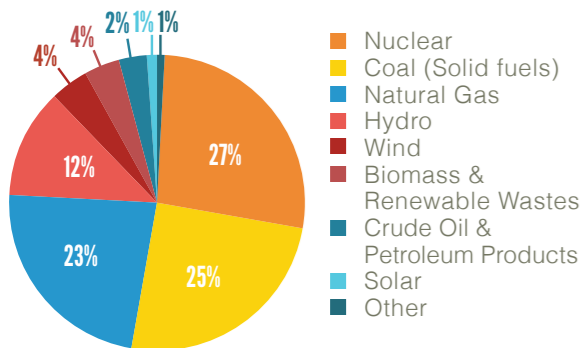


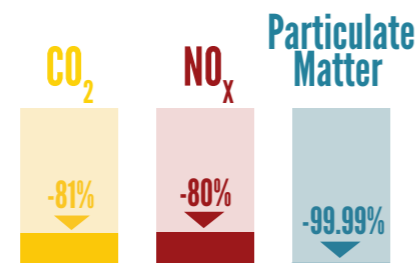
# Step 1 Reducing emissions with natural gas for power generation

# Step 2 Cleaner air with natural gas for transport

Gross Electricity Generation EU-27 by fuel, 2010<sup>(i)</sup>

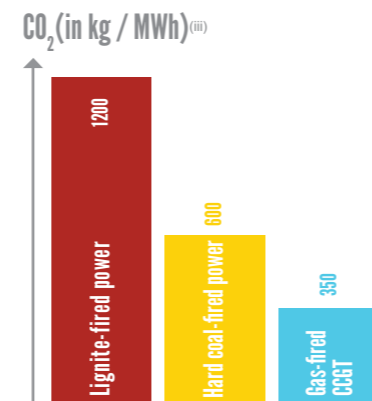


Natural gas power generation emits up to...



... less than coal.<sup>(ii)</sup>

Gas: The cleanest fossil fuel



Emission by fuel type

## Competitive technologies ensure natural gas for power generation is more EFFICIENT and FLEXIBLE

Coal Plant



Energy efficiency  
33-45% of primary energy is transferred into electrical power<sup>(iv)</sup>

Flexibility  
Time to full power generation capacity: >180 minutes<sup>(v)</sup>

Combined-Cycle Gas Turbine (CCGT)



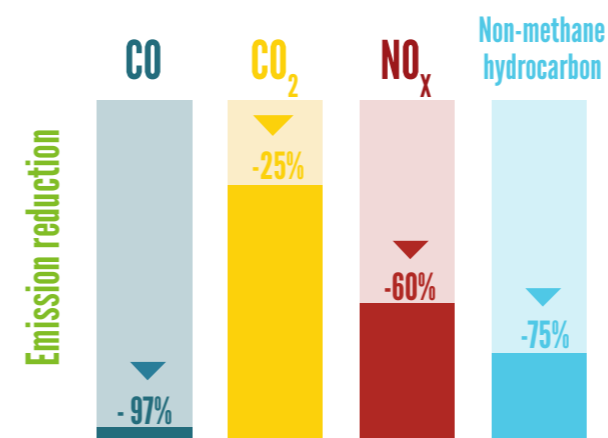
Energy efficiency  
55-60% of primary energy is transferred into electrical power

Flexibility  
Time to full power generation capacity: 60-90 minutes

Switching of all coal-fired power plants to modern natural gas fired plants could reduce EU power sector CO<sub>2</sub> emissions by almost **60%**<sup>(vi)</sup> and reduce global CO<sub>2</sub> emissions by **20%**<sup>(vii)</sup>

Natural gas is well suited for use in fleet vehicles in urban environments, increasing energy efficiency while reducing emissions. Opportunities also exist for the use of liquefied natural gas (LNG) for heavy duty trucks and in shipping.

