Natural gas, part of an efficient sustainable energy future

The Dutch case

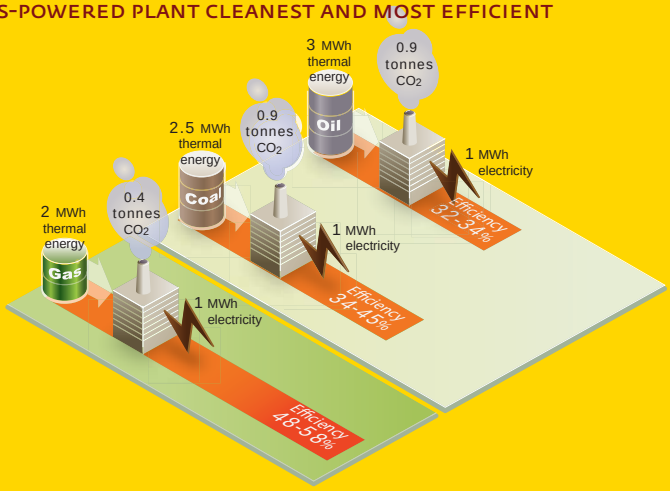
gasunie

1 Natural gas is the cleanest fossil fuel.

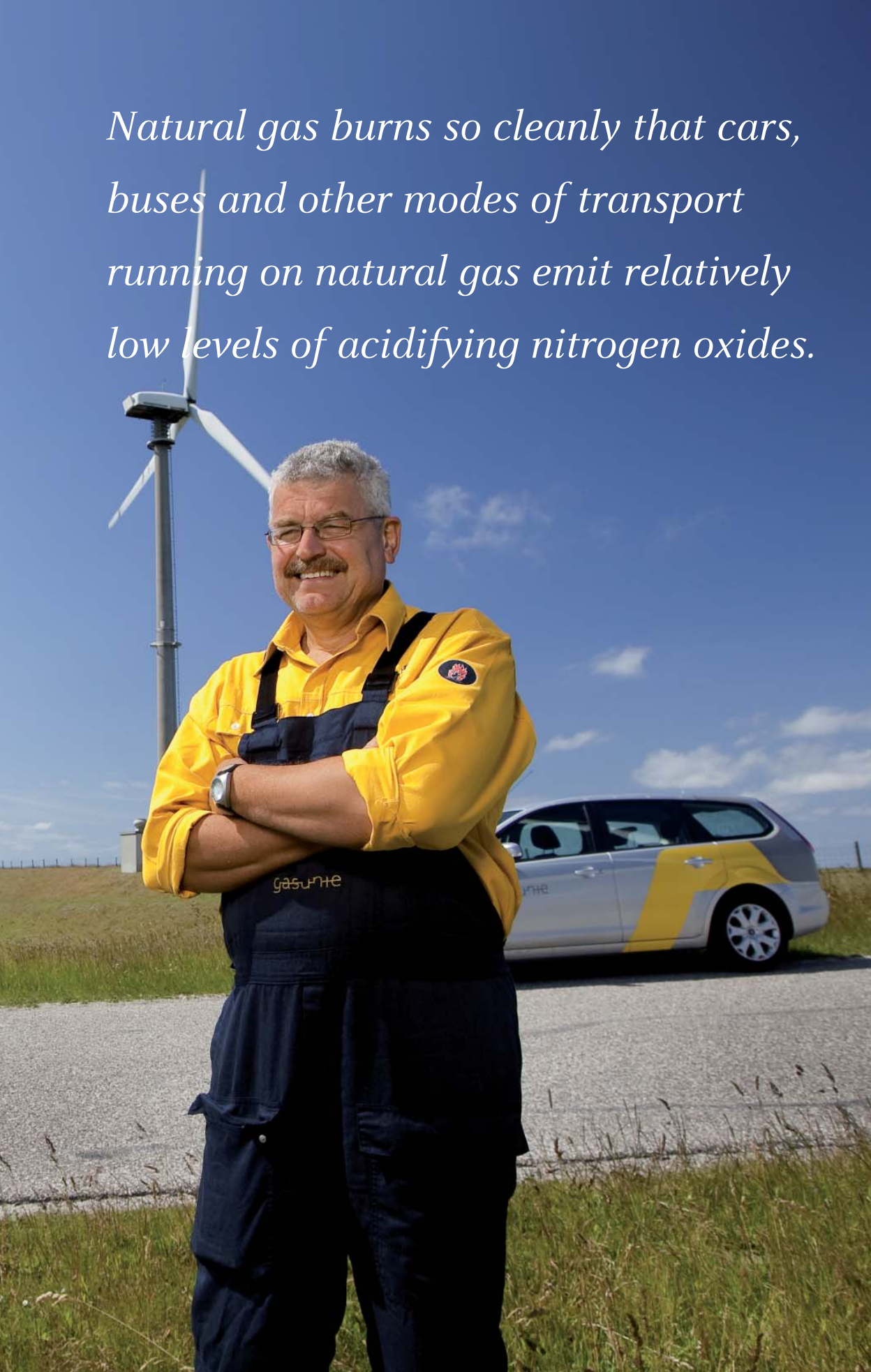
The Dutch energy supply relies on natural gas for approximately half of its energy requirements. 96% of all households, businesses and buildings are connected to the natural gas network. This makes natural gas the backbone of the energy supply.

