

Burning Issues

**A report on Combustion
Heating and Cooking
Accidents in Buildings**

2024



NovaAura



coolproducts
for a cool planet

Coolproducts is a coalition of European NGOs working to ensure that ecodesign and energy labelling truly work for Europeans and the environment. The campaign is led by the European Environmental Bureau and ECOS.

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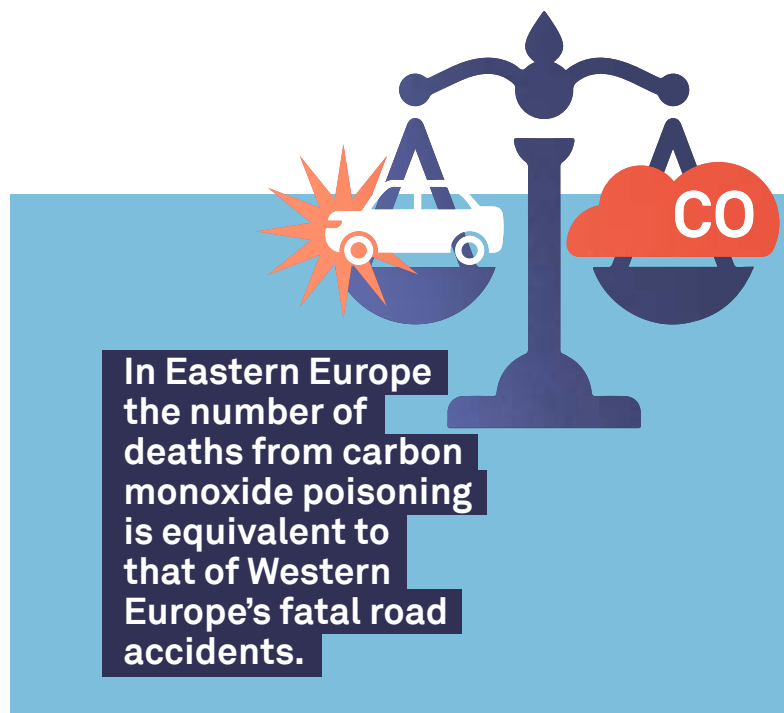
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Executive summary

Not only is it a heavy weight on people's bills and a contributor to greenhouse gas emissions, the widespread use of fossil fuels in homes is also a major health and safety concern in Europe due to accidents and carbon monoxide poisoning. With much cleaner, safer and cheaper alternatives available, the bloc is overdue for an exit plan from combustion in homes.

Combustion-based heating and cooking technologies present significant risks, including equipment failures, carbon monoxide poisoning, and associated injuries and fatalities. Additionally, with 75% of European homes still relying on outdated combustion heating and cooking technologies, the essential acts of heating and eating are heavily contributing to high energy bills and the bloc's greenhouse gas emissions.

Combustion technologies such as fossil fuels and biomass are the leading cause of carbon monoxide poisoning. In Eastern Europe, which experiences notably higher fatality rates from carbon monoxide poisoning compared to the rest of the bloc, the number of deaths is equivalent to that of Western Europe's fatal road accidents. Eastern European countries recorded between 5,000-6,000 deaths in 2021, highlighting urgent safety concerns.



Beyond toxic air, combustion technologies also bear additional accident and injury risks to a home. Unfortunately, data on accidents related to combustion technologies in European buildings is currently fragmented, hindering comprehensive risk assessment and policy formulation. Existing information likely underestimates the true extent of injuries and fatalities, which are alarmingly prevalent across the EU and preventable with transition to safer and cleaner technologies such as heat pump and solar.

The current analysis reveals frequent accidents and poisoning involving gas, oil-based systems, fireplaces, and chimneys, resulting

900 to 1,800 injuries each year resulting from fossil fuel use in homes.*

these data are very conservative, the situation on the ground could be much worse.

in potentially thousands of injuries across Member States annually.

When looking at explosions and other accidents, approximately 2 to 4 hospital-treated injuries per 1,000,000 EU inhabitants annually are attributed to fossil fuel heating and cooking technologies. Given the EU's population of 450 million, this translates to **900 to 1,800 injuries each year resulting from fossil fuel use in homes.** Despite these dangers, Europe has yet to formalise a roadmap to cut fossil fuels from homes and several European countries, including Italy, Germany, and others, continued to subsidise fossil fuel heating in the last years. In 2022, as much as €3.2 billions of taxpayers' money went to fossil heating subsidies, despite clear evidence linking these technologies to Europe's social, energy, and environmental crises.

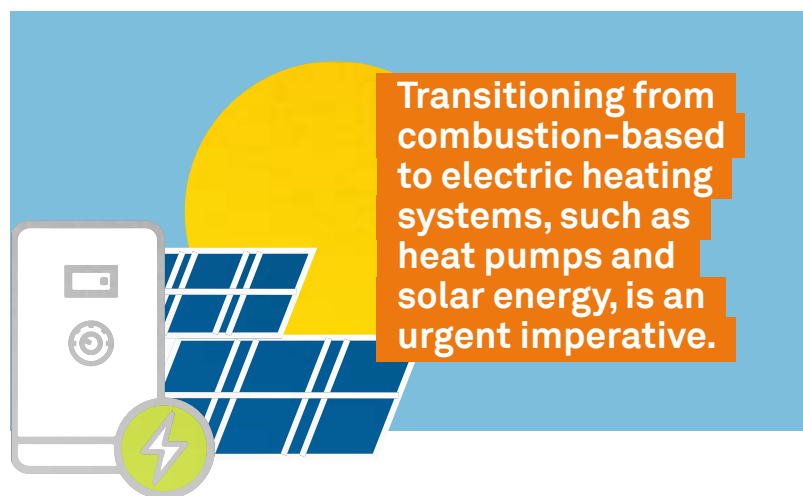
It's important to stress that **these data are very conservative** and are based on the limited data available at the EU level, hence **the situation on the ground could be much worse.** Italy, which is the country with the most detailed dataset, reported an average of 432 hospitalised injured per year between

2014 and 2019. If the same ratio of accidents were to be applied to countries with similar technology distributions, such as Spain or Portugal, we'd have 864 injured per year in these three countries alone, not counting minor injuries not reported to hospitals.

Transitioning from combustion-based to electric heating systems, such as heat pumps and solar energy, is an urgent imperative.

These technologies offer safer alternatives and mitigate the risks associated with combustion fuels, provided there is adequate investment in safe electrical infrastructure. The economic and social benefits of such a transition are substantial, reducing healthcare costs, minimising trauma-related societal impacts, and preventing building damage.

This report underscores the need to prioritise funding and resources for robust data collection and to accelerate the transition towards electric heating solutions. Heating and eating should not endanger families. It's about time Europe commits to safer, cheaper and cleaner homes for all.



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Introduction

This report is aimed at raising awareness about the safety of combustion heating and cooking technologies. It does so by analysing the amount and type of accidents in the EU related to the use of these technologies. These combustion accidents are typically characterised by fire, explosion, and carbon monoxide poisoning, resulting in burns, impact injuries, and death.

Based on the available data, taking a country-by-country approach - and an EU overview where possible - the report outlines the different technologies involved and the different ways in which these accidents take place, putting numbers and graphics to the data where possible.

The report finds that relatively sparse data on this topic is available and that there has been no comprehensive effort to gather it, either on a Member State level or on an EU level. Nevertheless, even from this limited data, it is clear that a significant number of EU residents are injured and killed every year from accidents involving combustion heating and cooking technologies.

Background

In April 2024, the EU approved the Energy Performance of Buildings Directive (EPBD) which contains some provisions prompting Member States to phase out the use of fossil boilers. While a clear, updated definition of such categories has still not been presented by the EU institutions at the time of publishing, it is safe to say that this category would include all boilers currently running on coal, heating oil, butane, LPG and methane (also known as heating gas or natural gas, or simply gas). These fuels are also used for cooking purposes in buildings, oftentimes in combination with heating.

The intention of the EPBD is to improve the energy efficiency of the heating systems, but this provision deals with a category of products that, together with other combustion technologies based on biomass, has created and creates accidents linked to its use daily

across the EU. Hence, moving away from these technologies into solar and heat pumps, where no explosive gases run in open circuit and no combustion takes place is also a matter of improved safety in both domestic and commercial buildings.

Outline of the report

From the early stage of this research, it is apparent that there is a lack of coherent data collection and accident description methodologies for our target incidents does not exist across EU nations. This means that data cannot be collected and compared across countries. The EU FireStat project is aiming to do so, and should begin recording harmonised fire and accident data across a trial number of EU states later this year (2024).

The current report is therefore based on efforts to contact the relevant data collection authorities in individual EU nations. These organisations include those collecting injury and fatality data, chiefly safety groups such as EuroSafe (collecting hospital Emergency Department data) and national fire services (collecting fire accident data). While it is difficult to compare data between countries, a picture of accidents caused by combustion related technologies can be built up country by country, with some trends discernible over time.

Throughout the report the reader will note the various terminologies and accident categories used by national data providers, which make country comparisons impossible. An exception is data from EuroSafe (see Results & Discussions section 'EU Overview') and for carbon monoxide (see Results & Discussions section 'Carbon monoxide fatalities in Europe'), both of which have allowed for a European overview (rather than a country-by-country perspective).

A complete database of all the data used in this report can be found here: 'EEB Combustion Heating & Cooking Accidents Master Database'.

Results & Discussion



EU Overview

The first result of this study is the lack of a coherent and thorough collection of data on causalities related to this domestic technology at the EU level. Given the severe data limitations across EU states, and the complete absence of relevant data in many states, it is then not possible to get an exact count of the number of all the accidents, injuries, and fatalities involving EU citizens caused by combustion heating and cooking technologies. Luckily, though, sufficient data is there to still extract some relevant figures and trends.

Another significant finding that warrants attention is the severity of carbon monoxide poisoning, which is as serious as explosions or fires. Our analysis of the current literature and data reveals that Eastern Europe has the highest age-standardized mortality rate in the world for such incidents, ranging from 19.8 to 23 deaths per 1,000,000 people annually. This equates to several thousand deaths each year. While the figures in Central and Western Europe are less severe, they still account for hundreds of deaths annually.

Results on other types of accidents are more difficult to frame: the best data available is the EuroSafe Injuries Database (IDB), but this does not categorise injuries in such a way as to allow us to make a clear determination for the purposes of this report. Moreover, the current database only encompasses a handful of Member States fully cooperate with EuroSafe.

