

SusWoodStoves – Sustainable wood stoves through stove, building integration and value chain optimisation



Newsletter 2-2021

Introduction

The overall objective is sustainable wood stoves through stove, building integration and value chain optimisation.

The sub-objectives are:

1. Speciation and quantification of particulate and gaseous emission levels from wood stoves for representative stove technologies and operating conditions
2. Reduction of climate and health related emission levels through emission reduction and energy efficiency measures
3. Optimum building integration of stoves
4. Assessment of value chain performance of existing and improved stove technologies and connected systems for different stove-building configurations in Norway
5. Techno- and socio-economic assessments of the current and future role of wood stoves in the Norwegian energy market
6. Development of a roadmap for sustainable wood stoves in Norway
7. Education of highly skilled candidates within this area and training of industry partners
8. Monitoring of activities and state-of-the-art within this area and dissemination of knowledge to the industry partners, and other interested parties when applicable

Previous projects have increased significantly the knowledge about wood log combustion in stoves to enable improving wood stoves with respect to emissions and energy efficiency, as well as combustion stability and optimum room and building integration. However, to ensure a sustainable wood stove future both in the existing building stock and the residential buildings of the future, further knowledge building within emission reduction, energy efficiency increase, proper building integration, and value chain, techno-economic and socio-economic assessments is needed. This will secure the

continued use of wood stoves as an important, comfortable and sustainable heat source in the existing building stock (replacing old/poor stoves) and the residential buildings of the future, providing also substantial socioeconomic benefits. Therefore, SusWoodStoves is established, and is working according to the following hypotheses:

1. The best wood stoves today are much better than some emission factors for new wood stoves in the Norwegian emission inventory indicates - still, they can be significantly further improved (reduced emissions, increased efficiency) by better understanding and controlling the wood log combustion process
2. Proper wood stove design and material choices can much reduce the influence of the typical heat production peak on thermal comfort
3. Wood stoves have the potential to be suitable for heating any kind of residential building if properly designed, sized, selected, installed and operated
4. The best wood stoves have a natural place in a sustainable future
5. Further improvements can be shaped in such a way to maximize benefits for climate change and health, increase the overall sustainability performance of the wood stove value chain in Norway, and make a quantifiable step forward in the country transition to a sustainable bioeconomy

The methodology chosen to address the project objectives and hypotheses are based on:

1. Collection and assessment of existing data
2. Laboratory experiments to provide additional needed data
3. Field measurements and questionnaires to collect end-user behaviour data
4. Use of the derived knowledge combined with modelling and simulations for improvement of wood stoves with respect to energy efficiency, emissions (climate and health focus) and satisfying thermal comfort

SusWoodStoves

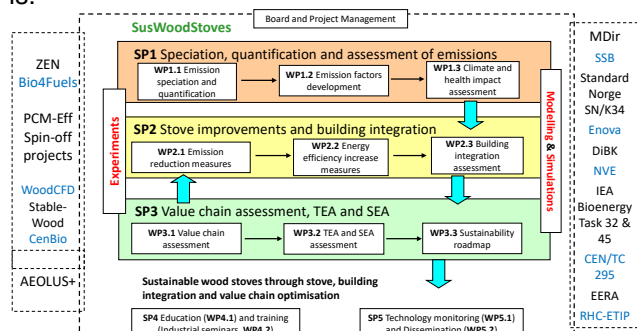
<http://www.sintef.no/SusWoodStoves>

- a Knowledge-building Project for Industry (KSP-K) co-funded by the Research Council of Norway through the ENERGIX-programme.
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5. Simulations based on advanced and up-to-date climate and sustainability impact models, with feedback to the stove improvements activities.

The Work Breakdown Structure of SusWoodStoves is:



SusWoodStoves management and work break down structure and project links and information flow.

SusWoodStoves will run for four years (2021-2024) and has a total cash budget of 18.6 million NOK, which is 80% financed by the [Research Council of Norway](#) through the [ENERGIX](#) program and 20% financed by the industrial partners.

The SusWoodStoves consortium

The project consortium covers all the necessary aspects and includes large and central industrial players in the wood stove area in Norway.

SINTEF Energy Research leads the project and focus on speciation and quantification of particulate and gaseous emission levels and reduction of climate and health related emission levels. **NTNU** (Norwegian University of Science and Technology) supervise two PhD candidates and Master candidates, with the main focus being building integration of stoves, assessment of value chain performance of stoves and techno- and socio-economic assessments.

