



The environmental safety aspects of domestic residential chimney sweeping

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Abstract

The gas supply crisis of recent months has led to the need for crisis management measures in several countries. Among other things, coal mines that had previously ceased production have been reopened, and there are plans to expand the alternatives to energy sources by cutting down wood for energy purposes.

The impact of the current energy crisis, as in so many other areas, is having a direct impact on the operation of domestic heating systems. Thus, the need to meet the communal demands of the population can lead to critical technical conditions at times during the normal pre-season heating inspections. Such a change in the energy situation could pose a serious threat to the safety of life and property for chimney sweeps who have not carried out this form of maintenance on solid fuel firing appliances and flue gas ducts that have been taken out of service but which are now being brought back into service because of the high cost of overheating.

Keywords: chimney sweeping, service, solid-fuel heater, exhaust flue, fire protection.

1 Introduction

The spread of the use of fire was a defining event in the rise of mankind. The first and most important step in understanding the nature of fire was the notification of the dangers of fire. The knowledge that this provided is still the basis for fire safety in its various uses. Although their risks are also significantly influenced by the environmental conditions of use. The fundamental problem with outdoor fires is to control their physical spread and prevent fire spread.

In settled human communities, fire very quickly takes up residence in the living space. Initially, it was used as a recess with an open firebox for heating the interior air and cooking food so that the smoke from the combustion products could escape freely through an opening in the roof, but the efficiency of this was far from optimal. For a long time, this commonly used solution was the dominant solution. Nevertheless, archaeological excavations have identified several very early traces of chimneys dating from the 5th century BC. [1]

The use of chimneys in the built environment, however, is now a highly reliable set of conditions for the safety of life and property, with the development of significant engineering methods. However, it is precisely the spread of combustion products in the open air, coupled with the resulting barrier, that can create life-threatening situations. This is due to the pyrolysis released in open-combustion fires and the rapidly decreasing oxygen levels as the combustion process progresses, with the formation of an increasing number of partially oxidizing components, most of which are

highly toxic, even for combustible materials of organic origin. This adds a very important element to the safety challenge by allowing the risk-free evacuation of these hazardous gases and solid combustion products from the interior through the chimney flue [2].

However, these combustion plants, like other systems, require technically defined maintenance of operating criteria. Therefore, special attention must be paid to maintaining their technical condition at the design stage and thereafter. [3]

In addition, the intermittent heating seasons, which often result in discontinuous operation, can pose an additional risk, as they can give rise to hidden technical problems. Moreover, in addition to their life-damaging nature, these combustion products can also cause considerable corrosive interaction with the building products that meet them. Not only does this create structural integrity problems, but the resulting leaks in rooms in contact with the flue gas ducts through their boundary structures are also unanticipated. More serious structural damage, directly caused by fire, can be expected if high-temperature combustion gases escaping from damaged flue gas ducts interact with combustible building structural elements. These occur mostly on roof structures. However, several developments that improve the quality of living conditions from a comfort point of view are heating systems and related building service upgrades, which are a major aspect of the safety of life and property.

The professional tasks involved, therefore, combined with the expertise of chimney sweeps, who are skilled in the operation and maintenance of buildings and based on engineering design, can help to maintain the expected level of safety and security of life and property in buildings.

The volume of chimney sweeping work has decreased significantly in recent years, thanks to the economical use of energy sources based on modern combustion technology. However, there is still a need for biomass-based ones, especially for less developed combustion plants which are still polluting and unsafe in terms of air quality protection. The figures in Figures 1 and 2 illustrate this. The former illustrates the very different levels of economic development of the different regions of Hungary. The second shows that more modern heating systems and associated chimneys are more common in developed urban settlements. Although their geographic extent differs, this in itself illustrates the existential relationship between the nature of residential heating technology.

