Norwegian University of Science and Technology

Energy Research

NTNU
Norwegian University of
Science and Technology

ENERGY HEALTH OCEANS SUSTAINABILITY

This brochure was produced by NTNU Energy, Norwegian University of Science and Technology (NTNU), May 2023.

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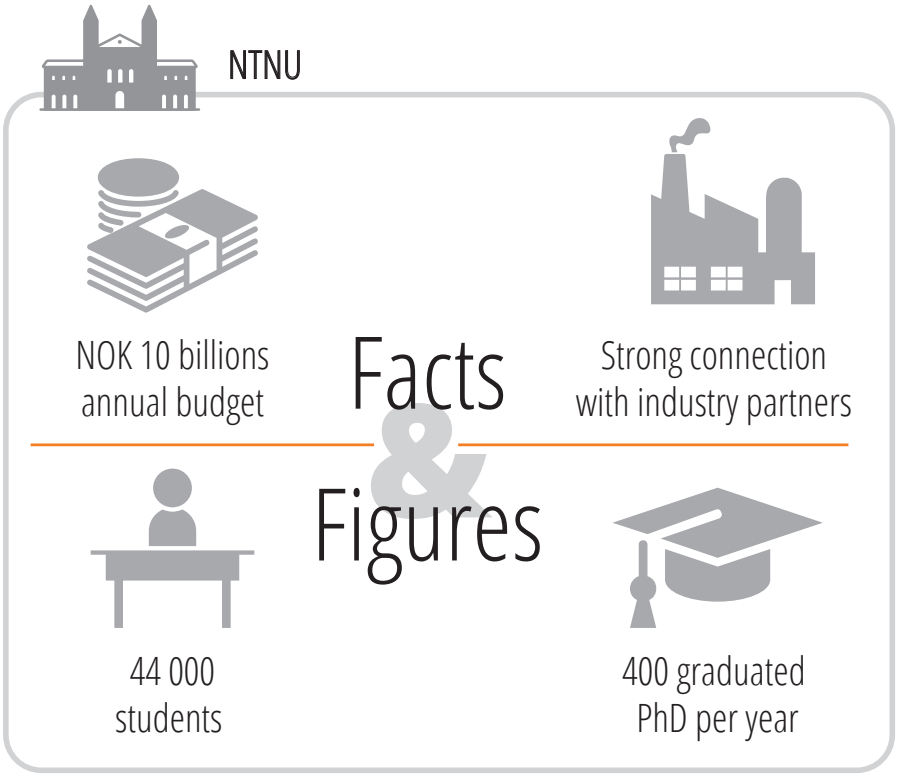
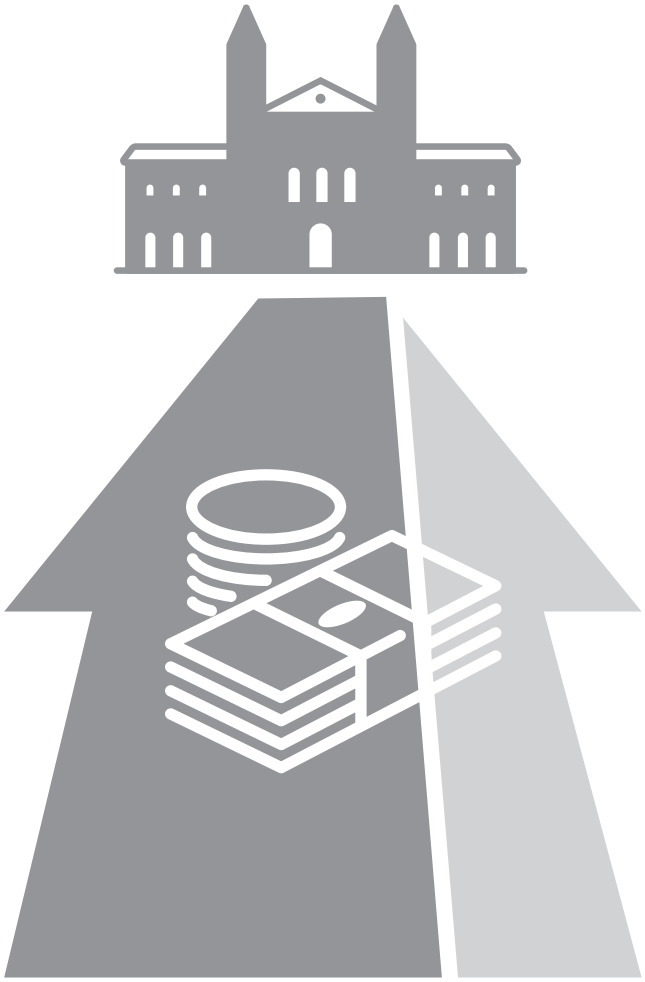
NTNU - Norwegian University of Science and Technology

