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## THE LINK BETWEEN GAS AND HEALTH: A RAPID REVIEW

NAMITA KAMBLI & RAPHAEL HANOTEAUX

Fossil gas negatively affects public health. The EU has yet to acknowledge just how much. Yet it is a critical consideration as the EU looks to diversify its energy supply amid geopolitical uncertainty and a renewed focus on the European Green Deal. This factsheet contributes to the evidence base on the health impacts of gas in our homes to further inform decision making.

Although recent studies<sup>1</sup> have highlighted the health burden of Europe's gas dependency, **the health harms of using fossil gas in our homes remain underexplored**. Drawing on grey and academic literature, this factsheet raises awareness of the indoor air pollution caused by gas-powered appliances and draws attention to the groups most at risk. It concludes by recommending policy avenues to regulate indoor gas emissions and ensure a clean and safe energy transition for all.

### How fossil gas impacts public health – what we know

#### **Growing body of gas and health-related research but gaps remain**

A rapid review reveals that, overall, **far more research has been conducted on the environmental – rather than health – impacts of gas**. When available, the latter is focussed mainly on outdoor air quality. Moreover, the data is largely US-centric despite a comparable level of gas use in European homes<sup>2</sup> (one in three

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<sup>1</sup> Health and Environment Alliance, May 2022, **False Fix: the hidden health impacts of Europe's fossil gas dependency**

<sup>2</sup> Eurostat, June 2022, **Energy consumption in EU households**



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households use gas burners<sup>3</sup>). A new report<sup>4</sup> has estimated that gas combustion in European homes is responsible for at least €3.5 billion in health damages per year due to outdoor air pollution. However, significant data gaps continue to exist on the effects of gas cooking on health.

### **Toxic appliances in our homes**

**Research indicates that gas-burning home appliances are a major source of indoor air pollution.**<sup>5</sup> Whereas gas furnaces and heaters produce more outdoor emissions overall, gas stoves expose residents to unsafe levels of poisonous gases in a closed environment. These include nitrogen dioxide (NO<sub>2</sub>) and carbon monoxide, often at levels that exceed legal outdoor air quality standards. These gases can have negative health impacts, such as dizziness and headaches, and can worsen existing respiratory conditions, even leading to the development of asthma through long-term exposure.<sup>6</sup> A poorly ventilated gas stove can in fact have a comparable impact on childhood asthma to second-hand cigarette smoke.<sup>7</sup>

### **A persistent planetary hazard**

**The risk of inhaling toxic gases is not necessarily lowered when appliances are switched off.** A landmark study published earlier this year by Stanford University<sup>8</sup> found that natural gas cooking appliances release methane even when turned off. Methane is a potent air pollutant that can trigger long-term health effects, such as cardiovascular diseases. Moreover, methane has a global warming potential 28 times higher than carbon dioxide over a 100-year horizon and 86 times over a 20-year horizon,<sup>9</sup> making it a potent contributor to climate change. The same study notes that yearly methane leakage in American homes is comparable to carbon dioxide emissions from 500,000 petrol-powered cars, making gas **stoves damaging to not only our health but also that of the planet.**<sup>10</sup>

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<sup>3</sup> Coolproducts, June 2020, **Take a deep breath – and regulate emissions from gas hobs now**

<sup>4</sup> CE Delft, March 2022, **Health-related social costs of air pollution due to residential heating and cooking in the EU27 and UK**

<sup>5</sup> Rocky Mountain Institute, 2020, **Gas Stoves: Health and Air Quality Impacts and Solutions**

<sup>6</sup> United States Environmental Protection Agency, 2022, **Nitrogen Dioxide (NO<sub>2</sub>) Pollution**

<sup>7</sup> Climate Council, 2021, **Kicking the gas habit: how gas is harming our health**

<sup>8</sup> Stanford News, January 2022, **Rethinking cooking with gas**

<sup>9</sup> European Commission, **Methane emissions**

<sup>10</sup> Stanford News, January 2022, **Rethinking cooking with gas**

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## The groups most affected by indoor air pollution

### Children at particular risk from gas stove pollution

Research from around the world<sup>11</sup> has conclusively documented that **children suffer from higher exposure to indoor pollution** as they spend a larger part of their day at home as compared to older children and most adults. Children in homes with a gas stove have a 24–42% increased (relative) risk of childhood asthma.<sup>12</sup>

A study conducted in Spain<sup>13</sup> found that early-life exposure to household gas appliances negatively impacts general cognitive functioning amongst pre-schoolers and puts them at a greater risk of developing symptoms of attention deficit hyperactivity disorder (ADHD). Since then, evidence has continued to grow on exposure to combustion-related air pollution and adverse effects on brain development amongst children.<sup>14</sup> Notably, it suggests that even short-term exposure in early childhood can have profound long-term consequences for individual life prospects.