However, according to Dr. Robert Bauer, a EuroSafe researcher, we can estimate - and expect - **2 to 4 hospital-treated injuries per 1,000,000 EU inhabitants per annum due to accidents related to combustion fossil fuel heating and cooking technologies. In absolute values, taking the population of the EU as 450 million (2024 estimate), this would amount to between**

900-1800 hospital treated injuries

per annum due to accidents related to combustion fossil fuel heating and cooking technologies across the bloc.

Many more combustion fuel-related injuries are missing from this figure though (wood for example), as our fire data below indicates, hence this is a **conservative estimate**. This estimate is based on a sample of data from seven EU states. The range 2 - 4 exists based on some assumptions. Firstly, the estimation requires extrapolating from the seven sample states, for which we have comparable data, to the entirety of the EU where accident and injury data is dearth. This extrapolation is based on a modelling strategy developed by EuroSafe.

Secondly, regarding the “mechanism of injuries” category employed by EuroSafe, only those related to poisoning and explosion injuries are likely to be exclusively caused by combustion fossil fuel heating and cooking technologies. However, accounting also for the remaining mechanisms– e.g. “contact with fire or flame” – where many of the cases will also be combustion fossil-fuel-caused, together with the likelihood of underreporting, we can assume 2 to 4 hospital treated injuries per 1,000,000 EU inhabitants per annum can be viewed as a reasonable estimate based on the evidence available.

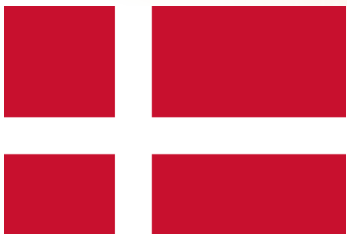
Also, a 2024 meta-review article in the Lancet, which examined studies conducted between 1980 and 2021 in a range of countries, including EU member-states, found that heating and cooking using solid fuels (e.g., wood and biomass) and kerosene have significantly negative respiratory health effects, while gaseous fuels (such as natural gas), though less harmful than solid fuels, are significantly more harmful than heating and cooking with electricity (Puzzolo et al. 2024).

Elimination of solid fuels in heating and cooking lowers the risk of chronic lung diseases (including asthma) by 64%. Using electricity instead of gas reduces the risk for bronchitis by 13%, chronic obstructive pulmonary disease by 15%, and acute lower respiratory infections or pneumonia by 26%.

According to the authors, the health risks alone of combustion fuels justify switching to electricity for heating and cooking, where possible.

In addition, a new study conducted by CLASP has found that households across Europe that use gas stoves and ovens are exposed to twice as much indoor air pollution compared to those with electric appliances. Gas cooking often results in indoor air pollution levels that would be considered illegal if they occurred outdoors.

Below is the more detailed reporting for each Member States where data is available.



Denmark

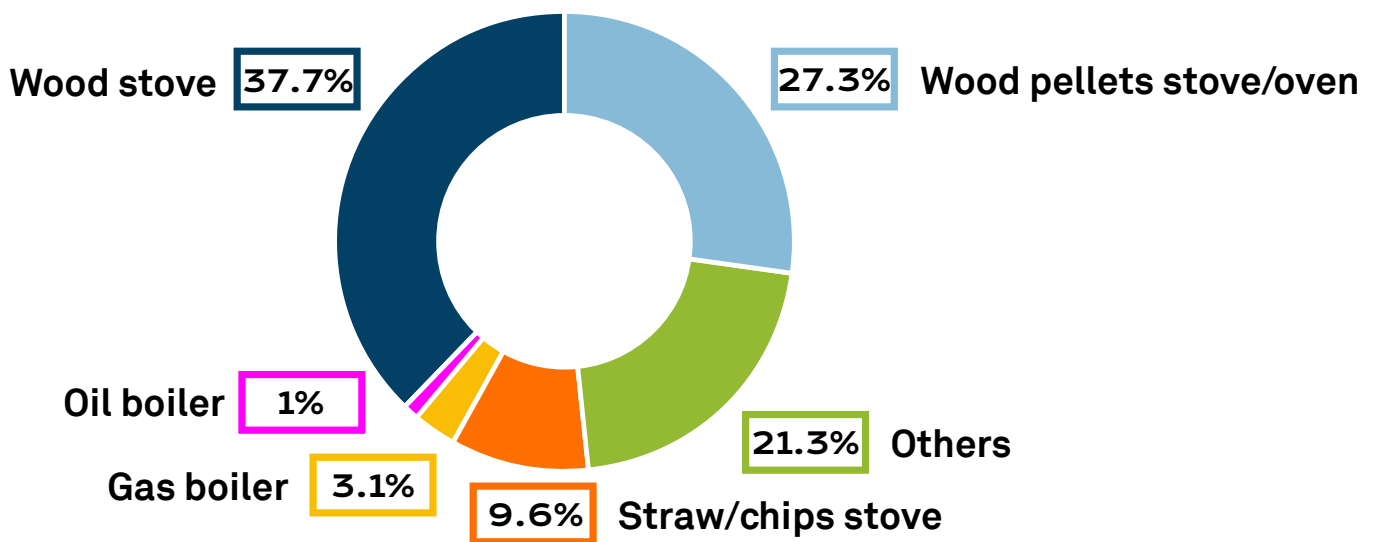
While Denmark is on track to phase out the remaining 400,000 gas boilers in the country in the upcoming years, the use of other combustion technologies is still prevalent, particularly biomass. As per their latest National Energy and Climate Plan (NECP), Denmark incentivises biomass with substantial tax exemptions and fixed subsidies, yet the NECP omits clear figures on direct subsidy values. The annual DKK 5.6 billion tax exemption for biomass, detailed by the Ministry of Taxation, contrasts sharply with the undisclosed overall subsidy amount. As renewable options like solar, wind, and heat pumps become increasingly viable, the sustainability of biomass subsidies is increasingly scrutinised in climate policy discussions.

The Danish statistics on fires, their causes, and their consequences are of high quality, but data is not available that links accidents and injuries more generally to combustible fuel cooking and heating in buildings. The statistics available for fires cover 2016-2022, during which time Denmark had at least 67,879 fires linked to equipment in homes and other buildings, an average of about 11,298 per year.

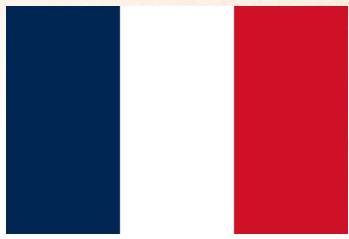
These fires are well-distributed amongst the various causes, with the single largest defined category – “hand tools and machines” – causing no more than 5.8% of the fires. Though distributed amongst various categories, combustion-fuelled heating and cooking technologies were linked to a 6.1% of fires, an average of about 688 fires annually, or 4,126 in total during the observation period of 2016-2022. Of this total, oil and gas boilers caused 168 fires, with the bulk of the rest coming from solid fuel stoves and heating systems.

Figure 1:

Percentages of fires caused by combustion fuels per technology (or equipment) in Denmark between 2016-2022



We also have data for the injuries caused by these fires, though we must remember that injuries and deaths caused by combustion technologies occur also without a fire (above all, carbon monoxide poisoning), so the data is only a subset of the total injuries data, which is not available. Over the eight years for which we have injury data (2016-2023), fires from combustion heating and cooking technologies caused 129 injuries, averaging at 16.2 per year and over 13% of the total injuries.



France

France's approach to energy subsidies reflects a complex balancing act between economic interests and environmental commitments. Despite global pressure to meet climate targets, France maintains support for biomass and fossil fuel sectors. The recent approval of a substantial €900 million state aid package underscores France's commitment to bolstering biomass resources. While specific details on phasing out all gas heating subsidies by 2024 are not fully outlined in recent reports, France aims to enhance support for alternatives like heat pumps through increased subsidies and investment aid. The data available in France has been collected by the Bureau for Analysis of Industrial Risks and Pollutions (BARPI), which is primarily responsible for industrial accidents, but also collects data on accidents involving gas for domestic use. There are significant practical difficulties in gathering gas-related accident data in France where, unlike in Italy, it is not on a statutory footing. Thus, the BARPI's ARIA database cannot be considered exhaustive, and the various years are not necessarily equally well-served. Time-series data in this case, therefore, may reflect only how well accidents were reported in a given year, as well as random variation.

Accidents

1,165 accidents involving domestic gas were recorded in France for the eleven years between 2013-2023, averaging 106 per year. The year-on-year trend fluctuates, but the trend over the whole period is down, with the first three years in the series showing an average of 113 accidents and the last three years 68.

Consequences

Of the total number of accidents, **461 caused injuries** and 42 of which involved at least one fatality. In 2020 alone, 11 people were killed in buildings in France due to gas equipment, mainly from explosions attributed to cylinders and gas leaks.

Figure 2:
Number of deaths (blue), serious injuries (black),
and minor injuries (green) in France
from domestic gas (by year of occurrence).

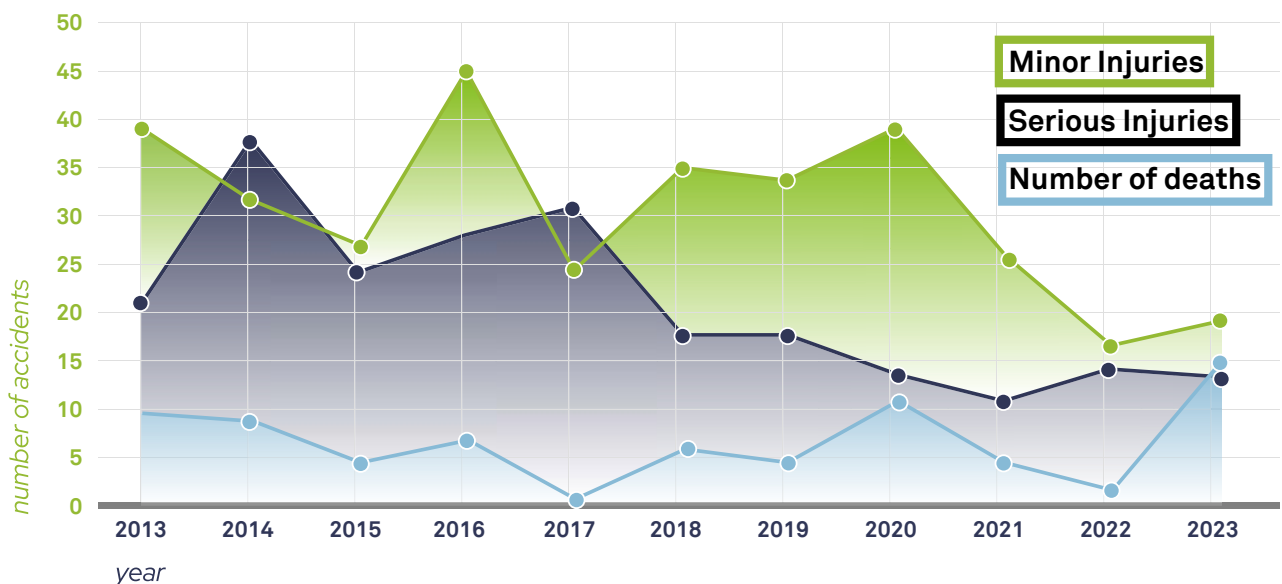


Chart included with thanks to Mr. Jérôme Bai of BARPI.

