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Taxation of residential burning

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Background

Residential burning of wood, lignite, straw and waste is (and will remain) the dominating emission source of fine particles and black carbon in many European countries and in EU as a whole unless further actions are taken. Ban on residential burning is, of course, the ultimate solution used in a few European cities. However, another solution, often not discussed, is taxation of the air pollution motivating to buy less polluting stoves and boilers, install filters and/or change to cleaner heat sources and better insulation.

Purpose

The purpose of this study was to develop a strategy for fair taxation of pollution from wood burning and to evaluate the health benefits.

Principle

In an ideal "polluter pays" society consumers must pay the damage costs caused by their pollution (i.e. all externalities are reflected in the market price). From a taxation point this is done by introducing tax on wood burning reflecting the damage costs of the emitted air pollution.

Methods

Health damage and the damage costs per kg fine particulate matter emitted (including condensates) from residential wood burning in Denmark were calculated for different geographical regions based on updated air quality models (1km·1km grid), demographic data, newest dose-response relationships and valuation of the mortality and morbidity.

The total annual fine particle emission in kg for each heat unit (stove/boiler) can be estimated, as basis of taxation, from the following three simple steps:

1) Particle emissions from heat units per GJ (kg particles per GJ wood burned) is known (can be estimated) from the type approval (assuming quite correct operation).
2) The GJ wood burned in each unit is calculated from the unit power (kW/MW) and efficiency according to the type approval multiplied with the operation time of the unit in seconds (W = J/s, Watt is Joule per second).
3) The annual operation time of each unit is measured by a simple temperature sensor placed and sealed in the chimney (close to the heat unit) connected to a simple logger measuring how many hours the temperature in the chimney is above 60 °C which only occurs when the heat unit is in use.

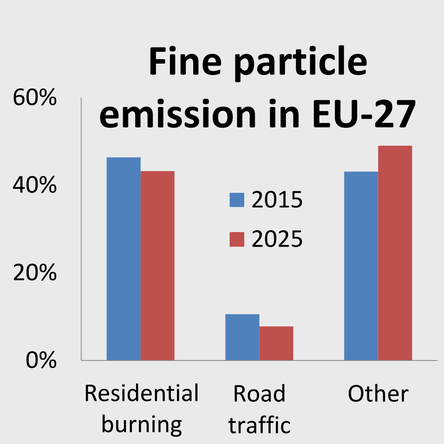
The annual tax for each unit can thereby be calculated by multiplying damage costs per kg fine particulate matter with the total annual fine particle emission in kg .

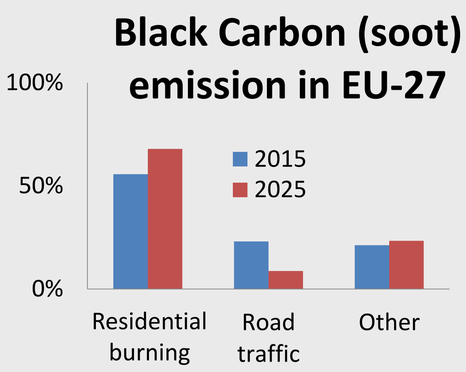
This methodology was used to calculate taxes per hour of use for three categories of wood stoves in larger cities and desolated areas in Denmark.

Results

The calculated taxes (euro per hour of use) due to health damage caused by fine particle emissions from different wood stoves are shown in the table for larger cities and in rural areas in Denmark.

The Danish Council of Economist and the Danish Centre for Environment and Energy have together concluded that the suggested taxation is the most cost-efficient way to reduce pollution from wood burning. They estimate that taxation will reduce pollution from wood burning and the related health effects by about 85 % and provide a major socio-economic benefit. The Danish Ministry of Taxation has confirmed this conclusion in a separate study.





