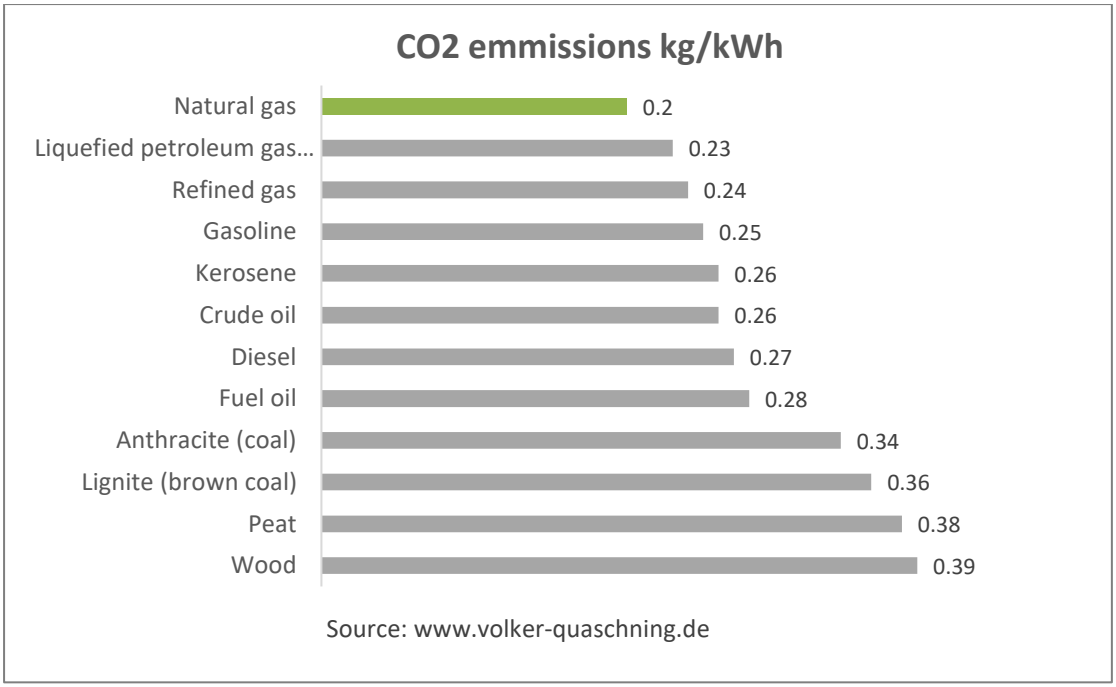
ENERGY EFFICIENCY

Environment

WHY IS NATURAL GAS THE MOST ECO-FRIENDLY FOSSIL FUEL?

Less CO2 and other emissions

Natural gas is the most eco-friendly fossil fuel because of its high heat capacity; it also does not produce any ash or sulphur compounds as it burns, with a reduced amount of CO2 emissions, resulting in minimal harm for public health and the environment. Burning natural gas only produces two substances: CO2 and water vapour. Making one kWh of energy of natural gas emits about 0.2 kilograms of CO2 into the Earth's atmosphere, which is 41% less if compared with coal, and 49% less than fuel wood.



Transportation of natural gas

Natural gas is transported via pipelines, which has many advantages:

- There are no energy losses in the gas supply: compare this to the heat losses in centralised heating systems;
- Natural gas is supplied continuously and exactly in the amount necessary for the client, preventing any energy consumption to deliver a product that is not needed;
- Natural gas-operated compressors are used to transport natural gas through pipelines, resulting in CO2 emissions from transport that are lower than those of other fuels, which require delivery, transhipping and storage.

Efficiency of equipment

Thanks to its physical properties and automated delivery, natural gas combined with modern equipment enables the highly efficient consumption of energy:

- Natural gas combustion technologies make it possible to produce energy efficiently, with an efficiency factor of 0.9 or 1.12;
- The use of natural gas energy can be fully automated, and programmed depending on the ambient temperature, day of the week and hour, ensuring the efficient consumption of energy and providing a high level of comfort.