Injuries, both severe and minor, are trending down somewhat over the period, but no discernible trend can be identified in fatalities. We must also bear in mind that the database is potentially less reliable for more recent years, when incident reports are still being collated.



Germany

In September 2024, Germany approved a contentious ban on the sale of new fossil-fuel heaters, set to take effect by 2028 at the latest. Initially targeting a complete phase-out of fossil fuel boilers by 2024, the law has since been diluted amid political tensions. In addition, 2023 saw a surge in fossil fuelled heating system sales to a record-breaking 1.3 million units, with a rise in the adoption of fossil gas and oil heating systems to 70%, which highlighted a setback in the government's efforts to reduce emissions from the heating sector.

According to the Forum for European Domestic Electrical Safety (FEEDS), in 2019 the German Institute for Damage Prevention and Damage Research investigated the causes of more than 2,000 domestic fires over the years 2002-2019, which is a representative sample for the country, of which 20% attributable to combustion technologies.



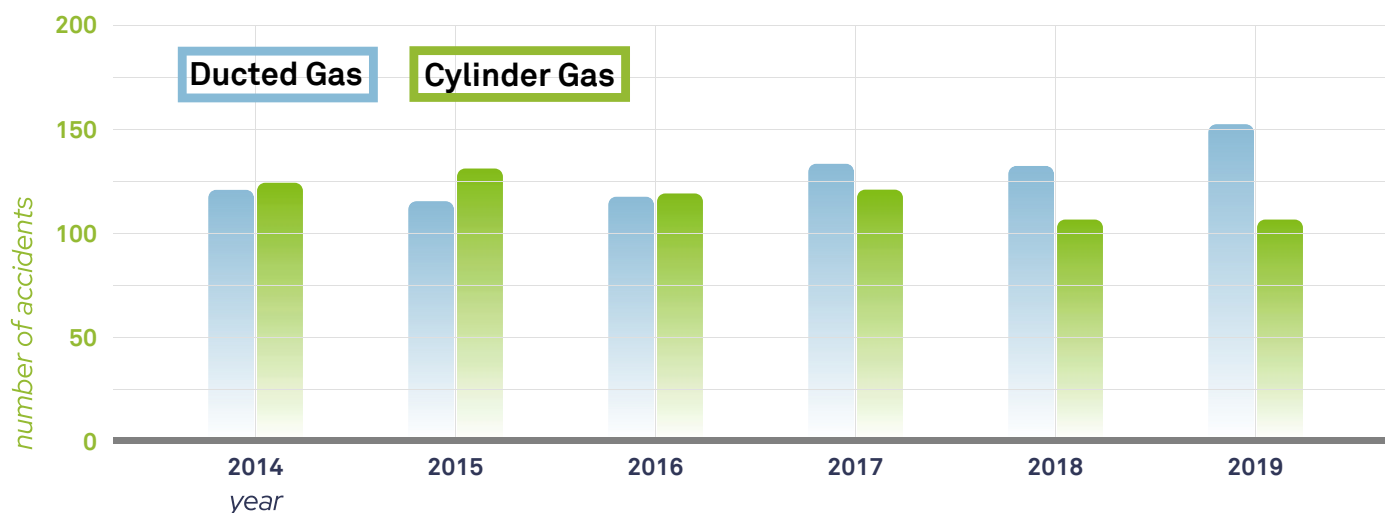
According to Italy's latest NECP, current policies continue to promote fossil-based technologies like gas heat pumps, supported by subsidies such as Conto Termico. Moreover, the 2030 targets for increasing renewable energy shares in the thermal sector indicate a shift away from contributions from all renewables in favour of boosting bioenergies, particularly solid biomass. This indicates that combustion technologies will maintain a significant role in Italy's energy strategy. The absence of a phase-out plan for gas across various sectors risks leading to investment decisions that are inconsistent with the actual needs of the national and European energy systems.

Accidents

The data in Italy is divided into two broad categories: ducted gas and gas in cylinders and small tanks. The data covers 2014-2019 in all categories and from 2012-2019 in some. Unlike that available for other states, it is highly granular and thus allows for much more specific analysis.

Over the period 2014-2019, there were 1,544 accidents in Italy caused by the use and distribution of gas. Italy averaged 134 accidents per year from ducted gas use and 123 accidents per year from gas cylinders and small tanks. In total, then, gas caused on average about 257 accidents per year in Italy over this six-year period.

Figure 3:
Number of accidents in Italy caused by ducted gas and cylinder gas for the years 2014-2019.



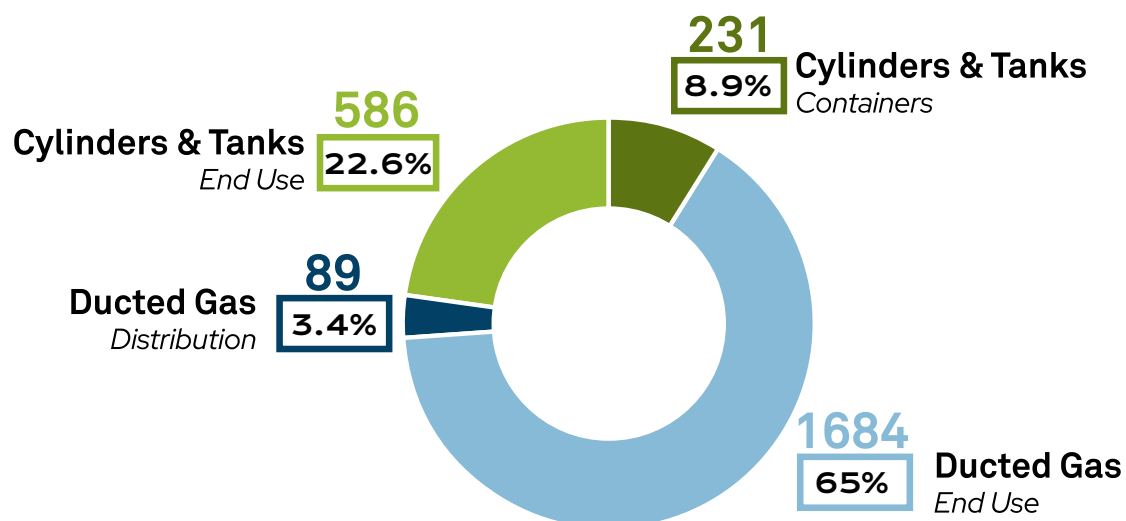
Of the accidents involving ducted gas, 92.7% came from equipment use by end customers (e.g., gas boilers), with the remaining 7.3% involving the distribution system (e.g., pipes). Of course, accidents involving pipes may well take place in homes and offices too. For cylinders and tanks, the distribution system (i.e., the vessels themselves) is the source of around 39% of accidents, with 61% coming from their use by customers. Again, a gas leak from a defective cylinder may well take place in a home.

Consequences

Between 2014 and 2019, there were a total of 1,743 injuries recorded from ducted gas, 97% of which came from end customer usage. During the same period, 817 injuries occurred due to gas cylinders and tanks, 72% of which came from end customer use, though again, cylinder or tank failures can occur in homes and office buildings. This gives us an average number of injuries from gas per year of 432. These numbers only include those injuries which led to hospitalisation or the issuing of a medical certificate (CIG, 2020, 18). It is safe to assume many injuries were unreported, and the actual number is higher.

Figure 4:

Gas related injuries in Italy which led to hospitalisation or the issuing of a medical certificate between 2014-2019



There are no clear trends in the number of injuries from ducted gas, gas in cylinders and small tanks over the six years. Hence, given the vagaries of data gathering, the relatively short time scale, and the lack of a consistent upward trajectory, one could not state with confidence that a factor other than random variation explains the differences in injuries year on year.

From 2014 to 2019, there were 207 deaths in total in Italy caused by gas use and distribution, an average of about 35 per year. Approximately 72.5% of these deaths came from the end use of the gas. Single-family boilers for independent heating were involved in 48% of total accidents, 47% of injuries and 35% of deaths.



Ireland

Ireland's heating energy landscape is currently reliant on significant consumption of gas and biomass. There are ongoing discussions about reducing subsidies for these energy sources to better align with broader EU sustainability objectives.

In a move towards sustainability, Ireland's NECP's new regulatory standards will be introduced to prohibit the installation of gas boilers in new dwellings starting in 2025, followed by a ban on gas boilers in new constructions from 2025 onward. Additionally, existing homes will progressively phase out their oil and gas boilers through a combination of incentives, informational campaigns, and regulatory measures.

With regards to combustion accidents, Ireland's fire brigade service produces reasonably good statistics on fires, their causes, and their consequences, but does not include data on the Dublin region, which is operated by a different fire service that collects data in an incomparable fashion.

The fire brigade service's categories of fire causes include 'Matches/Cigarette Lighters', 'Cooking and Heating', and 'Chimneys/Flues/Soot/Hot Ashes', amongst others. But data is not available which allows us to tease out exclusively fires caused by combustion cooking and heating in buildings.

We therefore can only analyse and discuss the data in their category related to fire callouts due to fires caused by 'chimneys/flues/soot/hot ashes' (see Figure 7), i.e., a category including a number of combustion products. Between 2017 and 2022, an average of 13,459 fires caused by chimneys/flues/soot/hot ashes were recorded, ranging from between approximately 1,500 and 2,250 per year.

