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MYTH BUSTER ON GASES AND RENEWABLE HEATING TECHNOLOGIES

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NATURAL GAS ACCOUNTS FOR ABOUT 45% OF EUROPEAN HOUSEHOLDS' HEATING. IT IS THE MOST WIDELY USED ENERGY BUT IS PERCEIVED AS LESS ENVIRONMENTALLY DAMAGING THAN IT REALLY IS. RENEWABLE HEATING SOLUTIONS ARE STILL RARE, ALTHOUGH THEY REPRESENT A GREAT OPPORTUNITY TO DECARBONISE HEATING. TOO LITTLE KNOWN ABOUT, THEY ARE SURROUNDED BY A LARGE NUMBER OF PRECONCEIVED IDEAS.

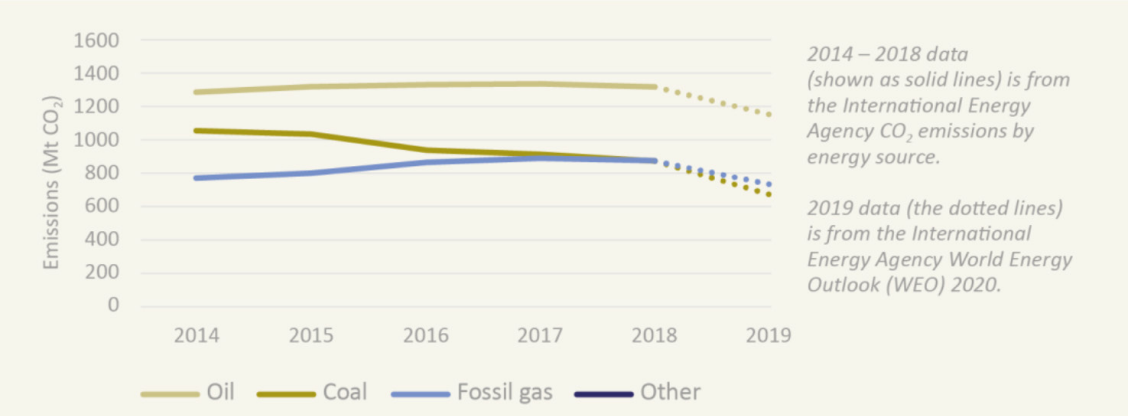
WITH THIS PAPER, WE AIM TO DISPEL THE MYTHS ABOUT BOTH GAS AND RENEWABLE HEATING TECHNOLOGIES IN ORDER TO CLARIFY THE PATH TOWARDS FOSSIL-FREE BUILDINGS!

MYTH BUSTER ON GASES

MYTH 1: NATURAL GAS CAN BE GREEN / CLEAN

What we call "natural" gas is a gaseous hydrocarbon composed primarily of methane and ethane. This fossil fuel is not readily available and has to be extracted and transformed before being used.

This process involves ***health, environmental and safety risks.*** Indeed, it uses and pollutes a lot of water when fracking methods are used and creates air pollution and risks of explosion and wildfires. But even more importantly, natural gas use is responsible for a large amount of greenhouse gas (GHG) emissions when burned (in total, life-cycle GHG emissions are ***516 gCO_2e/kWh*** for natural gas combined cycle plants against less than ***58 gCO_2e/kWh*** for wind, photovoltaic, concentrated solar thermal, hydro and geothermal power). As shown in the graph below, this fossil gas has now become the second largest fossil source of CO_2 emissions, ahead of coal, in the EU.



Gas is the second largest fossil source of CO_2 in the EU
Source: *E3G Graph* based on International Energy Agency

The use of Carbon Capture and Storage (CCS) infrastructure does not prevent CO_2 from being released into the atmosphere as ***around 10-20% of the CO2 generated cannot be captured.*** Natural gas is also responsible for methane leakages that occur during its transport, while methane is even more damaging for the atmosphere than CO_2. Thus, not **only is natural gas a finite resource, but it also plays a significant role in climate disruption.**

MYTH 2: NATURAL GAS IS A NECESSARY "BRIDGE" FUEL TOWARDS A CLEANER HEATING SYSTEM

Natural gas is presented as a bridge fuel to move away from more polluting ones, such as coal, to renewable energy while improving the health of consumers and air quality. But this **will only delay the energy transition through a lock-in effect.** Indeed, investment in gas infrastructure is costly and gas-fired power plants typically have "an economic lifetime of 20–30 years, which means anything built today will still be operating after 2040 when global electricity systems should be fully decarbonised" (***Energy Monitor***).

