

# TUM Sustainable Futures Report 2024

Progress and Achievements in the  
TUM Sustainability Transformation



# Foreword

The Technical University of Munich has embarked on a transformative journey towards sustainability progress. As a leading international research and educational institution, we accept responsibility, apply our knowledge and expertise, and diligently tackle the challenges ahead. We have committed to sustainability as one of our institution's core values and strategic priorities.

From our institution's founding to the present day, TUM has been at the forefront of sustainability innovation. While it might be a catchword for others, it is deeply woven into the fabric of our university. Making it integral to TUM's mission and vision for the future.

The TUM Sustainable Futures Strategy 2030, developed collaboratively with TUM students and employees through a participatory process, underlines our commitment to tackling one of humankind's greatest challenges. Together with the extended TUM family, we harness the power of many to accomplish the seemingly unattainable.

In a collective effort, we have already achieved notable successes in research, education, campus operations, and community engagement. To reach these milestones, we leveraged interdisciplinary collaboration and novel approaches. I am pleased to present this report as both a travel log as well as a performance tracker. Enabling us to monitor and evaluate our progress toward achieving our sustainability goals.

United in diversity and empowered by joint ambitions, we continue to address complex sustainability challenges, co-create innovative solutions, and foster a culture of sustainability that transcends our campuses. I firmly believe in the importance of collaboration with students, faculty, and staff in driving meaningful change. However, our activity radius extends beyond the boundaries of our campuses; it reaches out to local communities, industry partners, and external partners worldwide. A common pursuit is fueled by open dialogue and collaboration; this way, we are able to gain valuable insights and expertise as well as a sense of shared ownership and responsibility on our journey.



On behalf of TUM, I thank all individuals and organizations whose dedication and contributions have driven our sustainability undertaking forward. Your commitment to sustainability has been instrumental in shaping initiatives and driving meaningful change within our university and beyond. Your passion, expertise, and collaboration have enriched our sustainability endeavors and inspired others to join us. We appreciate your ongoing support and partnership as we continue together towards a more sustainable future.

Working hand in hand has been and continues to be pivotal to our success. I encourage you to join us, if you have not done so yet! Your participation and support are essential in propelling our efforts forward and ensuring the success of our sustainability endeavors.

I wish continued success to our TUM family and thank our Vice President Sustainable Transformation, the TUM Sustainability Board, and the TUM Sustainability Office, for driving the implementation of the TUM Sustainable Futures Strategy 2030 forward.

As we make our way towards a more sustainable future, let us remain committed to our values: talents • excellence • responsibility. Together, we can shape a brighter, more sustainable tomorrow.

A handwritten signature in blue ink, reading "Thomas F. Hofmann". The signature is fluid and cursive, written in a professional style.

Prof. Dr. Thomas F. Hofmann  
President

# Foreword

With its TUM Sustainable Futures Strategy 2030, published in October 2022, the Technical University of Munich defines its long-term vision and direction in the area of sustainability in its six action fields: research, education and lifelong learning, entrepreneurship and innovation, campus operations and resource management, governance and university community as well as communication and global engagement.

Building on existing activities, TUM thus supports the intensive, sustainability-related penetration and corresponding content orientation of the six action fields mentioned above. With the associated expansion, intensification and bundling of our sustainability efforts, TUM is developing into a driving force for tackling the most pressing global challenges in the field of sustainability and thus contributing to the creation of a sustainable society. With this in mind, I am delighted to present our first TUM Sustainable Futures Report which highlights TUM's ongoing commitment to sustainability and the remarkable progress we are making in this important area. This report demonstrates that sustainability at TUM is not just an abstract concept, but a guiding principle that permeates our collective sustainability efforts to help address sustainability challenges both locally and globally.

In addition to communicating the status quo with regard to the sustainability of our six action fields, this report serves directly to support the implementation of our TUM Sustainable Futures Strategy 2030 and the 18 goals mentioned here, as well as the measures assigned to each. By identifying and developing corresponding indicators, the impact of the measures introduced to achieve the goals is made measurable and controllable. In addition, a TUM Sustainability Dashboard will be developed with the involvement of all relevant stakeholders, making sustainability-relevant data available online. This dashboard will serve as a basis for identifying necessary adjustments and further developing the sustainability strategy.

The structure of this report is based directly on the TUM Sustainable Futures Strategy 2030, which addresses the action fields already mentioned: research, teaching and continuing education, entrepreneurship and innovation, campus operations and resource management, governance and university community as well as communication and global engagement.



**In the field of research and innovation we are looking for solutions to tackle global sustainability challenges in the areas of environment, energy, health and society.**

Our activities in the field of education and lifelong learning aim to integrate sustainability principles into education at all levels, from basic education to postgraduate studies and continuing education.

The entrepreneurship and innovation action field aims to promote sustainability-relevant results from research and development in order to achieve a positive impact on the environment and society through their implementation. This includes supporting start-ups and related projects.

In terms of making campus operations as sustainable as possible, we are developing fundamentally sustainable practices within the university's own operations and infrastructure, e.g. reducing carbon emissions, promoting energy efficiency, waste reduction, sustainable transportation and green building practices.

In relation to governance and the university community, we promote collaborative opportunities within the university and far beyond to jointly explore and implement solutions for a sustainable development.

With regard to communication and global engagement, we are strengthening our knowledge sharing initiatives and global collaboration to advance sustainability worldwide.



## **“We have no choice but to act sustainably.”**

Prof. Dr.-Ing. Werner Lang, Vice President Sustainable Transformation

All these fields of action aim to integrate sustainability into all aspects of the university’s activities and promote a holistic approach to sustainable development that encompasses environmental, social and economic dimensions.

At the heart of TUM’s sustainability efforts is a belief in collaboration and shared knowledge. By working with industry, government and civil society, we aim at effective change and promote sustainable practices beyond the boundaries of our campus.

This report would not have been possible without the extensive support of numerous stakeholders at TUM. I would therefore like to thank everyone at TUM whose commitment and passion contribute to our sustainability journey. This report is a testament to your hard work and serves as a roadmap for our continued commitment to sustainable development.

Let us continue to innovate, educate and inspire – for a future where sustainability is not just a goal, but a shared reality for a sustainable future for us humans on our planet. Thank you for joining us on this transformative journey and actively supporting us.



Prof. Dr.-Ing. Werner Lang,  
Vice President Sustainable  
Transformation

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# Our understanding of sustainability

## Our Sustainability Vision

Through responsibility, talent, scientific excellence, and innovative strength, we are shaping a sustainable transformation of societies to ensure health and prosperity in harmony with nature and the environment for future generations.

## Our Sustainability Mission

We are a globally connected, living laboratory for transformative action and make sustainable development central to our identity and activities.

We therefore

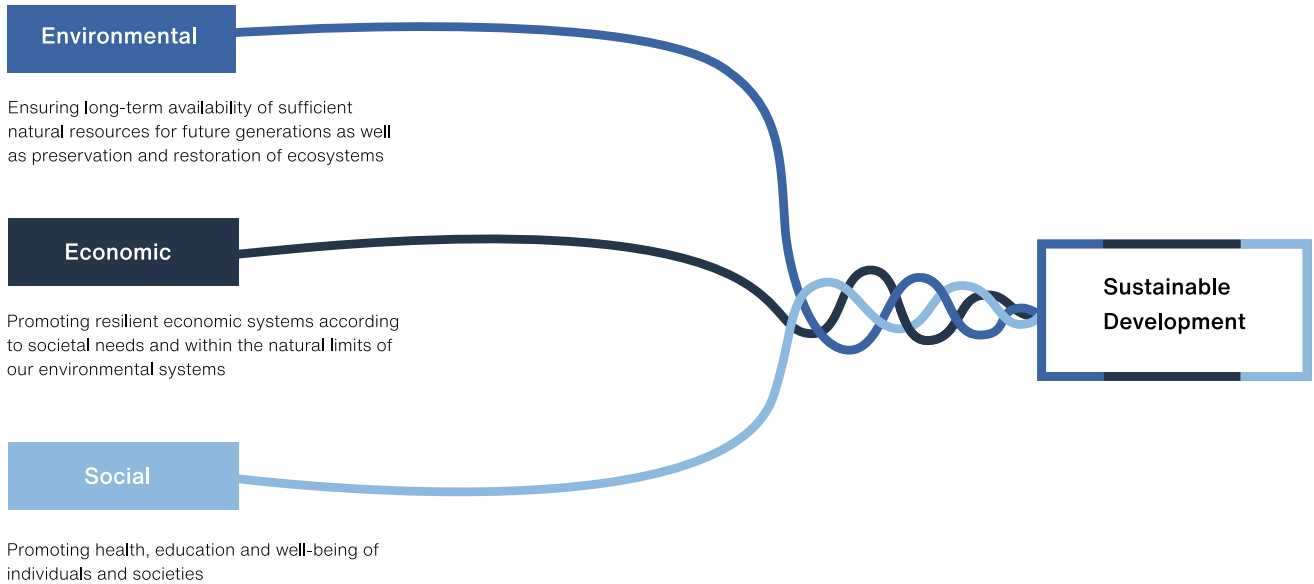
- empower students, employees, researchers, teachers, alumnae/alumni, professionals, and executives and connect them with partners from science, business, politics, and society to develop transformative solutions for a sustainable future;
- support research that improves understanding of the impact of our actions on the sustainable development of society and that reduces the environmental footprint of systems, processes, and products through responsible and scalable innovations;
- support founders in using their entrepreneurial talents to accelerate sustainable transformation;
- drive forward the adaptation of political and regulatory frameworks for sustainable solutions and increase their social acceptance;
- make TUM a role model for the design of sustainable and resilient societies through transformation by our own example.

At TUM, our sustainability endeavors are integral to our mission statement, emphasizing our commitment to innovation for the benefit of people, nature, and society: “With the aim of preserving the Earth’s ecosystem, we respect the needs of the natural world, use resources conscientiously and attach the highest priority to protecting people and the environment. Out of a sense of responsibility for future generations, the latest research findings flow directly into our cooperation with Schools, into the curricula of our degree programs, into continuing education and training programs, and into sustainable technology enterprises with the potential for growth.”<sup>1</sup>

Our definition of sustainability for both the TUM Sustainable Futures Strategy 2030 and the TUM Sustainable Futures Report follows the general idea of the Brundtland Commission (UN Report “Our Common Future”, 1987). This entails meeting present needs without compromising the ability of future generations to meet their own needs. This understanding of sustainability prioritizes preserving ecological, social, and economic resources for both current and future generations within a finite system. It emphasizes the importance of justice across generations and on a global scale.

At the same time, our understanding of sustainability is guided by the Sustainable Development Goals (SDGs). The SDGs aim to address a wide range of challenges the world is facing today. The SDGs are intended to guide global efforts towards a more sustainable, equitable, and prosperous future for all humans. They are interconnected, recognizing that progress in one area often depends on progress in others.

<sup>1</sup> [www.tum.de/en/about-tum/goals-and-values/mission-statement](http://www.tum.de/en/about-tum/goals-and-values/mission-statement)



[www.un.org/sustainabledevelopment](http://www.un.org/sustainabledevelopment)

The content of this publication has not been approved by the United Nations and does not reflect the views of the United Nations or its officials or Member States.



# Navigating the report: your guide to insightful reading

## From strategy to report

Starting in 2024, the TUM Sustainable Futures Report will be published on a regular basis, providing comprehensive insights into the progress regarding the implementation of the TUM Sustainable Futures Strategy 2030<sup>1</sup>. The report serves as a critical tool for evaluating the impact of the strategy, identifying areas for improvement, and facilitating informed decision-making. Through transparency and accountability, we aim to continually refine and improve our actions and practices to make meaningful progress towards our short-term as well as long-term goals.

The TUM Sustainability Office coordinated the participatory development process of the TUM Sustainable Futures Report 2024. This required active engagement of researchers, staff, and students through meetings, surveys, and discussions while also empowering them as change agents for a more sustainable TUM. The contributions of our dedicated data collectors, advisors, supporters, and idea givers are greatly appreciated.

The first TUM Sustainable Futures Report 2024 has the same scope as the TUM Sustainable Futures Strategy 2030: from the TUM Schools, Integrative Research Institutes, Corporate Research Centers, TUM Mission Networks, and Technology Core Facilities to the TUM Graduate School, the TUM IL<sup>3</sup>, and the TUM Institute for Advanced Study to the Central Administration, the Functional Units and Central Service Institutions.

## Chapter logic

This report aligns with the action fields, measures, and indicators of the TUM Sustainable Futures Strategy 2030. The six action fields are the cornerstones of our sustainability transformation. They include all relevant aspects of our activities and practices as a responsible, entrepreneurial university, contributing to global best practices in sustainable development. Therefore, the main chapters of this report are based on these action fields. Furthermore, four spotlights showcase noteworthy topics such as our agents of change in the TUM Green Offices or our TUM Climate Action plan for reducing our greenhouse gas emissions.

Within these chapters, we describe the respective goals and corresponding indicators outlined in the TUM Sustainable Futures Strategy 2030. These indicators allow us to measure and monitor the effectiveness of implemented measures, goal achievement, and the overall progress of TUM's sustainability transformation across each action field. Not all indicators could be backed by the necessary data at the time being but broadening the data base and quality is the highest priority for future reports. Certain elements from one chapter may also be reported in another chapter due to thematic overlaps or relevance.

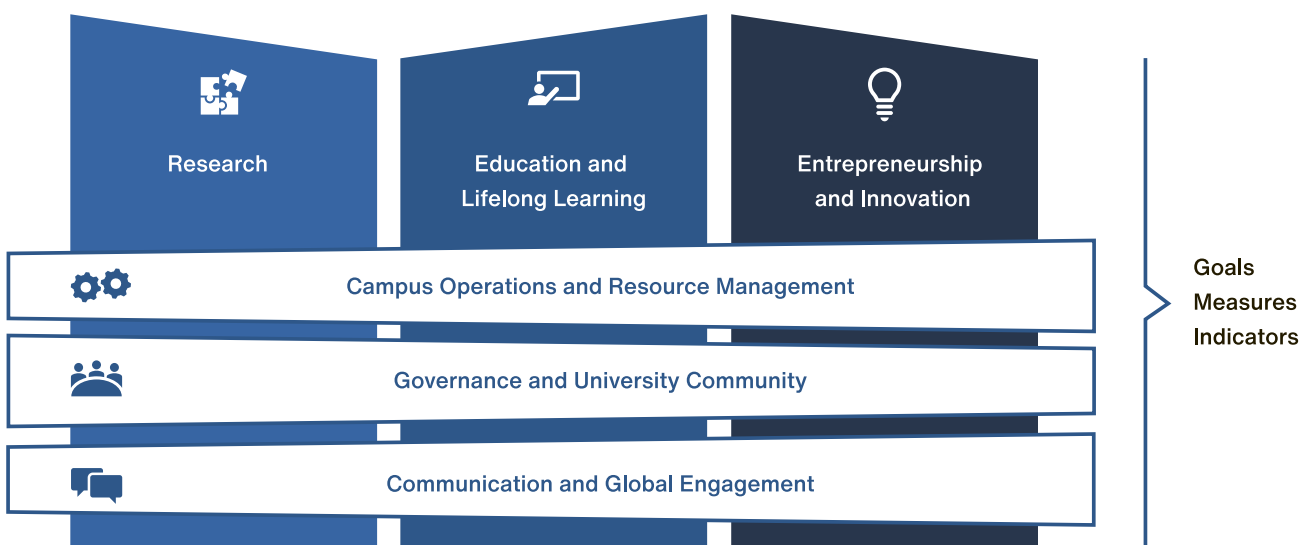
Within each action field, we aim to showcase individuals, projects, and achievements which serve as examples for our progress. "Sustainability stories" provide highlights that illustrate the various contributions from the community. It is important to acknowledge that these examples represent only a fraction of the numerous contributions made by our colleagues and the TUM community. We value inclusivity and recognize that many more individuals and initiatives deserve recognition.

In each chapter's "Outlook" section, we highlight the upcoming steps our community will take to implement the measures outlined in the TUM Sustainable Futures Strategy 2030. Every step, regardless of size, plays a crucial role in shaping our sustainable future.

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<sup>1</sup> <https://mediatum.ub.tum.de/1694551>

## Action fields



## Data

Considering our aim to publish our first report in 2024 and acknowledging the disruptive effects of the COVID-19 pandemic, the year 2022 was selected as baseline. It is important to recognize that the data following the pandemic may not accurately reflect typical trends or patterns due to the exceptional circumstances. Due to limited data availability, certain values may cover different years or time periods. We have included all available data and corresponding indicators in this report. In cases where data collection was already established, e.g. through already pre-existing digital platforms, we made efforts to extend our analysis further back in time to uncover meaningful trends.

Some indicators require data that is not readily available or standardized across our different schools and departments. As a result, the quality of available data is based on assessment

of the data collectors. Efforts to enhance data collection and standardization in the next steps will lead to even more comprehensive and comparable numbers, fostering greater transparency and informed decision-making. Indicators aligned with the TUM Sustainable Futures Strategy 2030 that lacked data or could not be collected by the time of publication are excluded from this report.

