

## One size won't fit all: Buildings have diverse effects on health and the environment across Europe and China

Marjo Niittynen, Arja Asikainen, Matti J. Jantunen and Jouni T. Tuomisto, National Institute for Health and Welfare, Finland

Professor Clive Sabel, University of Bristol, UK

Erkki Pärjälä and Tapio Kettunen, Municipality of Kuopio, Finland

Laura Perez and Stephan Trüeb, Swiss Tropical and Public Health Institute, Switzerland

### About the research

Across Europe heat and power generation for the buildings sector represents 35% of fossil and 37% of total CO<sub>2</sub> emissions. Buildings play a key role in policies regarding both greenhouse gases (GHG) and the disease burden from air pollution.

A building can cause GHG emissions directly via the combustion of fuels within it, and indirectly via its demand for electricity and district heat, the land cleared and materials used for its construction and maintenance, and the traffic flow generated by its daily use.

A building affects public health and wellbeing via the air pollution generated in meeting the requirements of its occupancy, and via its indoor environmental quality (IEQ).

The European-funded project *Urban Reduction of Greenhouse Gas Emissions in China and Europe* (URGENCHE) aims to effectively integrate policies relating to greenhouse gas emissions with those on health and wellbeing.

This particular sub-study of URGENCHE examines environment and health implications of the heat and electricity required by the buildings in: Kuopio, Finland; Basle, Switzerland; Stuttgart, Germany; Thessaloniki, Greece; and Suzhou and Xi'an in China.



### Policy implications

Potential for greenhouse gas (GHG) and air pollution reduction by building policies depends on how the heat and electricity are currently generated:

- Where the role of fossil fuels is already small and heat is distributed from centralised cogenerating stations (which is the case in Kuopio and Basle) policies should focus on traffic and other sources.
- Conversely, in Xi'an the extensive domestic and small business use of coal and coke should be replaced with gas and electricity for substantial air pollution reduction and health benefits.

Domestic heating by wood (and coal) should be discouraged in all cities. Compared to its contribution to heat supply (1% in Stuttgart, 3% in Kuopio for example), it emits a 10 times larger percentage of air pollution.

Fuel poverty (seen, for example, in Thessaloniki) should be managed so that people need not replace gas and electricity with cheaper wood and coal.

Renovation of buildings can exhibit positive or negative health and wellbeing impacts - irrespective of the energy conserved. This highlights the need for epidemiological research on renovation as well as training and auditing of renovation engineers, supervisors and labourers.

## Key findings

- Amongst the cities studied within the URGENCHE project the proportion of total energy which is used in buildings varies from major (34 % in Kuopio and 22 % in Basle) to marginal (5 % in Rotterdam and Suzhou).
- Natural gas produces only little air pollution and half of the CO<sub>2</sub> volume compared to solid fuels. Biofuels are not always 'greenhouse neutral': through its life cycle a fuel based on biowaste may absorb more greenhouse gas (GHG) than it emits (defined as having negative GHG emissions), and stemwood combustion may emit more GHG than coal. When the whole life cycle is considered, one biomass-based fuel may exhibit negative GHG emissions, while another emits more than coal.
- Air pollution emissions and the respective disease burden from alternative energy sources vary in orders of magnitude. Domestic solid fuel combustion is the most harmful, with natural gas, electricity and district heat being the most benign alternatives.

This project was supported by the 7th European Framework Program: Grant Agreement No. 265114



*Image: The source of the severe air pollution problem in Xi'an, China.*



## Further information

For further reading please see:

Paul Wilkinson, Kirk R Smith, Michael Davies, Heather Adair, Ben G Armstrong, Mark Barrett, Nigel Bruce, Andy Haines, Ian Hamilton, Tadj Oreszczyn, Ian Ridley, Cathryn Tonne, Zaid Chalabi (2009) *Health and Climate Change 1: Public health benefits of strategies to reduce greenhouse-gas emissions: household energy*. The Lancet, 25.11.2009 DOI:10.1016/S0140-6736(09)61713-X

Jantunen M, Oliveira Fernandes E, Carrer P, Kephelopoulos S. *Promoting actions for healthy indoor air (IAIAQ)*. (2011) European Commission Directorate General for Health and Consumers. Luxembourg: [tinyurl.com/oyx4fes](http://tinyurl.com/oyx4fes)

For information on environment, health and energy aspects of built environments please see: [tinyurl.com/ofvrdd](http://tinyurl.com/ofvrdd)

## Contact the researchers

Matti J. Jantunen, National Institute for Health and Welfare, Finland: [matti.jantunen@janding.fi](mailto:matti.jantunen@janding.fi)

Professor Clive Sabel, University of Bristol, UK: [c.sabel@bristol.ac.uk](mailto:c.sabel@bristol.ac.uk)