Recent Developments in Small Scale Combustion (SSC) Devices

Conclusions
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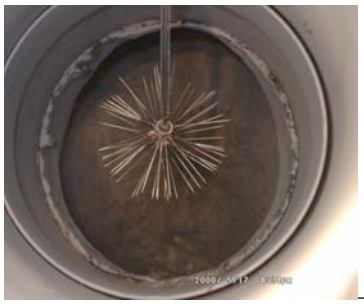
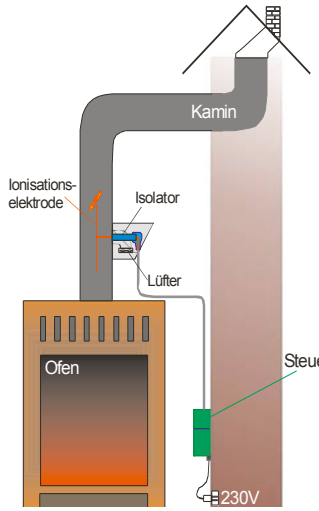


Electrostatic Precipitator ESP for residential wood combustion



Development in Switzerland by
EMPA (Swiss Federal Institute of Material Sciences and Technology)

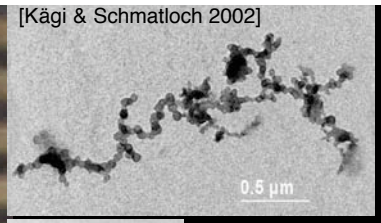
see: www.minipab.ch

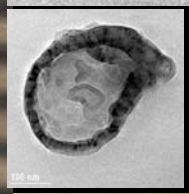
Schmatloch, V., Rauch, S.: Journal of Electrostatics (2005) Vol. 63(2), 85–100

Status of SSC Today

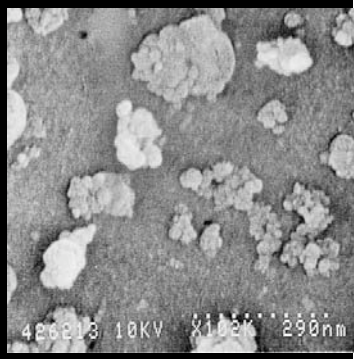
1. Small Scale Combustion is important today for two reasons:
   It has a high contribution
   a) to the global energy demand but
   b) also to the air pollution, mainly PM

