

WHERE RESEARCH SHAPES THE FUTURE

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WHERE RESEARCH SHAPES THE FUTURE



### **FOREWORD**

**Anna Mayer Climate Project Manager & Sustainability Coordinator** 

It is well known among universities with roots in the mining sector that the term "sustainability" dates back to Hans Carl von Carlowitz. He was a mining official who coined the term to denote a long-term and responsible approach to forestry due to the much-needed supply for wood in the mining industry in the 18th century.

It is one thing to be linked to the roots of sustainability but a targeted development towards a sustainable future for all needs our continuous engagement.

The SDG Report 2023 provides insights to Montanuniversität's contributions to sustainability and specifically the Sustainable Development Goals. Over the years the university's commitment to work towards a sustainable future has evolved and this year's edition provides insights into the foundations as well as the development. The readers can inform themselves about the university's sustainability strategy, its positioning towards the SDGs on a project level and recent events that have fostered new collaborations. Examples of these are the hosting of the Austrian Climate Day and the SCoRe A+



Hydrogen and Carbon Event. The first provided a good opportunity to discuss raw materials in the light of climate change. The second was an excellent opportunity to unite a vast amount of the university's researchers on a common topic. Be it in interdisciplinary partnerships or with new fields and partners - together we can achieve the most!

As university we are setting ourselves high targets and aim to achieve excellent research and teaching. In the section "Contribution to the Sustainable Development Goals" and the "Flagship Projects" one can observe how projects are linked to the SDGs. Likewise, its students are of great concern to Montanuniversität Leoben and to provide them with relevant education for sustainable development is our goal. Efforts in this direction can be reviewed on the dedicated education sections.

I hope this report will inspire all readers as well as Montanuniversität Leoben's staff and students to strife for a sustainable future together.

### **OUR VALUES**

At Montanuniversität Leoben, sustainability is our motivation to excel in research and teaching.

The university's new development plan is focused on five core values: Energy Efficiency, Climate Neutrality, Sustainability, Zero Waste and Circular Design.

A Sustainable Development Panel of university staff collects and ideates new approaches and pathways to act and live sustainable as staff, researchers, teachers and university.

Our scientists develop technical and scientific methods to solve today's challenges.

In our teaching, we provide our students with environmental challenges and the tools to deal with these issues, and prepare them for their future key role in improving our environment.

Our university stands for excellent science, outstanding education and absolute excellence in research and teaching, reflected in three areas of competence: Advanced Resources, Smart Materials and Sustainable Processes.

Montanuniversität Leoben's sustainable values and ethics at a glance



2900 students 26% female students

92 sports courses offered founded in 1840

80 nationalities

**8:1** ratio students:teachers

10 charging stations for EVs + 49 for e-Bikes

## OUR HISTORY IS A STRONG BASIS FOR THE FUTURE

Since the foundation of our university, its competences have been continuously deepened and developed in order to actively connect them to current, socially relevant issues. This has led to a broadening of the research spectrum with clear specialisation and positioning at the same time. Development is not standing now! On the contrary, it is progressing at an ever-increasing speed.

Since the first decades of the 19th century, rapid developments in engineering and transport required a drastic increase in output from the suppliers of mineral resources and building materials, and in particular from the mining and metallurgy production in the alpine region. It was only possible to achieve this rate of growth with more academically trained engineers.

As a consequence, a Chair of Metallurgy was established in Vordernberg in 1814. The Styrian Mining School was officially opened in 1840. Peter Tunner clearly stated his intentions of teaching at academic level and developing his institution into a centre of teaching and exchange for experts in mining and metallurgy from the entire alpine region.

In the revolutionary year of 1848 the university was taken over by the state and moved to the





nearby district town of Leoben in 1849. In 1861 it was promoted to a Mining Academy. 1874 the Mining Academy received a new statute which was to guarantee a sound and stable development, and the status of the teachers was ranked equal to professors at technical universities and was later renamed to Montanuniversität Leoben. With the right to grant doctoral degrees, the institution was at last set equal to the technical universities.

In recent years the great challenges of our time in the areas of resources, climate, energy and the environment required a new orientation of the university. Montanuniversität Leoben is therefore now increasingly researching and teaching for a better tomorrow, so that innovative ideas become sustainable reality.

