

**Summary and conclusions of the IEA Bioenergy, Task 32 workshop  
„Aerosols from small-scale biomass combustion plants“,  
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- **Low Dust Combustion Technologies**

- Relevant primary measures identified to reduce PM emissions are efficient air staging, fuel bed temperature control as well as improved process control.
- A big optimisation potential is given (up to a factor 10 in comparison to state-of-the-art systems).
- CFD based combustion design can be very effective for the development of low dust combustion systems.
- Fuel additives to reduce PM emissions are under investigation - some reduction potential seems to be given but also other issues have to be considered (e.g. increased ash content, ash melting behaviour, costs).

- **Small-scale precipitators**

- Precipitators need to be carefully designed for the framework conditions given and need careful evaluation.
- The already performed and ongoing developments in this area show that ESP systems seem to be the most promising solution for small-scale biomass combustion systems
- Danish and German experiences show that a lot of problems in first practical applications still exist and improvements are necessary.
- No installations in living rooms are acceptable, following, for stoves installations in or on the chimney are demanded.
- The availability and efficiency of small-scale precipitators is very important. An acceptable efficiency of a conventional ESP is higher than 90% - this seems to be an appropriate comparative value for evaluations. Regarding availability, an operation over a whole heating period without maintenance is required.
- An efficient automatic cleaning system of the filter is of great importance for a long-term and efficient operation.
- The consideration of particle properties and flue gas properties for the design and application of an ESP is important. Thus, a clear distinguishment between old and new combustion systems (bad and good burnout conditions) has to be made as the particles to be precipitated differ considerable regarding their chemical compositions (ash, soot, tars), their physical

characteristics and their electrical properties. Moreover, also the flue gas properties differ, especially regarding temperature as well as moisture content.

- The methodology to evaluate the precipitation efficiency of small-scale ESP systems needs to be standardised in order to make them comparable.

- **Health effects**

- The methodology to measure and evaluate health effects is relevant; a recommendation for suitable methodologies is given in the final report of the ERANET BioHealth project.
- Particle properties are of importance concerning health effects
- Also the particle mass emitted is of relevance as it acts as a multiplier.
- Lowest inflammatory responses are found for PM from new small-scale biomass boilers which show a good burn-out behaviour.
- Polycyclic aromatic hydrocarbons (PAH) play a key role concerning the toxicity of particles; high PAH concentrations are found in particles with poor burn-out.
- The genotoxicity of aerosols from old small-scale biomass combustion systems is considerably higher.

- **Future measures**

Primary measures are better than secondary measures; therefore highest priority should be on

- the replacement of old by new systems and
- the development and introduction of new low-dust combustion technologies.
- Support measures by appropriate incentives are important for the market introduction of new low dust technologies and boiler replacements

Small-scale filters need careful evaluation concerning applicability, availability and efficiency.

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