Moreover, it is now possible **to heat buildings without gas by using renewable and efficient technologies** even though there are financial and scale limits to a massive shift away from fossil fuels to renewable energy for heating. However, this problem can be overcome. Poland, known for its massive use of coal for heating, is ***on the right track***: the ban on coal-fired boilers and the creation of a favourable framework have led to an exponential increase in the installation of heat pumps.

Finally, the latest ***report from the International Energy Agency (IEA)*** stresses the need to reduce drastically the use of gas, stop gas exploration and phase out fossil fuel boilers by 2025. **This report from the international agency is a *turning point* as it puts an end to the idea of gas as a transitional fuel in its net-zero-emissions scenario.**

MYTH 3: HYDROGEN IS A LIKE-FOR-LIKE SOLUTION TO REPLACE NATURAL GAS IN HOME HEATING

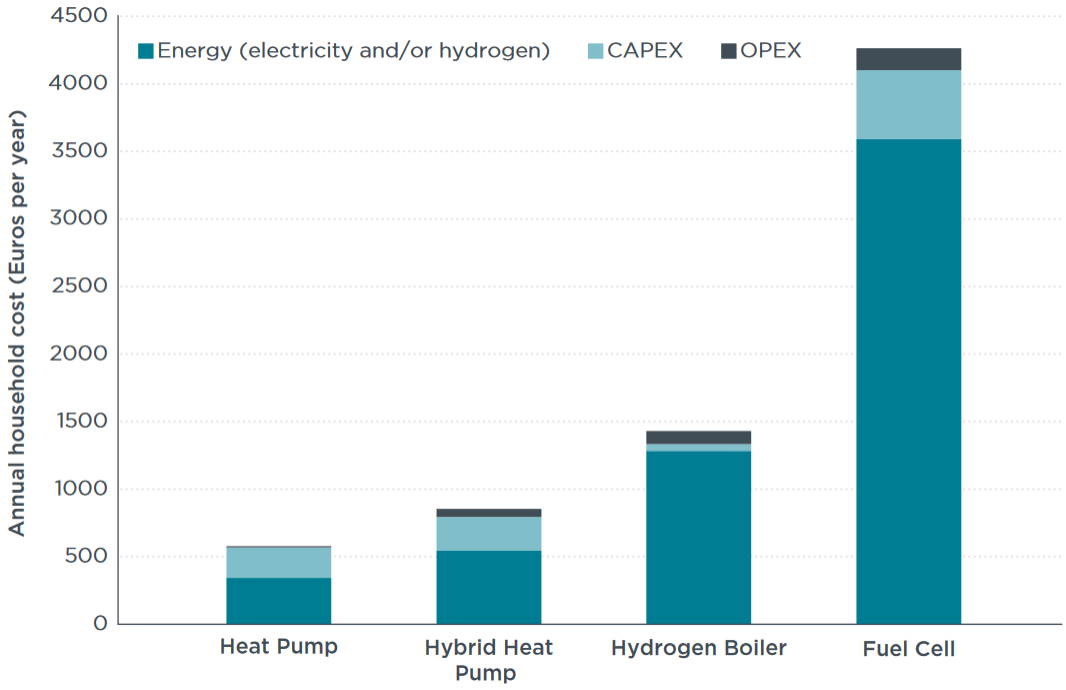
Hydrogen is not the silver bullet to decarbonise heating in cities (see our complete report *here*). Firstly, only "green" hydrogen, produced from the electrolysis of water using renewable electricity is renewable while the other grey or blue forms are derived from fossil fuels. In addition, using hydrogen for home heating is neither efficient, nor competitive, nor easy. Indeed:

» Renewable hydrogen requires *five times* **more electricity to heat a home than a heat pump.** Indeed, the transport, storage, various transformation stages and combustion of hydrogen lead to **multiple losses.**

» *Scientific studies* **conclude that hydrogen is not competitive in heating** as air-source heat pumps are at least **50% cheaper** than hydrogen-only technologies.

» The non-disruptive argument for homeowners to use hydrogen instead of natural gas is vague because the change of gas type could lead to **an increase in bills and would require replacing the equipment** in *people's homes* (*boiler, domestic pipes*, cooking stoves) and in their streets (pipes and compressors). There are still many uncertainties about hydrogen infrastructure costs and who will bear *the responsibility and the cost of these transformations.*

Thus, renewable hydrogen promises to be a scarce resource that must therefore be used very sparingly when no other renewable alternative is possible.



