

[Analysis](#) 27 January 2017

Wood-burners: London air pollution is just tip of the iceberg

By **Michael Le Page**

Last week, air pollution in London soared to heights not seen since 2011. The usual suspects were named and shamed, including traffic fumes and a lack of wind. But joining them was a surprising culprit.

“We think about half of the peak was from wood smoke,” says Timothy Baker, part of a team at King’s College London that monitors air pollution.

The trendy log-burning stoves producing much of this pollution are marketed as a source of renewable energy that can cut fuel bills while helping reduce global warming. But recent findings suggest they pose a serious threat to the health of their owners, and are also accelerating climate change in the short term.

If nothing is done to discourage log burning in homes, it could become the biggest source of air pollution in cities like London. In the UK as a whole, wood burning is already officially the single biggest source of [an especially nasty form of air pollution](#).

“I love sitting by a log fire as much as the next person but maybe we need to think again before it’s too late,” says climate scientist Piers Forster of the University of Leeds, UK.

Air pollution is awful for our health. The smallest particles get into our blood and even our brains, increasing the risk of many disorders including heart disease.

Natural killer

Children are especially vulnerable: high pollution levels impair their lung and brain development. Air pollution from all sources is estimated to cause some [10,000 premature deaths a year in London alone](#), where it frequently exceeds legal limits.

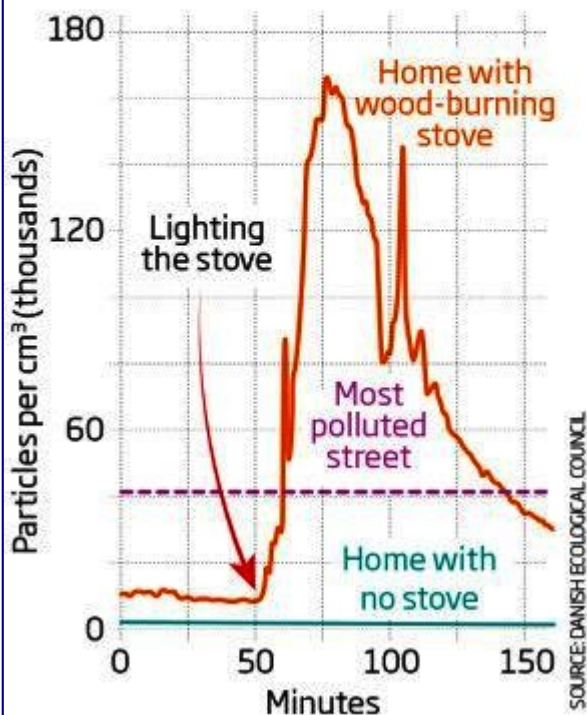
Wood smoke may be natural, but it contains many of the same harmful substances as cigarette smoke. It’s a massive killer worldwide, causing [as many as 4 million premature deaths every year](#) through indoor air pollution.

In the UK, however, the problem with pollution from wood fires was thought to have been solved by clean air laws introduced in the 1950s, which banned wood burning in open fires in cities. “The official view is that residential wood burning is a thing of the past,” says Gary Fuller of King’s College London.

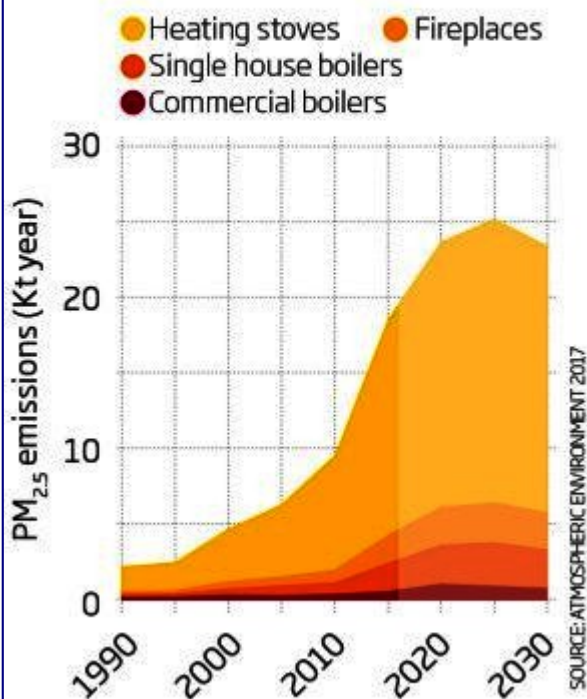
Yet logs can still be burned in officially approved stoves in cities. Sales of these stoves [have soared in the past decade](#), rising to nearly 200,000 a year. They are marketed as a way for people to drastically reduce their carbon emissions and save on fuel costs.

Smoking gun

A correctly installed wood-burning stove has made the air inside one home in Copenhagen more dangerous than the most polluted street there



In the UK, particulate emissions from wood-burning stoves have risen steeply and are projected to keep rising



Even modern stoves described as “low emission” are highly polluting. And in an echo of the diesel car emissions scandal, measurements during actual use in homes show that the stoves [produce more pollution than lab tests suggest](#).

In the “smokeless” fumes coming from the chimney of a house with a modern “eco-friendly” wood burner, Kåre Press-Kristensen of the Danish Ecological Council has measured 500,000 microscopic particles per cubic centimetre. The same equipment finds fewer than 1000 particles per cm³ in the exhaust fumes of a modern truck. The wood stove was certified as meeting Nordic Swan Ecolabel emission standards, which are stricter than the ones stoves in the UK have to meet.

