Norwegian University of Science and Technology

NTNU IN THE GLOBAL SOUTH



NTNU | Energy

NTNU
GLOBAL SOUTH
INITIATIVE

NTNU | Energy

NTNU Energy is one of NTNU's five strategic priority areas, aiming to strengthen energy research and support the several hundred researchers at the university working within the energy field. We seek to build knowledge that contributes to securing access to climate-friendly, nature-friendly, and fair energy for all. Our multidisciplinary research teams cover most areas of the energy sector and are working to develop solutions to the challenges society must address in the years ahead.

NTNU

GLOBAL SOUTH INITIATIVE

Strategic Initiative 2026–2028

NTNU's academic communities have a broad and well-established collaboration with a wide range of partners in low- and lower middle-income countries (LMIC) in the Global South. Over the past five to six years, we have carried out 146 collaborative projects with African universities, 124 in Asia, and 18 in (South) America.

In the period 2026–2028, we will place particular emphasis on strengthening the visibility, coordination, and further development of this collaboration.

This brochure was produced by NTNU Energy and NTNU Global South Initiative, Norwegian University of Science and Technology (NTNU), November 2026.
Graphic design: NTNU Communication Division / Graphic Centre.
Editors: Anne Lise Aakervik, Pedro Crespo del Granado, Lucio Rodrigo Alejo Vargas, and Majbritt Schanze.
www.ntnu.edu/energy | www.ntnu.edu/global-south-initiative

TABLE OF CONTENTS

Introduction **4**

NTNU's Long Standing Collaboration in the Global South **7**

The Engineering Adventure in Nepal 8
Long-term Cooperation with India – Norway 10
African Network in Energy Technology – Africa 12

Research Impact and Activities **15**

Wind Power for Offshore Oil – Brazil 16
Strengthening Safety and Sustainability – Southeast Asia 18
Village, Island, Culture – Papua New Guinea 20
Monitoring Remote Glaciers with Mountain Communities 22
Living with Water in Coastal Indonesia 24
Planning for Extreme Floods in India 26
Changing Waters, Changing Communities in the Himalaya 28
From Oil and Tin Mines to Clean Water – Indonesia, Namibia and Tanzania 30
Joint Learning on People Driven Urban River Regeneration – Nepal and Kenya 32
Connecting Coastal Science, Energy and Climate through Global Partnerships – Ghana and Tanzania 34
Bringing Local Experiences into Global Climate Pathways – Kenya, South Africa and Zambia 36
Building Capacity for Just Transitions in East Africa 38
Connecting the Dots in Renewable Energy in Nepal 40
Sharing Power Strengthens Rural Microgrids in Madagascar 41
Africa Energica - Towards a Green Path for Africa 42
Mineral Extraction for Energy Transition – Indonesia 44
Storing the Sun and Wind for a Grid Beyond Gas – Bolivia 46

Strategic Collaboration **49**

SINTEF – Global Sustainable Development 50
NORAD – Energy for Development 51
Research Infrastructure - Norway - Nepal 52
Education – Master Course Hydropower 53

Going Forward **54**

INTRODUCTION

Guided by the vision "Knowledge for a better world," NTNU is committed to addressing global challenges through interdisciplinary research, education, and innovation. As one of NTNU's five strategic research areas, **NTNU Energy** plays a central role in shaping sustainable energy systems that are equitable, resilient, and climate compatible. The transition must be rapid, inclusive, and deeply interdisciplinary: ensuring clean, affordable, and reliable energy for all, while safeguarding biodiversity, democratic governance, and sustainable industrial development.

In spring 2026, NTNU established the **NTNU Global South Initiative**, a strategic initiative for 2026–2028 that brings the university's collaborations with the Global South under one umbrella. Over the past five to six years, NTNU has carried out 146 collaborative projects with African universities, 124 in Asia, and 18 in South America. The project portfolio at NTNU is focused on four thematic areas: Just Climate Transition and Renewable Energy Global Health – Strengthening Public Health and Health Systems Global Development and Social Justice Biodiversity and Environmental Science

WHY THE GLOBAL SOUTH

The energy and climate transition presents a historic opportunity for low- and middle-income countries to leapfrog directly into sustainable, intelligent, and low-carbon energy systems. The Global South is where energy demand grows fastest, where climate change is felt first, and where the choices of the coming decade will shape global emissions for generations. It is also home to research communities from whom NTNU has much to learn. Since the first diploma course for engineers from the Global South was launched at NTH (the NTNUs predecessor) in 1976, the guiding principle has been partnership rather than transfer: helping partner institutions grow into self-reliant centres of expertise, as the Turbine Testing Lab at Kathmandu University demonstrates. Partnerships with the Global South need to transform from being driven by development assistance to being more equitable, open and fair in order to work towards common goals of knowledge driven climate transitions.

LESSONS LEARNT FROM GLOBAL SOUTH PARTNERSHIPS

NTNU's experience from technology partnerships in the Global South demonstrates that sustainable impact is achieved not through one way technology transfer, but through long term, mutually beneficial collaborations built on cocreation, local ownership, and capacity development. Successful partnerships integrate research, education, innovation, and institutional strengthening while engaging universities, industry, governments, and civil society across the entire innovation ecosystem. NTNU has found that technological solutions are most effective when adapted to local social, economic, and political contexts, supported by interdisciplinary collaboration and strong regional networks that facilitate knowledge

sharing and scaling. Investments in human capital through education, training, and joint research are critical, strengthening the full value chain surrounding technology, from development and deployment to maintenance, regulation, and commercialization. Overall, the most transformative outcomes emerge from long-term partnerships that combine technological excellence with local capacity building and shared ownership of development goals.

ABOUT THIS BOOKLET

The following pages highlight research and educational partnerships with **a focus on Energy and Climate** between NTNU and institutions across the Global South. Through joint projects, student exchanges, and co-developed solutions, these partnerships foster equitable access to clean energy innovation and empower developing economies to become active leaders in shaping a sustainable future.

Pedro Crespo del Granado
Rolee Aranya



Workshop with the participants in TEAM Low and Middle Income Countries.
www.ntnu.edu/energy/lmic



NTNU'S LONG STANDING COLLABORATION IN THE GLOBAL SOUTH

THE ENGINEERING ADVENTURE IN NEPAL

Nepal has vast hydropower potential. A long-term collaboration between NTNU and Kathmandu University (KU) supports its development through education, research and friendship.

Norwegian cooperation with Nepal dates back to the late 1950s, when NTH-educated engineer and missionary Odd Hoftun helped develop healthcare, industry and hydropower in the country.

In 1976, NTH/NTNU's Department of Electric Power Engineering launched an annual 10-month diploma course for young engineers from the Global South, eventually leading to an agreement with KU to establish a master's programme in 1991.

NTNU's hydropower community joined the collaboration in 1999, and the partnership gained momentum during Professor Ole Gunnar Dahlhaug's year as a visiting professor in Kathmandu in 2003/2004.

A MEMORABLE ENCOUNTER

Dahlhaug remembers feeling overwhelmed on arrival, but his doubts soon disappeared: "*But the next morning, when I pulled back the curtains and saw the Himalayas bathed in sunlight, I had no doubt*", he recalls. His stay helped establish a lasting collaboration in research and development of hydropower machinery, building on contacts NTH/NTNU had developed since the 1970s.



Professor Biraj Singh Thapa is investigating turbine performance in the Turbine Testing Laboratory at Kathmandu University.



The Turbine Testing lab and the expertise built around it in Kathmandu are unique in South Asia, says Professor Ole Gunnar Dahlhaug who has been working with Nepal since early 2000.



Turbine Installation team; Ole G. Dahlhaug, Sailesh Chitrakar, Bhuwan Bhattarai, Bård Brandåstrø, Åsmund Lerstad, Karina Talmo

A SELF-RELIANT UNIVERSITY

A guiding principle for KU has been to gradually assume full academic and financial responsibility for the master's programme in electric power engineering. This depends on qualified teaching staff, including graduates returning after completing PhDs abroad.

According to Dahlhaug, this strategy has proven successful with many former students in leading positions within Nepal's hydropower industry and bureaucracy, and many also teaching.

STRONG COLLABORATION YIELDS RESULTS

The partnership has strengthened NTNU's and Norway's reputation, benefiting Norwegian businesses establishing operations in Nepal. Nepal's first spin-off companies in hydropower technology have emerged from KU, demonstrating its capacity for education, research and innovation. The collaboration has also helped establish KU's Turbine Testing Lab, matching the capacity of NTNU's Waterpower Laboratory. Funding came from Norad, the Norwegian Embassy in Kathmandu, Nepalese industry and KU itself.

FACTS:

Kathmandu University was established in 1991.
Turbine Testing Lab was inaugurated in 2011.
Close collaboration with the Waterpower Laboratory at NTNU.
More information at https://ttl.ku.edu.np/

Contact:
Professor Ole Gunnar Dahlhaug, Department of Energy and Process Engineering, NTNU.
E-mail: ole.g.dahlhaug@ntnu.no

LONG-TERM COOPERATION WITH INDIA – NORWAY

For more than ten years, Professor Armin Hafner and colleagues at NTNU have worked with Indian academia and industry to develop cooling systems using natural refrigerants.

Supported by Norway's Ministry of Climate and Environment and Ministry of Foreign Affairs, the INDEE collaboration began with IIT Madras in Chennai. A CO2 refrigeration test facility provided a platform for sharing knowledge and adapting technology to Indian needs. The aim was to replace climate-damaging synthetic refrigerants with natural alternatives such as carbon dioxide, ammonia and hydrocarbons.

BUILDING LOCAL EXPERTISE

An early demonstration system was built in Italy and shipped to India. However, the partners found that importing equipment offered limited opportunities for knowledge transfer.

In the next phase, INDEE+ (2019 - 2025), they therefore worked directly with Indian manufacturers to develop local production capabilities.

Applications include cooling and freezing systems for the fishing industry, CO2-based hotel systems that combine water heating with cooling, and refrigeration at a chocolate factory.



Team INDEE3 at ACREX India 2025.

COOLING FOR DEVELOPMENT
As prosperity and demand for cooling grow in India, environmentally friendly systems can help meet essential needs while limiting emissions. In rural areas, shared "cooling hubs" provide storage for food, vaccines and products awaiting sale, supporting livelihoods and reducing food losses.

