

Norwegian University of Science and Technology

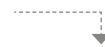
NTNU IN THE GLOBAL SOUTH





PHOTO: SHUTTERSTOCK

NTNU Energy is one of five strategic areas at NTNU.



CIVIL SECURITY | OCEAN AND COAST | COMMUNITY | ENERGY | HEALTH AND LIFE SCIENCE

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www.ntnu.no/energy

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INTRODUCTION

NTNU is Norway's largest university and a leading European institution in science and technology. 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.

NTNU Energy's strategy is grounded in the recognition that the global energy transition must be rapid, inclusive, and deeply interdisciplinary. The goal is to ensure access to clean, affordable, and reliable energy for all, while safeguarding biodiversity, promoting democratic governance, and enabling sustainable industrial development. This requires not only technological innovation but also systemic transformation across societal, economic, and environmental domains.

The global energy transition presents a historic opportunity for developing countries to leapfrog directly into sustainable, intelligent, and low-carbon energy systems. This booklet highlights research and educational partnerships between NTNU and institutions across the Global South. Through joint projects, student exchanges, and co-developed technological solutions, NTNU's collaboration with the Global South has been designed to foster equitable access to clean energy innovation. Sustained partnerships will not only accelerate the global energy transition but also empower developing economies to become active leaders in shaping a sustainable future.



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



NTNU LONG STANDING COLLABORATION IN THE GLOBAL SOUTH

THE ENGINEERING ADVENTURE IN NEPAL

Nepal holds vast potential in hydropower, and the country is well underway in developing this valuable, renewable resource. A long-term collaboration between NTNU and Kathmandu University is contributing to both knowledge and friendship.

The seeds of Norwegian cooperation with Nepal were sown as early as the late 1950s, when civil engineer and missionary Odd Hoftun was sent to Nepal. Educated at NTH, Hoftun primarily “missioned” as an engineer. He helped build up healthcare, industry, and hydropower in a country that had only recently opened to foreign visitors. Hoftun dismantled old power plants in Norway and had them rebuilt in Nepal.

AN ACADEMIC PARTNERSHIP

In 1976, the Department of Electric Power Engineering at NTH/NTNU launched a 10-month annual diploma course for young engineers from the Global South. This initiative has continued in various forms, depending on changing support schemes and requirements. One such requirement was to find a partner institution in Nepal. In 1991, an agreement was made with Kathmandu University (KU) to establish a master's program. Over the years, this collaboration has taken many forms.

In 1999, NTNU's hydropower community also joined the effort. The partnership gained momentum when Professor Ole Gunnar Dahlhaug spent a sabbatical year (2003/2004) in Kathmandu as a visiting professor.



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

A MEMORABLE ENCOUNTER

"I remember landing at Kathmandu airport for the first time. As I stepped off the plane, I was met with unfamiliar smells, sounds, and a chaotic traffic scene on the way to my accommodation. It was quite overwhelming, and I thought: What have I gotten myself into? But the next morning, when I pulled back the curtains and saw the Himalayas bathed in sunlight, I had no doubt," recalls Dahlhaug.

He speaks passionately about Nepal, highlighting the immense hospitality and the warm welcome extended everywhere.

The year as a visiting professor passed quickly and was full of experiences. A lasting collaboration in research and development of hydropower machinery was established. The contacts NTH/NTNU had built since the 1970s proved valuable.

A SELF-RELIANT UNIVERSITY

A guiding principle of the collaboration has been that Kathmandu University should gradually take full responsibility—both academically and financially—for the master's program in electric power engineering. A critical factor in this strategy is access to qualified teachers and ensuring that those who pursue PhDs abroad return to KU.

"And we know they do," says Dahlhaug. "We meet former students in leading positions within Nepal's hydropower industry and bureaucracy, and many also teach." Professor Bhola Thapa at KU earned his PhD in hydropower machinery at NTNU in 2004, and several others have followed the same path. KU's founder and former rector, Suresh Raj Sharma, was awarded an honorary doctorate from NTNU in 2014 for his initiative and efforts in developing an open and inclusive university in Nepal.



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.

