DEPARTMENT OF ENERGY
AND PROCESS ENGINEERING

NTNU

ANNUAL REPORT 2021

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CONTENT

We must all work to integrate our colleagues who have joined us during these last two years, in our work life and social environment. They started off during a very strange period, let us be the best colleagues we can to them.

LOOKING BACK AT **2021**

In terms of what we have achieved in 2021, it is clear business has been as usual at EPT despite of the pandemic.

It is beyond doubt that we have been through an exceptional period of our lives, both professionally and personally. We have been through something which will change us as individuals and as a society. We will not forget this period of working from home, virtual meetings, remote teaching, online conferences and so forth. My personal hope is still that we will come back to normal once again – that we all will come to the office every workday to be part of a work environment, engage in informal and spontaneous conversations and discussions with colleagues and students, which has much value for academic development.

When I state that business has continued as usual at EPT in 2021, I am looking at our achievements and activity on record high levels in many respects. We have a record high output of publications. We have had proposals granted from the Research Council of Norway and Horizon Europe on the same high level as previous years, and even a new ERC Grant. We keep developing new projects within our strategically prioritised research areas. All in all, we maintained high activity in our core responsibilities: education, research and innovation. In numbers, text and pictures, this report reflects the output of our achievements.

WE STAND OUT

I would like to emphasize that everyone at our department plays an important role in achieving our goals –everyone from PhD candidates and Postdoctoral Candidates, to researchers and administration, to lab technicians and Professors.

EPT should continue to stand out at NTNU and contribute when and where we can to form NTNU's future, as well as our reputation as a satisfying and meaningful workplace for all our employees to develop and strive towards new opportunities.

LOOKING AHEAD

Some things, however, remain a challenge that we still need to focus on. Our Department is located in four buildings, and will be so for the foreseeable future. This puts an extra strain, but also responsibility, on all of us to ensure as good an organization as possible.

As part of NTNU, we will be challenged for space, but also more dynamic use of space.

We must all work to integrate our colleagues who have joined us during these last two years, in our work life and social environment. They started off during a very strange period, let us be the best colleagues we can to them.

And last, but not least, we as part of the greater society will be challenged to meet the changes that we see with respect to climate change and to political and societal changes, both nationally and internationally. However, what we work with should equip us to contribute with our knowledge for a better world.

Terese Løvås
Head of Department
NTNU Energy and Process Engineering

THE **ENERGY** LANDSCAPE

The Energy Landscape spans the entire scope of energy research and competence development conducted at NTNU - Department of Energy and Process Engineering and SINTEF Energy.

Illustration: SINTEF/NTNU/Oxygen

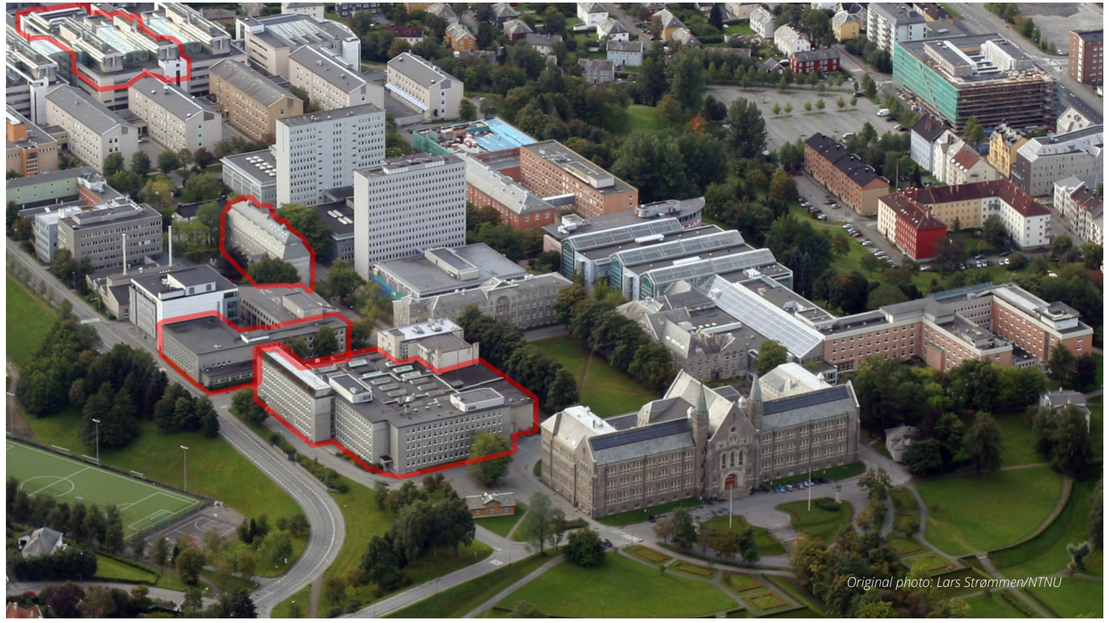
OUR **MISSION**

EPT shares the mission that as part of a university, we educate outstanding graduates with strong analytical and practical abilities, and our research focuses on expanding knowledge in science and technology for a better world. Furthermore, EPT's mission is to contribute to Norway's role in developing a viable foundation for society at the regional, national and global level.

Through research and education, the department shall contribute to the understanding of sustainable solutions, helping to solve complex problems and global challenges to assure effective resource utilization. In line with NTNU's goal to move from mission to action, we address the UN goals for sustainability (SDGs) (https://www.ntnu.no/baerekraftmaal) that are relevant based on the research and educational activity at the Department.

