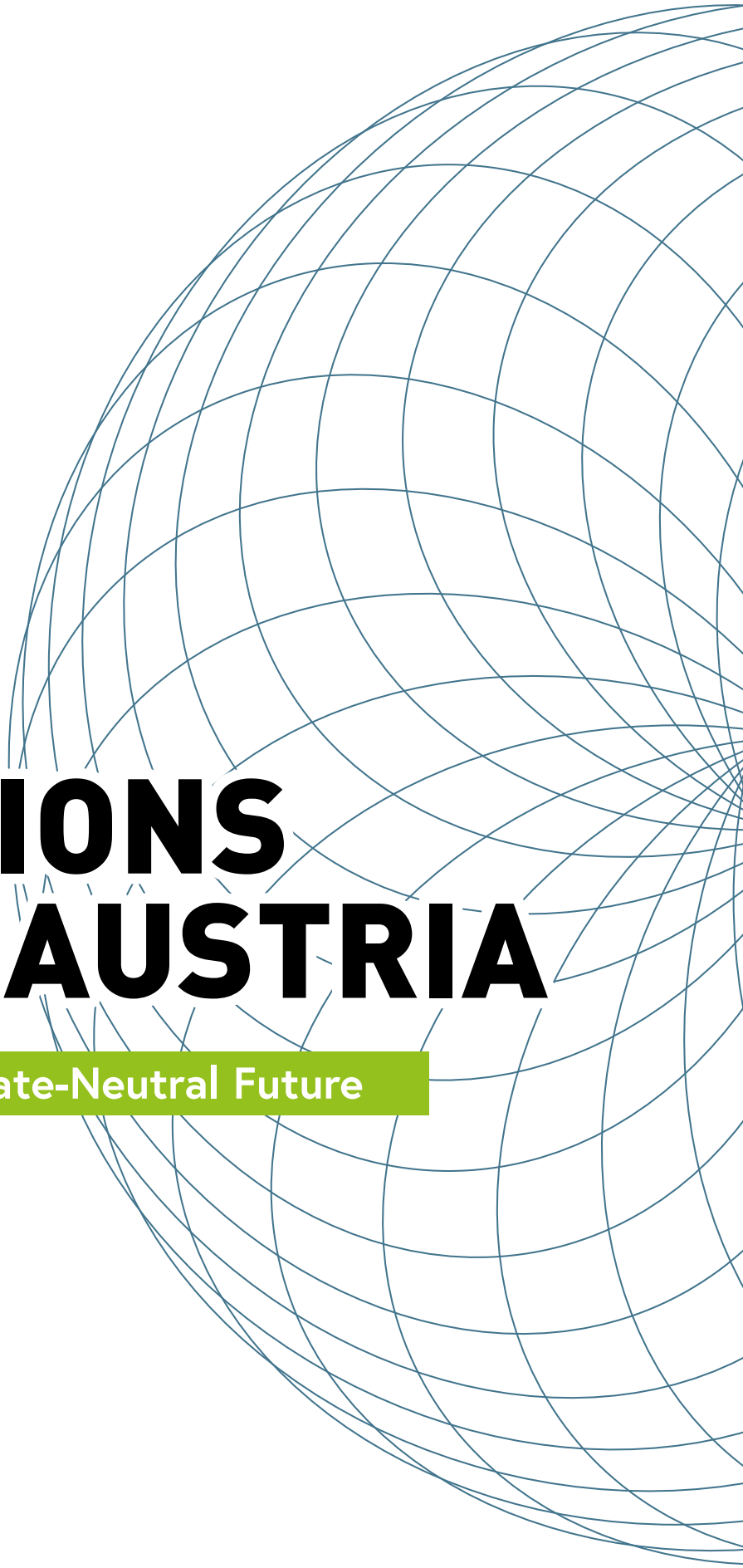
MISSION INNOVATION AUSTRIA



ENERGY INNOVATIONS MADE IN AUSTRIA

The Green Deal for a Climate-Neutral Future

TABLE OF CONTENTS

The research projects and initiatives described in this brochure are some examples of the many Austrian R&D activities under way in the field of future energy technologies.

