International Bioenergy Conference 2017

LowCarbon Firebox

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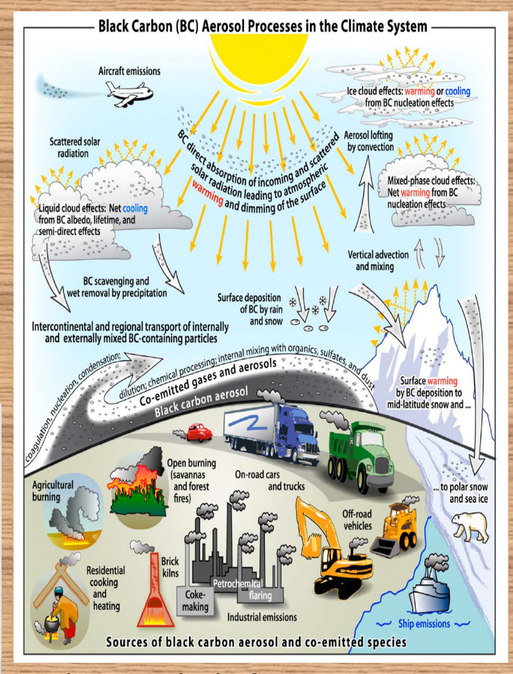
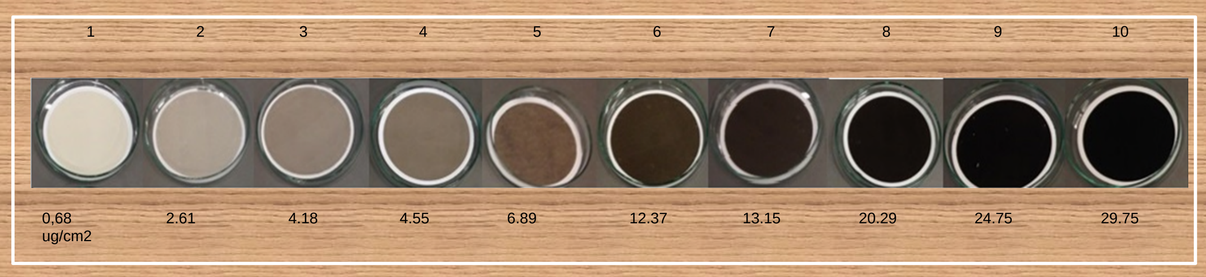


Black carbon aerosol processes in the climate system (Source: Bond et al, 2013)

✓ New measurement protocol and –method

2015

A thorough literature study of black carbon in general and a study of the present available black carbon measurement methods constitute the background for developing a new suitable measurement protocol and –method for measuring black carbon containing particles from wood burning stoves. Different wood quantities and air supply settings are combined for a greater insight of black carbon containing particulate emissions from intermittent stoking.



The measurement campaign revealed a correlation between the analysed and measured elemental carbon and the color from the collected particulate mass.

EC/OC analysis from measurement campaign for one quartz filter in different temperature steps and different spheres.