It is also the fossil fuel with the lowest CO_2 emissions. Using coal to produce one unit of heat releases 100% more CO_2 than when natural gas is used and using oil releases 40% more. Natural gas is also more efficient in the production of electricity (see illustration). That's one of the reasons – but not the only one - why natural gas can make a huge contribution towards pushing back CO_2 emissions in the future and thus towards the energy transition that is necessary to make the energy supply sustainable.

GAS-POWERED PLANT CLEANEST AND MOST EFFICIENT



Natural gas burns so cleanly that cars, buses and other modes of transport running on natural gas emit relatively low levels of acidifying nitrogen oxides.



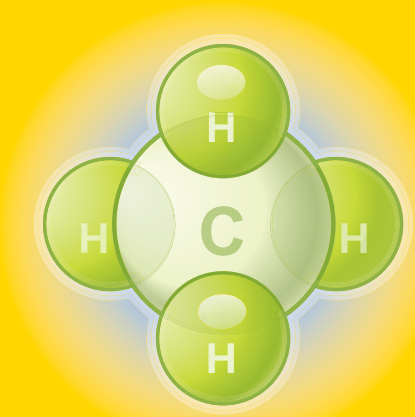
Natural gas does not contain sulphur and hence produces no acidifying sulphur oxides on combustion. It also releases fewer fine particles than other fuels and minimal quantities of other substances that are harmful to health and environment. Natural gas burns so cleanly that cars, buses and other modes of transport running on natural gas emit relatively low levels of acidifying nitrogen oxides (NOx). The extraction of natural gas from the ground is also carried out with great consideration for the environment.

It is Europe's intention to have reduced CO_2 emissions by 20% by the year 2020 (compared to 1990). The Netherlands wants to achieve a 30% reduction by 2020, and further reductions thereafter. A country that relies so heavily on natural gas can realise such a reduction for a large part via natural gas:

- by using more natural gas instead of less clean fuels and
- by increasing the sustainability level of natural gas, by adding green gas.

This is a way of making the energy supply more sustainable whilst retaining all the advantages of the existing natural gas supply.

The simple composition of natural gas - CH_4

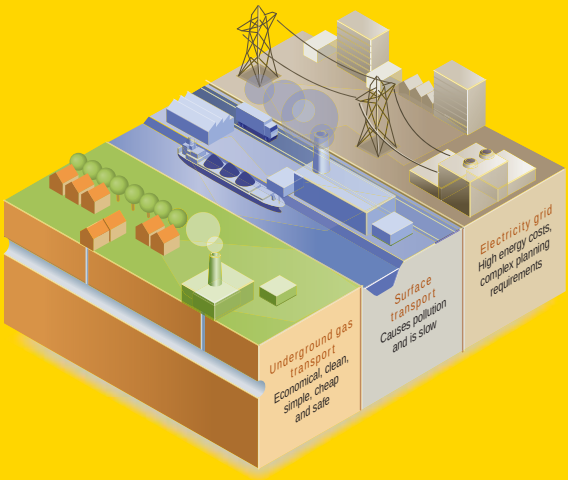


The simple composition of natural gas means that it burns extremely cleanly. CH_4 is a light molecule which explains the gaseous form. This ensures optimal combustion. For every carbon atom there are four hydrogen atoms, which leads to a very beneficial ratio between energy output and CO_2 production.

Underground gas transport has a relatively light impact on the environment compared to the surface transport of energy by lorry, train or ship.