Strong Collaboration Yields Results The partnership has also enhanced NTNU's and Norway's reputation, which benefits Norwegian businesses establishing operations in Nepal. The first spin-off companies in hydropower technology in Nepal have emerged from KU, demonstrating their capabilities in education, research, and innovation.

It has also led to significant outcomes in research infrastructure. With support from Norad, the Norwegian Embassy in Kathmandu, Nepalese industry, and KU itself, a turbine laboratory was built at KU. It matches the capacity of NTNU's Waterpower Laboratory and is known as the Turbine Testing Lab.

FACTS:

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

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Turbine Installation team; Ole G. Dahlhaug,
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Brandåstrø, Åsmund Lerstad, Karina Talmo



LONG-TERM COOPERATION WITH INDIA – NORWAY

For more than 10 years, Professor Armin Hafner and colleagues have collaborated with Indian academia and industry on developing better cooling systems based on natural refrigerants instead of harmful gases that damage our ozone layer and drinking water.

“It was the Ministry of Climate and Environment and the Ministry of Foreign Affairs that had a budget they wanted to use for collaboration with India, and of course we were interested and submitted a suitable application. We were also working on this in Norway and saw opportunities for synergies and collaboration”, says Professor Armin Hafner from Department of Energy and Process Engineering, at NTNU.

This is how INDEE 1 got started, which was a collaboration agreement with the university IIT-Madras in the Chennai region of South India. The focus was to utilize a test facility applying CO₂ as a refrigerant at IIT Madras to share both theoretical and practical knowledge on how such systems can be adapted for end users in India. In addition, they explored how to replace today’s fluorinated gases, which are climate-damaging refrigerants—with natural alternatives, such as carbon dioxide, ammonia, and hydrocarbons that already exist in nature and are not artificially produced chemicals.

THE GLOBAL COMMUNITY TOOK RESPONSIBILITY

The world had already taken a major step through the Montreal Protocol to reduce such chlorine-containing gases, which have been and still are a global problem. The protocol is one of



Team INDEE3 at ACREX India 2025.

the most successful international agreements of all time and has led to a near halt in harmful chlorine gas emissions. It was proposed in 1987 and adopted and ratified by all countries within two years, by 1989, it was in place. That has never happened before or since.

FROM DANGEROUS TO LESS DANGEROUS

But not all harmful gases used as refrigerants were gone. Alternatives based on fluorine compounds, which were introduced in the early 90s, negatively affect the climate in other ways. “What happened was that one type of chemical was replaced with another, without fully knowing how it affects the climate, environment and health”, says Hafner.

But there are refrigerants with so-called natural working media that can be used without major adaptations to the plants. These are

long-term solutions to the problems that many countries have in terms of taking care of all the refrigerants found in the plants that are in use.

GROUNDBREAKING NEWS

Therefore, it was groundbreaking to introduce natural working fluids in daily use right after the Montreal Protocol came into force. The Kyoto Protocol, which was ratified in 2005 (proposed in 1997), put the spotlight on climate challenges due to emissions from refrigerants. And was the first binding climate agreement. This accelerated the transition.

LOCAL COLLABORATION PARTNERS

During the INDEE1 project, a demo system applying CO₂ as refrigerant was built in Italy and sent for local use. "But this only partially succeeded in terms of knowledge transfer. It's a classic mistake when systems aren't produced locally, which led us to strengthen ties with local manufacturers and the supplier industry in India in the next phase," Hafner says. In INDEE+ (2019–2025), they partnered with 3–4 local manufacturers of cooling and heat pump systems who saw the potential and wanted to produce such systems in their own production facilities. The fishing industry has significant needs for cooling and freezing systems, and the demonstration system was developed in collaboration with them.

Additionally, such systems carry significant weight when European buyers need to report **Scope 3 emissions** from products containing raw materials from India. These forward-thinking end users simply receive higher scores from European buyers for environmental and health benefits.



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

HELPED BY INTERNATIONAL AGREEMENTS

So Norwegian expertise was the starting point for applications that got the ball rolling in India. Globally, there is a large chemical industry that is trying to remain in the sales position for many decades to come. But as India has also ratified the Paris Agreement, where countries commit to reducing greenhouse gas emissions and CO₂ equivalents, the country now need to plan the phase-out.