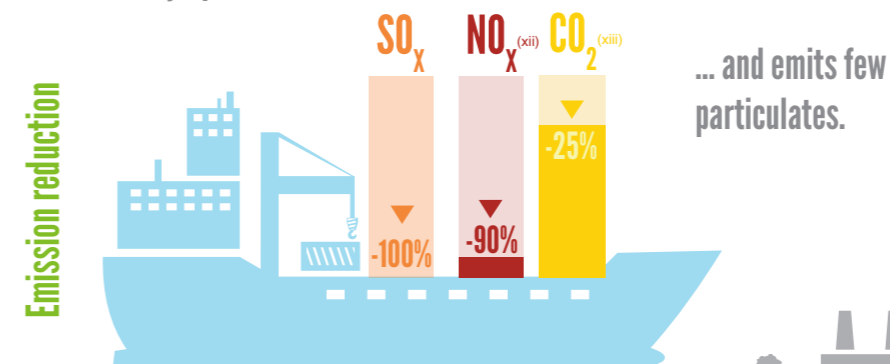
Compressed Natural Gas (CNG) vehicles reduce emissions<sup>(x)</sup> by up to:



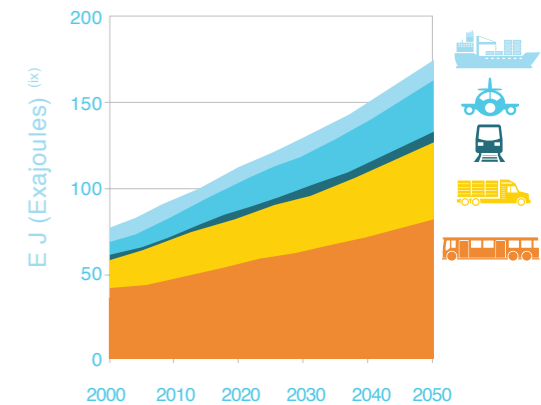
CNG should increasingly be used in urban fleets of buses, utility trucks and taxis.<sup>(xi)</sup>



Liquefied natural gas (LNG) is the alternative shipping fuel, reducing emissions by up to:



Projected growth of energy use in the global transportation sector



## EU ALTERNATIVE FUELS STRATEGY<sup>(xiv)</sup>

- GasNaturally supports the proposed strategy's ambitions to deploy CNG and LNG in Europe.
- A switch to CNG in vehicle fleets and to LNG for heavy-duty vehicles should be prioritised.
- Switching to natural gas will deliver not just CO<sub>2</sub> emissions reductions but also significant air quality benefits for citizens, with lower NO<sub>x</sub> emissions, lower SO<sub>x</sub> and few particulates.
- Developing refueling infrastructure for LNG in shipping for ports of the TEN-T core network will help reduce maritime sulphur emissions.

## About air quality and emissions<sup>(viii)</sup>

### Pollution/Emissions Sources

### Environment/Health Effects



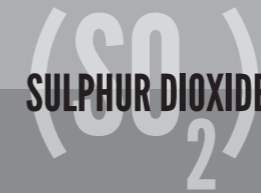
Combustion of fuels such as coal, oil, natural gas and biomass for industrial, domestic and transport purposes.

CO<sub>2</sub> is the most significant greenhouse gas influencing climate change.



Fuel combustion, such as from power plants, industrial facilities & transport.

Acidification and eutrophication of water and soils. Formation of particulate matter and ground-level ozone. Adverse effects on human respiratory systems.



Fuel combustion of fuels containing sulphur.

Acidification of local environments.



Industry, shipping, coal combustion, wood combustion, etc.

Can cause or aggravate cardiovascular and lung disease.