2 The most efficient, affordable, reliable, safe and clean method of energy transport is underground by pipeline in gaseous form

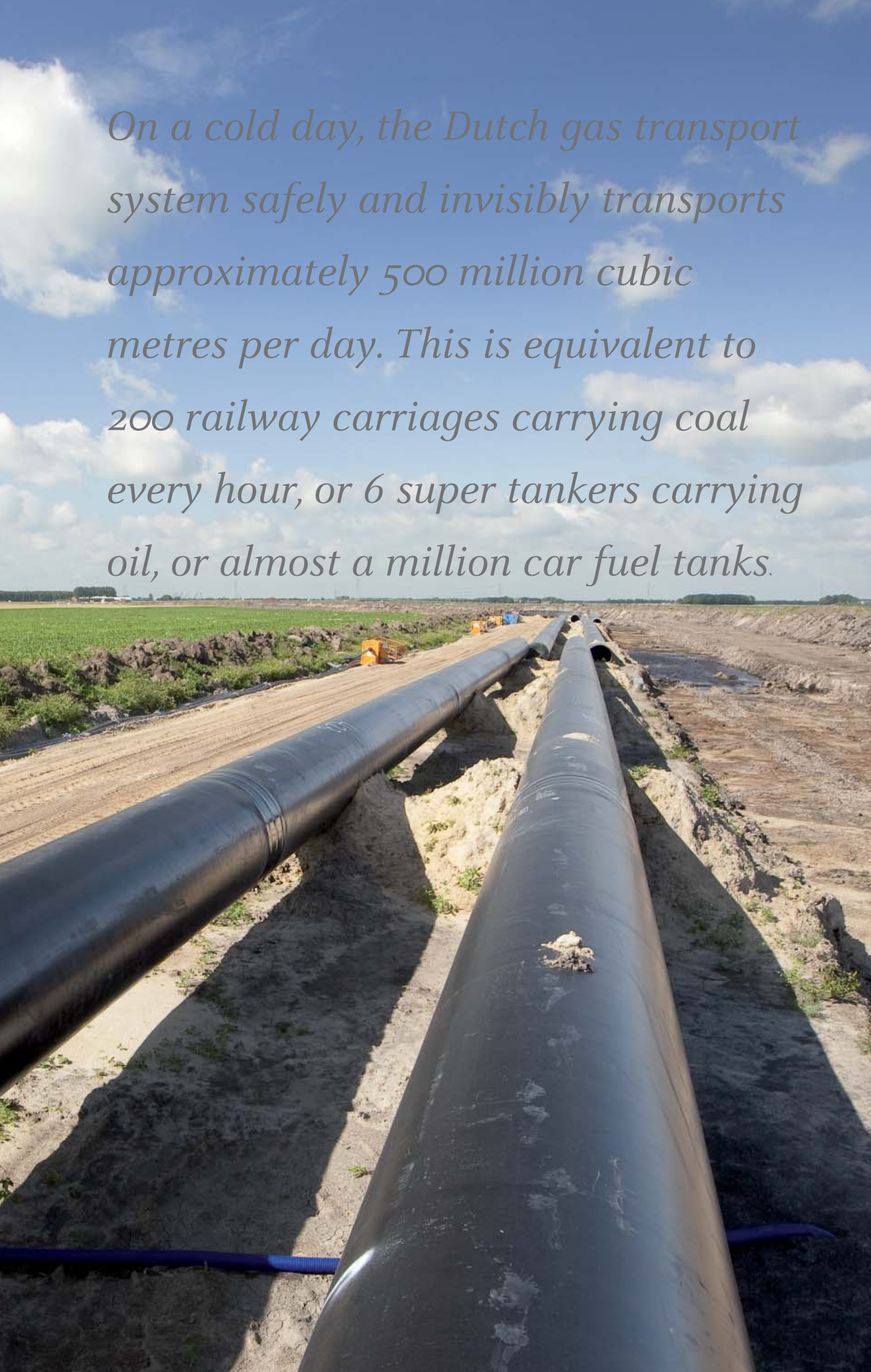
Energy transport modalities



Natural gas transport is one of the safest methods of energy transport and comes through every safety comparison study with flying colours. The track record on gas transport safety in the Netherlands over the past 50 years has been excellent.
Unlike the transmission of electricity or the transport of coal, gas transport takes place underground. The Netherlands is home to a main gas transmission network extending to 12,500 kilometres, which is in harmony with the landscape. When new, underground pipelines are constructed, they cannot be seen or heard after construction work has finished. Transporting energy in the form of gas through an underground transport network places a minimal burden on public spaces. It is also less vulnerable to external disruptions.