The INDEE+ project has been successful, and the Indian manufacturing industry has developed solutions for hotels with CO₂ based heating of

hot water, and free cooling as a side effect. This is a reintroduction of NTNU Professor Gustav Lorentzen's invention from the late 80s. In India we also find the world's largest chocolate producer, which now has a factory that has been equipped with a cooling system applying a natural refrigerant (CO₂), thereby reducing its emissions.

STRONG GROWTH CONTRIBUTES TO INCREASED EMISSIONS

India has a population of 1.4 billion people, and many need to be lifted out of poverty. This also means rising prosperity, which leads to increased consumption and higher emissions.

The development of systems with natural and thus environmentally friendly refrigerants also leaves a mark in rural areas, where programs have been established to encourage people to live there. "Cooling hubs" are being set up—shared cold storage facilities where food (and vaccines) requiring refrigeration, as well as products for sale, can be stored. (Similar to Norway in the 1950s.)

LONG-TERM COOPERATION CREATES GOOD SOLUTIONS

Now the third edition of the cooperation agreement is underway: INDEE 3. "We are again working with suppliers who develop systems and with the industry itself (end users), as well as on the safe transport of food in trucks with active cooling. Current systems are still not good enough. We have also incorporated the concept of food safety and food waste reduction due to poor refrigeration. Together with our local partners, we are researching solar-powered systems and thermal energy storage".

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.

Another equally important aspect of the INDEE collaboration is what happens between NTNU and local educational institutions. A successful exchange program with postdocs, Ph.D. candidates, and master's students is creating experts. Some of them pass on and develop knowledge from textbooks, educational programs, and courses, helping ensure that the expertise remains in India. The INDEE infrastructure, with all its systems at institutes and end users, is actively used for continuing education, research, and training.

NTNU AND THE GLOBAL SOUTH

Professor Armin Hafner emphasizes that NTNU and the global south have long traditions of real cooperation. - We must continue to use these agreements and contacts in the future. This means that we can quickly get started with the right projects for the countries and regions we already cooperate with. This helps to create lasting changes and lower climate emissions, as well as a competence boost that puts suppliers in a position to export products globally.

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AFRICAN NETWORK IN ENERGY TECHNOLOGY – AFRICA

A series of African joint university projects during the last 15 years have resulted in master programs and research capacity in Renewable Energy, with particular focus on small scale systems with off-grid applications.

The energy picture in low- and middle-income countries (LMICs) in Africa is different from the richer parts of the world. The electricity grid is often less widespread; the power is often unstable and wood-based biofuels are still the dominant energy source in both cities and rural areas. This is well known for Ole Jørgen Nydal, professor at NTNU who has worked with these projects for a long time.

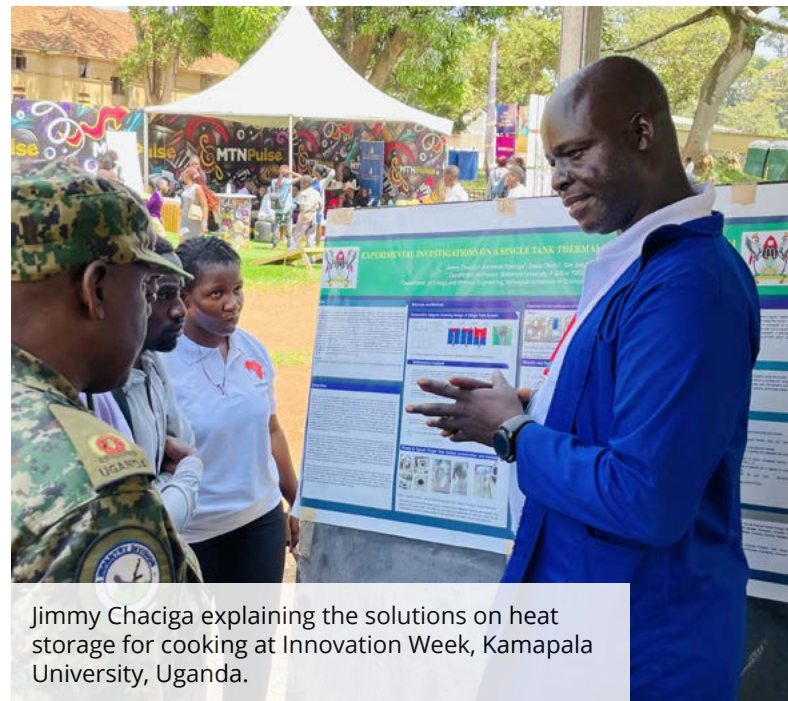
“A special opportunity for Africa is Distributed or Decentralized Renewable Energy Systems (DRE) as an addition to the expansion of the power grid and establishment of new centralized power plants”. The magazine “Economist” (June 2024) describes this as a “decentralized revolution” that will reshape Africa and could further be a model for the rest of the world. The transition to sustainable energy sources demands that new technologies should focus on home-grown, low-cost energy solutions, particularly for the global south.