FEDERAL MINISTRY FOR CLIMATE PROTECTION, ENVIRONMENT, ENERGY, MOBILITY, INNOVATION AND TECHNOLOGY

The Austrian government has set a bold target in its current policy programme: to make Austria climate-neutral by 2040. At the same time, the coronavirus crisis calls for a major effort to boost the economy. These two priorities are compatible, because climate protection is the ideal stimulus package. It will require an assertive approach to innovation policy. International collaboration will also play a key role. So it is important that Austria is an active participant in the "Mission Innovation" initiative. Together we can advance the development of clean energy technologies. Genuine and effective climate protection offers tremendous opportunities: for the environment, for people and for the many committed businesses and companies that are becoming – or already are – the pioneers of a climate-friendly economy, both in Austria and globally. This brochure presents the latest findings in energy research and is our contribution to the important process of international information exchange about successful example projects.

Leonore Gewessler
Federal Minister for Climate Protection, Environment, Energy, Mobility, Innovation and Technology

CLIMATE AND ENERGY FUND

Climate-neutral by 2040, while also stimulating the economy? Yes, that is possible. It can be done if all sectors pull together and cooperate to make fundamental changes to our energy system. It can be done if we work fearlessly towards ambitious goals. It can be done because Austria has the expertise and is already established in many areas as an innovation leader in the global market. Growth through innovative technologies – this is the principle for developing solutions that are compatible with the global target of 1.5 °C. The European "Green Deal" provides direction. Numerous projects supported by the Climate and Energy Fund show how we will get there.

Theresia Vogel
Managing Director of the Climate and Energy Fund

MISSION INNOVATION AUSTRIA

The path to a climate-neutral future

To meet the objectives of the Paris Agreement[1], we need to invest substantial amounts in climate protection, and to completely restructure our current energy systems; in terms of both supply and usage of energy in electricity, heating, industry and mobility. Innovation in the fields of clean energy technologies and intelligent energy solutions has to be pushed forward on a large scale over the next few years, in order to limit global warming to well below 2 °C.

The EU has announced its "Green Deal", which sets the goal of becoming the first climate-neutral continent by 2050. The European Green Deal is a comprehensive package of measures aimed at ensuring sustainable ecological change that will benefit both the people and the economy of Europe. The European Commission plans to mobilise investments amounting to EUR 1 trillion for climate protection by 2030.

Photo: Mariana Mazzucato

MARIANA MAZZUCATO

Professor in the Economics of Innovation & Public Value at University College London, Founding Director of the UCL Institute for Innovation & Public Purpose

"Mission-oriented innovation is based on the crafting of high-impact missions, through which public, private and civil society sectors can together co-shape markets and transform the focus of innovation towards society's largest challenges. Societal challenges like the climate crisis are complex, and 'wicked' problems. They are more complex than going to the moon, which was mainly a technical feat. To solve them requires attention to the ways in which socio-economic issues interact with politics and technology, to the need for smart regulation, and to the critical feedback processes that take place across the entire innovation chain.

Working with the European Commission on the development of its mission-oriented Horizon Europe research and innovation framework, the Institute for Innovation and Public Purpose, which I founded and direct at University College London, explored the sectors and projects needed for ambitious missions, such as '100 Carbon Neutral Cities by 2030'. As the five Horizon Europe mission boards are now in place, it will be important to consider how Austria's national policies and missions will interact with pan-European missions. National capacity for the development of mission-driven institutions is key to design, incentivise and achieve the missions themselves."

Climate neutrality in Austria by 2040

The Austrian federal government is committed to the Paris Agreement and to European climate change policy and has set ambitious targets, with the aim of positioning Austria as a pioneer of climate protection in Europe. The government's policy programme for 2020 to 2024 includes its stated objective of achieving climate neutrality for Austria by 2040. This requires a CO_2 budget compatible with the Paris Agreement and a corresponding roadmap to reduction. Binding sectoral targets are also planned within the framework of a climate protection law by 2040, with an interim target for 2030.