A significant data source was a survey amongst the TUM Schools conducted by the TUM Sustainability Office in April 2024. This survey offers valuable insights into the sustainability focus of study programs, professorships, and other pertinent areas. Furthermore, it allows for a comprehensive assessment of the Schools' sustainability efforts and their current status.

# Research

# 1

**64%** open-access publications in 2023

**3,553** publications related to SDGs in 2022

**317** professorships with reference to sustainability in 2024

Our commitment is to be at the forefront of creating sustainable solutions to regional, national and global challenges. Emphasizing comprehensive research approaches and skills, our work on sustainable development integrates disciplinary expertise with inter- and transdisciplinary experience. TUM supports researchers with excellent infrastructure and conditions, including well-equipped departments, institutes, networks and focus areas aligned with the principles of the TUM Agenda 2030. By adhering to a code of conduct and ethical guidelines, we empower our researchers to navigate the complexities of sustainable development responsibly and effectively.

Goals of the action field Research:

- Develop a sustainable work culture in research
- Expand research activities on sustainability



#### RESEARCH GOAL

# Develop a sustainable work culture in research

## Open access publications

### **Indicator: Open-access publications**

The open-access rate among publications by TUM authors has shown a consistent increase in recent years, progressing from 37% in 2019 to 57% in 2021, and further to 64% in 2023. This upward trend reflects our ambition to foster an open science culture. The university leadership aims to maximize the proportion of open-access publications at TUM by providing optimal support to researchers. Therefore, additional comprehensive agreements were signed with publishers in 2024, allowing TUM authors to publish open access. The open-access rate is expected to increase significantly over the coming years.



RESEARCH GOAL

# Expand research activities on sustainability

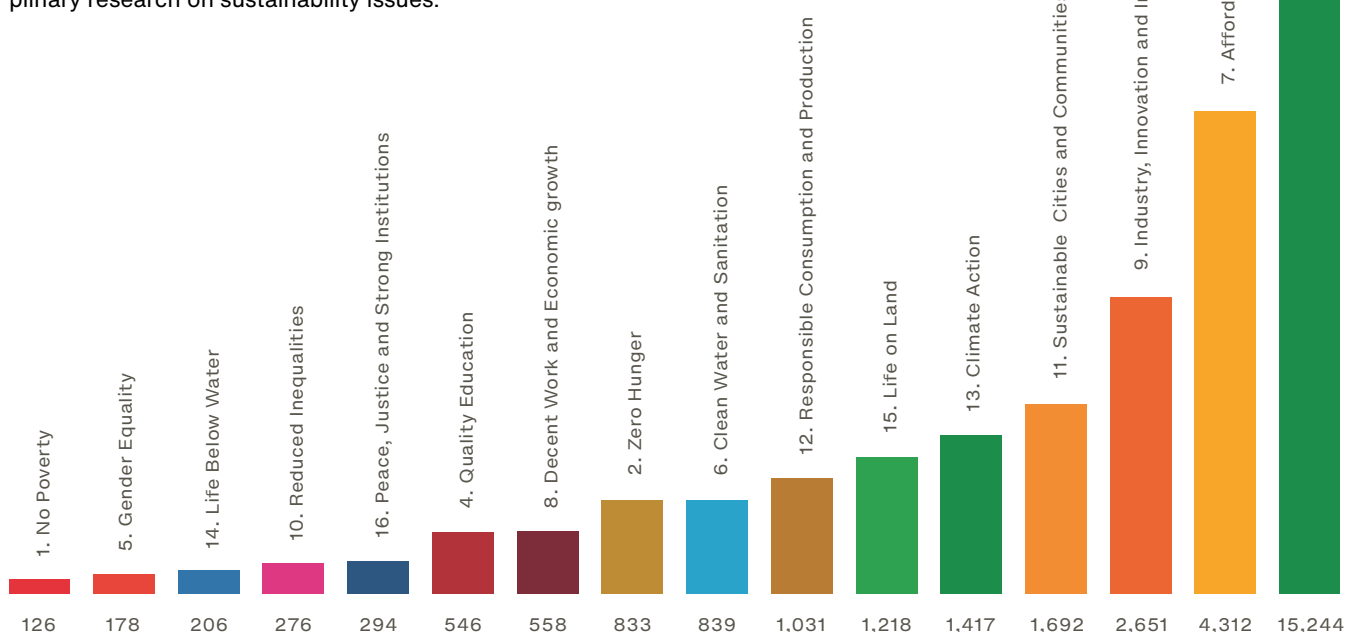
3. Good Health and Well-being

## Publications

### Indicator: Number of publications related to the 17 Sustainable Development Goals

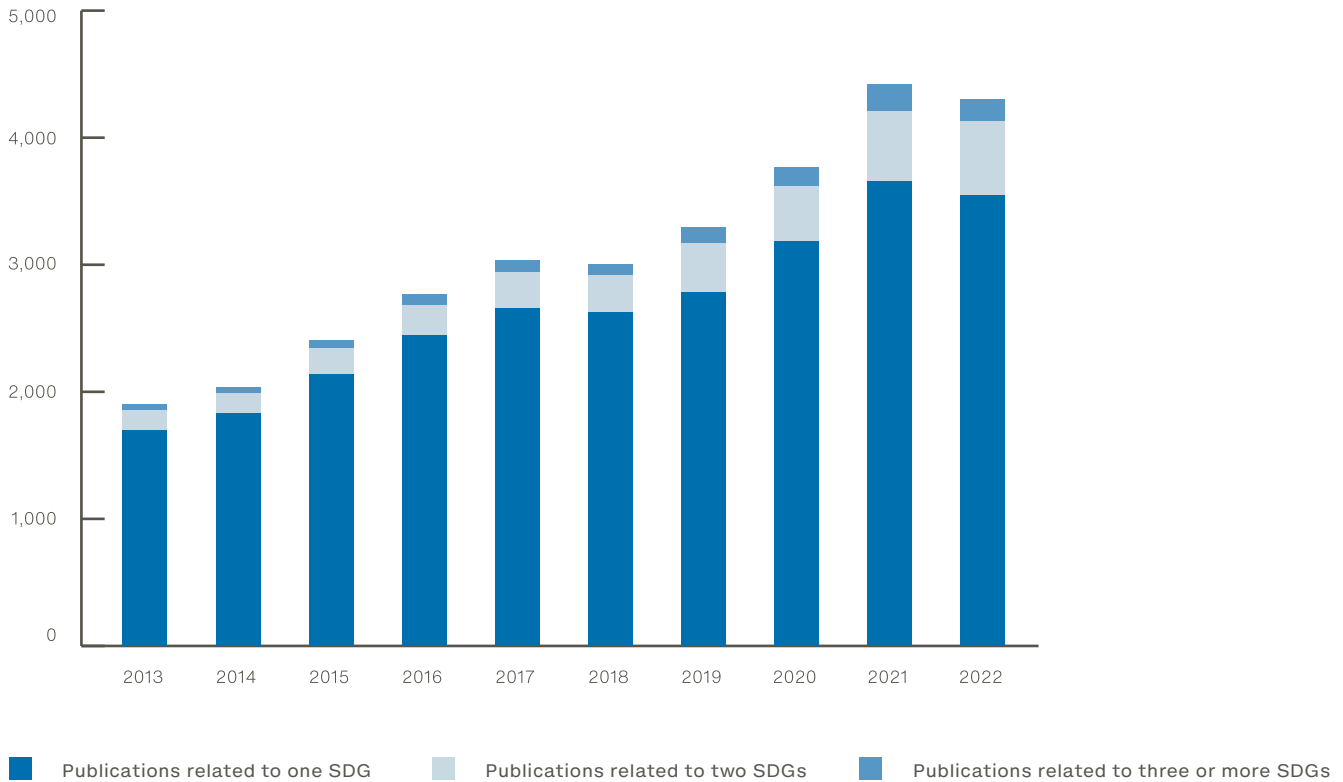
The materiality analysis of the TUM Sustainable Futures Strategy 2030 identified six focus areas: SDG 3 (Good Health and Wellbeing), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action) and SDG 15 (Life on Land). This emphasizes TUM's significant impact in research and education within these specific SDGs compared to others. This relevance is also reflected in the number of publications related to each of these SDGs.

In the past years, the total number of publications with authors affiliated with TUM show a notable increase, rising from 7,055 in 2013 to 10,747 in 2022. Concurrently, the proportion of publications related to SDGs also exhibited an even stronger growth. In 2013, 1,700 (24.1%) of the publications were SDG-related, which increased to 2,628 (29.4%) in 2018 and 3,553 (33.1%) in 2022. However, the majority of these publications are predominantly associated with a single SDG. The number of publications related to two or more SDGs is also growing which can be interpreted as a sign of increasing interdisciplinary research on sustainability issues.



Number of publications related to SDGs 2013-2022. Based on the Elsevier SDG Mapping dataset: Bedard-Vallee, Alexandre; James, Chris; Roberge, Guillaume (2023), "Elsevier 2023 Sustainable Development Goals (SDGs) Mapping", Elsevier Data Repository, V1, doi: 10.17632/y2zy9vwzy.1. Data is only depicted until 2022. More recent data is not yet fully complete and reliable.

### Number of TUM publications related to SDGs 2013–2022



### Professors and professorships

#### Indicator: Highly cited TUM professors with a sustainability focus

Within TUM's academic landscape, the influence and recognition of the professors are key markers of expertise and impact. This additional indicator sheds light on highly cited TUM professors who have made significant contributions to sustainability-focused research. Through their scholarly endeavors, these professors not only advance knowledge but also contribute to addressing global challenges related to environmental sustainability, climate change, and societal well-being.

#### Indicator: Number of TUM professorships with explicit reference to sustainability

The School survey identified 317 professorships (48% of the total number of professorships at TUM) as being related to sustainability. The SDGs most frequently addressed by these professorships correspond to the focus areas of the TUM Sustainable Futures Strategy 2030: SDG 13 (Climate Action), SDG 12 (Responsible Consumption and Production), SDG 9 (Industry, Innovation, and Infrastructure), SDG 15 (Life on Land), SDG 7 (Affordable and Clean Energy), and SDG 11 (Sustainable Cities and Communities).

## Highly cited TUM researchers 2021–2023

Name of researcher	Sustainability-related topics	Year(s)
Prof. Dr. Senthod Asseng	Climate Science and Technology	2021
Prof. Dr. Hubert A. Gasteiger	Climate Science and Technology; Energy Infrastructure and Sustainable Energy Systems	2021
Prof. Dr. Ingrid Kögel-Knabner	Climate Science and Technology, Circular Economy and Bioeconomy; Smart Agriculture and Resource Security	2021 2022 2023
Prof. Dr. Hans Pretzsch	Climate Science and Technology	2022
Prof. Dr. Rupert Seidl	Climate Science and Technology	2021 2022 2023
Prof. Dr. Wolfgang Weisser	Climate Science and Technology; Circular Economy and Bioeconomy; Smart Agriculture and Resource Security	2021
Prof. Dr. Xiaoxiang Zhu	Climate Science and Technology	2023

## Grants, prizes, and awards

### Indicator: Number of grants, prizes, and awards (national, international) for outstanding scientific work related to sustainability and climate protection

The School survey revealed that members across various TUM Schools received a total of 90 grants, prizes, and awards related to sustainability and climate protection in 2023. This includes 16 awards, 23 prizes, and 51 grants<sup>1</sup>. The TUM Campus Straubing for Biotechnology and Sustainability accounts for the largest share (26%), followed by the TUM School of Life Sciences (23%), the TUM School of Engineering and Design (17%), and the TUM School of Natural Science (16%). Of all grants, prizes, and awards, 47% were on a national scale, while the remaining 53% had an international scope.

Some notable examples of awards include the German Environmental Award (Deutscher Nachhaltigkeitspreis) given to Prof. Dr. Ingrid Kögel-Knabner in 2019 for her pioneering work in environmental protection. Prof. Dr. Thomas Brück received, the **e-Ward of the European Business Council for Sustainable**

**Energy** and the **GreenAward** at the GreenTechFestival. Thanks to the outstanding work of our researchers, TUM has achieved significant success in obtaining various ERC grants, such as the **ERC Starting Grant** awarded to Prof Dr. Janina Steinert for the project “Disentangling and Preventing Economic Violence against Women (ECOV)”.

Furthermore, TUM cooperates closely with the **Nobel Sustainability Trust** on the “Award of Leadership in Implementation”, and the “Award for Outstanding Research and Development”. Those were awarded to outstanding international persons for the first time in 2023 in a ceremony in the Bavarian Academy of Sciences.

The internal **TUM Sustainability Award** was initiated in 2019 to recognize and honor exceptional scientists whose contributions hold the promise of significantly impacting the environmental transformation of our economy and society.

<sup>1</sup> As per information by Schools, awarded by government bodies, private foundations, or other organizations to support academic research.

### TUM Sustainability Award recipients 2019–2023

Name of recipient	Professorship / chair	Research area	Year
Prof. Dr. Thomas Brück	Werner Siemens Chair of Synthetic Biotechnology (Faculty of Chemistry)	Climate-friendly conversion of atmospheric carbon dioxide and residual biomass streams	2019
Prof. Dr. Anja Rammig	Professorship for Land Surface – Atmosphere Interactions (TUM School of Life Sciences)	Land surface-atmosphere interactions	2020
Prof. Dr.-Ing. Johannes Fottner & Prof. Dr. Magnus Fröhling	Chair of Materials Handling, Material Flow, Logistics (TUM School of Engineering and Design); Chair of Circular Economy (TUM Campus Straubing)	Establishment of the interdisciplinary research network CirculaTUM and transition to a resource-saving circular economy	2021
Prof. Dr.-Ing. Werner Lang	Chair of Energy Efficient and Sustainable Planning and Building	Energy-efficient construction with a focus on optimizing the building envelope in ecological, functional, structural, and design terms	2022
Prof. Dr. Miranda Schreurs	Professorship for Environmental and Climate Policy (TUM School of Social Sciences and Technology)	Finding solutions to climate-related problems	2023

### TUM advisors on sustainability

#### Indicator: Number of TUM scientists with an advisory function on the topic of sustainability in science, business, politics and society

The School survey shows that 96 TUM researchers served in advisory roles on sustainability matters in science, business, politics, and society in 2022. Advisory topics encompass a wide array of issues, including specific SDGs, climate change, circular economy, public health, biotechnology, biodiversity, and energy transition.

#### Interdisciplinary and transdisciplinary research

##### Indicator: Pooling expertise through mission networks

Since interdisciplinary and transdisciplinary research are key to solving the world's most pressing sustainability issues, we introduced the **TUM Mission Networks**. They combine experts from an unparalleled range of disciplines. Using a human-centered approach, they seek answers to the most important social and technological problems the modern world faces.

Founded in 2020, the TUM Mission Network Circular Economy (**CirculaTUM**) has become Germany's largest university research network for circular economy. It bundles research, teaching, and innovation competencies to elaborate the scientific basics of this emerging field, develop solutions for sustainability problems and transfer them into practice. In doing so, it connects more than 30 units and 100 members across campuses, schools and further TUM institutions.

TUM collaborates with UnternehmerTUM, Europe's largest center for start-ups and innovation, in the "**Circular Republic**" initiative. This initiative empowers companies and start-ups to drive innovation within circular economy and develop new business models. Circular Republic serves as a platform to connect key stakeholders and aims to drive systemic change across the entire value chain.

One notable interdisciplinary project is **“Synergy Fuels”**, spearheaded by the Professorship Bioprocess Engineering, and funded by the German Federal Ministry of Transport and Digital Infrastructure. This initiative involves multiple professorships at TUM Campus Straubing, along with several research institutes and companies, all working together to develop renewable biofuels.

Another significant interdisciplinary project is the **“H2 Reallabor Burghausen”**. In this collaborative effort, several TUM research groups are working with 37 industry and science partners to transform the chemical industry in ChemDelta Bavaria into a sustainable hydrogen-based circular economy. The project focuses on developing new technologies to make hydrogen viable as both an energy carrier and a material basis for the chemical industry, with the goal of bringing these technologies to market maturity.

Additionally, the TUM Institute for Advanced Study (TUM-IAS) is heavily focused on sustainable development. Out of 81 Focus Groups within the TUM-IAS, 49 specifically target one SDG.





## RESEARCH

# Sustainability stories

With TUM creating great impact through its research, it is more than appropriate to acknowledge the efforts and results of our professors and research groups. Please note however, that the following paragraphs are notable examples representing the huge variety of disciplines, research topics, people, and institutions at TUM.



**Prof. Dr. Senthold Asseng** was listed as number 192 of the world's 1,000 most influential climate scientists. His main research areas include impact of climate variability and climate change, cropping sustainability, food security, and the application of systems analysis and crop modelling to support autonomous robot-managed cropping systems. He applies this both in traditional field agriculture and within fully environmentally controlled indoor vertical farming environments. A TUM team, led by Senthold Asseng, has reached the finals of the "Project of the Century" competition in 2023 and was awarded a 1 million Swiss Francs Research Prize from the Werner Siemens Foundation (WSS).

