

CenBio

Bioenergy Innovation Centre

Host institution

Odd Jarle Skjelhaugen
CenBio Deputy Centre Coordinator

Norwegian University of Life Sciences

Phone: + 47 918 56 972
Odd.Jarle.Skjelhaugen@nmbu.no

Coordinating institution

Marie Bysveen
CenBio Centre Coordinator

SINTEF Energy Research Norway

Phone: + 47 922 86 113
Marie.Bysveen@sintef.no

Read the full Annual Report 2015 at
www.CenBio.no

CenBio Bioenergy Innovation Centre



Partners

The following organisations are partners in CenBio as of January 2016

Research partners

- Norwegian University of Life Sciences - NMBU (Host institution)
- SINTEF Energy Research (Coordinating institution)
- Norwegian University of Science and Technology - NTNU
- Norwegian Institute of Bioeconomy - NIBIO
- SINTEF Materials and Chemistry
- Vattenfall



Industry partners

- Akershus Energi
- Norges Skogeierforbund
- Hafslund Varme
- Statkraft Varme
- Oslo Waste to Energy Agency - EGE
- Vattenfall, Heat Nordic
- Energos
- Cambi
- Jøtul
- Norsk Kleber



Design og trykk: www.eggrykk.no
Miljømerket trykken, lisensnr. 2041.08.11

Portrait photos: Signe Beate Skjelhaugen, Dag Karm Simo and NTNU



CenBio
Highlights 2015

Why do we need research on stationary bioenergy?

To counter the effects of climate change, the global average temperature must not rise beyond two degrees compared to pre-industrial times. Yet, the world's energy consumption is expected to increase by more than 50% between 2010 and 2040.

Bioenergy is expected to play a big role in our energy future according to the United Nations Panel on Climate Change: "Bioenergy's share of total regional electricity and liquid fuels is projected to be up to 35 and 75 percent, respectively, in 2050."¹

Enhanced use of renewable energy, such as bioenergy, is a part of the climate solution. Bioenergy relies on biomass, consisting of any organic material which has stored sunlight in the form of chemical energy. The ultimate goal of stationary bioenergy is to convert this energy into heat and/or electricity in the most sustainable way.

We need research and innovation to enable sustainable and cost-effective bioenergy.

Scientific excellence and increased visibility

We are proud of CenBio's track record when it comes to publications and dissemination. One of the overall targets for CenBio is to deliver 150 international publications, of which 75 in peer-reviewed journals. Now we are at 194 publications and exceeding our initial target!

In order to increase CenBio's visibility internationally, CenBio has chosen to send a delegation to the 24th European Biomass Conference & Exhibition (EUBCE 2016) on 6-9 June 2016. 24 abstracts were sent from CenBio members, where eight abstracts were accepted as oral presentations, and 16 as visual poster presentations. Our presentations are covering the whole CenBio value chain, and all sub-projects are represented. CenBio will also participate with a stand in the Exhibition area, and a workshop (side event).

A different international aspect is that the EU started to update the EU Strategic Energy Technology (SET) Plan in 2015. CenBio organised in April 2016 a workshop to provide input for the update of the part of the SET Plan concerning bioenergy and biofuels.

Two of the board members of CenBio, Petter Røkke (SINTEF Energy Research) and Øystein Johnsen (NMBU), contributed with viewpoints to Energimeldingen (Norwegian government work on energy politics). Petter Røkke presented in December CenBio's views on the three important topics; utilisation of biomass, bioenergy and biofuels, where he emphasised the Centre's desire for a clear prioritisation of research and development.

Since 2016 is the final operating year of CenBio we plan to hold a CenBio Final Conference early in 2017, and we will announce the dates and programme at www.CenBio.no and other channels as soon as they are fixed.