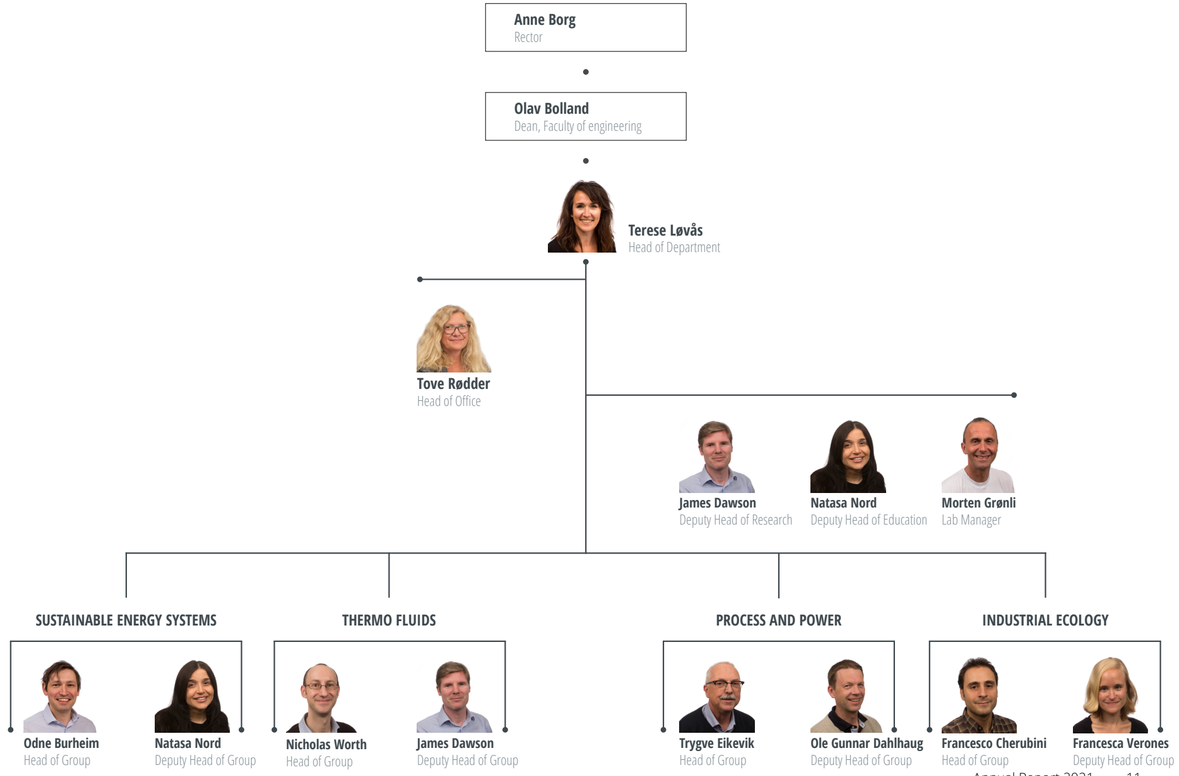
EPT AT **NTNU**

EPT is one of eight Departments at the Faculty of Engineering. There are nine Faculties at NTNU – Norwegian University of Science and Technology.



EPT is located in four different buildings across NTNU Gløshaugen campus.

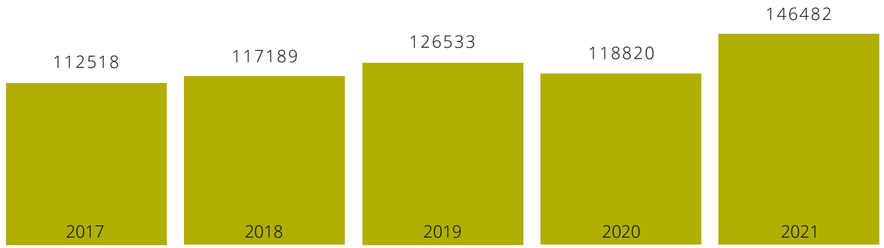
DEPARTMENT **ORGANIZATION**



2021 IN NUMBERS

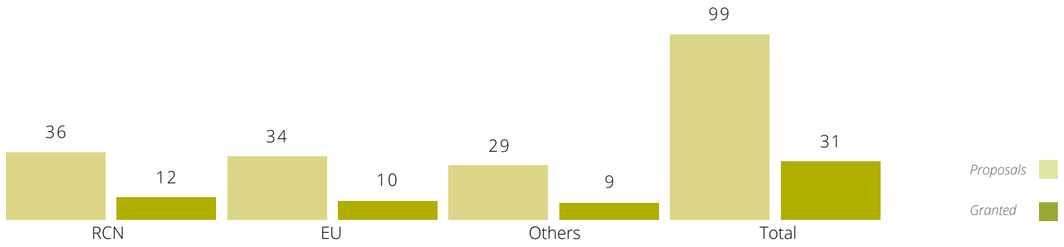
Projects where EPT gets funding from other sources than the grant from the Ministry of Education and Research will normally be defined as either sponsored activities ("bidrag" in Norwegian) or commission-based activities ("oppdrag" in Norwegian).