The **Centre for Urban Ecology and Climate Adaptation (ZSK)** has been a collaboration between the disciplines of urban and landscape planning, architecture, engineering, and ecology since 2013. The interdisciplinary team aims to provide practical recommendations for Bavarian cities and municipalities. They outline how the ecosystem services of urban green infrastructure (e.g. shading, water storage and humidification) can be used to adapt the sustainable city of the future to the consequences of climate change. The ZSK currently comprises 17 projects, of which nine are ongoing and six have been successfully completed.



**Prof. Dr. Anja Rammig** is professor for Land Surface-Atmosphere Interactions at the TUM School of Life Sciences. Her pioneering research on the impact of global environmental change on ecosystems has gained international recognition. Her innovative approach, combining computer modeling with observational data, has led to fundamental insights into ecosystem responses to climate variability and land-use changes. By focusing on the complex dynamics of plant responses to extreme drought conditions and interactions with elevated atmospheric carbon dioxide concentrations, Anja

Rammig aims to develop comprehensive models that can accurately predict future ecosystem changes on both regional and global scales. Her contributions have positioned her as a leading figure in the field of sustainability research, with profound implications for climate change mitigation and adaptation strategies worldwide.



**Prof. Dr.-Ing. Hartmut Spliethoff**, is professor of Energy Systems at the Department of Energy and Process Engineering at the TUM School of Engineering and Design, and also serves as Director of the Future Lab for Green Hydrogen. Hartmut Spliethoff's research focuses on the development and optimization of centralized and decentralized energy conversion systems and plants. Combining theory and experiment, he investigates ways to improve the efficiency and flexibility of thermal power plants, how to convert solid fuels like biomass and waste to capture carbon dioxide, and how to improve the efficiency of low-temperature heat conversion. The Future Lab aims to redefine the hydrogen economy by integrating thermo-, bio- and electro-chemical technologies for green hydrogen production and use.



**Prof. Dr. med. Clarissa Prazeres da Costa** at the Institute for Medical Microbiology, Immunology and Hygiene at the TUM School of Medicine and Health is a leading figure in global health and neglected tropical diseases (NTDs), focusing on the immunology of host-parasite interactions and their impact on maternal and child health. Her research group integrates experimental models and clinical trials data from Africa to advance NTD diagnostics and therapeutics. She is also co-director and co-founder of the TUM Center for Global Health, driving interdisciplinary efforts to address NTDs and environmental health challenges, particularly in sub-Saharan Africa.

## RESEARCH

# Outlook

## What do we research?

“Human centered engineering” is our vision for research as well as education. We facilitate this by creating an internal structure that promotes innovation, fosters collective creativity, integrates the humanities and social sciences, instigates a paradigm shift in teaching, and connects people across disciplinary, institutional, and generational boundaries. Our commitment is outlined in the **TUM Agenda 2030** – Innovation through Talent, Excellence, and Responsibility. By aligning our sustainability ambitions with the TUM Agenda 2030, we address pressing global challenges while maximizing the practical impact of our research.

The following examples show the commitment of TUM to contribute to and advance excellent research related to sustainability with a sustainable work culture in research.

The **TUM Campus Straubing for Biotechnology and Sustainability** is designed as an Integrative Research Institute to carry the topic of sustainability further and deeper into different parts of TUM. To connect people and enhance communication and collaboration between the different locations, joint appointments or staff allocation at TUM ForTe are put into practice.

To foster future interdisciplinary and transdisciplinary connections, the **Munich Design Institute** (MDI) will continue to bring together world-leading researchers and practitioners across diverse disciplines. By combining rigorous scientific research with ingenious creative imagination, the MDI aims to tackle some of the most pressing questions of our time, striving towards a sustainable and livable future.

To promote innovation, the **TUM Institute for Advanced Study** announced the “Dieter Schwarz Courageous Research Grant” in 2023, which is TUM’s highest-endowed award with 1 million Euros in research funding. It funds research projects on “**Digitization and Sustainability**” and will be awarded annually starting in 2024.

In order, to make research achievements more accessible and visible, TUM is currently implementing a **research information system**. It collects information on publications, projects, prizes and research fields of individuals and organizational units at TUM. One or several SDGs can be assigned to each of these items and therefore related to sustainability. This allows for future in-depth data analysis. The system will be linked to external partners at other universities and research institutions to present TUM’s research network.

## How do we research?

We would like to shed light on the exciting initial steps we are taking to enhance the sustainability of our research endeavors. Our professors belong to the most powerful agents of change, shaping TUM through their research, their teaching, their leadership, and their ways of working. Therefore, the Faculty Recruitment, Career Advancement and Dual Career team will work together with TUM Sustainability Office on integrating sustainability throughout the different stages of **recruitment processes**.

The efficient use of resources is highly relevant to make research more sustainable. At the **TUM Technology Core Facilities (TCFs)**, sharing technical infrastructure is promoted as a step towards a sustainable work culture. Equipment like the Electron Microscopy Facility (EMF) offers a wide range of users access to a shared infrastructure to support complex challenges with a joint use of resources.

# **Education and Lifelong Learning**

# **2**

# 49

study programs with sustainability at the core

# 69

study programs with a strong connection to sustainability

In our commitment to societal progress and innovation, our educational approach at TUM is designed to empower students to tackle current and future challenges in social, economic, technological, and scientific fields. Grounded in the rigorous scientific methods outlined in the TUM Teaching Constitution, we focus on equipping emerging talent with the necessary skills to effectively address sustainability issues.

As part of the TUM Sustainable Futures Strategy 2030, TUM has set itself the goal to integrate sustainability into its educational mission. The transfer of knowledge and skills related to sustainability topics aims at motivating and empowering students to assume responsibility and actively shape sustainability both during their studies and beyond.

Goals of the action field Education and Lifelong Learning:

- Enable students to shape society in a sustainable way
- Establish a culture of sustainability through education





#### EDUCATION AND LIFELONG LEARNING GOAL

# Enable students to shape society in a sustainable way

## Sustainability in study programs

**Indicator: Number of study programs related to sustainability**  
TUM offers a total of 180 study programs, thereof 125 Master's Degree and 55 Bachelor's Degree programs. In an internal survey conducted in 2024, schools categorized their study programs according to their level of sustainability integration. The classification differentiates **study programs** ...

→ ... with **sustainability at the core**: Sustainability is **the** central focus **of the study** programs. Category A signifies programs where sustainability principles are fully integrated into all aspects of the curriculum, including core mandatory courses, elective offerings, research opportunities, and extracurricular activities. These programs exemplify a comprehensive commitment to sustainability education and practice, fostering a deep understanding of sustainability challenges and solutions among students and faculty.

→ ... with a **strong connection to sustainability**: Sustainability is targeted but not at the core of the study program. Connections to sustainability-related topics are made throughout the study program, where some courses, or

a small number of core mandatory courses are directly linked to sustainability. The study programs offer a range of sustainability-related courses and initiatives, though the integration may be more selective or less extensive compared to the first category.

→ ... with **little connection to sustainability**: Study programs that do not have a focus on sustainability or are in the early stages of integrating sustainability into their curriculum and activities. While these programs may offer a few sustainability-related electives or initiatives, sustainability integration is not yet a focal point or may be limited in scope.

This self-evaluation resulted in 49 study programs that have sustainability at their core and 69 with at least a strong connection to sustainability.



Efforts to integrate competencies related to sustainability and climate protection into curricula, plug-in modules, and project weeks, are already underway. In 2022, TUM has already begun with the implementation of the Professional Profiles outlined within the framework of the Excellence Strategy. These profiles include disciplines such as Sustainable Engineering, Environmental Science and Management, Sustainable Resource Management, Resource-Efficient and Sustainable Building, Renewable Energy Systems, and others.

### Plug-in modules

**Indicator: Number of Plug-in Modules focusing on the acquisition of sustainability competencies and number of offerings within the SDG Campus network**

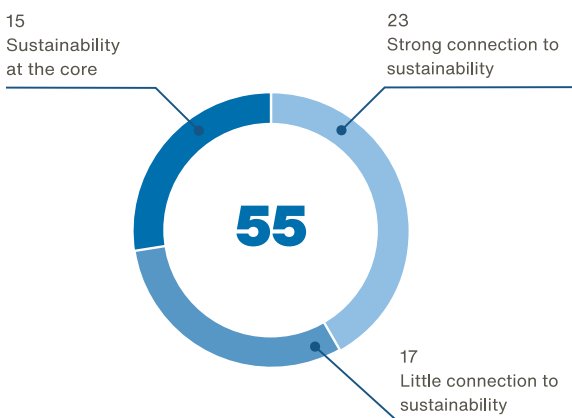
Plug-in modules are a new learning format of TUM with increasing importance and impact. They are disciplinary and transdisciplinary formats to intensify and expand specialist knowledge. Students increase their knowledge independently of the curricula of the respective degree programs. While the

format of plug-in modules is a sustainable way of learning per se, of the 100 plug-in modules offered between summer semester 2021 and summer semester 2024, 15 specifically and directly targeted sustainability topics. Examples are vertical farming, a project rally on behavioral economics meeting real world challenges, climate finance or impact entrepreneurship for transformational change. Besides plug-in modules, we are increasingly rolling out the format of **project weeks**, where students participate in condensed block courses on transdisciplinary topics and therefore gain highly relevant competencies as change makers.

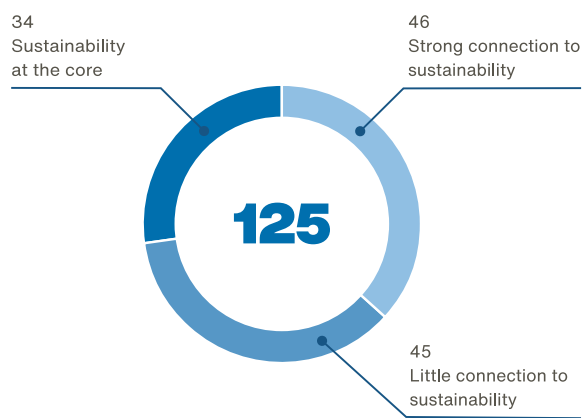
# 15

plug-in modules on sustainability topics

### Bachelor's Degree programs (2024)



### Master's Degree programs (2024)



EDUCATION AND LIFELONG LEARNING GOAL

# Establish a culture of sustainability through education

In 2020, TUM founded the TUM Institute for LifeLong Learning (TUM IL<sup>3</sup>) as a university-wide platform for continuing education. It supports experts and executives in science and business to have sustainable careers and to meet professional and societal challenges effectively and responsibly. In 2023, more than 2,000 employees were trained through more than 200 events of TUM IL<sup>3</sup>, including around 400 individuals in management and leadership roles. The training sessions focused on key topics such as digital skills, mental health, sustainability, and responsible leadership. In 2023, a Digital Work Learning Day was organized with more than 600 attendees. Furthermore, the IL<sup>3</sup> Mental Health Day was met with great interest: Almost 720 employees attended 20 online events to find out how they can strengthen their mental health and maintain their performance at work.

# 720

employees attended events at the Mental Health Day

# 2,000

employees trained in 200+ events in 2023



## IL<sup>3</sup> courses and learning events 2022/2023

2022	2023	
Workshop “The Paperless Office”	Lunch series for professors “Being a responsible leader”	Keynote “Human Sustainability” by Claudia Peus
Workshop “Sustainable Thinking”	Workshop “The Paperless Office”	Workshop “Digital Sustainability”
Workshop “Learning Hacks for Sustainable Learning Architecture”	Online learning day “Digital Work”	TUM Sustainable Communities Network Meeting
Workshop “Mental Health: Developing Resilience and Personal Resources at Work”	Workshop series “Sustainability for TUM Science Managers”	Online learning day “TUM IL <sup>3</sup> Mental Health Day’

### Internal training courses and programs

#### Indicator: Number of internal training courses and other offers with a partial or comprehensive sustainability focus

Throughout 2022 and 2023, TUM IL<sup>3</sup> organized several courses and learning events for TUM employees, with sustainability integrated into their discussions and themes. Within our People Development initiative at TUM IL<sup>3</sup>, more than 100 TUM employees registered for courses around the topic of sustainability within our open course program. 70 mid-level academics and science managers have engaged with CareerDesign@TUM since 2021, underlining the importance of professional development opportunities for sustainable careers.

Moreover, sustainability is integrated in TUM's teaching strategy. Through the dedicated efforts of the 45-member ProLehre team, we enhance teaching and learning skills of both students and faculty to prepare them to tackle the sustainability challenges of tomorrow. For instance, a ProLehre Media & Didactics course on “Sustainable Futures in Teaching” was conducted for the first time in 2024.

### Executive education

#### Indicator: Number of LifeLong Learning programs for external professionals and executives of the TUM IL<sup>3</sup> with sustainability relevance

TUM IL<sup>3</sup> offers innovative formats that enable experts and managers to address current and future social challenges responsibly and effectively. More than 50 programs, tailored to the needs of professionals and managers, deal with sustainability qualifications, e.g. Sustainable Management & Technology, Sustainable Real Estate, Sustainable Investing, Ecological Building, TUM.wood, Street Experiments for Sustainable & Resilient Cities, and Smart Farming & IOT in Agriculture. Until the end of 2023, 5,200 external professionals and executives have participated in TUM IL<sup>3</sup>'s further qualification programs with a sustainability focus.

The TUM Institute for **LifeLong Learning (IL<sup>3</sup>)** stands for evidence-based, future-oriented and sustainable continuing education. Adopting a holistic approach, it offers a wide range of individual courses and structured programs for professionals and executives in academia and business. It ensures that teaching and learning at TUM is both effective and sustainable by combining latest insights about learning and teaching with cutting-edge educational technology. TUM IL<sup>3</sup> contributes to human sustainability by creating a vibrant learning community at TUM where people can learn with and from each other.

## EDUCATION AND LIFELONG LEARNING

# Sustainability stories

At TUM, we offer a wide array of study programs tailored to empower students to specialize in various facets of sustainability. These programs are designed to foster interdisciplinary learning, critical thinking, and practical experience, equipping students with the tools they need to tackle real-world sustainability challenges head-on.

## Degree programs

The following list shows a few examples of study programs with sustainability at their core:

- Agricultural Systems Science (M.Sc.)
- Bioeconomy (B.Sc., M.Sc.)
- Biogenic Materials (B.Sc., M.Sc. degree in planning)
- Engineering Ecology (M.Sc.) Environmental engineering (B.Sc., M.Sc.)
- Forest Science and Resource Management (B.Sc.)
- Green Electronics – Master of Science (M.Sc.) at TUM Asia, Singapore
- Industrial Biotechnology (M.Sc.)
- Politics & Technology – Master of Science (M.Sc., Bavarian School of Public Policy)
- Resource-efficient and Sustainable Building (M.Sc.)
- Sustainable management (B.Sc., M.Sc.)
- Sustainable Resource Management (M.Sc.)
- Technology of Biogenic Resources (B.Sc., M.Sc.)

Especially at the **TUM Campus Straubing for Biotechnology and Sustainability**, the degree programs have a strong focus on sustainability. Two key topics come together: the development of sustainable technologies and their economic integration.

## Study courses

TUM has joined forces with six leading science and technology universities to promote the European spirit through the EuroTeQ initiative, which is dedicated to advancing innovative engineering education across Europe. In 2022, the first **EuroTeQ Collider** was launched, focusing on addressing challenges under the theme of **“Leave no waste behind”**. This innovative learning format serves as a collaborative hub for driving impactful solutions and promoting sustainability through interdisciplinary cooperation and knowledge exchange among participating universities.

For two years, the teaching project **“Digitainability”** has provided students from all over TUM with the latest theoretical and practical knowledge at the intersection of digitization and sustainability. It enables students to develop concrete solutions and applications for specific problems in four key areas: “Responsible Digital Literacy”, “Sustainable Smart Cities”, “Sustainable Industry 4.0”, and “Responsible E-Participation”.

The **TUMMEC OPEN Week**, organized by the TUMMEC InnovationLab in cooperation with the Medical Student Council, the MindYourHealth group and external experts, is designed to enhance an important competency: self-efficacy, the belief in your ability to accomplish tasks, solve problems, or achieve goals in specific situations. This event provides students with the chance to actively engage in experiences that cultivate self-efficacy and reinforce their underlying individual resources and skills.

At the virtual SDG-Campus, a joint project of several German universities including TUM, students can attend a wide variety of courses related to SDGs. In its ongoing engagement with the **SDG-Campus learning platform**, TUM supports SDG 12 (Responsible Consumption and Production), and SDG 17 (Partnerships for the Goals), and also offers courses related to SDG 3 (Good Health and Wellbeing). This support enables students to acquire extensive sustainability skills in addition to their regular course offerings. Recognizing the potential of technological transformations in contributing to sustainable development, TUM develops quality-oriented, contemporary, cross-university learning opportunities.

