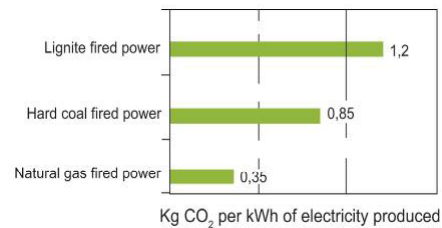
- Natural gas - consisting mostly of methane - is the most environmental friendly of the fossil fuels
- A modern gas fired power station will therefore typically produce about 1/3 of the CO₂-emission of a lignite coal fired power plant
 - Partly due to the high hydrogen content of methane
 - Partly due to the ability to use superior technology (in this case gas turbines)

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Electricity and natural gas - twins of clean energy

- There is a strong link between the future of electricity and natural gas
- Today 41 percent of global energy related CO₂ originates in electricity generation, mostly from coal
- The positive role of natural gas as part of a climate mitigation strategy is to a large part connected to natural gas - rather than coal - being preferred for future electricity generation

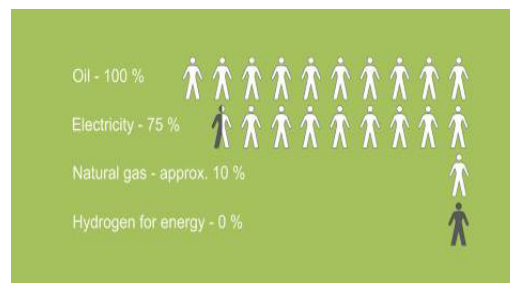


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Limited availability of gas is sometimes a problem for climate mitigation

- If natural gas is to play an important role in climate change mitigation, it must become available to more of its potential users
- As indicated in this illustration, natural gas reaches only about 1 out of 10 at present while oil is universally available and electricity available to about 3 out of 4
- This may not be the only way to look at the availability issue, but it still illustrates that it may limit end-use growth



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Fuelling vehicles and ships with natural gas

- The use of natural gas as a fuel for all sorts of vehicles (NGV's) are increasing rapidly around the world
- This would greatly enhance local and regional air quality and at the same time boost climate change mitigation
- It is projected that this end-use sector ten-fold to 65 million vehicles by 2020 with a gas use amounting to 14 percent of today's consumption
- Another important - and mostly overlooked - sector is the use of natural gas (LNG) as a ship fuel
- Outside the LNG-trade itself, only a couple of handful's of large ships use LNG as a fuel. Like for vehicles, the benefit to air quality and climate will be substantial
- This is an area where the local availability of natural gas is an important issue



Natural gas bus in India



LNG-fuelled ferry Bergensfjord

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Capturing and storing CO₂ in Geological Formations (CCS)

- The gas business is the pioneering industry in the area of CO₂-capture, -transportation and -storage
- This is expected to become an important technology for mitigating climate change through keeping CO₂ usually emitted from large point sources away from the atmosphere
- Some energy and climate modellers think that perhaps 20+ percent of necessary mitigation can come from this technology



- There are at present four large scale operating CCS projects in the world.
- From left to right the Sleipner project in Norway, the In Salah project in Algeria, The S no^{h} vit project in Norway and finally the Weyburn-Midale projects in Canada

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Hydrogen Energy from Natural Gas

- Like electricity, hydrogen is an energy carrier that is CO₂-free at the point of end-use
- The global production currently stands at around 500 billion Nm³, mostly derived from steam reforming of natural gas
- Both the production and the use are typically taking place inside the fence of refineries, ammonia plants and so forth, but extensive hydrogen pipeline networks are also found around the world
- An aspect not widely known is that when making hydrogen, CO₂ is already today captured in a concentrated form suitable for geological storage
- Hydrogen as an energy carrier was used extensively in the form of so-called "town gas" which usually contained fifty percent H₂ plus carbon monoxide



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Renewables and Natural Gas - Weaving a Mutual Relationship

- The electric grid is used for all generation types (coal, nuclear, wind, solar, geothermal+)
- In much the same way we are starting to see the natural gas grid being used for biogas
- Renewables are of an intermittent nature and not necessarily available according to customers demand
- This is why for instance solar thermal energy team up with natural gas to generate steam (night, clouds)
- Gas turbines can start and stop much more rapidly than coal or nuclear boilers for generating electricity. Storable natural gas fired in gas turbines is therefore ideal in combination with fluctuating renewable power