Transporting energy in the form of gas is considerably cheaper than via electricity. This makes an approximate difference of a factor of 20.

An enormous quantity of energy is transported to millions of users almost invisibly every day, every second, at high pressure, via this sophisticated, dense gas infrastructure. This is carried out efficiently, safely and reliably.



On a cold day, the Dutch gas transport system safely and invisibly transports approximately 500 million cubic metres per day. This is equivalent to 200 railway carriages carrying coal every hour, or 6 super tankers carrying oil, or almost a million car fuel tanks.

3 Natural gas and green gas: the ideal fit for the future.

One particular feature of natural gas is that it can be mixed with other gases. For instance with biogas, which is created from the fermentation of organic material like VFG (vegetable, fruit and garden) waste or residual waste streams from agricultural activities, which do not represent any competition to food production. Production of biogas fits in well on a farm or a group of farms. They also include gases of natural gas quality, produced by high-temperature 'gasification' of biomass, which in future might take place on large-scale basis.

There is a large potential for the production of green gas in the near future. In order to stimulate the market for green gas, Gasunie has set up a certification system called Vertogas for reliable trading in green gas. Green gas could have a share of three percent in the Dutch gas supply by 2015. By 2030 it is considered possible that this proportion will have risen to around twenty percent. Green gas opens up new perspectives. It is particularly promising for the transport sector which is seeking low-carbon alternatives.

Three percent share in the natural gas supply by 2015 perhaps does not seem spectacular at first glance. However, in terms of CO_2 emission avoided, this corresponds to approximately 3000 megawatts of wind power. This makes green gas an important factor in enabling the Netherlands to fulfil its international climate obligations.

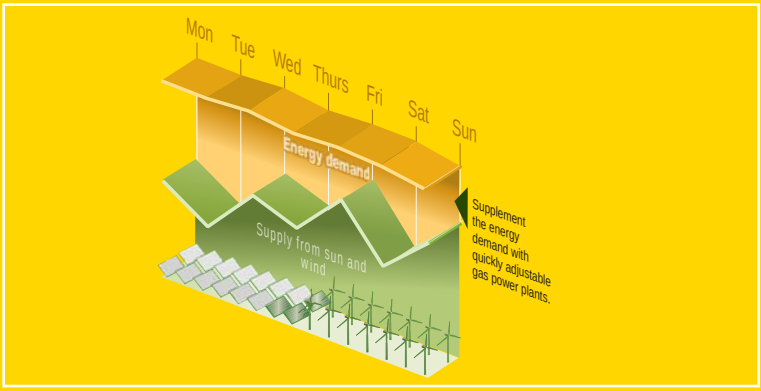
Green gas not only counteracts CO_2 emissions, it can also contribute towards diversification of energy sources. This is an additional reason why the Dutch government decided green gas is part of its energy policy.

Vital to the further development of this green gas perspective is the fact that a sophisticated and robust gas transport network is already in place. It will function as a nationwide – or even Europe-wide – carrier for green gas. In combination with Green Gas Certification, this unlocks the market for green gas. This makes it possible to start the transition towards a sustainable energy transition right now, in an efficient manner.

Natural gas forms the stable and flexible linking element in our future sustainable supply.

4 Natural gas enables solar and wind energy by absorbing fluctuations and keeping demand and supply matched.

Renewable sources of energy such as solar and wind energy play an important part within a sustainable energy supply. A particular characteristic of these sources of energy is that their supply pattern is not stable. The sun does not always shine and the wind does not blow continually. Because sun and wind mainly supply electricity, this presents a challenge for the stability of the electricity supply. In future, the electricity supply will need more and more flexibility to meet this challenge.



If we want to make optimal use of solar and wind energy, we need a flexible source of energy that can be used on demand on a large scale to balance fluctuations in electricity production with customer demand at all times. Power plants which run on natural gas can be adjusted upwards or downwards quickly and easily and can absorb peaks and troughs in energy demand. In this way, natural gas offers the necessary flexibility required to make the application of sustainable sources possible. Using gas means that wind and solar power can always be accommodated as soon as they become available. When the sun and the wind let us down, gas steps in again to meet the need for power. By the application of natural gas we can benefit from sustainable energy to the best extent possible while keeping the energy supply as a whole reliable and stable.