Comparison of the cost components for hydrogen and heat pumps pathways
Source: *the ICCT Report*, 2021

MYTH 4: ALL BIOGASES ARE ALWAYS SUSTAINABLE

The multiple terms surrounding renewable gases are ambiguous. The sustainability of biogases **is very much linked to the feedstocks that are used.** ***To be sustainable***, a biogas must not encourage massive deforestation or increase the price of food resources by occupying land and resources normally used for food production. Indeed, it should be remembered that some resources provide more benefits in terms of carbon sequestration when used for growing food than the GHG savings made once transformed into biogas. The most sustainable resources are therefore agricultural and forestry residues, but this considerably limits production capacity. **Thus, caution must be exercised when considering biogas by questioning how sustainable the resources used really are.**

GAS GLOSSARY

Gases have many different names that are very ambiguous. Here is a glossary inspired from ***Corporate Europe one.***

RENEWABLE GASES

» **Renewable gases** are a category which includes gases from renewable sources like biomass **(biomethane)** and renewable electricity **(green hydrogen)**.

» **Biogas** is produced by the fermentation of organic matter (food scraps, animal waste, sludge, etc.) in the absence of oxygen. It is composed mainly of methane and carbon dioxide. ***89%*** of biogas is today used locally to generate electricity and/or heat.

» **Biomethane** is obtained by cleaning and enriching biogas, i.e. by removing its carbon dioxide, water and hydrogen sulphide components. It can be injected into the grids or used locally to generate electricity.

» **Green Hydrogen** is produced via electrolysis of water using renewable electricity. It can be injected in limited quantity into the current gas grid.

» **Synthetic Methane** is green hydrogen to which CO_2 is added captured from industrial processes or the air. It can be directly used in the current gas grid, as it has the same properties as natural gas.

FOSSIL GASES

» **Natural gas** is the gaseous hydrocarbon composed primarily of methane and ethane. The industry tends to play on the term “natural” to depict it as cleaner than other fuels like coal, although it produces CO_2 when burned and is a finite resource.

» **Low carbon gas / decarbonised gas** refers to fossil gas whose combustion is combined with carbon capture and storage (CCS). Nevertheless, around 10-20% of the ***CO_2 generated cannot be captured.***

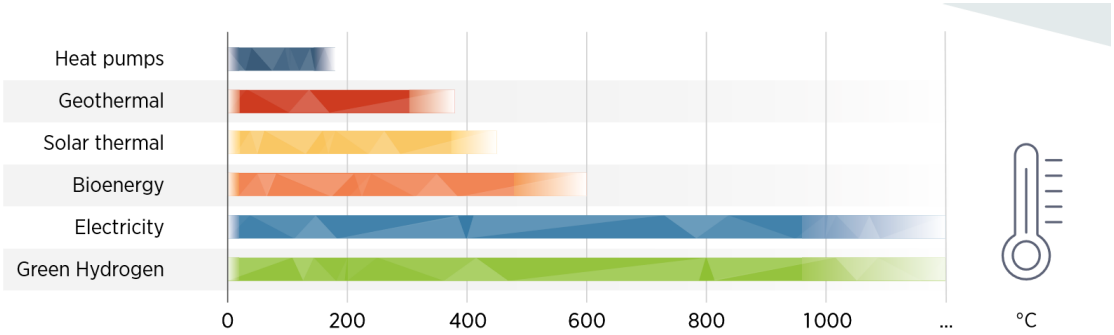
» **Blue hydrogen** is produced from fossil gas (natural gas) using steam methane reforming and carbon capture and storage.

» **Grey hydrogen** is produced from fossil gas (natural gas) using steam methane reforming. This is how most hydrogen is produced today.

MYTH BUSTER ON RENEWABLE HEATING TECHNOLOGIES

MYTH 1: RENEWABLE HEATING PROVIDES LESS COMFORT FOR HOUSEHOLDS ESPECIALLY IN WINTER

This is a recurring criticism of heating technologies based on renewable energies: they are unable to provide the desired temperatures especially in winter. Renewable heating technologies can provide high temperatures (see the graph below) and can therefore provide the required temperature for low-temperature heating systems (usually around 55°C-65°C). In buildings, renewable technologies heat well-insulated houses even better, which is anyway a necessity to achieve a reduction in heat demand.



Working temperature for various renewable heat technologies.
Source: *IRENA*, 2020.

