Reducing health risks of gas cooking

Overview

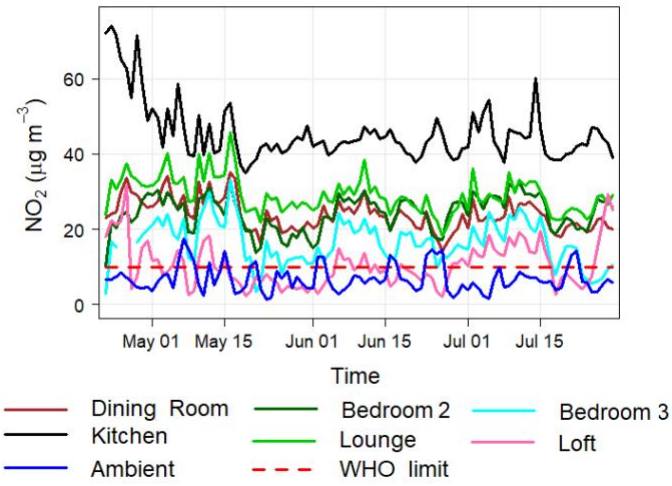
- Gas cooking in a typical kitchen can produce high levels of nitrogen dioxide pollution exceeding health-based World Health Organisation Guidelines.
- Nitrogen dioxide pollution, among other pollutants, is linked to an increased risk of chronic lung disease and early death.
- Replacement of gas hobs with electric and induction alternatives can reduce greenhouse gas emissions, improve indoor air quality and protect health.

Do gas hobs cause indoor air pollution?

Gas appliances are a major source of indoor air pollution. In the UK more than half of homes use gas hobs for cooking.[1] The UK Government has set a target to phase out gas cooking by 2040 to achieve legally binding net zero commitments by 2050. Achieving progress towards this target could deliver major indoor air quality and health co-benefits, however, there are currently no specific policies which target the replacement of gas hobs.

Nitrogen dioxide (NO_2) is the main indoor pollutant caused by gas hobs and is a gas formed during the burning (combustion) process when nitrogen combines with oxygen at high temperatures. Research has shown that there is a link between gas cooking and increased levels of NO_2 pollution,[2] which can be as twice as high in the kitchen as in other rooms and remain elevated for several hours, depending on fresh air supply. The peak NO_2 concentrations produced inside homes often exceed typical outdoor levels and average values may surpass World Health Organisation Global Air Quality Guidelines reflecting the potential risks to health.[3] Additional pollutants from gas hobs include carbon monoxide, methane, particulate matter including ultrafines.[1]

Indoor air pollution from gas cooking is typically highest in homes which are poorly ventilated. Ventilation which enables air exchange - for example, the use of externally ventilating extractor fans and/or opening windows during cooking - can improve airflow and help dispel pollutants released by gas hob cooking.[2] However, it is estimated that in the UK 80% of houses do not have adequate ventilation strategies and airflow rates.[4]



Daily average NO_2 concentrations over a 3-month period in multiple rooms in an urban home .[3]

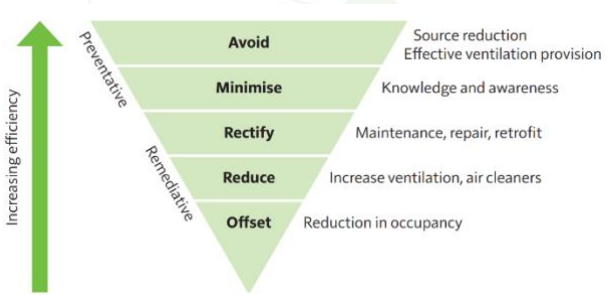
Is gas cooking linked to poorer health?

People spend about two-thirds of their time in their homes where they are exposed to a wide range of pollutants, particularly those from gas hobs. A study

undertaken across 14 European countries estimated that the health harms associated with gas cooking contribute to the early deaths of 40,000 people in Europe each year.[5] Exposure to NO_2 pollutants can both exacerbate existing health conditions and potentially lead to respiratory diseases. According to WHO, children living in houses with gas hobs have a 20% increased risk of suffering from asthma,[6] while a recent study has found that more than 12% of childhood asthma in the USA is attributable to gas hobs usage.[7] For children, the impacts of gas hobs on respiratory disease are comparable to second-hand smoking.[1] New insight is also starting to emerge about NO_2 negatively affecting infants' memory and verbal development.[8] In adults, long-term exposure to NO_2 can affect both the respiratory system (asthma and reduced lung functions) and circulatory system (cardiovascular diseases, and blood pressure),[9] with increased overall mortality rates.[5]

Which measures can reduce the health risks of cooking on gas hobs?

Removal of common pollutant-emitting products is widely agreed as an important step to improve indoor air quality. This reflects the hierarchy of interventions for indoor air quality, with the greatest benefits achieved by reducing pollution at source (as shown below).



