The Hospitality Sector, COVID-19 and Air Quality

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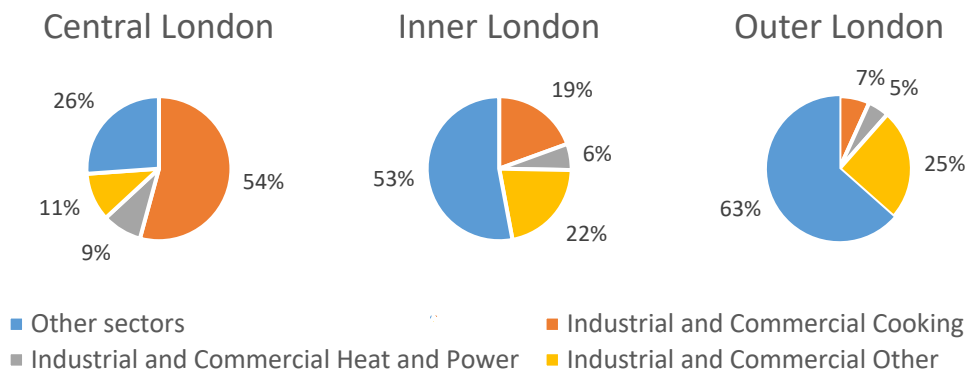
Air Quality: The Hospitality Sector and COVID-19

The hospitality sector has been one of the worst affected by the coronavirus pandemic. The closure of pubs, restaurants, cafes and bars between March and July 2020 led to significant job losses with business shutting down in spite of government support and job protection schemes. Recognising the damage that was being done to this sector of the economy, the government announced that the sector could resume business during the summer, provided health and safety guidelines were followed to mitigate against COVID transmission.
The guidelines include recommendations to optimise premises' ventilation and use of outdoor spaces. For businesses in the hospitality sector this will lead to a rise in energy use, particularly for heating, and associated environmental impacts and costs. This report examines the contribution the hospitality sector makes to air pollution, the effect COVID measures will have on emissions, and ways to support businesses to reduce their impact on air-quality. The paper focusses on pollution from NOx and particulate matter, the health impacts of which are well documented and not discussed here.

Hospitality in London

Hospitality is a major part of London's economy. Pubs alone contribute around £2.6 billion a year in gross value added to London's economy[1]. The city has around 13,900 premises classified as either a pub, restaurant or cafe[2]. Data from the London Atmospheric Emissions Inventory (LAEI) [3] shows that the contribution to PM2.5 levels from commercial cooking, account for one half of PM2.5 emissions in Central London. This makes up 47% of PM2.5 emissions in Westminster and 54% in the City of London, around twice as high as emissions from transport[4]. Investigation of each London borough's air quality action plans, reveals barely any actions to reduce emissions from cooking, save for action against breaches in smoke control areas[5].

Sector split of PM2.5 emissions across London

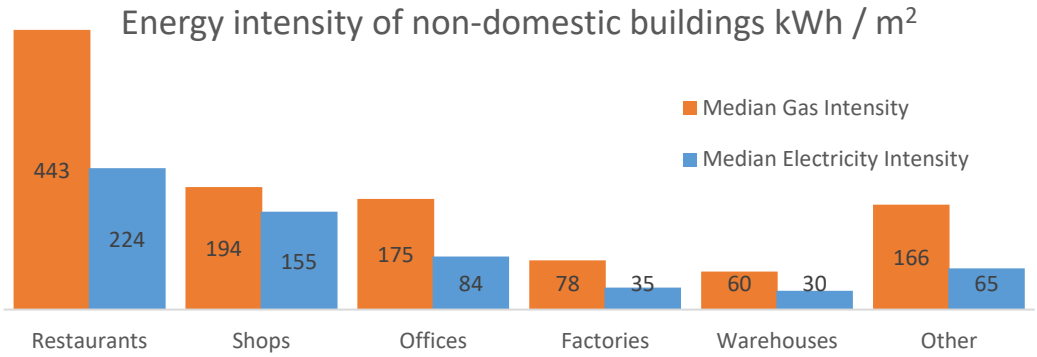


An energy intensive sector

It is challenging to characterise energy use in non-domestic buildings as they encompass a variety of premises and business activities. However, it is clear that even under normal operating conditions