UNIVERSITY COLLABORATION ON RENEWABLE ENERGY

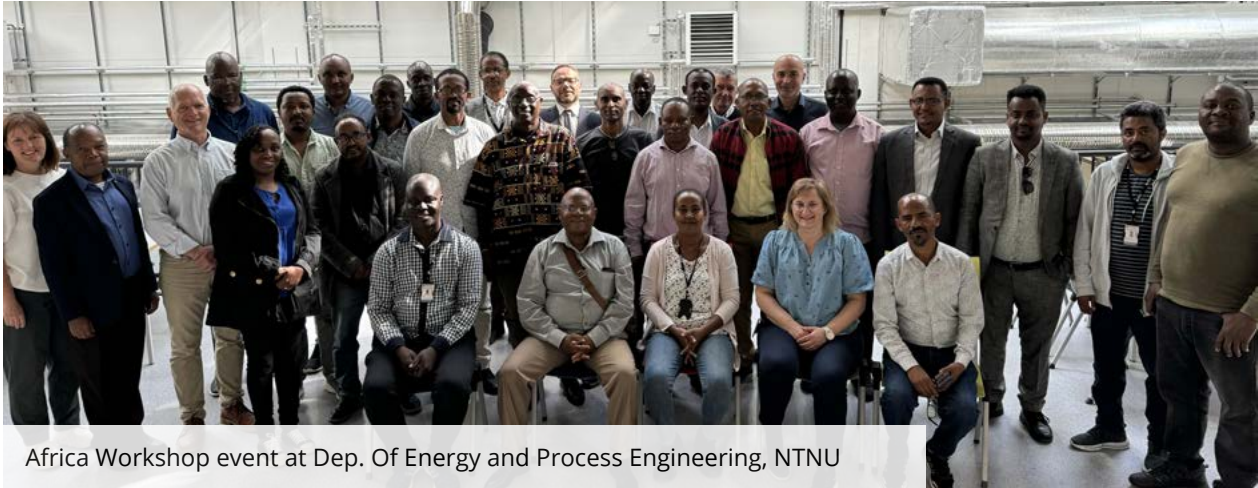
“Since 2007, the Department of Energy and Process Engineering at NTNU has collaborated with a group of African Universities under a string of NORAD programs,” says Ole Jørgen Nydal (Coordinator), Professor. “We know that universities can play an active role in

this picture, training people with relevant skills and participating in relevant research and technology development. The results are sustainable, as the universities are permanent institutions and the staff are stable.”

The aim has been to encourage intra-Africa collaboration on educational programs and on applied energy research. The outcomes are 5 master programs, development of joint PhD courses and coordinated research on renewable energy technology (about 30 PhDs and a large number of master students). Research focuses on:



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

- Solar energy: both thermal and Photovoltaics
- Hydropower: Pumps as turbines
- Wind power: Small scale hybrid systems
- Refrigeration technology: Solar powered systems

HOW CAN FUTURE COLLABORATION LOOK LIKE?

On the educational side, we are globally in the middle of a digital revolution, where teaching will no longer require physical presence in a lecturing room. This does not apply to the research side of the collaboration, as development of energy technology requires access to research infrastructure, laboratories cannot be digitized.