The third phase, INDEE 3, extends the partnership to refrigerated food transport, food safety, solar-powered cooling and thermal energy storage.

LASTING KNOWLEDGE AND PARTNERSHIPS
Education is central to the collaboration. Exchanges involving postdoctoral researchers, PhD candidates and master's students build expertise, while courses, textbooks and training help knowledge remain in India.

For Professor Armin Hafner, these long-standing relationships are essential: they enable projects tailored to local needs, strengthen research and industrial capabilities, and support lasting emissions reductions.



INDEE3 Flake Ice unit (R290) at BITS Pilani India.

FACTS:
Harmful gases: the use of fluorine-containing gases should not only be reduced, they should be phased out completely.
Natural gases: such as carbon dioxide, ammonia, hydrocarbons and water can replace all synthetic refrigerants used today in all applications.

Contact:
Professor Armin Hafner, Department of Energy and Process Engineering, NTNU.
E-mail: Armin.Hafner@ntnu.no

AFRICAN NETWORK IN ENERGY TECHNOLOGY – AFRICA

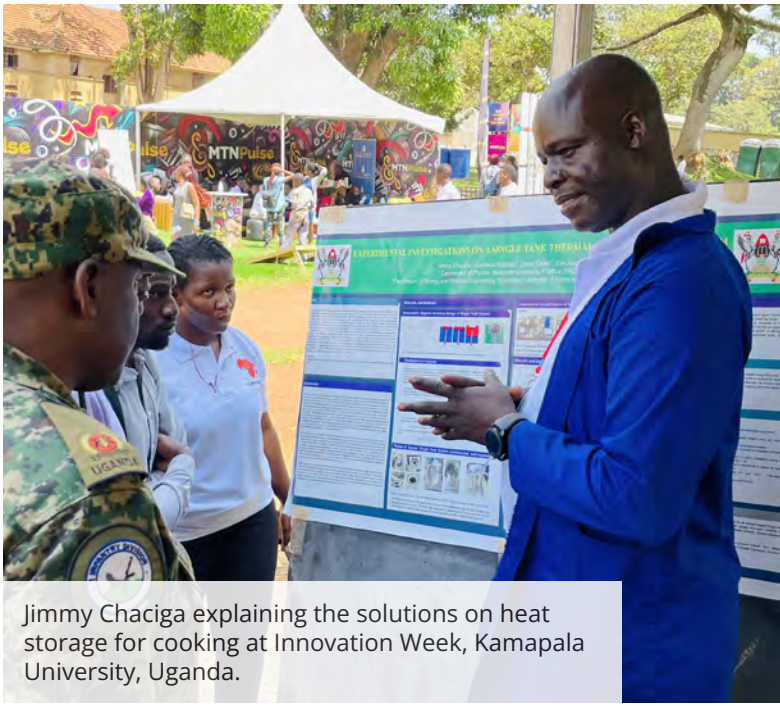
For more than 15 years, joint projects between NTNU and African universities have built master's programmes and research capacity in renewable energy, with a particular focus on small-scale, off-grid systems.

In many low- and middle-income countries in Africa, the electricity grid is limited, power supply is often unstable, and wood-based biofuels remain the dominant energy source in both cities and rural areas. Professor Ole Jørgen Nydal, who has coordinated the collaboration for many years, sees a special opportunity in Distributed or Decentralized Renewable Energy Systems (DRE) as a complement to grid expansion and new centralized power plants, a development The Economist (in June 2024) described as a "decentralized revolution".

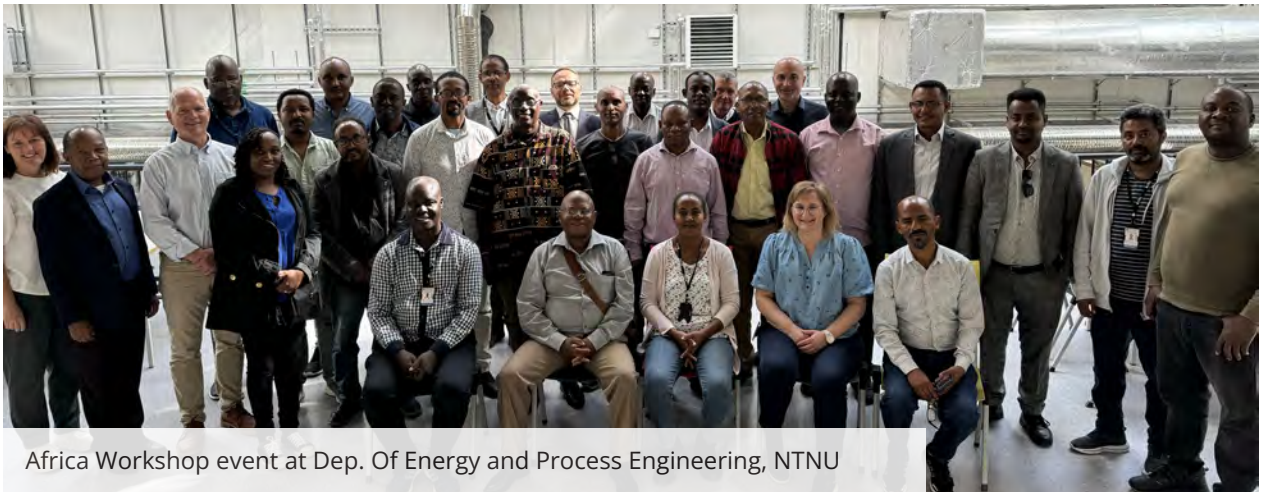
UNIVERSITY COLLABORATION ON RENEWABLE ENERGY

Since 2007, NTNU's Department of Energy and Process Engineering has worked with a group of African universities under a series of Norad programmes. "*We know that universities can play an active role in this picture, training people with relevant skills and participating in relevant research and technology development*", says Professor Ole Jørgen Nydal.

The aim has been to strengthen intra-African collaboration on education and applied energy research. The results include five master's programmes, joint PhD courses and coordinated research, with about 30 PhDs and a large number of master's students. Research covers solar energy (thermal and photovoltaics), hydropower (pumps as turbines), small-scale hybrid wind systems and solar-powered refrigeration.



Jimmy Chaciga explaining the solutions on heat storage for cooking at Innovation Week, Kamapala University, Uganda.



Africa Workshop event at Dep. Of Energy and Process Engineering, NTNU

LOOKING AHEAD

A survey among project coordinators at 11 universities showed that partners now prioritize research over education, with photovoltaic and solar thermal energy (39%), wind power (17%) and hydropower (16%) as the most popular areas. Based on this experience, the consortium highlights four priorities:

- Research collaboration with joint student supervision and shared resources
- Partnerships and commercialization, for example through seed funding, to bring results from the lab into local business
- Research infrastructure, as many partners lack laboratories and equipment
- Mobility and scholarships, to sustain recruitment and motivation

FACTS:

Partners: Addis Ababa University and Mekelle University (Ethiopia), Makerere University and Busitema University (Uganda), University of Dar es Salaam and Dodoma University (Tanzania), Eduardo Mondlane University and UNISave (Mozambique), Malawi University of Business and Applied Sciences (Malawi), University of Juba (South Sudan).

Funding: Norad and other programmes – NUFU, NOMA, EnPe, NORPART, NORHED II, NORGLOBAL, EnergiX, NTNU Discovery, the Quota Program, EU Erasmus+.

Contact:
Professor Ole Jørgen Nydal, Department of Energy and Process Engineering, NTNU.
E-mail: ole.j.nydal@ntnu.no



RESEARCH IMPACT AND ACTIVITIES

WIND POWER FOR OFFSHORE OIL – BRAZIL

Norwegian Brazilian Research Collaboration Explores Energy Storage Solutions.

Over the past four years, researchers from NTNU have collaborated with São Paulo State University (UNESP) and the Federal University of Minas Gerais (UFMG) in Brazil and Norwegian Industry to explore how offshore oil and gas platforms can be powered by renewable wind energy. The project, funded by the Research Council of Norway and supported by Equinor, ABB, and SAFT, focused on integrating wind power and energy storage into isolated offshore grids. The collaboration began with academic exchanges and evolved into a full research project under the Petromaks2 call.

RESEARCH GOALS AND INDUSTRIAL RELEVANCE

"*The goal was basically to try to identify the challenges, but also the advantages, that followed the integration of wind power into isolated offshore oil and gas platforms*», says professor Elisabetta Tedeschi from Dept. of Electric Energy, NTNU.

The project coincided with the development of Hywind Tampen, by Equinor which is the world's first floating wind farm powering offshore oil and gas platforms, highlighting the relevance of the research.

CHALLENGES OF WIND INTEGRATION

Wind energy's intermittency poses challenges for isolated offshore grids, which are small and vulnerable to fluctuations.

"*We have these power quality problems, but if we install energy storage, we can potentially not only mitigate some of these problems but also counteract the intermittency of the wind.*"

The team explored how energy storage could stabilize the system, make it more efficient, and provide additional services, such as inertia emulation and primary frequency control.

PHD RESEARCH AND TECHNICAL FOCUS

Two PhD candidates were hired to investigate different aspects over three years:

- Power Quality and Stability: One focused on short-term dynamics and the behavior of power electronic converters.
- Techno-Economic Analysis: The other examined the cost-effectiveness and sizing of energy storage systems.

A Researcher supported the scientific work to investigate system interactions between wind turbines, storage units, and intelligent loads. Laboratory validation was also conducted to test the capability of storage systems to perform critical grid support functions

Both PhD candidates defends their thesis in 2025. The findings are mostly theoretical but offer practical insights into future projects "*We think this will become more relevant. Through this project we gained a clearer idea of the advantages energy storage could bring, while the very first storage installations on O&G platforms are starting worldwide*".