Big in London

What this means is that a small increase in wood-burning stoves can produce a big increase in pollution. In Copenhagen, a city of 600,000 people, just 16,000 wood stoves produce more PM_{2.5} pollution – the most dangerous particles, smaller than 2.5 micrometres – during winter than traffic does all year round, says Press-Kristensen.

Wood burning is becoming a big problem in London, too. In 2010, when Fuller analysed particulate pollution to discover its source, he found that 10 per cent of all the city’s wintertime pollution was from wood.

There are many reasons to think that figure is higher now. A 2015 government survey found that domestic wood consumption in the UK was three higher than previous estimates, with 7 per cent of respondents reporting that they burned logs. “Wood consumption is increasing substantially,” says Eddy Mitchell at the University of Leeds, UK.

When he, Forster and others fed the data on wood consumption into a computer model of air pollution, their conclusion was disturbing: PM_{2.5} pollution from residential stoves [is soaring in the UK](#) (see diagram, below).

“There is a real risk that if we have a lot more residential wood burning then it could undo our other efforts to control air pollution,” says Fuller.

The harm far exceeds traffic pollution, he says. While people are exposed to high levels of traffic pollution mainly when travelling on busy streets, wood burning produces huge amounts of pollution where people live, when they are at home.

Indoor smog

Press-Kristensen has been measuring that pollution inside homes in Copenhagen. In three out of seven tests done so far, he has found very high levels. In one home with a modern log-burning stove, he found particulate levels several times higher than the highest ever recorded outdoors there (see diagram, above).

So do the health impacts outweigh any climate benefits? Astonishingly, [there might not be any climate benefits](#), at least in the short term.

Burning logs is often touted as being carbon-neutral. The idea is that trees soak up as much carbon dioxide when growing as they release when burned.

In fact, [numerous studies show that wood burning is not carbon-neutral, and can sometimes be worse than burning coal](#). There are emissions from transport and processing. Logs are often pre-dried in kilns, for instance.

Burning wood also emits black carbon – soot – that warms the atmosphere during the short time it remains in the air. Most studies ignore this, but Mitchell and Forster calculate that over 20 years – the timescale that matters if we don’t want the world to go too far above 2°C of warming – soot cancels out half the carbon benefits of all wood burning.

For home wood burning, the figures are even worse. “On a 20-year timescale, wood stoves provide little or no benefit, but they do on the 100-year timescale as they remove some of the long-term warming effect of CO₂ emissions,” says Forster.

Press-Kristensen’s calculations show much the same thing. And both sets of findings almost certainly underestimate the problem, because they assume wood burning is carbon-neutral.

Defenders of wood stoves point out that there is a lot of uncertainty about how much black carbon is emitted when wood is burned and how large its effect is. Patricia Thornley of the University of Manchester, UK, thinks we need more real-world measurements before coming to conclusions.

But the uncertainties cut both ways. For instance, the effects of black carbon can be amplified if it is deposited on snow and melts it, exposing dark land that absorbs more heat. It’s possible soot from wood burning is [contributing to the fall in spring snow cover in Europe](#), but it’s very hard to study.

More research is needed to pin down the precise climatic effects of wood burning, which can vary hugely depending on factors such as the source of wood and where the pollution goes. What is clear, however, is that burning logs in homes in towns and cities is not the best use of the wood we have.

It produces more pollution than wood-burning power plants that can be fitted with expensive filters, it produces that harmful pollution where lots of people live, and it has the least climate benefits, if any. “If we are going to burn biomass to meet climate targets, then we ought to do it in big, remote power stations,” says Martin Williams of King’s College London, who is studying the health impacts of the ways the UK could meet its climate targets.

Most researchers say it isn’t their role to make policy recommendations, but it would be best if cities like London discourage private wood burning before it becomes an even bigger health problem. At the moment, all the focus is on diesel vehicles.

Press-Kristensen doubts governments will ban wood-burning; France recently backtracked on a proposed ban on open fires, for example. Instead, he proposes installing heat sensors in chimneys and taxing people when they burn wood, with the level of tax depending on how polluting the appliance is.

Most importantly, governments must not ignore health impacts when deciding climate policies, says Press-Kristensen. “I like fires, but I have to say they are as polluting as hell,” he says.

Thinking of getting a wood-burner?

Wood-burning stoves are touted as an eco-friendly way to heat your house cheaply. But tests now show that even new, properly installed stoves can produce dangerous levels of outdoor and indoor pollution (see main story). What other options are there?

Consider instead

Stick with gas or oil for heating, and spend your money on insulation. Get a heat pump if you can afford it

Fake it

You can get the same cosy feeling from a log-effect electric or gas fireplace, the best of which are hard to distinguish from the real thing

Already have a wood-burner?

Here’s how to minimise its effects:

Don’t burn scrap wood

Scrap wood or painted wood can release highly toxic substances such as arsenic when burned

Burn wood that’s just right

Burning dry wood with a moisture content of about 20 per cent minimises pollution. But if wood is wetter or drier than that, pollution increases

This article appeared in print under the headline “Where there’s smoke”

Article amended on 1 February 2017

PM2.5 particles measure 2.5 micrometres or less