The industrial partners contribute with finances as well as stoves and their extensive industrial knowledge generated through their commercial activities within the wood stove area: Jøtul AS, Nordpeis AS, Norsk Kleber AS and Norsk Varme.

The constellation of project partners is very strong, bringing together leading research organisations within the field and major industrial players.

Project background

SusWoodStoves, with its focus on sustainable wood stoves, is a response to the open Research Council of Norway KSP call and the topic Environment-friendly energy and its focus on the long term, sustainable development of the energy system, that enhance the competitiveness of Norwegian trade

and industry and accelerate the transition to a low-emission society, including reducing anthropogenic greenhouse gas emissions. It is also directed towards the [ENERGIX](#) program plan and its focus on sustainable utilisation and consumption of renewable energy resources - as biomass, reduction of Norwegian and global emissions of greenhouse gases - from bioenergy, enhancement of Norway's security of supply - through increased use of domestic biomass resources, strengthened innovation in Norwegian trade and industry and the public sector - for the wood stove value chain, further development of Norwegian research and educational institutions - to be able to support innovation efforts in the wood stove industry.

Bioenergy is important in Norway and the current national bioenergy strategy is influenced by e.g. [Klimakur 2030](#), [Klimameldingen](#), [Bioøkonomistategien](#), [Energi21](#) and [Skog22](#). Wood log combustion has long traditions in Norway, constituting above 40% of the total use of biomass for stationary energy purposes, and accounting for about 12% of the domestic heating.

Using wood logs is important for security of supply in Norway, where we today rely heavily on the electricity grid to deliver the needed space-heating for our houses, which are typically wooden (with relatively low thermal mass). With a high nominal power, wood stoves can significantly reduce power peaks in the electricity grid, prevent blackouts and act as backup heating system. In a context of increasing electricity use in households, including electric cars, reducing peak electric power is strategic as it enables to prevent or postpone large investments to reinforce the distribution grid. New houses, as well as retrofit/upgrading of old houses, have increasingly focused on improved energy efficiency (e.g. the [Norwegian passive house standard](#), the [TEK17 regulation](#) and nearly-zero energy buildings from 2020, NZEB). The space-heating effect (power) required for these highly-insulated buildings is drastically reduced, which means that wood stoves for these buildings should be able to deliver a close to constant heating effect to the building as low as ~1 kW, which is much lower than for a new stove in an old house.

Combining heat production, storage and distribution in an optimum way, would make it possible to achieve a substantially more stable heat release and distribution, and with lower heating effect. This was a key focus of the knowledge-building projects [StableWood](#) (2011-14) and [WoodCFD](#) (2015-18), the predecessors to SusWoodStoves. The StableWood studies confirmed that wood stoves have a place in future's buildings, while WoodCFD progressed the knowledge and especially modelling tools significantly, to enable

improving wood stoves with respect to emissions and energy efficiency, as well as combustion stability and optimum room and building integration. Additionally, FME [CenBio](#) (2009-17) made a first effort to assess the wood stove value chain, comparing old and new wood stoves, at nominal and part load operation.

SusWoodStoves builds on the previous work, and will through further knowledge building within emission reduction, energy efficiency increase, proper building integration, and value chain, techno- and socio-economic assessments, contribute to ensuring a sustainable wood stove future both in the existing building stock and the residential buildings of the future.

Project overview

The project is divided into 5 subprojects (SP), each subproject is itself divided into several work packages (WP).

- Speciation, quantification and assessment of emissions - SP1
- Stove improvements and buildings integration - SP2
- Value chain assessment, TEA and SEA - SP3
- Education and training - SP4
- Technology monitoring and dissemination - SP5

Speciation, quantification and assessment of emissions - SP1

Addressing sub-objective 1 (Speciation and quantification of particulate and gaseous emission levels from wood stoves for representative stove technologies and operating conditions) and hypothesis 1 (the best wood stoves today are much better than some emission factors for new wood stoves in the Norwegian emission inventory indicates - still, they can be significantly further improved (reduced emissions, increased efficiency) by better understanding and controlling the wood log combustion process).