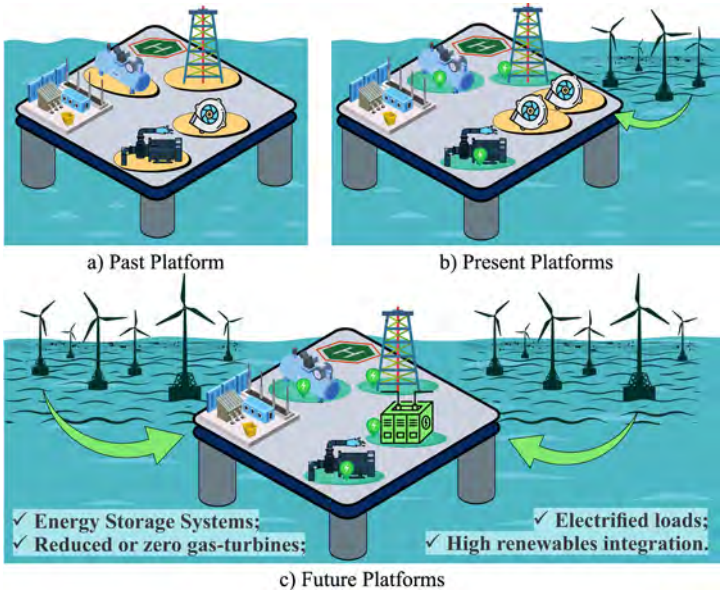


Illustration from article: L. Araujo, Lucas; J.M. Callegari, A.A. Adeyemo, J.K. Banda, D.I. Brandao, E. Tedeschi "Co-operation of Converter Interfaced Devices for Enhancing Flexibility, Efficiency and Resilience. Application on Low emissions Offshore Oil and Gas Platforms» accepted by: IEEE Power and Energy Magazine.

FACTS:
Efficiency increase and emissions reduction in offshore O&G platforms by wind integration, storage deployment and cooperative control - Prosjektbanken

The research suggests that energy storage could enable larger wind farms and higher renewable penetration on offshore platforms.

INDUSTRY-ACADEMIA COLLABORATION
The project was a strong example of cooperation between academia and industry. Equinor, ABB and SAFT provided both cash and in-kind contributions, actively participating in meetings and publications.

"We had meetings every two weeks. They followed up closely the work of the PhD candidates. And they were included in our publications because they really contributed. Brazilian partners also contributed in-kind, with their time and knowledge, strengthening the international collaboration."

LOOKING AHEAD
The team is now seeking ways to continue the collaboration and expand the research.

"*It was a very good experience, especially for the PhD candidates. We would like to have a follow-up, because it's not always that you find industrial partners that are so engaged.*"

Contact:
Professor Elisabetta Tedeschi
Department of Electric Energy, NTNU, Norway.
Department of Industrial Engineering, University of Trento, Italy
E-mail: Elisabetta.Tedeschi@ntnu.no

STRENGTHENING SAFETY AND SUSTAINABILITY – SOUTHEAST ASIA

Norwegian universities are playing a pivotal role in international academic cooperation through research and educational programs like NORPART and NORGLOBAL, fostering student mobility, joint research, and knowledge exchange with institutions in Southeast Asia.

Professor Yiliu Liu from the Department of Mechanical and Industrial Engineering, NTNU shares insights into how these initiatives contribute to industrial safety and sustainable ocean development.

NORPART: BUILDING SAFETY AND ACADEMIC BRIDGES WITH VIETNAM

The **NORPART program** (Norwegian Partnership Program for Global Academic Cooperation) aims to enhance the quality of higher education in Norway and selected partner countries through long-term academic collaboration and mutual student mobility. Liu's research group, RAMS (Reliability, Availability, Maintenance, and Safety), partnered with five Vietnamese universities and industry partners to improve industrial safety in Vietnam.

The program facilitated semester-long exchanges for around 30 Vietnamese students to Norway each term, and internships for Norwegian students (10) in Vietnam, particularly with Norwegian companies operating there.

"*The program is very popular, and the Vietnamese students are very active for applying for the exchange*." The program concluded in 2023, but its legacy continues.

NORGLOBAL: RESEARCHING SAFER OCEANS ACROSS ASEAN

Funded by the **Research Council of Norway, NORGLOBAL** supports high-quality, policy-relevant research to advance sustainable development goals (SDGs).

The consortium, known as **NESS** (Norway-ASEAN Consortium in Risk Management for Safer and Sustainable Ocean), includes eight countries and focuses on aquaculture, offshore operations, and maritime transport. Activities that are well established in Norway and have safety in common.

Norwegian universities such as NTNU, University of Stavanger, and University of Southeast Norway are central to this collaboration. They lead one work package each, so Liu's team at NTNU leads a work package on offshore safety, collaborating with countries like Malaysia and Indonesia, whose offshore industries share similarities with Norway's.

"*The Malaysian university want to establish a joint study program with NTNU in this field, so, it is a lot of collaboration with Malaysia already.*

For the aquaculture work package, the university of Stavanger has the leading role while university of Southeast Norway handles the maritime transport work package.

"*We organize the annual workshop every year. This year at the beginning of December, we will have the last annual workshop in Indonesia, in*



Photo of Vietnamese students taking part in an interaction workshop between Norwegian and Vietnamese students, supported by NORPART project.

FACTS:
More information: https://ness2025.web.id/

Jakarta. Here we will disseminate joint research results. We support short visits of researchers, and most the partners have sent their researchers and professors to the collaborating universities in Norway."

NORWEGIAN UNIVERSITIES' ROLE AND FUTURE OUTLOOK

Both programs highlight the strategic role of Norwegian universities in global academic cooperation. NTNU, University of Stavanger, and University of Southeast Norway have been instrumental in leading research and facilitating exchanges.

"*This kind of project is very important, but it is relying on the national interest... Still, we try to find some opportunities for future collaboration*."

While government interest in funding such initiatives may be changing, the academic community continues to seek new avenues for collaboration and impact.

Contact:
Professor Yiliu Liu, Department of Mechanical and Industrial Engineering, NTNU
E-mail: yiliu.liu@ntnu.no

VILLAGE, ISLAND, CULTURE – PAPUA NEW GUINEA

How do you show a court what climate change is doing to a community? NTNU researchers combined testimony, geospatial data and 3D modelling to make the losses of a Papua New Guinean village visible.

The village of Veraibari lies at the mouth of the Kikori River in Papua New Guinea's Gulf Province, caught between the river and the rising ocean. Since the 1990s, the sea has risen at an accelerating rate, swallowing coconut groves, homes and traditional burial grounds. The community has already relocated four times and is now planning a fifth move.

EVIDENCE FOR THE WORLD COURT

Between 2024 and 2025, Climate Rights, a research project at the Trondheim Academy of Fine Art (KiT), worked with the Trondheim-based research agency INTERPRT to produce visual evidence of these impacts. The Climate Rights project is funded by the Research Council of Norway and dedicated to developing visual forms of evidence for climate change cases. The work supported the Melanesian Spearhead Group at the International Court of Justice (ICJ), which heard the advisory proceedings on states' obligations in respect of climate change in December 2024.

The project required close collaboration with Blue Ocean Law, an Indigenous-led law firm in Guam representing the Melanesian group before the Court, and Piku Biodiversity Network, a Papua New Guinean community-based conservation group that has worked with Veraibari for ten years.



Digital reconstruction of sacred tree and surrounding context, based on Mrs Aviri Neau's situated testimony. Credits: Climate Rights (NTNU)/INTERPRT, with data from Maxar and NASA



Digital reconstruction of Veraibari showing vegetation and shoreline change between 2007 and 2024.
Credit: Climate Rights (NTNU)/INTERPRT, using own data and data from Maxar and NASA

FROM TESTIMONY TO 3D MODELS

The team recorded video testimony from community leaders on site and combined it with geospatial analysis and new methods for 3D modelling and data visualization, turning a slow, hard-to-see process into evidence a court could examine. In July 2025, the ICJ delivered a unanimous advisory opinion confirming that states have binding obligations under international law to address climate change.

The material has since been adapted into a 20-minute advocacy film, shown at public forums including the Bergen Assembly in 2025 and a legal conference in Port Moresby. For the researchers, it raises a broader question: what counts as evidence in the pursuit of climate justice, and whose knowledge should shape it?

"*When we talk about the obligations of states, in regards to climate change, then we think of the many stories that are untold, like [those of] the 50 villages that no longer exist in the Gulf of Papua, that are mixed in with the stories that are told, like Veraibari, that the people have taken it upon themselves to tell.*"
Yolarnie Amepou, co-founder of Piku Biodiversity Network, quoted in *Village, Island, Culture: Climate Impacts in Veraibari*, the 20-min advocacy video adapted by Climate Rights/ INTERPRT

FACTS:
Project: Climate Rights – Designing Visual Evidence for Climate Cases, led by Professor Nabil Ahmed, KiT, NTNU.
Funding: Research Council of Norway, NOK 8.9 million (2023 – 2028).
Partners: INTERPRT, Blue Ocean Law (Guam), Piku Biodiversity Network (Papua New Guinea).

Contact:
Oskar Johanson, Researcher, Trondheim Academy of Fine Art (KiT), Faculty of Architecture and Design, NTNU.
E-mail: oskar.johanson@ntnu.no

MONITORING REMOTE GLACIERS WITH MOUNTAIN COMMUNITIES

A pilot study in Ladakh brings NTNU researchers, local collaborators and mountaineers together to explore how visits to remote glaciers can help fill gaps in climate and hazard observations.

Many high-altitude glaciers are difficult to monitor, yet mountain guides and experienced mountaineers already visit them. PEAK, a new collaborative project involving Pascal E. Egli at NTNU, aims to use those visits to collect glacier data in Europe, High Mountain Asia and South America.

A PILOT IN LADAKH

In summer 2026, Egli and Karuna Sah, a collaborator from Ladakh, India, carried out a pilot study at Kang Yaze, a 6,250-metre mountain. Working with locals, they collected snow data on a high-altitude glacier. The study provides a starting point for a wider effort to improve observations at locations that are rarely monitored.

The project aims to involve mountain guides and professional mountaineers in collecting snow accumulation and ice-loss measurements to understand glacier mass changes. Participants would also observe potential hazards, including ice avalanches and glacier lakes.

WORKING WITH PARTNERS IN MOUNTAIN REGIONS

Collaboration with partners in the Global South is central to the proposed data collection. The approach builds on the presence and experience of people travelling in mountain environments to extend the reach of glacier observations.