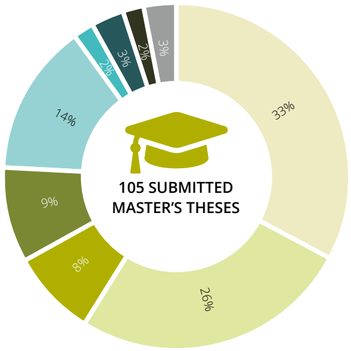
SPONSORED AND COMMISION-BASED ACTIVITY - BOA



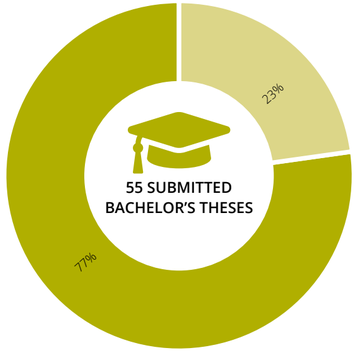
Figures in NOK million

PROJECT APPLICATIONS AND GRANTED PROJECTS IN 2021

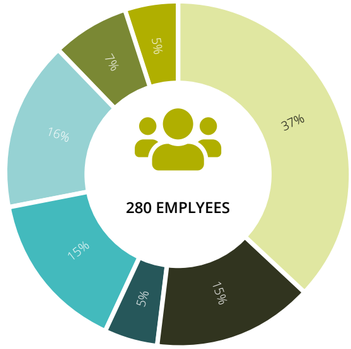




- Energy and Enviromental Engineering (5 yrs)
- Mechanical Engineering (5 yrs)
- Energy Use and Energy planning (2 yrs)
- Industrial Ecology (2 yrs)
- Mechanical Engineering (2 yrs)
- Exchange students
- Natural Gas Technology (2 yrs)
- Enviromental Engineering (2 yrs)
- Innovative Sustainable Energy Engineering (2 yrs)



- Renewable Energy
- Mechanical Engineering



- PhD Candidates
- Researchers
- Adjunct Professors and Adjunct Ass. Professors
- Professors and Associate Professors
- Administrative and technical staff
- Research Assistants
- Postdoctoral Candidates

SUBMITTED AND DEFENDED PHD THESES

Research Group	Name	Title of Thesis	Supervisor
Industrial Ecology (IndEcol)	Bjelle, Eivind Lekve	Advancement in environmentally extended multiregional input-output analysis: modeling drivers. pressures and impacts	Wood, Richard
IndEcol	Lausselet, Carine	The use of LCA for evaluating and planning net-zero emission neighbourhoods	Brattebø, Helge
Process and Power (PP)	Sagmo, Kristian Forfot	Trailing edge vortex shedding in hydraulic turbines and the effect of streamwise vorticity on vortex induced vibrations	Storli, Pål Tore
PP	Agromayor Otero, roberto	Advancements in Automated Methods for Fluid-Dynamic Turbomachinery Design	Nord, Lars O
PP	Rua Pazos, Jairo	Optimisation of flexible operation of natural gas combined cycles with post-combustion CO2 capture	Nord, Lars O
PP	Allymehr, Ehsan	Investigation of Hydrocarbon Two-phase Flow for Charge Reduced Heat Exchangers	Eikevik, Trygve
PP	Smitt, Silje Marie	Investigation of integrated CO2 heat pumping systems for hotels in cold climates	Hafner, Armin
Sustainable Energy Systems (SES)	Ivanko, Dmytro	Identifying important variables and profiles of domestic hot tap water energy use by using statistical methods in Norway	Nord, Natasa
SES	Dziedzic, Jakub W	A novel monitoring and modeling technique for energy-related occupant behaviour.	Novakovic, Vojislav
SES	Islam, Md Hujjatul	Sonochemical and sonoelectrochemical conversion of CO2 into hydrocarbons	Pollett, Bruno
SES	Raka, Yash	Hydrogen production using reverse electrodialysis	Burheim, Odne S
SES	Rabani, Mehrdad	Retrofitting of Norwegian Office Buildings towards nearly zero energy-technical environmental, and economic aspects	Nord, Natasa
Thermo Fluids (TF)	Jalili, Zohred	New Insights into the Modeling of Energy Generation and Storage by Salinity Gradients	Einarsrud, Kristian
TF	Dhoke, Chaitanya	Demonstration of Swing adsorption cluster concept (SARC) for CO2 capture	Amini, Shahriar
TF	Nygård, Håkon Tormodsen	Experimental Measurement of Flame Describing Functions in an Azimuthally Forced Annular Combustor	Worth, Nicholas
TF	Zhang, Jingyuan	Computational fluid dynamics (CFD) modeling for biomass and waste to energy production	Løvås, Terese
TF	Indlekofer, Thomas	The dynamic nature of self-excited azimuthal modes in annular combustors	Dawson, James
TF	Koothur, Vipin	Tracking and sizing of particles in the Mie scattering regime using a laser scanning technique	Dawson, James
TF	Osman, Mogahid S	A pressurized Internally Circulating Reactor (ICR) for streamlining development of chemical looping technology	Amini, Shahriar
TF	Ding, Wenwu	Conical micro-structures for super-repellent surfaces and their effect on droplet impac	Fernandino, Maria
TF	Salimath, Prashant S	Numerical simulations of combustion near solid and hydrogen permeable walls	Ertesvåg, Ivar Ståle
TF	Subramanian, Avinash Shankar R	Optimization under uncertainty of hybrid feedstock polygeneration systems	Gundersen, Truls
TF	Rømcke, Olav	Colliding Jamming Fronts in a Dense Suspension	Hearst, Jason R

Number of defended PhD theses: 23

THERMAL **ENERGY** AND FLUID MECHANICS

THERMO FLUIDS (TF)

"Our research group focusses on both fundamental and applied research in the general areas of thermal energy and fluid mechanics," says Nicholas Worth, Head of Research Group.