SP1 leader: Chief Scientist [Øyvind Skreiberg](#), SINTEF Energy Research

Stove improvements and buildings integration - SP2

Addressing sub-objective 2 (Reduction of climate and health related emission levels through emission reduction and energy efficiency measures) and 3 (Optimum building integration of stoves) and hypothesis 1-3 (1) the best wood stoves today are much better than some emission factors for new wood stoves in the Norwegian emission inventory indicates - still, they can be significantly further improved (reduced emissions, increased efficiency) by better understanding and controlling the wood log

combustion process, 2) proper wood stove design and material choices can much reduce the influence of the typical heat production peak on thermal comfort, 3) wood stoves have the potential to be suitable for heating any kind of residential building if properly designed, sized, selected, installed and operated)

SP2 leader: Associate Professor [Laurent Georges](#), NTNU

Value chain assessment, TEA and SEA - SP3

Addressing sub-objective 4 (Assessment of value chain performance of existing and improved stove technologies and connected systems for different stove-building configurations in Norway), 5 (Techno- and socio-economic assessments of the current and future role of wood stoves in the Norwegian energy market) and 6 (Development of a roadmap for sustainable wood stoves in Norway) and hypothesis 4 (the best wood stoves have a natural place in a sustainable future) and 5 (further improvements can be shaped in such a way to maximize benefits for climate change and health, increase the overall sustainability performance of the wood stove value chain in Norway, and make a quantifiable step forward in the country transition to a sustainable bioeconomy).

SP3 leader: Professor [Francesco Cherubini](#), NTNU

Education and training - SP4

Addressing sub-objective 7 (Education of highly skilled candidates within this area and training of industry partners).

SP4 leader: Professor Francesco Cherubini, NTNU

Technology monitoring and dissemination - SP5

Addressing sub-objective 8 (Monitoring of activities and state-of-the-art within this area and dissemination of knowledge to the industry partners, and other interested parties when applicable).

SP5 leader: Chief Scientist [Øyvind Skreiberg](#), SINTEF Energy Research, who also is the SusWoodStoves project leader

Progress in 2021

In 2021 efforts have been focused on establishing the project, detailing the annual work plan for 2021 and recruiting the two PhD candidates. The scientific work including experimental activities is in good progress. A critical review and discussion on emission factors for wood stoves that is in progress shows large variations in a number of the emission factors used for wood stoves in different countries' national emission inventories. There is a real need to establish more reliable and representative emission factors for the different wood stove categories and to differentiate within a category based on technology

development level. This goes especially for the modern and clean burning wood stove category (based on staged air combustion), where technological development has much reduced emissions of unburnt during the last two decades. Wood stove technology are continuously developing, and the future of wood stoves and the further development potential should be based on the performance of the stoves on the market today, and not on an average of the technologies that are in operation today.

SusWoodStoves workshop and Steering Committee meeting by web

Due to the Covid-19 virus, also the first workshop and SC meeting were arranged online, 1 December. The event went smooth, using Teams, and with many interesting presentations on the workshop agenda.

SusWoodStoves kick-off meeting by web

Due to the Covid-19 virus, the kick-off meeting in 2021 was arranged online, 11 June. The event went smooth, showing that it is possible to carry out such events online, if it is required.

PhD work 1

A PhD position in data-driven analysis of the real building performance using wood stoves has been [announced](#), and **the application deadline is 20 January 2022**. The position is connected mainly to SusWoodStoves SP2.

PhD work 2

The PhD position in advancing methods for climate change and air quality impacts in LCA has been filled, by [Sofie Sødal Eiksund](#). The position is connected mainly to SusWoodStoves SP3.

SusWoodStoves at EERA Bioenergy webinar

A presentation entitled "Norwegian WtE and wood stoves research for the European future" was presented at an EERA Bioenergy webinar (arranged by SP4 Stationary Bioenergy), 16 November 2021, and highlighted the continued importance of these two traditional bioenergy sectors in the European renewable energy future.

SusWoodStoves in EERA Bioenergy Newsletter

An article entitled "Sustainable wood stoves through stove, building integration and value chain optimisation" presents SusWoodStoves in a EERA (European Energy Research Alliance) Bioenergy newsletter, [Issue 15 June 2021](#).

SusWoodStoves publications

Silje Skogvang, Øyvind Skreiberg m.fl. [Denne fyringsmetoden er verst for klimaet: – Feil fyring kan gi store konsekvenser](#). Dagsavisen Fremtiden 19 desember 2021.

Øyvind Skreiberg. [The 10 commandments of wood burning stoves](#). SINTEF blog 16 December 2021.

Øyvind Skreiberg. [Vedfyringens 10 bud](#). SINTEF blogg 16 desember 2021.