NATIONAL TARGETS: CLIMATE PROTECTION & ENERGY

- Austria will be a climate protection pioneer in Europe – Climate neutrality in Austria by 2040
- Specify and implement the National Energy and Climate Plan (NECP)
- Launch technology-oriented energy research campaign on decarbonisation
- By 2030: 100% of electricity (national balance) from renewable energy sources, with clear expansion targets for all technologies
- Phase out use of fossil fuels for building heating from 2020 onwards: strategy for complete decarbonisation of the heating market
- Renewable Energy development Act and enhancement of the Energy Efficiency Act
- Public sector to act as a model in thermal refurbishment projects
- "1 million roofs" photovoltaic programme
- Cross-sector strategy for climate protection and the circular economy for trade and industry
- Bio-economy strategy with appropriate action plan
- Hydrogen strategy: Austria to become the number one hydrogen nation

(Extract from the government's policy programme)

www.bundeskanzleramt.gv.at/bundeskanzleramt/die-bundesregierung/regierungsdokumente.html

[1] At the Paris climate change conference in 2015, 195 countries negotiated for the first time a broad, legally binding, international climate protection agreement, which includes a worldwide action plan designed to limit global warming to well below 2 °C. The aim is to limit the increase to 1.5 °C, as this would substantially reduce the risks and effects of climate change.

National Climate and Energy Plan

By the year 2030, Austria will have to reduce its CO_2 emissions by 36% compared to the year 2005. The proportion of renewable energies in the gross final consumption of energy (which was 33.5% in 2018), needs to increase to 45-50% by 2030. In December 2019 the Austrian federal government sent Brussels a comprehensive plan for achieving the 2030 climate targets. This "Integrated National Energy and Climate Plan" (NECP) sets out specific details for the implementation of mission#2030 – the Austrian Climate and Energy Strategy – and shows how the 36% reduction in greenhouse gas emissions can be achieved, in order to meet the binding targets agreed for 2030.

The transformation into an efficient and green energy, mobility and economic system will have to include the entire energy value creation chain (generation, transport, conversion and consumption), including all the products and services in connection with it. Energy research and technological developments have a key role to play in this far-reaching process. The challenge of making the decarbonisation agenda not only technologically possible, but also economically viable and socially acceptable, requires long-term policy-making for research, technology and innovation. The NECP anticipates a gradual increase in public funding for energy research by 2030.

www.bmk.gv.at/energie_klimaplan

INTERNATIONAL COLLABORATION
Austria as a partner in worldwide research networks

International collaborative programmes are extremely important for Austrian climate and energy policy. Austria is an active participant in many multilateral activities in the field of energy innovation. The most important of these include participation in the global Mission Innovation initiative, collaboration with the EU's Strategic Energy Technology Plan (SET-Plan), and with the programmes of the energy technology network led by the International Energy Agency (IEA). In the IEA's latest report on participating countries, Austria is recognised as a "strong innovator" in the field of energy research. Active networking of Austrian energy technology providers in international RTI initiatives is crucial to the successful global positioning of Austrian areas of strength.

Accelerating the clean energy revolution

At the 2015 UN Climate Change Conference in Paris, the leading energy technology countries launched a global initiative: Mission Innovation (MI). Its goal is to combat climate change in cooperation with private investors and to push the development of clean energy technologies forward. The network consists of 24 countries[1] and the European Union.

Austria joined this global initiative in 2018, taking an important step towards positioning itself as an "energy innovation country". An important characteristic of Austrian Mission Innovation activities is that they are strongly linked to the economy. One of the key factors to success here in Austria is the close cooperation between entrepreneurs and the public sector. With the help of public funding, the aim is to incentivise companies to invest as extensively as possible in research.

"Mission Innovation 2.0" is the process through which the next phase of the global initiative is being prepared, for the period 2021 to 2025, and the key themes defined for goal-oriented research activities for the next few years. The goal is to launch new, ambitious innovation missions to ensure that by 2030 clean energy solutions are available, applicable and affordable.