“We did a mini survey among the project coordinators at 11 universities on the areas of

priority for future collaboration showed, and the results show that they prioritize collaboration on research over education”, says Nydal. “It was also noted that the younger universities put more emphasis on educational programs and that the visiting master’s students better carry out the research part of the study at the NTNU laboratories rather than taking courses”.

The most popular areas for cooperation were photovoltaic and solar thermal energy (39%), wind power (17%), hydropower (16%), bioenergy (12%), energy systems (6%), environment and climate (7%) and socio-economic conditions (3%).

MORE COLLABORATION AND RESEARCH

Based on our experience from this long-term project collaboration the consortium sees the following elements as particularly useful in the development of home-grown solutions for the energy needs of communities in Africa:

- **Research collaboration.** Researcher-based projects on renewable energy technology with joint student supervision and utilization of common resources.
- **Extended partnership and technology commercialization.** To get results from the laboratory out for use and as a basis for local commercial activities, it may be fruitful with seed-funding schemes and with interaction schemes with other types of Global South actors.
- **Research infrastructure.** A common challenge among the group of partner universities is insufficient laboratories and equipment for research and training in renewable energy technology. The general picture is that the institutions could make a stronger impact by having better research facilities, both on the education and research side.
- **Mobility and scholarships.** It is important for utilization of resources, mutual understanding, motivation for collaboration, continuing progress, strong recruitment and support from management that there is room for mobility and scholarships in the collaboration.

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Africa Gashaw and Fikadu testing a frying pan with photovoltaic power at Addis Ababa University, Ethiopia.

FACTS:

Participants in the African University network projects: 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).

The string of projects with the African universities have been financed by the NORAD and other programs: NUFU, NOMA, EnPe, NORPART, NORHEDII, NORGLOBAL, EnergiX, NTNU Discovery, the Quota Program, EU Erasmus+ capacity building program.







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 defend 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”.

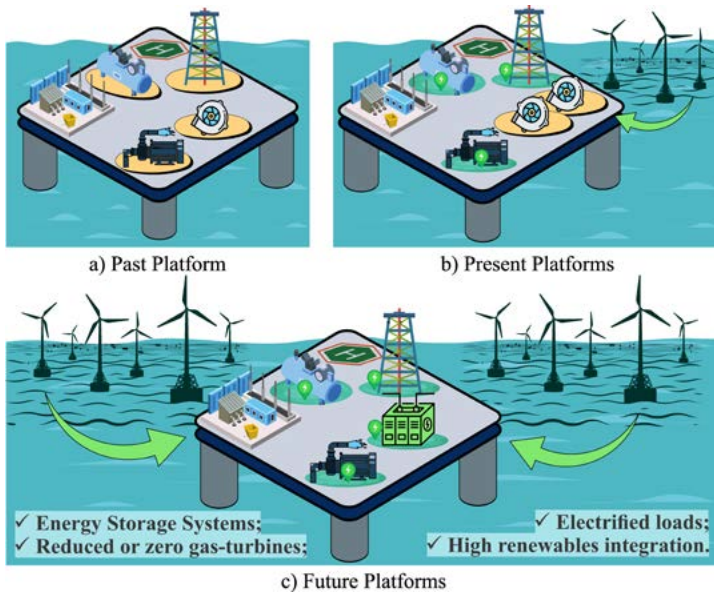


Illustration from article: L. Araujo, Lucas; J.M. Callegari, A.A. Adeyemo, J.K. Banda, D.I. Brandao, E. Tedeschi "Co-operation of Converter Interfaced Devices for Enhancing Flexibility, Efficiency and Resilience.

Application on Low emissions Offshore Oil and Gas Platforms» accepted by: IEEE Power and Energy Magazine.

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.

FACTS:

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



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MINERAL EXTRACTION FOR ENERGY TRANSITION – INDONESIA

The global demand for critical minerals has transformed daily life for many local communities in the global south. This is a story of one of them.