## Alumni in sustainability

The long-term impact of studying at TUM is shown by our many alumni who are actively engaged in sustainability initiatives, championing efforts that advance environmental stewardship and social responsibility. Already in 2020, TUM's Alumni Magazine KontakTUM published an issue dedicated to sustainability<sup>1</sup> and the number of alumni creating sustainable impact in the region and worldwide has been growing ever since.



**Prof. Dr. Lilian Busse**, who earned her Diploma in Biology in 1993, is dedicated to preserving water, the earth's largest ecosystem. Her passion for freshwater ecology began during her studies at TUM. Since 2021, she is the Vice

President of the German Environment Agency working on a wide range of environmental issues. In 2023, she returned to TUM to share her passion for the environment and her expertise at the interface between science and policy.



**Carina van Weelden** completed her Master's in Sustainable Resource Management in 2015 and now serves as a implementation manager for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Her projects, funded by the German government and implemented in cooperation with local governments, focus on the sustainable and socially equitable management of marine and forest ecosystems, as well as the conservation of biodiversity in partner countries.



**Prof. Dr. Uchendu Eugene Chigbu** earned his Master's in Land Management and Land Tenure in 2009, followed by a doctorate in Land Management in 2013. He has dedicated his career to realizing his childhood dream of

building a sustainable and productive rural economy in Africa through strategic land management. In 2020, he was appointed Associate Professor of Land Management at the Namibia University of Science and Technology (NUST), and since February 2024, he has held the position of Full Professor. He was appointed by the government of The Gambia as the lead international advisor for the formulation of the country's National Land Policy in January 2024. He is the coordinator of the African Union's land network, Network of Excellence on Land Governance, in the Southern African region. Additionally, he serves as the co-chair of the International Research Cluster of the Global Land Tool Network (UN-Habitat) and is associate editor of the journal Land Use Policy.

You can read more about the engagement of our alumni in the chapter on Communication and Global Engagement.

## EDUCATION AND LIFELONG LEARNING

# Outlook

Starting in 2023, we have begun to define relevant sustainability and digitalization competencies within each discipline-specific context, including plans to include them in the Quality Management (QM) processes of our degree programs. These competencies have been and still will be progressively incorporated into competency profiles and documented in course materials of each study program for upcoming accreditations. By 2025, our goal is to have separate sections on sustainability and digitalization in the Schools' annual reports dedicated to the results of the QM circles. Furthermore, sustainability and digitalization competencies are intended to be included in our teaching constitution.

To enrich teaching practices, we have increased the use of sustainability-related applications and practical examples. We also aim to expand our offerings, including plug-in modules and project weeks, that focus on the acquisition of sustainability skills. The modules developed within the SDG-Campus network will be accessible to students by the end of 2024, further promoting sustainability education and awareness. The professional profiles, started in 2022, will be further developed and sustainably will be integrated throughly.

<sup>1</sup> <https://go.tum.de/570010> (available in German)

# Entrepreneurship and Innovation

# 3



# 43

out of 78 TUM start-ups were sustainable start-ups in 2022

# 16

cooperations for sustainable entrepreneurship with external partners

# 17.5%

female founders in 78 established start-ups in 2022

TUM is dedicated to promoting university-based start-ups that contribute to sustainable development of our society and economy. Our students and researchers develop many ideas and technologies for environmental, health and social benefit. We offer strong support to technology-based founders, helping them to develop an entrepreneurial mindset through various qualification programs and consulting services. Over the past two years, our efforts have been focused on helping founders turn sustainable ideas into reality. Focusing on building a culture of sustainable entrepreneurship, improving sustainability skills, and nurturing sustainable start-ups. After all, sustainability in start-ups has two perspectives. It means sustainable products and services on the one hand but also sustainable management and processes on the other.

Goals of the action field Entrepreneurship and Innovation:

- Entrepreneurship culture: guided by sustainability
- Develop sustainability competencies
- TUM start-ups for sustainable transformation

ENTREPRENEURSHIP AND INNOVATION GOAL

# Entrepreneurship culture: guided by sustainability

## Sustainable entrepreneurship events

**Indicator: Number of formats (without teaching modules) offered centrally by TUM ForTe Entrepreneurship, TUM Venture Labs, the TUM Entrepreneurship Research Institute or the Social Entrepreneurship Academy to raise awareness of sustainable entrepreneurship.**

In 2022, a total of 11 entrepreneurship events explicitly related to sustainability took place. They helped to develop our entrepreneurship culture further towards sustainability and raised awareness throughout diverse target groups.

- Visit & Talk by Arun Mujamdar Stanford Doerr School
- Presentation of Green Tech Award at the TUM Sustainability Day
- Munich Global Impact Sprint
- TU9 Innovation Week
- Global Challenge Lab
- TIE2 International Lab
- TUM IDEAward - Award Ceremony
- Christmas Meet & Mingle in Straubing
- Workshop “Why sustainability matters” @ Eday
- Workshop Impact@Eship
- Founders Breakfast on “Impact of sustainability”



## Number of people at sustainability events

### Indicator: Number of people and founding teams reached by these events

Apart from incorporating sustainable entrepreneurship in teaching modules for students, we offer various events to address a wider public at TUM and beyond to raise awareness about sustainable entrepreneurship. These either take place within the context of larger flagship events such as the yearly TUM Entrepreneurship Day or the TUM Sustainability Day or stand alone. Examples are talks or keynotes, gatherings, network events, competitions or award ceremonies. In 2022, 11 such formats were offered with more than 1,900 participants in total.

Participants at 11 sustainable entrepreneurship events in 2022

## External partners

### Indicator: Number of cooperations with external partners to strengthen sustainable entrepreneurship

In 2022, we established or maintained 16 collaborations with partner organizations promoting sustainable entrepreneurship, fostering joint offerings, sharing best practices, and raising awareness and resources. These partners included other universities and scientific institutions, as well as stakeholders from business, industry non-governmental organizations and civil society.

- Ludwig-Maximilian-University (LMU)
- University of Applied Sciences Munich (HM)
- University of Applied Sciences Landshut (HAW)
- Bundeswehr University Munich (UniBw M)
- Munich Business School (MBS)
- Stanford University
- BMW AG
- BayWa AG
- Nemetschek Group SE
- Rhode & Schwarz GmbH & Co. KG
- Wacker Chemie AG
- Social Entrepreneurship Academy
- German Entrepreneurship Foundation
- Zeidler Research Foundation
- Circular Republic

ENTREPRENEURSHIP AND INNOVATION GOAL

# Develop sustainability competencies

## Employees in sustainability training

**Indicator: Number of employees at TUM ForTe Entrepreneurship and TUM Venture Labs who participated in measures offered centrally by TUM ForTe Entrepreneurship, TUM Venture Labs, the TUM Entrepreneurship Research Institute or the Social Entrepreneurship Academy to promote sustainability competences**

To foster sustainable entrepreneurship among our talents and (potential) founders, we enable employees to participate in trainings related to sustainability. In 2022, 12 employees at TUM ForTe Entrepreneurship and at the TUM Venture Labs participated in skill enhancement trainings aimed at sustainability competences.

## Talents in sustainability training

**Indicator: Number of talents interested in founding and (potential) founders who participated in measures offered centrally by TUM ForTe Entrepreneurship, TUM Venture Labs, the TUM Entrepreneurship Research Institute or the Social Entrepreneurship Academy to promote sustainability competences**

To foster sustainable entrepreneurship, we equip talents and (potential) founders with the necessary skill sets regarding sustainability. In 2022, 20 talents and (potential) founders participated in skill enhancement trainings aimed at sustainability competences.

## Female founders

**Indicator: Number of female founders.**

**In general, and also at TUM, founding a new company still has a significant gender bias with a strong surplus of male founders.**

In 2022, 78 start-ups were established by current or former TUM members. Those 78 start-ups account for 183 co-founders, since entrepreneurs usually found their start-ups in teams, and thereof 32 (17.5%) were women.

78

start-ups

32

female founders

ENTREPRENEURSHIP AND INNOVATION GOAL

# TUM start-ups for sustainable transformation

**Indicator: Number and share of TUM start-ups with a focus on sustainability, i.e. sustainable start-ups founded by TUM students, scientists/employees or alumni**

At TUM we track start-ups founded by current and former members of the university, i.e. start-ups established by at least one co-founder who is a TUM student or TUM alumnus/alumna or a current or former employee. Of the 78 TUM start-ups incorporated in 2022, 43 (55%) were sustainable start-ups according to our definition.

# 55%

sustainable start-ups

## What is a sustainable start-up?

As a publicly funded university, TUM supports founding teams at a very early stage of their development. Defining “sustainable start-ups” therefore is complex due to the teams’ evolving nature and the multifaceted aspects of entrepreneurship and sustainability. When assessing whether a TUM start-up is considered sustainable, we are essentially looking at its sustainability potential. If the founding team has developed a product, technology or service that addresses at least one SDG, we list it as a “sustainable start-up” once founded.



## ENTREPRENEURSHIP AND INNOVATION

# Sustainability stories

The TUM Venture Labs are a joint initiative of TUM and UnternehmerTUM consisting of twelve entrepreneurial innovation hubs each with a different core domain. **The Venture Lab Sustainability / Circular** supports venture teams seeking impact in the areas of climate action, resilience and resource management. Through a strong network of experts, emerging sustainability start-ups are guided from the early discovery phase through to incorporation and first external investment. Besides the direct support of our teams, it is the specific task for this Venture Lab to integrate sustainability practices and competencies into the other eleven Venture Labs.

Since 2011, the **TUM IDEAward** has honored science-based ideas and technologies with market potential that address societal challenges and create added value. Ten finalists are selected each year to compete for three prizes totaling € 37,000. They receive coaching, mentoring, and – to foster their sustainability skills – a tailor-made “Impact Session” workshop that outlines practical first steps towards a sustainable start-up. Over the years, we have seen a significant increase in both the diversity of participants and the sustainability and impact orientation of the innovations and pitches.

In 2022, **HopfOn** won the TUM IDEAward for making building materials from hops, realizing the potential of the plant beyond it's use for beer. They are tackling waste by offering acoustic tiles and building panels made from unused plant material. Their innovation not only minimizes environmental impact, but also promotes local sustainability by reducing transport emissions.

In 2023, **lonselect** won the TUM IDEAward by presenting the development of a tool that promises to transform fertilizer management by analyzing nutrient levels in real time during field application. By adjusting fertilizer rates on the move, it optimizes efficiency and reduces overfertilization and waste. Its potential to streamline data transmission to the authorities promises to reduce the administrative burden on farmers and promote sustainable farming practices.



## Start-ups

TUM's vibrant entrepreneurial ecosystem has already inspired and supported numerous **sustainable start-ups** which are now becoming role models for talents and future entrepreneurs. The following selection can thus only name an exemplary few:

### → BAVERTIS

BAVERTIS develop a software-driven battery ecosystem combined with a modular direct inverter to increase the battery life of electric vehicles by up to 80%. They make energy storage efficient, durable, fast, and independent.

### → Carbon Atlantis

Carbon Atlantis tackles the climate crisis at the root by capturing CO<sub>2</sub> in a low-cost, modular, and scalable way. The founders have developed an electrochemical direct air capture approach which extracts CO<sub>2</sub> from the oceans.

### → CargoKite

CargoKite works on zero-emission ocean transportation via autonomous micro ships using wind energy. They thus provide a cheap and feasible way to fully decarbonize commercial freight shipping.

### → Esencia Foods

Esencia Foods is the first startup in Europe developing whole cut fish and seafood alternatives, using natural fungi fermentation.

### → Reverion

Reverion offers revolutionary power plants which double the efficiency of existing biogas production, utilize surplus renewable energy and capture CO<sub>2</sub> – all with zero carbon emission.



**“It is my true belief that boosting scalable and innovative cleantech startups is one of the key mechanisms to address climate change and to help reach global net-zero emission targets. TUM and its ecosystem have unique knowledge and expertise in deep tech research, and the TUM Venture Lab Sustainability/Circular is the perfect means to translate this research into scalable, circular businesses with global reach.”**

Prof. Dr. Claudia Doblinger, Academic Director  
TUM Venture Lab Sustainability / Circular

## ENTREPRENEURSHIP AND INNOVATION

# Outlook

TUM ForTe Entrepreneurship has dedicated resources to focus on sustainability issues: A sustainability assessment tool is being developed to integrate sustainability into the start-up support process. TUM ForTe will increase the education and empowerment of talents and founders on sustainable entrepreneurship through events, qualifications and skill enhancement of consultants and program managers.

TUM aims to further increase the number of spin-offs from science. At the same time, the proportion of women founders is to be increased significantly by 2030. TUM Female Founders was created for this purpose and aims to create synergies together with UnternehmerTUM and TUM Venture Labs and promote women in the Munich ecosystem. One measure within this program is the EXIST Women pilot project of the Federal Ministry of Economics and Climate Protection (BMWK), now for the first time at TUM. It offers financial support, qualification and awareness programs, as well as mentoring to support women in all phases of the start-up process, from idea generation to market launch and scaling their business.

To improve our knowledge about our founding teams and start-ups and to keep track of their developments we are constantly expanding and improving our database and data quality. Thus, in addition to the 2022 baseline as described above, future reports will not only include incorporated sustainable start-ups, but also the number of sustainable early-stage start-up projects supported by the entire ecosystem at TUM, TUM Venture Labs and UnternehmerTUM. In addition, we develop measures to determine, which sustainable start-ups have been able to secure venture capital funding and the total amount of these investments, in order to give an indication of the realized impact of our start-up initiatives. Going forward, we aim to track our early-stage sustainable ventures throughout their life cycle to assess their actual sustainability performance, footprint and impact over time.

# **Campus Operations and Resource Management**

# **4**

**59,214** t CO<sub>2</sub>e emissions in 2021

**36.4%** of total energy consumption in 2021 from renewable sources

Campus operations and resource management are probably the most visible and tangible aspects of our every-day life at TUM. We encounter many challenges in our daily practices, yet we have started to tackle them and work on the urgent challenges regarding greenhouse gas emissions, energy and resource consumption, mobility, biodiversity, equality, and inclusion, as well as ensuring sustainable studies and working conditions. Our pursuit of scientific excellence and social progress cannot be decoupled from the global environmental impact of our own activities. Through our own transformation, we pursue the goal of making TUM a role model for shaping a sustainable and resilient society with responsible and data-based campus operations and resource management.

Goals of the action field Campus Operations and Resource Management:

- Reduce greenhouse gas emissions in scope 1 and 2 by 80% by 2030
- Reduce energy and resource consumption, enhance efficiency
- Reduce mobility-related GHG emissions
- Prioritize sustainability in campus development
- Foster a sustainability culture

# Spotlight: Climate action at TUM

How is TUM tackling one of humanity's greatest challenges - of the climate crises? It requires decisive action from all of us, both as individuals and as a university community. Together with this community, the TUM Sustainability Office with its two climate action managers has developed a Climate Action Plan which includes specific activities to meet TUM's responsibilities.

## Status Quo

Greenhouse gas (GHG) emissions are the primary indicators for measuring the climate impact of organizations and companies. We calculate our GHG emissions balance according to the BayCalc guideline adopted by many Bavarian higher education institutions and based on the internationally recognized Greenhouse Gas Protocol. A thorough examination was undertaken to evaluate all activities of TUM that contribute to greenhouse gas emissions. Since carbon dioxide (CO<sub>2</sub>) is not the only but the most prominent GHG, other relevant gases such as methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) or fluorinated gases are converted to CO<sub>2</sub>-equivalents (CO<sub>2</sub>e). Nevertheless, not all activity data could be gathered yet. The greenhouse gas emissions of TUM for 2021 were meticulously calculated, despite the ongoing impact of the COVID-19 pandemic. Overall, TUM emitted 59,214 t CO<sub>2</sub>e in 2021 and 65,939 t CO<sub>2</sub>e in 2022.

According to the above-mentioned standards we categorize and report our GHG emissions in three main scopes:

### → Scope 1 direct emissions from owned or controlled sources (mandatory)

Scope 1 emissions mainly originated from the combustion of natural gas to generate heat and electricity in TUM-owned power plants, especially in Garching. Fleet emissions only played a minor role, as mobility was limited in 2021 and still in 2022 due to the pandemic. The high demand for electricity arises from TUM's energy-intensive research activities, while heating and cooling requirements stem from building operations.

### → Scope 2 indirect emissions from energy procurement (mandatory)

The main source of emissions in Scope 2 was district heating (2021: 28% from renewable sources). Purchased electricity does not significantly contribute to this scope, as 99.8% of it is derived from renewable sources.

### → Scope 3 other indirect upstream and downstream emissions (voluntary)

Upstream and downstream energy emissions were the most important contributors to Scope 3 emissions, followed by mobility-related categories and purchased goods and services. However, mobility-related emissions were under-represented in 2021 due to the COVID-19 related travel restrictions but significantly rising in 2022. Also, Scope 3 generally encompasses additional categories, such as commuting or construction activities, which could not yet be integrated for 2021 and 2022. These categories may and will additionally cause significant emissions, as presented in the chapter on Campus Operations and Resource Management.