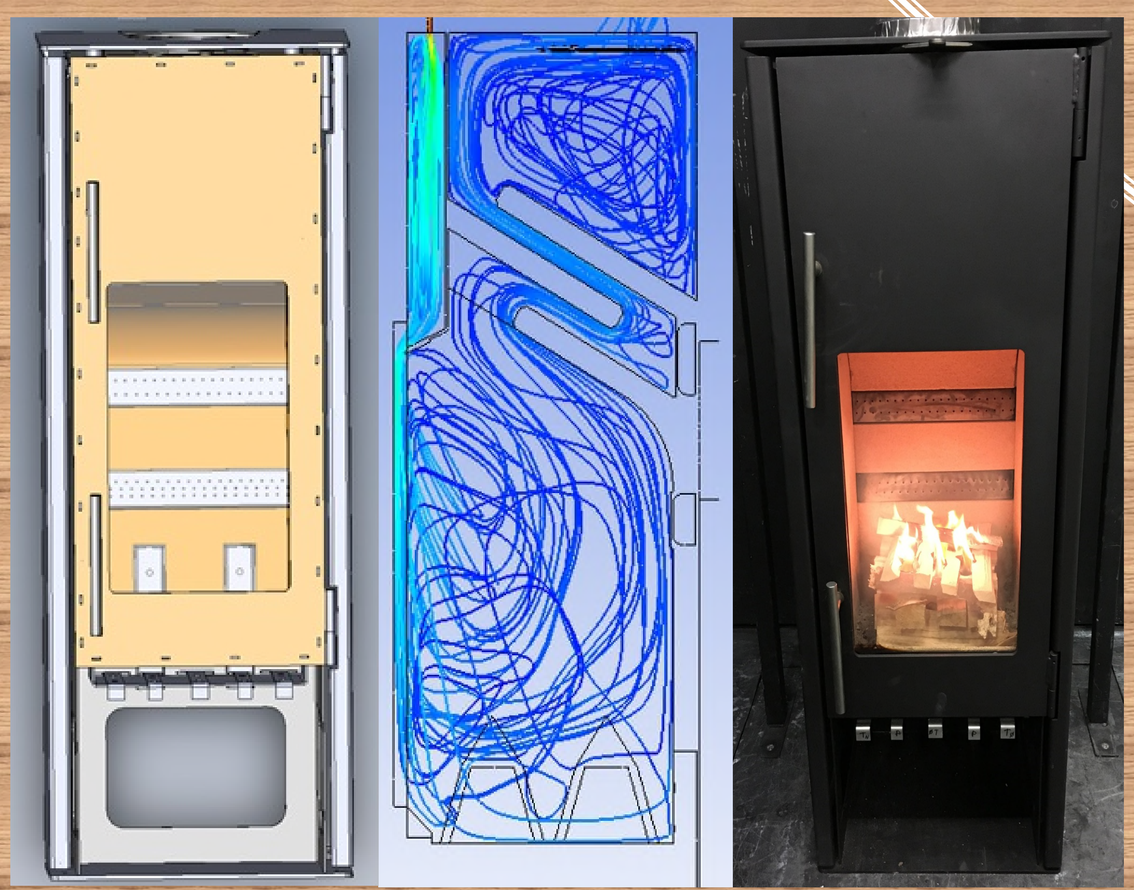
✓ Understanding of parameters causing black carbon

The EC-OC analysis revealed the possible main reasons regarding the formation of the black carbon containing particles. It suggested that the placement of the combustion air supply and construction of the firebox could be the main reasons more than the geometry of the firebox itself.