Additionally, the percentage of incidents caused by chimneys/flues/soot/hot ashes, as a percentage of total fires, varies between 10% and 18%, annually, with an average of approximately 15%.

Figure 5:

Number of fires attended by fire brigade services in Ireland per annum caused by Chimneys/Flues/Soot/Hot Ashes (excluding Dublin region) in the period 2017-2022

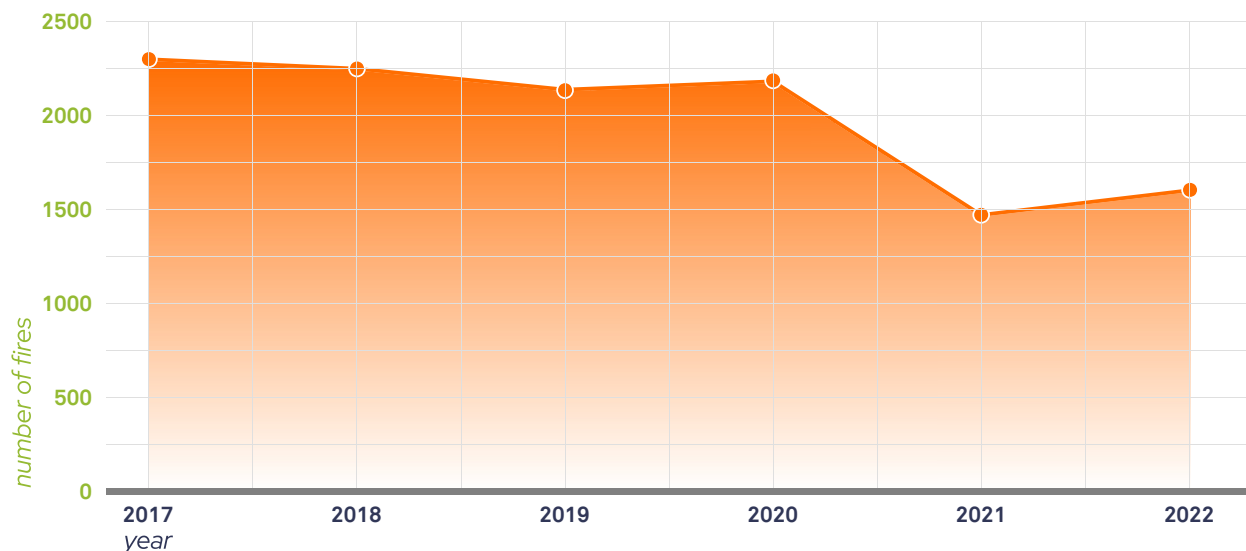
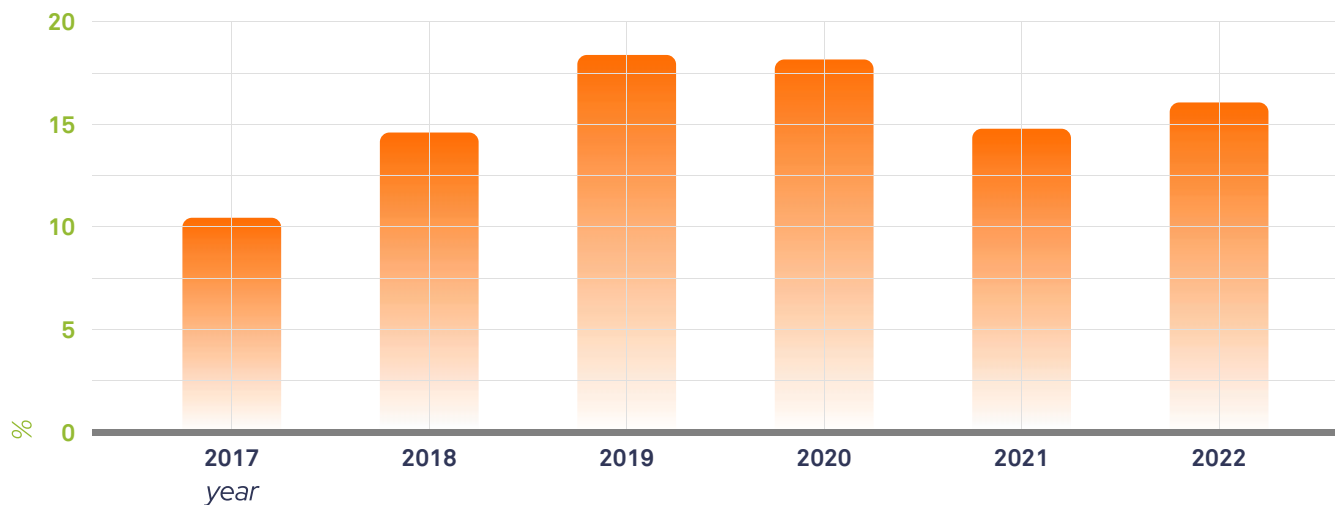


Figure 6:

Number of fires attended by fire brigade services in Ireland per annum caused by Chimneys/Flues/Soot/Hot Ashes as a percentage of Total Fires (excluding Dublin region) in the period 2017-2022





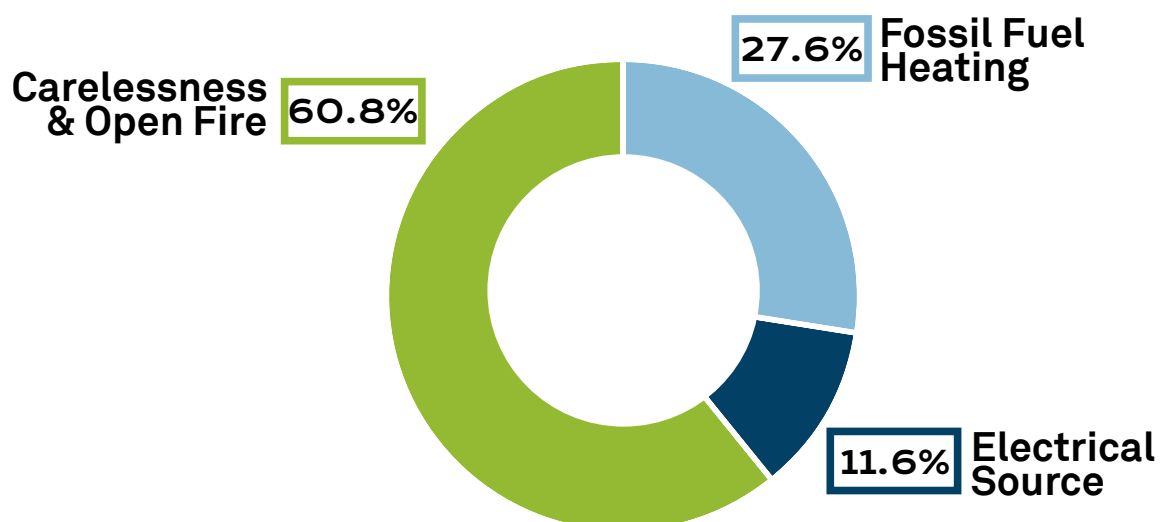
Poland

Coal remains the predominant primary energy source for heating in Poland. In 2021, Poland established a goal aiming to eliminate coal usage in individual household heating by 2040 and significantly reduce its presence in urban areas by 2030. Transitioning away from coal in individual heating poses considerable challenges, particularly in replacing existing coal infrastructure with alternative technologies like heat pumps. There is growing emphasis on integrating energy sources such as biomass to complement these efforts.

According to the Forum for European Domestic Electrical Safety (FEEDS), the Polish State Fire Service data reports the following breakdown for the cause of accidental domestic fires in Poland in 2017. A whopping 27.6% is due to combustion fossil fuel heating.

Figure 7:

Accidental domestic fires in Poland by source (2017)



Our other source of data for Poland comes from the International Association of Fire and Rescue Services (CTIF), although only for the year 2022. Earlier editions of the CTIF's annual statistics report do not include data on accidents and injuries caused by combustion heating and cooking technologies.

In 2022, Poland had 431 fires caused by failures of gas equipment. Assuming that all of these fires are likely to be residential, gas equipment failures would make up 1.4% of the 29,873 residential fires.

Based on statistics for injuries and deaths from fires overall in Poland, we can make some very rough estimates of the consequences of the fires caused by combustion technologies. There were 135,965 fires in Poland in 2022, 508 deaths, and 3,237 injuries. The bulk of these deaths, 363, were in residential fires. We can thus estimate that roughly 5 deaths in Poland in 2022 were due to fires started by failures of gas equipment. Similarly, we can estimate that about 31 people were injured. The average number of fires in 2022 were identical to that from the period of 2018-2022. Thus, we can roughly estimate 5 deaths and 31 injuries on average per year for the entire period, assuming a correlation between the number of fires and the number of people harmed.

Carbon Monoxide events & fatalities in Poland

Beyond fire accidents, according to Polish government data from the State Fire Service, firefighters recorded 4,350 interventions in 2023, in which 53 people were fatally poisoned by carbon monoxide and 1,468 were poisoned. This is 15 fewer carbon monoxide deaths than in 2022. Since the beginning of the heating season in October 2023 (until the writing of this report in June 2024), firefighters have intervened 1,089 times in connection with carbon monoxide emissions. As a result of carbon monoxide poisoning, 22 people lost their lives and 538 were injured.