Important characteristics of future MI activities should include a broad scope of application, clear political support, results-oriented goal-setting and the involvement of a broad spectrum of stakeholders, to ensure that solutions developed in the research sector can be brought to the market quickly. Austria is an active contributor to this process, in keeping with its national thematic positioning.

By launching the "MICall Series", a new instrument was created for annual multilateral financing of R&D projects in the field of energy. More than 15 countries, including India and Morocco, took part in the first "MICall 19", which focused on integrated energy storage systems (total funding budget of EUR 22.5 million). Countries showing interest in "MICall 20" include Australia and the United Kingdom.

mission-innovation.net

[1] Australia, Austria, Brazil, Canada, Chile, China, Denmark, Finland, France, Germany, India, Indonesia, Italy, Japan, Morocco, Mexico, the Netherlands, Norway, the Republic of Korea, Saudi Arabia, Sweden, the United Arab Emirates, the United Kingdom, the United States

IEA Collaboration in Research

For a clean, secure and sustainable energy future, international cooperation is essential to the development of global solutions. The global energy technology network led by the International Energy Agency (IEA) promotes the exchange of ideas and strategic expertise in the politics of technology. It is also an opportunity for countries to make national strengths known worldwide. Around 6,000 experts from 54 countries are working together in a total of 38 technology programmes, known as 'Technology Collaboration Programmes' (TCPs).

Austria has been a member of the International Energy Agency (IEA) since it was founded in 1974. The national 'IEA Collaboration in Research' programme enables Austrian experts to participate actively in this network. Austria is currently involved in 21 of these TCPs, with 80 individual projects. This makes it to one of the most intensively committed countries in the energy technology network, benefitting more than average from these worldwide collaborations. These projects focus mostly on renewable energy sources and end-use technologies (energy efficiency, transfer and storage).

nachhaltigwirtschaften.at/de/iea/

Joint Programming Platform Smart Energy Systems

ERA-Net Smart Energy Systems is a multilateral joint programming platform. Its purpose is to support transnational RTI projects for the development of intelligent, integrated energy systems that will enable our energy supply to be produced from 100% renewable sources. By including the relevant innovation stakeholders, technology developers and users in the participating countries and regions, a transnational knowledge platform is developing on the transition of energy systems. The initiative is coordinated by the Austrian Federal Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology, and already involves over 30 public funding institutions from more than 25 countries in Europe and worldwide, all working together. The platform organises annual bids for research funding on themes such as integrated regional energy systems, storage solutions, digitalisation and smart grids.

www.eranet-smartenergysystems.eu

Joint Programming Initiative Urban Europe

JPI Urban Europe is a strategic research and innovation programme whose goal is to find European solutions to create forward-thinking, liveable and prosperous cities of the future through coordinated urban research and development. Since 2012, nine transnational calls for tender have been completed amongst the 20 European countries in the network. Under Austria's presidency, a programme has been launched as part of the European SET-Plan: between 2018 to 2025, 100 European plus-energy districts are to be planned and built.

jpi-urbaneurope.eu

Other transnational collaborations

Austria is also an active participant in two other transnational European initiatives: ERA-Net Bioenergy and SOLAR-ERA.NET.

www.eranetbioenergy.net
www.solar-era.net

ENERGY INNOVATIONS MADE IN AUSTRIA
Research and technology development

An integral part of the "National Energy and Climate Protection Plan for Austria" is the implementation of a technology-oriented energy research initiative. The objective is to expedite the development of pioneering technologies and solutions for decarbonisation of the energy and mobility systems, and to gain a leading position in technology through extensive testing of innovations in real operating conditions.

