



Improving biofuel moisture assessments

Replacing fossil fuels with biofuels, like wood chips, for district heating and electricity generation helps countries to become carbon neutral. But moisture in wood, which changes with tree species and the season, leads to weight differences and affects combustion efficiency. Inconsistencies between moisture content measurements made by suppliers and consumers can lead to trade disputes. Reducing these requires greater measurement accuracy to help increase the use of this sustainable fuel.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Wood chips produced from sustainable forestry are a carbon neutral source of energy for district heating and other biofuel power generation plants. Denmark is embracing this approach and aims for woody biomass to supply 100 % of district heating by 2035, as part of its goal to be independent of fossil fuels by 2050.

Wood type and seasonal weather affect the moisture content of wood chips. Buyers, who pay by the kilogram, don't want to be charged for the added weight of moisture, which also reduces energy efficiency on burning. When truckloads of chips arrive, they assess moisture content to confirm the price for each truck load is fair.

Moisture content assessment often use a the 'Loss on Drying' method, where a sample is taken to a laboratory to be weighed, heated to evaporate water, then re-weighed to establish its water content. This takes 16 - 24 hours and results can be inconsistent between different laboratories, leading to disputes between suppliers and consumers.

To establish a fair and trustworthy trade in wood chips, greater accuracy and comparability between different loss on drying laboratory measurements is needed. Longer term, methods that are rapid yet simple to use are required to accurately determine wood chip moisture content on delivery.

Solution

The EMRP project, *Metrology for Moisture in Materials*, improved the traceability of the loss on drying method by developing highly accurate techniques for determining moisture content, traceable to the SI, and then using them to characterise different reference materials. These materials were used to investigate sources of measurement error and make comparisons between highly accurate NMI methods and the loss on drying methods routinely used in the forestry industry.

DTI, the Danish Designated Metrology Institute for moisture measurements, participated in the project, and used the project developed reference materials to improve their own highly accurate moisture measurement methods. These are now available for confirming the performance of probes and laboratory methods routinely used to assess the moisture content of wood chips and other products.

Impact

HedeDenmark has sustainable forestry management contracts across Denmark and the Baltic countries and is a large supplier of wood chips for Danish district heating plants. It uses the time-consuming loss on drying method to assess moisture content and set prices. Hededenmark is now benefitting from the new reference methods available through the DTI, which create more reliable measurements and greater comparability between the moisture measurements made by different laboratories. Improving confidence in moisture content determined by the loss on drying method is key to reducing arguments between suppliers and consumers of the wood pellets used as biofuels.

The Danish Energy Agency has now granted funding for a new project investigating faster methods to assess moisture in wood chips, which will build on knowledge and reference methods developed by this EMRP project. These will ultimately allow district heating plants and other biofuel energy generators to

make fast assessments of wood chip moisture content as they are delivered, confirming they are as described by suppliers, such as HedeDenmark. This will reduce delays in payments whilst disputes are settled, thereby supporting an emerging industry which is helping countries become carbon neutral.

Improving moisture measurement accuracy for industry

Moisture content critically affects the quality of industrial products ranging from foodstuffs to fuels, but measurements for this parameter have lacked the traceability needed to improve accuracy.

The EMRP project, *Metrology for Moisture in Materials*, developed new techniques and reference materials to make industrial moisture measurements more accurate and provide robust traceability to the SI units.

Several measurement methods and a spectroscopy-based calibration system were developed, as well as a model to investigate water absorption and transport in materials. To provide calibration laboratories with traceability to National Measurement Institutes, well-defined reference materials were also developed. Two best practice guides are now available, with end-users in sectors such as biofuels and agriculture set to benefit from the project's results.



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Martti Heinonen

VTT, Finland

+358 40 0686 553 | martti.heinonen@vtt.fi

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