The university has received distinction and recognition from the professional world, the state, industry and economy in the past for its excellence and outstanding work and dedication in research and teaching. Today, Montanuniversität Leoben aims to contribute to a more sustainable future and to continue its successful path.

## SUSTAINABILITY VISION AT MONTANUNIVERSITÄT LEOBEN

The great social challenges of our time in the areas of resources, climate, energy and the environment demand the adaptation of our behaviour, as well as a reorientation of our university. In recent years, the implementation of sustainability has become increasingly important in all areas of global societal development. With strategies and frameworks such as the UN Sustainable Development Goals and the EU Green Deal it has become clear in which direction research and education will advance in the future. Interdisciplinary and excellence-based approaches are needed to address today's societal challenges for a better future.

Already in its 2017 development plan, the university defines "safe, clean and efficient energy, climate protection, environment, resource efficiency and raw materials, inclusive, innovative and reflexive societies [and] safe societies" as relevant topics in connection with European research.

## How do we contribute to sustainability?

In the course of this evolutionary development, the university is self reflectively placing its core competencies along the value-added cycle in relation to societal and ecological developments. Thus, it has meaningfully developed further by adapting a range of topics connected to resource use, energy and sustainable development. Today, the cycle of resources and materials is fully mapped at MUL and its definition is the center of the institutional philosophy, reflected in teaching and research.































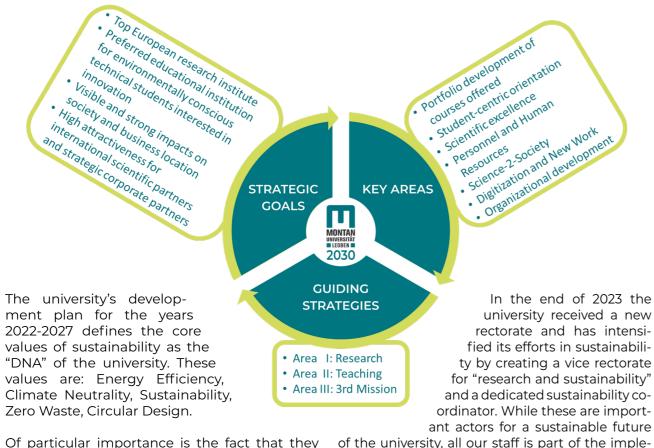






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### SUSTAINABILITY STRATEGY



Of particular importance is the fact that they encompass all levels of the university and are reflected in the document as strategic key areas.

of the university, all our staff is part of the implementation. Each person needs to be aware of their potential for transforming towards sustainability.



# CONTRIBUTING TO THE SUSTAINABLE DEVELOPMENT GOALS

Montanuniversität Leoben is working on a variety of projects to achieve the SDGs and reviews its projects according to the SDGs biannually.

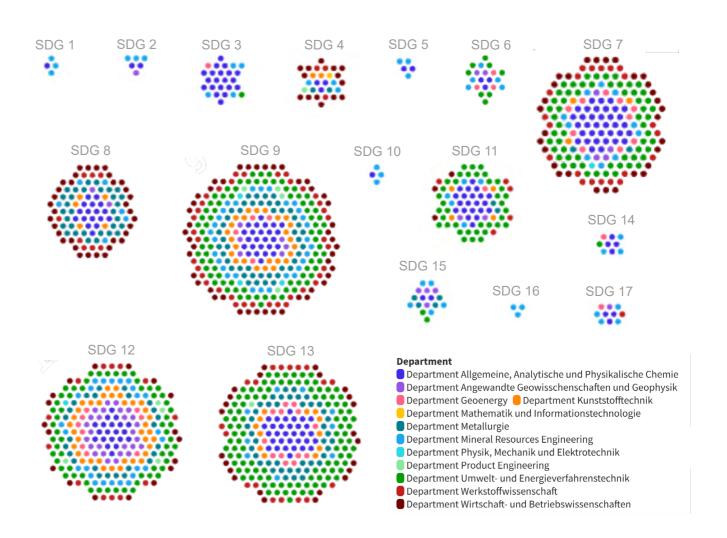
Raw materials and their processing and the related energy consumption contribute considerably to development, economy and modern society. Montanuniversität's expertise in the raw materials life cycle is therefore important in relation to sustainable development and, as the present survey shows, diverse.