"We develop and use cutting-edge theoretical, experimental and numerical methods to help address major societal challenges in energy, sustainability, transport, health and the environment." The SDG's most relevant to this research area are no. 3, 6, 7 and 13.

Ongoing major research projects and affiliated centres	Responsible
LowEmission – Research Centre for a Low-Emission Petroleum Industry on the Norwegian Continental Shelf	James Richard Dawson
FME Bio4Fuels – Norwegian Centre for for Sustainable Bio-based Fuels and Energy	Terese Løvås
Breaking the paradigm: A new approach to understanding and controlling combustion instabilities	Nicholas Worth
Distributed Hydrogen Injection and Combustion Technology for Next Generation Pre-Combustion CCS Schemes (DiHI-Tech)	Andrea Gruber, Jason Hearst
Fire Research and Innovation Centre (FRIC)	Ivar Ståle Ertesvåg
Near-wall mixing by free-stream turbulence (WallMix)	Jason Hearst
Reheat2H2 - Towards clean and stable hydrogen reheat combustion in gas turbines	Jonas Moeck
Stability Through Asymmetry: Breaking vortical symmetry to enable zero-carbon combustion	Nicholas Worth
Cardio Exosomes - Biomedical engineering platform for cardio exosomes	Carlos Dorao
Dyndrops - Mechanisms controlling droplet growth dynamics during condensation on micro-patterned surfaces	Maria Fernandino

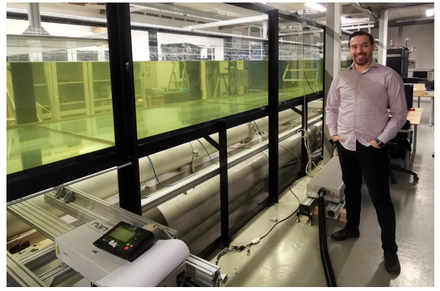
Nicholas Worth
HEAD OF RESEARCH GROUP

Photo: Thor Nielsen/NTNU

ERC GRANT ON CO2 UPTAKE BY THE OCEANS

On the left:
How does turbulence affect the ability of the ocean to absorb CO2? Led by Jason Hearst, researchers will use NTNU's Fluid Dynamics Lab to answer this question.

On the right:
Associate Professor Jason Hearst standing next to the large Water Channel Facility at EPT. The water tunnel is 11.2 m long, 0.8 m high and 1.8 m broad.



Jason Hearst, an associate professor at EPT, have received the highly competitive European Research Council (ERC) ERC Starting Grants from the European Research Council. The grant will be used to study the ocean's uptake of CO2.

Jason Hearst has been given supportawarded funding to investigate how the uptake of carbon dioxide (CO2) in the ocean is affected by turbulence both in the atmosphere and in the ocean.

"We know that turbulence affects the contact surface between liquid and gas, but because this is so complex, we do not know the mechanisms that control this process or how they are connected to carbon dioxide and oxygen," says Hearst, who works at NTNU's Department of Energy and Process Engineering.

NTNU LABORATORY IS AN IMPORTANT TOOL.

The ocean has stored almost 50 per cent of all human-created CO2. How turbulence plays a role and contributes to the uptake of gas in the ocean is the subject of a research project called GLITR. Hearst is leading the project.

One of NTNU's laboratories will be central to the research project. The water channel in the Fluid Dynamics Laboratory allows researchers to tailor experiments to recreate the intensity and other conditions of ocean turbulence.

The GLITR project will run for five years, and has a budget of EUR 2.6 million Euros. Hearst has will have three PhD candidates and two postdocs in the project group.

RADICAL RESEARCH ON CLEAN FUEL

AMMONIA AS FUEL REPRESENTS A GREEN TRANSITION FOR THE MARINE INDUSTRY

In 2021, NTNU received funding from the Research Council of Norway and Nordic Energy for several new projects to conduct research on how to solve some well-known issues for ammonia as a fuel in combustion engines. One is an Innovative Project for the Industrial Sector (IPN) project with Bergen Engines AS and other partners. Another project is based on a radical idea involving a certain type of nanomaterial for ignition– hence the project acronym NanoIgnite. Two other projects are based on Nordic and European collaboration with other academic and industrial partners.

But why the interest in ammonia? First, it carries hydrogen chemically bonded, which makes hydrogen easier to store and transport. Second, when ammonia burns, it does not emit carbon dioxide. Third, ammonia is among the top 10 most used chemicals in the world, typically used in fertilization.

"We need a fast transition to fuel without CO2 emissions. Long-distance ships with heavy goods will not be electrified soon," says Corinna Netzer, Postdoctoral candidate at NTNU – Department of Energy and Process Engineering. She and her colleague, Michal T. Lewandowski, also a Postdoctoral candidate, conduct numerical research on how to adapt ammonia as a fuel. They are involved in several research projects where NTNU, SINTEF and other institutions join forces on the topic.

IMPORTANT ISSUES TO SOLVE

Ammonia as fuel has its advantages from an environmental perspective, but it is also very different from hydrocarbon-based fuels. #Three important technical issues must be solved and optimized before ammonia can be used as regular fuel", says Lewandowski. "How to get ammonia into the engine, how to ignite it, and how to tackle the emissions."