[1] Oxford Economics (September 2020) UK Beer and Pub Sector: Coronavirus Scenarios Report, A report for the British Beer and Pub Association (BBPA). https://tinyurl.com/yxfupaj5
[2] Valuation Office Agency (2020) Non-domestic rating: stock of properties including business floorspace, 2020 https://tinyurl.com/yxshtwzs
[3] London Atmospheric Emissions (LAEI) 2016, General London Assembly https://tinyurl.com/ycvdub9m [note: NOx emissions from cooking are not estimated. Other hospitality sector emissions, such as space heating are not quantified separately within the overall industrial and commercial emissions data.
[4] See appendix: Sector split of emissions by local authority
[5] See Appendix A: analysis of London Borough Air Quality Strategies and Action Plans.

the hospitality sector is very energy intensive, and that major environmental gains could be made by tackling this sector, particularly for boroughs with a high density of restaurants and pubs. The Department for Energy and Climate Change's Non-Domestic National Energy Efficiency Data Framework[6] shows that per square meter, restaurants use around three times more gas and electricity than the average non-domestic sector building.



Guidance for pubs, restaurants and cafes, operating under COVID-19 advises ventilation should be optimised in communal areas and use of outdoor space maximised. In colder months this makes maintaining a comfortable ambient temperature challenging. As businesses are likely to prioritise keeping their premises warm over reducing energy use. What then, can struggling businesses in the hospitality sector do to continue to serve their customers, whilst limiting the potential for COVID transmission and minimise their impact on the environment?

Outdoor Heating

Outdoor heating has been maligned by environmentalist as an irresponsible waste of energy, given the urgent need to decarbonise the global economy. In 2008 the European Parliament's Committee on Industry, Research and Energy called for a complete ban on patio heaters on climate grounds.[7] The measure was not adopted by the commission, but in recent years several municipalities, including Berlin, Barcelona, Rennes and Brussels, have banned gas outdoor largely due to concerns over air quality.

Following the smoking ban in 2007 outdoor heating in the hospitality sector rose. In opposition to the calls to ban patio heaters, the trade magazine, The Publican, claimed that outside heaters contributed £250 million in additional trade for pubs, cafés and restaurants. When pubs, bars and café's reopened after the first lockdown in 2020 customers sought drinking spots with heated outdoor areas. The Independent newspaper reported the popularity of a google map created by an epidemiologist showing pubs in London with outdoor heating[8]. An indication of the public's safety concerns are illustrated by the map's creator "Personally, I'm only really comfortable socialising outside. I think that's the safest way. I'm appropriately cautious with what I do." Understandably with current economic and public health concerns landlords and restauranteurs will want to use outdoor heaters in colder months to invite cautious punters to use their premises.

Given the inevitability that, business owners will try to utilise outdoor heating to maximise trade, what are the least-worst options for outdoor heating available in ecological and economic terms?

[6] Department of Energy and Climate Change (March 2015) The Non-Domestic National Energy Efficiency Data-Framework: Energy Statistics 2006-12. https://tinyurl.com/y2krwets

[7] European Parliament, Committee on Industry, Research and Energy (January 2008) Report on an Action Plan for Energy Efficiency: Realising the Potential (2007/2106(INI))

[8] Barrie, J. (29 October 2020). An epidemiologist on accidentally going viral with a Google map of London pubs with outdoor heaters. *iNews.* Retrieved from: https://tinyurl.com/y3ldeke3

