



Annual Conference, Vienna, June 24 - 25, 2010

**Gas storage development in a low-carbon energy world:
Underground gas storage, today and tomorrow**

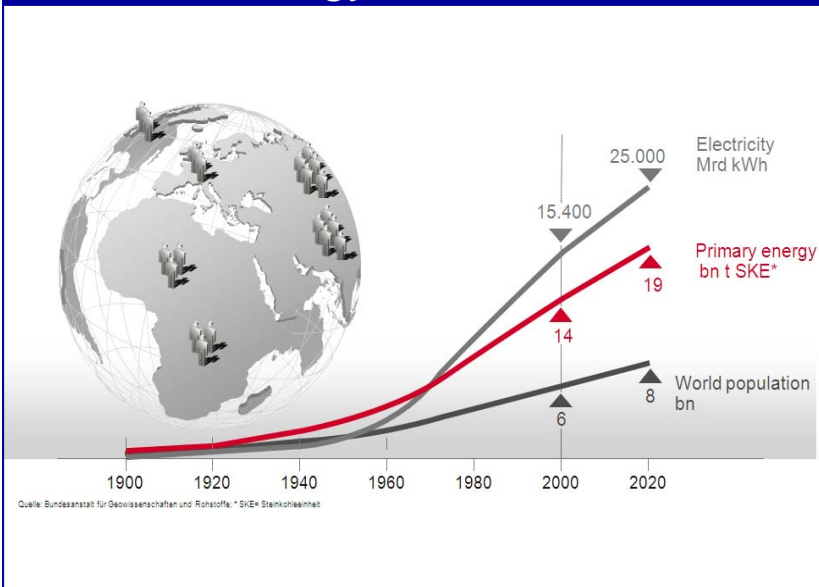
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Vice-President, Gas Storage Europe

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- II. Market challenges & the role of gas storage
- III. Storage for new technologies
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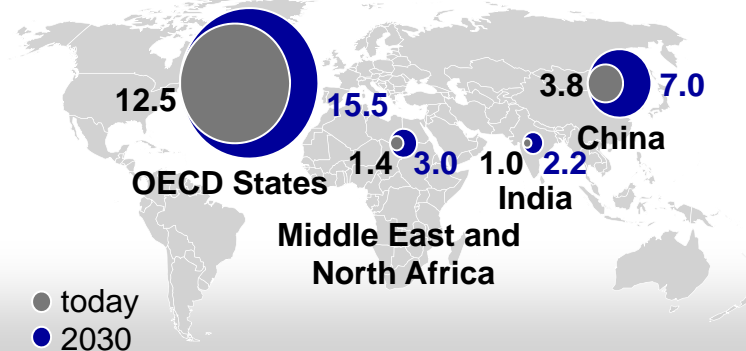
We are facing a global challenge

Growing world population is driving energy demand...



... and is predicted to increase greenhouse gas emissions

Increase in CO₂ emissions by regions until 2030 (billion tonnes)



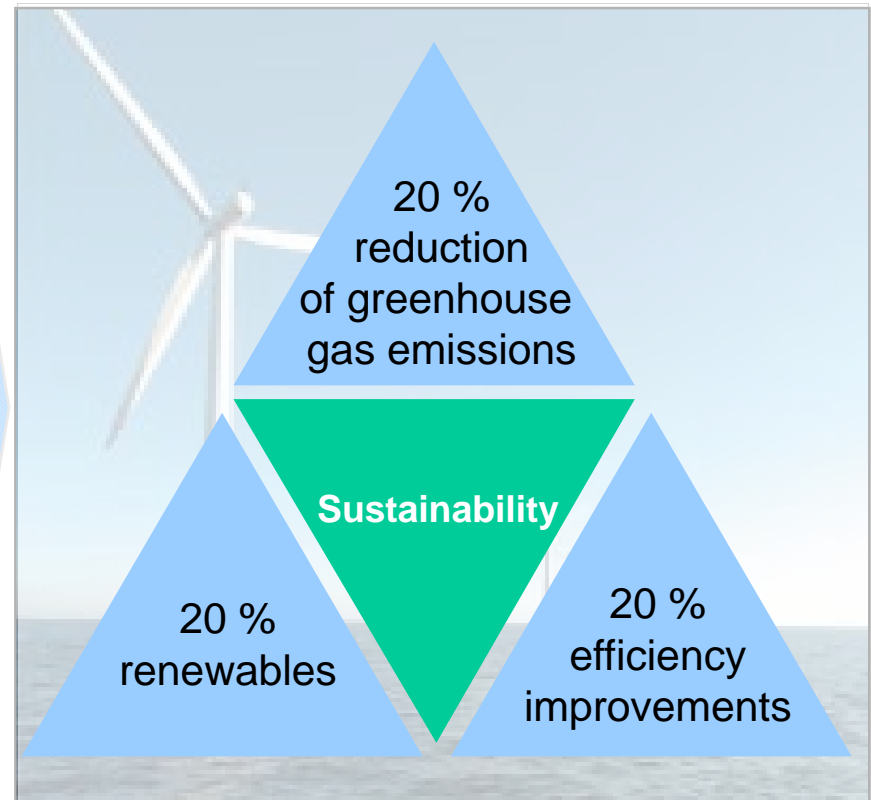
How can gas storage contribute to meeting the challenge ?

