

Development of Concepts for Handling Firewood for Wood-Burning Stoves

Reducing Cases of Burning Moist Firewood

M. Rasmussen and N.C.E. Andersen

DTU Design and Innovation, Technical University of Denmark

INTRODUCTION

Burning moist firewood is a common problem, which leads to particle emissions and loss of energy in the firewood, both due to low combustion temperatures. The main problem is that it is difficult for many users to estimate the correct moisture-content of the firewood. Often the users do not store the firewood properly, keeping the firewood from drying fast. Two concepts were developed to solve these problems in order to reduce the number of cases with users burning moist firewood. The dry firewood provides up to 25 % more energy, making the use of wood-burning stoves more sustainable and less polluting.

ABSTRACT

Burning moist firewood most often happen in the group of users of wood-burning stoves, who does not have the stove as their primary source of heat. This group of users buys their firewood from retailers in amounts of 2 m³ as either “air dried”, containing about 25 % water, or “oven dried”, containing about 20 % of water. The users find it difficult to estimate the correct moisture content of their firewood, which leads to burning moist firewood. It adds to the problem that the firewood is often not stored properly: covered from rain with a roof, lifted off the ground and with plenty of air-circulation. This was concluded through user-interviews, visits and analysis of the data collected on field work. To obtain a combustion temperature high enough to reduce the emission of particles, the firewood should contain less than 18 % water, but optimally about 15 % water.

The first concept is short pieces of firewood. Regular pieces are 0.35 m long, but these will be 0.15 m. Results of drying-tests, performed for Copenhagen University by A. Bergstedt, show that short pieces dry faster than long pieces, but they also absorb moisture faster, which emphasizes the importance of proper storage. Storage and doubt-issues are solved by the other concept; The Cassette. The Cassette will isolate the firewood from moisture, drying it actively by circulating dry air around it. The moisture content will be measured by either moisture-content of the air in the cassette or the total weight of the firewood. LEDs will show when the firewood is ready to be burnt: Red for too moist, green for dry enough.

Calculations show that drying 2 m³ firewood, from containing 25 % water to 15 % water, will provide the user with up to 25 % more energy when burning the firewood. By only burning dry firewood, the users will only have to buy 2 m³ instead of 4 m³ to cover their required amount of energy, 2400 kWh/season, since 2m³ of beech containing 25 % water will provide about 2120 kWh and 2 m³ of beech containing 15 % water will provide 2650 kWh (more than the energy needed for one season).

This way the user can halve the amount of firewood that must be bought every season. The amount of particles emitted by burning firewood will be lowered in general and the users will be able to use their wood-burning stoves in a more sustainable way by using less firewood.