✓ Development of a model-firebox

2016

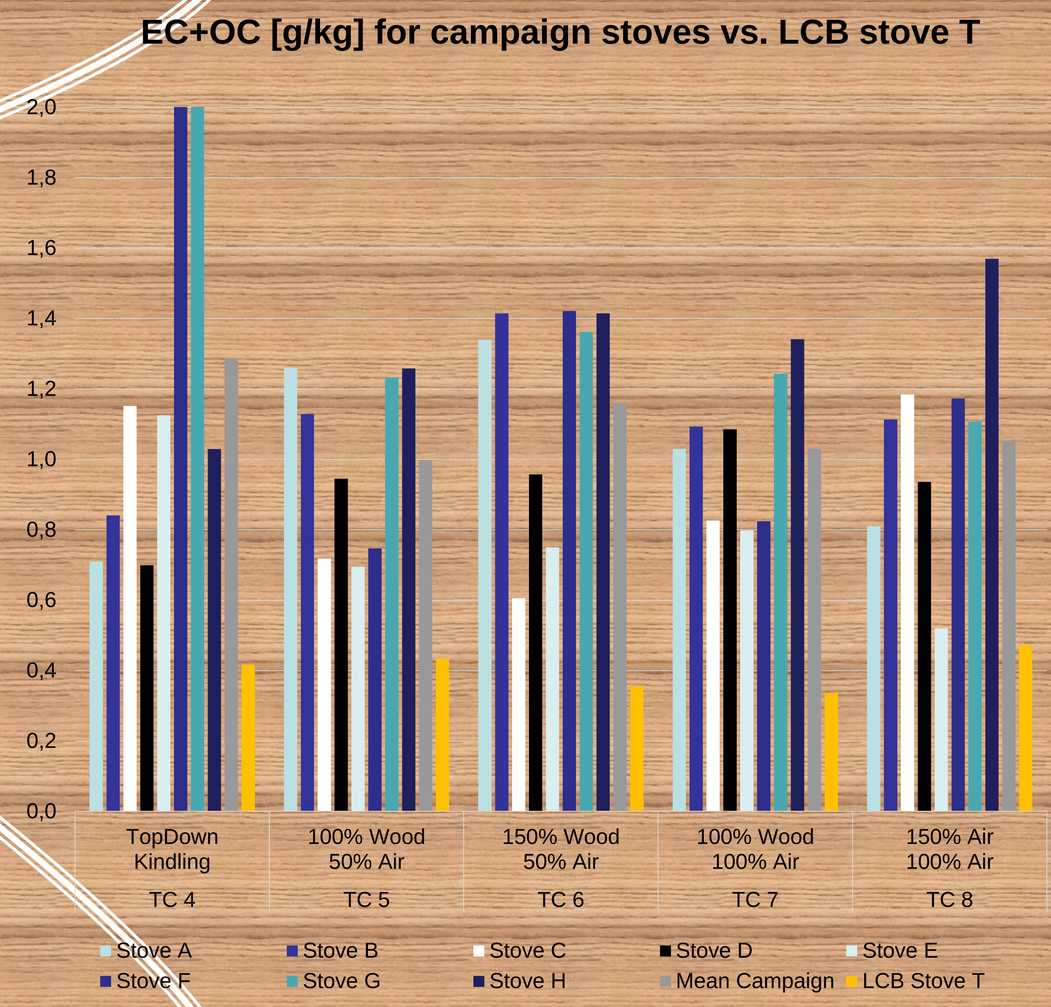
Based upon the collected knowledge and the interpretation of the analysis, a LowCarbon Firebox was designed, CFD-simulated and physically built for verification of a less black carbon emitting design than the tested stoves for the campaign.



LCB-stove from CAD-drawings, through CFD-simulations to final product.

✓ Wood burning stove measurement campaign and analysis

Eight modern wood burning stoves with different geometry and combustion air supply have been measured after the developed measurement protocol. The collected mass of the particulate emissions has been analysed with a Thermal-Optical analysis approach, which divides the particulate mass into an organic- and elemental carbon fraction. The results are furthermore compared with other valid emission parameters.



An overview of the collected and emitted elemental and organic carbon for the eight stoves, a combined mean from the campaign and the produced LCB Stove T for the different test cycles (TC) of wood quantities and air supply settings.

Parameter:	Efficiency	CO-emission	OGC-emission	EC-emission	OC-emission
[Unit]	[%]	[%]	[mgC/Nm³ dry gas at 13% O_2]	[g/kg (dry matter)]	[g/kg (dry matter)]
Mean Campaign Stove A-H	77	0,125	138	0,48	0,62
LCB stove T	81	0,046	41	0,20	0,20
%-wise Improvement	**5%**	**61%**	**65%**	**58%**	**67%**

The LCB Stove T compared to the stoves in the campaign. Out of a total of 225 parameters, the LCB Stove had a ***success rate on 94%!***

“ Results from the designed fire-box showed a 5% more efficient and a 63% less polluting firebox – for both black carbon containing particles and other present emission factors ”

2017

✓ Set of guidelines for preventive less black carbon emitting firebox designs

Experiences from the project ends up with a set of guidelines for future less black carbon emitting firebox designs. This knowledge is very useful for the partners in case of an implementation of black carbon containing particles as a future emission factor for intermittent stoking.

Project funded by:
Danish Ministry of the Environment
Environmental Protection Agency

DANISH TECHNOLOGICAL INSTITUTE

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