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EU target 2020: 20 % reduction of greenhouse gases

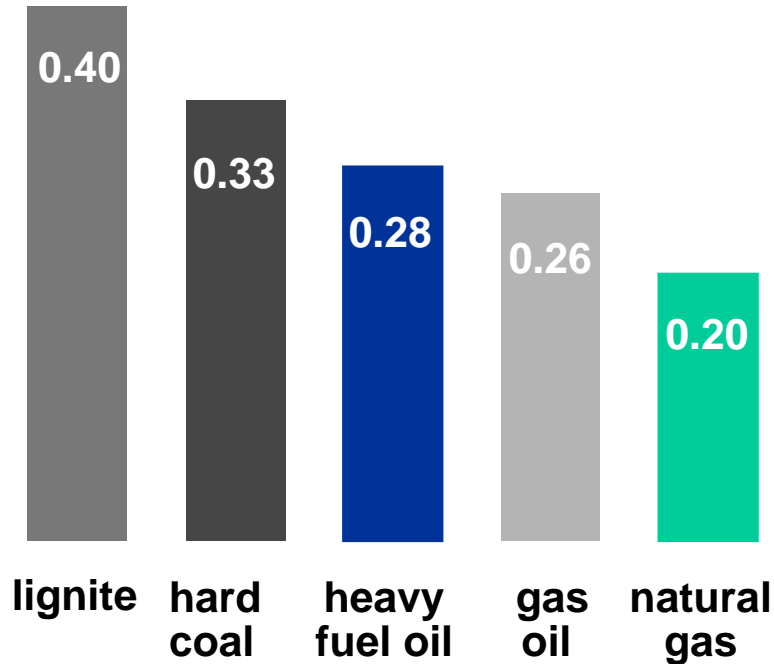
- **Increase in energy efficiency**
 - Reduction of primary energy consumption by 20% until 2020
 - Increase of cogeneration plants and local and district heating
 - Energy labelling
 - Buildings Directive II
- **Increase in renewables**
 - Minimum of 20% share of energy consumption in 2020
 - Promotion of wind, solar, bio fuels, biomass



Natural gas – particularly suited to reducing emissions

CO₂ formed by combustion of fossil fuels

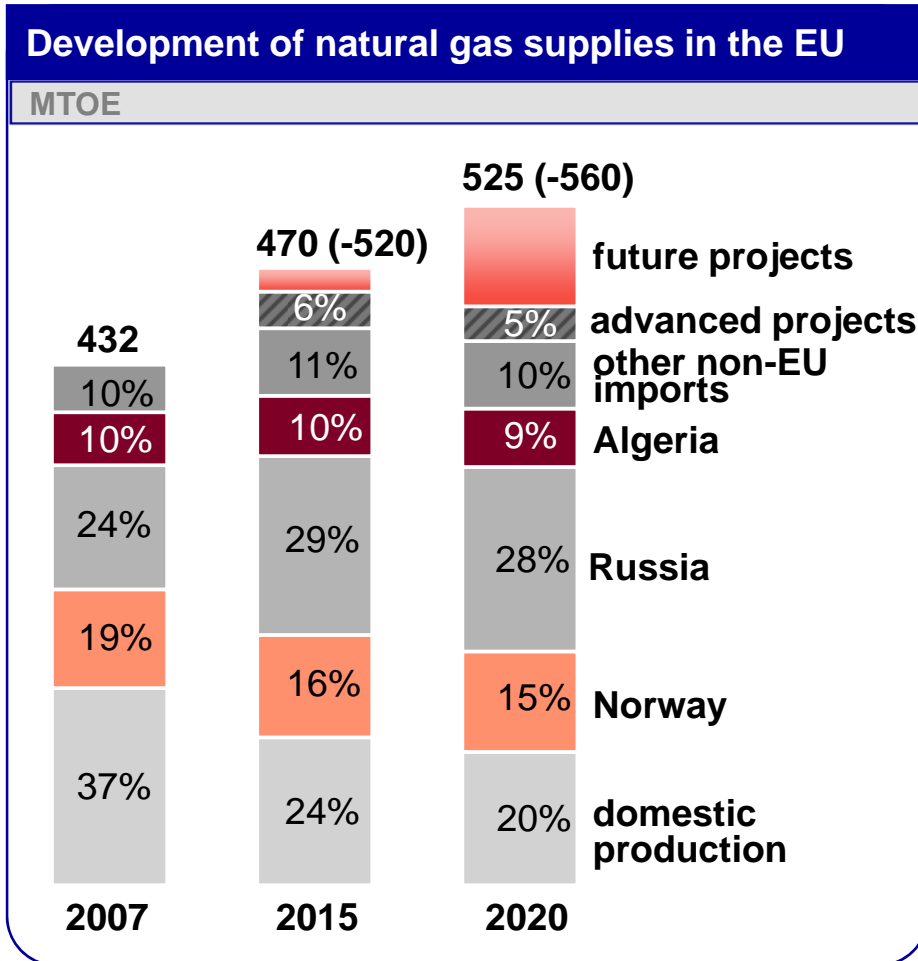
(kg CO₂/kWh fuel input)