The Norwegian University of Science and Technology (NTNU) is Norway's biggest university and has a strong international focus. Its headquarters are in Trondheim, Norway, with campuses in Ålesund and Gjøvik.

NTNU has a main profile in science and technology, a variety of programs of professional study, and great academic breadth that includes the humanities, social sciences, economics, medicine, health sciences, educational science, architecture, entrepreneurship, art disciplines and artistic activities. More than 30% of the teaching and research personnel are from outside Norway, and 42% are women.





30 % CONTRACT RESEARCH

Industry partner collaboration at European and national level

1200 companies from Norway

760 companies from outside of Norway

Energy research at NTNU

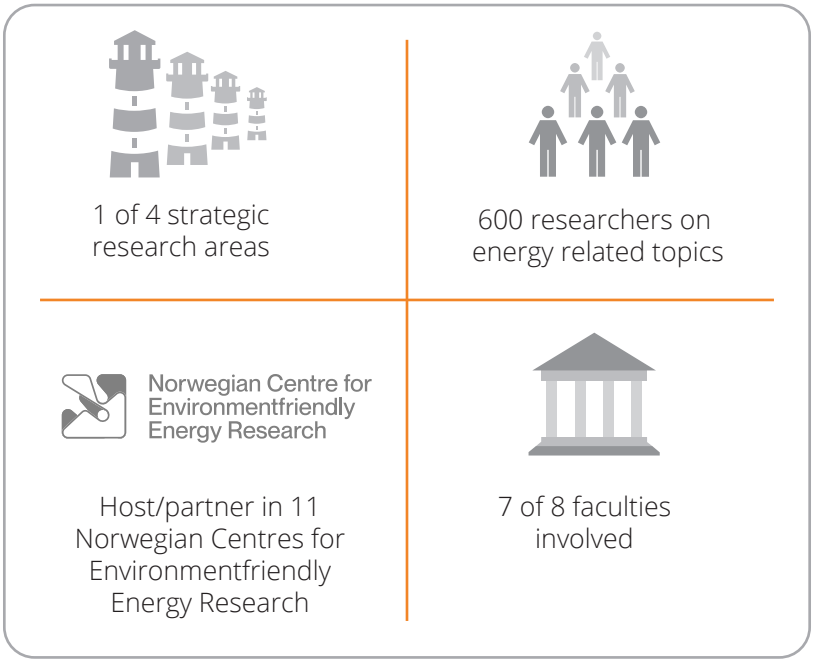
The energy research at NTNU covers a large range of activities. It includes but is not limited to stationary energy systems, energy in transport systems, energy efficiency, energy in buildings, neighbourhoods and industry, etc.

NTNU ENERGY

NTNU Energy is one of the university's four strategic research areas and gathers 600 competent energy researchers, teaching and technical personnel that work on energy-related topics. In total, researchers from seven out of NTNU's eight faculties conduct energy research.

NTNU Energy is an entry point to the energy research at NTNU for industry, authorities and researchers. We boost interdisciplinary research, collaboration and innovation through developing strategies, initiating activities and creating meeting places. In addition, we raise important issues and give research-based input to energy-related topics in the public debate.

One of NTNU Energy's central activities is to establish and support ten interdisciplinary research teams that address current issues in the energy field and society at large. The teams' topics are hydrogen, batteries, wind power (on- and offshore), carbon capture utilisation and storage (CCUS), nuclear energy, low- and middle-income countries, society, smartgrid, solar energy, and hydropower.