# Step 3 New technologies, natural gas & air quality

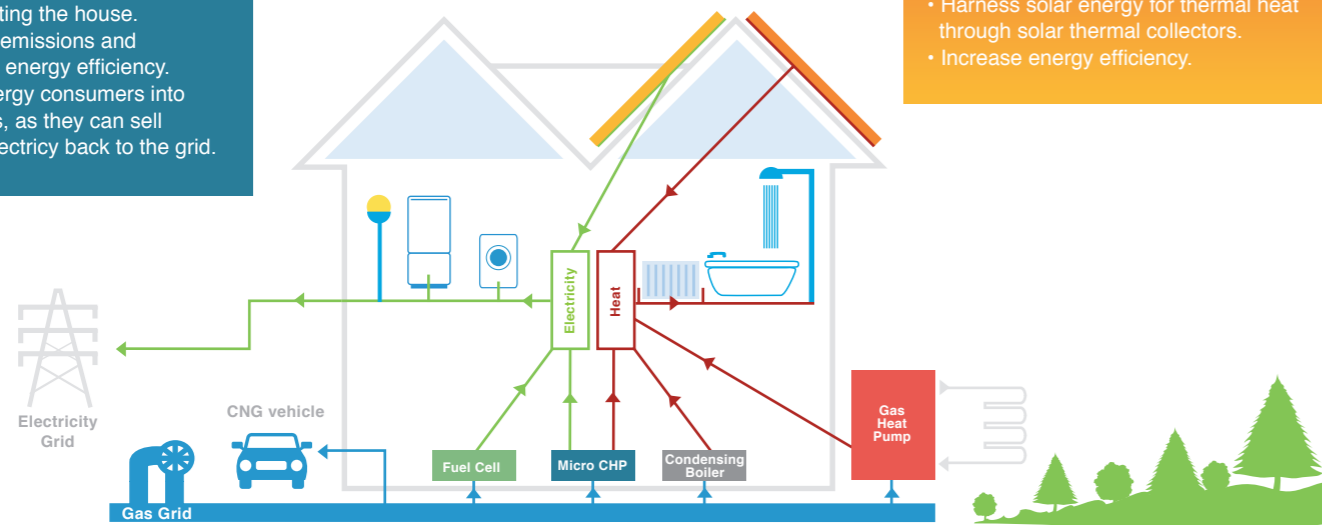
New technologies are making gas use in households more **energy efficient** and less polluting

## Micro-CHP Unit

- Micro combined heat and power (Micro-CHP) generates power while heating the house.
- Reduces emissions and increases energy efficiency.
- Turns energy consumers into producers, as they can sell excess electricity back to the grid.

## Solar Energy Systems

- Use solar energy to generate power through photovoltaics.
- Harness solar energy for thermal heat through solar thermal collectors.
- Increase energy efficiency.



## Fuel Cells (technology in development)

- Convert natural gas into ultra-clean hydrogen.
- Stationary fuel cells are used for commercial, industrial and residential primary and backup power generation.
- Are clean (no emissions) and dependable (can operate for 1000s of hours) power generation. <sup>(xv)</sup>

## Gas Heat Pumps

- Use conventional refrigeration technology to extract the sun's energy stored in the environment and raise it to a temperature suitable for heating purposes.
- Are more efficient than an electric heat pump.

# Air quality and natural gas

3 Steps to a Cleaner Energy Future for Europe

## REFERENCES

- <sup>i</sup> European Environment Agency, "Revealing the costs of air pollution from industrial facilities in Europe" Report, November 2011.
- <sup>ii</sup> European Commission, EU Energy in Figures – Statistical Pocketbook 2012.
- <sup>iii</sup> Gas Naturally, "Gas: Cleanest Fossil Fuel" 2012.
- <sup>iv</sup> IGU - Global Vision for Gas - The Pathway towards a Sustainable Energy Future.
- <sup>v</sup> GasNaturally, "A cleaner energy source," 2013
- <sup>vi</sup> Wärstillää, "Smart Power Generation," 2012
- <sup>vii</sup> IHS CERA, "Sound Energy Policy for Europe - Pragmatic Pathways to a Low-Carbon Economy," 2011. p24.
- <sup>viii</sup> International Gas Union: News, views and knowledge on gas- worldwide 2010 pg. 6.
- <sup>ix</sup> International Gas Union, "Natural Gas Unlocking the Low Carbon Future." September 2010.
- <sup>x</sup> The U.S. DoE Alternative fuels & Advanced Vehicles Data Centre: (International Gas Union: News, views and knowledge on gas – worldwide, 2010 pg. 6).
- <sup>xi</sup> European Commission Communication: Clean Power for Transport: A European Alternative fuels strategy, pg. 6.
- <sup>xii</sup> DNV (Det Norske Veritas), "LNG offers best impact on local environment." 2011.
- <sup>xiii</sup> European Commission Staff Working Document: Actions towards a comprehensive EU framework on LNG for shipping, 24 - 1 - 2013, pg. 6.
- <sup>xiv</sup> European Commission Staff Working Document: Actions towards a comprehensive EU framework on LNG for shipping, 24 - 1 - 2013, pg. 6 and International Gas Union: News, views and knowledge on gas – worldwide, 2010 pg. 46.
- <sup>xv</sup> U.S. Department of Energy, Energy Efficiency and Fuel Cell Technologies Program "Comparison of Fuel Cell Technologies". February 2011