Egli's related work includes GOTHECA in northern Pakistan, where researchers collected drone and radar data on surge-type glaciers, which can advance rapidly and produce glacial lake outburst floods. Although GOTHECA has ended, data analysis and collaboration with local partners continue.

Egli also works on CryoSCOPE, an EU-funded project with Indian partners. The team models glacial lake outburst floods for a glacier in southern Norway, studies future droughts due to glacier retreat in Switzerland, and investigates how cryospheric changes affect communities and the economy in Ladakh and Switzerland.



Pascal Egli measuring snow density at Kang Yaze II (6,250 m) in the Ladakh Himalayas, India, on 9 August 2026. Credit: Pascal E. Egli

FACTS:
Project: PEAK, a collaboration to improve glacier measurements.
Pilot location: Kang Yaze, Ladakh, India; summer 2026.
Research focus: Snow accumulation, ice loss and glacier hazards.
Related collaborations: GOTHECA (Research Council of Norway), Pakistan; CryoSCOPE (EU), with Indian partners.

Contact:
Pascal E. Egli, NTNU.
E-mail: pascal.e.egli@ntnu.no

LIVING WITH WATER IN COASTAL INDONESIA

NTNU researchers are working with Indonesian partners and coastal communities to explore adaptation choices that combine scientific climate-risk evidence with residents' everyday experience.



A child walks through an alley affected by daily tidal flooding in Eretan Wetan, West Java, Indonesia, on 22 June 2026.
Credit: Bintang Noor Prabowo / NTNU.

In Eretan Wetan and Eretan Kulon, fishing communities on the northern coast of West Java live with recurring tidal flooding, coastal erosion and changing water conditions. Through the Indonesian Living Lab of PARCS, NTNU works with Institut Teknologi Bandung, other consortium partners, local authorities and residents to explore how settlements and livelihoods can adapt.

DEVELOPING CHOICES WITH COMMUNITIES

The Living Lab is located in Kandanghaur District, Indramayu Regency. Here, tidal flooding, extreme rainfall and saltwater intrusion affect homes, infrastructure and livelihoods. Participatory discussions and scenario-building connect these risks with local knowledge and community priorities.

The work explores possible responses such as improved drainage, coastal protection, resilient housing and nature-based measures. These are pathways under consideration within an ongoing research and co-design process. The intended outcome is a community-informed adaptation blueprint to help residents and decision-makers assess which options fit their circumstances.

ASSESSING LONG-TERM SUSTAINABILITY

NTNU contributes research on participatory resilience scenarios, energy and water management, and life-cycle sustainability and circularity. Visual tools help communicate and compare adaptation options. Considering the resources and requirements of each option supports discussion of its feasibility and long-term sustainability.



FACTS:
Project: PARCS — Participatory Approaches for Regenerative Climate Solutions.
Funding: 2023 New Frontiers in Research Fund – International Joint Initiative, involving funding agencies in Canada, Norway, the UK, the US and Switzerland.
Local university partner: Institut Teknologi Bandung, Indonesia.
Living Labs: Indonesia, Colombia and the United States.

The PARCS team visits the Indonesia Living Lab in Eretan Wetan, West Java, Indonesia, on 22 June 2026. Credit: Bintang Noor Prabowo / NTNU.

PARCS also works through Living Labs in Colombia and the United States. The Indonesian collaboration brings the project's interdisciplinary approach into dialogue with the particular conditions of West Java's coast. By examining trade-offs and implementation requirements with local participants, the research aims to support adaptation decisions that communities can help shape.

Contact:
Bintang Noor Prabowo, Department of Architecture and Technology, NTNU.
E-mail: bintang.n.prabowo@ntnu.no

PLANNING FOR EXTREME FLOODS IN INDIA

After unprecedented monsoon floods in Wayanad, NTNU research examined how emergency responses and long-term planning can reflect local resources, capacities, governance and community resilience.

The 2018 and 2019 floods brought compounded uncertainty to Wayanad, a peri-urban hill district in Kerala, India. Research by Mrudhula Koshy at NTNU's Department of Architecture and Planning uses qualitative fieldwork conducted over time to connect immediate humanitarian needs with planning for future events.

CONNECTING EMERGENCY RESPONSE AND PLANNING

The research examines institutional responses when extreme weather disrupts established plans and protocols. It develops contingency planning grounded in local circumstances, linking humanitarian action with spatial planning under uncertainty.

"*Planning traditionally operated with static knowledge and tools which are insufficient to account for current urban complexities which combine climate change effects with geopolitical tensions, rapid urbanization, financial crises and forced displacement*", says Associate Professor Mrudhula Koshy. Her research also examines what institutions can learn from communities' informal, organic responses to disruption.

WHOSE KNOWLEDGE INFORMS ADAPTATION

Exploratory fieldwork in peri-urban South Asia examines whose knowledge, voice and power shape planning. "*In this regard, we need methods, modalities and frameworks that can decolonise planning under uncertainty and redress colonial legacies and policy transfers from the Global North to Global South contexts*", Koshy says.

Her international collaborations address resilient urban rivers through NORPART PEARLS, localising the Sustainable Development Goals through the Norway–India–South Africa partnership NISA, and equity and justice in climate policies through Horizon EU RECAPS.

She also leads the Adaptation thematic group under NTNU Societal Security, investigating how cities, critical infrastructure and communities can adapt to compounded crises. These transdisciplinary initiatives connect planning research, innovation and education with local contexts.



Paddy fields in Wayanad, northern Kerala, India, in October 2019.
Credit: Mrudhula Koshy.

FACTS:
Research focus: Extreme weather, community resilience, climate adaptation and planning under uncertainty.

Related collaborations: PEARLS (NORPART, 2025–2028); NISA (UTFORSK, 2022–2026); RECAPS (Horizon EU, 2026–2030).

Contact:
Mrudhula Koshy, Department of Architecture and Planning, NTNU.
E-mail: mrudhula.koshy@ntnu.no

CHANGING WATERS, CHANGING COMMUNITIES IN THE HIMALAYA

Threatened Lifelines combines research on changing meltwater flows and societal change with community engagement to explore just and sustainable adaptation pathways in Ladakh.

Communities in the semi-arid Himalayan region of Ladakh depend heavily on seasonal meltwater. Climate-induced changes to snow and glaciers are altering these vital water flows, creating significant uncertainties about the future. NTNU's Threatened Lifelines project brings together researchers from human and physical geography, and hydrological modelling with communities to investigate how climate change affects mountain water systems and the people who rely on them.

UNDERSTANDING CHANGING WATER FLOWS AND COMMUNITIES

The physical geography and modelling component links climate scenarios with glacier and water-flow models, calibrated using precipitation and streamflow measurements, to improve understanding of how water availability may change in the future. The human geography research examines how changing water flows affect communities and their adaptation strategies and relates these experiences to wider societal changes, which in turn shape potential future adaptation pathways.

EXPLORING FUTURE ADAPTATION AND DEVELOPMENT PATHWAYS WITH COMMUNITIES

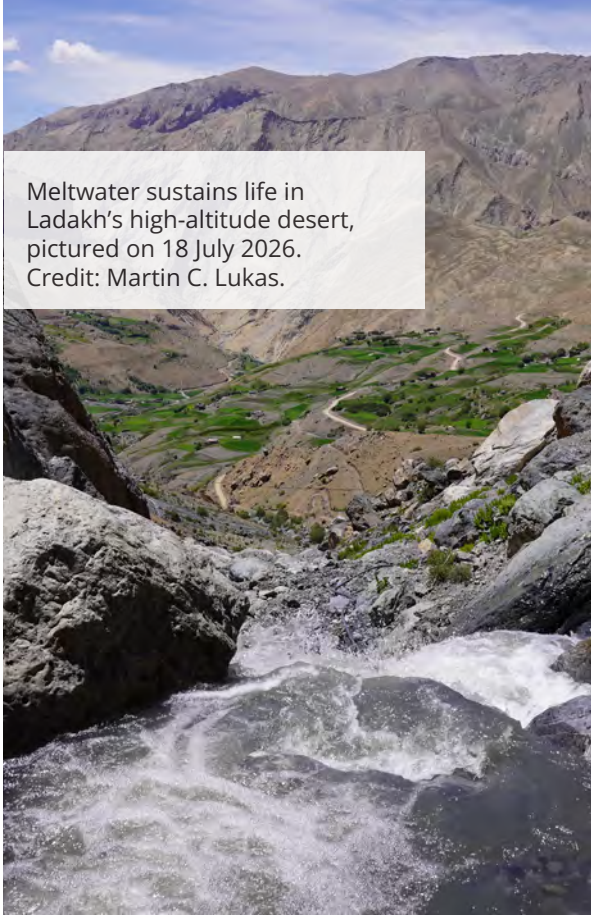
Ladakh has a strong tradition of equitable water and resource management rooted in village communities. Wider development processes are reshaping these communities while climate change alters their water flows. The project involves communities in analysing both processes through conversations, reflective photography, participatory precipitation and streamflow measurements, and workshops. Connecting scientific analysis with local knowledge, concerns and aspirations, the team and communities jointly explore sustainable and equitable adaptation and development pathways in Ladakh's high-altitude deserts.



The modelling team and village representatives after installing a level logger in the river above the village on 18 July 2026. Credit: Martin C. Lukas.



The modelling team and village representatives installing a level logger in the river above the village on 18 July 2026. Credit: Pascal E. Egli.



Meltwater sustains life in Ladakh's high-altitude desert, pictured on 18 July 2026. Credit: Martin C. Lukas.

BUILDING LONG TERM PARTNERSHIPS IN THE HIMALAYA

Threatened Lifelines is also building collaborations with Himalayan scholars and civil society organisations, laying foundations for long-term interdisciplinary and transdisciplinary research and educational cooperation on climate adaptation and sustainable mountain development.

FACTS:

Project: Threatened Lifelines. Analysing and managing the impacts of shrinking glaciers and snow cover on water flows and livelihoods in mountain communities of the Indian Himalayas.
Funding: NTNU Community.
Location: Ladakh, India.