Key facts

- Fossil fuels are still required to meet world's energy demand in the future: share of natural gas increasing
- Natural gas has the lowest carbon content of all fossil fuels.
- Extended use of gas in existing and new application areas helps to achieve a reduction in CO₂ emissions.
- “Natural gas goes renewable” Integration of biomethane leads to further CO₂ reductions

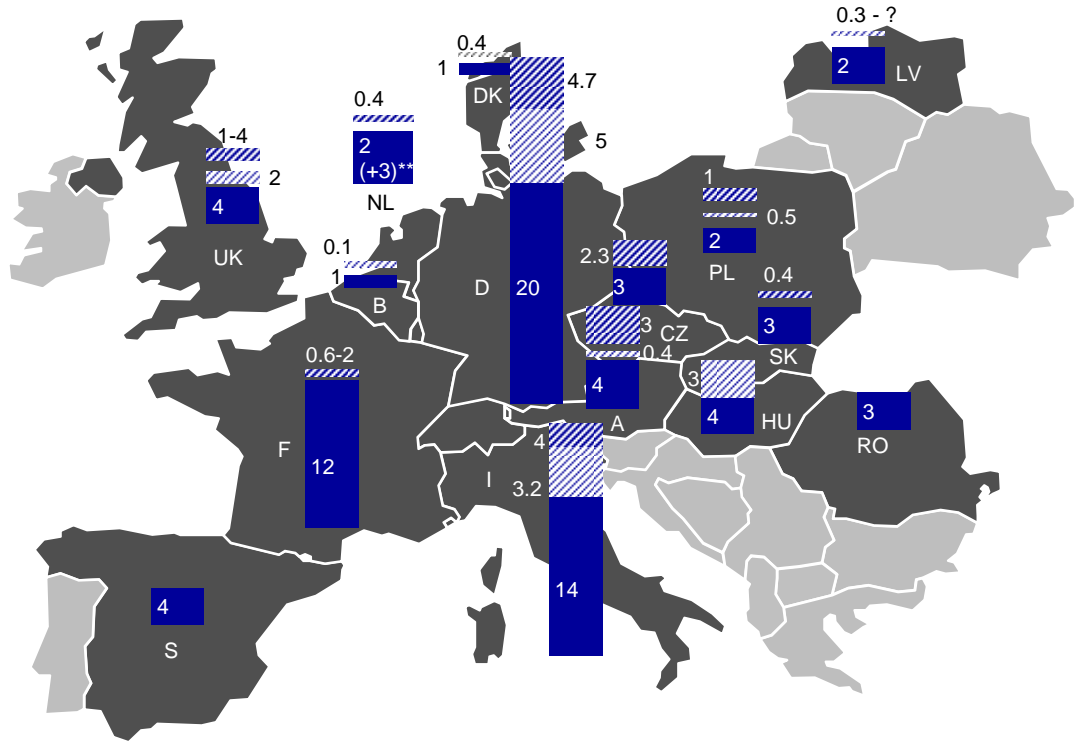
Rising demand for natural gas can be met by supplies ... however, European import reliance and thus transport distances will increase



- Domestic production is expected to fall by over 40% in 2020: Import ratio >72%
- Growing need for imports and locations of gas reserves lead to more long-distance/baseload gas transportation.
- Inevitably stronger integration into global gas developments
- Supply security will need to be actively managed.
- Increase in gas storage demand