Habits

SAVING ONE kWh IS EASIER AND CHEAPER THAN PRODUCING ONE

Temperature

Studies have shown that reducing the temperature of a heated room by 1° can save up to 5% in energy consumption. You can save a significant amount of energy if you maintain the optimum temperature levels for various areas in the building, without any loss of comfort.

Optimum temperature levels:

- Living room, 21—25 °C
- Bedroom, 18—22 °C
- Children's room, 21—25 °C
- Kitchen, 18 °C
- Bathroom, 23 °C
- Corridor, hall, 16 °C
- Storage room, 12 °C
- Garage, 8 °C

Heater thermal valves are the best way to control temperature in any room.

Use automation and programming

You should adapt the heating system to your lifestyle in order to use natural gas energy in an even more efficient and economical way. If, currently, no one is at home, you can use the heating boiler's automation to reduce the temperature in the heated rooms by 2—3 °C. If the heating system is only to work at its optimum in the evening, then for most of the day, it will operate in a reduced temperature mode, which can save 7—10% in natural gas consumption. It is not recommended to reduce the heating temperature by more than 3 °C within a single 24 h period, because heating the room back to its optimum temperature may take more energy that has been saved from lowering it.

Consumption of hot water

Energy used to heat water has a major impact on the total energy consumption of your house. The temperature of hot water should be set as low as possible, but no less than 45 °C, to protect your water supply system against any germs that are undesirable and harmful to human health. You can save a great deal of energy by turning the tap off when you don't need hot water when showering or doing the dishes.

Efficiency of equipment

CHOOSE MODERN EQUIPMENT ACCORDING TO THE EXPECTED CONSUMPTION

Assess your current system, its efficiency, and whether its capacity is sufficient

The maximum output capacity of the heating boiler must be determined based on the amount of heat necessary on the coldest day of the year. In a very well-insulated house, the maximum power for heating should not be less than 15—20 kW, because the building would need power to heat up the water. Compared to modern boilers of the same type, heating boilers from more than 15 years ago are not as economical and eco-friendly.

There are a number of economising factors and technologies that affect the efficiency of natural gas heating boilers:

- Burner power modulation: fuel consumption is most efficient when the burner operates at its maximum output. The heat consumption of a building changes constantly, and the boiler must be capable of adjusting to the continuously changing load, which is done via burner modulation. This means that the boiler can function efficiently at different heating outputs, e.g. at 25%, 50%, 75% or 100% of its maximum capacity. The higher the burner modulation degree, the more efficient the fuel consumption.
- The heating system must undergo maintenance at least once a year, because a few millimetres of soot and a badly configured burner can cause a 5—10% increase in energy consumption. All expansion tanks, pumps, filters, valves of the heating system must undergo regular maintenance, because they are a part of the system as a whole, and any of the components not working properly results in increased energy consumption.

Comparison of natural gas combustion systems

Convection boilers have an efficiency factor of up to 94% (at the 70 °C/60 °C temperature setting of the heating system). Natural gas is combusted with a burner, without recovering heat from the exhaust gases. The types of gas convection heating boilers are:

- Boilers with an atmospheric burner (i.e. they do not have a fan) are simple, robust and low-priced. Makes sure that the control system of the heating boiler is equipped with an electrically-operated room air valve control, to only ventilate the heated room if air needs to be supplied to the burner; this will prevent heat losses when the heating boiler is switched off.
- Boilers with an electric fan that mixes the air with the fuel can be operated independently from room air.

Condensation boilers have an efficiency factor of up to 109% (at the 40 °C/30 °C temperature setting of the heating system). They consume less energy, because they recover heat from the exhaust gases, which reduces your heating costs and is more

eco-friendly. Condensation boilers are at their most efficient in buildings with floor heating.