Contact:
Martin C. Lukas, Department of Geography and Social Anthropology, NTNU.
E-mail: martin.c.lukas@ntnu.no

FROM OIL AND TIN MINES TO CLEAN WATER – INDONESIA, NAMIBIA AND TANZANIA

When natural resources are extracted or new technologies arrive, do local communities actually benefit? And do their perceptions and expectations of government change? Through survey and field experiments in different resource-rich countries, NTNU economists are testing what happens on the ground.

INDONESIA – INFORMED CITIZENS IN OIL AND MINING DISTRICTS

Publishing revenue information is a common remedy for the resource curse, on the assumption that informed citizens will hold leaders to account. Professor Christa Brunnschweiler tests this assumption. In the oil-producing regency of Bojonegoro, East Java, revenue information has been published since 2009, yet in a 2022 survey 87% of residents felt they knew little or nothing about how the sector was managed. A follow-up experiment showed that short videos featuring positive local examples strengthened people's sense of their right to benefit from, and influence, resource revenues. In tin-producing Bangka Belitung, where 80% of residents had never heard of the community development scheme funded by mining companies, a 2025 experiment with 610 people found similar effects. "*We have learned what works to inform people of their rights regarding resource revenues but getting them to act on the information has proven more challenging*", says Professor Christa Brunnschweiler. The lesson from both studies: information helps, but citizens also need real channels to act on it.



A survey enumerator interviews a randomly selected respondent using a visual aid to explain the answer scale on Bangka Island, Indonesia, pictured in 2025. Credit: Tiara Elgifienda.

NAMIBIA – WHAT HAPPENS BEFORE THE OIL BEGINS TO FLOW

Namibia recently discovered giant offshore petroleum deposits. The estimated impacts in terms of job creation and GDP contribution of future oil production diverge widely between the Namibian government and the foreign oil companies. A survey experiment among 800 randomly chosen respondents in Namibia's capital Windhoek run in May 2026 exploited these different predictions and finds that citizens are more willing to compromise on impartiality, environmental standards and civil rights when they hope to benefit from future oil production. "*The timing of our experiment allows us to get a unique insight into how resource extraction starts affecting people's attitudes long before any revenues materialize – and the results unfortunately do not look very promising for Namibia's future institutional quality*", says Professor Christa Brunnschweiler.

Solvatten solar water-treatment containers being distributed to households in Uyui District, Tanzania, in 2026. The containers use sunlight to make water safe to drink. Credit: Samwel Nassary.



TANZANIA – SOLAR-POWERED SAFE WATER
In Uyui District, Tabora Region, a randomized controlled trial assigns 900 households a solar water-treatment canister, an equivalent cash transfer, or neither. The researchers will study the effects on children's health and schooling, especially for girls, on women's time use and work outside the home, and on willingness to pay for collective water provision. The trial runs in autumn 2026.

FACTS:
Indonesia partners: Universitas Gadjah Mada, Universitas Bangka Belitung, University of Oulu, FITRA and Gubuk Foundation; funded by the Research Council of Finland.

Namibia partners: University of Oulu, The Institute for Public Policy Research (IPPR); funded by NTNU and the Research Council of Finland (AsPredicted #288,068 and #288,259)

Tanzania partners: University of Copenhagen, Ghent University, Cornell University, University of Dar es Salaam, Solvatten, World Vision Tanzania; funded by DANIDA and NTNU (AEA RCT Registry, AEARCTR-0019427, AEARCTR-0019426, AEARCTR-0019305).

Contact:
Professor Christa Brunnschweiler, Department of Economics, NTNU.
E-mail: christa.brunnschweiler@ntnu.no

JOINT LEARNING ON PEOPLE DRIVEN URBAN RIVER REGENERATION – NEPAL AND KENYA

Urban rivers have always been lifelines of cities. However, they are often still treated as drains and dumping grounds. Through the PEARLS collaboration, NTNU and partners in Nepal and Kenya are learning together how to turn them into safe, healthy and inclusive public and natural spaces.

In the pursuit of economic growth, many cities have exploited their rivers, filling them with waste and untreated wastewater. With climate change bringing more intense floods and droughts, rivers have become places of risk, and the poorest communities, often living closest to the water, are hit hardest.

PEOPLE AND NATURE TOGETHER

NORPART-PEARLS (People-centred and Resilient Spaces related to Urban Rivers) builds on a simplethe idea: that social and environmental sustainability are closely intertwined. Public spaces along rivers can strengthen bothHence the project aims at promoting , supporting climate-resilient urban transformation with local communities at the centre.

Led by Professor Peter Andreas Gotsch, from the Department of Architecture and Planning at NTNU, the collaboration brings together the Institute of Engineering at Tribhuvan University (Nepal), the University of Nairobi (Kenya), the Centre for Integrated Urban Development (Nepal), the Kounkuey Design Initiative, and UN-Habitat (Kenya).

A polluted, canalised tributary of the Bagmati River without riparian buffer zones attracts new property investment in Kathmandu, Nepal, pictured in 2022. Credit: Peter Gotsch.





Urban gardening and small-scale farming along the Nairobi River support vulnerable communities' livelihoods amid rising development pressures, pictured in 2025. Credit: Peter Gotsch.

JOINT LEARNING ACROSS CITIES

Through research, teaching, fieldwork and mobility programmes, PEARLS connects universities, organizations, students and residents across very different cities. In the fall of 2025, students and young researchers joined fieldwork and an international workshop in Nairobi on nature-based solutions, informal settlement upgrading and resilient housing.

The collaboration grew out of a global community of knowledge and practice that NTNU helpedPeter Gotsch launched with the support of NTNU in 2021 and that has been present at several globel events such as UN-Habitat's World Urban Forums in Poland and Egypt. It is complemented by the doctoral research of Vija Viese, in the project titled "Stewards of Surging Streams", which examines flood resilience and community stewardship of urban rivers.

FACTS:

Funding: NORPART, Norwegian Directorate for Higher Education and Skills (HK-dir), project NORPART-2024/10111 (2025 – 2028).

Partners: Tribhuvan University (Nepal), University of Nairobi (Kenya), Centre for Integrated Urban Development, Kounkuey Design Initiative, UN-Habitat.

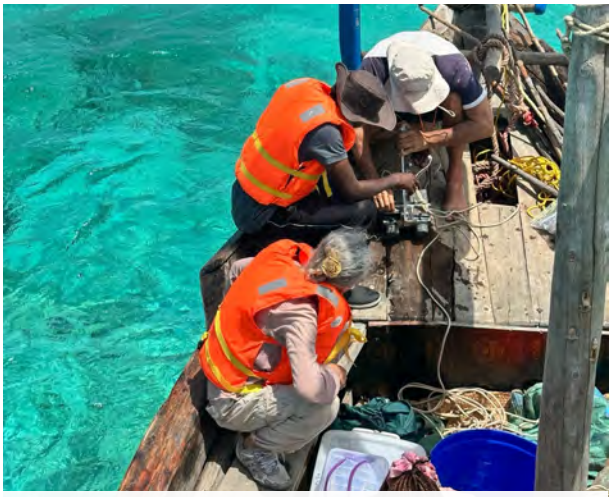
More information at
https://sites.google.com/view/norpart-pearls/home

Contact:
Professor Peter Andreas Gotsch, Department of Architecture and Planning, NTNU.
E-mail: peter.a.gotsch@ntnu.no

CONNECTING COASTAL SCIENCE, ENERGY AND CLIMATE THROUGH GLOBAL PARTNERSHIPS – GHANA AND TANZANIA

Phytoplankton are the ocean's own solar energy system. NTNU and partners in Ghana and Tanzania are building the skills and low-cost tools needed to protect the coastal ecosystems that depend on them.

These microscopic algae turn sunlight into chemical energy, forming the base of the marine food web. Warming, mangrove loss and pollution weaken this natural energy flow. Case study areas range from e-waste, gold-mining and agricultural pollution sites in Ghana to the densely populated coasts of Dar es Salaam and Zanzibar and the Mnazi Bay–Ruvuma Estuary in Tanzania. Yet data on these coastal environments are scarce.



Credits: Mathew K. Avarachen

BUILDING CAPACITY TOGETHER

NTNU's Marine Chemistry and Biogeochemistry group coordinates two projects that help fill this gap: BC5 (Building Capacity to Crosslink Coastal Pollution with Climate Change), funded by Norad, is a strategic North-South-South collaboration with the University of Ghana, and the University of Dar es Salaam, building long-term research capacity through 11 PhD and 33 master's students.

DiverSea, funded by Horizon Europe, combines environmental DNA, satellite images and artificial intelligence to monitor coastal biodiversity. In Ghana and Tanzania, local researchers are trained to use these methods with local boats and simple equipment.



Credits: Catherine A. Maso



Credits: Mathew K. Avarachen

FRUGAL METHOD AND TOOLS: AFFORDABLE TOOLS, LOW FOOTPRINT, AND BIG DATA COVERAGE

Frugal methods are at the core of the work: low-cost, robust and easy-to-use tools that need little servicing. They make researchers independent of costly engineering and service support, which is one of the main reasons why many countries cannot yet produce their own data and knowledge. Because the tools are affordable and easy to use, partners can sample more sites, more often, filling data gaps across the Global South. The tools also have a small CO2 footprint, and Sailing4Science, an UN Ocean Decade Action initiated by NTNU, reduces this footprint further by using wind power and sampling from local fishing boats in Tanzania and canoes in Ghana.

FACTS:

BC5: Norad (NORHED II), NOK 19.8 million; NTNU, University of Ghana, University of Dar es Salaam.

DiverSea: EU Horizon Europe, about €9.6 million, 19 partners in 13 countries (2023 - 2027).

Sailing4Science: UN Ocean Decade Action, NTNU and University of Gothenburg.

Contact:
Mathew Kuttivadakkethil Avarachen, Researcher and Project Coordinator, Department of Chemistry and Biomedical Science, NTNU.
E-mail: mathew.avarachen@ntnu.no

Murad V. Ardelan, Professor, Department of Chemistry and Biomedical Science, NTNU.
Email: murat.v.ardelan@ntnu.no

BRINGING LOCAL EXPERIENCES INTO GLOBAL CLIMATE PATHWAYS – KENYA, SOUTH AFRICA AND ZAMBIA

Climate policies are designed globally and nationally, but their effects are felt locally. NTNU researchers and partners in Africa and Europe are exploring how people's experiences of these policies can inform fairer transitions and more representative global scenarios.