Øyvind Skreiberg. SINTEF Energi jobber for fremtidens vedfyring. Varmenytt, desember 2021.

Lena-Christin Kalle, Øyvind Skreiberg m.fl. [Dette kan koste deg garantien på peisen](#). Nettavisen 9 desember 2021.

Øyvind Skreiberg. [Wood stoves and wood-burning – how to ensure “hygge”, heating comfort and eco-friendliness](#). SINTEF blog 28 November 2021.

Franziska Kausch, Øyvind Skreiberg, Morten Seljeskog. [Slik kan du fyre med god samvittighet](#). SINTEF blogg 18 november 2021.

Øyvind Skreiberg. Norwegian WtE and wood stoves research for the European future. EERA Bioenergy webinar, 16 November 2021.

Morten Seljeskog, Franziska Kausch. [Vedfyring: Hvordan kan du gjøre det på en miljøvennlig måte?](#) Smart forklart SINTEF-podkast 4 november 2021.

Øyvind Skreiberg. [Vedfyringens rolle i fremtiden. Biomassens og bioenergiens bidrag i fremtidens bærekraftige energisystem](#). SINTEF blogg 29 oktober 2021.

Rikke Åserud, Steinar Johannesen, Svein Sanne, Øyvind Skreiberg, Christian Kildahl Hansen (2021). Mye å spare på å lukke peisen. Hus & Bolig nr. 3, 2021.

Øyvind Skreiberg (2021). [Sustainable wood stoves through stove, building integration and value chain optimisation](#). EERA Bioenergy Newsletter 15:12-13.

Øyvind Skreiberg. [New project: Sustainable wood stoves through stove, building integration and value chain optimisation](#). SINTEF blog 11 May 2021.

Øyvind Skreiberg, Morten Seljeskog. [Dette må du vite om å fyre i den gamle vedovnen på hytta](#). Adresseavisen 2 april 2021.

Øyvind Skreiberg, Morten Seljeskog. [Hvordan fyre smart i den gamle ovnen på hytta?](#) Gemini 30 mars 2021.

Øyvind Skreiberg. [Vedovner og vedfyring – Hvordan sikre hygge, varmekomfort og miljø- og klimavennlighet](#). Forklaring med video. SINTEF blogg 24 mars 2021.

Øyvind Skreiberg. Status of wood stove technology and further emission reduction potential. Innoasis Science Talks, 9 February 2021.

Franziska Kausch, Øyvind Skreiberg, Morten Seljeskog. [These simple tips will help you reduce your wood-burning stove's environmental footprint](#). SINTEF blog 8 February 2021.

Øyvind Skreiberg. [Folk kan bli flinkere til å fyre rett med ved](#). Stavanger Aftenblad 22 januar 2021.

Øyvind Skreiberg. [Vedfyring i et større perspektiv](#). SINTEF blog 13 januar 2021.

Øyvind Skreiberg. [Vedfyring i et større perspektiv](#). Stavanger Aftenblad 13 januar 2021.

Other news

Standardisation work

To ensure more efficient and sustainable products to the market the Ecodesign directive and the energy labelling regulation will come into force 1st of January 2022 with stricter requirements to local space heaters, including wood stoves. Besides requirements to efficiency also requirements are set to PM (particulate matter), CO, OGC (unburned hydrocarbons) and NOx emissions. Norwegian PM emission limits will be tightened from 10 to 5 g/kg. Ecodesign is supposed to be complemented by harmonised products. The harmonisation of the standard for roomheaters fired by solid fuels is still on hearing.

Opposite to the Norwegian standard NS3058/59, the new proposed standard EN16510 does not require testing at low heat output. Without a harmonised test standard three test methods are available: heated filter, dilution tunnel and electrostatic precipitator.

[Franziska Kausch](#) and [Morten Seljeskog](#) at SINTEF Energy Research are representing Norway in wood stove testing standardisation work.

IEA Task 32 Biomass Combustion

The first [IEA Bioenergy Task 32](#) meeting in 2019, the first year of the current triennium, was arranged in June in Hurdal, Norway. The meeting was combined with a field trip to a 56 MW wood powder fired heating plant at Haraldrud and the Arbaflame steam explosion plant at Grasmo.