Natural gas heat pumps, with an efficiency factor of 120% to 160%. The main difference of a natural gas heat pump from an electric heat pump is in that its compressor is powered by natural gas (with a primary energy factor of 1.1), and not electricity (with a primary energy factor of 2.4). Furthermore, it uses either a natural gas engine, or a so-called thermal compressor (gas-absorption heat pump). Natural gas heat pumps provide 1.2 to 1.6 kWh of heat for every kilowatt-hour of natural gas consumed, leading to significant energy savings, considering the primary energy consumption.

Micro/macro cogeneration involves simultaneous production of heat and electricity, and if compared to separate production of the two, it reduces fuel consumption by up to 36%, and CO2 emissions, by up to 58%. The heat produced by a cogeneration system is used for heating, while the corresponding electricity is consumed for own needs; if there is no electricity consumption at the moment, then it is transmitted to the electric power grid operator, to be used later when electric power is needed. The main argument when opting for a cogeneration system is that in order for it to function and be economical, a constant level of heat consumption must be maintained, so that the system works for as long as possible, even in summer, and using a secondary heating boiler for additional consumption during winter. There are a few types of cogeneration systems:

- Stirling cogeneration units are usually convection-based natural gas heating boilers, in which the heat of the exhaust fumes is used by a Stirling engine to produce electricity. A Stirling engine can produce up to 1—2 kWh of electricity that can be used for household needs, reducing electric bills and being more eco-friendly, because this energy does not need to be produced by a power plant.
- Internal combustion cogeneration systems involve a natural gas-powered internal combustion engine that operates an electric generator. A broad range of such cogeneration systems is on the market, with output capacities starting at 15.5 kW for heating, and 5.5 kW for electricity, without limitation for the maximum output for such systems. Internal combustion engines are one of the most efficient options among low-power electricity generating systems.
- Gas turbines and microturbines: the energy of natural gas is used to push the blades of the turbine, powering the electric generator. Gas turbines are not efficient in situations where the system would be frequently switched on and off, because this reduces the service life of the system and increases its operating costs. There are systems available with output capacities ranging from tens of kWe to tens of MWe.

Energy efficiency in buildings

IN LATVIA MOST ENERGY IS LOST THROUGH BUILDING STRUCTURES

Key factors causing heat losses in a building

Energy consumption in a building is affected by various factors, such as the material and condition of the building envelope structures, the habits in the use of specific rooms, the geographic location of the building, and its environment. According to the LBN 002-01 standard, in detached houses with natural ventilation, the heat necessary for their needs will be expelled into the environment and lost in the following ways:

- Through windows and doors: 25%
- Through walls: 18%
- Through ventilation: 18%
- Through hot water: 17%
- Through the attic and the roof: 5%
- Through infiltration, heating system losses, floors, basement: 17%

An immediate effect in improving the energy efficiency of a building can be achieved by saving hot water and regulating the temperature levels of specific rooms, as explained in the 'Habits' section. Comprehensive solutions that involve improving all problematic areas of the building and increasing its energy efficiency have the most impact in reducing energy consumption. However, more often than not, energy efficiency measures take a lot of investment, and determining a minimum scope of required and low-cost measures that can give you the best results for the cost may be a necessary step. Therefore, the key issue here is striking a balance between how much you invest, and how much you save in the end, thus reducing your monthly heating bills.

Materials and solutions that limit heating loss

Insulation materials: a distinction is made between natural insulation materials, such as sheep wool or linen, and artificial insulation materials, such as glass and rock wool, and polystyrene. Artificial insulation materials are the most common ones. However, you should remember that making them takes a lot of energy, and their recycling is limited. The advantage of natural materials is that they create a pleasant ambience, reduce health risks and save resources. Depending on the intended use, these materials are available as chunks, plates, carpets, sheets of felt, granules or finer-particle materials. Insulation materials made out of regrowable resources can absorb and emit up to 30 percent of their weight in humidity. Because of this, they can largely ensure that the microclimate in the building is balanced.