Natural gas forms the stable and flexible linking element in our future sustainable supply.

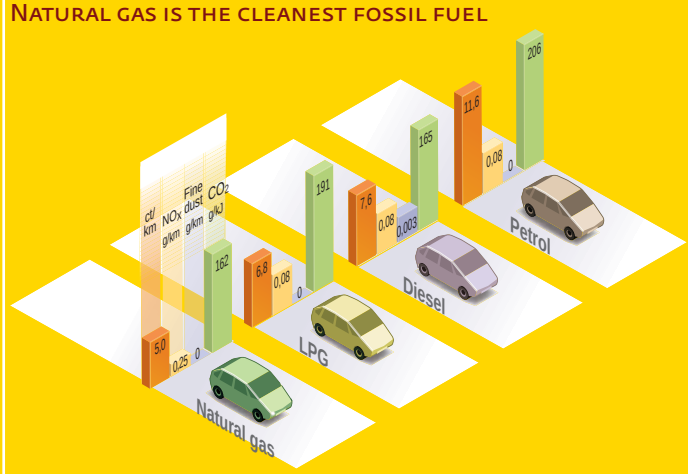
Driving on natural gas represents the link between our current transport system and climate neutral driving in the future.

5 Natural gas can fulfil an important role in the development of sustainable mobility.

In towns and cities the air quality is often a source of great concern. Heavy traffic accounts for a significant part of the problem. This problem can be combated using the cleaner natural gas as a motor fuel rather than diesel or petrol. Air quality in a town will improve significantly if municipal transport, such as buses, taxis and waste trucks switch to natural gas.

As regards CO_2, cars running on natural gas score the same as a modern clean diesel car, but score much better when it comes to fine particles and NO_X. Natural gas does this naturally, without technical measures, because it burns relatively cleanly due to its simple molecular structure

NATURAL GAS IS THE CLEANEST FOSSIL FUEL



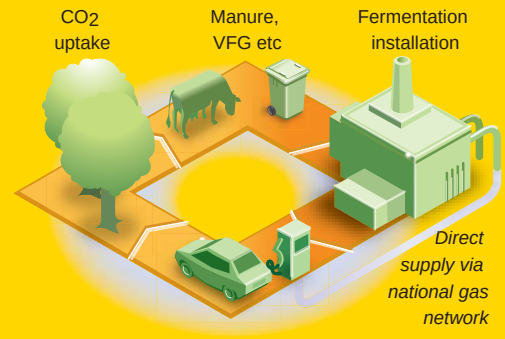
Under pressure from environmental standards, diesel cars are being manufactured to perform ever more cleanly as a result of technological modifications to their exhaust pipes. However, this is a modification after combustion when the pollutant effects have already taken place. These technologies are not yet fully ready for use and will, moreover, involve extra costs.

(source: CROB)

As more green gas becomes available, more drivers will switch to green gas by simply using green gas certification.

Biogas is even cleaner

Driving on fuel made from waste



- *100% climate neutral*
- *No competition to the food chain*
- *Green gas certified supply*

As more green gas becomes available, more drivers will switch from natural gas to green gas by using green gas certification. This will contribute to climate neutral mobility. In this way, driving on natural gas represents the link between our current transport system and climate neutral driving in the future.

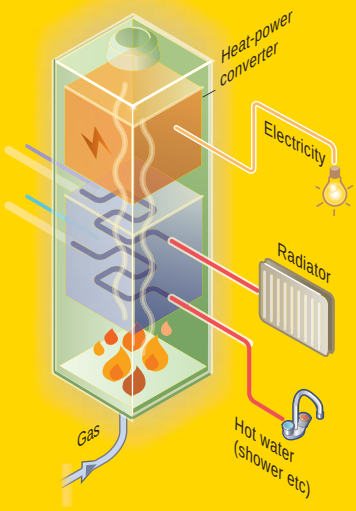
There have been continuous efforts to find ways of using natural gas more cleanly and more efficiently.

6 The use of natural gas is becoming ever more efficient due to new, innovative technologies.

One of the most sustainable ways of saving energy is to use less of it. This is why, since the discovery of natural gas, there have been continuous efforts to find ways of using natural gas more cleanly and more efficiently. The development of the HE boiler is a good example: HE stands for High Efficiency, meaning that a maximum proportion of the gas is converted into heat. HE technology has recently seen a new innovation: the HEe (Dutch: HRe) boiler, also known as a micro-combined heat-and-power system (micro-CHP). This is a central heating boiler that supplies electricity in addition to heat. The electricity can be used in the consumer's own house or supplied back to the electricity grid if there is a (temporary) surplus in one's own house. If all households had a 'mini power plant' like this, a huge energy efficiency improvement would be the result.