Marie Bysveen
Centre Coordinator

SINTEF Energy
Research



Odd Jarle Skjelhaugen
Deputy Centre Coordinator

NMBU - Norwegian
University of Life Sciences

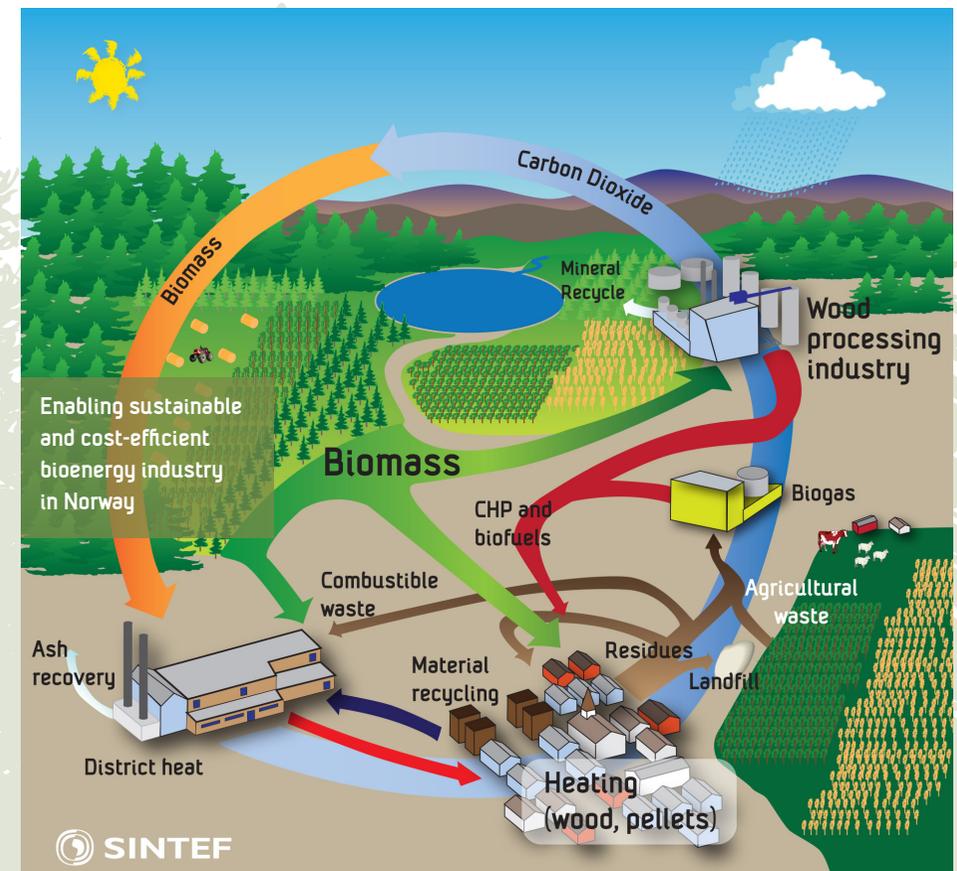
¹ mitigation2014.org

Vision and Goal

CenBio – the Norwegian Bioenergy Innovation Centre, is an eight-year (2009–2016) research centre on bioenergy co-financed by the Research Council of Norway, industry and research partners.

CenBio addresses the entire value chains of virgin biomass and biodegradable waste fractions, including their production, harvesting and transportation, the conversion to heat and power, and the upgrade of residues to valuable products. CenBio researchers develop effective, environmentally sound ways of utilizing more biomass and waste for energy purposes. Educating and training the next generation of bioenergy researchers and industry players are essential to attain these ambitious goals.

As a result, consumers and society will be supplied with more renewable and low-carbon energy. By further developing the Norwegian bioenergy industry, a substantial number of new jobs, especially in rural districts, will be created.





Innovation

CenBio innovations

11 completed innovations

- Importance of Albedo for climate, forest management and policy development (NTNU)
- Climate impact of CO₂ emissions from biomass (GWP Bio) (NTNU)
- Special sand in urban grey environments (NIBIO)
- Soil mixture for urban greening (NIBIO)

- Spreadsheet tool for strategic supply chain configuration (NIBIO)
- Short-lived vs long-lived climate forcers (NTNU)



- Test method for wood-stoves (SINTEF Energy Research)
- Afterburners for implementation in stoves from Norsk Kleber AS (SINTEF Energy Research)

- Bio bottom ash as raw material for manufacturing of Portland Cement clinker (SINTEF Materials and Chemistry)
- Online syngas calorific value measurement (Energos)
- Firewood calculator (NIBIO)

- Biomass equations for Birch in Norway (NIBIO)
- Improved grapple (NIBIO)
- Method for measuring moisture in forest fuel (NIBIO)
- Global model development (NMBU)

Innovations about to be finalised

CenBio innovations completed since the beginning of the Centre.

22 potential innovations in progress

- Biomass expansion factors for Spruce, Pine and Birch in Norway
- Cost efficient harvesting and transportation
- Tailored fuel mixtures
- New fertilizers
- Organic NPK fertilizer
- Additives and fuel mixing procedures
- Reduced emissions of NOx and particulate matter
- Smart fuels
- Biocarbon production
- Increased energy yields from anaerobic digestion
- Clean-burning stoves and fireplaces
- New measurement techniques
- New and revised standards
- Ultra-efficient district heating plants
- Fossil C measurements
- CHP with 100% energy efficiency
- Low-emission plants
- Recommendations for sustainable harvesting
- Contribution to development of international standards
- Environmental performance for biomass value chains
- Criteria and indicators for sustainable bioenergy
- National forest sector model for Norway

Bioenergy Innovation Award

CenBio has introduced the "Bioenergy Innovation Award" (BIA) a nationally-advertised innovation award within stationary bioenergy.

The award was established to stimulate and reward knowledge based innovation and entrepreneurship.

