Zusammenfassung der Präsentation

Evaluation of small-scale ESP for older wood stoves and boilers in Denmark

Ole Schleicher, FORCE Technology, Denmark

Introduction

Wood fired stove and boilers is a main contributor the emission of particles, PAH and NMVOC in Denmark and flue gas odour nuisances is a widespread problem. The emissions from older wood stoves and wood boilers are in general much higher than from new ones, and the potential for reducing the emissions are consequently high. The objective of this project was to evaluate and test technologies which can reduce the emission of the mentioned pollutant from existing older wood stoves and wood boilers, and evaluate their applicability on typical Danish installation.

Material and Methods

Five technologies were tested; whereas three of them were the ESPs (Electro Static Precipitators) named Zumikon, Airbox and CleanAir from the companies Rüegg Cheminée AG, Spartherm Feuerungstechnik GmbH and Applied Plasma Physics AS respectively. The two last technologies were the MoreCat catalyst for stoves from MoreCat GmbH and a retrofit system for old stoves from ECOXY AS.

All the technologies where first tested in a test facility on an old stove and the ESP was also tested on an old bottom up burning boiler, and the results was compared to test without any technology installed. Also test with a modern Swan Eco Labelled stove was used for comparison. Additionally the potential emissions reduction by replacing old appliances with new ones was evaluated based on emission factors used in the Danish emission inventory. Secondly a field test with four CleanAir ESPs was performed, by mounting them on four private installations and the effect on the ambient air was measured.

The stove test period consist of lightning, re-stoking twice with high performance, followed by re-stoking twice with reduced air. The boiler was lighted and re-stoked four times with high load only. The emission of total PM, particle size distribution, CO, NMVOC, PAH and dioxin was measured in a dilution tunnel. Also odour emission was measured on spot samples, but only from some of the test. The applicability of the technologies for mounting on typical stoves and boilers in Denmark was evaluated, and cost for installation, maintenance, regularly cleaning and obstacles for salableness was estimated.

Results and Conclusion

The colour on the filter used for the particle sampling showed that soot particles could be removed by the ESP, but the test could not document any significant reduction of the total emission of particles, or any of the other parameters measured in the dilution tunnel, except for a small particle reduction for the CleanAir ESP.

The ESP technology seems to have the effect of changing the particle size distribution towards an increased number of fine particles < 0.1 µm. This is apparently caused by the removal of the larger soot particles by the ESP, because the there are no larger particles for the condensables to condense on, and then they will condense as fine particles.

The lowest emissions was measured from the new Swan Eco labelled stove, showing that a more efficient reduction of all the pollutants CO, particles, condensable/NMVOC, PAH and most likely also odour, can be achieved by replacing old stove or boiler with a new and more efficient ones, rather than installing any of the tested technologies. This is also documented by the differences in the official emission factors. The cost for a new stove will for many installations be comparable to the cost for the

installation of an ESP and the maintenance for some years. The cost for replacing a boiler will be much higher, than for installing and maintain an ESP, but the emission reduction are much higher, and there is also saving from increased efficiency and reduced operation work.