Moreover, cold peaks in winter are not an issue since air source heat pumps can operate *down to -15°C*, ground source heat pumps can operate all the year round and district heating can deliver heat throughout the winter, by combining different energy sources, including sources that are not dependent on the external temperature (waste heat, geothermal energy, industrial heat pump) and using seasonal storage to cope with cold peaks.

In addition, some heat pumps can be reversible and cool homes in summer. This is another important advantage for consumer comfort as the demand for cooling is rising.

MYTH 2: RENEWABLE HEATING TECHNOLOGIES ARE TOO EXPENSIVE TO INSTALL

The upfront cost of installing a heat pump or a district heat network can be *significant*. For district heating, the cost of installation will largely depend on the length and size of the pipes, the population and heat densities. Generally it is a cost-effective solution in urban areas and city centres. A growing number of cities, such as Strasbourg (FR), ***Frankfurt-am-Main*** (DE) and Rotterdam (NL), intend to extend their district heating and cooling (DHC) systems. For individual heat pumps, the cost varies depending on model and quality, but they are still costlier than a gas boiler for example. Today, the additional cost of this equipment ***can be covered fully or largely*** by various subsidies in many EU Member States.

The long-term returns on investment (see below the functioning costs), effects of scale and benefits for the climate must be considered. To cope with this barrier, a **new economic framework, business models and public support are still needed.**

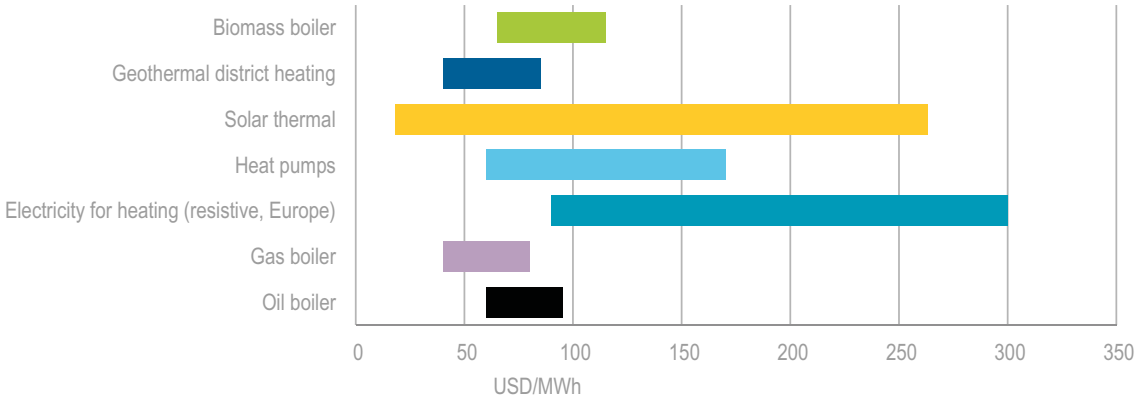
MYTH 3: RENEWABLE HEATING TECHNOLOGIES ARE TOO EXPENSIVE TO RUN COMPARED TO FOSSIL FUELS ONES

Today, natural gas is a low-cost energy source only because it benefits from subsidies and a favourable tax system. This unfair playing field greatly prejudices the use of renewable energy.

The operating cost of renewable heating technologies depends largely on local factors and the heat source used. For heat pumps, the price of electricity is the key factor. Renewable electricity prices ***have fallen considerably*** in recent years (the levelised cost of energy for solar PV fell by 13% year on year in 2019 and by 9% for offshore and onshore wind globally), but they still suffer from taxes and surcharges. However, due to the high-level of efficiency of heat pumps, their ***operating costs*** can be similar to those of gas boilers.

According to the French environmental and energy transition agency ***(ADEME)*** most individual renewable heating solutions are (close to being) competitive with natural gas in France. For collective heating technologies, only deep geothermal energy and waste heat are cheaper, while thermal solar and biomass are competitive with gas even without public subsidies. But public subsidies are still needed to boost the use of efficient collective heating technologies.