In fact, ammonia does not burn easily. NanoIgnite suggests a solution for ignition with photosensitive nanomaterials. "We will inject a photosensitive nanomaterial that ignites upon light exposure into the engine, thereby igniting ammonia more efficiently," says Terese Løvås, Project Manager of NanoIgnit

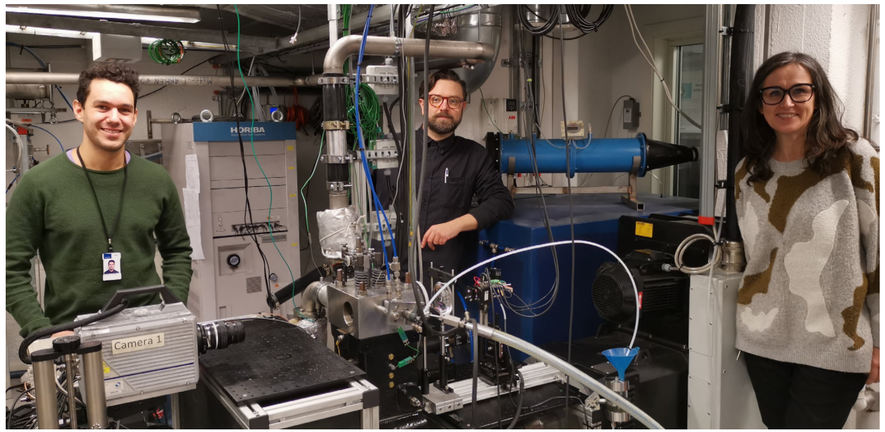
Researchers Corinna Netzer and Michal T. Lewandowski explain the basics of the building blocks of ammonia and how it will consequently not produce carbon dioxide when burnt.

NTNU AND SINTEF COMBINE LONG EXPERIENCE

NanoIgnite is a cooperation between NTNU (coordinator) and SINTEF. Together, the two institutions combine long experience with research on everything from fundamental combustion processes and engine research, to engine modelling, optical measurements and emissions characterization and ignition mechanisms. The research activity on clean fuel and sustainable combustion processes utilize the Turbulent Combustion lab, the Motor lab and the marine labs at Tyholt among others.

Marine industry is only one of the applications for ammonia. "In 2023, a pilot project foresees a tractor using ammonia and a very small dosage of biofuel for ignition," explains Lewandowski.

Karl Oskar Pires Bjørgen (SINTEF/ NTNU), David Emberson (NTNU) and Terese Løvås (NTNU) in the motor lab at NTNU campus Gløshaugen in Trondheim.



BRIDGING **TECHNOLOGY AND SCIENCE**
- THE INDUSTRIAL ECOLOGY PROGRAMME (INDECOL)

"Industrial Ecology is the study of the material side of the economy and society and investigate how resource use contributes to welfare, as well as how and where the environmental impacts occur," says Francesco Cherubini, Head of the Industrial Ecology Programme.

"Our teaching and research activities bridge technology and the social sciences." The SDG's most relevant to this research area are no. 7, 8, 9, 11, 12, 13 and 15.

Ongoing major research projects and affiliated centres	Responsible
FME NTRANS – Norwegian Centre for Energy Transition Strategies	Edgar Hertwich
Smart Maritime SFI	Anders Hammer Strømman
Ocean NETs – Ocean-based negative emission technologies	Helene Muri
Mind-P – opportunities and barriers to how the Norwegian bioeconomy can be transformed to achieve direct independence from imported mineral phosphorus by 2030	Daniel Beat Müller
ATLANTIS – Whales, waste and sea walnuts: incorporating human impacts on the marine eco-system within life cycle impact assessment	Francesca Verones
LASTING – Sustainable prosperity through product durability	Johan Berg Pettersen
MITISTRESS – Strategies to Mitigate Pressures on Terrestrial Ecosystems from Multiple Stressors	Francesco Cherubini

Francesco Cherubini
HEAD OF INDUSTRIAL ECOLOGY PROGRAMME

Photo: Titt Melhuus/NTNU

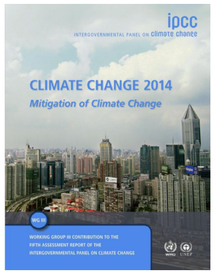
INDUSTRIAL ECOLOGY RESEARCHERS NAMED TO IPCC AND IPBES

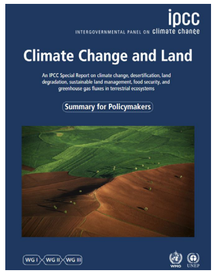
Through the years, several researchers from IndEcol have been asked to serve as Lead Author for assessments by the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

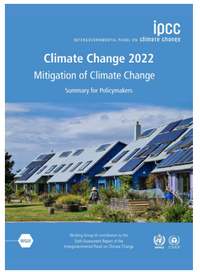
Not every student at NTNU knows that there are lecturers at this university who contribute to large and important international climate-related panels such as the IPCC and the IPBES. As many well know, the IPCC shared the 2007 Nobel Peace Prize with Al Gore for contributions to the human understanding of climate change. The IPBES is intended to serve a similar role to the IPCC.

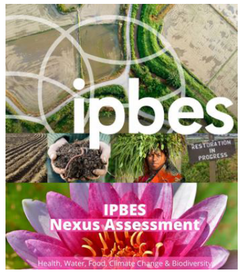
These are the IPCC and IPBES reports with Lead Authors from the Industrial Ecology Programme at NTNU:

The IPCC reports above have all been published between 2014 and early 2022, except the IPBES Nexus Assessment report which is upcoming.









ABANDONED CROPLAND SHOULD PRODUCE BIOFUELS

By Steinar Brandslet

More biofuels are needed to counteract climate change. But producing them shouldn't diminish food production or wilderness areas. The solution may be to grow more grass on recently abandoned cropland, according to a publication in Nature Sustainability.

