



StableWood

New solutions and technologies for heating of buildings with low heating demand: Stable heat release and distribution from batch combustion of wood

www.sintef.no/StableWood

This newsletter focuses on material phase change as a heat storage option. In addition information is given from other bioenergy activities and programs.

Heat storage for wood stoves and fireplaces

The heat output from ordinary wood stoves is highly transient as a result of feeding the stove with fuel in batches. Some time after firing up, the heat release peaks when the wood logs have heated up sufficiently to release the volatile components. When the volatiles have been released and combusted, the heat output decrease as only the slow burning charcoal is left.

In modern well insulated houses, this transient heat output is problematic and results in poor fuel economy because the heat output tends to be too high during the high heat output period. This results in too high room temperature and one may also need to ventilate out much of the heat. In the StableWood project, the goal is to develop stoves that have low heat output during a longer period, keeping a more stable and comfortable room temperature and utilizing more of the energy in the wood logs.

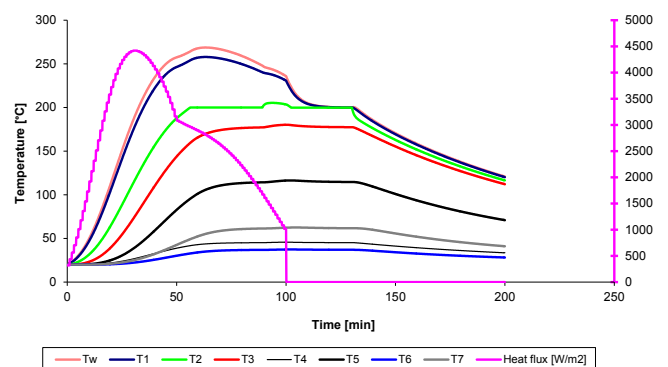
One way to extend and smoothen out the heat release period is to store heat during the high burning rate period and to release heat during and after the low burning rate period. Traditionally this has been done in heavy stone or brick stoves and fireplaces. However, this is not practical in many houses because of limitation in the load capacity of the floor beams and limitations in space.

A more ideal way is to store heat in media with much higher heat storage capacity per unit mass. All substances release or absorb heat when going from one phase to another, i.e. absorbing heat when going from solid to liquid and releasing heat when going from liquid to solid. By utilizing this heat storage capacity of phase change materials, much lighter constructions with high heat storage capacities can be made. 8 – 10 times as much heat can be stored per unit mass in this way compared to storing heat in stone or brick.

In the StableWood project, SINTEF and NTNU are working together with the industry to find suitable substances to use as heat storage media. Important factors to consider is the melting point, the phase change enthalpy, the chemical stability and compatibility with the container material.

A complicating factor is that the substances have a limited temperature window between the melting temperature and the maximum temperature that it can withstand before it starts to evaporate or degrade chemically. To avoid overheating, the heat transport from the hot combustion gases to the heat storage must be controlled.

Several solutions for heat transfer control have been proposed and discussed. At the moment, a model for flexible composite walls with the possibility to include heat radiation shields and air cooling channels between the hot stove surfaces and the heat storage container is being developed.



Results from modeling of a wood stove wall with phase change medium. The pink line shows the heat flux through the inner wall, the other lines shows temperatures in different layers of the composite wall. Layer 2 (T2) contains the phase change medium, showing a flattened temperature profile for the phase change layer and all wall layers outside of this layer.

Other news

Energiforskningskonferansen and RENERGI.X

The Research Council of Norway (RCN) arranged 24 May 2012 the Energy Research Conference in Oslo. The main goals were to inform the participants about strategic efforts, ongoing programs and

coming research programs in EU and Norway within the renewable energy sector. Further to get feedback on a draft of the program plan for the new RCN research program that will replace the RENERGI program. The new program is called RENERGI.X and will run for 10 years from 2013. SINTEF Energy Research was represented by a number of key people that participated in the discussions to make sure that their area would be adequately covered in the program plan. Small scale wood combustion in stoves and fireplaces will be included also in the RENERGI.X program.