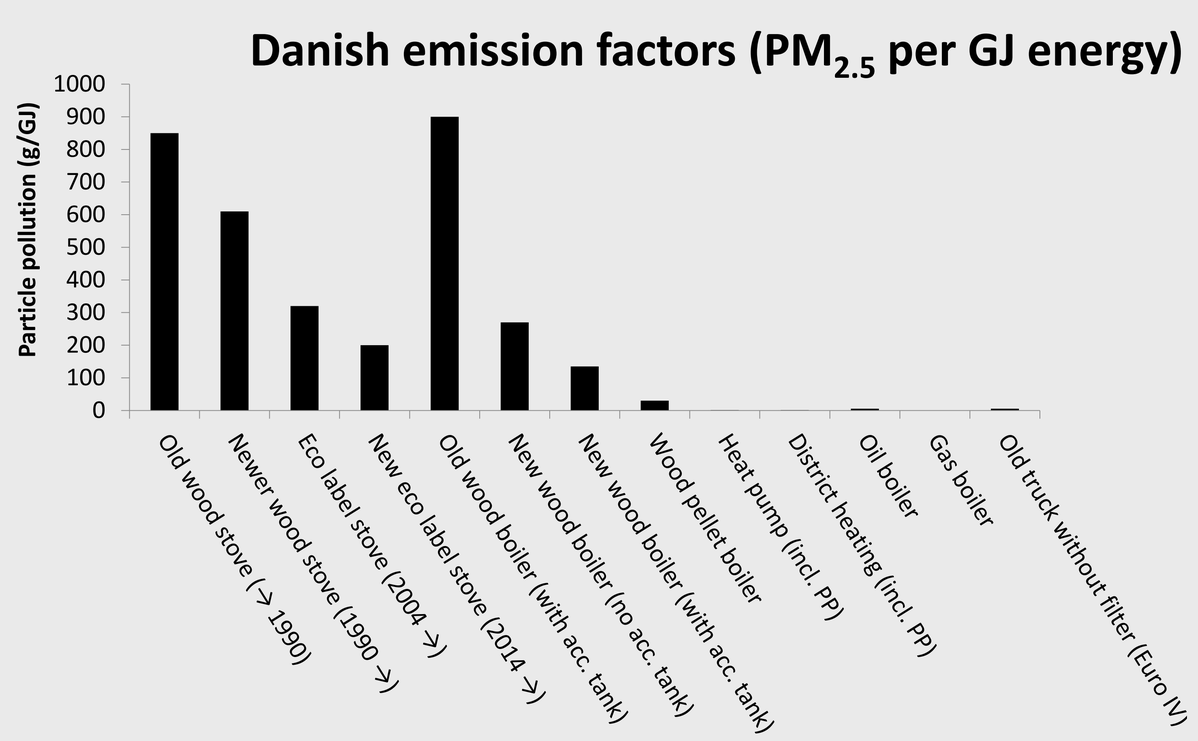


Table: Taxes reflecting health damage from fine particles emitted by wood stoves in Denmark

Taxes (euro per hour operation)	Old wood stove (→ 1990)	Newer wood stove (1990-2004)	Eco-label wood stove (2004 →)
Larger cities	5.5	3.3	1
Rural areas	0.7	0.4	0.15

Discussion

The taxation method suggested is equivalent to payment of electricity, gas, water etc. after measured consumption. The only difference is that people will pay after their air pollution (reflected in hours of stove operation). The system can be read remotely like modern electricity meters and controlled by the chimney sweep. The Danish meter producer CB Svendsen has calculated that the technical system for logging the hours of operation will have the same costs as a standard electricity meter. Hence, the system is believed to be socially accepted by the population.

The largest uncertainty is that air pollution depends much on fuel (type/humidity) and stove operation. Taxes in the table assumes dry wood and correct operation underlining the need for ongoing campaigns on correct fuel and operation. However, this does not affects the calculated benefits from the taxation since these mainly arise from people insulation their homes and changing to cleaner heat sources.

The taxation does not reflect specific health costs of ultrafine particles and black carbon, indoor air pollution from stoves or costs of Danish pollution abroad. However, these externalities can directly be integrated in the taxes if quantifiable.

Taxes for small boilers (wood, straw, coal) and coal stoves can be calculated using the method with specific emission factors.

Conclusion

Taxation of air pollution from wood burning can efficiently be done by introducing a tax per hour of operation reflecting the costs of the resulting air pollution. This is estimated to reduce pollution from wood burning in Denmark by 85 % providing a major socio-economic benefit.

Acknowledgement

We acknowledge the great work on health effects and health costs of wood burning performed by the Danish Centre for Environment and Energy and the Danish Council of Economist. Furthermore, we thank CB Svendsen for designing/valuating the technical system for logging the hours of operation. We could not have performed our work without their contribution.

Further info:

Clean Heat website: www.clean-heat.eu

Danish Ecological Council: www.ecocouncil.dk

Deutsche Umwelthilfe: www.duh.de

LIFE program of the EU: ec.europa.eu/environment/life/

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Kaare Press-Kristensen holds a master degree and a Ph.D. in environmental engineering from the Technical University of Denmark. His work is mainly focused on reducing emissions from wood burning, road traffic, ships, aircrafts, non-road machinery etc. His work both considers emissions, ambient air concentrations and the connected risk to public health as well as work related exposure and public information.

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