The COVID-19 pandemic has led to more children – and adults – being confined to their homes, although the consequences of this increased exposure to indoor pollutants remains to be determined. What is clear, however, is that gas stove pollution can trigger health inequalities among children in the first years of life. **Combating this would support the EU Strategy on the Rights of the Child and the European Child Guarantee.**<sup>15</sup>

### Vulnerable households at higher risk of exposure

**Low-income groups and communities of colour disproportionately bear the health harms from gas combustion-related pollution, mirroring the link between social inequalities and poorer health outcomes.**<sup>16</sup> This is because these groups tend to live in smaller and older residences,<sup>17</sup> rely more on fossil gas as a

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<sup>11</sup> Climate Council, 2021, **Kicking the gas habit: how gas is harming our health**

<sup>12</sup> Rocky Mountain Institute, 2020, **Indoor Air Pollution: the Link between Climate and Health**

<sup>13</sup> Morales et al., June 2009, **Associations of Early-life Exposure to Household Gas Appliances and Indoor Nitrogen Dioxide with Cognition and Attention Behaviour in Preschoolers**

<sup>14</sup> Payne-Sturges et al., April 2019, **Healthy Air, Healthy Brains: Advancing Air Pollution Policy to Protect Children's Health**

<sup>15</sup> European Commission, **The EU Strategy on the Rights of the Child and the European Child Guarantee**

<sup>16</sup> World Health Organisation (Europe), 2010, **Environment and health risks: a review of the influence and effects of social inequalities**

<sup>17</sup> Energy Innovation, October 2020, **Why Your Gas Stove Has To Go: Bruce Nilles On Achieving An All-Electric Future to Protect Health And The Climate**

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source of heat,<sup>18</sup> and are less able to afford proper maintenance.<sup>19</sup> These are also the groups that typically rent and, as tenants, have little say over the type of appliances in their homes.

Faulty appliances and dilapidated housing can, in tragic instances, also result in deadly explosions, as has been witnessed in several cities across Europe.<sup>20</sup>

**Addressing the differential exposure to health risks is a matter of health equity and a pathway towards implementing the European Pillar of Social Rights,<sup>21</sup>** which is also considered a Pillar for Health.<sup>22</sup> This is also a particular area in which more research is needed to determine the extent of the problem.

## Healthier, cleaner alternatives

**Safeguards help to a limited extent but do not eliminate the risk**

**Adequate ventilation can contribute towards improving indoor air quality.<sup>23</sup>**

Range hoods and furnace flues for gas stoves help as long as they are properly installed and maintained with a fan that leads to the outside. Nonetheless, this is the exception and not the norm.<sup>24</sup> Moreover, given that gas stoves leak pollutants even while switched off (see Stanford study above), ventilation alone is not sufficient to mitigate indoor health hazards, such as respiratory illnesses.

**Electrifying appliances and buildings is the cleanest and safest option**

**Emerging data suggests that replacing gas stoves with induction tops that are powered through a renewable energy source is a more efficient, emissions-free, healthier alternative.<sup>25</sup>** Additionally, electrifying new buildings or retrofitting existing ones with electric appliances brings with it added cost-saving benefits,<sup>26</sup> including on public healthcare spending over the long term. Non-condensing gas boilers have lower health costs than wood stoves, but still three

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<sup>18</sup> Mashhoodi, December 2021, **Who is more dependent on gas consumption? Income, gender, age, and urbanity impacts**

<sup>19</sup> Climate Council, 2021, **Kicking the gas habit: how gas is harming our health**

<sup>20</sup> Euronews, December 2021, **Eight dead in Sicily after gas explosion causes building collapse**

<sup>21</sup> European Commission, **European Pillar of Social Rights**

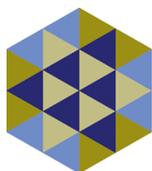
<sup>22</sup> EuroHealthNet, November 2020, **The European Pillar of Social Rights: A key vehicle to improving health for all**

<sup>23</sup> SmarterHOUSE, **Proper Ventilation for Gas Appliances**

<sup>24</sup> Carbon Switch, **How bad is my gas stove? (Part Two)**

<sup>25</sup> Carbon Switch, **Induction Cooktop and Stove Buyer's Guide**

<sup>26</sup> Energy Innovation, October 2020, **Why Your Gas Stove Has To Go: Bruce Nilles On Achieving An All-Electric Future to Protect Health And The Climate**



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times higher than heat pumps.<sup>27</sup> Switching to heat pumps powered by renewable electricity could eliminate the current €29 billion per year in health costs in the EU.