THE TEN INTERDISCIPLINARY ENERGY RESEARCH TEAMS

Director **Prof. Johan Hustad**

Head of communications **Annika Bremvåg**

EiT InnoEnergy **Karl Klingsheim**

Scientific coordinator **Eleni Patanou**

Project coordinator China: **Qiaoqiao Wang**

Communications // Innovation // Funding // EU // Collaboration

Team Wind
Leader:
Prof. Trond Kvamsdal

Team Hydrogen
Leader:
Prof. Nicola Paltrinieri

Team Battery
Leader:
Prof. Ann-Mari Svensson

Team CCUS
Leader:
Prof. Hanna Knuutila

Team Solar
Leader:
Assoc. Prof. Steve Völler

Team Nuclear Energy
Leader:
Prof. Erik Wahlström

Team LMIC
Leader:
Prof. Ole Jørgen Nydal

Team Smart Grid
Leader:
Prof. Irina Oleinikova

Team Hydropower
Leader:
Prof. Tor Haakon Bakken

Team Society
Leader:
Prof. Tomas Moe Skjølsvold

More information: *https://www.ntnu.edu/energy*

Norwegian Centre for Environmentfriendly Energy Research

HYDROGENi

MOZEES
Mobility Zero Emission Energy Systems

HighEFF

HydroCen

SUSOLTECH
The Norwegian Research Centre for Sustainable Solar Cell Technology

NCCS
NORWEGIAN CCS RESEARCH CENTRE
Industry-driven innovation for fast-track CCS deployment

CINELDI
Centre for intelligent electricity distribution
- to empower the future Smart Grid

NTRANS
Norwegian Centre for Energy Transition Strategies

ZEN
Research Centre on
ZERO EMISSION
NEIGHBOURHOODS
IN SMART CITIES

BIO4FUELS

NORTH WIND

NORWEGIAN CENTRES FOR ENVIRONMENTFRIENDLY ENERGY RESEARCH

NTNU Energy collaborates with eleven Norwegian Centres for Environmentfriendly Energy Research which are funded by the Research Council of Norway and work closely with industry and public authorities. NTNU Energy supports them by taking strategic initiatives across disciplines and providing communication assistance in order to generate more innovation from energy research.

The Norwegian Centres for Environmentfriendly Energy Research carry out long-term research targeted towards renewable energy, energy efficiency, CCS and social science aspects of energy research. The centres must demonstrate the potential for innovation and value creation. Research activities are carried out in close collaboration between research groups, trade and industry, and the public administration, and key tasks include international cooperation and researcher training. The centres are established for a period of maximum eight years.

Out of the eleven Norwegian Centres for Environmentfriendly Energy Research, NTNU hosts three: Hydrocen on hydro power, NTRANS on the role of the energy system in the energy transition and ZEN on zero emission neighborhoods in smart cities. The eight remaining Centres NTNU is a partner in: NorthWind, NCCS, CINELDI, HighEFF, Bio4Fuels, MoZEES, SUSOLTECH and HYDROGENi.

Find out more about the energy research at NTNU, the interdisciplinary energy research teams and the Norwegian Centres for Environmentfriendly Energy Research on our website:
https://www.ntnu.edu/energy

ENERGY TRANSITION TOPICS AT NTNU

- Renewable energy sources (solar, hydropower, wind, bio energy)
- Energy storage and carriers (batteries, hydropower, hydrogen)
- Energy efficiency in industry, buildings and neighbourhoods in smart cities
- New energy systems (smart grids)
- Zero emission mobility (land-based and maritime)
- Carbon capture, utilization and storage (CCUS)
- Politics, innovation and public engagement for sustainable energy
- A just energy transition

HORIZON 2020

Societal Challenge:
secure, clean and efficient energy

€21 million

31 projects

4th place

among 53 universities

15th place

among all kinds of organizations

HORIZON EUROPE

Cluster 5: Climate, energy and mobility & Joint Undertakings

€14 million

21 projects

4th place

among 331 higher education institutions

26th place

among 3418 organizations

All data on this page as of March 2023

YOU WILL MEET NTNU'S ENERGY RESEARCHERS IN THE FOLLOWING EU PLATFORMS:

EERA European Energy Research Alliance

EMIRI Bridging the Innovation Gap

eawe european academy of wind energy

EUROPEAN BATTERY ALLIANCE EBA250

eit RawMaterials

FCH FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

Hydrogen Europe

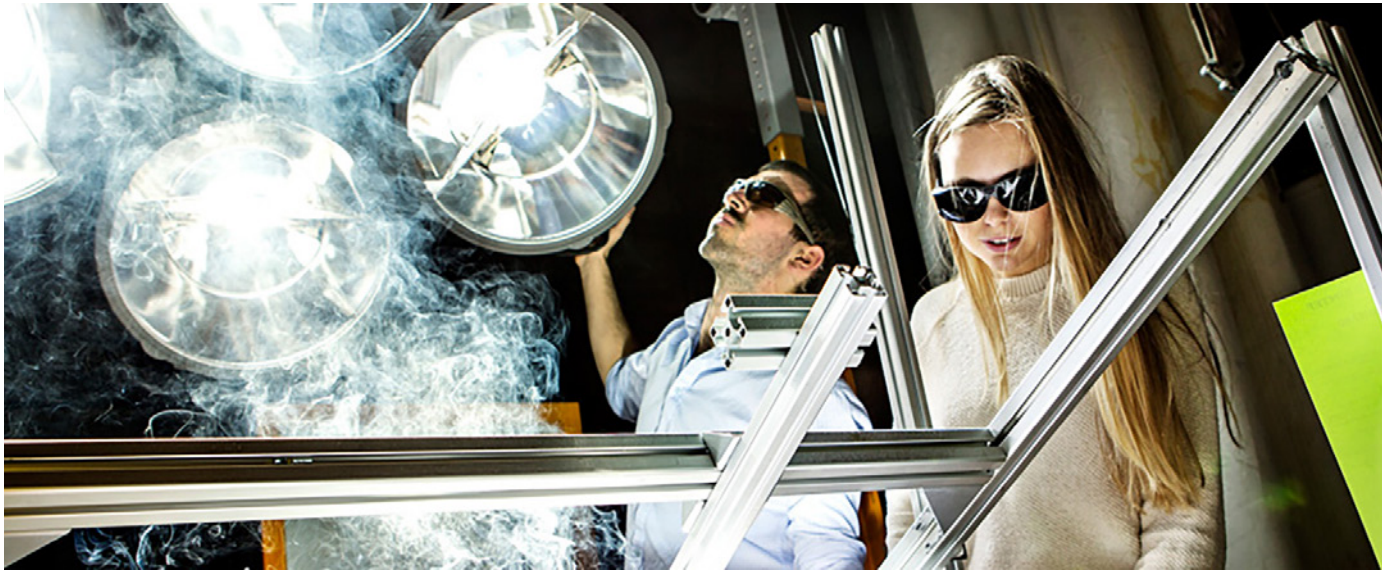
BATTERIES EUROPEAN PARTNERSHIP (BEPA)

HySafe

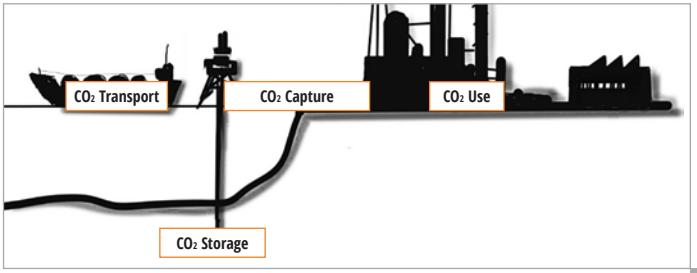
eit InnoEnergy

European Clean Hydrogen Alliance

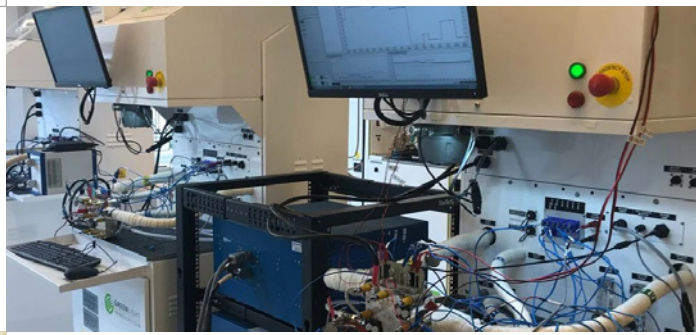
EUROPEAN GREEN HYDROGEN ACCELERATION CENTER (EGHAC)



NTNU has more than 200 laboratories. Some of NTNU's labs relevant to energy research are displayed on the following pages.