Gas and electric outdoor heaters

Outdoor gas heaters burn LPG which produces, along with CO_2, NOx and small amounts of particulate matter at the site of combustion. A significant proportion of the heat that is produced is lost through convection and conduction to the outside air. During windy days, the warmth felt from standard domed heaters will come from heat radiated from the metal mesh enclosing the flame plus radiation reflected from the dome. As well as dome heaters, there are gas heaters designed to provide more directional radiative heat, and vertical flame tube heaters. Little conclusive evidence is available about the relative performance of these heaters compared to domed gas heaters.
Outdoor electric heaters convert electricity into infrared heat via a heating element or lamp which is directed at the area to be heated. Unlike common heaters that mostly disperse heat via convection and conduction, these transmit heat via infrared radiation. They are designed to emit infrared at specific wave-lengths, that can transmit heat to surfaces without losing energy by heating the air in between. Electric heaters can be mounted to walls, stands and awnings and readily controlled delivering near instantaneous heat when switched on.
There are two forms of infrared heater on the market: Shortwave infrared and medium to longwave infrared heaters. Manufacturers of each have competing claims about which are most efficient, with no independent studies to determine the suitability of either. Manufacturers of short-wave heaters claim that air absorbs less short wavelength infrared compared to long and medium wavelength and that these are therefore most suitable for outside use[9]. It would appear that one manufacturer of long and medium wave infrared heaters concedes on this point, claiming that their long and medium wave heaters are best suited to enclosed and sheltered outdoor spaces[10]. A report by an Irish manufacturer claim that for 'comfort heating' long and medium wavelengths are preferable to human skin[11]. The paper also warns of premature ageing of the skin from extended exposure to short-wave infrared radiation, but does not state whether standard exposure to an outdoor heater would pose significant risk.
Guidance for businesses produced by the City of Westminster Council compares the carbon emissions and costs of running an LPG vs an Electric heating system in commercial premises[12]. The modelling assumes that four (1.3 kW) electric radiant heaters, can provide the equivalent heat coverage of one (8.9 kW) LPG heater, and assumes that with suitable controls an electric heater will run for two hours less per day. If these assumptions are correct, then the CO2 produced by gas heating is two and a half times higher than for electric heating. The running cost for electric heating is around £250 less suggesting these are the better option both financially and in terms of greenhouse gas emissions. It is not explicit from the guidance what coverage these heaters would provide. Given that the manufacturer Herschel estimates that a 2.5 kW heater is suitable for a space between 7-12 square meters we might expect that the worked example would provide heating for a space between 14 – 25 square meters.

	LPG Domed heater	Electric radiant
Power input (kW):	8.90	5.20
Days in use	237	237
Hours per use	5	3
Energy (kWh / yr)	10,500	3,700
CO2 emissions (t / yr)	**2.5**	**1.0**
Running cost (£ / yr)	**£760**	**£510**

[9] https://www.heat-outdoors.co.uk/help-desk/useful-articles/choosing-the-right-heater.html
[10] https://www.herschel-infrared.co.uk/outdoor-heaters/herschels-guide-to-outdoor-heating/
[11] https://www.ceramicx.com/information/media/white-papers/preferred-wavelengths-for-comfort-heating/
[12] City of Westminster (2010) Green Guide to Outside Heating https://tinyurl.com/y7l8q3j4

The 2019 joint EMEP/EEA air pollutant emission inventory guidebook suggests a NOx emissions factor of 60 g/gJ can be applied to outdoor LPG heaters[13]. In this instance the LPG heater would emit 2.2 kg NOx per year. The upstream NOx emissions from electric radiant heating are also 2.2 kg NOx using the BREEAM emission factor of 617 mg/kWh of electricity consumed[14]. For comparisons sake a typical gas heated home produces around 2.2 kg NOx per year[15]. This should be taken as an approximate calculation. However, it shows that the NOx emissions from a single commercial LPG outdoor heater is of an order of magnitude comparable to the contribution made by a typical home.

Alternative and complementary measures

It is possible that outdoor heating might not be the most effective solution for comfortable dining and drinking. As radiant heaters provide uni-directional heat the experience of having only certain parts of the body warmed whilst others remain cool could feel uncomfortable. Glass or Perspex barriers and awnings can help make outdoor spaces more comfortable retaining heat and reducing draughts. Blankets and cushioned seating are another good low-tech solution, although blankets would probably require laundering after each use to reduce the risk of Covid transmission. Businesses could encourage customers to bring their own blankets and coverings when eating. Electrically heated seating and cushions require far less energy (40W per seat) than electric radiant heating[16]. These are simple devises, similar to electric blankets, that can run off rechargeable batteries as well as mains electricity. Each seat could cost as little as £4 per year to run, and emit only 8kg of CO2[17]. Although these only warm a limited part of the body, these in addition to blankets, warm clothing and shelter could be the most environmentally suitable heating option. In-situ testing might reveal whether customers find these are a satisfactory alternative to radiant heaters in colder months.