Combined heat and power has already been applied within industry, greenhouses and office buildings for a long time on a larger scale. Micro-CHP is specially designed for use in private homes. In addition to the economic advantages for the consumer due to lower energy costs, less energy is consumed with micro-CHP leading to lower CO_2 emissions.

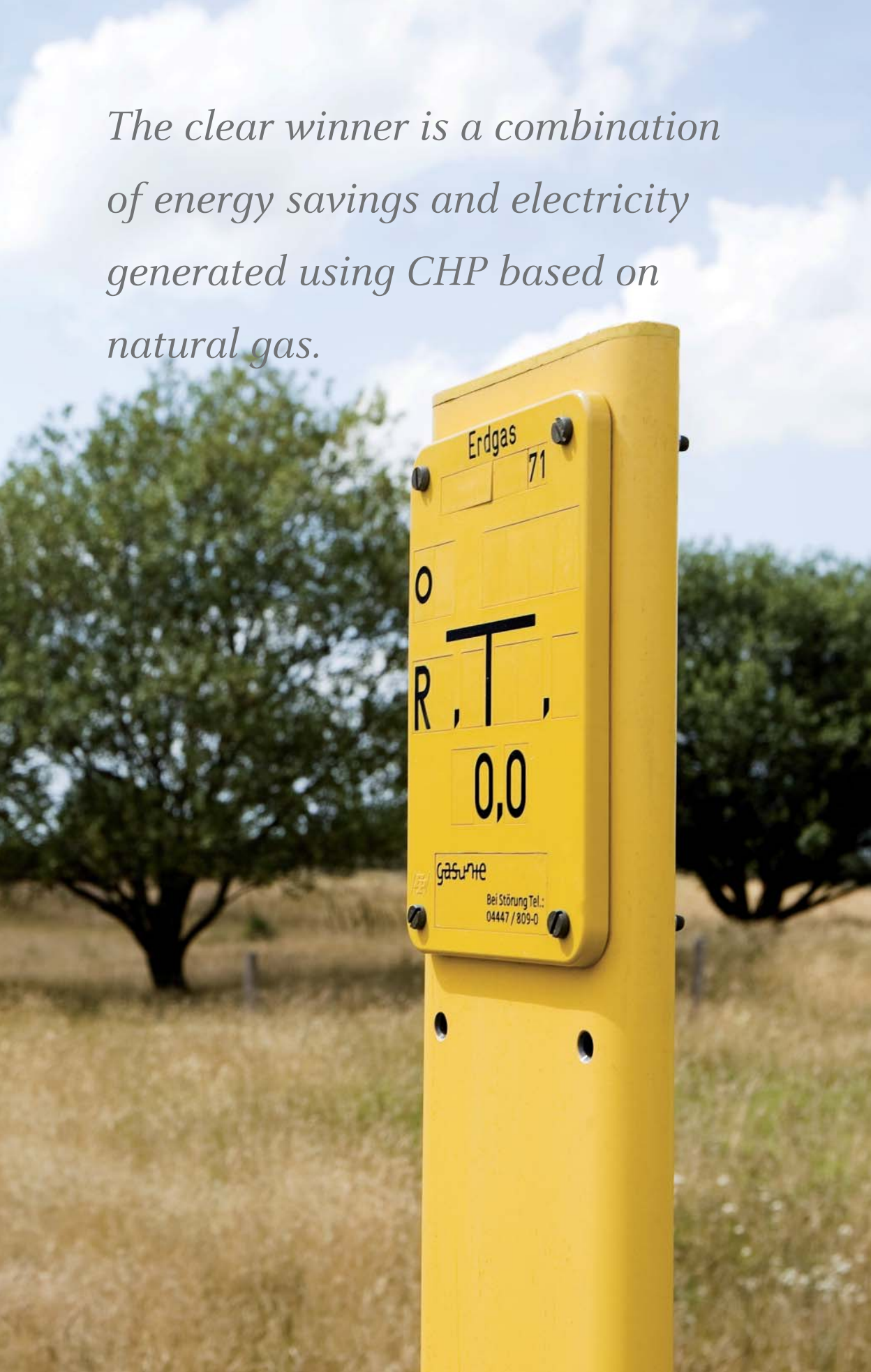
Micro-CHP
A central-heating system that also converts heat to power.