IEA Task 32 Biomass Combustion and Cofiring

Small scale wood combustion is receiving continuing and considerable interest, and is also one of the subjects addressed in IEA Task 32 (<http://www.ieabcc.nl/>). The workshop on Aerosols from Small Scale Biomass Combustion Plants arranged by Task 32 in Graz 27 January 2011 will be followed up in connection with the IEA Bioenergy Conference in Vienna 13-15 November this year. (<http://www.ieabioenergy2012.org/>)

Irish national workshop on local developments in small scale biomass combustion

IEA Bioenergy Task 32 organized a national Irish workshop on 'Local developments in Small Scale Biomass Combustion' in Dublin 18 October 2011, together with Sustainable Energy Authority Ireland and Teagasc. The presentations can be downloaded from the Task 32 website.

Status report on small scale particle precipitation devices

On behalf of Task 32, TU Graz and BIOS BIOENERGYSYSTEME GmbH carried out a survey on the present status of various technologies for particle precipitation for residential biomass combustion (up to 50 kW). The first part of the report gives an overview of the current level of emissions from small scale biomass combustion in the various Task 32 member countries, and the need to reduce these emissions. The second part of the report provides an assessment of the various technologies currently under development in terms of their technical performance, costs and convenience. The full report is available at the Task 32 website.

Wood Burning: Nordic Solutions for Climate and Health

A Chatham House meeting to discuss potential Nordic "stoves strategies" was arranged 8 May 2012 in Copenhagen. The aim was to bring together various stakeholders and experts to discuss and strategize on joint Nordic "stoves strategies" through open and informal discussions. The concern about black carbon emissions from wood burning is related to climate impacts, through accelerated ice melting in the Arctic. An increasing focus on the black carbon part of the particle emissions from wood stoves and fireplaces can be seen, and SINTEF Energy Research is also involved in this through a governmental organ funded study to assess how large the black carbon fraction of the particle emission level actually is, in both old and new types of stoves.

20th European Bioenergy Conference and Exhibition

This annual conference is this year arranged in Milan from the 18th to the 22nd of June. Results from the StableWood project will be given in two presentations, one on "Environmental and energetic performance history and further improvement potential for wood stoves" and one on "Transient fuel models for wood log combustion". IEA Task 32 – Biomass Combustion and Cofiring will arrange a torrefaction workshop during the conference, with invited presentations on several torrefaction related aspects. (<http://www.conference-biomass.com/>)

The Renewable Heating and Cooling (RHC) technology platform

A European Technology Platform (ETP) is a European network bringing together industry, researchers and other relevant stakeholders in a particular technological field in order to foster European research and development in the concerned area. A number of ETPs have been created so far on various topics (http://cordis.europa.eu/technology-platforms/individual_en.html), including one on Renewable Heating and Cooling. The Biomass Panel of the RHC platform has recently finalised a "Strategic Research Priorities for Biomass Technology" document. This publication represents a first step in this process, defining a common vision and outlining the strategic needs for future European support to R&D. SINTEF Energy Research has contributed to the inclusion of stoves and fireplaces in the Strategic Research Priorities. Øyvind Skreiberg from SINTEF Energy Research is one of the in total 20 Biomass Panel steering committee members. (<http://www.rhc-platform.org/>)

The European Energy Research Alliance (EERA)

SINTEF is leading an effort to establish a stationary platform under the EERA umbrella (<http://www.eera-set.eu/>). So far only thermochemical, sugar, algae and cross-cutting bioenergy platforms exist in EERA Bioenergy. The EERA Bioenergy board has welcomed the establishment of the Stationary platform, and a process is now ongoing to establish a group of participants. In addition to SINTEF, VTT and ECN have been involved in the startup so far. Other participants may join the further work. Three key topics have been defined: Residential heating and cooling, Industrial CHP and Utility cofiring. SINTEF Energy Research will be heading the key topic Residential heating and cooling. A work programme for the Stationary platform will be assembled in the coming months. Michael Becidan and Øyvind Skreiberg will be the key persons from SINTEF Energy Research in the platform.

Technoport Renewable Energy Research Conference 2012

This scientific conference was arranged 16 - 17 April 2012, in Trondheim, and focused on renewable energy technologies. In addition to interesting lectures on general issues concerning renewable energy, there was 13 detailed scientific parallel sessions. One session was devoted to bioenergy including heat, cooling and/or power generation from biomass. Three presentations related to stoves and fireplaces were presented. The conference was arranged by SFFE - Centre for renewable energy. (<http://2012.technoport.no>)

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