Growing perennial grasses on abandoned cropland has the potential to counteract some of the negative impacts of climate change by switching to more biofuels, according to a group of researchers at the Industrial Ecology Programme at NTNU.

Researchers consider increased use of biofuels to be an important part of the solution to achieve reduced CO2 emissions. But the production of plants for biofuels can have some unfortunate trade-offs.

Now, the researchers have come up with a scenario that would put less pressure on food production and plant and animal life.

"We can grow perennial grasses in areas that until recently were used for growing food but that are no longer used for that purpose," explains Jan Sandstad Næss, a PhD candidate at the Industrial Ecology Programme at NTNU. These areas are usually still potentially cultivable and have the advantage that they are already connected to farms, which means that the infrastructure is in place and they are close to the markets.

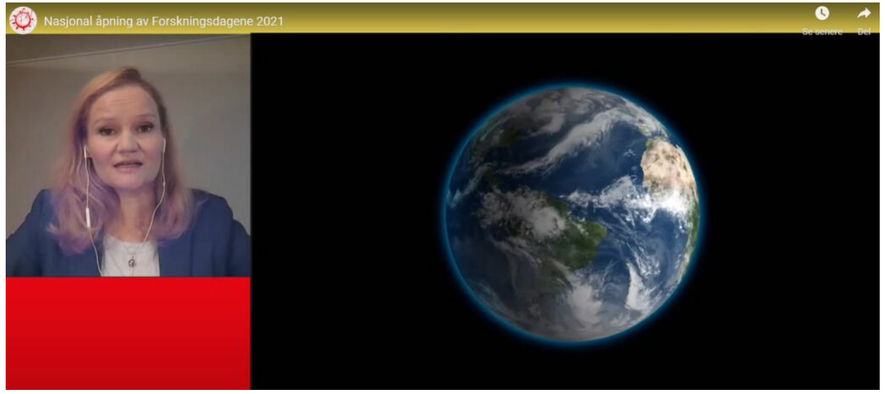
The results from the study have now been published in Nature Sustainability.

Source: Jan Sandstad Næss, Otávio Cavalett and Francesco Cherubini. The land – energy – water nexus of global bioenergy potentials from abandoned cropland. Nature Sustainability. https://doi.org/10.1038/s41893-020-00680-5

Common to all biofuels is that plants are broken down and transformed into a product we can take advantage of in vehicles and machines, for example. Photo: Colourbox.dk

HELENE MURI AT NATIONAL OPENING OF FORSKNINGSDAGENE

Screenshot from the recording of Helene Muri during the national opening of Forskningsdagene (in Eng: The Research Days) 2021.



Senior researcher Helene Muri was invited to speak during the national opening of the Forskningsdagene 2021, with the topic: "Geoengineering - Plan B of the Paris Agreement or source of conflict?"

Muri says: "It was easy to say yes this time, when I was invited by the Research Council. The theme was Peace and Conflict, which fits as a dimension in some of the research I do through UNESCO where I supervise research groups from developing countries. "

FROM **HYDROGEN** AND **BATTERIES** TO **BUILDINGS**
- SUSTAINABLE ENERGY SYSTEMS

"The Sustainable Energy Systems group works with integration of energy systems", says Odne Burheim, Head of Research Group.

"Our aim is to increase sustainability. We use diverse technologies such as hydrogen and battery, and applications such as energy supply and use in buildings."

The SDG's most relevant to this research group are no. 7 and 11.

Ongoing major research projects and affiliated centres	Responsible
FME ZEN – The Research Centre on Zero Emission Neighbourhoods in Smart Cities	Vojislav Novakovic
ExPOSe - Transparent Energy Planning	Natasa Nord
ChiNoZEN - Key technologies and demonstration of combined cooling, heating and power generation for low-carbon neighbourhoods/buildings with clean energy	Vojislav Novakovic
BattMarine – Safety and modelling of new and aged Li-ion Batteries	Odne Burheim
WASTELESS Wastewater secondary treatment in RAS with microbial biomass output	Jacob J. Lamb
Probing the electronic properties of nickel oxide (NiO) as electrocatalyst for renewable and sustainable electrolytic hydrogen production (Forskerprosjekt - SANOCEAN)	Bruno Pollet
IEA HPT Annex 52 Norwegian participation	Maria Justo Alonso
Opptre - Energy upgrading of wooden dwellings to nearly zero energy level (2018-2021)	Laurent Georges

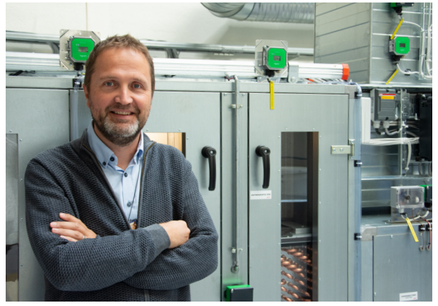
Odne Burheim
HEAD OF RESEARCH GROUP

Photo: Thor Nielsen/NTNU

LAURENT GEORGES IS PRESIDENT OF NORDIC IBPSA

On the left:
Associate Professor Laurent Georges in front of an air-handling unit in the lab.

On the right:
From Natasa Nord's lecture during RN Live 2021 (screenshot of recording).



The Nordic branch of the International Building Performance Simulation (IBPSA) has announced their new President: Laurent Georges, Associate Professor at NTNU – Department of Energy and Process Engineering.