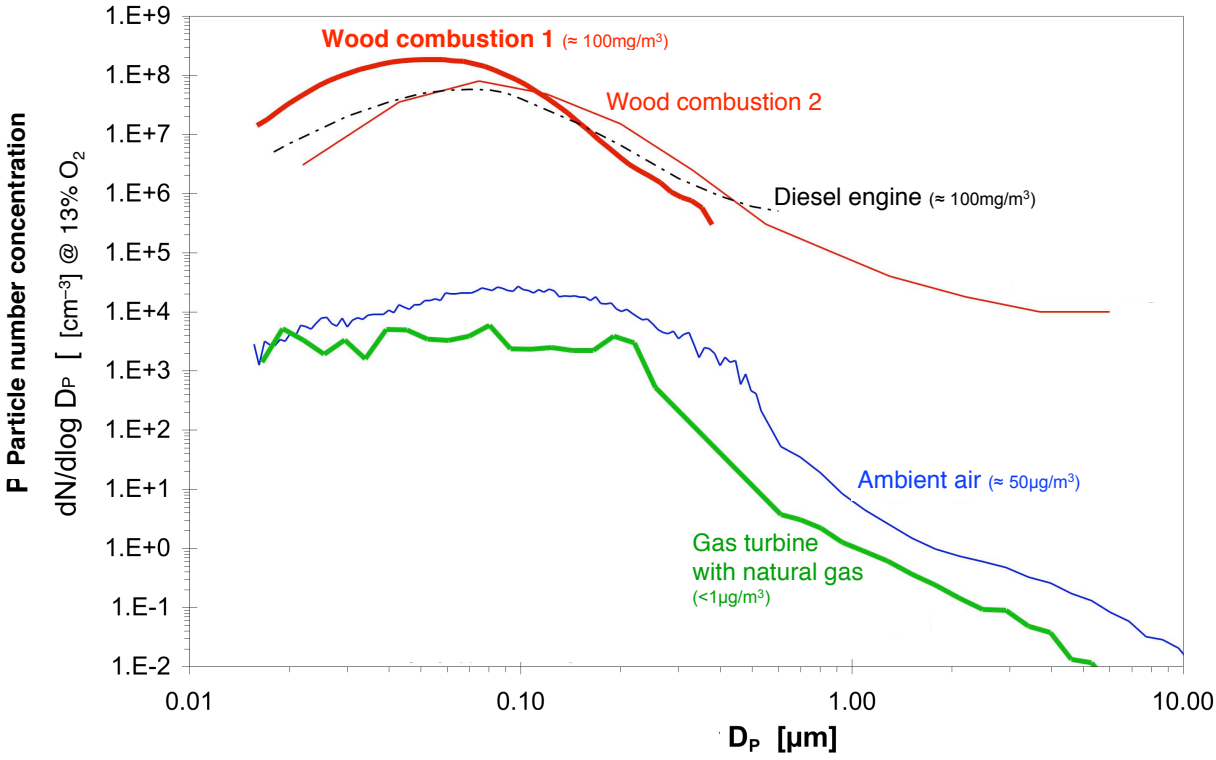
2. Small Scale Combustion is increasing





Two types of PM need to be distinguished:
Organic PM (left) and inorganic PM (right)





Gas turbine & ambient (Baden, CH): [Klippel et al. 2003] SMPS und OPC
Wood 1 & Diesel: [Oser et al. 2000] & [Schmatloch 2000] with SMPS
Wood 2: [Johansson 2002] with ELPI transformed to Stokes D

Where are we going ?

2 Examples of new developments:

Example 1: 1-stage combustion with flame quenching ....

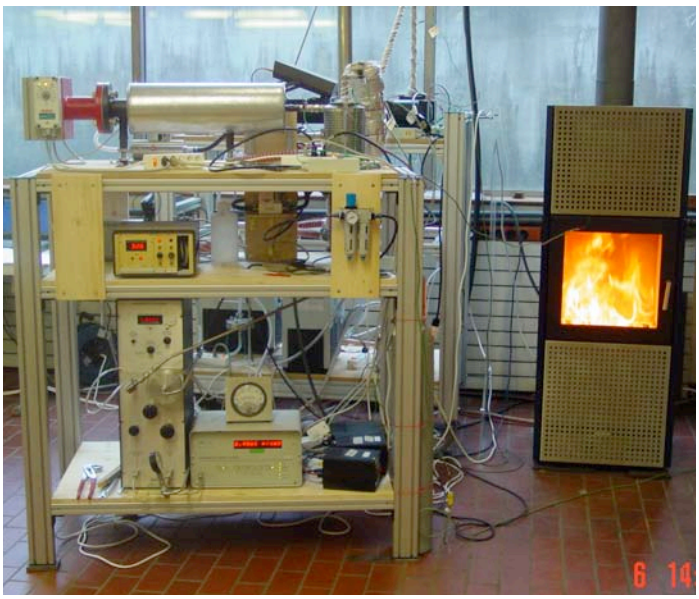
ches System: Brennholz rein und anzünden.

NZZ am Sonntag • 24. Oktober 2004

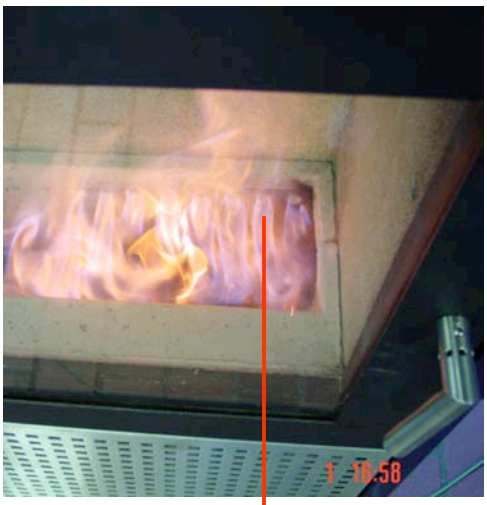
Auf kleiner Flamme: Im Dutchtub lässt es sich mit oder ohne Bier gut auch bei herbstlichen Aussentemperaturen aushalten.

Der Kannibalenkochtopf

Example 2: 2-stage combustion for log wood is possible !