The illustration shows how the projects at the university contribute to the SDGs. Since often several SDGs can be assigned to a single project, the visualization is based on SDG impact

points. In this sense, a project can have multiple impact points. A total of 494 projects with sustainability relevance have been submitted. The survey resulted in a total of 1284 SDG impact points.

Montanuniversität Leoben contributes to SGDs in its scientific output, with special focus on:

- » SDG7: Affordable and Clean Energy
- » SDG 9: Industry, Innovation and Infrastructure
- » SDG 12: Responsible Consumption and Production
- » SDG 13: Climate Action





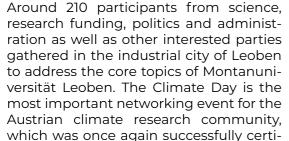
## AUSTRIAN CLIMATE DAY AT MONTANUNIVERSITÄT LEOBEN

## SUSTAINABLE RESOURCE USE IN AN INTERDISCIPLINARY DISCOURSE



In 2023, the motto of the 23rd Climate Day - 'Resources in Transition' - set the goal of bringing sustainable resource use into the interdisciplinary discourse of the Climate Day.





fied as a Green Meeting.

The conference focused on topics such as energy, raw materials and resources in the context of climate change.

The MUL provided the ideal setting for this, as it combines technology with science and all areas of raw materials science. Sustainability research is also becoming increasingly important.

After official welcoming speeches by Harald Rieder (CCCA Chairman), Wilfried Eichlseder (Rector), Bernd Vogl (Managing



Director of the Climate and Energy Fund), Karolina Begusch-Pfefferkorn (Head of Division at the BMBWF), Helmut Hojesky (Head of Department at the BMK) and Andrea Gössinger-Wieser (Climate Protection Coordinator for Styria), the keynote speech was delivered by Anke Weidenkaff, Professor of Materials Engineering and Resource Management and member of the German Advisory Council on Global Change, spoke, among other things, about materials for the energy transition and recycling of fuel cells, thus providing the basis for the subsequent audience discussion, which highlighted the 'clash of cultures' in the various schools of science and led to intensive discussions. This once again demonstrated the need for comprehensive interdisciplinary exchange. The Climate Day is intended to create precisely this framework, as cooperation and input from all disciplines is needed in order to successfully deal with the social, ecological and economic challenges and opportunities posed by climate change. The discussions also confirmed that on the road to a sustainable future, social innovations are needed in addition to technical innovations in order to achieve a change in resource utilisation.



## SCoRe A<sup>+</sup> RESEARCH ON HYDROGEN AND CARBON



On 15 February 2023, scientists met at Montanuniversität Leoben to discuss hydrogen and carbon research. The great potential of hydrogen to play a significant role in cross-sector decarbonisation is currently inspiring a large number of research projects at a global level. At Montanuniversität Leoben, the topic of hydrogen is inevitably linked to the valuable material carbon due to the research activities in the field of methane pyrolysis.

Around 120 scientists from 23 different organisational units at the university are currently working on topics in the Strategic Core Research Area (SCoRe A+ Hydrogen and Carbon). The topics cover the entire value chain of the two valuable materials hydrogen and carbon: from production (pyrolysis and electrolysis) to transport and storage (from small-volume storage for mobile applications to large-volume storage in rock formations) as well as specific applications of hydrogen (e.g. metallurgy, mobility, chemical process engineering) and carbon (e.g. agriculture, building materials, highly porous storage media).

The promising research results led to the internal decision at the end of 2021 to continue researching methane pyrolysis on a larger laboratory scale in order to make a significant

contribution to the future implementation of this technology on an industrial scale. In addition to the pyrolysis of methane, other components of the pilot research facility include a hot gas filter for separating the solid carbon, a membrane system for product gas purification, a combustion chamber and a post-treatment plant for solid carbon.

The H2-C research centre will go into



12 RESPONSIBLE CONSUMPTION AND PRODUCTION

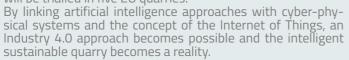
operation by the end of 2024 and enable interdisciplinary collaboration between several research groups at Montanuniversität Leoben. It will thus make a significant contribution to the further development of methane pyrolysis technologies towards industrial implementation.



