



# **Health-related aspects of bioenergy production**

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# Governmental bioenergy strategy

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- The target for the consumption of renewable energy (38% of total) by 2020 is planned **to be achieved largely by increasing biofuel consumption in Finland**
  - **Small-scale wood burning** to be continued at a high level 13 TWh (2005 →)
  - **Forest chips** to be increased from 6 TWh (2005) to 21 TWh, mostly in small power plants (<20 MW)
  - **Wood pellets and agricultural biomass** to be increased from 0.1 TWh (2005) to 3 TWh, mostly in small power plants
  - **Bio-oils** to be increased from 0 TWh (2005) to 6 TWh, half in motor vehicles





# Conflict of the strategy with public health

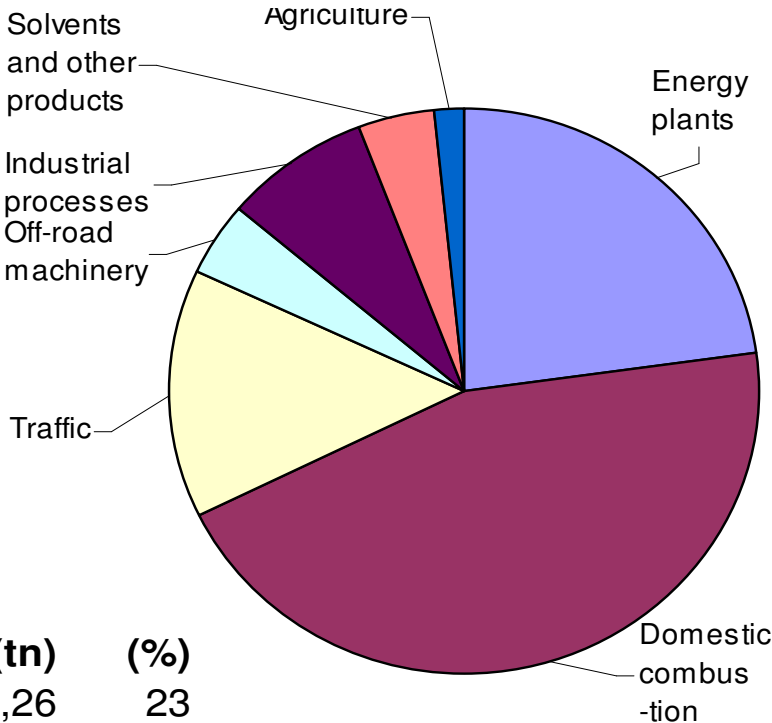
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- About one third of the small-scale wood burning in communities with substantial population
  - **No regulations for energy efficiency** of the combustion appliances, no emission limits
  - **Even inappropriate boilers without water tank are allowed as primary heaters** (fine PM mass emission ~100-fold compared to good combustion technology)
  - **No CE marking** to advice the customers to buy low-emitting appliances
- Many of the small power plants (<20 MW) in the middle of the community
  - **No filtering of fine PM emissions**, whether biomass, peat or heavy fuel oil are used





**Assessed contribution of wood combustion is ~25% to the total PM<sub>2.5</sub> emissions in Finland (Karvosenoja et al. 2008)**



<b>PM<sub>2.5</sub> emissions in 2005</b>	<b>(tn)</b>	<b>(%)</b>
Energy plants	7740,26	23
Domestic combustion	15359,71	45
Traffic	4930,24	14
Off-road machinery	1356,00	4
Industrial processes	2804,70	8
Solvents and other products	1398,72	4
Agriculture	560,04	2
Other	12,27	0
<b>Sum</b>	<b>34161,93</b>	<b>100</b>



