Needs to reduce particle emissions from biomass combustion

Conclusions from the IEA Bioenergy Task 32 session at 20th ETH Conference on Combustion Generated Nanoparticles in Zurich Switzerland, 14 June 2016

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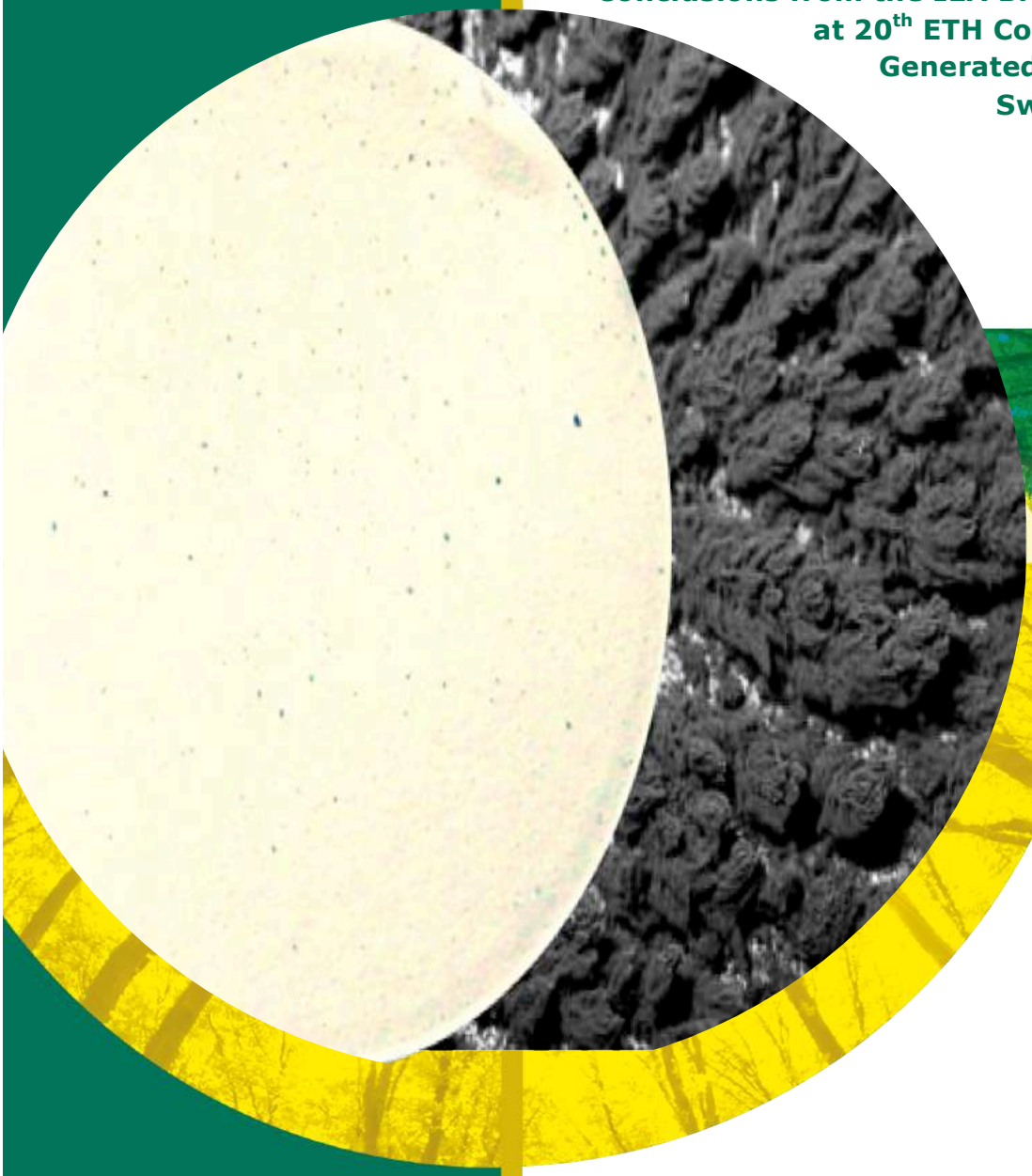

Particles from near-complete biomass combustion collected on a filter (left) and soot agglomerates from incomplete combustion trapped in an electrostatic precipitator (right). Photos: Bioenergy Research Group, Lucerne University of Applied Sciences, Switzerland.