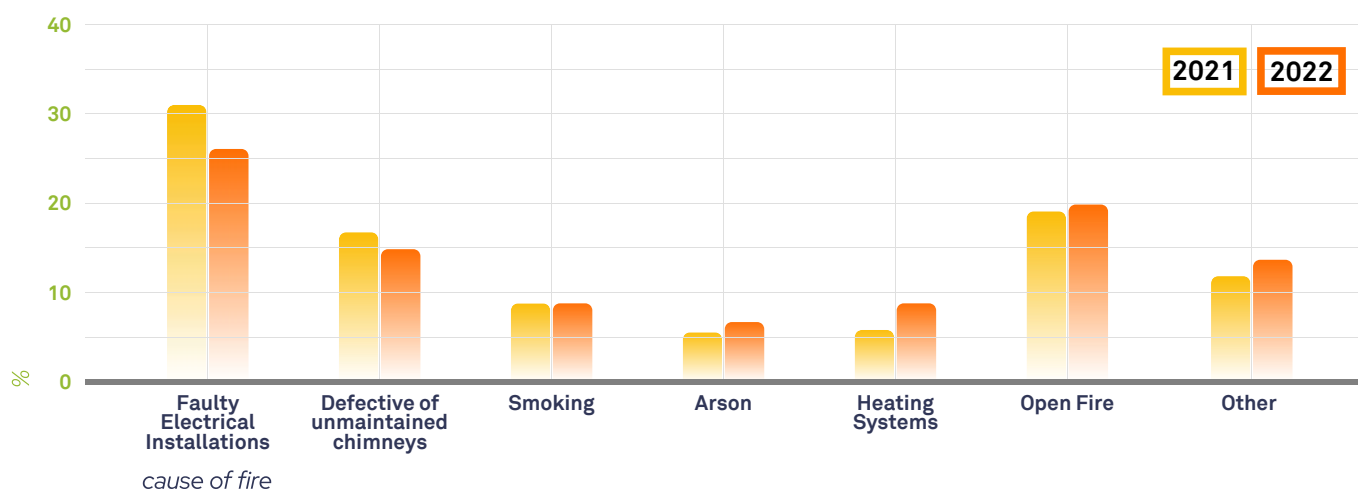


Romania

Romania relies heavily on natural gas for its energy needs, with a substantial portion of its electricity generated from gas-fired plants. Biomass, though less dominant, plays an important role, particularly in rural areas where it is used for heating and small-scale power generation. In 2021, roughly 3.5 million households used firewood for heating.

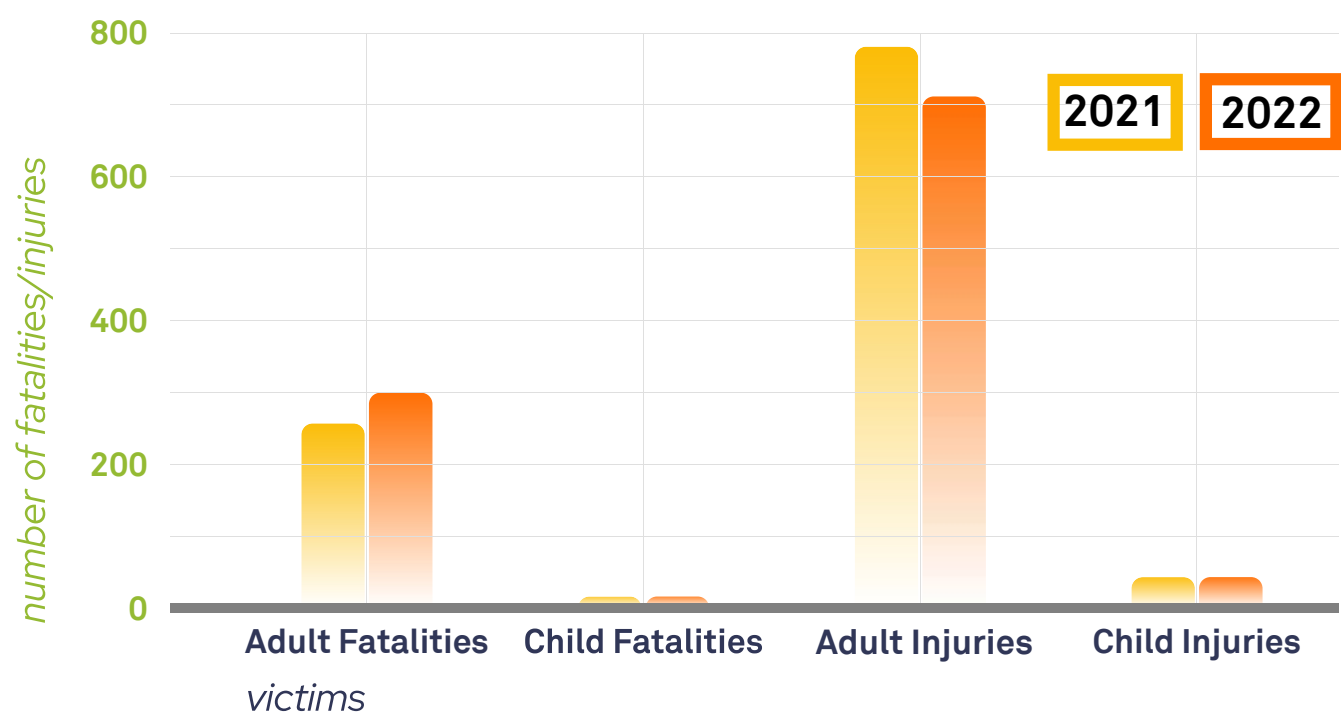
Data from the Romanian National Inspectorate for Emergency Situations includes a breakdown of the causes of fires. Their categories include “heating systems” which is separate from “faulty electric installations”. We interpret this to imply a separation between electric and combustion appliances for heating. Their data also includes “defective or unmaintained chimneys” and “open fire”. Results are plotted in Figure 8 below.

Figure 8:
Percentage breakdown of causes of fires
in Romania in 2021 and 2022



The data also includes numbers on fatalities and injuries to both adults and children, but is presented for fires of all causes. In 2021, there were 262 adult fatalities, 7 child fatalities, 774 adult injuries, and 40 child injuries. In 2022, there were 305 adult fatalities, 10 child fatalities, 702 adult injuries, and 40 child injuries.

Figure 9:
Adult and child fatalities and injuries in Romania in 2021 and 2022 (all fires)





Sweden

Traditionally, in Sweden, the use of gas for heating and cooking is limited to some urban areas, with oil heating being slightly more popular in rural areas and heat pumps and electric hobs being very common across the whole country.

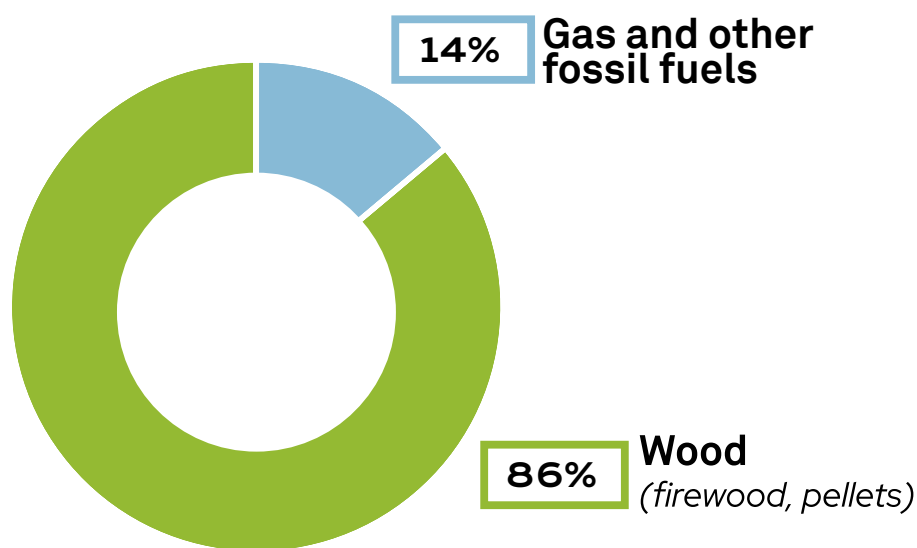
The Swedish government has implemented a range of measures designed to bolster energy efficiency and expand the use of renewable energy sources in heating. Over the past few years, support for fossil fuel-based heating has been scaled back significantly. Instead, biomass has emerged as the primary source of energy in district heating plants, playing a crucial role in meeting roughly a third of domestic heating demands.

For Sweden, also, we are relying on fire data, gathered in this case by the Swedish Civil Contingencies Agency (MSB). Unfortunately, not all available variables can be correlated with each other. For example, deaths in fires can be correlated with the room in which the fire started, but not the technology that caused the fire. We are thus undoubtedly missing deaths and injuries relevant to our study.

Overall, between 2018-2023, Sweden recorded at least 6,572 building fires and fire incidents begun by combustion heating and cooking technologies. Of these, about 14% were related to gas, oil, and coal-fuelled equipment, with the remainder mostly originating from wood-fuelled fireplaces and boilers. No clear trends are discernible over the period.

Figure 10:

Combustion heating and cooking fires by cause in Swedish buildings in 2018-2023



From the limited fire data available, we can say that fires beginning in boiler rooms caused 5 recorded deaths between 2013 and 2022, with no discernible trend. In addition, it should be noted that, according to the MSB (2018, 58), around half of all fatal fires have no recorded cause, so the recorded number may be far short of the total numbers of relevant fatalities.

From medical diagnoses data, we know that 77 people were injured by gas cylinder explosions during the same period, also with no discernible trend. A further 11 people were injured by boiler explosions, though no breakdown of boiler type is available, and no injuries of this type have occurred since 2019. Accidental carbon monoxide poisoning led to the deaths of 39 people over the same ten years, again with the numbers fluctuating minimally.

Brief overview of other Member States:

Portugal, Austria, Czech Republic, Hungary, Greece, Bulgaria, Lithuania and Cyprus

Portugal

Our data from Portugal is limited to a few articles which reference information from the National Statistics Institute (INE), and the Antiven Information Centre (CIAV), in Portugal.

According to the National Statistics Institute (INE), between 2002 and 2016 there were, on average, 10 deaths per year caused by “fireplace accidents”. Most of these accidents happened in the northern region of the country, where there are lower temperatures. In the same region, 71% of these deaths were caused by domestic accidents with fireplaces.

According to INE, these accidents are more frequent in rural areas of the country.

Carbon Monoxide fatalities in Portugal

The intoxication caused by the inhalation of fumes and gases (carbon monoxide), which includes accidents with fireplaces, braziers and heaters, led to the deaths of 171 people in Portugal in the last five years, between 2018 and 2022.

In 2017 there were 38 cases of death by carbon monoxide poisoning, an increase compared to 29 registered by the Antiven Information Center in 2016, numbers that may not reflect the total occurrences since not all situations at the national level pass through the CIAV.



Austria

Dr. Bauer, from EuroSafe, based on the Austrian cause of death register, makes a calculation of 2 fatalities due to carbon monoxide per 1 million inhabitants annually. From 2018-2022, the register tells us that 90 people died from accidental carbon monoxide poisoning, an average of 18 per year.



Czech Republic

For the Czech Republic, we only have data from the 2022 CTIF report. As with Poland, and all other countries for which this data is our only source, editions of the CTIF's annual statistics report prior to 2022 do not include data on accidents and injuries caused by combustion heating and cooking technologies.