Led by Professor Rolee Aranya, NTNU's CREST-GLOBAL network brings together eight senior researchers from three departments of the Faculty of Architecture and Design. Their expertise is in equitable, inclusive and sustainable urban and societal transitions. The network's flagship Horizon Europe project, ReCAPS, connects international climate ambitions with the realities of implementing them locally.

LEARNING FROM SIX URBAN REGIONS

ReCAPS examines how international and national climate policies affect equity and justice in six urban regions:

- Greater Nairobi (Kenya)
- Cape Town (South Africa)
- Lusaka (Zambia)
- Zagreb (Croatia)
- Greater Lisbon (Portugal)
- Trondheim (Norway)

Local research in Africa is led by partners including the University of Nairobi, the University of Cape Town and the University of Zambia. In Europe, the research is led by university and not for profit partners in Lisbon (LNEG and S.ENERGIA), Zagreb (IRMO and DOOR) and Trondheim (NTNU and OI-MAT).

The team will gather evidence of lived experiences. It will look at who is left out, what blocks a fair transition, and which trade-offs are made during implementation. Competing development priorities, overlapping institutional responsibilities and existing climate vulnerabilities all shape what policies achieve and who benefits. Comparing African and European contexts allows partners to assess societal readiness, meaning whether climate policies can be implemented in ways that are both feasible and just.

CONNECTING LOCAL EVIDENCE AND GLOBAL SCENARIOS

The researchers will use this evidence to extend the Shared Socioeconomic Pathways. These are the storylines of possible global development used in integrated assessment models, including those behind IPCC reports. The team will also propose supplementary Just Climate Policy Pathways, linking global scenarios with local implementation challenges and justice considerations.

Through inclusive research and co-produced insights, ReCAPS aims to make climate strategies more socially relevant and to better align national ambitions with local policies and needs.





The photos show the Waste to Energy Plant in Ngong Municipality, Kajiado County, Kenya.
Credits: Researchers in ReCAPS

FACTS:
Project: ReCAPS — Re-assessing climate policies for equity and justice through societal readiness.

Funding and duration: Horizon Europe, September 2026–August 2030. Coordinated by NTNU.

Contact:
Professor Rolee Aranya, Department of Architecture and Planning, NTNU.
E-mail: rolee.aranya@ntnu.no

BUILDING CAPACITY FOR JUST TRANSITIONS IN EAST AFRICA

NTNU and university partners in Uganda, South Sudan and Kenya are strengthening research and education on the social dimensions of climate and energy transitions.

Energy transitions raise questions about equity, inclusion and governance alongside the development of new technologies. The Just Transitions project brings NTNU together with East African institutions to strengthen the knowledge and skills needed to address these questions in local contexts.

A UNIVERSITY PARTNERSHIP ACROSS EAST AFRICA

The collaboration involves Makerere University and Makerere University Business School in Uganda, the University of Juba in South Sudan, and the Technical University of Kenya. Funded through Norad's NORHED II programme, it focuses on building research and educational capacity in interdisciplinary social sciences and humanities.

These perspectives help researchers and practitioners examine how uneven development and institutions shape transitions. They also bring attention to the people affected by changes in energy systems and climate policy, and to the conditions needed for socially just outcomes.

CONNECTING DECARBONISATION AND DEVELOPMENT

Social sciences and humanities remain underrepresented in research and training programmes across the Global South. Just Transitions addresses this gap by equipping academics, researchers and practitioners with knowledge and skills to develop responses suited to their contexts.

Through its East African collaborations, the project has strengthened research and educational capacity. Its aim is to support solutions that advance decarbonisation alongside social justice and development goals. For universities, this means building the capacity to study the social consequences of transitions and to inform how they are planned.

The collaboration was initially funded for 2021–2026 and has received a one-year extension to December 2027.

FACTS:

Project: Just Transitions, capacity building for socially just and sustainable transitions in East Africa.

Funding: Norad, NORHED II; NOK 20 million. Initially 2021–2026, extended to December 2027.

Partners: NTNU; University of Stavanger; Makerere University; Makerere University Business School; University of Juba; Technical University of Kenya.

Students from the NORHED II summer school on Just and Sustainable Transitions overlook construction of the Kingfisher Oil Field on Lake Albert's shores, Uganda, in 2023.
Credit: Alexander Dodge.



Students from the NORHED II summer school on Just and Sustainable Transitions visit the burial site of Omukama Kabelaga II in Bunyoro, Uganda, in 2025.
Credit: Alexander Dodge.

Contact:
Charlotte Anne Nakakaawa-Jjunju, Department of Geography and Social Anthropology, NTNU.
E-mail: charlotte.jjunju@ntnu.no

CONNECTING THE DOTS IN RENEWABLE ENERGY IN NEPAL

When people in Nepal talk about hydropower and clean energy, one name almost always comes up: Dr. Biraj Singh Thapa.

Dr. Thapa is one of Nepal's most recognized voices in renewable energy and green hydrogen. He's an Associate Professor at Kathmandu University (KU) and has also trained at the Norwegian University of Science and Technology (NTNU). Over the years, he has built a career that connects research, policy, and industry—driven by a long-term ambition to help position Nepal as a regional leader in green hydrogen and low carbon industrial development.

FORMATIVE YEARS

His time at NTNU played a major role in shaping how he thinks about education and societal change. It strengthened his commitment to linking high-quality research with real-world implementation —an idea he has carried with him into his work with universities, government agencies, and industry partners in Nepal.

Dr. Thapa's work looks at how hydropower-based green hydrogen can support cleaner transport, make difficult-to-decarbonize industries greener, and at the same time strengthen local value chains and create new industrial opportunities in Nepal.

At KU, he leads the Green Hydrogen Lab, where he and his team are in the front of exploring how renewable power can be turned into green products like fertilizer, cement, steel, and synthetic fuels—supporting both emission cuts and local industry.

Contact:
Professor Ole Gunnar Dahlhaug, Department of Energy and Process Engineering, NTNU.
E-mail: ole.g.dahlhaug@ntnu.no

LONG-TERM COOPERATION

A key part of Dr. Thapa's career has been his effort to build long-lasting cooperation between Kathmandu University and NTNU, and more broadly between Nepal and Norway. For more than a decade, he has helped launch and run major joint projects—such as RenewableNepal, EnergizeNepal, and Hydro-Himalaya.

SHAPING NATIONAL ENERGY POLITICS

Beyond academia, Dr. Thapa has been actively involved in shaping Nepal's energy and climate policies. He has served on several national expert committees, including those working on Nepal's Green Hydrogen Policy. His role helps ensure that local priorities, scientific evidence, and global best practices are included in national strategies.

His goal is clear: to help co-create knowledge and solutions that support a fair, scalable, and context-appropriate energy transition in Nepal, South Asia, and other regions facing similar challenges.



Dr. Biraj Singh Thapa (left) and his long time cooperating partner at NTNU, Ole Gunnar Dahlhaug. (Photo: privat)

SHARING POWER STRENGTHENS RURAL MICROGRIDS IN MADAGASCAR

This project explores how interconnected solar nano grids can improve energy access, affordability, and reliability in rural Madagascar.

The work was carried out in the Diana Region, where communities lack access to the national electricity grid and rely on small, off-grid energy systems for basic services such as lighting and phone charging.

The research idea focused on clusters of nano grids, each serving four to six households through a shared solar PV system and battery. Rather than operating these systems in isolation, the research investigated how nano grids could be physically interconnected to form microgrids, enabling the sharing of surplus electricity between neighbouring clusters. To support this technical interconnection, the project developed and evaluated local electricity market designs that allow peer-to-peer (P2P) energy trading between nano grids.

REAL DATA SHOWS THE VALUE OF ENERGY SHARING

Using real operational data from existing installations, the research combined techno-economic modelling with on-the-ground system layouts to compare different market mechanisms, including bilateral trading and central market clearing.

The results show that P2P trading can improve the financial viability of microgrid projects by enabling energy sharing that reduces required PV and battery sizes.

Overall, the project demonstrates how combining decentralized technologies with simple market coordination can support sustainable development and scalable energy access in rural contexts.

Contact:
Ida Fagerli, Associate Professor / Victor Andreu Banuls Ramirez, PhD Candidate,
Department of Electric Energy, NTNU
E-mail: ida.fagerli@ntnu.no / victor.a.b.ramirez@ntnu.no

FACTS:
Funding: The Horizon 2020 ENERGICA project (funded by the European Commission



Tim Britton, Nikolas Schöne and Nicolas Saincy from Nanoe company talking to people in the villages

AFRICA ENERGICA - TOWARDS A GREEN PATH FOR AFRICA

A team of researchers from NTNU is contributing to a transformative energy project ENERGICA focused on climate change mitigation and sustainable development in the Global South.

It aims to improve access to sustainable energy through locally adapted, community-driven solutions in three demonstration sites—Kenya, Madagascar, and Sierra Leone, each showcasing innovative green energy applications tailored to local needs. NTNU researchers contribute to several tasks of this EU projects. Researcher Haiping Shen at Department of Industrial Economics and Technology Management explains the different demonstration projects in each country.

"*In Kenya, Nairobi, they use solar-powered charging stations for e-bikes, and for urban mototaxis (boda-bodas), supported by battery systems and smart charging infrastructure, which is great for clean mobility*" says Haiping Shen.

In Madagascar, in the Diana Region, they build Nano-grids powering water and food production in 50 rural villages, integrating agri-specific, water-specific, and cooling-specific solutions. This will provide decentralized electricity.

And in Freetown, Sierra Leone, they convert organic waste into electricity and fertilizer, and apply water purification technologies for agriculture in peri-urban and urban areas.

Haiping explains: Each site is tailored to the community's needs. But these technologies are not only reducing emissions but also improving energy access, supporting local economies, and enabling long-term replication and business development.

PREDICTING FUTURE CLIMATE MITIGATION AND ADAPTATION POTENTIAL

Haiping Shen and colleagues are focusing on how these green technologies contribute to climate change mitigation. It is almost done, and the project finishes in October 2025.