## Goal

In alignment with the TUM Sustainable Futures Strategy 2030, achieving climate neutrality in terms of energy consumption by 2028 had been the overarching objective. The first GHG footprint for 2021 and the subsequent scenarios have prompted a reassessment of this ambitious goal. The scenarios indicated that TUM will be able to achieve net-zero emissions by 2045, in line with the German government's target. Nevertheless, the urgency of action was recognized, and TUM has now set the binding goal to achieve a reduction of 80 % of Scope 1 and 2 emissions by 2030 based on the emissions in 2021.

## Outlook

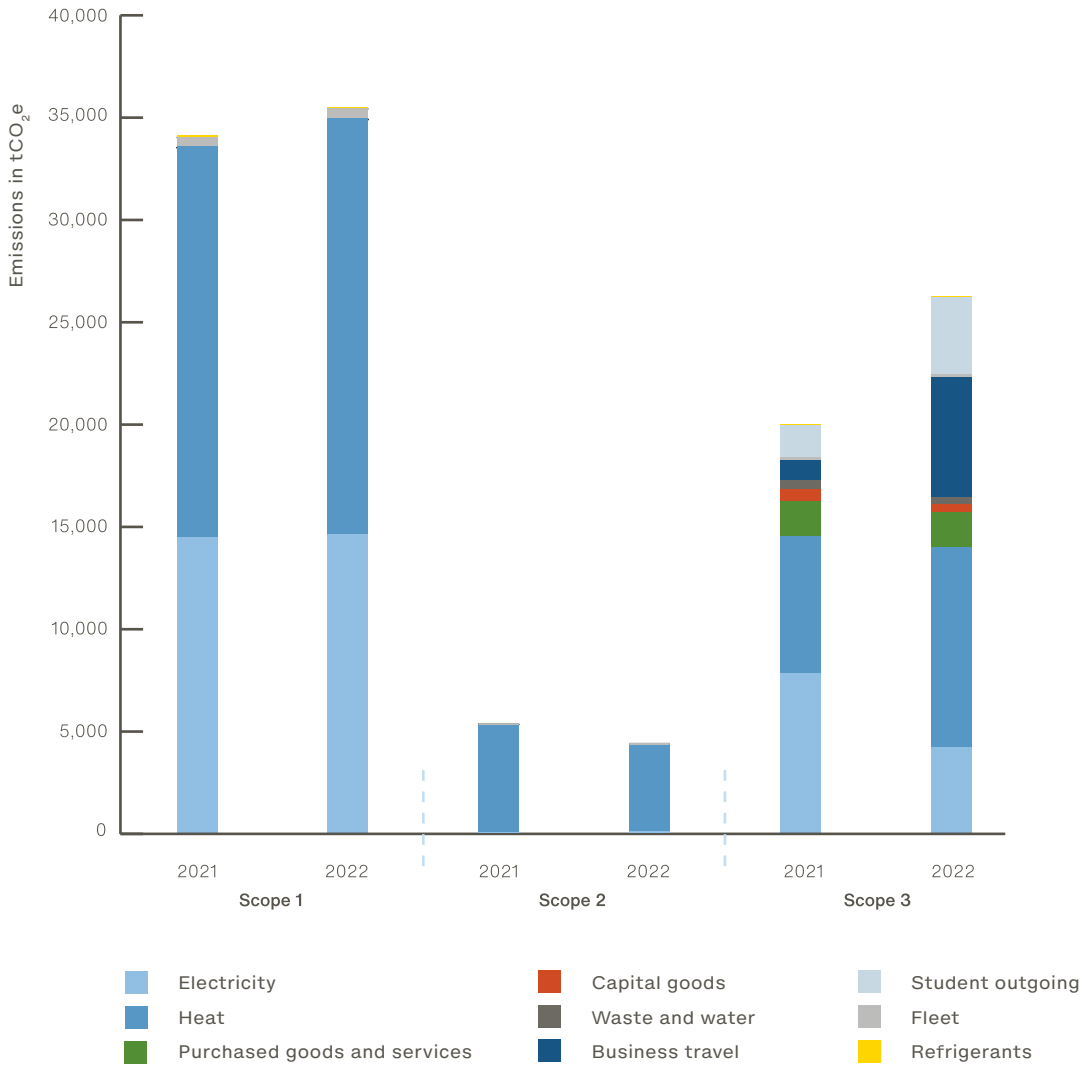
Over the next three years, approximately 30 priority projects outlined in the TUM Climate Action Plan will be launched under the coordination of TUM's climate action management. In this process the participation of the university community and their behavior will play an important role. In addition, TUM's buildings will require large investments by the Free State of Bavaria in the upcoming years to refurbish the buildings, optimize energy efficiency and transition to renewable energy sources.

Download and read the TUM Climate Action Plan (available in German):

<https://mediatum.ub.tum.de/1743493>



**Total TUM GHG emissions by scopes and category in 2021/2022**



**7**  
areas of transformation

**24**  
goals

**58**  
projects



#### CAMPUS OPERATIONS AND RESOURCE MANAGEMENT GOAL

# Reduction of the greenhouse gas emissions in Scope 1 and 2 by 80% by 2030

This original goal from the Sustainable Futures Strategy 2030 (“Climate neutrality in terms of energy consumption by 2028”) was reassessed during the development of the TUM Climate Action Plan. It proved not to be realistically achievable especially because of external and financial factors. Therefore the new and binding target set by the TUM Climate Action Plan focuses specifically on Scope 1 and Scope 2 emissions and is both ambitious and achievable.

## Emissions

### Indicator: Energy-related greenhouse gas emissions in scope 1 and 2

Note: see the special pages on climate action for more details.

The GHG emissions in Scope 1 and 2<sup>1</sup> largely depend on the energy that is being used on campus. Decarbonizing TUM's various campus sites presents various challenges depending on their size and location. Due to energy-intensive research activities

and its considerable size, the Garching campus accounts for 79% of TUM's total GHG emissions in Scope 1 and 2.

To get a complete picture, we also need to consider the energy-related emissions of Scope 3, which include upstream and downstream emissions of energy production such as the production, transport and recycling of photovoltaic modules or the extraction and transport of fossil fuels.

## Photovoltaic

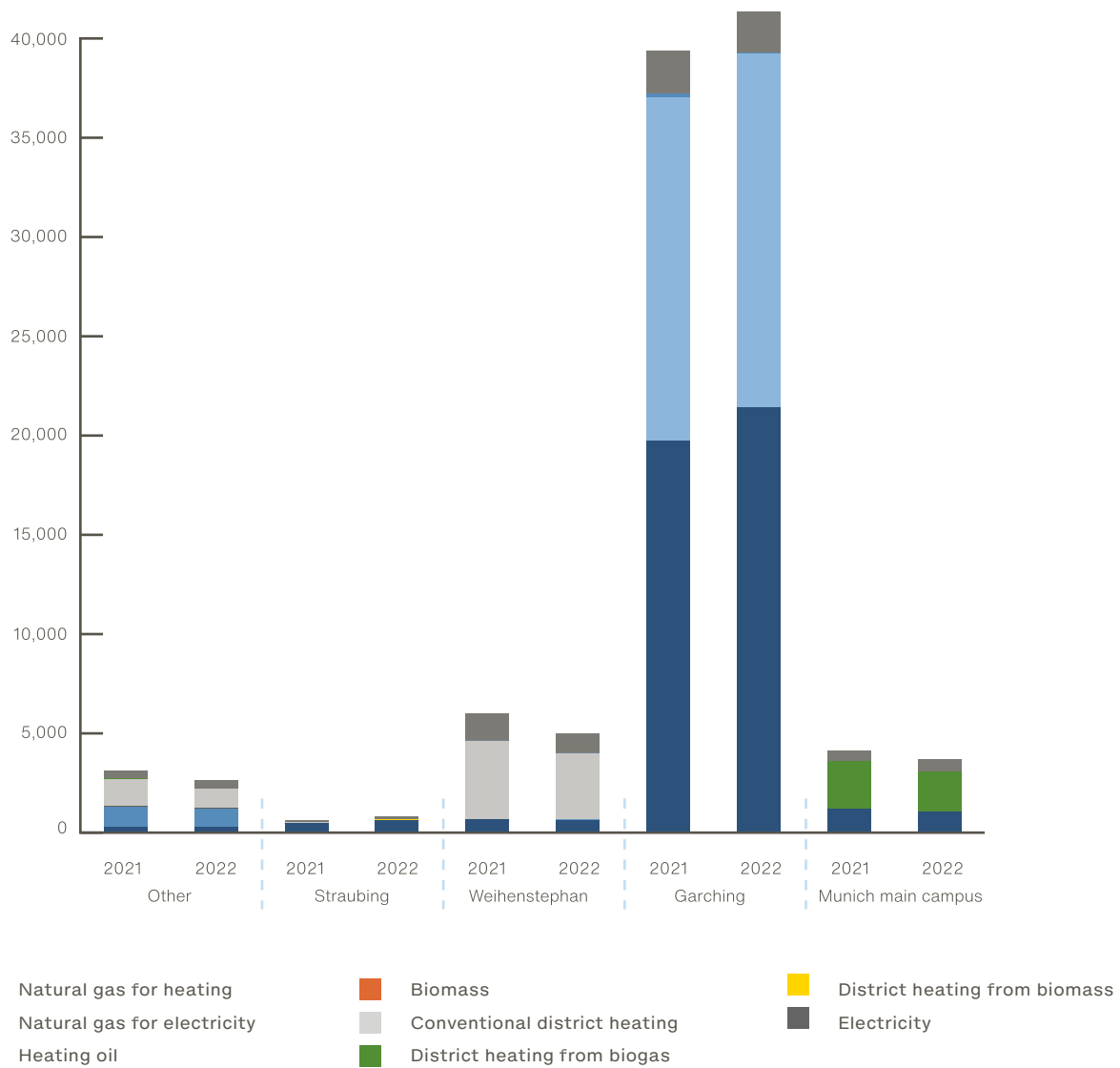
### Indicator: Installed capacity of photovoltaic systems

Generating electricity through photovoltaic (PV) panels is one of the most energy- and cost-efficient ways to produce green energy. In 2023, about 2,500 PV modules were installed with a total capacity of about 1 MWp to produce electricity for the Campus Garching. Between 2023 and 2026, a total of € 7.2 million is provided by the Free State of Bavaria for the expansion of photovoltaics at TUM.

Energy-related GHG emissions in Scope 1 and 2 in 2021/2022

TUM Campus	2021			2022		
	Scope 1	Scope 2	Total	Scope 1	Scope 2	Total
Munich main campus	906	744	1,650	794	628	1,422
Garching	30,699	0	30,699	32,149	0	32,149
Weihenstephan	498	3,303	3,801	487	2,800	3,287
Straubing	316	78	394	440	83	523
Other <sup>2</sup>	1,056	1,162	2,218	980	825	1,805
<b>TOTAL</b>	<b>33,475</b>	<b>5,287</b>	<b>38,762</b>	<b>34,850</b>	<b>4,336</b>	<b>39,186</b>

Total energy-related GHG emissions by campus and category 2021/2022



1 According to the Greenhouse Gas Protocol, Scope 1 means the direct emissions e.g. from the usage of fossil fuels and Scope 2 means the indirect emissions associated with buying energy e.g. electricity.

2 Berchtesgaden, Olympiapark Campus, Ottobrunn Campus, Dachau, Eichenau, Research Station Viehhausen, Freising-Achering, Garching (Other), Garmisch-Partenkirchen, Iffeldorf, Kapuzinerhölzl, Munich (Other), Obernach, Pasing, Raitenhaslach, Schwabing-West, Starnberg, Veitshof, Experimental Station Dürnast, Experimental Station Roggenstein, and Experimental Station Thalhausen; The Campus Heilbronn and other legally independent sites and units are not considered.

CAMPUS OPERATIONS AND RESOURCE MANAGEMENT GOAL

# Reduce energy and resource consumption and increase energy and resource efficiency

## Energy consumption

### Indicator: Total energy consumption

Since energy in general is an important resource, reducing the total energy consumption, even from renewable sources, is highly important on a local as well as regional, national, and global scale. The Garching campus stands out with its high energy consumption due to its size as well as the energy-intensive research. The current primary energy source for this campus is a combined heat and power plant fueled by natural gas. The Munich and Weihenstephan campuses also account for significant energy usage. These sites predominantly rely on biogas and district heating, resulting in lower emission levels both overall and per square meter.

Notably, 99.8% of the electricity purchased by TUM came from renewable sources in 2021. However, renewable sources covered only 8.7% of TUM's heat supply during the same period. The overall share of renewable energy at TUM in 2021

was 36.4% whereas the average share of renewable energies of the gross final energy consumption of Germany in 2021 was 19.4%<sup>1</sup>.

**136.6 GWh**  
total electricity demand in 2021

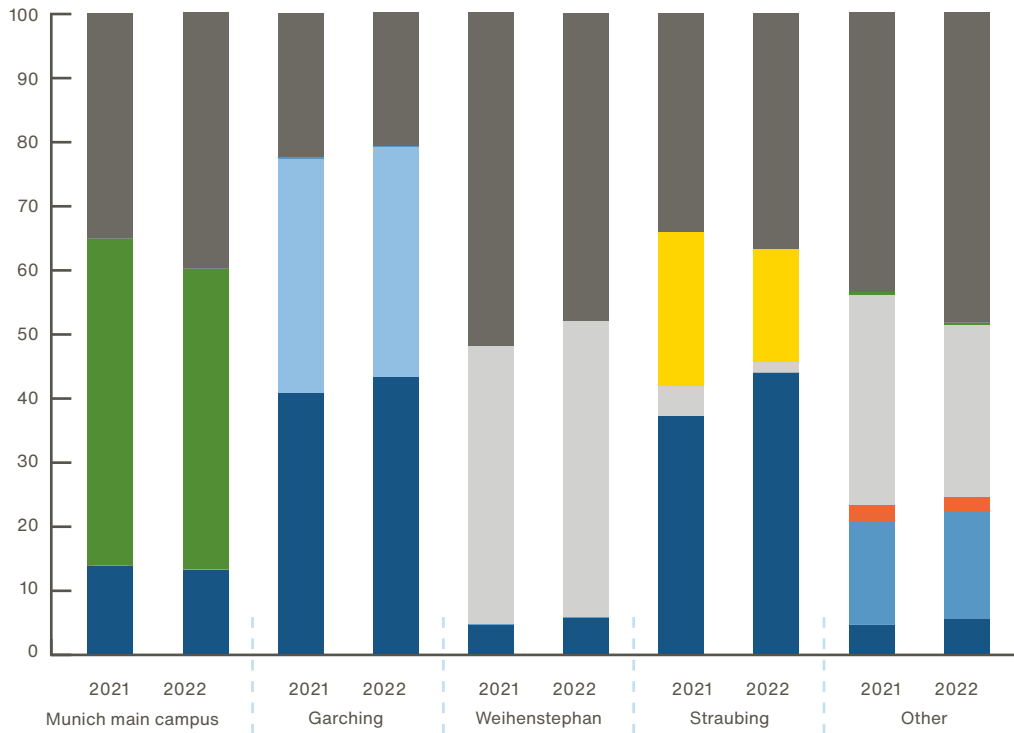
**154.2 GWh**  
total heat demand in 2021

### Energy consumption in 2021 (MWh)

	Munich	Garching	Weihenstephan	Straubing	Other	Total
Natural gas (for heat production)	4,978	88,563	2,641	1,738	927	98,847
Natural gas (for electricity production)	0	79,337	0	0	0	79,337
Oil	0	501	65	0	3,322	3,888
Biomass	0	0	0	0	492	492
District heating conventional	0	0	25,240	221	6,767	32,228
District heating biogas	18,604	0	0	0	77	18,681
District heating biomass	0	0	0	1,125	0	1,125
Electricity	12,797	48,938	30,259	1,610	8,983	102,587
<b>TOTAL</b>	<b>36,379</b>	<b>217,339</b>	<b>58,205</b>	<b>4,694</b>	<b>20,568</b>	<b>337,185</b>

<sup>1</sup> UBA 2024: [www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/2024\\_uba\\_hg\\_erneuerbareenergien\\_dt.pdf](http://www.umweltbundesamt.de/sites/default/files/medien/479/publikationen/2024_uba_hg_erneuerbareenergien_dt.pdf) (available in German)

## Share of energy sources by campus and category in 2021/2022 (%)



## Energy consumption in 2022 (MWh)

	Munich	Garching	Weihenstephan	Straubing	Other	Total
Natural gas (for heat production)	4,362	96,176	2,591	2,418	977	106,524
Natural gas (for electricity production)	0	80,234	0	0	0	80,234
Oil	0	128	58	0	3,004	3,190
Biomass	0	0	0	0	403	403
District heating conventional	0	0	21,396	96	4,801	26,293
District heating biogas	15,690	0	0	0	0	15,690
District heating biomass	0	0	0	971	66	1,037
Electricity	13,342	46,377	22,337	2,033	8,678	92,767

## Resource consumption

**Indicator: Resource consumption: (i) water consumption (drinking water, process water), (ii) number, circulation and share of printed publication formats, (iii) other materials to be specified**

Until now, the only data available regarding resource consumption is the use of drinking water. The relevant data is listed below.