## Implications for Fit-for-55 package and the European Green Deal

### Patchwork legislation

**Tackling air pollution is one of the main political priorities for the EU,**<sup>28</sup>

including and especially Central and Eastern Europe. The link between climate action and clean air is firmly established in the Zero Pollution Action Plan,<sup>29</sup> which is a key deliverable of the European Green Deal. Nonetheless, the focus remains on outdoor pollution, with EU legislation on indoor air pollutants being largely fragmented.<sup>30</sup> Moreover, the literature review demonstrates the limited recognition within the EU of how gas combustion-related appliances contribute to poor indoor air quality and health. A case in point is that there are no existing limits on nitrogen oxide (NOx) emissions from cooking appliances.<sup>31</sup>

### Opportunities exist to regulate gas emissions and improve indoor air quality through EU legislation

**The adverse impact of gas on our health is being increasingly recognised and enshrined into legislation** in places such as California<sup>32</sup> and the Australian Capital Territory.<sup>33</sup> In the EU context, the upcoming revision of the Ambient Air Quality (AAQ) Directive<sup>34</sup> and the delivery of the Zero Pollution Action Plan<sup>35</sup> present important opportunities to not only update the EU's outdoor air quality standards but also include indoor air quality standards, and related monitoring.

Other regulatory avenues to introduce health safeguards against gas include the Energy Performance of Buildings Directive (EPBD).<sup>36</sup> This mandates the exclusion

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<sup>27</sup> European Public Health Alliance, March 2022, [The impact of residential heating and cooking on air quality in Europe](#)

<sup>28</sup> European Commission, [Environment, Air](#)

<sup>29</sup> European Commission, [Zero Pollution Action Plan](#)

<sup>30</sup> Politicopro, January 2022, [COVID spurs efforts to clean up indoor air](#)

<sup>31</sup> Coolproducts, June 2020, [Take a deep breath – and regulate emissions from gas hobs now](#)

<sup>32</sup> Reuters, August 2021, [New California rules move state away from natural gas in new buildings](#)

<sup>33</sup> Climate Council, 2021, [Kicking the gas habit: how gas is harming our health](#)

<sup>34</sup> European Union, May 2008, [Directive on ambient air quality and cleaner air for Europe](#)

<sup>35</sup> European Commission, [Zero Pollution Action Plan](#)

<sup>36</sup> European Commission, [Energy Performance of Buildings Directive](#)



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of fossil-based appliances from new buildings and a gradual phase-out in existing buildings, together with attention to indoor air quality and ventilation. Similarly, the Energy Efficiency Directive (EED)<sup>37</sup> foresees the ending of incentives for fossil-based heating and cooling and an increase in the mandatory share of renewables. Other policy pathways include eco-design requirements<sup>38</sup> for domestic kitchen appliances, which could go further to introduce health labels for gas boilers and stoves.

**Health advocates have previously recommended that compliance with air quality standards should also be a conditionality when using public funds,<sup>39</sup>** such as the Just Transition Fund.<sup>40</sup> A similar conditionality should also be applied to the Social Climate Fund<sup>41</sup> and its use towards fossil gas-related appliances. Finally, the European Environment Agency (EEA) should aim to strengthen Europe's database<sup>42</sup> on health and gas by bridging the research gaps highlighted above with respect to the use of gas boilers and stoves and indoor air pollution.

Together, the above steps will allow the EU to further reduce its dependency on fossil gas, while protecting public health and ensuring a clean and safe energy transition for all.

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<sup>37</sup> European Commission, [Energy Efficiency Directive](#)

<sup>38</sup> European Commission, [Sustainable product policy & ecodesign](#)

<sup>39</sup> Health and Environment Alliance, December 2020, [Just transition for health protection](#)

<sup>40</sup> European Commission, [Just Transition Fund](#)

<sup>41</sup> European Commission, [Social Climate Fund](#)

<sup>42</sup> European Environment Agency, December 2021, [Air Quality in Europe 2021](#)

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## About E3G

E3G is an independent climate change think tank with a global outlook. We work on the frontier of the climate landscape, tackling the barriers and advancing the solutions to a safe climate. Our goal is to translate climate politics, economics and policies into action. E3G builds broad-based coalitions to deliver a safe climate, working closely with like-minded partners in government, politics, civil society, science, the media, public interest foundations and elsewhere to leverage change. More information is available at [www.e3g.org](http://www.e3g.org)

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