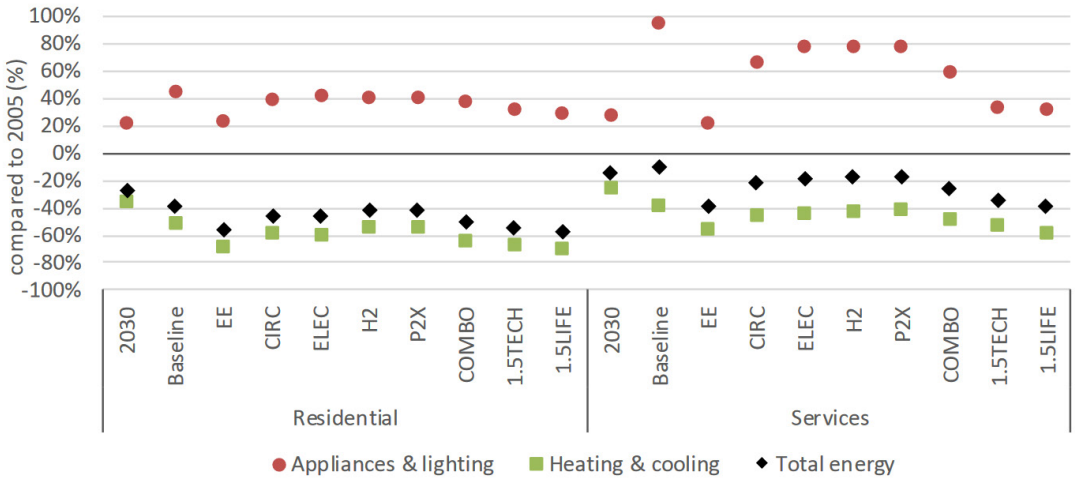
This graph shows that even if the cost varies greatly from one source to another, the cost of delivered heat from renewable sources is starting to be competitive with fossil-fuel boilers. It is important to keep in mind that fossil fuel costs do not consider the cost to the environment (negative externality), and will most probably increase with the introduction of and increase in the CO_2 price.



Cost of residential renewable heat versus fossil-fuel alternative (delivered heat)
Source: IEA, ***Renewables 2017***.

MYTH 4: ALL CURRENT ENERGY CONSUMPTION MUST BE REPLACED WITH RENEWABLES

The aim is not to simply replace natural gas and other fossil fuels used for heating in terms of quantity. In fact, thanks to more efficient technologies, such as heat pumps, **for the same amount of heat supplied, less primary energy will be needed. In addition, ambitious building renovation will broadly reduce the heat demand of buildings, while providing co-benefits in terms of comfort, safety and health.**



Evolution of the energy consumption in buildings in 2050 (compared to 2005) according to different scenarios from the European Commission
Source: *EC communication*, p.99.

MYTH 5: THE GRID CANNOT HANDLE THE ELECTRIFICATION OF HEAT

By switching to renewable energy sources, part of the heating demand will be electrified with solar or wind energy for example. It will therefore be necessary to carry out **infrastructure work to ensure that the electricity grid can support this new demand.**

However, it will be possible to reduce the pressure on the grid through **increased flexibility and a demand response mechanism** (involving greater digitalisation, heat and electricity storage technologies and an attractive pricing system).

Heat pumps are themselves a ***source of flexibility*** for the power system. The heat demand itself will be drastically reduced through retrofits and the electricity demand for heat pumps will be limited due to their high efficiency. Finally, other renewable heating technologies based on sources other than electricity such as waste heat (from industries, the tertiary sector, data centres), sustainably-managed biomass, solar thermal and geothermal energy, will cover the remaining heat demand.

MYTH 6: RENEWABLE HEATING TECHNOLOGIES CANNOT BE INSTALLED IN OLD, NON-RENOVATED BUILDINGS

Heating technologies based on renewables can be installed in *the vast majority of cases* in buildings, regardless of whether they are new, renovated or old and provide a sufficient temperature. "Heat pumps can provide the required heat with satisfactory efficiency even in existing buildings" assures Dr Marek Miara from the Fraunhofer Institute. There are also various examples of renewable district heating systems installed in non-retrofitted buildings such as in Grenoble where the DHC system is 79% supplied by renewable and waste energy.

However, performing energy retrofits at the same time as switching to renewable heat appliances will reduce the size of and the investment in the heat appliance and will result in improved energy performance, greater comfort and lower GHG emissions. **The development of renewable thermal solutions and the roll-out of building renovation should therefore go hand in hand.**

CONCLUSION

There are many myths around fossil gases and in particular natural gas, including its environmental impact and irreplaceability. This largely acts as a brake on ending its use. Renewable heating solutions are also subject to misconceptions about their price, ease of use and comfort. Overcoming these myths will be essential to move quickly and safely towards renewable heating. More related information is provided in *our policy paper* for local, national and European policy makers and stakeholders in which we share best practices and recommendations for moving towards a fossil-free future in our cities.

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