### Water consumption per campus in 2021/2022 (m<sup>3</sup>)

Campus	2021	2022
Munich	106,779	116,332
Garching	n.a.	n.a.
Weihenstephan	821,097	672,999
Straubing	2,539	4,094
Other	47,013	42,411
<b>TOTAL</b>	<b>977,428</b>	<b>835,836</b>

## Waste and recycling

**Indicator: Waste: (i) residual waste, (ii) recycling rate**

Data on residual waste (waste for disposal) and packaging waste cannot be provided, as the amount of TUM's waste in these categories is not measured by the disposal companies. All possible recyclable waste categories have been identified and quantified for 2022.

The waste produced by TUM is collected in the categories listed in the table on page 47, in order to be recycled as required by the federal Kreislaufwirtschaftsgesetz. The category "waste for recycling", includes various types of waste, which cannot be sorted beforehand. These unsorted materials are then separated for further recycling and returned to the raw materials cycle. Since the recyclable materials have already been collected beforehand, only a small share of the category "waste for recycling" is sent for recycling. The last step of sorting by the recycling facility, is a costly and elaborate process. Due to the lack of data on residual waste and packaging waste, it is not possible to report an overall recycling rate (in relation to all waste).

However, thanks to the system of recycling points and the separation of commercial waste into multiple categories, TUM can keep commercial waste for recycling to a minimum. We are therefore able to increasingly close the loop and return more recyclable materials to the materials cycle in a targeted manner. This increases the overall recycling rate. Besides non-hazardous waste some of the hazardous waste in 2022 could also be recycled. By law, the remaining hazardous waste must be sent for hazardous waste incineration.



### Recyclable waste categories and quantities of TUM in 2022

	Munich			Garching			Weihenstephan		
	t	m <sup>3</sup>	Items	t	m <sup>3</sup>	Items	t	m <sup>3</sup>	Items
<b>Documents for destruction *</b>		70.88			6.91			9.24	
<b>Construction waste*</b>	155.92			13.35			18.12		
<b>Biowaste*</b>	4.14			93.21			27.05		
<b>Scrap metal*</b>	26.07			74.69			15.57		
<b>Paper/cardboard*</b>	265.34			419.30			71.68		
<b>Car tires*</b>			15.00	0.92					27.00
<b>Bulky waste*</b>	50.27			102.78			18.09		
<b>Polystyrene*</b>				103.00			51.00		
<b>Waste for recycling</b>	390.31			528.34			99.26		
Recycling rate		6.95%			7.92%			7.92%	

\*Recycling rate 100%

### Categories of hazardous, recycled waste of TUM in 2022 (t)

	Munich	Garching	Weihenstephan
<b>Lead batteries</b>	0.78	1.19	0.00
<b>Dry batteries</b>	0.35	0.41	0.58
<b>Fluorescent tubes</b>	0.50	1.24	0.12
<b>Electronic waste</b>	23.31	33.37	19.21
<b>Refrigerators</b>	0.47	1.90	3.26

# Spotlight: Waste and recycling

**TUM's Disposal and Environment Unit** is part of the Real Estate Management (Central department 4). The team is responsible for all waste management operations at TUM. Every year, more than 1,100 internal orders are handled specifically for hazardous waste. To streamline sorting and recycling efforts, the unit introduced a standardized recycling bin system across the campuses in Munich and Garching, expanding to the Weihenstephan campus in 2017.

Color-coded recycling containers ensure proper sorting of recyclable materials like paper, glass, metal, wood, and plastic items, fostering consistency across the university. A comprehensive **waste disposal guide**, digitally available to all TUM students and staff, assists in navigating disposal routes and recycling options for various waste types. Departmental document destruction, compliant with data protection laws, recycles shredded paper into the raw material cycle. Building management and cleaning services oversee daily waste collection and disposal within TUM premises, aligning seamlessly with the recycling system. Personalized consultations are offered to encourage sustainable waste disposal practices, raising awareness and empowering individuals to make informed choices during procurement and waste disposal.

A collaboration of the TUM Green Office Weihenstephan and the Mathematics, Physics, Computer Science, and Chemistry, Student Council's Sustainability Unit has enhanced waste management efforts within the buildings of the campuses, effectively communicating strategies to staff and students. To support recycling efforts of students, the Green Office Straubing has collaborated with the municipal waste management company and introduced a plastics separation station on campus.

The primary goal remains waste reduction and avoidance, while still emphasizing meticulous sorting and achieving high recycling rates. Moreover, TUM mandates the use of eco-friendly waste collection vehicles through procurement contracts, further demonstrating its commitment to sustainability in waste management practices.

# 1,100

Internal orders are handled annually specifically for hazardous waste

## CAMPUS OPERATIONS AND RESOURCE MANAGEMENT GOAL

# Significantly reduce mobility-related greenhouse gas emissions

Mobility is a highly relevant topic regarding GHG emissions. The data to keep track of the emissions is constantly increased in quantity and quality for highly relevant dimensions. Those are business travel, TUM's own vehicle fleet, our students travelling abroad for exchanges as well as commuting of students and employees.

## Commuting

### Indicator: Greenhouse gas emissions due to commuting

As data from other universities shows, commuting of students and staff to the campuses accounts for a significant share of GHG emissions. While developing the TUM Climate Action Plan, it was discovered that there was hardly any data available on staff and student commuting, with no information for 2021 or 2022. Thus, two TUM research groups were commissioned to carry out a respective survey about commuting behavior of all TUM members in November 2023. The total amount of GHG emissions extrapolated from the survey data is 31,600 t CO<sub>2</sub>e per year which corresponds to around 0.5 tons per person.

### Mobility-related GHG emissions per category in 2021/2022 (t CO<sub>2</sub>e)

Category	2021	2022
Business travel	993.3	5,860.7
Fleet	628.6	656.7
Student outgoing	1,584.3	4,438.7
Commuting	n.a.	n.a.
<b>TOTAL</b>	<b>3,206.2</b>	<b>9,956.1</b>

## Electric vehicles

### Indicator: Number and share of electric vehicles in the TUM fleet

In 2022, the TUM fleet comprised 237 motorized vehicles, including agricultural vehicles. Most vehicles run on diesel or gasoline, but there is also a small proportion of alternative propulsion technologies (5% battery electric, 1% hybrid electric vehicles).



## Business travel

### Indicator: Greenhouse gas emissions from business travel

Business travel activities in 2022 were still influenced by the fading out effects of the COVID-19-pandemic. Nevertheless, a massive increase of travel activity from 2021 to 2022 can be observed. The GHG emissions are largely related to flights, especially medium-distance flights. Short-distance flights still account for a significant share of emissions and has the highest potential for reduction.

### Offsetting international flights

#### Indicator: Offsetting costs for greenhouse gas emissions from international business flights

On its path towards GHG-neutrality, the Free State of Bavaria is compensating for its employees' business air trips by buying emission certificates. In 2022, those compensations were paid for directly from the state budget after acquiring certificates through the "Landesagentur für Energie und Klimaschutz" (LENK). Once TUM has to pay itself for the certificates, we will be able to report on this data.

### GHG emissions from business travel per means of transport in 2021/2022 (t CO<sub>2</sub>e)

Means of transport	2021	2022
Plane <1,000 km	249.1	1,070.2
Plane 1,000 km – 10,000 km	511.7	3,938.4
Plane >10,000 km	24.4	422.6
Local rail transport	15.0	44.0
Long-distance rail transport	59.8	194.1
Car	132.3	186.4
Bike	0.1	0.0
Taxi	0.7	4.7
Motorbike	0.3	0.3
<b>TOTAL</b>	<b>993.4</b>	<b>5,860.7</b>
<b>TUM fleet</b>	<b>628.6</b>	<b>656.7</b>
<b>TOTAL incl. TUM Fleet</b>	<b>1,622.0</b>	<b>6,517.4</b>

# 56%

of business trips in 2022 by train, bus & public transport

# 27%

of business flights produced 93% of total business travel emissions in 2022

### GHG emissions from student outgoing (ERASMUS and TUM Exchange) per means of transport in 2021/2022 (t CO<sub>2</sub>e)

Means of transport	2021	2022
Plane <1,000 km	24.0	107.9
Plane 1,000 km – 10,000 km	1,376.6	2,662.7
Plane >10,000 km	76.0	483.1
Long-distance rail transport	26.0	49.2
Bus	4.7	7.5
Ship	n.a.	0.1
Car	76.0	125.9
Electric car	0.8	1.3
Bike/ e-bike	n.a.	0.4
Motorbike	0.3	0.5
<b>TOTAL</b>	<b>1,584.3</b>	<b>3,438.7</b>
<b>GHG emissions per student outgoing</b>	<b>0.93</b>	<b>0.96</b>

### Outgoing students

#### Indicator: Greenhouse gas emissions due to outgoing students travelling to and from their places of study

Travel restrictions during the Covid-19-pandemic heavily impacted student outgoing activities in 2021. Therefore, the number of students studying abroad has doubled from 2021 to 2022. It is anticipated that the number of students studying abroad will continue to rise in the 2023 data.

# 3,598

students abroad via ERASMUS and TUM Exchange in 2022



CAMPUS OPERATIONS AND RESOURCE MANAGEMENT GOAL

# Prioritize sustainability in campus development

## Spaces for students

### **Indicator: Spaces for students and gathering places to connect with nature**

The StudiTUM buildings in Freising, Garching, and Munich cater to the diverse needs of students by providing both individual study areas and spaces for group collaboration. Located on the main TUM campus, these buildings offer flexible layouts to accommodate various activities. Despite space constraints, emphasis is placed on versatility to ensure ample study areas

and meeting spaces for numerous TUM student groups. Additionally, the Student Initiative “Plant a Seed” aims to raise awareness of food production and consumption while fostering a deeper connection with nature, thereby promoting sustainability within the university campus. The TUM Green Office Weihenstephan is collaborating with Plant a Seed as well as the local student representatives to create a greener campus with inspiring learning spaces.





CAMPUS OPERATIONS AND RESOURCE MANAGEMENT GOAL

# Foster a culture of sustainability

## Duration of employment contracts

### Indicator: Average duration of employment contracts (by employee group)

Job security and long-term positions are a pressing issue and relevant challenge in academia especially in Germany. For **scientific staff** there has been a significant extension of the average contract duration from 11.4 months in 2014 to 16.6 months in 2022. More than 90% of scientists and researchers have fixed-term contracts according to § 2 I WissZeitVG, compared to 65% in Germany<sup>1</sup>. The application of the preferential time limitation under § 2 I WissZeitVG is in favor of employees. In addition, this opens various possibilities for researchers to extend their contracts due to parental leave/maternity protection and the care of children.

As of January 2024, the majority of the **science-supporting staff** (77.2%, 3,615 persons) is employed at the TUM for an indefinite period while less than a quarter (22,8%, 823 persons) have temporary contracts. We work further on extending the minimum duration of limited contracts both for academic and non-academic staff.

## Further qualification for TUM employees

### Indicator: Number of attendees in further qualification programs at TUM

In the rapidly changing working environments of today, lifelong learning is key to success for employees of all kinds. Further qualification, flexibility and new skill sets support our employees' careers and help us maintain our status as a cutting-edge institution in academia. The TUM Institute for **LifeLong Learning (IL<sup>3</sup>)** promotes lifelong learning in a systematic, scientifically sound, and impact-oriented manner by offering a broad range of learning events for all employees of TUM through various offers and programs. Notable examples are the structured programs of CareerDesign@TUM in four fields: TUM Researcher (Research), TUM Learning Professional (Learning and Development), TUM Science Manager (Science Management); TUM Entrepreneurship Advisor (Innovation and Spin-off Management) and TUM Digital Expert.

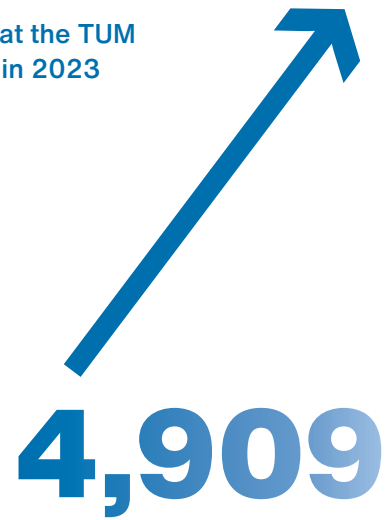
<sup>1</sup> Source: HIS-Institut für Hochschulentwicklung (2022). Evaluation des novellierten Wissenschaftszeitvertragsgesetzes.

From the academic and scientific perspective, doctoral candidates are in an essential development phase of their career. Besides their academic progress, they also develop their soft skills and personality. As of 2014, all TUM doctoral candidates are automatically part of the TUM Graduate School, and benefit from extensive qualification and continued education programs as well as target group-specific services and advising. The number of course bookings at TUM Graduate School, including kick-off seminars, subject-specific courses, and transferable skills training) increased from 4,909 in 2022 to 6,854 in 2023.

TUM also has offers for the next career step in academia. The **TUM Talent Factory** for post-docs organized 19 events with about 380 participants in 2022 and 42 events with about 800 participants in 2023.

6,854

course bookings at the TUM Graduate School in 2023



4,909

course bookings at the TUM Graduate School in 2022

#### Number of attendees in IL<sup>3</sup> programs at TUM 2020–2023

IL <sup>3</sup> programs at TUM	2020	2021	2022	2023
ProLehre   Media and Didactics	834	701	629	815
People Development •TUM horizons •CareerDesign@TUM •Faculty@TUM •ScienceManagement@TUM	1,502	2,041	2,016	2,362
<b>TOTAL</b>	<b>2,336</b>	<b>2,742</b>	<b>2,712</b>	<b>3,177</b>

#### Number of doctoral candidates at TUM 2021–2023

Doctoral candidates at TUM	31.12.2021	31.12.2022	31.12.2023
On doctoral candidacy list	7,158	7,758	8,108
Preliminary candidates	1,694	1,530	1,637
<b>TOTAL</b>	<b>8,852</b>	<b>9,288</b>	<b>9,745</b>

## CAMPUS OPERATIONS AND RESOURCE MANAGEMENT

# Sustainability stories

At TUM, we value tolerance and responsible action with respect for others. The **TUM Respect Guide** defines the standards we strive to uphold in our treatment of one another in our university. It is intended to serve as a deterrent to inappropriate behavior, such as disrespect, discrimination, bullying, threats, harassment or even violence. With the appointment of Prof. Christian Peschel as the first **Ombudsperson Respect**, TUM is expanding the area of compliance to include the topic of “culture of appreciation”.

To increase participation of staff and students various events are organized to enhance exchange and discussions especially with university leadership. The **Presidential Student Lunch** offers the opportunity to talk to the president at a lunch for students. Professors at TUM can discuss ideas and wishes at the **Presidential Faculty Lunch**. At the **Presidential Staff Lunch** and the TUM Dialogue events employees can share their ideas and needs. Each of the events takes place three times per year.

With the **TUM Sustainability Day**, we invite students, employees, and everyone who is interested to experience specifically the diversity of sustainability topics and activities at TUM as well as to engage in discussions and joint activities. The first Sustainability Day took place in October 2022 right after the approval of the TUM Sustainable Futures Strategy 2030. The second Sustainability Day was organized in June 2024 together with the publication of the TUM Sustainable Futures Report 2024.

With the **TUM Dual Career Support**, we are part of the International Dual Career Network Munich (IDCN). Our goal is to jointly attract and retain international talents. Part of talent retention is the promotion of a sustainable hiring strategy. With the networking opportunities at IDCN, partners are supported, and the social aspect of our hiring strategy is increased. For professors, the Munich Dual Career Office (MDCO) offers additional services regarding dual career and relocation.



Unlike universities in many other countries, TUM as all German universities does not have direct influence on the canteens and cafeterias. The public corporation “Studierendenwerk München Oberbayern” is responsible for catering on most campuses. They increasingly improve sustainability in the food they provide for students and staff through a growing share of organic products as well as vegetarian and vegan meals. The Studierendenwerk Niederbayern-Oberpfalz which runs the cafeterias on our TUM Campus Straubing has a specific sustainability initiative in collaboration with all the higher education institutions in their area. Multiple student initiatives (MENSArevolution, Green Office) and the student representatives support this development including reducing the GHG-footprint.

With the **TUM Center for Culture and Arts (CCA)** founded in 2023, we are bridging the gap between art, culture, and science. High-level cultural events, inspiring teaching formats, and experiments using technological innovations for entirely new art forms are the transformative power to create positive change. By addressing pressing societal issues, the CCA supports the sustainability transformation and contributes to a more holistic approach.