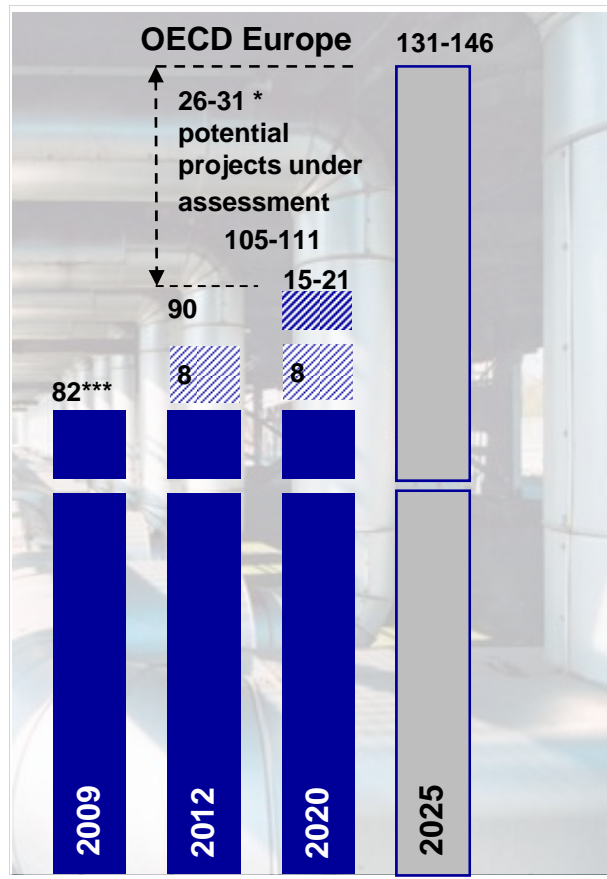
Are we prepared to face the rising demand? Europe can develop enough storage capacity to secure supplies