Bioenergy Innovation Award winners

- 2011:** Edvard Kvalsvik, SINTEF Energy Research – for his innovative work with combustion technology for residential woodstoves
- 2012:** Cambi AS – for their innovative biogas production process for biomass from waste and sewerage, which is implemented in many plants worldwide
- 2013:** Solør Bioenergi – for exclusively using contaminated timber as energy source in their 10 MW combined heat and power (CHP) plant
- 2014:** Mjøsen Skog SA on behalf of the ALLMA group – for the development of the first web-based GIS-system in Norway that integrates up-to-date forestry plans with operative logistical functions
- 2015:** Vincent Eijsink, NMBU – for his work within the field of enzyme technology and biogas processes
- 2016:** the BIA-winner will be announced in association with CenBio's participation at an international biomass conference in June (EUBCE 2016)



Rune Volla from the Research Council of Norway (right) presents the winner of the BIA 2014 Mjøsen Skog represented by Erik A. Dahl (left).



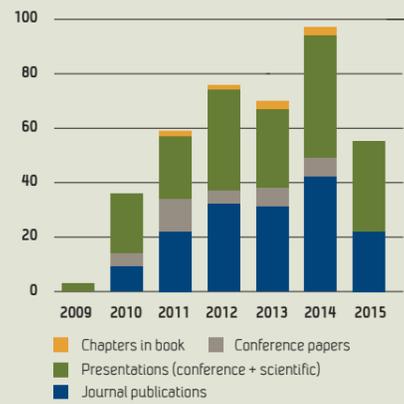
Vincent Eijsink (NMBU) who won the BIA for 2015.

Photos: NMBU



Research

CenBio publications



CenBio has published 158 journal publications since its beginning.

Events organised by CenBio in 2015

- The traditional CenBio Days was arranged over three days in March 2015, and gathered 61 participants. The event included technical topics, challenges with legal aspects and standardization bioenergy research in the rest of the world and bioenergy innovations.
- The CenBio Strategic Days were held over two days in October.
- CenBio organised a workshop *How to ensure bioenergy production in a sustainable and efficient manner in Norway?* on 22 September 2015.
- CenBio members did also participate in the SINTEF/Bellona seminar on Bio-CCS 16 November.

In addition to the larger events mentioned here, other workshops/meetings have also been organised



Members of CenBio visiting the Statkraft Varme plant at Heimdal during the CenBio Strategic Days 2015. (Photo: CenBio)

CenBio organisation and research areas

CenBio host institution: NMBU		CenBio lead: SINTEF	
Management and coordination SPO/SINTEF			
Biomass supply and residue utilization	Conversion mechanisms	Conversion technologies and emissions	Knowledge transfer and innovation
SP1/NIBIO	SP2/SINTEF	SP3/SINTEF	SP5/NTNU
Feedstock WP1.1	Combustion WP2.1	Small-scale WP3.1	Bioenergy graduate school WP5.1
Logistics WP1.2	Gasification WP2.2	District heat WP3.2	Knowledge transfer and dissemination WP5.2
Biomass and residue characteristics and quality WP1.3	Pyrolysis WP2.3	Heat and power WP3.3	Innovation management WP5.3
Residues upgrading and use WP1.4	Anaerobic digestion WP2.4	Emissions WP3.4	
	KMB STDP, Torrefaction WP2.5		
Sustainability assessments SP4/NMBU			
Life cycle assessment (LCA) WP4.1	Ecosystem management WP4.2	Cost assessment and market analysis WP4.3	
Value Chain Assessment SP6/NTNU			
Environment and cost characteristics			WP6.1

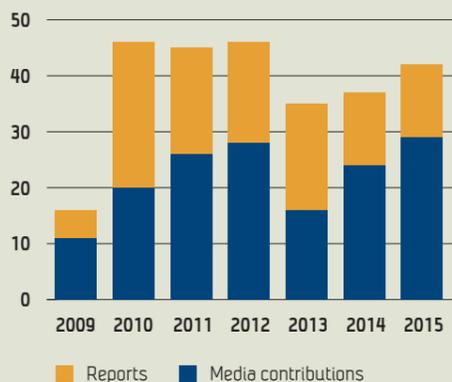
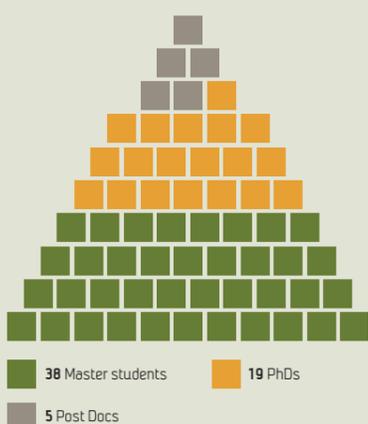


Education



Communication

Finished in 2009–2015



CenBio contributed to blogs and was present in media in 2015. Here is a selection:



Simen Gjølsvik from NIBIO present at "TV2 hjelper deg" when moisture content in wood was tested



Best Paper Award of the 22nd FBC goes to a CenBio publication from Vattenfall!