IBPSA is a large international association comprising researchers and industry in the field of building performance simulation. These simulations include energy and indoor climate, for example to evaluate energy efficiency and thermal comfort in buildings. The IBPSA-Nordic is a regional affiliate of IBPSA and includes about 160 members, mostly from Norway, Denmark, Sweden and Finland.

"I will work actively to enable even more active cooperation between researchers and the industry," says Laurent Georges about his Presidency in IBPSA-Nordic.

TALKING TO YOUTH AT RESEARCHER'S NIGHT

"We [EPT] should do this on an annual basis," said Professor Natasa Nord after the presentation at Researcher's Night.

Professor Natasa Nord contributed with the lecture "Heating a home with a CO2 heat pump" during Researcher's Night (RN), the Youth's research night at NTNU. The event, which has a long tradition, was held this year partly digitally and partly physically in the Realfagbygget. Young people were also offered a tour of NTNU's HVAC laboratory.

It is important to show that engineering is fun and future-oriented "Through teaching experience and in contact with today's youth, one understands that they take a lot for granted and expect fun and enjoyment," says Nord. "It's more popular to be an influencer or PR consultant on Twitter than an engineer. I who think that engineering is fun will show the young people that by being an engineer, you can actively contribute to a more environmentally friendly and digital future."

FROM HEATING AND COOLING TO **HYDROPOWER** AND **ENERGY EFFICIENCY**

Our research group works with power, processes, systems and components," explains Trygve Eikevik, Head of Research Group.

"We work with energy efficiency in all industrial processes, especially in the oil and gas, metal and food industry." The SDG's most relevant to this research area are no. 2, 7, 12 and 13.

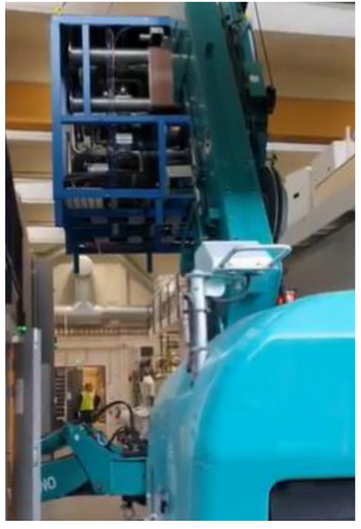
Ongoing major research projects and affiliated centres	Responsible
European Energy Research Alliance Joint Programme Hydropower	Ole Gunnar Dahlhaug
HydroFlex – Increasing the value of Hydropower through increased Flexibility (H2020)	Ole Gunnar Dahlhaug
TRI-HP – Trigeneration systems based on heat pumps with natural refrigerants and multiple renewable sources	Armin Hafner
Coolfish: Energy efficient and climate friendly cooling, freezing and heating onboard fishing vessels	Armin Hafner
CoolCern – Large Hadron Collider detector cooling with R744 refrigeration technology (CERN project)	Armin Hafner
FME HydroCen – Norwegian Research Centre for Hydropower Technology	Liv Randi Hultgreen
FME HighEFF – Centre for an Energy Efficient and Competitive Industry for the Future	Truls Gundersen
Innovative hybrid energy system for stable power and heat supply in offshore oil and gas installation (HES-OFF)	Lars O. Nord

Trygve Eikevik
HEAD OF RESEARCH GROUP

NEW RIG RELATED TO HIGHEFF

A long-awaited lift happened on a Friday in November: 4.4 tonnes was lifted up one floor in Varmeteknisk.

The rig will help our researchers find out more about how we can use waste heat to make electricity. Related to the infrastructure project HighEFF and FME Higheff.



A rare kind of crane was needed to lift this extra heavy load inside the lab.

Photo: Lars O. Nord

IMPACTS FROM HYDROPOWER AT #EUGREENWEEK

Prof. Ole Gunnar Dahlhaug attended as Acting Coordinator of EERA's Joined Programme Hydropower, during #EUGreenWeek.

How can innovation reduce the sources of pollution and impacts from hydropower? This was the topic of a discussion at #EUGreenWeek, where prof. Ole Gunnar Dahlhaug attended on the 8th of June 2021. Over 70 of the almost 100 attendees joined the experts in a roundtable discussion. The EERA Joint Programme Hydropower aims to facilitate a new role for hydropower as enabler for the renewable energy system by aligning and targeting research efforts in Europe.

The #EUGreenWeek discussion was a digital event in 2021.

BEST LECTURER: TRULS GUNDERSEN

During "Energidagen" (In Eng: Energy Day) under the auspices of the Energy and Environment students at NTNU, a prize was awarded from the students to the best lecturer of the year at the study programme: Professor Truls Gundersen.

"Congratulations. It is not the first time you have received this honorable award, and is well deserved. This makes EPT proud," said Terese Løvås, Head of Department, to Truls Gundersen. Gundersen himself says he hopes this can be a contribution to the department's recruitment efforts. He adds: "Even after 17 years of lectures in thermodynamics, there is no question of recycling last year's slides. A double lecture requires 60-90 minutes of preparation, preferably the night before.
The Energy and Environmental Engineering students (EMIL) wrote the following to Gundersen in the award:

"[..] we [present] the award to the lecturer the students at EMIL think is the best. Congratulations, this award goes to you this year for your efforts in Thermodynamics!"

The award ceremony took place in the auditorium EL5.

Left photo:
Stian Jørgensen / Energidagen

On the right:

Vera Gütle, student, and
Wolf Ludwig Kuhn, PhD Candidate, is conducting an experiment in the DeGas project in the Waterpower laboratory.

