



IEA Bioenergy
Technology Collaboration Programme

Advanced Test Methods for Pellet Stoves

Report on Consequences of Real-Life Operation on
Stove Performance

Summary Series

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Summary

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Pellet stoves become more and more popular as renewable and sustainable heating technology in Europe. Compared to manually operated firewood room heating appliances pellet stoves are featured with an automatic fuel supply into the combustion chamber and offer various options for an automatic as well as low-maintenance operation. In future, pellet stoves might also be implemented in smart-home systems and can be combined with other residential (heating) systems. Furthermore, emissions and thermal efficiency are typically advantageous compared to manually operated firewood stoves.

TESTING STANDARDS

This study provides an overview of most relevant test standards for performance evaluation of pellet stoves regarding emissions and thermal efficiency. In detail most relevant characteristics as well as differences of the testing methods regarding preconditioning of the appliance in advance of testing, fuel requirements, testing procedure, measurement methods, data evaluation and testing results were reviewed.

The number of tested load settings, repetitions of measurements, respected emissions and PM measurement procedures were identified as most relevant differences between the reviewed testing methods. All reviewed test standards evaluate the appliance performance under heated-up conditions. Load changes are only considered by the latest official test standard, the US Standard - ASTM E2779 - 10 (2017). Concluding the review of existing official test standards indicates that international standardization (ISO) in principle seems feasible. This would enable better international market opportunities for manufacturers and therefore support the industry to increase their market shares and market volumes, especially for high quality pellet stoves.

ADVANCED TESTING METHODS

The “beReal” test concept was presented as an example for an advanced testing method for real-life performance evaluation of pellet stoves. The “beReal” method is based on a large end-user survey and evaluates the appliance performance regarding emissions and thermal efficiency considering cold and warm starts as well as different load settings, load changes and further transient phases, like cleaning intervals or cool down phases.

Comparative tests in the lab as well as in the field according to the existing test standard (EN 14785) and “beReal” revealed that the new method is capable to reflect real-life performance and could also be used to estimate emission factors (EF) of pellet stoves in the lab. This might be useful for a regular update of air pollution inventories and to update and evaluate the progress of technological development.

REAL-LIFE PERFORMANCE

The comparison of field test results with the proposed Austrian and European (EMEP/EEA) emission factors leads to the impression that some of the EF for gaseous compounds and particulate matter might be too high to reflect real-life performance. This result of course needs further investigations, as only four appliances were tested in this study.

Moreover, the field test results compared to official type test (ott) results confirmed that EN test results do not reflect real-life performance of pellet stoves. EN test results underestimate the real-life emissions up to 100%. Even the reproduction of the original type test results was not possible with serial-production appliances.

The EU ecodesign directive has set a benchmark of performance criteria for new stove technologies. Recent studies, however, show that that it will be no challenge for most manufacturers to comply with most of the new emission requirements as they are met already by existing products. Only the compliance with PM emission limits might be a challenge for some manufacturers.

Conclusions

The review of existing official test standards indicates that international standardization (ISO) of testing standards seems feasible. This would enable better international market opportunities for manufacturers and therefore support the industry to increase their market shares and market volumes, especially for high quality pellet stoves.

The development of new testing methods should focus on real-life-oriented testing conditions. The beReal test concept is one example for such advanced methods which has already proven its ability to provide realistic performance data for pellet stoves. Quality labels based on such advanced test methods could support a later standardisation.

Emission legislation is able to trigger technological development. Therefore, it is crucial that the requirements are challenging but also realistic. Furthermore, legislation should always be complemented with an effective market surveillance. Therefore, the implementation of a market surveillance concept, as it is introduced by the new ecodesign directive, might represent an effective measure to guarantee a constant product quality of sold appliances.