Biogas plant feeding gas pipeline



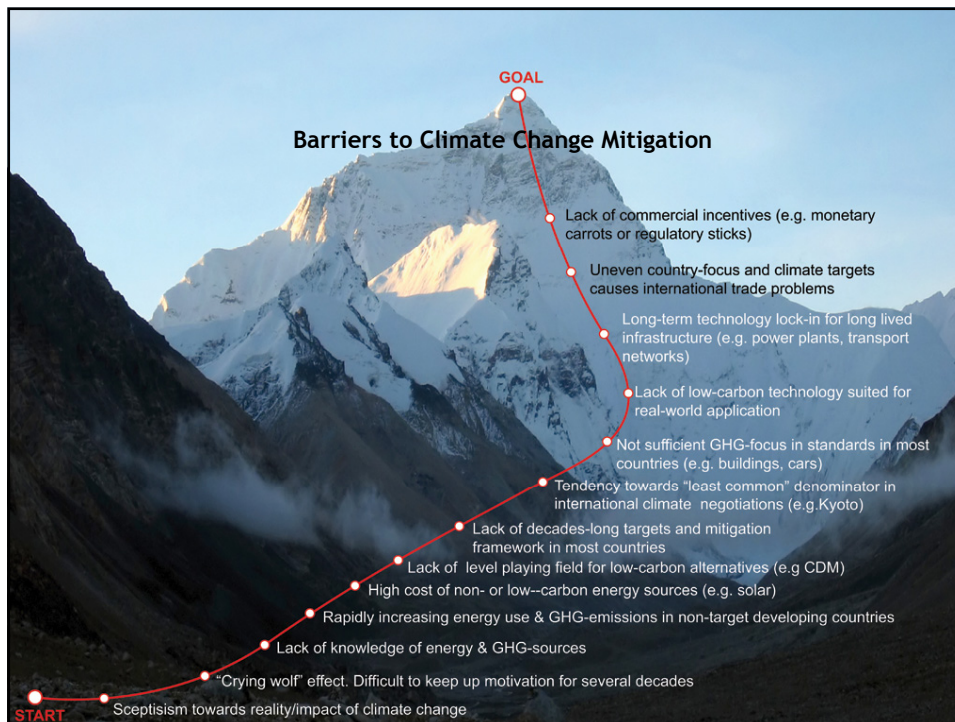
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The Natural Gas Industry; Its Emissions and Areas of Climate Action

- The average of own consumption plus losses for production and processing of natural gas amounts to about 3,5 percent of the throughput with LNG production well above this average
- The energy consumption from the transmission stage is closely connected to the transportation distance both for pipelines and LNG-shipment. For pipelines the average is about 4,5 percent of throughput, 9/10 of which is energy use
- Climate actions in the gas industry are typically:
 - Energy efficiency improvement
 - Cutting flaring and venting emissions
 - The use of renewables in own operations
 - And last, but not least → geological storage of CO₂

	Production	Transmission	LNG production	LNG transport	LNG regasification	Storage		Distribution
	Average	Average	Average (existing)	BAT (1000 km)	Average	Min	Max	Average
Percentage covered	54%	79%	69%	N.A.	27%	N.A.		34%
Natural gas consumption:	3,52%		10,3%					
- Energy	2,73%	4,1%	8,8%	0,21%	0,43%	0,13%	2,0%	0,16%
- Fugitive/venting	0,58%	0,4%	0,2%		0,00%	0,00%	0,10%	0,42%
- Flaring	0,48%		0,5%					
Electricity (MJ/Nm ₃)					0,042	0,047	0,205	0,003
Fuel oil (MJ/Nm ₃)				73,8				
Emissions (g/Nm ₃)								
CO ₂	62,05	132,12	280,22	9,59	8,88	3,39	10,80	0,16
CH ₄	4,01	3,35	5,90		0,03	0,16	0,75	4,32
NO _x	0,07	0,05	0,99	0,01	0,004	0,002	0,10	
SO ₂			0,003	0,01				

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The Main Messages

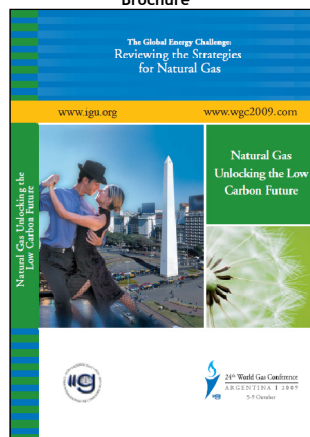
- As we are faced by climate change, natural gas may for many decades serve as a bridge towards a less carbon intensive society
- Natural gas - consisting mainly of methane (CH₄) - is by far the most clean-burning of the fossil fuels
- Natural gas is already contributing to a lower global climate footprint by replacing more carbon rich (and hydrogen-poor) coal and oil. This role can be greatly expanded in the next decades through:
 - Expansion of the geographical availability of gas
 - Promote natural gas use in transportation (land, sea)
 - Cooperation with renewable energy sources
 - Using the expertise and empty reservoirs of the gas industry to make geological storage of carbon dioxide (CO₂) a truly global climate solution

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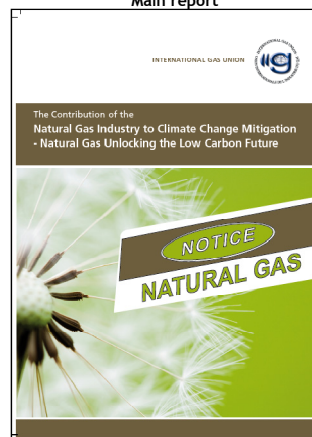


Reports available from the IGU climate project on www.igu.org:

Brochure



Main report



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