# Spotlight: Gender and diversity

TUM cultivates a university culture of appreciation, openness and diversity. That is why TUM takes a holistic approach to implementing its Gender & Diversity Strategy, through which the percentage of women in professorships has increased from 7.7% to 23.6% between 2007 and 2023. TUM is a forerunner among Germany's technical universities and competitive at international level, with 38% of all newly appointed professors in 2023 being women.

As part of the Gender & Diversity Governance at TUM, the Staff Unit Diversity & Equal Opportunities is a central unit which develops, shapes and supports TUM's gender & diversity strategy. They work closely with the Gender Equality Office, the Vice Deans for Talent Management & Diversity and the respective diversity offices at the schools, and report to Senior Vice President for Talent Management & Diversity. The TUM Family Service is also part of the Staff Unit Diversity & Equal Opportunities and supports TUM members with various measures to aid the compatibility of career and family.

The introduction of the TUM-wide Diversity Controlling ensures that reliable data on the different dimensions of diversity is available for monitoring measures and for impact coordination and evaluation. The dimensions comprise all people centrally and at school level who work in the realm of diversity dimensions, diversity-related resources at the schools, research projects and teaching courses, and measures dedicated to diversity-related initiatives.

The Gender & Diversity Incentive Fund provides funds from the Excellence Initiative for the implementation of diversity measures in the schools, faculties and central (scientific) institutions. Examples of diversity measures approved within the Gender & Diversity Incentive Fund include gender awareness trainings for members of hiring and tenure committees, or "WISTUM", a cooperative discussion game on diversity, equality and inclusion.

Through the "Women in STEM Round Table", we aim to reduce stereotypes related to STEM (science, technology, engineering and mathematics) and to an academic career by providing a stage for inspiring female STEM role models. We want to encourage and support all bachelor's and master's students as well as doctoral students and postdocs at TUM, plus STEM-interested schoolgirls and thus women, intersex, non-binary, trans and agender people.



**“We thrive on the diversity of talents, which serves as the essential foundation for scientific breakthroughs, innovation, and societal progress at large.”**

Prof. Dr. Claudia Peus, Senior Vice President for Talent Management & Diversity



#### CAMPUS OPERATIONS AND RESOURCE MANAGEMENT

## Outlook

The sustainable transformation of our campuses is one of our biggest challenges. Many buildings are not in an energy-efficient or structurally sound condition, as 51% of them were built before 1984. Therefore, they have a high energy demand for heating and cooling. Many information details about the buildings are still incomplete or not available digitally. For this reason, a comprehensive database on the energetic and structural conditions of all buildings on the Garching campus is being compiled with an external engineering consultant to identify a sequence of building refurbishment. The other campus locations will subsequently be integrated into the database and sequence.

The corporate mobility management project PRIMA (“Participatory Living Lab for Innovative Mobility management with App-based incentives”) as a joint project of administration (TUM Sustainability Office) and research (Chair of Traffic Engineering and Control and Chair of Urban Structure and Transport Planning) will use digital and physical methods to improve the framework conditions for the use of sustainable mobility options for employees and students. By testing and researching various incentive-based interventions (innovative and digital “pull measures”) in living labs on campus until 2025, we want to implement more targeted projects in the future to significantly reduce emissions from commuting mobility and increase the share of public transport and bicycle use.

# **Governance and University Community**

# **5**



# 40

professorships appointed in 2022 and 2023 are sustainability related

# 19

student clubs focused on sustainability and health

# 8,000

active students in 186 TUM student clubs

Governance profoundly influences sustainability through its capacity to shape policies, allocate resources, and foster collaboration toward achieving long-term objectives for sustainable transformation. Introducing essential structures to support this transformation has been a key activity since the adoption of the TUM Sustainable Futures Strategy 2030. Driven by a shared commitment to sustainability and climate protection, we aim to empower and inspire faculty, students, and staff at all levels of TUM and therefore actively involve them in the creation of our path towards sustainability. The combination of the top-down commitment of our Board of Management and the bottom-up initiatives from all parts of the TUM community are essential for creating impact on the outside and improving the practices and activities on the inside.

Goals of the action field Governance and University Community:

- Incorporate sustainability in governance
- Community engagement for sustainability
- Intensify internal sustainability communication



#### GOVERNANCE AND UNIVERSITY COMMUNITY GOAL

# Incorporate sustainability in governance

## Governance structures

### Indicator: Sustainability anchored in the TUM board of management as well as in the TUM schools (vice dean)

Sustainability is increasingly embedded in the governance and decision-making processes at TUM, with a clear commitment from the Board of Management. This is underlined by establishing the position of **Vice President Sustainable Transformation** within the Board of Management in March 2023. The first renowned expert to fill this position is Prof. Dr.-Ing. Werner Lang who holds the Chair of Energy Efficient and Sustainable Planning and Building. Besides representing the topic internally and externally and therefore being the “face” of the transformation, the Vice President directly and actively works with the TUM Sustainability Office and many other stakeholders. The Vice President also chairs the TUM Sustainability Board which was introduced in April 2023 as a successor for the Sustainability Taskforce which had existed since December 2019.

Sustainability is integrated in the Charter of the Technical University of Munich (GoTUM), which states since May 2023 that the **School Executive Boards** are responsible for the further development of sustainability of the School under the leadership

of the Deans and/or one or more Vice Deans (§ 17 3). Considering the integrative nature of sustainability throughout the responsibilities of all Schools’ Executive Board members, no specific position for Vice Dean Sustainability has been introduced yet.

The **TUM Sustainability Office** was introduced in April 2020 as presidential staff unit to become the central hub to conceptualize, trigger and coordinate the sustainability transformation of the university. It does so through an approach in two directions: On the one hand, the strategic development manifests in the TUM Sustainable Futures Strategy 2030 and the TUM Sustainable Futures Report, the TUM Climate Action Plan and the engagement in all sorts of processes. On the other hand, tangible results have been produced from the very beginning with a partly agile approach of implementing and supporting many concrete projects to create momentum and visibility for the transformation. Many of these projects are also represented in this report. Since its beginning in 2020, the TUM Sustainability office has been growing in people-power and now has six full-time equivalent positions.



## New appointments

### Indicator: Number and share of appointments with sustainability relevance

Based on a preliminary assessment of new appointments at TUM, which increased from 47 in 2022 to 55 in 2023, a significant proportion of newly appointed professors work in areas directly or indirectly related to sustainability (2022: 24; 2023: 16).

## TUM Sustainable Futures Report

### Indicator: Regular publication of a progress report (TUM Sustainable Futures Report)

The first TUM Sustainable Futures Report is published in June 2024. Following reports will be published every two years under the responsibility of the TUM Sustainability Office. The reporting efforts are jointly developed and improved with all relevant units at TUM with the goal to increase efficiency in data collection, broaden the amount of indicators and improve data accuracy and reliability.



TUM Sustainability Office team 04/2024. From left to right: Veronica Becker, Selina Orsi-Coutts, Tobias Michl, Jonathan Bauer, Sina-Marie Rupp, Luisa Marie Otte, Florian Dietrich

## GOVERNANCE AND UNIVERSITY COMMUNITY GOAL

# Community engagement for sustainability

## Student initiatives

### Indicator: Number and proportion of accredited student initiatives with an explicit reference to sustainability

The engagement of our students reflects their commitment to sustainability. As one of many, the Environmental Department of the Student Representation actively contributes to shaping university life through many different initiatives and activities, which are aimed at fostering an increasingly sustainable TUM. Collaboration with the TUM Sustainability Office and regular meetings underline this ambition. The efforts encompass campus projects, environmental education initiatives, and the promotion of sustainable lifestyles. In total, 186 accredited TUM Student Clubs with around 8,000 active students shape our university life. Thereof, 19 initiatives specifically relate to the field "Sustainability & Health".

# 186

accredited TUM Student Clubs

### TUM Student Clubs in the field 'Sustainability & Health'

- 100 Voices – One Planet
- Ingenieure ohne Grenzen
- PAN UG München TUM
- ReparadTUM
- SusTUMable Design
- TUM Renewable Energies Initiative
- VACCtion
- Akademische Energiegenossenschaft@TUM
- LBV Hochschulgruppen Freising and Straubing
- Plant a Seed
- Ringvorlesung Umwelt
- The Green Team
- TU Peak Seekers
- AIAS München e.V.
- Nightline München
- Referat für Umwelt der Studentischen Vertretung
- SRM Talks
- TU eMpower Africa e.V.
- uniMIND München



#### GOVERNANCE AND UNIVERSITY COMMUNITY GOAL

## Internal communication

### Sustainability events

#### Indicator: TUM sustainability events

By hosting various sustainability-related events, TUM creates valuable opportunities for education, networking as well as empowering students and staff to actively contribute to a more sustainable TUM community. The first TUM Sustainability Day in October 2022 was the biggest event of that kind so far. The day marked an important step in TUM's transformation into a sustainable institution through the presentation of the TUM Sustainable Futures Strategy 2030 by the President. It was followed by many different opportunities such as workshops for the development of the climate action plan and

campus-related events by the TUM Green Offices. Of course all the events directed aimed at the public (see chapter on "Communication and Global Engagement") are also relevant for the internal community building. The second TUM Sustainability Day is happening in Juni 2024 together with the publication of the TUM Sustainable futures Report 2024.



# Spotlight: Green Offices – how to make our campuses more sustainable

Establishing our student-run TUM Green Offices has been an important step towards integrating sustainability into every aspect of university life and implementing the TUM Sustainable Futures Strategy 2030. Through many different activities and projects on our campuses and a lot of motivation the TUM Green Offices empower students and staff to become agents of sustainable change in the community. The Green Office Straubing has been the pioneer since 2018, followed by the TUM Green Office Weihenstephan in 2021. Additional Green Offices are planned for the campuses in Garching and Munich.

## Mission

The Green Office Weihenstephan has created its own mission statement which can be seen as a general guideline for all TUM Green Offices:

“Our goal in the Green Offices is to promote a culture of sustainable living across the campus by bringing sustainability into everyday life. Through project management, teamwork, and idea generation, we hope to address issues on campus and encourage broad participation. As we move forward, we’re committed to initiating more events and projects to reach as many students and employees as possible, building a community united by its dedication to sustainability and a greener future.”

The TUM Green Offices work together with all kinds of different stakeholders on campus: collaborations with researchers, students, initiatives, and volunteers. Like this, they become transformation hubs for the implementation of the TUM Sustainable Futures Strategy 2030.

**“Networking, open communication, and patience are key to developing new ideas on campus. In projects such as TUM Bee Paradise and Biodiversity Week, I have seen how important scientific communication and environmental education are in inspiring people of all ages.”**

Tsveta Davidkova – biology student and one of the Green Office Weihenstephan's first members.

## TUM's first Green Office in Straubing

The joint efforts of the campus management of the TUM Campus Straubing and an environmental working group of students lead to the foundation of the first top-down introduced Green Office in Bavaria in 2018. The two founding students, Jonathan Bauer and Adrian Heider, developed a project office with many different focus areas and in collaboration with researchers, staff and external stakeholders. Clean-up-days, office plant swaps, recycling stations, water fountains, sustainable dinners and many other activities began to make the campus more sustainable and continue to do so every day.

## Events and projects

Each semester, both Green Offices facilitate 4-6 major events and additional smaller meetups each. One of the smallest events is a gardening session with around 5 participants, and the biggest has up to 200 participants. On average, workshops and excursions involve around 20 to 30 students. Additionally, they organize different short-term projects and take care of several long-term ones.

Projects and events encompass a wide range of activities, and some of the most popular ones include cleaning days, swap parties, sustainable dinners, sustainable movie nights, planting and building events with raised beds, and many more.





**“We all share the same goal: making TUM more sustainable – and together, we can achieve that more easily!”**

Jonathan Bauer, co-founder of the Green Office at TUM Campus Straubing

### TUMCS GreenTalk

The purpose of this initiative at the TUM Campus Straubing is to inspire students to amplify their own sustainable impact. It does so by providing a platform for students to connect with sustainability pioneers through events focused on sustainability and sustainability-oriented entrepreneurship.

### TUM Bee Paradise

After winning a competition for ideas on how to make the campus more sustainable in 2022, the TUM Bee Paradise has become one of the most extended ongoing projects of the Green Office Weihenstephan. As a joint project with the professorships “Plant-Insect-Interaction”, “Plant biodiversity” and “Urban Productive Ecosystems”, it aims to help the local wild bee population by improving their habitat on campus and raising awareness about the importance of pollinators. It is complemented by workshops and events like the Weihenstephan Biodiversity Week in May 2024.

### Raised beds and Plant a Seed

The campus gardening initiative “Plant a Seed” and the Green Office Weihenstephan work together on a greener and more biodiverse campus with increased educational value. Together, they plan and raised beds in different locations. They grow insect-friendly herbs and blooming flowers and vegetables which are then harvested and eaten together in community engagement events.

### Sustainable Dinner

Both Green Offices regularly organize “Sustainable Dinner” events. In collaboration with different stakeholders on and off campus, including food-saving and food-sharing initiatives and local farmers, they raise awareness through talks on issues in food production and food waste while jointly preparing delicious meals and creating a community, especially also with international students.

### From Green Office founder to climate action manager

One of our climate action managers in the TUM Sustainability Office Jonathan Bauer, started his career as founder of the Green Office Straubing in his bachelor studies. Over the years he learned a lot about the importance of networking, stakeholder engagement and acquired organizational skills, now valuable in his current role. Besides he gained in-depth knowledge about the TUM Campus Straubing which has helped both with his Master Thesis and now in his role in the TUM Sustainability Office. His message to the students at our university underlines the importance to persist in their collaborative sustainability efforts: ‘Keep engaging in sustainability at our university! We all share the same goal: making TUM more sustainable – and together, we can achieve it more easily than alone!’

Follow the TUM Green Office Weihenstephan and TUM Green Office Straubing on social media for regular updates.



TUM Green Office  
Weihenstephan



TUM Green Office  
Straubing



## GOVERNANCE AND UNIVERSITY COMMUNITY

# Sustainability stories

Transparency and participation are among our guiding principles. With many different formats, units and structures, we commit to community and stakeholder engagement to guide us in our decision-making.

The university's governance structures play a crucial role in driving sustainable practices and policies, ensuring accountability, transparency, and effective decision-making to advance environmental stewardship and social responsibility within the institution. The **TUM Sustainability Board** supports the implementation of the Sustainable Futures Strategy 2030, accompanies its further development as a think tank and works on certain projects of various kinds. For further work on specific topics, the Board can also suggest to implement taskforces (see below). All TUM Schools, the TUM Campus Straubing and the student community are represented in the board which works with big efforts and at least monthly meetings and workshops.

The **Taskforce Sustainable Campus Development** was set up to reduce energy and other resource consumption as well as greenhouse gas emissions through joint efforts with Real Estate Management (central department 4). The group consists of renowned experts from science and administration of TUM. A holistic sustainable campus development including mobility, biodiversity, climate resilience and adaptation and many more topics is the long-term aim of the taskforce.

Besides the specific sustainability governance structures already outlined in this chapter, adhering to regulations and standards is essential for ensuring the long-term success of sustainability efforts. Therefore, the **TUM Compliance Office** with the Vice President Compliance is accountable for the multiple TUM Codes of Conduct.



TUM Sustainability Board 02/2024. From left to right: Prof. Dr. Magnus Fröhling, Prof. Dr.-Ing. Werner Lang, Prof. Dr. Alwine Mohnen, Manuel Lerschmacher, Prof. Dr. Clarissa Prazeres da Costa, Prof. Dr. Miranda Schreurs, Prof. Dr. Monika Egerer, Dr. Anton Frank, Yorina Färber, Prof. Dr. Peter Müller-Buschbaum

## Formats / structures at TUM to create transparency and participation

Formats/structures	Description
Presidential Lunches	Students, staff, and professors exchange ideas with the President in target group specific lunches and contribute their ideas, concerns and wishes.
TUM Dialogue	Moderated discussion with members of TUM and the President to address current challenges.
Staff Welcome Day	Introduction and welcome event for new employees.
Welcome@TUM	Welcome event for all new TUM students.
Gender Equality Office and Gender Equality Officer	Enforce real equality of women and men at TUM (students and academic staff) and participation in committees and boards.
Equal Opportunity Officer	Responsible for employees supporting scientific research and education (science and research management).
Staff Unit Diversity & Equal Opportunities	Central unit of the Senior Vice President for Talent Management & Diversity to significantly develop, shape and support TUM's diversity and equal opportunities strategy.
TUM Family Service	Information, advice and services to support the combination of career or study at TUM with home and family life.

### Principles of our university culture

- Diversity code of conduct
- Faculty recruitment code of conduct
- TUM diversity & gender equality plan
- Research code of conduct
- Dual career code of conduct
- Fundraising code of conduct
- Global engagement principles
- Respect guide

## GOVERNANCE AND UNIVERSITY COMMUNITY

# Outlook

We are dedicated to expanding internal communication on sustainability topics. The upcoming **TUM Sustainable Communities Network** will provide the opportunity for all interested members of the university community to exchange ideas and experiences, connect across administrative boundaries, learn new things, and develop projects. Synergies exist with the external communication that is already taking place (see chapter on “Communication and Global Engagement”).