Photo: Juliet Landrø/HydroCen

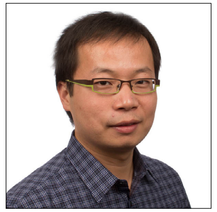
ORGANIZATIONAL **STORIES** & **MOMENTS**

Gender and equality: The EPT Women in Science initiative had more than 30 members in 2021. Although there were few occasions for physical meetings, there were monthly virtual coffee breaks with guest speakers. A successful mentorship programme was introduced in spring semester 2021, with 3 mentors and 7 mentees within the department. The programme will continue in autumn 2022.

Sustainability projects at NTNU: In 2021, NTNU announced 43 PhD positions related to sustainability, affiliated with 9 interdisciplinary projects. When they are hired, 3 of these PhD candidates will work at EPT. They will be affiliated with projects at IndEcol (MAPLE, SusHydro, CircularCity).

Recruiting applicants for PhD positions: EPT hires about 20 new PhD candidates a year, and we organized a "PhD chat" for graduate students in November.

4 NEW MEMBERS OF THE PERMANENT SCIENTIFIC STAFF AT EPT



During 6 months in 2021, we welcomed all four new members of our permanent scientific staff at EPT: Jacob J. Lamb, Associate Professor in Future Energy Systems, Luca Brandt, Professor and International Chair in Fluid Mechanics, Steven Boles, Professor in Energy Storage, and Lihao Zhao, Associate Professor in Fluid Mechanics.

NORTH AND WORTH PROMOTED TO FULL PROFESSOR POSITIONS

We were happy to see that Lars. O. Nord and Nicholas Worth were promoted to full Professor positions.

Lars O. Nord is Professor in Thermal Energy, and Nicholas Worth is Professor in Experimental Fluid Mechanics.

EPTRAINING AND SOCIAL

EPTraining is great for meeting up and having fun with colleagues while training and being healthy. In the winter we normally have ski training sessions, which are very popular. Running sessions, the St. Olavsloppet relay race from Trondheim to Östersund in Sweden and kayak courses keep us active in the Summer.

KAYAK

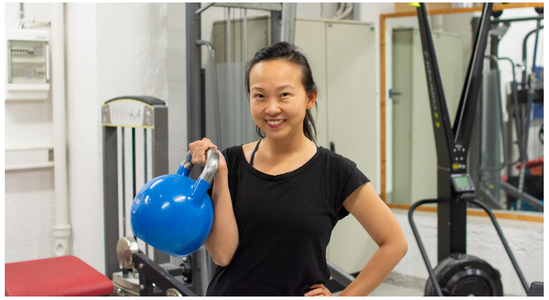
The kayak course was held in October this year.

Photos: Jørgen Røst/PadleNorge, Ignat Tolstorebrov, Marthe Alnes Høiberg, Ida Kristin Antonsen

ST. OLAVSLOPPET

This years relay race was held virtually, but was still fun.

EPT GYM



The EPT Gym was reopened in October.

SKI

The ski training sessions were cancelled in 2021, but fortunately some went skiing with their nearest colleagues.

WALK IN THE CITY

On 4 October 2021 on a guided tour, 58 employees got to know the city of Trondheim and their colleagues better.

EPT IN 3 YEARS' TIME

Almost half-way to the goal set in 2020, there will be time to carry out a revision of our upcoming challenges and goals.

Development in society requires constant renewal of engineering knowledge, combined with interdisciplinarity and based on fundamental disciplines. To succeed in the competition for research and learning environment excellence, and to be an attractive partner, we must continue to improve our core activities and support functions.

WIDE RANGE OF RESEARCH

EPT is known for its wide range of research. This can be both a strength, fostering interdisciplinary activity and innovative research and a challenge to common identity and visibility. A common set of priorities must form the basis of the department's core activity, independently of fundamental or applied focus.

STUDY PROGRAMMES

EPT provides a wide range of courses for bachelor's and master's/siv.ing study programs. We must ensure that the department maintains a strong position and visibility in the study programmes. We must secure study and learning environments that are recognized for their high quality and relevance for further studies and career. We must further ensure that our students succeed in the job market and prevent dropout and delays in the completion of studies.

IDENTITY AS ONE DEPARTMENT

For historical reasons, EPT has several different locations on the Gløshaugen Campus. This imposes organizational challenges in terms of both identity building and visibility as one Department. Furthermore, it requires attention to efficient communication, procedural structure for research and educational activities, as well as robustness of support functions.

UPCOMING GOALS

EPT's vision is long-term. At the same time national and global societal changes are happening fast, with the need for a rapid and flexible response. The value of knowledge and understanding of the core principles governing our activity is crucial to increase competence, and to meet society's demands and expectations with state-of-the art solutions.

IN 2025, EPT

- is nationally and internationally recognized as a provider of excellent research and research-based education within its core areas of energy engineering, process technology and industrial ecology.
- is a preferred partner in collaborative research with academic and industrial partners.
- hosts internationally leading research groups fostering theoretical and lab-based fundamental and applied science.
- is a provider of high-quality learning environments for candidates to private, public and academic sector, both in Norway and abroad. has a strong and unified, yet interdisciplinary, identity attractive to both employees and students.
- is a collaborative partner with the highest level of professionalism and integrity on all levels (scientific, education, administration and laboratory).
- Is a visible and active actor in societal debate.
- offers a work environment embracing diversity and gender balance.

This is a summary of EPT's strategy for 2020 – 2025.

Read the whole document here:

EPT's management group adopted a strategy for 2025, in 2020. It is based on NTNU's overall strategy.

Photo: Lars R. Bang/NTNU