Another example of an efficient gas innovation is the gas-fired heat pump, which has higher efficiency than the usual electric heat pump.

New technologies such as the gas-fired heat pump and (micro) CHP are being developed and improved all the time. This will make the appliances better and less expensive. For industrial customers, great efforts are being made to develop a new generation of fuel cells, the so-called SOFC (Solid Oxide Fuel Cell), which, when combined with a gas turbine, enables higher electric efficiency in CHP applications. At the same time, a lot of work is being carried out to make the electricity grid more and more suitable for all small suppliers, in the form of smart grids. Continuous innovations such as these mean that natural gas can be applied ever more cleanly and efficiently.

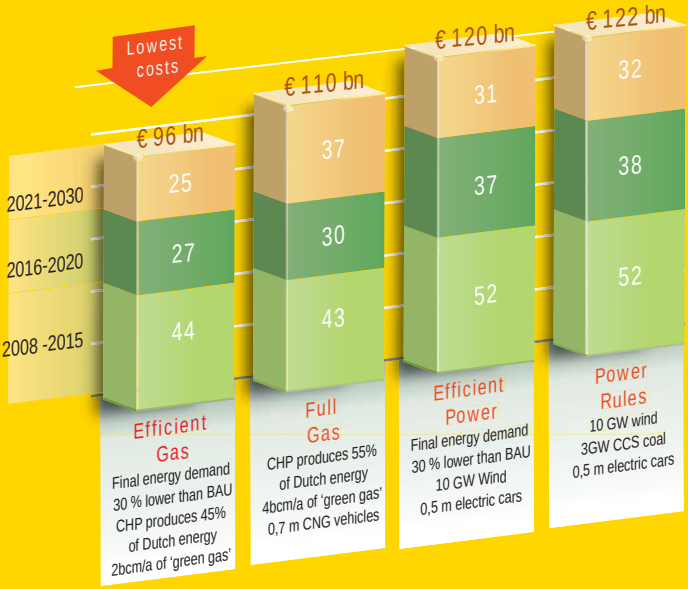
The clear winner is a combination of energy savings and electricity generated using CHP based on natural gas.



7 Reaching CO_2 targets is easier and more efficient with natural gas.

Scientists have researched the best ways for achieving EU and Dutch government targets for power generation for 2020/2030. The clear winner is a combination of energy savings and electricity generated using CHP based on natural gas. This has resulted from the high efficiency achieved by generating electricity in CHP installations and from the increasing proportion of green gas in the Dutch gas system. Technological progress in these areas is playing a significant part here.

GAS SCENARIOS REQUIRE LEAST COSTS FOR REALISING CLIMATE OBJECTIVES



The Netherlands has a well-functioning gas transport network with broad coverage. The application of natural gas in combination with solar and wind energy can provide an affordable and, at the same time, sustainable and flexible energy supply. An electricity supply based substantially on gas is a keen future-oriented investment.

Natural gas reserves throughout the world are so extensive that gas can play a crucial role in the transition towards a sustainable energy supply and as a functional, green component in this sustainable future itself.

8 Natural gas supplies until well beyond 2050.

Our natural gas supplies are far from being exhausted. In the Netherlands alone there still is – according to current data – around 1,350 billion m^3, of which over 1,000 billion m^3 is located in the Groningen field. The small gas fields have another 300 billion m^3 natural gas, of which approximately 180 billion m^3 is located under the Dutch part of the North Sea and the rest on land. In addition, the import of gas from the very large gas fields in Norway and Russia, and also from the Middle-East and Africa, will become more important for Europe, including the Netherlands. These new gas flows will be accommodated by gas infrastructure development, such as LNG-terminals, pipeline construction, storage projects.

The quantities mentioned here are 'recoverable' natural gas, using current technology. But technology is continuously developing and, for that reason, an increasing amount of gas can be tapped, like 'shallow gas', for example, which has potential for development. It is also becoming increasingly cost-effective to extract 'unconventional' natural gas, such as gas located in hard rock, thanks to new technologies. US production of unconventional gas from claystone has boomed unexpectedly over the last few years.