Working gas in bcm

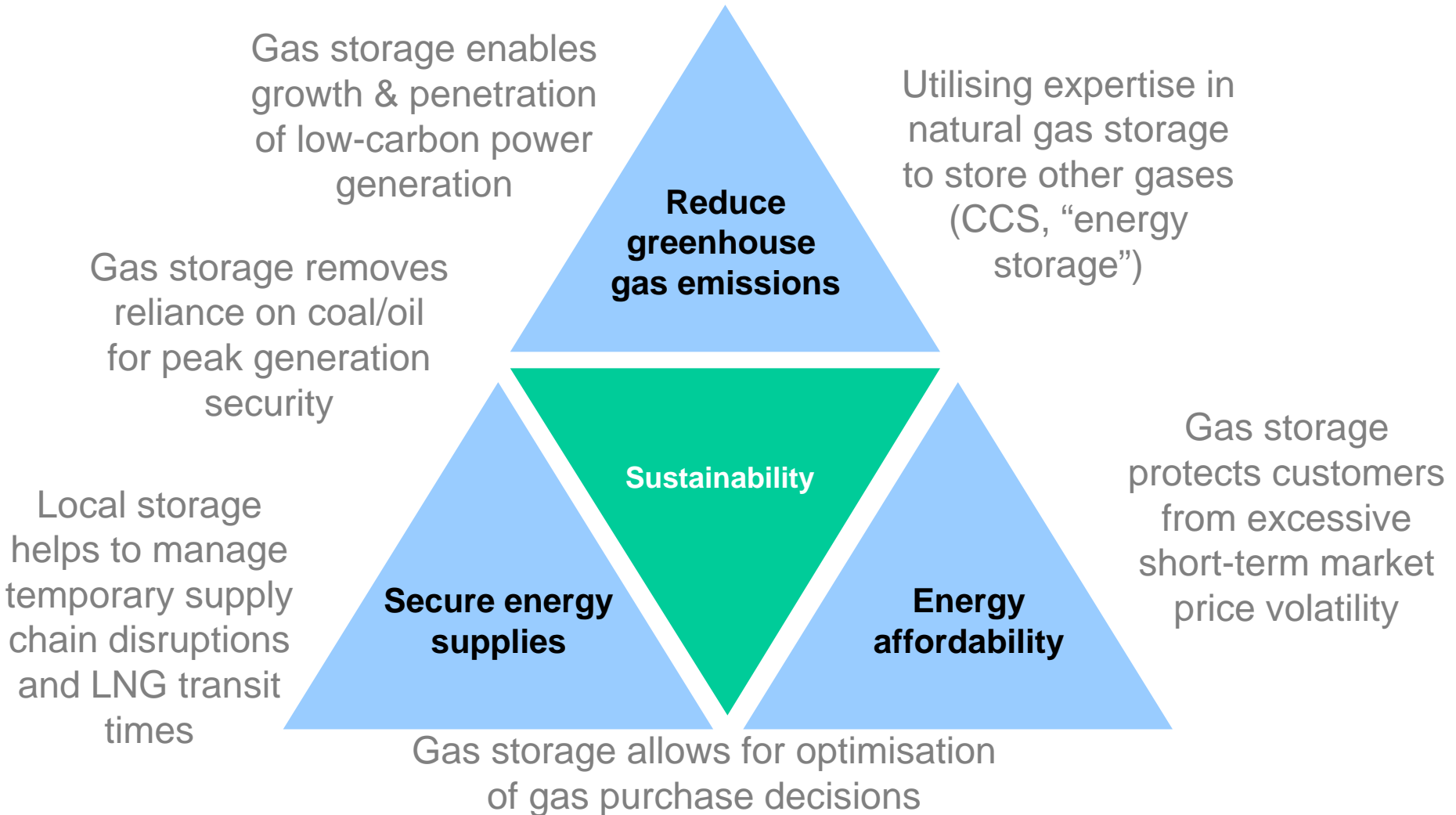


Capacity 2009
 Build-up until 2012 (under construction)
 Build-up 2012 - 2020 (planned)
 Demand forecast until 2025 (EU OECD)

* GSE publication 01/2009: up to plus 60 bcm planned until 2015; ie. nearly doubling of the 2006 capacities
 ** NL: ~3 bcm exempted for production purposes
 *** as of July 2009 GSE Storage Map



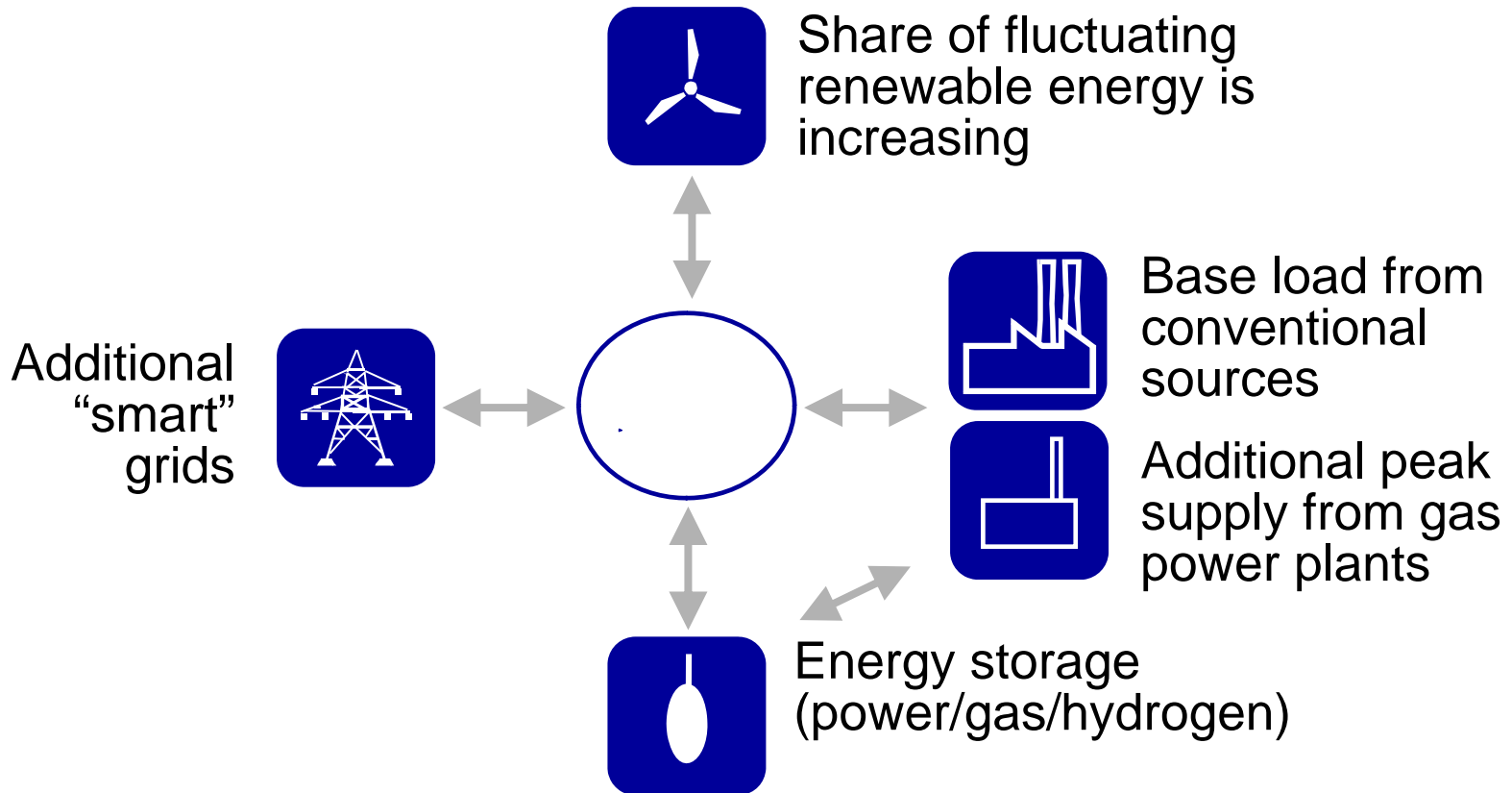
Market challenges and the role of gas storage