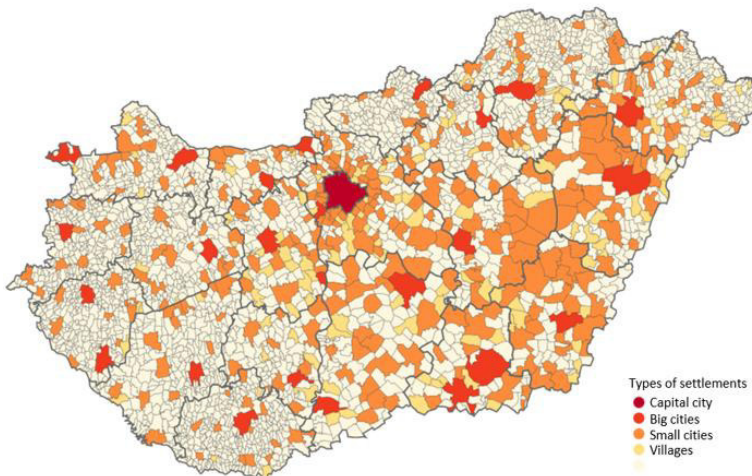


Figure 1. Distribution of settlement structure according to spatial development indicators, Source: CSO (20221) [4]

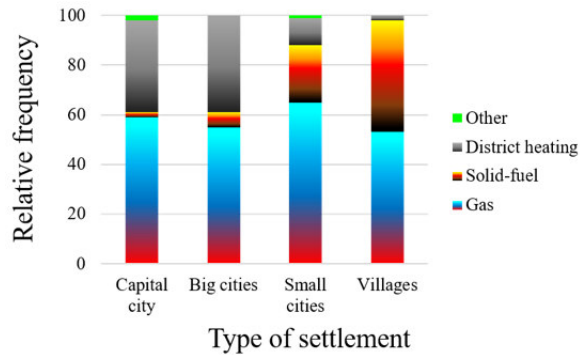


Figure 2. Distribution of settlement structure according to spatial development indicators
Source: Edited by the author based on CSO (2008) [5]

However, the energy crisis we are now witnessing has not only brought about a halt to the positive changes that have been achieved over many decades but could also lead to a significant step backward in terms of changes in combustion methods, fuel equipment, waste incineration and, not least, the energy mix. Given their increasing expenditure, many are likely to plan to revert to more outdated mixed or solid fuel heating systems, where the possibility of doing so has not been fully explored. Rural homes are a typical example, but in more than one case, minor or major modifications are required to bring combustion flues into operation. Not to mention the chimney sweep inspections that are essential in such cases. This is because modern heat generators operate in a different way from older types. For example, the parameters of the combustion products produced have changed considerably, which has led to different requirements for chimneys and flue gas ducts. From an organizational point of view, it also requires an increase in the speed of the service, which is already understaffed and understaffed because of the shortage of time in the run-up to the heating season.

2 Environmental aspects of residential chimney sweeping

The restructuring of energy production in the wake of the energy crisis has led to an increasing number of voices nowadays on the harmful effects on our environment, the harm caused by the increasing pollution of environmental elements, and the expected negative effects of climate change. Given that one of the most sensitive environmental elements in this respect, the atmosphere is no longer the only one directly affected region of the globe to face worsening emissions. As we have seen during the COVID epidemic, the reduction in intensive industrial and consumer activity has led to an extraordinary drop in air pollution levels in all parts of the world, even in the most remote and isolated corners.

However, industrial pollutants cannot be characterized by a general emission figure. For, technologies that use only natural gas and are therefore highly efficient in generating electricity or heat can be operated with more favorable air pollution quality parameters than other fossil fuel technologies. The latter is, in principle, almost equivalent to other combustion chemical technologies in terms of emission performance. In other words, they were, in-deed, highly polluting and dangerous during the earlier period of industrial production with little regard for the environment. Nothing proves this better than the fact that in 1775, in his monograph on chimney sweeps cleaning chimney flues during the Industrial Revolution, the London surgeon Sir Percival Pott described testicular cancer as an occupational disease of chimney sweeps, the cause of which he defined as the

repeated and persistent contact of soot from coal burning with the skin. [6]

However, nowadays, the solid components of the combustion products generated can be separated from the combustion products with very good efficiency, including the combustion gases that can cause adverse environmental effects. It can therefore be said that in contrast to the emissions of pollutants into the environment from domestic combustion plants, heating systems used by industry and other businesses typically use advanced combustion processes, so the emissions of pollutants from these systems are incomparably more favorable than those from almost unregulated residential buildings.