### **FLAGSHIP PROJECTS**



DigiEcoQuarry will develop systems, technologies and processes for the integrated digitalisation and automation of the process control of raw material operations in real time, which will be trialled in five EU quarries.









The main objective of MaDiTraCe is to improve the reliability of the traceability of critical raw materials (CRM) and the transparency of complex supply chains.

The project aims to develop and test independent digital and geo-based approaches for CRM traceability and integrate them into a general certification system for CRM throughout the mineral supply chain. This methodology will enable downstream industries to demonstrate the reliability of their sustainability claims while complying with current regulations and anticipating the implementation of future regulations (EU Directive on corporate sustainability due diligence).







The H2020 project illuMINEation highlights essential aspects of digitalisation in underground mining with the core objective of improving efficiency as well as health and safety of the European mining industry and its personnel.

The illuMINEation project addresses all three key factors that influence sustainability and profitability of mining operations: Occupational health and safety (including health and safety aspects for surrounding stakeholders), environmental impact and efficient resource extraction.











S34I researches and develops new data-driven methods for analysing Earth Observation (EO) data that support systematic mineral exploration and continuous monitoring of extraction, closure and aftercare, with the aim of improving Europe's knowledge and autonomy in relation to mineral resources.

S34I uses EO not only for the management of technical and environmental issues, but also to support social acceptability of mining (SLO) and better legislation. S34I will utilise Copernicus and other satellite sensors, while other techniques/methods and fieldwork will be used to either calibrate, validate or complement Copernicus data.







## **EDUCATION AT MONTANUNIVERSITÄT**

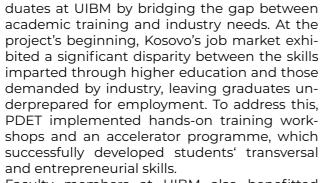
#### **Professional Development for Engineers of Tomorrow (PDET)** Project (2021-2023): SDGs Impact and Achievement

The Professional Development for Engineers of Tomorrow (PDET) project, which ran from November 2021 to November 2023, was an Austrian Development Agency HERAS+ funded collaboration between Montanuniversität Leoben (MUL) in Austria and University "Isa Boletini" Mitrovicë (UIBM) in Kosovo. It aimed to address a critical skills gap for engineering graduates in Kosovo by equipping them with entrepreneurial and employability skills, directly supporting SDG 4: Quality Education, SDG 8: Decent Work and Economic Growth, SDG 5: Gender Equality, and SDG 10: Reduced Inequalities. By focusing on economically disadvantaged regions, the project fostered sustainable growth, inclusivity, and equal opportunity.



#### **Quality Education**

SDG 4 seeks to ensure inclusive, equitable, and quality education while promoting lifelong learning opportunities. The PDET project's primary objective was to



enhance the employability of engineering gra-

Faculty members at UIBM also benefitted from specialised training on integrating entrepreneurship and soft skills into their courses. This capacity building strengthened both student and faculty competencies, making the education at UIBM more relevant to job market demands. This enhancement supported a future-oriented curriculum, preparing graduates for a broader range of professional paths, contributing to the aims of SDG 4.



#### Decent Work and Economic Growth

The project aligned strongly with SDG 8. which promotes inclusive and sustainable economic growth,

full employment, and decent work. PDET's core mission was to foster entrepreneurship among students, encouraging them to establish start-ups and engage in innovative projects that could generate employment. This was especially impactful in the Mitrovica region, where job opportunities were limited. and the local economy faced persistent



By equipping engineering students with essential skills through the professional development accelerator, the project enabled graduates to enter the workforce confidently, either as employees or entrepreneurs. The training workshops provided practical skills essential for job market readiness, covering topics from entrepreneurship fundamentals to advanced jobspecific competencies. By enhancing graduates' intrapreneurial and entrepreneurial skills, PDET contributed to economic diversification and resilience in Kosovo's underserved regions, thereby supporting the goals of SDG 8.



challenges.

#### **Gender Equality**

Gender inequality in Kosovo, particularly in engineering and technology fields, remains a significant challenge, with female representation notably low. The PDET

project directly addressed SDG 5 by setting a target of 50% female participation in its training programmes, thereby promoting gender equality and empowerment. By actively involving female students and graduates, the project helped mitigate gender disparities in employment and entrepreneurship within engineering.