"*A key focus of my research is understanding how future climate conditions, towards the year 2050 will effect on designing the future energy systems. Traditionally, energy system optimization relies on historical climate data. This study goes further by integrating future climate projections into energy system optimization models*" Haiping says.





FACTS:
The ENERGICA project, funded by the EU's Horizon 2020 Green Deal program, spans four years (2021–2025) and brings together 28 partners from Europe and Africa.

energica-h2020.eu/about-the-project/

My research investigates:

- **Temperature increases**, which raises cooling demand and overall energy consumption.
- **Changes in wind speed**, affecting wind power generation potential.
- **Life cycle assessment (LCA) on the future energy system, observing the life cycle emissions within different scenarios**.

This approach helps design resilient energy systems that can adapt to changing climate conditions. However, the uncertainty in climate projections can be high.

"*To get the full picture, LCA is conducted, a method that considers emissions from the whole life cycle phases from material extraction to decommissioning. It gives a full picture. "*

"*Findings show that while renewable technologies like wind and solar have near-zero emissions during operation, their supply chains can be material-intensive. In some scenarios, systems with strict CO_2 limits and high energy demand resulted in low climate mitigation potential but very expensive*" says Haiping.

"*In ENERGICA we're using a regional climate and energy model to optimize energy planning. The aim of the project is to guide African nations towards a green development path, using locally adapted technologies and climate-smart strategies*" .

Contact:
Haiping Shen, Researcher / Pedro Crespo del Granado, Associate Professor
Department of Industrial Economics and Technology Management (IØT), NTNU
E-mail: pedro@ntnu.no

MINERAL EXTRACTION FOR ENERGY TRANSITION – INDONESIA

The CitRes network explores how the global rush for critical minerals is changing people's lives and communities across the Global South.

Green transition technologies, such as electric vehicles and renewable energy systems, rely on minerals such as nickel, cobalt, and tin. Most of these resources are extracted in the Global South, including Indonesia, where the islands of Bangka, Belitung, and Sulawesi as key extraction sites. Through research in these regions, the Citizens Engagement in Transnational Resources Management Network (CitRes) examines how mineral extraction in the Global South is linked to the EU policies for transition to a low-carbon society.

THE EXTRACTION DILEMMA

Mineral extraction provides jobs, income and social development. Yet it often threatens local livelihoods, environments and long-term sustainability. These dilemmas are at the core of more than ten years of collaboration between NTNU and four Indonesian universities.

"Together, we examine how growing global demand for minerals shapes everyday life in resource-rich communities in the Global South, and how local experiences are connected to wider political and economic transformations, including EU policies", says Ståle Angen Rye, Professor of Human Geography at NTNU.

CREATING SYNERGIES

At the heart of CitRes network is the integration of research, education, and capacity building. By connecting local experiences of resource extraction with global debates on resource governance and energy transitions, the network develops knowledge and strengthens international collaboration.

Students are important in the network through internships, fieldwork, and academic exchanges. Working in collaboration with researchers and local communities, they contribute to research while developing their own understanding of the social and political implications of sustainability transitions.



Small-scale offshore tin mining in Banka, Indonesia. Credit: Nanang Indra Kurniawan.

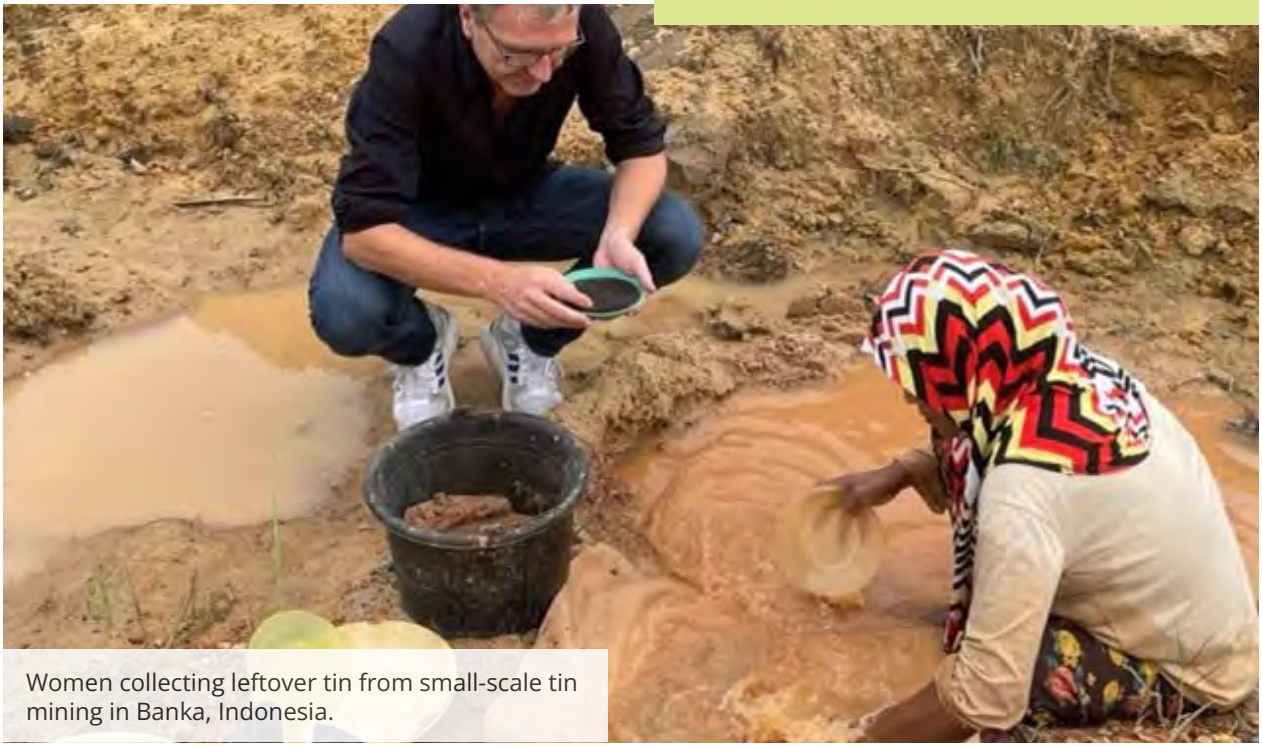
JUST AND SUSTAINABLE TRANSITIONS

In dialogue with governments, industries and local communities, CitRes explores how low-carbon transitions intersect with democracy, justice and sustainable development. "*We are critically examining the unintended consequences of the green transition, and how these transition policies can create inequality and injustice*", says Professor Ståle Angen Rye.

FACTS:

Partner universities: Universitas Gadjah Mada, Universitas Nusa Cendana, Universitas Bangka Belitung and Politeknik Negeri Pontianak.

Projects: SUSTAIN (2020 – 2027, NORHED II/Norad), EPICC (2020 – 2025, ERA-NET COFUND/Horizon 2020), CitRes-Edu (2019 – 2026, NORPART/HK-dir), EnJuST (2024 – 2028, NORPART/HK-dir).



Women collecting leftover tin from small-scale tin mining in Banka, Indonesia.

Contact:
Professor Ståle Angen Rye
Department of Geography and Social Anthropology, NTNU
E-mail: stale.angen.rye@ntnu.no

Storing the Sun and Wind for a Grid Beyond Gas – Bolivia

Solar and wind power are expanding rapidly across the world, but variable generation needs storage that can hold energy for hours, days or seasons. NTNU researchers and partners in Europe, Canada and Bolivia are developing the tools to plan, operate and finance long-duration energy storage, and bringing a Global South perspective into a European flagship project.

Coordinated by Associate Professor Pedro Crespo del Granado at NTNU's Department of Industrial Economics and Technology Management, the Horizon Europe project PowerMAX unites 24 partners from 11 countries: universities, research institutes, utilities, technology providers and transmission system operators. The project studies three storage technologies, molten salt, hydrogen and lithium-ion batteries, and how a single storage asset can earn revenues from several electricity markets and grid services at the same time.

FROM EUROPEAN DEMONSTRATORS TO GLOBAL REPLICATION

The technologies are tested in real operating environments:

- Molten-salt storage at the Gemasolar concentrated solar power plant near Seville (Spain)
- Hydrogen storage at the IdrogeMO site in Modena (Italy)
- A coordinated "swarm" of lithium-ion batteries in Toronto (Canada)

Operational data from these sites are used to validate two open-source planning tools, PyPSA-SMS++ for grid investments and PowerVision for market simulation. Both are released with documentation, training material and cloud access, so that system planners and researchers anywhere can apply them. Replication cases in Norway and Bolivia test whether the methods hold under very different grid and market conditions, and a Stakeholder Forum with more than a quarter of its members from outside the EU keeps the project connected to needs beyond Europe.

BOLIVIA: PLANNING A POWER SYSTEM BEYOND NATURAL GAS

Bolivia's electricity supply still relies heavily on gas-fired generation, while solar power in the southern highlands and wind in the Andean region are growing fast. Declining gas reserves and the gradual reform of fuel subsidies make flexibility a strategic question, and many renewable resources lie far from demand centres, creating transmission bottlenecks. The country has no large-scale energy storage technology today beyond hydropower.

Universidad Mayor de San Simón (UMSS) in Cochabamba and the national transmission system operator CNDC are full partners in PowerMAX. Together with NTNU and SINTEF, UMSS will extend PyPSA-SMS++ with technologies relevant to the Bolivian context, such as flow batteries, compressed-air and sand-based storage, and analyse a 2040



High-level meeting with Bolivian authorities, researchers, and stakeholders in the local kickoff of the PowerMAX project in La Paz.

transition in which a portfolio of storage complements renewables, strengthens the grid and replaces the flexibility now provided by gas plants. The results feed into CNDC's grid-investment planning and into PowerMAX's global technology roadmap for long-duration storage.

A FIRST FOR HORIZON EUROPE IN BOLIVIA

PowerMAX is the first Horizon Europe project in which Bolivian institutions participate as fully eligible, funded partners, made possible by Bolivia's status as a low- and middle-income country under the programme. A regional launch in La Paz in July 2026 brought together the Ministry of Hydrocarbons and Energies, the EU Delegation, system operators and universities to discuss Bolivia's energy transition and the role of storage in a future beyond gas.