Regarding **new appointments**, the classification of professorships regarding relevant SDGs is currently underway and will also be used for strategic planning of new appointments. For new appointments, a section on the future impact of each professorship will soon be included in the job dossiers, which are detailed information packages for applicants for each professorship. Moreover, the importance of sustainability and climate action will be included in the guidelines for appointment committees as well as the yearly onboarding event for new professors “TUM Prelude”.

A **new daycare center** at the Munich main campus marks another milestone on our path to combining studying and working with family life and adds up to the existing infrastructure. Two architects of TUM are responsible for the planning of the building and perfectly represent the sustainability ambition: Prof. Francis Kéré, winner of the Pritzker Prize in 2022, who holds the Chair of Architectural Design and Participation and is a world-famous representative of socially engaged architecture with a focus on participation, materials and sustainability. Prof. Herrmann Kaufmann held the Chair for Architectural Design and Timber Construction and has emphasized eco-friendly processes and the creation of a healthy environments through wooden constructions.

# Communication and Global Engagement

# 6



# 30

international sustainability events across 5 continents with partner universities

# 2,194

participants in sustainability-related events

# 26

collaborations fostering international relationships in 2022

Communication is key to shaping sustainability transformations – in societies, economies, politics, as well as in our university community. But how does TUM communicate regarding sustainability? How do we engage our researchers, teachers and students, dedicated employees, widely experienced alumni, strong partners and the diverse people in Munich, Bavaria and around the globe? Through transparent and self-critical yet motivating communication, we want to join forces within the university and beyond.

TUM aims to take a proactive role and a creative function in the sustainability discourse and contribute to the accelerating change towards sustainability. Our impact can be even bigger since we are part of a global community and network of universities, research institutions and industry partners. Our research and teaching agenda aims at a global impact. Through inter- and transdisciplinary projects, we jointly develop solutions beyond borders.

Goals of the action field Communication and Global Engagement:

- Establish external sustainability communication
- Strategically expand partnerships



#### COMMUNICATION AND GLOBAL ENGAGEMENT GOAL

# Establish external sustainability communication

## Communication strategy

Sustainability has been firmly anchored in TUM's communication strategy since the TUM Sustainability Office was established in 2020. The topic is regularly and strategically placed across all communication channels. In 2021, a special edition of the university magazine TUMcampus was dedicated to the topic of sustainability<sup>1</sup>. During the relaunch of the corporate website, the sustainability landing page was also redesigned<sup>2</sup>. It presents the strategic approach with its action fields transparently and comprehensibly to the public. It also has a motivational effect and invites readers to actively participate in sustainability initiatives. The website is very popular and has been accessed by a monthly average of more than 450 users since April 2023. The web content is therefore currently being expanded and a full website focusing on sustainability is under construction.

The strategic importance of sustainability is also reflected in the user guidance on the website: both the classic news ([tum.de/news](https://tum.de/news)) and the upcoming dates/events ([tum.de/events](https://tum.de/events)) are tagged with a "Sustainability" label and can be viewed thematically bundled. The visibility of TUM regarding sustainability in the German media landscape is also growing continuously. Articles as well as interviews with key persons such as the President and Vice President Sustainable Transformation are published in newspapers as well as online. Furthermore, sustainability is also part of our social media strategy. Sustainability is also a popular topic on all internal communication platforms such as chat platforms, employee newsletters and others.

<sup>1</sup> <https://mediatum.ub.tum.de/1609090> (available in German)

<sup>2</sup> [tum.de/sustainability](https://tum.de/sustainability)



## Communication channels

**Indicator: Number and share of communication content with sustainability relevance per communication channel; additional differentiation by reach**

Beyond university-wide channels, different TUM Schools and the TUM Green Offices promote sustainability-related content through their individual communication and social media platforms as well as many other newsletters (e.g. EuroTech). The TUM Green Offices Weihenstephan and Straubing with their dedicated sustainability social media channels have a total of >2,300 followers (as of April 12th, 2024). The social media channels of the Environmental Department of the Student Representation are also successful with >2,600 followers, not yet counting the many other initiatives and student groups who also spread the word about sustainability at TUM.

## Public events and engagement

**Indicator: Number of formats/events and participants for exchange with society, politics and business on sustainability issues**

To increase the impact of research and education, public presentation and public engagement formats are essential. Through many different events and events series, with some examples outlined in the table below, we commit to facilitating dialogue and collaboration.

### TUM events, projects, and formats on sustainability topics

Format/event	Description
<b>AgScience on Tap</b>	Lecture series with speakers from various fields of agricultural and environmental sciences in a casual atmosphere
<b>Environmental Lecture Series</b>	Student-organized public lecture series since 1985
<b>Hans Eisenmann-Akademie</b>	Interface for knowledge exchange among academia, industry, policy, and society, offering public lecture series, workshops, and conferences to facilitate interdisciplinary dialogue within the fields of agricultural science and economics
<b>M-Cube Public Lecture Series</b>	Lecture series on different topics regarding the future of mobility in metropolitan regions
<b>Seminar Series of European Universities on Sustainability</b>	Seminar series organized by the TUM Institute for Advanced Study (TUM-IAS) in collaboration with partner universities across Eastern, Southeastern, and Central Europe about topics linked to the SDGs
<b>Straubinger Sustainability Talks</b>	Platform to provide impulses for ongoing discussions and societal engagement on sustainability issues by exploring the scientific fundamentals, mitigation strategies and policy implications around CO <sub>2</sub> emissions
<b>Sustainability Career Day Straubing</b>	Networking event at TUM Campus Straubing to connect students with companies regarding future careers in the fields of sustainability, bioeconomy, and biotechnology
<b>TUM Sustainability Day and TUM Sustainability Week</b>	Largest sustainability event at TUM to promote awareness and engagement with sustainability topics through a diverse program of workshops, lectures, discussions and a sustainability fair, providing opportunities for learning, networking, and discussion within and outside the university
<b>TUM JA! &amp; Graduate Center: Fireside Chats</b>	Panel discussions organized by TUM Junge Akademie featuring different speakers to explore the topic of future skills considering current challenges of humanity, such as "Global Skills in Research - Are we equipped for tomorrow? Future skills in a transforming world."
<b>TUM Speaker Series</b>	A student-run event series with multiple high-level guests from around the world related to diverse sustainability topics
<b>TUM Think Tank</b>	Platform to bridge theory and practice, leveraging TUM's technological advancements to achieve interdisciplinary collaboration and innovative solutions in key areas such as digital transformation, mobility, health, and sustainability
<b>TUM@Freising</b>	Lectures and discussions on various cross-cutting topics by researchers at the TUM School of Life Sciences, specifically aimed at the public in Freising

COMMUNICATION AND GLOBAL ENGAGEMENT GOAL

# Strategically expand partnerships

## Global South cooperation

### Indicator: Number of cooperation projects with partners in the Global South

The TUM Global Incentive Fund is the central seed funding initiative for fostering international relationships with 26 collaborations funded in 2022 to 2023. The TUM Global Visiting Professor Program supported 20 outstanding academic talents for temporary teaching or research stays in the same period. Activities under this program include co-conducting seminars, co-authoring publications, collaborating on project proposals, and designing international master's programs. The TUM Office for Research and Innovation (TUM ForTe) supports all research proposals for third party funding projects and is the main coordinator for all contractual negotiations regarding cooperative research and commercial ventures. In 2022 and 2023, 15 projects with partners in the Global South were funded.

15

internally funded projects with partners in the Global South

## Alumni engagement

### Indicator: Number of alumni in professional or voluntary sustainability projects

A survey conducted in November 2023 by the Alumni & Career Office shows that over two thirds of TUM alumni are involved in sustainability topics through their professional, volunteering, and private endeavours. Specifically, 33% of the respondents of the survey are engaged in ecological sustainability, 18% in economic sustainability, and 17% in social sustainability topics.

## Events with partner universities

### Indicator: Number of sustainability-related events held jointly with partner universities and number of participants

We have strengthened our strategic flagship partnerships as well as our networks, including the EuroTech Universities Alliance and the EuroTeQ Engineering University, to leverage potentials and collaborate on sustainability initiatives. Additionally, we have broadened our engagement with partners in the Global South across various domains. From 2022 to 2023, we facilitated 30 sustainability-related events in collaboration with partner universities across five continents, involving 2,194 participants. Selected collaborations, programs and events are outlined in the following table.

### Sustainability-related events held jointly with partner universities of TUM

Projects, Alliances & Events	Partners	Description
<b>EuroTech Universities Alliance</b>	Technical University of Denmark (DTU), École Polytechnique Fédérale de Lausanne (EPFL), École Polytechnique de Paris (IPX), Israel Institute of Technology (Technion), Eindhoven University of Technology (TU/e)	EuroTech Sustainability Symposium Sustainable Innovators Program EuroTech Future Award Initiatives@Scale Sustainable Campus Development
<b>EuroTeQ Engineering University</b>	Technical University of Denmark (DTU), Institut Polytechnique de Paris (IP Paris), Eindhoven University of Technology (TUE), HEC Paris, Tallinn University of Technology (TalTech), Czech Technical University (CTU), IESE Business School	EuroTeQ Collider (Hackathon)
<b>Global Bioeconomy Alliance</b>	University of Queensland (Australia), UNESP (Brazil) and others	Annual conference in Straubing in 2022 with 170 participants from partnering universities and industry
<b>TUM Mumbai Office</b>	German Center for Research and Innovation (DWIH) New Delhi	Indo-German Forum on the Energy Transition and the Role of Sustainable Urban Mobility
<b>Indo-German Partnerships (IGP) Project (e.g. Indo-German Dialogue on Common Risks and Shared Pathways to Sustainability)</b>	TUM Mumbai, TUM São Paulo	Webinar during the 2022 TUM Global Week
<b>The Future of Agriculture – Smart Farming in India and Brazil</b>	TUM Mumbai, TUM São Paulo	Webinar during the 2022 TUM Global Week
<b>Tsinghua-TUM Talks</b>	Tsinghua University	Hybrid event with 100 attendees and 30,000 viewers worldwide to discuss the universities' roles in campus carbon emission reduction
<b>TUM.Africa Talent Program</b>	Sub-Saharan partners, including Kwame Nkrumah University of Science and Technology (KNUST)	PhD candidates from KNUST and other Sub-Saharan partners conduct research at TUM while also receiving additional training for personal and professional development around the topic of sustainable global leadership
<b>TUM Imperial Zero Pollution Network</b>	Imperial College London (ICL)	Focus on key technologies to mitigate pollution
<b>TUM Without Borders</b>	Various partners in Central and South America, Africa and Southeast Asia	Support for more than 140 sustainability-related projects, often driven by TUM students

COMMUNICATION AND GLOBAL ENGAGEMENT

# Sustainability stories

**Prof. Dr. Annette Menzel** is one of Germany's leading climate scientists and a contributing/lead author to the Intergovernmental Panel on Climate Change Assessment Reports. At TUM, she holds a professorship in Ecoclimatology and has been honoured for her interactive teaching methods in the Master of Sustainable Resource Management program with the Prize for Good Teaching. As the founder of the citizen science portal BAYSICS, her motto "impart knowledge – promote awareness – communicate complexity" aims to convey climate change impacts to the public. Notably, in 2007, she registered TUM as a non-governmental organization (NGO) in the United Nations Framework Convention on Climate Change (UNFCCC), granting observer status and providing students with the unique opportunity to participate in international climate negotiations.

The **TUM SEED Center** links sustainable energy, entrepreneurship, and development in the Global South. With the installation of mini-grids in selected villages, the center not only provides sustainable energy but also promotes education and self-reliance. Collaborating with universities across Africa, Asia, and Latin America, TUM SEED Center blends research with real-world application.

On a European level, TUM is part of the **EuroTeQ Engineering University**, a strategic consortium to advance collaboration in the context of the European Universities Initiative. Through its Collider program, it provides a unique challenge-based learning experience regarding sustainability topics such as "leave no waste behind". From 2022 to 2023, three challenges were organized, each attracting 60–70 participants.

However, we do not only aim at international and global impact but also work locally in cooperation with the municipalities where our campuses are located. A notable example is the innovation cluster **M-Cube** with the City of Munich as key partner. In participatory approaches, TUM researchers from diverse fields develop and test mobility solutions for the future in metropolitan regions together with the city as well as partners from industry, society and academia.





## COMMUNICATION AND GLOBAL ENGAGEMENT

# Outlook

TUM remains firmly committed to advancing sustainability through external communication including stakeholder and public engagement. We will continue working on a global scale with an increasing focus on the Global South. Through initiatives such as this report, the TUM Sustainability Day, the involvement of citizens in an extended TUM Sustainable Communities Network, the activities of the TUM Think Tank as well as lifelong learning programs for external professionals and executives, we offer diverse possibilities for engagement, facilitate public dialogue and empower external decision-makers with evidence-based insights.

Our commitment to driving positive change and contributing significantly to a more sustainable future extends beyond TUM, as we establish partnerships around the world to

collaboratively address global challenges, aligned with the SDGs and engaging international stakeholders in our sustainability initiatives. Through initiatives such as the TUM SEED Center and the TUM.Africa Initiative, we will forge new alliances and involve international stakeholders in our sustainability projects.

On state-level, TUM is a founding member of the Bavarian Center for Higher Education and Sustainability (BayZeN) and continually increases cooperation with cities and municipalities as key steps in enhancing the sustainability of TUM's locations.



# The voice of our schools

**“At the TUM School of Management, we are committed to integrating sustainability into our core activities – education, research, and operations. We aim to develop responsible leaders equipped to address global challenges and advance sustainable futures.”**

TUM School of Management (MGT)

**“We design groundbreaking products, systems, and infrastructures. Our focus is on analysis, simulation, and development in the fields of mobility, energy, nature, materials, and the built environment. Our experts and talents approach complex challenges with a sense of responsibility for people and planet earth. In innovation partnerships, we create solutions for a sustainable future.”**

TUM School of Engineering and Design (ED)

**“Electronic systems, computational technologies and digital infrastructures have a huge demand in energy and rare materials. CIT develops systems, methods, algorithms, and technologies which drastically reduce the resource consumption of the digital society. Mathematics, data science, machine learning etc. act as ‘hidden enablers’ for sustainability research in other scientific fields.”**

TUM School of Computation, Information and Technology (CIT)

**“The TUM School of Life Sciences significantly contributes to sustainability by integrating diverse life science disciplines, fostering a holistic understanding of ecosystems, sustainable land use, food production, and processing. Its research and education drive TUM's sustainability transformation, emphasizing the well-being and health of people, the environment, and innovations for a sustainable tomorrow.”**

TUM School of Life Sciences (LS)



**“TUM Campus Straubing focuses on research for sustainable solutions in bioeconomy and biotechnology. Our research and teaching initiatives drive innovation towards a more sustainable future through interdisciplinary collaboration and practical applications. By supporting a Climate Action Manager and participating in the TUM Sustainability Board, we contribute to TUM’s sustainability transformation.”**

TUM Campus Straubing (TUMCS)

**“SOT contributes to sustainable development through a broad range of research, teaching, and outreach activities, focusing on the intersection of technological advancements and social innovations as enablers and drivers of sustainability. The TUM Think Tank serves as a multi-stakeholder platform to translate academic insight into actual practices in the private and public sector.”**

TUM School of Social Sciences and Technology (SOT)

**“At the TUM School of Medicine and Health, sustainability extends beyond safeguarding current health to protecting the well-being and vitality of future generations. Our commitment encompasses preserving human health, enhancing quality of life, and advancing sustainable healthcare practices, thus contributing to TUM’s journey towards a more sustainable future.”**

TUM School of Medicine and Health (MH)

**“Combining physical, chemical, and biological concepts bridged by engineering approaches, we create sustainable solutions for the fundamental societal challenges and educate the next generation. The 17 sustainability goals of the UN are key factors in our overall research & education strategy.”**

TUM School of Natural Sciences (NAT)

# Imprint

## TUM Sustainable Futures Report 2024

June 2024

### Publisher

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80333 Munich, Germany  
www.tum.de

### Format

This report follows the English format for numbers.

This report employs English spelling and language. German words and phrases (e.g. "Grundordnung") remain in German without translation.

### Data collection

Data collection for this report was completed by the editorial deadline on 29 April, 2024.

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The continuous support from of a multitude of stakeholders at TUM has truly been the foundation of our efforts. We want to extend a sincere thank you to each and every person at TUM whose commitment and passion fuel our journey towards sustainability. This report is a reflection of your hard work and dedication and serves as a roadmap for our continued commitment to sustainable development.

This report would have not been possible without the contribution of the following people:

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**Pages 15, 16:** SciVal based on Scopus (as of 7 March, 2024)

**Page 17:** Highly Cited Researchers - Evaluation and selection - Clarivate (as of March 7<sup>th</sup>, 2024)

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**WE  
WALK  
THE  
TALK**