Female graduates in the municipalities of Mitrovica, Vushtrri, and Skenderaj faced disproportionately high unemployment, with local companies often hesitant to hire women due to perceived risks such as maternity leave. Through entrepreneurship training, PDET empowered female engineers to establish their own businesses, creating self-employment opportunities and jobs for other women in their communities. This approach not only aimed at reducing gender-based economic inequalities but also strengthened female representation in Kosovo's engineering sector in support of SDG 5.



#### **Reduced Inequalities**

Kosovo's socio-economic landscape is marked by pronounced regional disparities, with voung graduates from poorer regions facing greater barriers to

employment. SDG 10 aims to reduce inequality within and among countries by promoting social, economic, and political inclusion. The PDET project tackled these issues by focusing on the economically challenged municipalities of Mitrovica, Vushtrri, and Skenderai, Through tailored training programmes, PDET provided graduates from these regions with valuable skills and opportunities to enhance their socioeconomic status.

UIBM serves a diverse student population, including students from Bosnian and Turkish minority backgrounds. By providing equitable access to high-quality education and targeted support for entrepreneurial development, PDET fostered social mobility and inclusivity, enabling graduates from varied backgrounds to succeed in their careers. The project thus contributed to SDG 10 by empowering students from underrepresented groups to become active participants in their local economies.

#### Conclusion

The PDET project represented a strategic initiative that promoted sustainable development in Kosovo through education, employment, and economic empowerment. By aligning with SDGs 4, 5, 8, and 10, the project effectively addressed critical social and economic challenges in Kosovo, offering practical and sustainable solutions.

By fostering a skills-based education system tailored to meet local economic needs, PDET positioned UIBM as a regional leader for positive change. This project not only benefitted its direct participants but also exemplified how higher education institutions can contribute meaningfully to regional development, thereby supporting Kosovo's sustainable growth in alignment with global SDG objectives.



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## TReBooks

#### MiReBooks - Mixed Reality Handbooks for Engineering Education

MiReBooks is an innovative educational initiative that leverages Mixed Reality (MR) to modernize mining education. Traditional resources often struggle to effectively convey complex mining concepts, but MiReBooks transforms static materials into immersive, interactive experiences. Using MR-enhanced handbooks and specialized software, students can access 3D models, animations, and simulations directly within their textbooks, providing hands-on learning that makes mining processes, equipment, and safety protocols more accessible and engaging.

With these tools, MiReBooks prepares students for the digital demands of the modern mining workforce, equipping them with essential digital skills. By enhancing educational quality, promoting digital competencies, and supporting technological advancement, MiReBooks aligns closely with the Sustainable Development Goals, specifically SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 9 (Industry, Innovation, and Infrastructure).

### Supporting Quality Education MiReBooks aligns with SDG 4: Quality

learning.

Education by transforming mining education through interactive MR tools. As students increasingly expect digital, immersive learning experiences, MiReBooks integrates 3D models, animations, and simulations into traditional handbooks, making complex mining concepts easier to grasp. Using smartphones, tablets, or MR headsets, students access layered content that turns static textbook material into engaging, hands-on

This approach equips students with essential digital and technical skills, preparing them to meet the demands of a technology-driven workforce. MiReBooks provides a safe and accessible way for students to explore complex equipment and processes that are challenging to visualize through traditional methods, ensuring their learning is both comprehensive and relevant to modern industry needs.



### **Enabling Decent Work and Economic Growth**

In a rapidly evolving mining industry, MiReBooks prepares students with essential digital skills, aligning with

SDG 8: Decent Work and Economic Growth. By equipping students with competencies in MR and digital tools, MiReBooks enhances employability and readies graduates for technology-driven roles. This creates a productive, adaptable workforce capable of meeting the mining sector's modern needs.

MiReBooks also promotes lifelong learning and adaptability, essential for career readiness in a fast-changing field. By aligning educational outcomes with industry requirements, MiReBooks ensures students can apply their technical skills effectively, fostering a resilient workforce that supports sustainable growth through innovation and digital literacy.