Technology for the green shift, such as electric vehicles, relies on nickel, cobalt, tin and other critical minerals that we depend on for a more sustainable future. Most of these resources are extracted in the Global South, including Indonesia, where the islands of Bangka, Belitung, and Sulawesi are key sites of extraction. And many people have left farming and fishing to mine so-called energy transition minerals, often with limited training and under poor working and environmental conditions.

TIN-DILEMMA

At the same time, extraction and processing industries provide vital sources of income and economic value for these communities. This highlights the dilemma faced by many local communities involved in mineral extraction.

These are among the stories resulting from more than ten years of academic collaboration between NTNU and four university partners in Indonesia through the Citizens Engagement in Transnational Resources Management Network (CitRes).

– Together, we have examined how the rising global demand for minerals and materials shapes everyday life in resource rich communities, says Ståle Angen Rye, professor of Human Geography, NTNU.

CREATING SYNERGIES

At heart of the CitRes Network is the combination of research, education and capacity building, all of which are important for developing cross-cutting research where insights from resource rich communities are discussed in relation to global politics and urgencies for energy transitions.

NTNU students are having internships where they work closely with Indonesian researchers, and we collaborate on student mobility and the development of researched based education across NTNU and the Indonesian partner universities. This creates synergies between our research projects and education, and raise awareness about the implications of energy transition.



Offshore small-scale tin mining Bangka, Indonesia (photo: Nanang Indra Kurniawan)

JUST TRANSITION

Through research, and in dialogues with governments, industries, communities and fellow students in Indonesia, the students explore how global low-carbon transitions intersect with questions of democracy, justice, and sustainable development.

- We are studying the consequences and negotiations of climate politics. And we must dare to discuss the downside of the green transition,.

Rye says that one of the most important assets is the students, either they come from Norway or Indonesia; they can make a change.

- We've had 80 master students from both countries over the years being engaged in these projects. And our mission is to move towards a more knowledge-based and ethical sustainable transitioning of our societies across the global north and south.

Cooperating universities in Indonesia:

Universitas Gadjah Mada
Universitas Nusa Cendana
Universitas Bangka Belitung
Politeknik Negeri Pontianak.

FACTS:

Key achievements from NTNU's collaboration with Indonesian partners og energy transitions (2019-2028)

- 37 mil NOK in external funding (NTNU) 8 mil NOK internal funding (NTNU)
- 19 active researchers , 11 PhD projects
- 30 journal articles, 6 policy briefs, 6 co-edited books
- 1 big-data lab (in Indonesia)
- 6 Study program developed



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

Research and education projects:

SUSTAIN – Citizens Participation in Resource Governance and Sustainable Transition, 2020-2027 Funding: NORHED – NORAD/UD

EPICC – Environmental Policy Instruments across Commodity Chains Multilevel governance for Biodiversity, 2020-2025 Funding: ERA-NET COFUND/HORIZON 2020

CitRes-Edu – Citizen Engagement and Natural Resource Governance Education, 2019-2025 Funding: NORPART/HK-DIR

EnJuST - Engaging with Just Sustainable Transition, 2024-2028 Funding: NORPART/HK-DIR



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AFRICA ENERGICA - TOWARDS A GREEN PATH FOR AFRICA

A team of researchers from NTNU is contributing to a transformative energy project ENERGINA 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.

My research investigates:

- **Temperature increases**, which raises cooling demand and overall energy consumption.
- **Changes in wind speed**, affecting wind power generation potential.



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/

- **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 CO₂ 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” .



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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.



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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.

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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.

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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.