In collaboration with stakeholders from companies and research institutions an implementation programme was devised for the energy research initiative which sets out development plans for selected areas of technology. Between 2020 and 2030 certain goal-oriented research priorities will be intensified, in order to develop and implement key elements for the energy systems of the future: plus-energy areas, integrated regional energy systems, breakthrough technologies for industry, and energy-efficient mobility systems of the future. Building on the experiences of the RTI initiative "Flagship Region Energy", extensive field testing of innovative energy technologies will continue in real operating conditions.

https://nachhaltigwirtschaften.at/up-efi

RESEARCH PRIORITIES

Plus-energy areas are urban districts that are able to meet their entire energy needs from renewable sources. This is to be achieved by optimising building infrastructure, introducing measures to maximise efficiency in every area of final energy consumption, and by developing suitable integrated national business models. In plus-energy areas, energy will be locally produced and also to a large extent locally used. This requires more flexible final energy consumption, and the use of storage systems and synergy effects in infrastructures.

Intelligent systems and networks are a prerequisite if we are to achieve up to 100% renewable energy in local and regional energy supply in the foreseeable future; they are also essential to enable companies and citizens to participate in regional value chains and national markets.

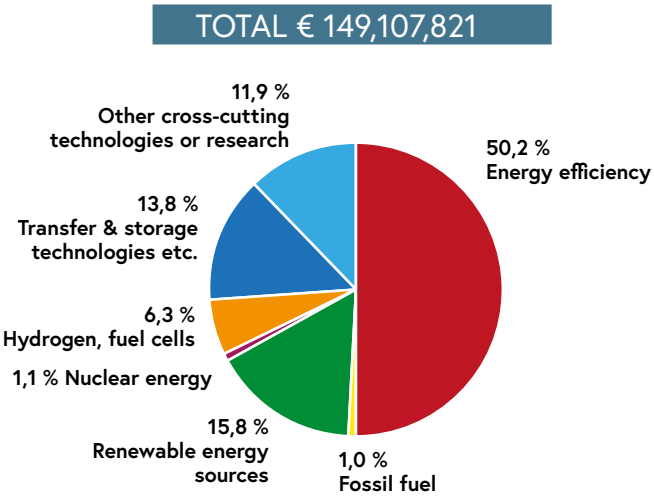
Breakthrough technologies for industry are needed to advance the decarbonisation of industrial processes and products, particularly in energy-intensive industrial sectors. Consumption of raw materials and energy must be reduced, while maintaining the same level of output; emissions must be significantly diminished and greater autonomy ensured in the supply of raw materials and energy. Key issues are a highly efficient use of resources, and coordination of the energy demand from industrial facilities with the energy supply from fluctuating renewable sources.

Energy-efficient mobility systems are central to achieving climate neutrality in Austria. RTI development in this area also strengthens the competitiveness of the Austrian automotive industry in the radical technological transition towards zero- and ultra-low-emission vehicles, lightweight construction and automated driving. To facilitate a breakthrough in e-mobility, it is important to supplement EU initiatives, such as those focused on battery cell production in Europe, with complementary national support programmes. The aim is to integrate the Austrian industry into international supply chains, in a complete system for battery-vehicle-energy supply, from manufacturing right through to recycling.

Energy research expenditure in Austria

In 2019 total public expenditure on research, development and demonstration projects in Austria was EUR 149.1 million – a decrease of EUR 2.3 million or minus 1.5% compared to the previous year, amounting to 0.037% of GDP. The largest proportion of this was expenditure on three research priorities: energy efficiency (EUR 74.9 million), followed by renewable energy sources (EUR 23.5 million) as well as transmission, distribution and storage technologies (incl. smart grids, EUR 20.5 million).

A survey of expenditure on energy research in the corporate sector for 2017 revealed that 561 companies allocated a total of EUR 681 million of their research and development expenditure to the socio-economic objective of energy. This total was almost EUR 200 million higher than the value reported in a 2015 survey. It is clear from these data and the significantly increased figures reported by energy research programmes that companies are rapidly becoming more interested in investing in energy research.