The main activities are:

- Testing methods and real-life performance of pellet stoves
- Technical guidelines for design of low emission stoves
- Survey of national strategies for reducing the impact on air quality from residential and commercial wood combustion

- Biomass for process heat in industry
- Biomass-based CHP for balancing an energy system with a large portion of uncontrollable production (intertask project)
- [Workshop on improved combustion in stoves and small biomass boilers](#)
- Workshop on experiences with combustion of pulverised non-woody solid biofuels
- Workshop on experiences with wood chips for large scale CHP production

In the previous triennium, relevant deliverables were:

- [Aerosols from biomass combustion](#)
- [Advanced test methods for firewood stoves](#)
- [Particle emission measurement techniques](#)
- [State of the art on innovative CHP concepts](#)
- [Strategic study for renewable heat](#)
- [Bioenergy for heat - the Hot Cases](#)
- [Workshop on Solid Recovered Fuels](#)
- [Workshop on Biomass Combustion Generated Nanoparticles](#)
- [Workshop on New Emission Measurement Methods](#)

The second IEA Task 32 meeting in the current triennium was arranged 21-24 January 2020 in Graz, Austria, in connection with the 6th Central European Biomass Conference. In connection with the meeting a [workshop](#) was arranged on residential wood combustion. The third meeting was arranged in June 2020 as a virtual task meeting due to Covid-19. In the fall the fourth meeting was planned to be arranged in Copenhagen together with a workshop, but the Covid-19 situation made that impossible. Therefore, a new digital meeting was arranged in December and continued in early 2021, where in addition to the progress of the activities of the current triennium, there were also discussions about possible activities in the next triennium (2022-24), and a draft proposal has in the following months been prepared, submitted and revised. The number of member countries in Task 32 in the next triennium will decide if the proposal can be executed in its entirety, which was a topic of discussion in the next mini-task meeting, December 16, which will be followed by two more meetings, in January. There will be a focus on wood stoves also in the next triennium.

One recent and interesting task event regarding wood stoves was a [webinar](#) entitled "Residential Wood Combustion – Towards Low Emission Systems" arranged for presenting an upcoming task report with the title "Design of Low Emission Wood Stoves".

For information about IEA Bioenergy Task 32 activities, see the webpage and newsletters, and for IEA Bioenergy news, see the [newsletters](#). Øyvind

Skreiberg from SINTEF Energy Research is the Norwegian participant in IEA Bioenergy Task 32.

IEA Bioenergy publications/resources

Some recent publications:

2021 country reports on implementation of bioenergy, [here](#), including for [Norway](#).

IEA Tracking Clean Energy Progress – biofuels/bioenergy, [here](#).

Sustainability governance of bioenergy and the broader bioeconomy, [here](#).

Applying a science-based systems perspective to dispel misconceptions about climate effects of forest bioenergy, [here](#).

Bioenergy for climate change mitigation: Scale and sustainability, [here](#).

The role of bioenergy for climate and sustainable development targets, [here](#).

Campaigns questioning the use of woody biomass for energy are missing key facts, [here](#).

IEA publications

Some recent publications:

Net Zero by 2050 A Roadmap for the Global Energy Sector, [here](#).

Energy Technology Perspectives 2020, [here](#).

EERA Bioenergy – SP4 Stationary Bioenergy

The effort in 2019 was focused on revising the SP focus and the description of work, and this work is now finalized. In 2020 an updated [Strategic Research and Innovation Agenda](#) (SRIA) was made for the whole EERA Bioenergy. For more info on EERA Bioenergy, visit the [website](#), and see the [newsletters](#). Julien Blondeau from the Free University of Brussels in Belgium is the leader of SP4 Stationary Bioenergy in EERA Bioenergy, following Berta Matas Güell from SINTEF Energy Research who led this SP for about 5 years.

RHC technology and innovation platform

The European Technology and Innovation Platform on Renewable Heating & Cooling ([RHC-ETIP](#)) brings together stakeholders from the biomass, geothermal and solar thermal sector - including related industries such as District Heating and Cooling, Thermal Energy Storage, Hybrid Systems and Heat Pumps - to define a common Research, Development and Innovation strategy for increasing the use of renewable energy technologies for heating and cooling. Previously concrete work has been carried out by the Biomass Panel in the RHC-ETIP connected to giving input to the SET-plan issues paper on renewable fuels and bioenergy, as well as work connected to the Implementation of the biomass technology roadmap of the Biomass Panel. The aim of the latter was to update the progress in R&I

priorities identified by the Biomass technology roadmap. This work continues through different efforts. Øyvind Skreiberg from SINTEF Energy Research is a member of the Biomass Panel Steering Committee.