Equipment for analysis of analysis of particle size distribution from 15 nm to 40 microns by Verenum (SMPS and OPC)



Premixed gas flame

Prototype stove with two-stage combustion achieving < 50 mg/m3 during start-up and < 15 mg/m3 during stationary period, TIBA Holzfeuerungen AG Bubendorf (Switzerland)

Conclusions (1)

1. Relevant improvements have been achieved during the past 10 years:
   – Control systems
   – Pellet combustion
   – Particle removal
   ...

2. Good combustion systems with high efficiency and low emissions are available

Conclusions (2)

BUT:

1. Hugh differences
   between technologies and countries

2. a) Log wood is under estimated
   b) Log wood is more difficult (batch !)

   gap between developmtents and relevance

Where should we go ?

Outlook/Target for SSC:

–> Implementation of SSC

1. To increase biomass share as energy source by additional SSC

2. To replace existing low quality systems by improved systems
   (this enables a) a relevant increase of useful energy with the same amount of currently used wood and b) a huge reduction of air pollution)

Outlook/Target for SSC:

–> Implementation of SSC

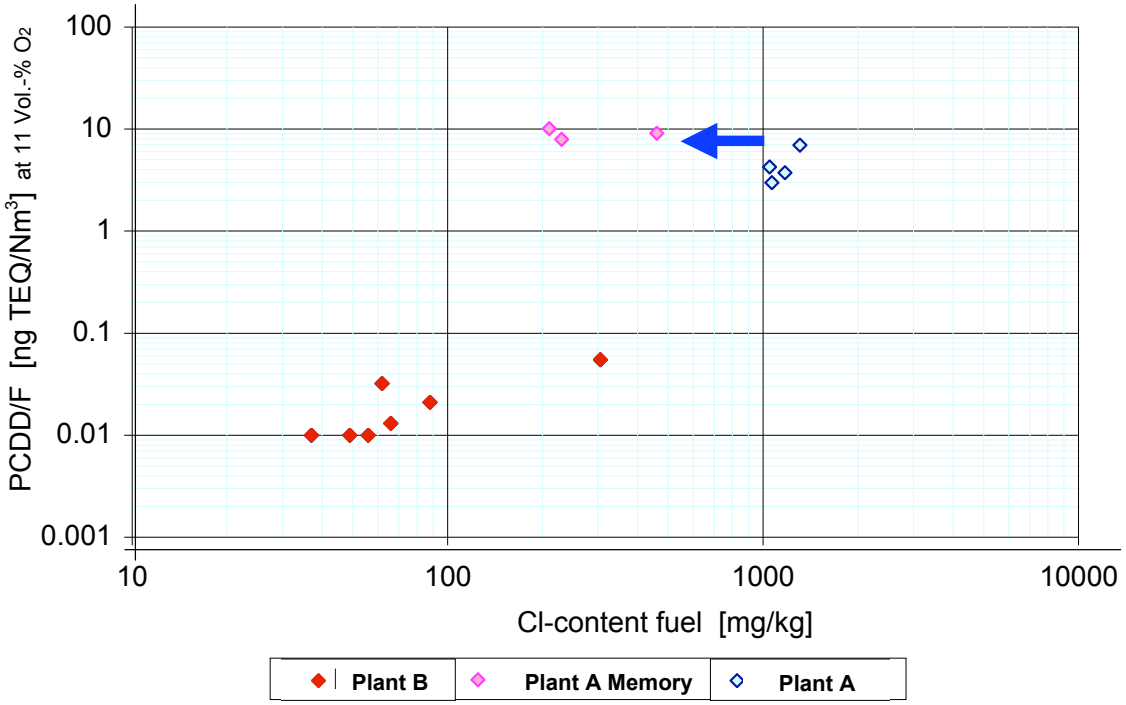
But with high requirements, i.e., ONLY high quality SSC with

1. High quality SSC systems	–> Certification test, Quality labels & Quality assurance
2. Correct operation	–> Information, technical measures, periodic control (and consequences, i.e., penalty for illegal incineration)

Fuel is very important: Example of hard wood which is dry outside

But wet inside –> w > 25%

Memory-Effect for PCDD/F (Hypothesis)



[Fastenaekels 2003]

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Outlook/Target for SSC:

–> Implementation of SSC

But with high requirements, i.e., ONLY high quality SSC with

1. High quality SSC systems	–> Certification test, Quality labels & Quality assurance
2. Correct operation	–> Information, technical measures, periodic control
3. Optimum fuel	–> Fuel standardization

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