Graphic from the 2019 Energy research survey

https://nachhaltigwirtschaften.at/schriftenreihe/2020-10

MARKET DEVELOPMENT FOR RENEWABLE ENERGY TECHNOLOGIES IN AUSTRIA

In 2019 as in the previous years low prices for fossil energy sources, the competition among the various technologies for the use of renewable energy, low rates of refurbishment as well as the warm weather conditions are regarded as diffusion-impeding factors in the area of renewable energy technologies. On the other hand the general economic growth and the increasing private spendings had a diffusion-promoting effect. In total the Austrian companies of the areas biomass, solar thermal, photovoltaics, heat pumps and wind power had a turnover of 5.3 billion Euro and employed approximately 30,500 people. Through the use of the technologies 4.5 million tons $C0_2$ were saved in 2019.

In 2019 photovoltaic power plants of 247 MW were newly installed in Austria which corresponds to an annual growth of 32.7 %. Thus, photovoltaic power plants with a cumulated overall power of 1,702 MW were in operation end 2019. In 2019 the total sales of heat pumps increased to 39,138 plants which corresponds to an increase of 13.1 %. A strong growth could be observed especially for space heating for a small power segment up to 20 kW. For pellets boilers a growth of the domestic production of 30 % could also be observed in 2019. The sales of biomass fuels stagnated while the technology areas wood-fired boilers, biomass stoves, solarthermics and wind power showed a clear market decline.

Reliably and dynamically growing diffusion rates being necessary for a system change from fossil to renewable energy could only be observed in the sector heat pumps in the past years. If the aimed national energy and climate targets for 2030 and 2040 shall be reached the energy-political efforts have to be clearly increased. A definite increase of the market diffusion of all technologies for the use of renewable energy is needed as well as a definite increase of energy efficiency in all sectors. Only an efficient and effective mix of instruments can develop the required lever for the accomplishment of this task. Thereby subsidies, taxes, regulatory and educational policy measures, normative instruments, an ambitious spatial planning with regard to energy, further research and development as well as the social balance are important starting points.

https://nachhaltigwirtschaften.at/schriftenreihe/2020-14

THE CITIES OF TOMORROW

INNOVATIONS FOR CLIMATE PROTECTION AND QUALITY OF LIFE IN URBAN ENVIRONMENTS

In the future, the number of people living in cities and urban areas will grow – by 2030 it will be 70% of the global population. Rapidly expanding cities face major challenges. The increasing scarcity of energy and raw materials demands a fundamental transformation in the energy supply, industry and mobility sectors. Cities are also particularly severely affected by the consequences of climate change. Extreme weather events such as heatwaves are intensified in cities as a result of the "urban heat island" effect, and pose a threat to people's quality of life. On the other hand, urban areas also offer great opportunities to implement new solutions and concepts for efficient use of energy and material resources, and the transition to renewable energy sources. Current R&D priorities for the "city of tomorrow" include energy-oriented tools for digital planning, construction and operation of buildings, technologies and solutions for energy-flexible buildings and districts, as well as innovative technologies for urban greening.

Plus-energy areas are urban districts where the entire demand for energy can be met using renewable, largely local sources of energy. New urban technologies, technological systems and services are needed to establish districts like this. Digitalisation will play a central role in this process. The focus of research and development is on innovative technologies and concepts for generation, distribution, conversion and storage of energy; optimising energy consumption in buildings or groups of buildings; and on appropriate technologies and efficiency measures in new construction and renovation projects.

Photo: Energy Planning Department, City of Vienna

BERND VOGL

Head of Energy Planning, City of Vienna

"Cities are part of the solution – to tackle the climate crisis we need a profound structural transformation in the energy supply system. Primarily we need technical innovations in addition to an organisational, economic and social dynamic as a key driver for transformation. A further key factor for change is collaboration. Cities and their regions meet regularly and are working together to facilitate a complete transition to renewable energy sources - with wind, solar and ambient energy being the most important alternatives. Cities' future energy consumption and options for storage will be oriented towards the expansion of renewable energy sources. Cities certainly face major challenges, but at the same time they are centers for development and implementation of climate friendly solutions for a sustainable future."