The same conclusion has been reached by scientific research, which has shown that air pollutants are a significant part of the environmental burden of air pollution. This is particularly true in the case of particulate matter and polycyclic aromatic compounds, which are harmful to health. They increase the amount of particulate matter released into the air and cause air pollution reaching very high concentrations in the vicinity of built-up areas, especially during the heating season. This is mainly due to the fact that heating systems are often operated in a way that is outdated or does not comply with technical standards. [7]

On the other hand, the choice of fuels used is no longer in line with technical requirements. Often, plant owners use inappropriate combustion equipment as 'incinerators' to re-cover part of the municipal waste while emitting seriously harmful substances in the combustion gas mixture. In this respect, the combustion products are very similar in material quality to the components to be measured in the flue gases from hazardous waste incineration. [8]

A good example of this is the dense smog that develops in municipalities in residential areas with individual heating systems, typically in single-family houses. This is due to the fact that unfavorable atmospheric conditions, which often occur during the winter heating season and are characterized by weather conditions that invert the vertical stability of the air, specifically promote the trapping of combustion products in the near-surface air layers, causing relatively long and concentrated persistent disperse pollution. The solid and irritant gaseous components of the smoke that partly make up this, which is emitted from the chimneys, can cause acute upper respiratory tract complaints in the case of short-term exposure and serious chronic health problems in the longer term. [9]

The protection of our immediate living environment and the wider natural environment is of fundamental interest to society today. Therefore, effective solutions for cases involving the emission of airborne particles from residential fire aerosols can also be directly linked to the operation of combustion devices attached to chimneys. In other words, the priority is to increase the efficiency of the combustion equipment responsible for the emissions and, on the other hand, to improve the quality of the fuel choice. Regular and professional inspection and maintenance of flue gas ducts, using chimney sweeping services, should be a priority in maintaining the air pollution conditions that are conducive to the health benefits to be achieved.

A significant contribution to this can be made by gas-fired boilers, which have increasingly replaced individual solid fuel systems in recent years through domestic heating modernization programs, and which produce heat for residential heating with greater techno-logical efficiency. Unfortunately, however, where the current energy crisis will lead to a shift towards renewable energy sources, such as firewood, the combustion technology systems to be used will be scaled back. This, coupled with the lack of professional chimney sweeping and cleaning to ensure that flue gas ducts, which are essential to maintain them in good technical condition due to the earlier shutdown of combustion installations, are likely to worsen the already very poor air quality in some municipalities, as illustrated in Figure 3, during and after the coming heating season.