Food preparation

The LAEI data shows that commercial cooking process responsible for a significant proportion of London's particulate matter (PM) pollution. Particulate matter emissions arise particularly from cooking practices involving grilling and frying – anything where fat is heated or smoke is produced. Changes in cooking practices have been shown to reduce emissions such as: using oils with higher smoke points, cooking on electric rather than gas burners, reducing the exposed surface area of oil when frying[18]. Cooking using solid fuels, such as wood and charcoal, will also inevitably lead to PM emissions.

In addition to particulate matter, the use of gas flames produces NOx. NOx emissions from commercial cooking are not quantified in the LAEI but, Sierra Club research[19] shows that gas use for domestic cooking significantly increases indoor NOx levels, posing a health risk to inhabitants. Switching gas to electric cooking would cut both PM and NOx levels, but it is not clear how readily restauranteurs would be willing to adopt such measures. Switching the gas grid to hydrogen has

[13] European Environment Agency (2019) EMEP/EEA air pollutant emission inventory guidebook 2019, Tier2 emission factors for source category 1.A.4.b.i, Table 3.13 https://tinyurl.com/yblcqukx

[14] https://www.breeam.com/ndrefurb2014manual/content/12_pollution/pol02.htm

[15] Defra (2019) LAQM Support, Emission Factors for Small Combustion Appliances https://tinyurl.com/yb9sdn5v

[16] "Sit & heat" website: https://www.sitandheat.com/hospitality/

[17] Assumes heated seat is used on average for 3 hours per day, 237 days per year.

[18] Torkmahalleh, M. A., Gorjinezhad, S., Unluevcek, H. S., & Hopke, P. K. (2017). Review of factors impacting emission/concentration of cooking generated particulate matter. Science of The Total Environment, 586, 1046-1056.

[19] Seals, B. et al (2020), Health Effects from Gas Stove Pollution, Rocky Mountain Institute, Physicians for Social Responsibility, Mothers Out Front, and Sierra Club, https://rmi.org/insight/gas-stoves-pollution-health

been mooted as a decarbonising strategy, but evidence suggests that this could increase, rather than decrease NOx emissions from cooking and heating[20].
Enfield, Barnet, Barking and Dagenham, Newham, are the only boroughs that mention specific actions to tackle emissions from restaurants in their air quality action plans. These primarily seem to concern compliance with smoke control area enforcement for charcoal grill and pizzeria restaurants. Southwark mentions it is revising technical guidance standards regarding complaints about emissions from commercial kitchens. The entirety of each of these boroughs has been declared a smoke control area, with the exception of Barnet. Parts of Barnet are smoke control areas.
No central London borough has detailed action it will take to reduce emissions, beyond compliance with smoke control zone measures. It is evident that some strategic action plan for this sector is needed, bearing in mind it is difficult to see what action local authorities can take utilising their current powers.
Further research is needed into practices that can reduce air quality impacts from cooking. This will be imperative for local authorities where hospitality is a major part of the local economy, many of whom are in the most polluted boroughs.

Recommendations for the hospitality sector

- Choose high quality electric radiant heating for outdoor heating. This is likely to be much cheaper to run than LPG gas heating and produces significantly less green-house gas emissions, and does not contribute to local air pollution.
- Seek guidance from a professional installer about positioning heaters. This will help to optimise what parts of the space are heated, and prevent certain areas becoming uncomfortably warm
- Install timer controls and motion sensors. This guarantees that heaters are only on when needed and can save considerable amounts of energy.
- Use wind barriers and awnings to protect customers from draughts and to keep heat in.
- Invite customers to bring along blankets and warm clothes when eating outside.
- Electrically heated seats and cushions have significantly lower running costs than radiant heaters. Battery powered seats are available, although their running time may be limited.
- Avoid burning wood or charcoal wherever possible, either for cooking or outdoor heating. Even though these fuels may be allowed to be burnt in smoke control areas in approved appliances, they can still have a large impact on local air-quality. Wood burning is the largest PM 2.5 emission source in the UK.
- Make sure that kitchen filtration systems are operational and well maintained.

[20] Department of Business and Industrial Strategy (April 2019), H_2 Emission Potential Literature Review, E4tech (UK) Ltd for the Department for Business Energy and Industrial Strategy (BEIS). https://tinyurl.com/y2443er2