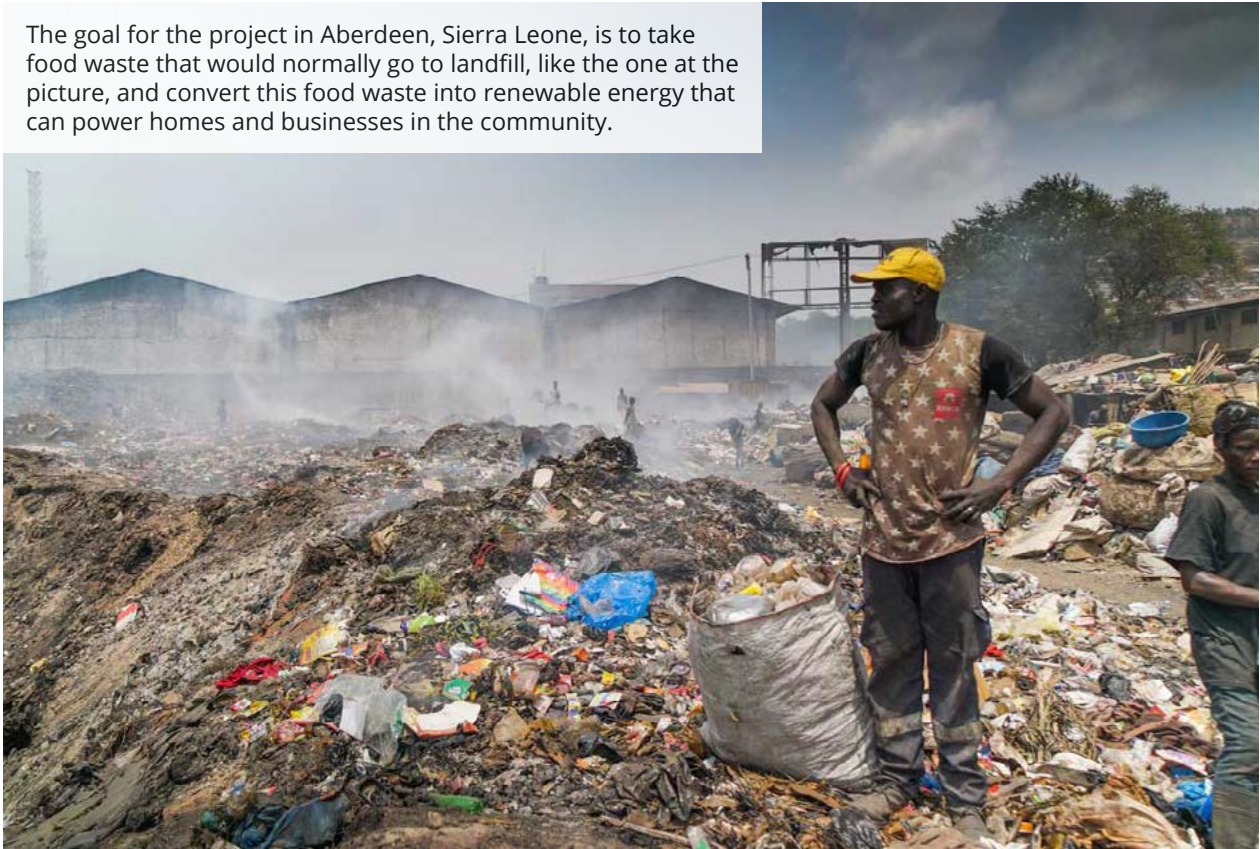
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GOING FORWARD

RECOMMENDATION, OUTLOOK, WORKSHOPS

- **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.
- **Strengthen Capacity Building and Knowledge Exchange**
Expand joint degree programs, PhD supervision, and staff exchanges. Encourage co-teaching, co-publication, and co-supervision as central elements of collaboration to build sustainable academic capacity on both sides.
- **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.
- **Support Innovation networks in the Global South**
Collaborate with partners like SINTEF, local universities, startups, and public institutions to co-develop context-appropriate technologies and scalable solutions that contribute to sustainable and inclusive economic growth.
- **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.
- **Ensure Ethical and Responsible Collaboration**
Establish clear frameworks for data sharing, intellectual property, and fair distribution of research benefits. Promote ethical fieldwork and safeguard local communities' rights and knowledge.
- **Leverage Global Networks and Funding Opportunities**
Strengthen engagement in international funding schemes (e.g., Horizon Europe, NORAD, the Research Council of Norway, and multilateral donors) that support partnerships in the Global South.
- **Enhance Visibility and Coordination Across NTNU**
Create an internal coordination platform or "Global South Hub" to share experiences, connect researchers, and align initiatives across faculties and with external partners such as SINTEF, NORAD, and Innovation Norway

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.





 NTNU

| Strategic Research Areas