For the three years period 2019-21 there has been a special focus on work to be carried out in horizontal working groups (HWG) that focus on contributing to 1) vision (finalized in 2019), 2) research and innovation priorities (finalized in 2020) and 3) deployment and implementation strategy (in 2021) documents. Øyvind Skreiberg chairs the HWG 100% Renewable Buildings, where a number of members from the different RHC-ETIP panels are contributing to the HWG. The work progressed well and HWG 100% Renewable Buildings submitted in 2019 their contribution to HWG Vision 2050, which finalized the [Vision 2050](#) based on input from all the HWGs, including also 100% Renewable Districts, 100% Renewable Cities and 100% Renewable Industry. In 2020, focus was on defining research and innovation priorities, and a [Strategic Research and Innovation Agenda](#) (SRIA) was finalized. In 2021, the focus has been on developing an Implementation and deployment strategy, where a [co-creation workshop](#) was arranged dedicated to industry and research experts as well as public authorities, to identify and verify research & innovation trends and priorities of renewable heating and cooling sectors recently. The [Implementation and deployment strategy](#) has now been finalized.

As a continuation of the SET-Plan work, workgroups were established to provide specific input to the SET-Plan work, e.g. Action 5 Energy Efficiency in Buildings with the sub-action 5.2 Heating and Cooling Technologies for Buildings and Action 8 Renewable Fuels and Bioenergy. The work and an endorsed implementation plan were finalized. Øyvind Skreiberg was involved in the Action 5 work, representing the Biomass Panel. The work is now continued, focusing on the implementation of the SET-Plan, both for Action 5 and 8.

Recently, a [website](#) was established for the Action 5 on buildings.

See the RHC-ETIP [news](#) webpage for other news.

Recent events

29th European Biomass Conference & Exhibition, 26-29 April 2021. e-conference
<http://www.eubce.com/>

IEA Task 32 Webinar: [Residential Wood Combustion – Towards Low Emission Systems](#), 6 May 2021.

Bioenergidagene 2021, 22-23 November 2021, Gardermoen, Norway. + e-conference
<http://www.bioenergidagene.no/>

IEA triennium conference, 29 November – 9 December 2021. e-conference
<https://www.ieabioenergyconference2021.org/>

Upcoming events

30th European Biomass Conference & Exhibition, 9-12 May 2022, Marseille, France. + e-conference
<http://www.eubce.com/>

IConBM 2022, International Conference on BIOMASS, 5-8 June 2022, Naples, Italy.
<https://www.aidic.it/iconbm2022/>

Links (click on the links or logos to get there)

[WoodCFD](#)

[SKOG22](#)

[Energi21](#)

[Renewable Heating and Cooling ETIP](#)

[EERA Bioenergy](#)

[IEA Task32 Biomass Combustion](#)

[IEA Task45 Climate and Sustainability Effects of Bioenergy within the broader Bioeconomy](#)



SusWoodStoves

Increased sustainability for the wood stove value chain

Background

Wood log combustion is important in and for Norway and contributes much to residential space heating and relieves the pressure on the electricity grid, as well as provides energy security when the electricity grid goes down. However, wood log combustion contributes also to air pollution, and there is a need to increase the sustainability through stove, building integration and value chain optimization, which is the main project focus.

Goals

- 1) Speciation and quantification of particulate and gaseous emission levels from wood stoves for representative stove technologies and operating conditions,
- 2) Reduction of climate and health related emission levels through emission reduction and energy efficiency measures,
- 3) Optimum building integration of stoves,
- 4) Assessment of value chain performance of existing and improved stove technologies and connected systems for different stove-building configurations in Norway,
- 5) Techno- and socio-economic assessments of the current and future role of wood stoves in the Norwegian energy market,
- 6) Development of a roadmap for sustainable wood stoves in Norway,
- 7) Education of highly skilled candidates within this area and training of industry partners,
- 8) Monitoring of activities and state-of-the-art within this area and dissemination of knowledge to the industry partners, and other interested parties when applicable.



Project title: Sustainable wood stoves through stove, building integration and value chain optimization (SusWoodStoves)

Project leader: SINTEF Energy Research

Partners: NTNU, Jøtul AS, Nordpeis AS, Norsk Kleber AS, Norsk Varme

Project period: 2021-2024

Type: Knowledge building project for the industry

Financing: 18.6 mill. kroner (15.1 from Research Council of Norway)

Project number: 319600