The report tells us that in 2022, the Czech Republic had 4 fires caused by failures of gas equipment. This is too small a number though to infer the deaths and injuries statistics proportionately.

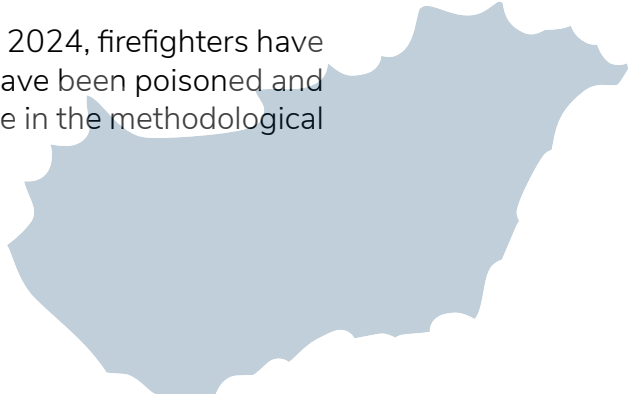
Hungary

Similar to Czech Republic and Poland, the 2022 CTIF report is the only source of statistics available for Hungary.

The report tells us that in 2022, Hungary had 32 fires caused by failures of gas equipment. Again, assuming that all of these fires are likely to be residential, gas equipment failures would make up 0.5% of the 6451 residential fires.

Based on statistics for injuries and deaths from fires overall in Hungary, we can make some very rough estimates of the consequences of these fires. Residential fires led to 83 deaths and 588 injuries in 2022. We can thus estimate that roughly 3 injuries and 0-1 death in Hungary in 2022 were due to fires started by failures of gas equipment. The number of fires in 2022 in Hungary is a little lower than the five-year average, so these injury and death figures might be a little lower during 2022 than the period's average.

In addition, regarding carbon monoxide poisoning, as of July 2024, firefighters have been called 1,020 times for carbon monoxide, 186 people have been poisoned and ten have died since the start of the year (see article reference in the methodological annex for Hungary).



A light blue silhouette map of Greece, showing the mainland and several islands, positioned in the upper left quadrant of the page.

Greece

In 2022, Greece had 43 fires caused by failures of gas equipment, according to the CTIF report. Again, assuming that all of these fires are likely to be residential, gas equipment failures would make up 0.3% of the 16,343 residential fires.

The overall statistics for injuries and deaths from fires overall in Greece do not allow us to make any estimates. Residential fires led to 51 deaths and a suspiciously low 37 injuries in 2022. The Czech Republic, with the same number of fires, had around 20 times that many injuries and as it is highly unusual to have fewer injuries than deaths. The researchers of this report deem the data unreliable.

A light blue silhouette map of Bulgaria, showing the country's outline, positioned in the lower right quadrant of the page.

Bulgaria

In 2022, Bulgaria had 208 fires caused by failures of gas equipment, according to the CTIF report. Again, assuming that all of these fires are likely to be residential, gas equipment failures would make up 6.5% of the 3,217 residential fires.

Based on statistics for injuries and deaths from fires overall in Bulgaria, we can make some very rough estimates of the consequences of these fires. Residential fires led to 139 deaths and 233 injuries in 2022. We can thus estimate that roughly 15 injuries and 9 deaths in Bulgaria in 2022 were due to fires started by failures of gas equipment. The number of fires in 2022 in Bulgaria was only slightly higher than the five-year average, so the injury and death figures for 2022 ought to be about average. We can estimate, then, roughly 75 injuries and 45 deaths over the period 2018-2022 from failures in gas equipment.



Lithuania

In 2022, Lithuania had 23 fires caused by failures of gas equipment, according to the CTIF report. Again, assuming that all of these fires are likely to be residential, gas equipment failures would make up 1.4% of the 1,643 residential fires.

The statistics do not appear entirely reliable. Residential fires apparently led to 47 deaths and 49 injuries in 2022, which flags the data as suspicious as injuries are too low as a function of total fires and deaths to be considered reliable. However, the death figures are likely to be correct, as deaths are much better recorded. Hence, we can estimate 0-1 death for the year 2022 and perhaps 2 deaths from gas equipment failure fires for the period 2020-2022 (no earlier figures are recorded).



Cyprus

In 2022, Cyprus had 28 fires caused by failures of gas equipment, according to the CTIF report. Again, assuming that all of these fires are likely to be residential, gas equipment failures would make up 35% of the 80 residential fires.

No data on the number of deaths and injuries in residential fires in Cyprus is available.

Focus on:

Carbon Monoxide fatalities in Europe

Fatalities by Unintentional Carbon Monoxide Poisoning

Alongside fires and explosions, carbon monoxide poisoning is another typically combustion-based cause of death or injury in Europe, and occurs from breathing in carbon monoxide (CO) at excessive levels. It is produced during incomplete burning of organic matter, most commonly fossil fuels (but also wood). Our research revealed some surprising numbers, especially with regards to Eastern Europe.

According to the research paper “Global, regional, and national mortality due to unintentional carbon monoxide poisoning, 2000–2021: results from the Global Burden of Disease Study 2021” there were between 21,700–32,800 deaths due to unintentional carbon monoxide poisoning globally in 2021. Note that the words ‘unintentional’ and later ‘accidental’ are used to distinguish from carbon monoxide poisoning in suicide (which would increase the numbers if included). The following is a breakdown of the numbers across Europe.





-  Fatalities due to unintentional carbon monoxide poisoning in 2021: **Eastern Europe** had the highest age-standardised mortality rate in the world, at 19.8 - 23 deaths per 1,000,000 per annum (Global Burden of Diseases, Injuries, and Risk Factors Study (GBD)).
-  Across Eastern Europe this amounted to 5,180–6,080 deaths in 2021.
-  **Central Europe** had an age-standardised mortality rate, in 2021, of 3.35 to 3.89 per 1,000,000 per annum (Global Burden of Diseases, Injuries, and Risk Factors Study (GBD)). This led to 582 fatalities in 2021
-  **Western Europe** had an age-standardised mortality rate in 2021, of 0.825 to 0.889 deaths per 1,000,000 per annum (Global Burden of Diseases, Injuries, and Risk Factors Study (GBD)). **Depending on values used in the range, this is around 4% of the rate in Eastern Europe. This led to 536 fatalities in 2021**

Figure 11:
**Regional fatality rates due to accidental
Carbon Monoxide poisoning in 2021**

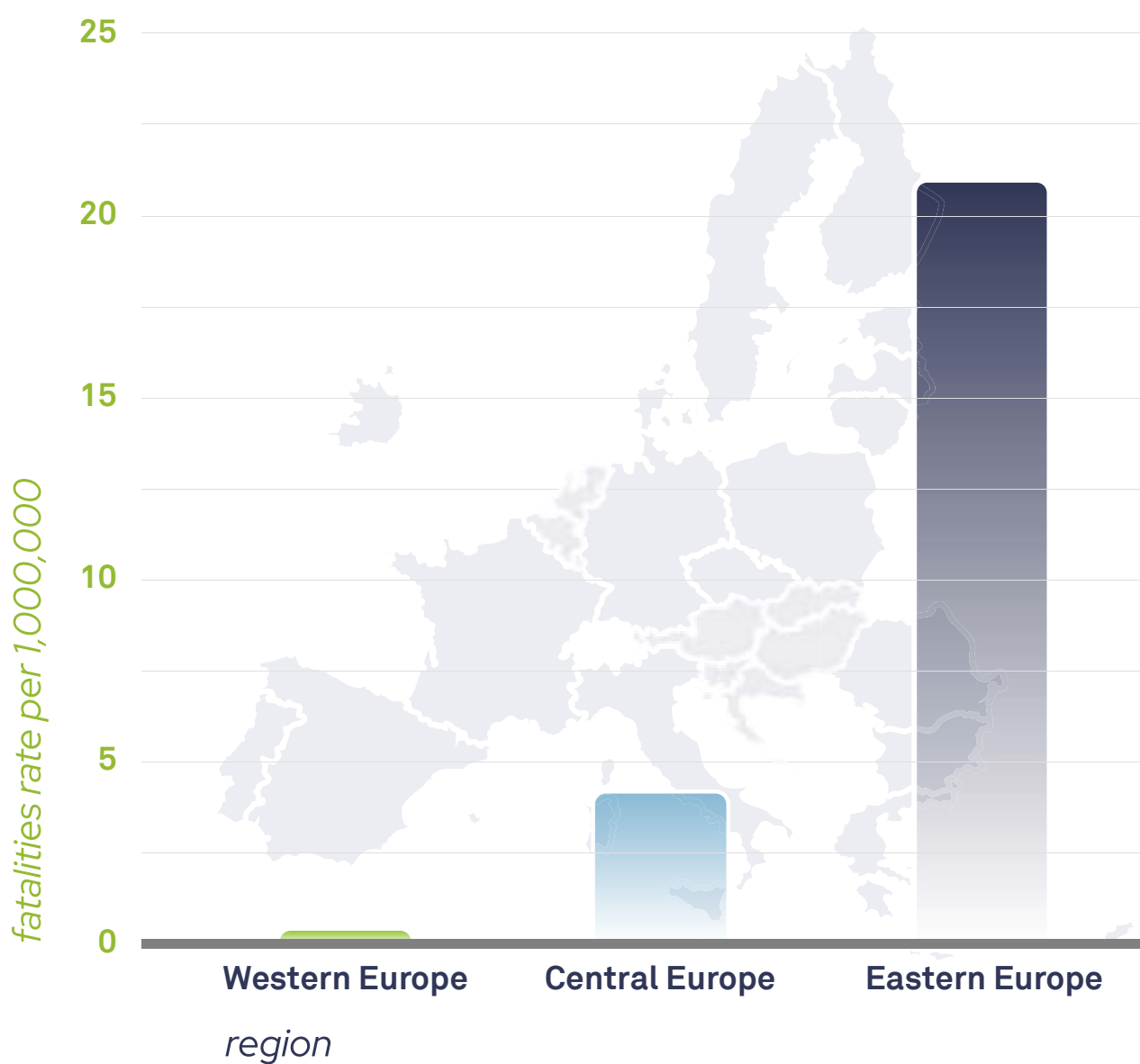
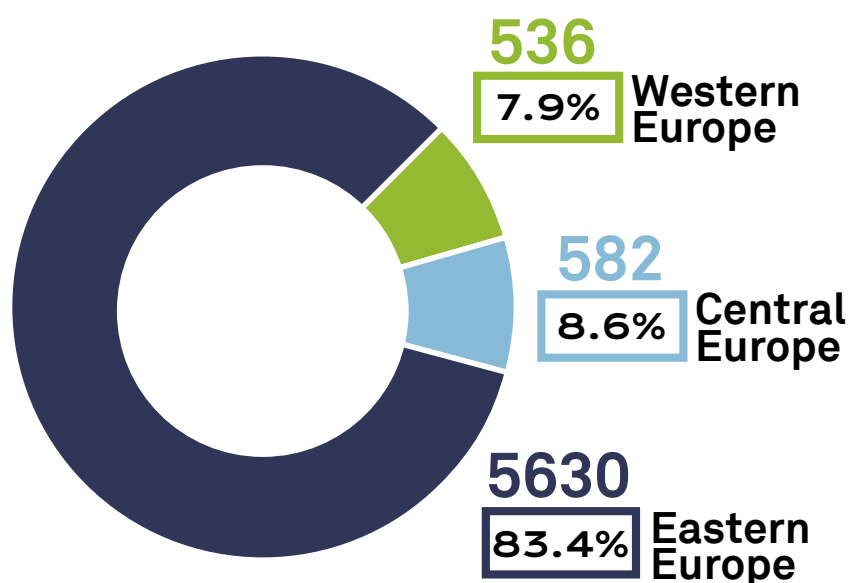