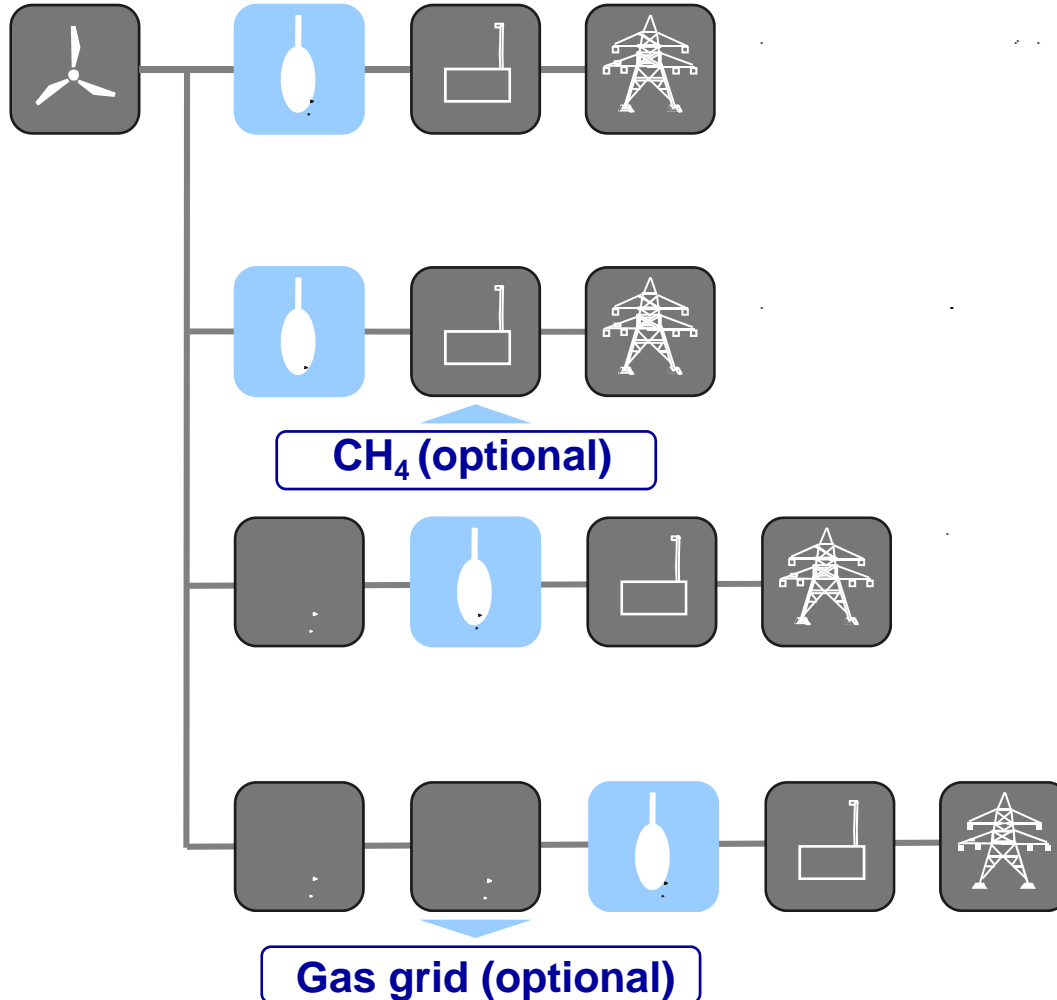
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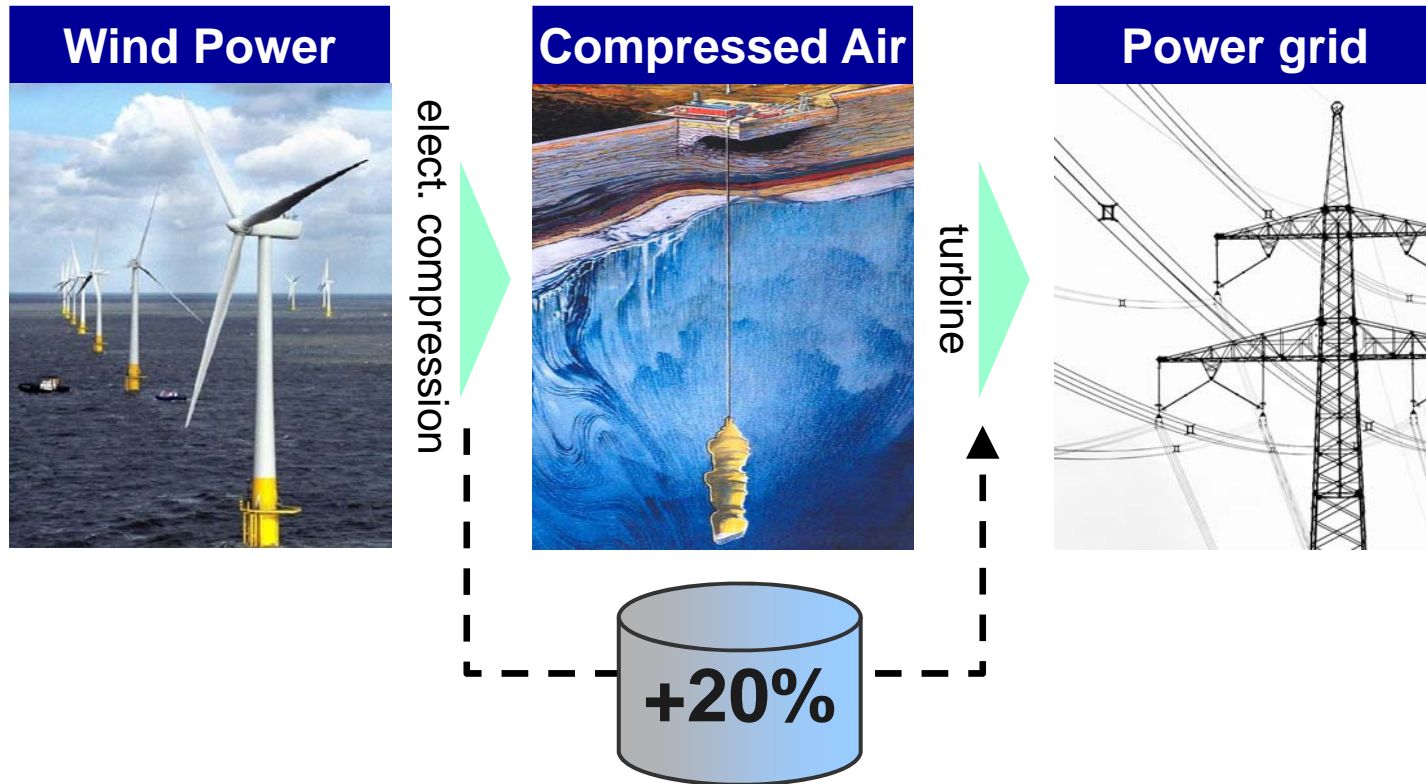
The energy system will need more flexibility to accommodate the increasing share of renewable energies