Photo: Wien Energie GmbH

BRIGITTE BACH

Head of Telecommunications and New Business Opportunities, Wien Energie GmbH

"We are addressing the enormous challenges of climate change. Cities and urban districts have a key role to play in the transformation of energy and transport systems. Our mission is to provide support on the path towards CO_2-free urban areas, with a range of initiatives and services focused on decentralised renewable energy supply, sustainable mobility solutions and services associated with the Internet of Things, based on state-of-the-art communications infrastructure. Wien Energie is also working systematically to develop integrated solutions, from research projects through to the launch of market-ready products for energy communities."

HARALD FEIEL

Chief Digital Officer PORR AG

"Digitization is leading to a massive paradigm shift for the construction industry: buildings, roads, vehicles, power plants, etc. are increasingly becoming platforms for sensors and data that are interconnected in huge complex networks. At the same time, the use of digital methods and technologies makes workflows more efficient, processes more transparent, costs reduced and people relieved of routine tasks. Smart LEAN methods, digital twins using Building Information Modeling, comprehensive modularization, standardization, automation and the use of artificial intelligence form the basis for this. Of course, the human being will remain at the centre of our work in the future. People are and will remain the most important part of any construction project. Because only with the commitment and expertise of our employees, coupled with the pioneering spirit of PORR can the future potential of digitization be successfully leveraged."

Photo: PORR AG/Marie Marinelli

Photo: Niko Formanek

SUSANNE FORMANEK

CEO GRÜNSTATTGRAU Forschungs- und Innovations- GmbH

"Our cities are characterised by densely packed buildings, a high proportion of impermeable surfaces and thermal storage masses. This results in rising temperatures, an unhelpful microclimate and ultimately in the "urban heat island" effect, which has a negative impact on the quality of life and health of the urban population. The buildings of tomorrow will need multifunctional attributes. If building surfaces are planted with greenery, the building envelope can contribute to energy generation, storage and supply, and also help compensate for the loss of green spaces. Other benefits include oxygen production, dust suppression, noise reduction, heat reduction, enhanced output from photovoltaic systems, shading and rainwater retention. GRÜNSTATTGRAU is an innovation lab which serves as a centre of expertise for greening buildings; it promotes innovations for the green, smart city of tomorrow, and provides concepts for green infrastructure to combat urban overheating."