Figure 12:

Regional fatality rates due to accidental Carbon Monoxide poisoning in 2021 represented as percentages of total, and as absolute values.



To put these numbers into context, in 2021 the fatality rate due to motor vehicle accidents in developed wealthy nations like Japan, Sweden, and Ireland range from 21-28 per 1,000,000 per annum.

That is to say, in 2021, **the fatality rate due to unintentional carbon monoxide poisoning in Eastern Europe is similar to the fatality rate due to motor vehicle accidents in Western Europe.** A similar statement can be made about homicide rates and work accident fatality rates (see *Figure 13, 14, 15*).

Figure 13:

Comparison between Accidental Carbon Monoxide Fatality Rate in Eastern Europe with Vehicle Fatality Rates in a selection of nations in 2021

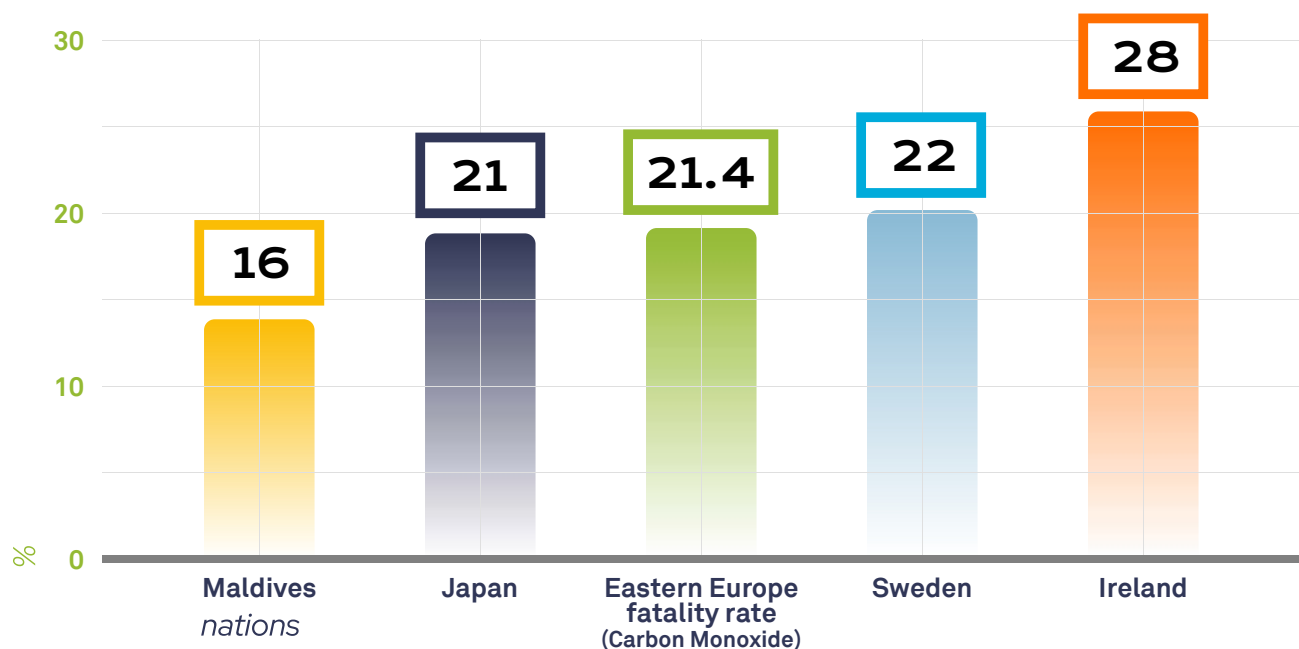


Figure 14:

Comparison between Accidental Carbon Monoxide Fatality Rate in Eastern Europe with Homicide Rates in a selection of nations in recent years

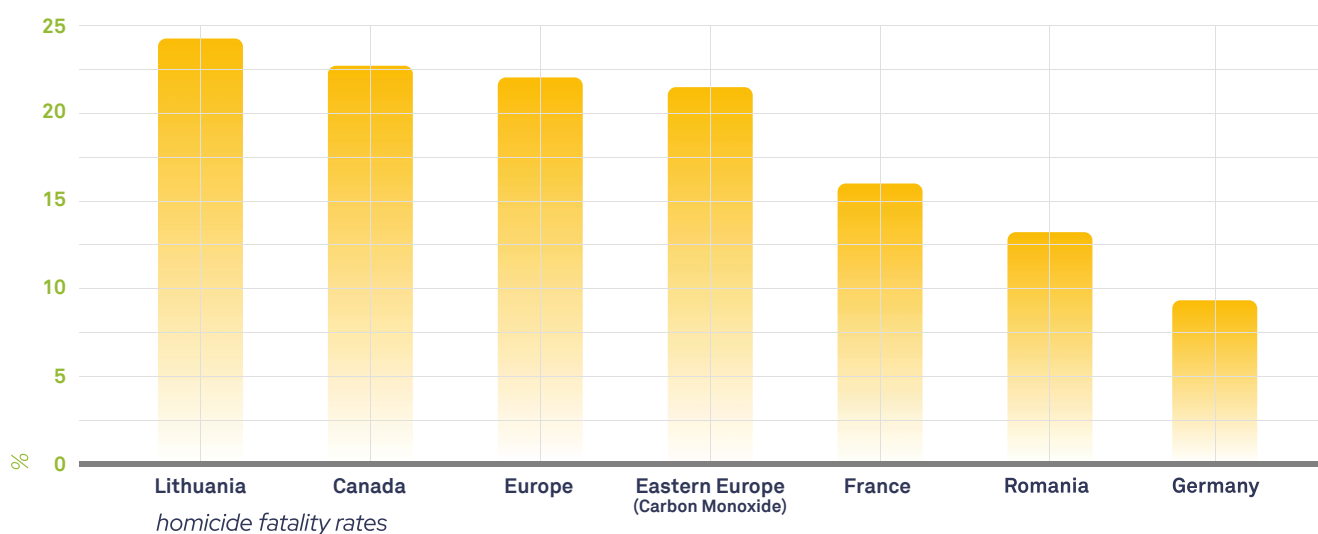
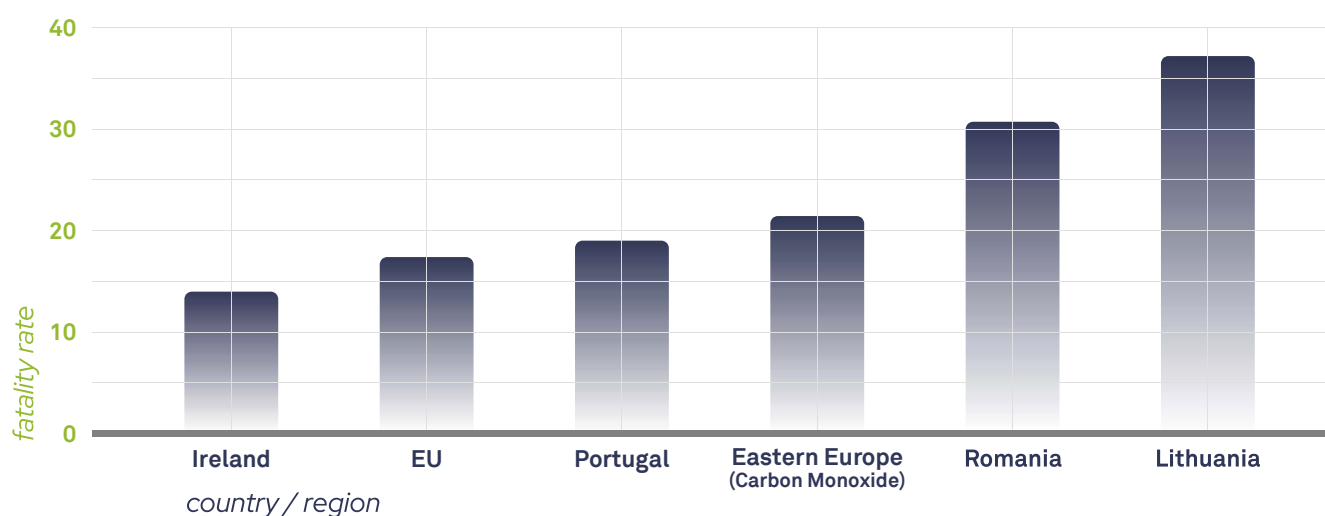


Figure 15:
Comparison between Accidental Carbon Monoxide Fatality Rate in Eastern Europe with Work Accident Fatality Rates in for a range of countries in 2021



The authors of the paper on which this data is based (GBD 2021 Carbon Monoxide Poisoning Collaborators, October 2023) recommend the prioritisation of policy-level interventions that lower the risk of carbon monoxide poisoning events, “such as those that increase access to improved heating and cooking devices.” Considering the high rate of carbon monoxide poisoning in comparison with other regions of Europe and with other causes of fatalities, it is clear that nations across Eastern Europe need to prioritise this major issue.