Different concepts with underground storage



Concept of Compressed Air Energy Storage (CAES and A-CAES)

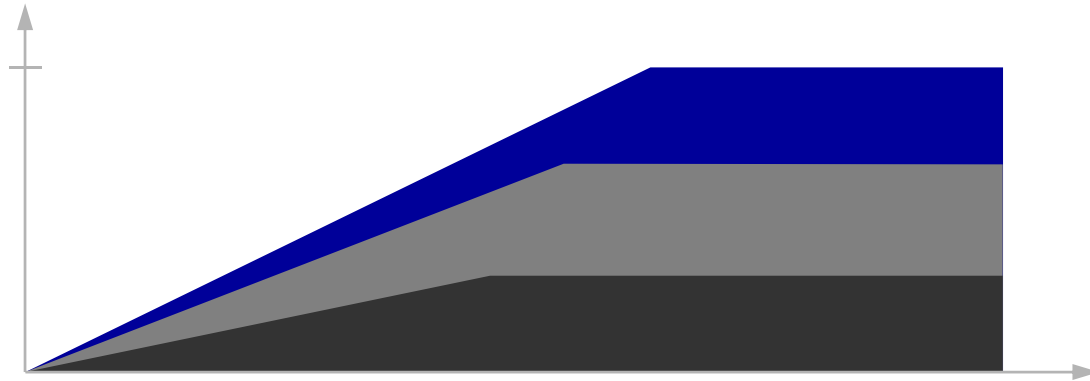


**Efficiency is around 50%,
heat storage improves efficiency to 70%**

Why underground storage?