IEA Bioenergy

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Biomass is used as a renewable energy carrier to substitute fossil fuels for heat and power production. Modern biomass boilers that comply with today's emission limits and that are operated appropriately have typically a low environmental impact. Biomass can therefore be used in an environmentally friendly way, if the necessary requirements are met. There are, however, undesired situations which can lead to non-ideal conditions. This can cause a negative impact to the ambient air mainly with an increased contribution to volatile organic compounds (VOC) and inhalable particulate matter in the size range smaller than 10 micrometres (PM_{10}).

From the activities of various research groups represented in the International Energy Agency (IEA) Bioenergy Task 32 and at the ETH Conference on Combustion Generated Nanoparticles in June 2016 [1–5] it is concluded, that the following topics need to be supported to avoid a high impact of biomass combustion to ambient air quality:

1. The operation of the combustion devices has a strong influence on the air pollutant emissions. This is true for all devices, however most relevant for manually operated boilers and stoves. One important issue is the use of an appropriate fuel with respect to fuel moisture, size, and ash content for the dedicated combustion device. Furthermore, an appropriate ignition is required. Investigations show that an "ignition from the top" is favourable for many conventional wood stoves. In addition, the amount of wood for one batch needs to be adjusted to the size of the combustion chamber. Finally, sufficient combustion air, although not exceeding a reasonable amount, needs to be supplied during the combustion phase.

2. Standardisation of biomass fuels, combustion devices, type-tests, and measurement technologies can assist a target-oriented development to further improve the quality of biomass combustion applications and ensure a low impact on air quality. For the definition of new standards, test conditions which represent a real-life operation should be considered.

3. Design guidelines and quality management for the planning and implementation of biomass combustion plants can assist an appropriate layout and dimensioning as a pre-condition for an ideal operation of the combustion and the flue gas cleaning. Furthermore, plant monitoring can assist an on-going optimisation of the operation mode and an adaptation on varying requirements and fuel parameters.

4. An international exchange of experience between all stakeholders from research, industry, energy economics, and national authorities can assist this process. Nevertheless, the enforcement of regulations on energy standards and on air quality plays an important role and needs to be followed also on a national basis.

The presentations [1–5] from the IEA Bioenergy Task 32 session at the 20th ETH Conference on Combustion Generated Particles in Zurich in 2016 are available at

http://www.nanoparticles.ch/2016_ETH-NPC-20.html

Literature

[1] Nussbaumer, T.: Particulate Matter (PM) from biomass combustion – An overview on particle types and measures to reduce particle emissions (keynote lecture), 20th ETH Conference on Combustion Generated Nanoparticles, ETH Zürich, 13.–16.6.2016

[2] Jokiniemi, J.; Tissari, J.; Lamberg, H.; Sippula, O.: Chemical and Physical Properties of Biomass Combustion Aerosols, 20th ETH Conference on Combustion Generated Nanoparticles, ETH Zürich, 13.–16.6.2016

[3] Hartmann, H.; Schön, C.: User and fuel impact on emissions of wood stoves, 20th ETH Conference on Combustion Generated Nanoparticles, ETH Zürich, 13.–16.6.2016

[4] Schmidl; C.; Kelz, J.; Klauser, F.; Kumar-Verma, V.; Schwabl, M.; Schwarz, M.: Real-life emission of automatically stoked biomass boilers, 20th ETH Conference on Combustion Generated Nanoparticles, ETH Zürich, 13.–16.6.2016

[5] Seljeskog, M.; Sevault, A.; Østnor, A.; Skreiberg, Ø.: Variables Affecting Particulate Emissions from Residential Wood Combustion – Simultaneous Sampling on Hot and Ambient Filter, 20th ETH Conference on Combustion Generated Nanoparticles, ETH Zürich, 13.–16.6.2016

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