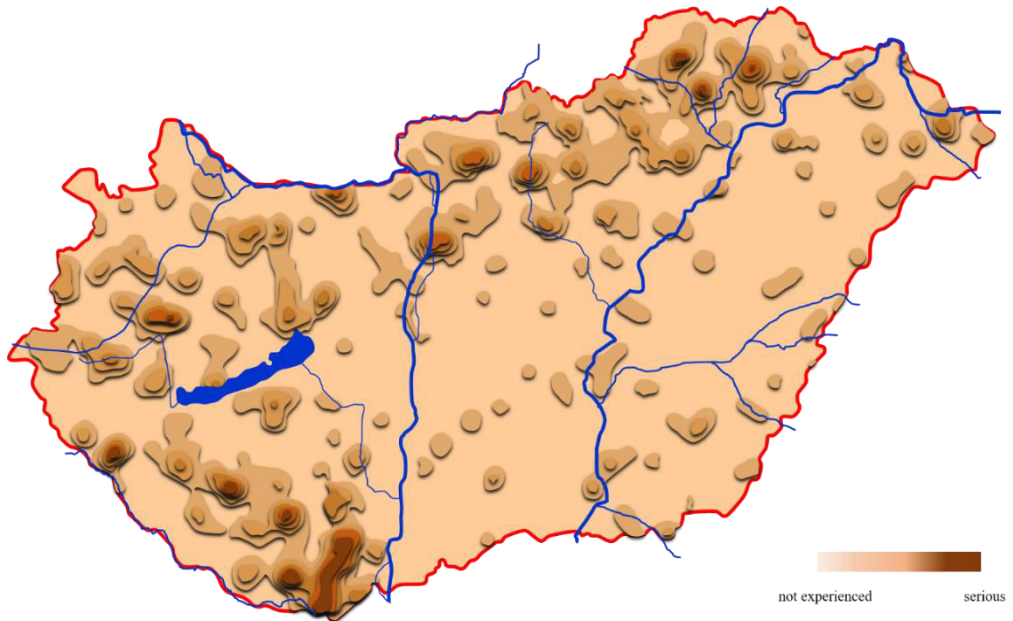


Figure 3. The severity of the air pollution in Hungarian municipalities, Source: Edited by the author based on WWF Hungary (2017) [10]

Old-new heating systems made operational in this way will certainly bring cost savings in today's high gas prices. However, not carrying out periodic chimney sweeping and any necessary cleaning, apart from the environmental degradation that is not directly reflected in the cost to the public, seriously compromises the safety of life and property.

Chimney sweepers, in the context of their service to the public, make a significant contribution to the safety of residential property by ensuring that inspections and sweeping are carried out in good time. Nothing is better proof of this than the fact that around 80 per-cent of the nearly 5 million chimneys in Hungary, as shown in Figure 4, are in residential properties. [11]

Thus, residential chimney sweeping is indeed part of the preventive fire protection system, which is a well-known professional objective of fire protection, but also a priority for the layman, and which is also evident to the layman. Naturally, the larger the population of a given region, the greater the added value of chimney sweeping in this way. Thus, the central region of the country, the capital, and the counties immediately adjacent to it account for most chimneys inspected. On the one hand, this can obviously only be achieved with a very intensive supply of tasks, considering the technologically required cycle times. On the other hand, this is considerably facilitated by the relatively high density of built-up areas compared with the dispersed settlement structure of other geographically more extensive regions.

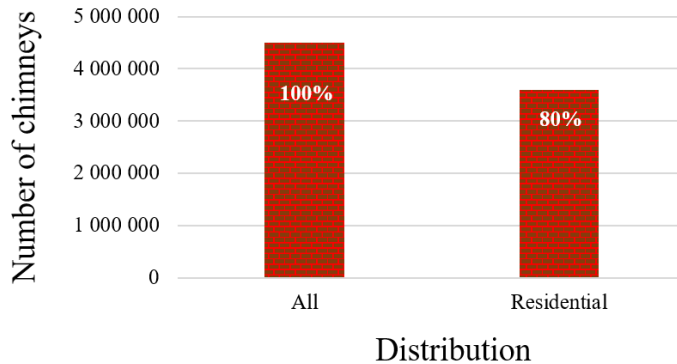


Figure 4. The distribution of chimneys in Hungary, Source: Edited by the author based on the database of chimney sweeping services [11]

3 Conclusion

On the basis of the above, it can be generally stated that the chimney sweep service, which is the largest residential service provider in Hungary and belongs to the professional disaster management organization, is the most important segment of this task system in terms of consequences, and is facing an unexpected workload in terms of serving the Hungarian real estate population of nearly 2.5 million chimneys. Consequently, we must also take into account the current and expected evolution of the energy mix in the world and especially in the European Union.

The resulting domestic energy use may bring a return of the challenges that are now beginning to disappear, not only for the domestic organizations involved in managing these challenges but also for the public itself, and in which not only the chimney sweeping industry but all domestic chimney sweeping service providers have an important role to play.

Acknowledgments

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