Windows: modern windows offer almost as much protection against cold as massive walls. The thermal conductivity factor, U (W/m^2*K), is used as a general indicator of the quality of windows; it shows the amount of heating energy lost through the walls, windows and the roof. The rule of thumb is: the lower this value, the better the insulation. For windows with simple glass glazing, which can still be found in older buildings, the U-value is 5.5 to 5.8. In contrast, currently available sealed windows

with glass units have a heat insulation of 1.1 – 1.3 W/m^2*K. With triple glazing used in energy-efficient buildings, the U-value can be as low as 0.5 W/m^2*K

Ventilation is a set of equipment intended for the controlled supply and removal of air, and in a sealed building, its main function is maintaining the necessary circulation of air. If this ventilation system is equipped with a heat recovery system, then most of the heat expelled and, therefore, lost can be reused for heating, improving energy savings. In this way, about 85% of the heat lost through the ventilation system can be reused.

Industrial energy efficiency

FOR MANY INDUSTRIAL COMPANIES, ENERGY IS A KEY RESOURCE THAT CAN BE SAVED

The most complete understanding of energy efficiency solutions available for a production process can be gained through an industrial energy audit. The energy audit must encompass 90% of the entire company, and individually determine the sources and consumers of energy:

- the energy consumed to heat the buildings owned or used by the company;
- the energy consumed to produce hot water necessary for non-production personal needs;
- the energy consumed by the lighting system;
- the energy consumed by the ventilation systems;
- the energy used to cool rooms;
- electric, heating and other types of energy (also fuel, if it accounts for more than 10% of the total energy consumption).

After the information is collected and all the calculations are made, it is determined, which of the main objectives in improving energy efficiency will affect the production process the most; these may include, for example, automating production units, replacing certain devices with more efficient ones, installing automation systems for heating or lighting, introducing changes in habits, insulation, or other similar solutions.

Additional equipment

Solar arrays

Using a solar array in combination with a natural gas heating system can result in particularly large energy and cost savings when producing hot water. These solar systems have been known and used for hundreds of years. One system with a flat panel (1.5 m^2 per resident) and a tank that can store hot water for about three days can cover some 70% of the energy consumed to heat water.

Air conditioning

Natural gas heat pumps can be used not only for heating, but also for cooling. The main difference of a natural gas heat pump is that the compressor is operated by a

natural gas engine, and not an electric motor. Such devices are 48% more energy-efficient than electric cooling devices.

Remote heating control

Nowadays, household heating systems can be controlled through mobile apps. Such a remote heating control system will use your smartphone to maintain the room temperature set in the app, or entered in the scheduler. Active use of such solutions can save up to 30% in the energy necessary for heating.

Cars

Natural gas can be used as fuel in cars, and refuelling is possible through the household gas distribution network, for cars equipped with a system for using compressed natural gas (CNG). Natural gas-powered cars relieve the environment of emissions and your wallet, of costs. Natural gas-powered vehicles have the best environmental indicators when compared to traditional fuels, such as petrol or diesel; for example, compared to petrol cars they produce about a fourth less in greenhouse carbon dioxide (CO2) emissions that are harmful to the climate. They reduce soot and fine particle pollution down to a near-zero level. Compared to diesel vehicles, they emit 99% less fine dust. The situation is similar for other harmful substances as well.

Household appliances

We use various household appliances, in which heating takes up a major portion of their power consumption. Using natural gas for generating heat can save a great deal of energy, and money.

Appliances that are eco-friendly and save you money:

- Driers, in which the heat is produced from the energy of natural gas, and the power is consumed for the electric motor and automation;
- Infrared heaters, hot air blowers for open terraces, garages and industrial premises, where heat is necessary to ensure comfort, and is provided with infrared heaters or hot air blowers. If the heat is produced from natural gas, no electric power is necessary for this purpose;
- Backyard lighting: natural gas can be used to provide lighting, saving electric power and the energy necessary to make lightbulbs.

Useful links

MINISTRY OF ECONOMICS

- Energy efficiency, regulations, studies and other valuable information
  www.em.gov.lv/lv/nozares_politika/majokli/eku_energoefektivitate

RIGA ENERGY AGENCY

- Detailed information about energy efficiency
  www.rea.riga.lv