# Residential biomass heating in community → impaired air quality

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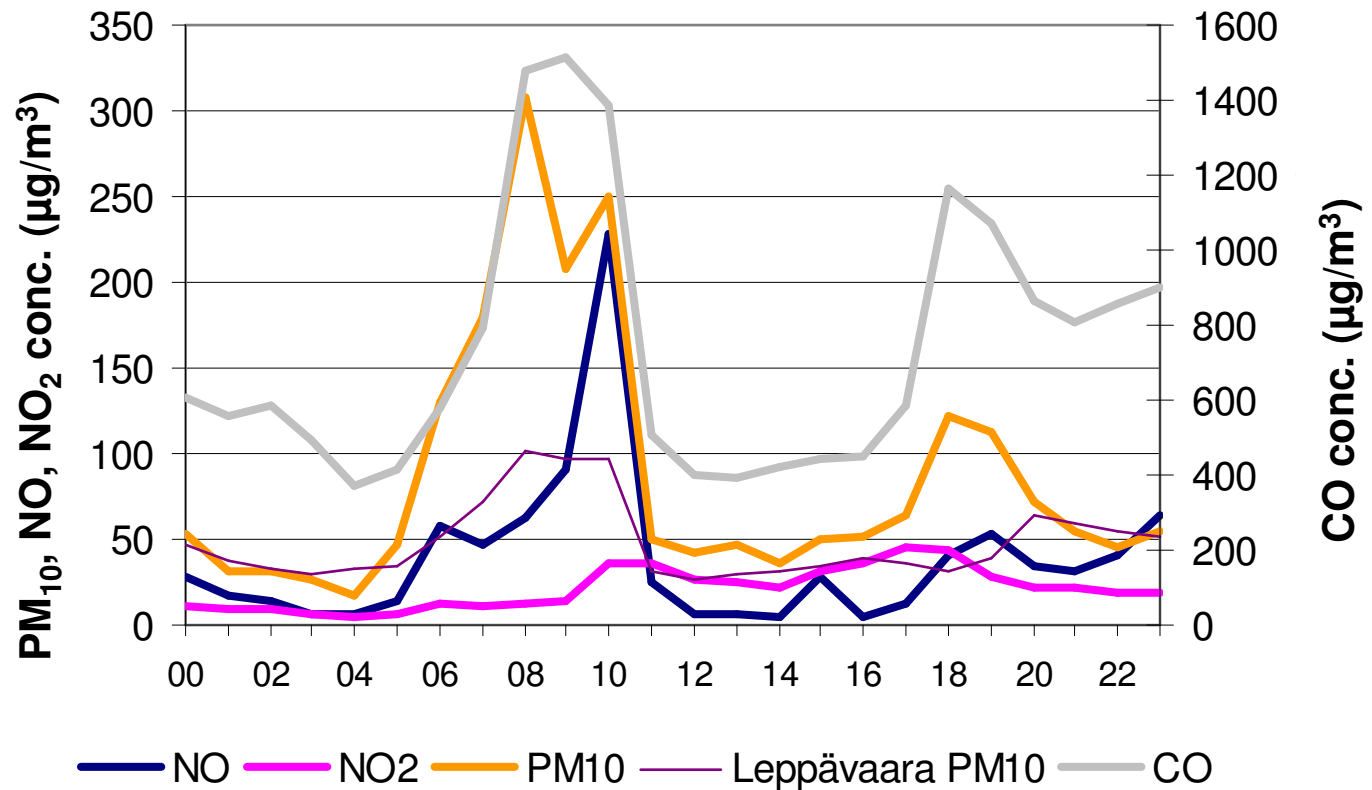
- **A high probability of elevated exposures** in the neighbourhoods to fine particles (PM<sub>2.5</sub>), carcinogenic PAHs, CO and VOCs
- **Release of combustion emissions** from domestic heating appliances and small power plants **close to the ground**:
  - Poor aerosol mixing in cold season days leads to **elevated local outdoor pollutant concentrations** ⇒ **penetration indoors**
  - Use of domestic heating appliances most active in the evenings, when most of the neighbours are at home
- **Little research done until now** on air quality problems, and on the human exposure and health effects related to poor biomass combustion in residential areas





# Residential biomass heating and air quality

Lintuvaara, Espoo, Finland 13.10.2005



**One day with weak winds: higher PM<sub>10</sub> concentrations than with busy traffic in Leppävaara (Espoo) or Helsinki downtown (YTV, Helsinki, 2006)**





## **Rough estimate of the present disease burden from poor biomass combustion**

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- **Hundreds of premature deaths due to excess fine PM (total ~1300 per year in Finland as assessed by the Clean Air for Europe, CAFE project in 2005)**
- **Thousands of adult asthmatic or other respiratory disease subjects, and thousands of children, with impaired health and restricted activity days due to excess fine PM**
- **Excess health costs in the order of tens of millions of euros per year in Finland (see CAFE 2005)**
- **Health risks among subjects with cardiovascular disease and health risks from gaseous pollutants (CO, VOC) poorly known**





## **”Not-so-nice picture” of the societal burden from poor biomass combustion**

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- **Newly retired people in good health and with a lot of spare time change oil or electric heating in their 20- to 50-year old houses to inappropriate wood heating due to savings in costs (wood mostly from own forest)**
  - **Frank poisoning of other retired people with cardio-respiratory illnesses and small children & their mothers in neighbourhoods**
  - **Tens-to-hundreds of official complaints in recent years by the exposed people → mostly poor handling of the cases by officials in municipalities → appeals to administrative courts and occasionally to civil courts → variable decisions that rarely help those who appealed**
  - **Conflicts lasting for many years lead to poor relations between neighbours, excess work by the administration etc.**





# Governmental control measures

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- A statute for energy efficiency of the small-scale combustion appliances & emission limits first suggested to the Ministry of the Environment in 1997
  - Appeal of three health NGOs to the political groups in the Parliament started preparation of the statute in 2005
  - Statute ready for implementation in 2007 but not done
- The Ministry of Social Affairs and Health gives instructions to municipalities on the health aspects of poor wood combustion (STTV 6/2008)
  - These instructions are nearly toothless without the statute on energy efficiency & emission limits
- The Ministry of the Environment has prepared a statute to be given to the Parliament on very loose PM emission limits for small-scale power plants (said to represent BAT)





# What should be done better?

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- **A statute for energy efficiency of the small-scale combustion appliances & emission limits right now!**
  - **Even the Finnish industry manufacturing these appliances wants the statute → no national reference for markets of low-emitting appliances**
  - **Ban of inappropriate boilers without water tank**
- **PM emission limits for small-scale power plants should be tightened to represent current BAT in the Parliament (if not before by The Ministry of the Environment)**
- **The central, regional and local governments should start to bear better responsibility for the health aspects of bioenergy to avoid excess premature deaths & new cases and exacerbations of chronic cardiorespiratory diseases**