### Promoting Industry Innovation and Infrastructure

MiReBooks strongly supports SDG 9: Industry, Innovation, and Infrastructure by integrating digital innovation

into mining education. MiReBooks bridges traditional learning with modern industry needs through MR-enhanced handbooks that provide students hands-on experience with the digital tools increasingly used in the field.

This initiative cultivates a workforce that is both innovative and proficient with digital technologies, aligning with the goal of advancing scientific and technological capabilities. By giving

students direct exposure to MR technology, MiReBooks not only enhances their educational experience but also prepares them to adopt similar tools within the industry.

Additionally, MiReBooks represents an investment in educational infrastructure, creating a pipeline of digitally skilled professionals ready to support sustainable growth in mining. This alignment with SDG 9 makes MiReBooks a valuable asset in the industry's shift toward a more efficient, technology-driven future.

#### Conclusion

MiReBooks is more than just a set of educational tools; it is a strategic initiative that promotes

sustainable development across key areas. By advancing quality education, preparing students for meaningful careers, and fostering industry innovation, MiReBooks aligns with SDGs 4, 8, and 9. The project ensures that mining education is both relevant for today's students and aligned with the broader goal of building a sustainable, skilled, and adaptable workforce. Through its innovative use of MR technology, MiReBooks bridges the gap between traditional education and the digital future of the mining industry, positioning students to thrive in a rapidly evolving world while meeting the needs of a sustainable, technology-driven industry.



## SUSTAINABILITY INITIATIVES

#### **University Development**

Montanuniversität's new development plan sets a clear key task for the university: the consistent further development of the university profile, especially in the "path already taken towards climate, environment, energy & resources". There is general agreement on the fact that our scientists all excel in these areas. The strategic goals formulated in the new plan are: Firstly to become a top European research institute in core topics. Secondly, to become the preferred educational institution for environmentally conscious technology students. Thirdly, to be highly attractive for international scientific partners and strategic corporate partners and last but not least to have visible and strong impacts on society and business location.

#### **Sustainable Development Panel**

Complementary to the strategy planning on Montanuniversität Leoben's governance level via its development plan, the Sustainable Development Panel was founded at Montanuniversität Leoben to anchor the idea of sustainability in the areas of research, teaching and in the university organization. The panel is a consortium of dedicated staff members interested in sustainability. It works to centrally organize developments and activities related to sustainability, as well as to stimulate and initiate new initiatives. At its foundation, the vision and goals of the Sustainable Development Panel were set out in a position paper.



## TripleN - the sustainability initiative of Montanuniversität Leoben

TripleN was created as a brand by the Sustainable Development Panel and bundles all efforts of the university to promote a sustainable development of the planet. With TripleN, Montanuniversität Leoben shows its commitment to sustainability to the public and has established the following actions:

- » Triple N Talks: In the public lecture series research on current topics is presented.
- » Triple N Magazine: Online and print publication on all issues concerning sustainability at the university
- » Sustainability in research and teaching in various projects at the university
- » Green Office Initiative: An assessment of sustainable work habits

Foto © Max Manavi-Huber

## NETWORKS & PARTNERSHIPS

### Together for more sustainability!

As stated in SDG 17 "Partnerships for the Goals", partnerships are needed to promote and achieve sustainable development. Therefore, Montanuniversität Leoben is part of a number of networks and initiatives.

Many of these partnerships are managed by the Resources Innovation Center Leoben (RIC). RIC is responsible at international projects in the fields of sustainability, raw materials and education. The vision of the RIC is to support the creation of a sustainable future. Thereby the topics are: Raw materials, climate protection and sustainability at the university. The center works towards making a valuable contribution to the global goal - a sustainable planet earth.

## Alliance of Sustainable Universities

The Alliance of Sustainable Universities in Austria is a national association of 18 Austrian universities which form a unique network with the common goal of sustainable development. In 2018, Montanuniversität Leoben joined and has since been active in various working groups.

## **UniNEtZ - Universities and Sustainable Development Goals**

In the UniNEtZ project, 18 partner institutions have joined forces to present options on how the UN Sustainable Development Goals can be implemented. In the period 2019-2021, they worked on an options report to support the Austrian government in implementing the SDGs.

The follow-up project UniNEtZ II aims at a strong dialogue with society.