The European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) is a permanent pan-European distributed research infrastructure, ERIC (European Research Infrastructure Consortium). 21 service providers, NTNU being one of them, offer open access to more than 79 world class CCS research facilities across Europe.
More information: *www.eccsel.org/*



The Norwegian Fuel Cell and Hydrogen Centre is a set of advanced laboratories with the required instrumentation and personnel to facilitate high quality research, the development of components, and the testing and validation of systems for fuel cells and electrolysers.
More information: *www.sintef.no/projectweb/nfch/*

NTNU NanoLab is one of 4 cleanrooms within the Norwegian Micro- and Nanofabrication Facility (NorFab). It is run by a staff of 9 engineers and has 700 m2 cleanroom facilities with cleanliness ranging from ISO7 to ISO5 and vibration reduced zones at VCF-level.
More information: *www.ntnu.edu/nano/nanolab*

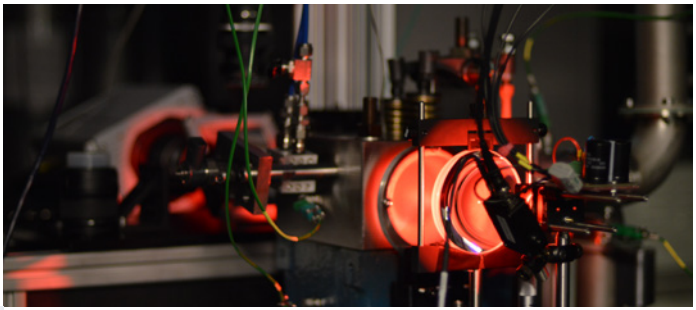
The National Smart Grid Laboratory provides state-of-the-art infrastructure for the demonstration, verification, and testing of a wide range of smart grid use cases, testing the smart grids of tomorrow.
More information: *www.ntnu.edu/smartgrid*

The ZEB laboratory is a zero-emission office laboratory - an arena where new and innovative materials and solutions are developed, investigated, tested and demonstrated in mutual interaction with people.
More information: *https://zeblab.no/*

The ZEB living laboratory is occupied by real persons using the building as their home. The focus is on the occupants and their use of innovative building technologies like intelligent control of installations and equipment, interactive user interfaces and interplay with the energy system as a whole.
More information:
zeb.no/index.php/en/pilot-projects/158-living-lab-trondheim

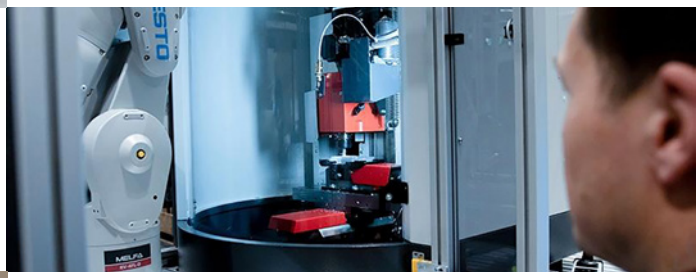
The ZEB test cell laboratory is used for testing low-energy, integrated building systems under realistic operational conditions. The test cell can be divided into two smaller chambers that can be used to compare different technologies.
More information: *zeb.no/index.php/en/test-cell-laboratory*

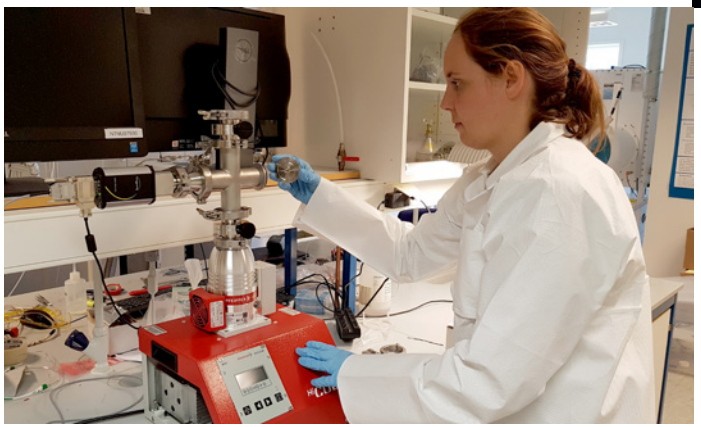
In **the Internal Combustion Engine Laboratory**, a Mercedes compression ignition engine is fitted to a Stuska water brake and used with a range of fuels, including 1st generation and 2nd generation biofuels.
More information:
www.ntnu.edu/ept/internal-combustion-engine-laboratory