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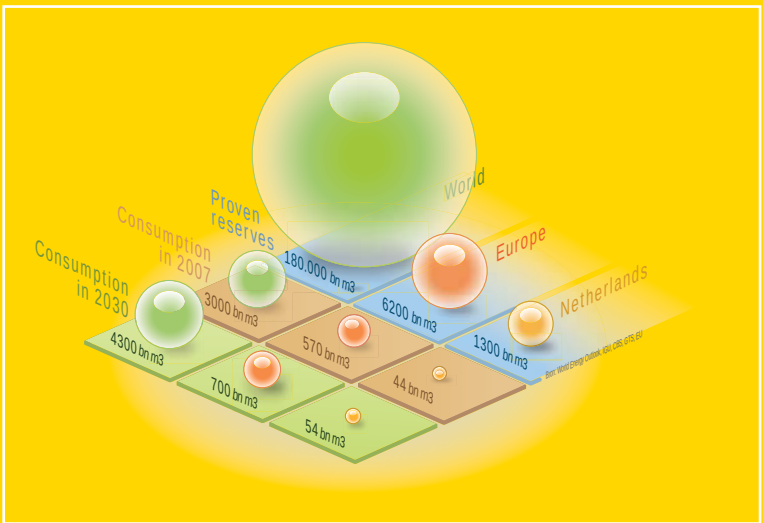

Source: EBN report, gas roundabout letter, Ministry of Economic Affairs

The gas roundabout can fulfil a pivotal role in the energy supply of North West Europe.

9 The exclusive gas transport network enables a pivotal role for natural gas towards and in a sustainable European energy supply.

Natural gas is the cleanest fossil fuel, which can play an ideal role as a linking element in a sustainable energy supply. A sustainable energy supply based partly on natural gas offers the most efficient use of energy.

This places demands on the gas network. The Dutch gas network offers a good starting point for natural gas's central role in the energy supply. The Netherlands also has depleted gas fields which can be used to store gas and excellent port facilities where liquefied natural gas (LNG) and biomass (for green gas) can be brought ashore. The Netherlands can fulfil a pivotal role in the energy supply of North West Europe with these strong attributes constituting the 'gas roundabout'.

Transition in phases

The Dutch government has made the gas roundabout into an important element of its policy and supports its further development. Projects currently contributing to the further expansion of the gas roundabout include, for example, new underground natural gas storage facilities in the Northern Netherlands, an LNG terminal on the Maasvlakte and extension of the transport network in vulnerable places. This policy also includes linking up with more remote sources, such as via the Nord Stream pipeline. The gas roundabout can, over time, be 'greened', when green gas becomes available in substantial quantities, and the energy transition will gradually take effect. Thus, also when the transition has taken shape, gas will continue to play an important part as the flexible and reliable basis of a sustainable European energy supply.


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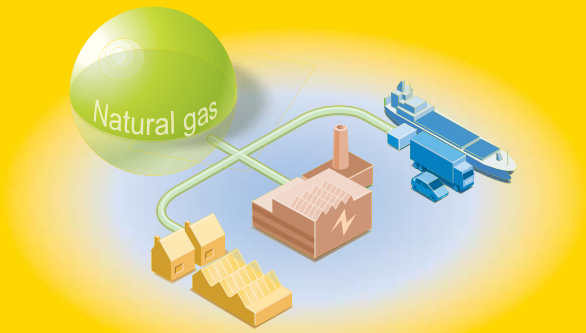
More than a bridge: natural gas is part of an efficient and responsible sustainable energy supply.

With natural gas as an energy source and the existing natural gas infrastructure, the energy supply can be made more sustainable relatively quickly and affordably.

The energy transition costs money. Major investments are necessary for expanding the infrastructure for sustainable sources like wind and sun. This is exactly why the natural gas network, both in the Netherlands and Europe, is helpful to give shape to the energy transition in a reliable and efficient manner.

GAS CAN BE APPLIED IN MANY DIFFERENT WAYS
Not only for generating heat but also for producing electricity or as a fuel for modes of transport such as cars, buses and boats



Due to its special features, gas is the most suitable means for supporting sustainable practices because:

- it is cleaner than all other fossil fuels;
- it allows the supply and demand for energy to be linked to each other perfectly;
- it can upgrade its sustainable quality through the addition of green gas.

Gas fulfils a dual function in the energy transition by making it possible to decrease CO_2 emissions and to increase the use of sustainable sources, while optimally utilising the valuable existing gas infrastructure.

Gas is more than a bridge from existing energy supplies over to a sustainable energy supply; it is an essential part of the transition sequence.

Colophon

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