It's also worth stressing that electrified and solar heating and cooking systems do not produce any Carbon Monoxide.

Conclusions

It is not yet possible to obtain and compare comprehensive data on accidents in Europe owing to combustion heating and cooking technologies in buildings. A harmonisation strategy for collecting such data is in development by EU Firestat who have already rolled out a pilot programme and are collecting data this year (2024). Given the data limitations, we suspect that the data we uncovered represents an underestimate of the injuries and fatalities associated with the use of combustion products for heating and cooking.

By reaching out to relevant data collection organisations at EU and Member State level, such as safety groups like EuroSafe (which collects hospital data) and national fire services (which collect fire accident data), it is possible to develop a picture of accidents caused by combustion-related technologies on a country-by-country basis, though this picture may be uneven.

Based on our analysis of a range of EU nations, looking at fire accident data and injury databases, it is clear that accidents related to gas and oil-based cooking and heating systems, as well as fireplaces and chimneys, are ubiquitous across the bloc, likely injuring thousands of citizens annually.

Across the EU we can expect 2-4 hospital-treated injuries per 1,000,000 EU inhabitants per annum due to combustion fossil fuel heating and cooking technologies. In absolute values, taking the population of the EU as 450 million (2024 estimate), this would amount to between 900 and 1,800 hospital treated injuries per annum due to accidents related to combustion fossil fuel heating and cooking technologies across the bloc. This number would rise significantly if all combustion fuels are included, as is clear from the fire data we have amassed. It is unclear what the fatality rate is for the EU as a whole.

Considering carbon monoxide poisoning, the highest fatality rate is in Eastern Europe at a staggering 19.8 - 23 deaths per 1,000,000 in 2021 (5,180–6,080 deaths in total), which is at least an order of magnitude higher than in Western and Central Europe. To put those numbers into context, the fatality rate due to unintentional carbon monoxide poisoning in Eastern Europe is similar to the fatality rate due to motor vehicle accidents in Western Europe. This would suggest that, in terms of safety, Eastern Europe has the most to benefit from the adoption of new technologies for heating and cooking.

In addition, our report has not investigated other losses such as the economic cost uniquely associated with combustion technologies and their complications compared to cleaner and safer alternatives: building destruction and damage; healthcare/hospital costs; costs associated with investigating and reporting accidents; and the cost of implementing annual safety checks.

More difficult ramifications to measure include the social cost and wellbeing cost of family trauma and generational trauma, which are known to affect rates of depression, addiction and criminality (and further associated economic costs).

It is clear that the mass introduction of non-combustion heating systems such as heat pumps and solar technology - as long as they are implemented within suitable and safe electrical infrastructure - will reduce injury and fatality due to fires, explosions and carbon monoxide poisoning associated with combustion fuels in buildings.

The EU and its Member States do not put nearly enough resources into gathering accident and injury data. EuroSafe - a private organisation which has been the largest concerted effort to gather this data in the EU - was made possible mostly by time-limited grants to individual Member State organisations. These grants have increasingly run out and have not been replaced. If Europe wants to pursue rational technology policies, it must have up-to-date and relevant data on safety. Funding organisations to gather this data comprehensively in each Member State is therefore a necessity.

Policy recommen- dations

Combustion heating and cooking technologies, in particular gas and oil, contribute to European rate of energy poverty as well as greenhouse emissions. The additional evidence found in this report regarding the health and safety concerns further substantiates the call to phase out of combustion technologies, and in particular fossil ones from our homes.

1

End the promotion of new fossil boiler by ending subsidies and set an end date for the sale of new boilers. In 2023, [nine Member States still subsidised](#) the installation of new boilers with taxpayers' money. These subsidies should be redirected to the promotion of cleaner and safer technologies (e.g., heat pump and solar thermal, PV and PVT).

2

Dedicate the whole of the ETS2 revenues to the Social Climate Fund in order to support Member States' just and clean transition for heating and cooking systems. The fund should primarily target low to middle income households who might struggle with the upfront costs of installing new equipment but who will benefit the most from the lower running costs of these technologies.

3

Whenever possible, promote solar and storage in combination with heat pump, particularly in renovation, as this improves the payback time of the investment and guarantees lower running costs compared to fossil solutions.

4

Create a "EU clean & safe heating fund" to funnel the existing scattered sources of funding. This fund, complemented with national funds, could trigger investments from the private sector, thus leading to a quick technology turnover.

5

Ensure a dedicated electricity tariff enjoying the lowest possible taxation is present in every Member State: switching to safer heating and cooking technology would not be possible otherwise, as the investment would result in increased heating and cooking running [costs](#).

6

Promote dedicated training and awareness raising on these technologies in the existing heating workforce and future professionals: the technical expertise has been mentioned as a key factor for the adoption of renewable technologies and in future-proofing the European labour market.

Method- ological Annex

EU



<https://www.eurosafe.eu.com/home> (data from this source was obtained through private communication because it is not publicly available. This data is contained in the master database file sent to the EEB).

Puzzolo et al. 2024. "Estimated Health Effects from Domestic Use of Gaseous Fuels for Cooking and Heating in High-Income, Middle-Income, and Low-Income Countries: A Systematic Review and Meta-Analyses." *The Lancet. Respiratory Medicine*, vol. 12 (4), 281–93. [https://doi.org/10.1016/S2213-2600\(23\)00427-7](https://doi.org/10.1016/S2213-2600(23)00427-7).

<https://www.clasp.ngo/research/all/cooking-with-gas-findings-from-a-pan-european-indoor-air-quality-field-study/>

Bulgaria



CTIF. *Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services*. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Cyprus



CTIF. *Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services*. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Czechia



CTIF. *Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services*. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Denmark



Redningsberedskabets Statistikbank of Denmark: <http://statistikbank.brs.dk>

Danish Emergency Management Agency - personal email from Steen Hjere Nonnemann, Head of Statistics (data contained in updated master database)

https://www.92grp.dk/files/Danish_92_Group_comments_to_the_Danish_NECP.pdf

<https://prodstoragehoeringspo.blob.core.windows.net/7ebad7e0-25b1-4462-a64a-72dcc77d9c71/Ajourf%C3%B8ring%20af%20Danmarks%20nationale%20energi-%20og%20klimaplan.pdf>

France



Bureau for Analysis of Industrial Risks and Pollutions (BARPI)

<https://www.aria.developpement-durable.gouv.fr/?lang=en&s=>

https://ec.europa.eu/commission/presscorner/detail/en/ip_24_1549

<https://www.euractiv.com/section/energy-environment/news/frances-battle-plan-to-produce-one-million-heat-pumps-a-year/>

Germany



<https://www.feedsnet.org/wp-content/uploads/2023/01/FEEDS-accidental-fires-202104.pdf>

<https://www.ifs-ev.org/>

<https://www.euractiv.com/section/energy-environment/news/germany-adopts-watered-down-fossil-boiler-ban-for-2028/>

<https://www.cleanenergywire.org/news/record-sales-new-heating-systems-germany-led-gas-based-units>

Greece



CTIF. Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Hungary



CTIF. Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

<https://magyarnemzet.hu/belfold/2023/12/az-on-elete-biztonsagban-van-mutatjuk-hol-tudja-ellenorizni-biztonsagos-e-a-szen-monoxid-erzekeloje>

Italy



Comitato Italiano Gas (2020) Statistica Incidenti da gas combustibile in Italia anno 2019. Available at: <https://www.cig.it/wp-content/uploads/gara2020/08-Statistica-Incidenti-da-gas-2019.pdf>

https://eccoclimate.org/wp-content/uploads/2024/07/PNIEC_La-pagella-di-ECCO.pdf

Ireland



<https://www.gov.ie/pdf/?file=https://assets.gov.ie/94442/f3e50986-9fde-4d34-aa35-319af3bfac0c.pdf#page=null>

<https://www.gov.ie/en/collection/3c982-causes-of-fires-statistics/>

Lithuania



CTIF. Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Poland



https://commission.europa.eu/document/download/5118b15e-d380-49ae-b8bb-41cc81a28e15_en?filename=PL_NECUpdate_Projekt_EN.pdf

<https://www.feedsnet.org/wp-content/uploads/2023/01/FEEDS-accidental-fires-202104.pdf> which cites the Polish State Fire Service, 'data collection regulated by the Minister of Interior and Administration (regulation of 3 July 2017 on the detailed organization of the national fire-fighting and rescue system).'

CTIF. Fire Statistics for 2024: Annual Report of the International Association of Fire and Rescue Services. June 2024. Accessed July 3, 2024. https://www.ctif.org/sites/default/files/2024-06/CTIF_Report29_ERG.pdf.

Carbon Monoxide events & fatalities in Poland

Interwencje strażaków w 2023 roku - Komenda Główna Państwowej Straży Pożarnej - Portal Gov.pl (www.gov.pl)

Portugal



Fireplace accidents: <https://htq.pt/acidentes-com-lareiras/>

Carbon monoxide fatalities in Portugal

<https://www.cmjornal.pt/portugal/detalhe/monoxido-de-carbono-mata-171-pessoas-em-casa-nos-ultimos-cinco-anos-em-portugal>

<https://www.inem.pt/2018/01/05/intoxicacoes-por-monoxido-de-carbono-um-perigo-invisivel/>

Romania



<https://www.euractiv.com/section/biomass/news/romania-wont-prohibit-wood-for-household-heating-energy-minister-says/>

<https://igsu.ro/Resources/COJ/RapoarteStudii/Analiza%20operativa%2001.01-31.12.2022.pdf>

Sweden



Swedish Civil Contingencies Agency (MSB). (2018). *Analys av utvecklingen inom bostadsbrand 2018: målstyrning av brandsäkerhetsarbetet mot etappmålen 2020*. Swedish Civil Contingencies Agency.

<https://statistik.msb.se/>

Carbon Monoxide across Europe

[https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667\(23\)00185-8/fulltext](https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(23)00185-8/fulltext)

<https://www.europeanfiresafetyalliance.org/wp-content/uploads/2017/04/12.pdf>

Road traffic fatality rates: <https://apps.who.int/gho/data/view.main.RoadTrafficDeathREG?lang=en>

Homicide rates: <https://dataunodc.un.org/dp-intentional-homicide-victims>

Work accident fatality rates: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Accidents_at_work_statistics

Full database for the analysis can be found [here](#)



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