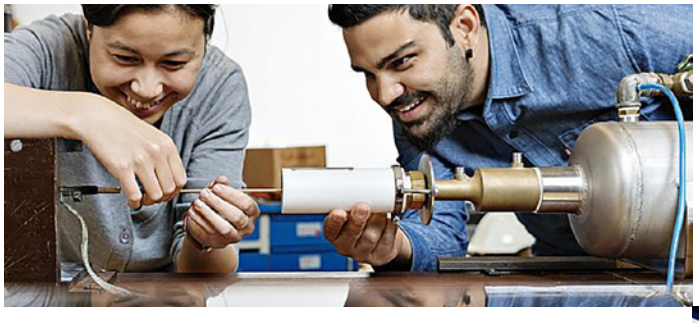
The Hybrid Power Systems Laboratory provides experimental facilities to test different types of hybrid power systems applicable to green shipping for educational and research purpose.
More information: *www.ntnu.edu/imt/lab/hybrid*

The MANULAB has 11 laboratories for state-of-the-art manufacturing research. It comprises advanced scientific equipment and facilities, a scientific database and e-infrastructure.
More information: *www.ntnu.edu/ivb/manulab*



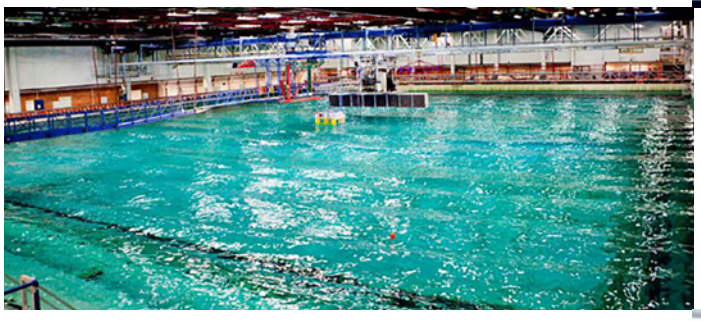


The Micro- and Nanoscale Design Laboratory is funded by the ERC Starting Grant 2020 and addresses functional materials from the nano- to the mesoscale.
More information: *www.microandnanoscaledesign.com/*



In **the High Current / Circuit Breaker Laboratory**, a grid-connected high current test facility together with precise synchronization and control circuitry enables experimental investigations on various switching phenomena in power circuit breakers as well as high current testing of other power equipment.
More information:
www.ntnu.edu/iel/high-current-/-circuit-breaker-laboratory

The Fluid Mechanics Laboratory and Wind Tunnel include several facilities designed for the investigation of fundamental fluid mechanics problems.
More information:
www.ntnu.edu/ept/laboratories/aerodynamic



The Ocean Basin Laboratory has a depth of 10 metres and a water surface of 50x80m. It is excellent for investing existing or future challenges within marine structures and operations. A total environmental simulation including wind, waves and current offers a unique possibility for testing models in realistic conditions.
More information:
www.sintef.no/en/all-laboratories/ocean-laboratory/

The Hydropower Laboratory offers state-of-the-art facilities that are unique in Europe. It includes a high-pressure pumping system, a long conduit to investigate discharge measurement techniques, and several other test facilities for basic research in fluid mechanics including turbines, hydraulics, geology/tunnels, etc.
More information:
www.ntnu.edu/ept/laboratories/waterpower#/view/about

The Solar Simulator Laboratory is used for absorber testing with an assembly of strong 7 lamps as a setup.
More information:
www.ntnu.edu/ept/solarlab#/view/publications

NTNU's 20 kW Solar Rooftop Installation is connected to the National Smart Grid Laboratory and consists of 62 panels in 11 different angles and azimuth orientations.
More information:
www.ntnu.edu/web/energy/solar/infrastructure

The Daylight Laboratory includes an artificial overcast sky, an artificial sun for research, and an artificial sun for teaching.
More information:
www.ntnu.edu/web/energy/solar/infrastructure

The Norwegian Ocean Technology Centre is Norway's future national knowledge centre for ocean space technology. It includes updated, state-of-the-art laboratories on a floor-space of 49.000 m^2. The budget is around NOK 7.7 billion.
More information: *www.ntnu.no/norskhavteknologisenter/*


NTNU