Underground energy storage ...

- is proven technology,
- provides quickly high power rates over several hours,
- has little impact on the environment,
- complements regionally with pumped hydro,
- Energy storage is a prerequisite for the development of renewable energies,
- has a market: 80 TWh would be the European demand for adiabatic CAES, assuming 100% renewable energies and an optimum extension of the grid.



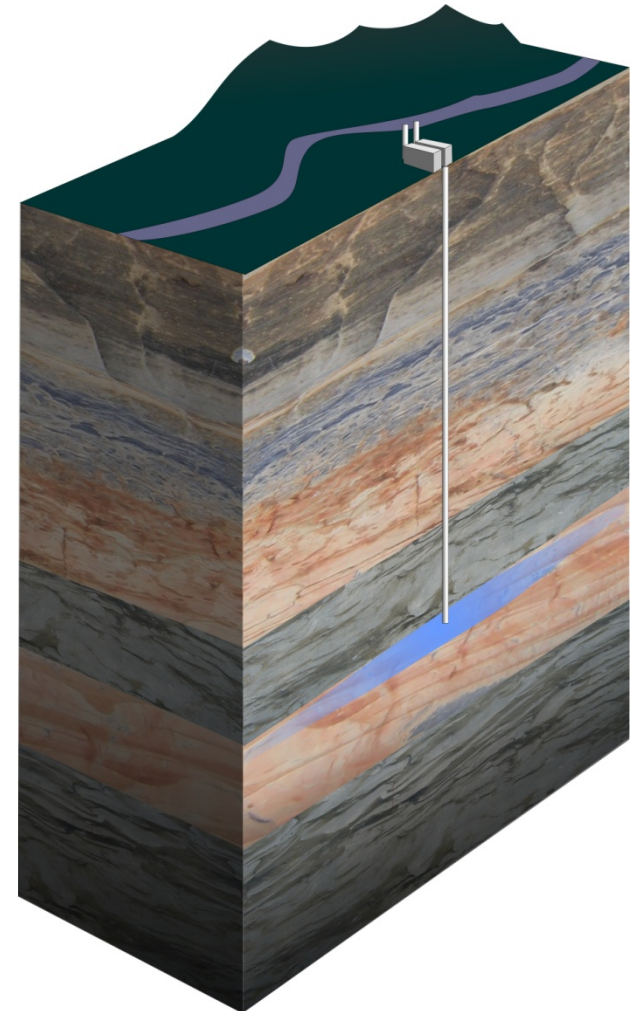
Carbon Capture and Storage (CCS)

Carbon **Capture (1)** and **Transport (2)** and permanent **Storage (3)**
in deep porous rock reservoirs in depths of more than 1,000 m

Coal-fired power plant with CCS technology
or other industrial source

CO₂ storage provides ...

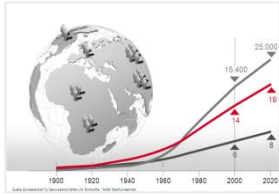
- climate protection
- security of supply
- a bridging technology
- modern infrastructure
- export of technology
- international energy policy



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Conclusions



Global Challenge I: Increasing import dependency

Global increase in demand and competition for natural gas:
Gas storage facilities are needed to structure and secure imports.



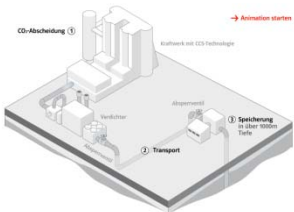
Global Challenge II: Meeting climate protection targets

Decrease of conventional and growth in renewable power will increase the demand for flexible power supply ... and drive the need to use natural gas and advanced gas storage technologies.



Power from natural gas will be of increasing importance

Natural gas can already be combined effectively with renewables. By adding biomethane, natural gas “goes renewable”. The integration of biomethane leads to further significant reductions of CO₂ emissions.



Underground storage for new technologies

A-CAES competes against pump storage, flexible gas power plants, and management of the demand side. CCS can help to “clean up” conventionals.