The collaboration works in both directions. UMSS contributes expertise on energy-system analysis for emerging economies, and the Bolivian case challenges European tools to handle gas-dependent, hydro-rich systems with limited transmission. Through joint modelling workshops, open-access publications and the open release of all tools, PowerMAX also serves as a template for how Latin American institutions can join and lead future European research consortia.

FACTS:

Project: PowerMAX — Maximizing Grid Integration and Optimization of Long Duration Energy Storage to Synergize Revenue Streams.
Funding and duration: Horizon Europe (grant agreement 101268626), June 2026–May 2030. Total budget approx. EUR 8 million. Coordinated by NTNU.
Bolivian partners: Universidad Mayor de San Simón (UMSS) and Comité Nacional de Despacho de Carga (CNDC). Other partners outside Europe: University of Toronto, Hydro One and eCAMION (Canada).

Website: https://powermax-project.eu

Contact:
Associate Professor Pedro Crespo del Granado, Department of Industrial Economics and Technology Management, NTNU.
E-mail: pedro@ntnu.no


3

STRATEGIC COLLABORATION

SINTEF – GLOBAL SUSTAINABLE DEVELOPMENT



Technology, science, innovation, and interdisciplinary collaboration are essential to achieving the United Nations Sustainable Development Goals. As one of Europe's largest independent research organizations, SINTEF plays a key role in developing and applying knowledge and technology for a better society. While SINTEF has long collaborated extensively with high-income countries, the organization is now strengthening its engagement in low- and middle-income countries through the corporate initiative Global Sustainable Development.

The vision of the initiative is for SINTEF to contribute more actively to sustainable development and equitable transitions in the Global South. This will be achieved through partnerships with industry, academia, public institutions, and civil society. The aim is to create solutions that foster local value creation, strengthen resilience to global crises, and promote fair access to technology and innovation.

The initiative builds on the recognition that global challenges—such as climate change, biodiversity loss, energy crises, conflict, pandemics, and poverty—disproportionately affect people in low- and middle-income countries. SINTEF acknowledges that countries like Norway share responsibility for both the problems and the solutions and seeks to share its knowledge and technology with partners in the Global South.

SINTEF shares this vision with its strategic partner NTNU and has formally established a Gemini- Center Partnership called Global Impact to coordinate our efforts, with Energy being one of our focus areas.

Global Sustainable Development was established in February 2023 and is led by Research Director Anneli Alatalo Paulsen. The initiative enables greater engagement, innovation, and knowledge exchange across SINTEF's institutes, with the goal of generating research results that create lasting and positive global impact.

Contact: Petter Støa PhD,
Vice President Research, SINTEF Energi AS
E-mail: petter.stoa@sintef.no
www.sintef.no

NORAD – ENERGY FOR DEVELOPMENT



Access to reliable and sustainable energy is fundamental to achieving the Sustainable Development Goals and enabling social and economic development in the Global South. Norad's energy initiatives focus on expanding access to modern energy services, promoting renewable energy solutions, and building local capacity for long-term, climate-friendly energy systems. The Energy for Development program supports authorities, businesses, and institutions in countries such as Malawi, Mozambique, Nigeria, Nepal, Somalia, and Tanzania, while also working through international partners to mobilize investment and reduce risk in renewable energy projects.

NTNU's strong foundation in research, innovation, and education makes it a valuable partner in this agenda. Through collaboration with Norad, NTNU can contribute scientific knowledge, technological expertise, and capacity development to strengthen sustainable energy systems in partner countries. Joint efforts may include research on renewable energy technologies, policy and systems development, training programs, and innovation partnerships that connect academia, industry, and local communities.

Together, NTNU and Norad can accelerate the transition to sustainable energy and support inclusive growth and resilience in the Global South.

RESEARCH INFRASTRUCTURE - NORWAY - NEPAL



Francis turbine model fabricated in PTM, Norway arrived KU-TTL on August 16, 2024.
The installation of the turbine is planned in the presence of manufacturers.

The Turbine Testing Laboratory (TTL) at Kathmandu University (KU) represents a long-term achievement in the collaboration between KU and NTNU, supported by Norad and the Royal Norwegian Embassy in Kathmandu. The idea for the lab emerged in the late 1990s when KU recognized Nepal's growing need for quality assurance, research, and innovation in hydropower. Early planning began around 1997–2001, with technical and academic support from NTNU's Waterpower Laboratory. KU committed to training its staff through postgraduate studies at NTNU and allocated land and resources for the lab's construction.

Construction of the TTL began in the mid-2000s and was completed in 2011. The facility was designed to serve as a national center for testing mini- and micro-hydropower turbines, conducting certification, product development, and sediment erosion research — a major challenge for Himalayan hydropower plants. The collaboration strengthened through the efforts of key figures such as Professors Arne Kjølle, Hermod Brekke, and Ole Gunnar Dahlhaug at NTNU, and Bhola Thapa, Biraj Singh Thapa, Sailesh Chitrakar, and Hari Prasad Neopane at KU.

From 2016 onward, the EnergizeNepal program, funded by the Norwegian Ministry of Foreign Affairs, enabled TTL to reach international standards for turbine testing. The project supported the design, fabrication, and installation of a new Francis turbine test rig, developed in partnership with SINTEF Energy Research, Hydro Lab Pvt. Ltd., and PTM Industrier AS in Norway. By 2024, TTL had received its newly fabricated stainless-steel model turbine, marking a milestone for Nepal's hydropower research capacity.

Today, TTL is a state-of-the-art research and testing facility, serving as a hub for academic and industrial collaboration. It continues to produce skilled engineers and researchers, advance hydropower technology for sediment-heavy rivers, and symbolize over two decades of successful Norwegian–Nepalese cooperation in sustainable energy development.

Contact:
Norway: Ole Gunnar Dahlhaug
Department of Energy and Process Engineering, NTNU
E-mail: ole.g.dahlhaug@ntnu.no

EDUCATION – MASTER COURSE HYDROPOWER



Students taking part in the Hydropower Development Program.

Professor Dagfinn K. Lysne founded the Hydropower Development program (HPD) as a one-year diploma course in 1976 at the Department of Hydraulic Engineering at NTNU. In 1993, the diploma course was converted into a two-year master's program, and student admissions have continued annually since then.

The HPD program has been highly successful and over the years benefiting more than 450 students from 50 countries across the globe. From 1976 to 1993, a total of 256 NORAD scholars completed the diploma course. From 1993, it has admitted about 12 NORAD scholars per year. The majority of the HPD scholars have returned to their home countries and made a significant contribution to the domestic development of hydropower.

The Hydropower Development Program was originally aimed at people with a prior bachelor's degree within civil engineering and focused on hydraulic and civil engineering. Over the last year the program has broadened and has brought together the broad expertise NTNU has built up over the last century as an internationally leading institution in hydropower education to provide students with the best possible selection of courses and specializations in hydropower and energy management.

Contact: Professor Oddbjørn Bruland
Study program leader for MSc. in HydroPower Development.
E-mail: oddbjorn.bruland@ntnu.no

GOING FORWARD

OUTLOOKS TO FURTHER STRENGTHEN ACTIVITIES IN THE GLOBAL SOUTH

- **Develop Long-Term, Equitable Partnerships**
  Move beyond short-term project collaborations toward long-term institutional partnerships based on mutual benefit, shared governance, and local ownership. Ensure that research agendas are co-created with partner institutions in the Global South, addressing locally defined priorities, and anchor them in NTNU's strategy for 2026–2035.

- **Strengthen Capacity Building and Knowledge Exchange**
  Expand joint degree programmes, PhD supervision, and staff exchanges at bachelor's, master's and PhD level. Encourage co-teaching, co-publication, and co-supervision as central elements of collaboration, so that partnerships remain active between visits.

- **Invest in the Next Generation of Researchers**
  Build networks of early-career academic staff and PhD candidates across NTNU and partner institutions, using the Global South Initiative's and NTNU Energy seed funding for early-career networks as a starting point. Give young researchers on both sides ownership of joint workshops, and spin off projects, so that today's projects become tomorrow's long-standing partnerships.

- **Promote Interdisciplinary Research for Sustainable Development**
  Use NTNU's strengths in technology, innovation, and interdisciplinary collaboration to tackle complex global challenges in partnership with local researchers, communities, and industries. Within the Global South Initiative's thematic areas, NTNU Energy should take the lead on just climate transition and renewable energy, and connect energy with biodiversity and environmental sciences.

- **Develop a Research Agenda on Just Energy Transitions**
  Through NTNU Energy's focus area Energy Transition in the Global South, develop new research questions and methods on how the energy transition can be accelerated in low- and middle-income countries: leapfrogging to decentralised and intelligent energy systems, institutional and governance conditions, financing models, and the social dimensions of large energy developments. Use dialogue meetings and workshops with partner institutions to shape this agenda jointly.

- **Support Innovation Networks in the Global South**
  Collaborate with partners like local universities, startups, public institutions, and Norwegian industry to co-develop context-appropriate technologies and scalable solutions that contribute to sustainable and inclusive economic growth. Treat entrepreneurship and innovation as cross-cutting fields in all partnerships, and involve Innovation Norway and the Norwegian embassies early.

The goal for the project in Aberdeen, Sierra Leone, is to take food waste that would normally go to landfill, like the one at the picture, and convert this food waste into renewable energy that can power homes and businesses in the community.



- **Engage in Policy and Societal Impact**
  Link research collaborations to policy dialogues and societal applications. Facilitate evidence-based policy development in areas such as renewable energy, digital transformation, health technologies, and climate adaptation. Build on NTNU's presence at COP30 and COP31 by making COP and other international arenas a regular platform for bringing research and Global South partners' voices to decision-makers, together with SINTEF and Nordic university partners.

- **Leverage Global Networks and Funding Opportunities**
  Strengthen engagement in international funding schemes that support partnerships in the Global South, in particular Horizon Europe, Norwegian Aid Agency's (NORAD) higher education and research collaboration funding, the Research Council of Norway, Erasmus+, and multilateral donors. Use the Global South Initiative's and NTNU Energy's seed funding to prepare competitive consortia, and build the administrative capacity needed to lead and manage large international projects.



NTNU | Strategic Research Areas