Classification of indoor air quality solutions.[13]

Replacement of gas hobs with electric or induction hobs has been shown to lead to lower levels of NO_2 pollution in homes,[1,9] and reduce safety issues related to gas leaks and open flames.[1] Electric hobs use electric current to heat elements under a glass or ceramic surface. Induction hobs use coils to create a magnetic field that heats the cookware directly. Induction (~90%) and electric (~75%) hobs are more efficient in the way they consume energy into heat for cooking compared to gas hobs (~40%).[10] Additionally, gas hobs rely on fossil fuels and contribute to greenhouse gas emissions, whereas electric and induction hobs can be powered by clean energy sources.[1]

Replacing gas cooking hobs can involve financial, logistical and practical challenges, creating barriers to replacing existing appliances, particularly at scale. These include higher upfront costs and the potential need for rewiring, especially in older homes.[11] Induction stoves, while cheaper to run than electric stoves, are more expensive to buy and may require specific cookware (e.g. cast iron and stainless steel).[11] Moreover, electric and induction hobs are often seen as more expensive to run due to the current lower cost of gas in the UK in terms of both cost per unit and standing charges.[12]

It is important to note that, at a societal level, cooking with gas incurs significant costs linked with increased healthcare needs, lost earnings and productivity. A recent study found that, in the UK, NO_2 exposure from gas cooking is linked every year to around £23.5 billion lost due to 4,000 premature deaths, £2.5 billion lost due to 17,000 years of life lost, £104 million lost and 608 disability-adjusted life years due to 16,000 children's hospital admission for asthma.[5]

Recommendations

- Consider the public health benefits of replacing cooking appliances in energy programmes to achieve co-benefits.
- Develop opportunities to include gas hob replacement with electric alternatives in social housing (for example by working with housing associations), to reduce indoor air pollution.
- Use public engagement opportunities to raise awareness of the health harms associated with gas hob cooking. Signpost to advice on adequate ventilation and hob installation (such as the NICE Indoor Air Quality guidelines)[2] where no alternative to gas hob use is available.

Authors

This briefing note was prepared on behalf of the WM-Net Zero project by Carlo Luiu (University of Birmingham)

Contact

School of Geography, Earth and Environmental Sciences
University of Birmingham
Edgbaston B15 2TT
Email: wm-netzero@contacts.bham.ac.uk

Funding

The WM-Net Zero project is supported by the Wellcome Trust (227150_Z_23_Z) under the *Advancing climate mitigation policy solutions with health co-benefits in G7 countries* scheme.

Suggested citation

Luiu, C., Day, R., Reardon, L., Cavoski, A., Singh, Leach, F., A., Nasar, Z., Pfrang, C., Shi, Z. Bartington, S.E. (2025). 'Reducing health risks of gas cooking'. WM-Net Zero, Birmingham, UK. Available online at: https://doi.org/10.25500/pure.bham.258583195

References

[1] CLASP. The Public Health and Environmental Impacts of Cooking with Gas. 1–40 (2023).

[2] NICE. Indoor air quality at home. National Institute for Health and Care Excellence Guideline 1–48 (2020).

[3] Singh, A., Bartington, S.E., Abreu, P., Anderson, R., Cowell, N., Leach, F.C.P., Impacts of daily household activities on indoor particulate and NO2 concentrations; a case study from oxford UK. Heliyon 10, e34210 (2024).

[4] O'Leary, C., Jones, B., Dimitroulopoulou, S., Hall, I. P. Setting the standard: The acceptability of kitchen ventilation for the English housing stock. Building and Environment 166, (2019).

[5] Delgado-Saborit, J. M., Cartanyà Hueso, À., Hole, A.R., Carrasco, P., Esplugues, A., Estarlich, M., Ballester, F., Assessment of the Health Impacts and Costs Associated with Indoor Nitrogen Dioxide Exposure Related to Gas Cooking in the European Union and the United Kingdom. https://repositori.uji.es/server/api/core/bitstreams/ddfd7cb7-32b6-4745-a628-0792f94f8a87/content (2024).

[6] WHO Regional Office for Europe. WHO Guidelines for Indoor Air Quality – Selected Pollutants. https://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf (2010).

[7] Gruenwald, T., Seals, B. A., Knibbs, L. D., Hosgood, H. D. Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States. International Journal of Environmental Research and Public Health 20, 10–13 (2023).

[8] Payne-Sturges, D. C. Marty, M.A., Perera, F., Miller, M.D., Swanson, M., Ellickson, K., Cory-Slechta, D.A., Ritz, B., Balmes, J., Anderko, L., Talbott, E.O., Gould, R., Hertz-Picciotto, I., Healthy air, healthy brains: Advancing air pollution policy to protect children's health. American Journal of Public Health 109, 550–554 (2019).

[9] Blair, H., Kearney, N., Pricop, C. & Scholand, M. Exposing the Hidden Health Impacts of Cooking with Gas. CLASP and European Public Health Alliance 1–37 (2023).

[10] Sweeney, M., Dols, J., Fortenbery, B. & Sharp, F. Induction Cooking Technology Design and Assessment. ACEEE Summer Study on Energy Efficiency in Buildings 370–379 (2014).

[11] Lane, K. Daouda, M., Yuan, A., Olson, C., Smalls-Mantey, L., Siegel, E., Hernández, D., Readiness for a clean energy future: Prevalence, perceptions, and barriers to adoption of electric stoves and solar panels in New York city. Energy Policy 194, (2024).

[12] Ofgem. Energy price cap. https://www.ofgem.gov.uk/energy-price-cap (2024).

[13] Chief Medical Officer. Chief Medical Officer's Annual Report 2022: Air Pollution. report: http://ow.ly/Omag50LYwGH (2022).