## The climate research network CCCA

The Climate Change Centre Austria was founded in 2011 and since then it is the contact and networking point for climate change research in Austria. It defines itself as a one-stop-shop for research, politics, media and the public in all questions of climate research in Austria and thus promotes a sustainable climate dialogue.

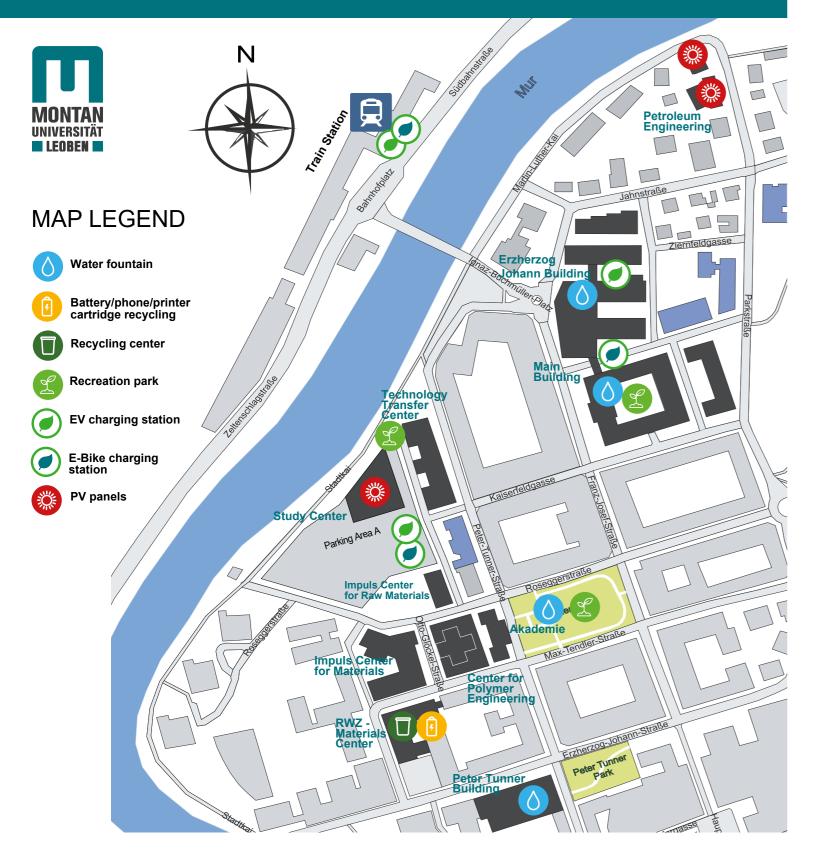
#### **EIT RawMaterials**

The EIT RM strategy is primarily aimed at making the European minerals, metals and materials sector sustainably competitive by promoting and encouraging innovation, and by training innovators along the entire raw materials value chain. EIT RM is characterized by its focus on the following topics: Securing the supply of raw materials, designing material solutions and closing material loops. These three themes are always pursued with the aim of strengthening the regions and developing their potential to support a sustainable and innovative raw materials sector in Europe.

The EIT RawMaterials Regional Center Leoben contributes to the raw materials community in Europe through its vast project portfolio and numerous public events.



## Montanuniversität SUSTAINABLE CAMPUS



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See TripleN - Montanuniversität Leoben's sustainability initiative:



Link to Montanuniversität Leoben's website:



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## WHERE RESEARCH SHAPES THE FUTURE

ADVANCED MATERIALS SCIENCE AND ENGINEERING APPLIED GEOSCIENCES CIRCULAR ENGINEERING EM JOINT MASTER IN SUSTAINABLE MATERIALS SCIENCE SUBJECT OF THE MASTER IN SUSTAINABLE MATERIALS SCIENCE INTERNATIONAL MASTER IN SUSTAINABLE MATERIALS CIRCULAR ENGINEERING EM JOINT MASTER IN SUSTAINABLE MATERIALS AND ELIMPATER PROTECTION TECHNOLOGY GEOLEGE IN BUILDING MATERIALS AND BUSINESS ADMINISTRATION INTERNATIONAL MASTER PROCESSING APPLIED AND EXPLORATION AND PRODUCTION AND PRODUCTION