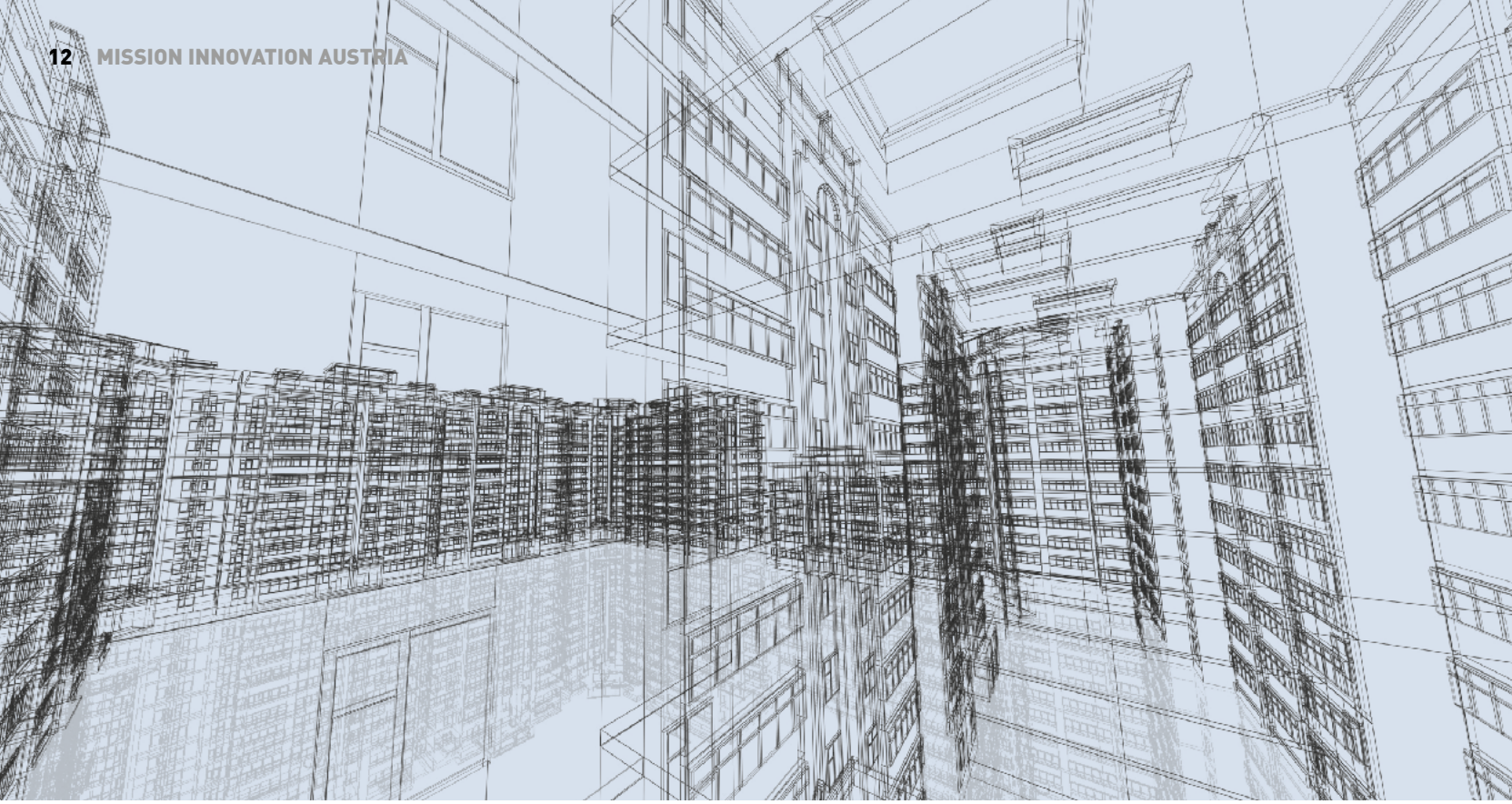


Image: fotolia.de

6D BIM TERMINAL

Holistic building planning

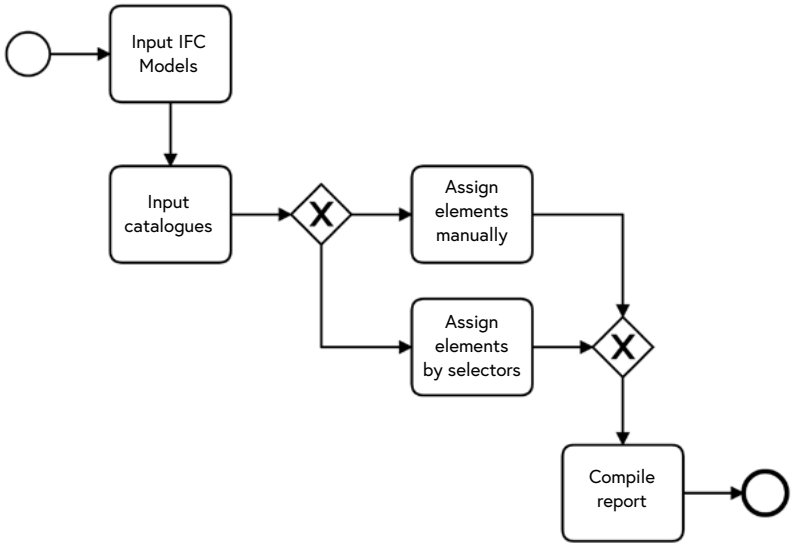
Images: stock.adobe.com

Building Information Modelling (BIM) makes it possible to take account of environmental and sustainability aspects for the whole life cycle of a building, from the planning phase onwards. Life-cycle assessments of the environmental impact and costs play a key role in holistic planning. The "6D BIMterminal" was a project led by the IBO[1] with the aim of closing the gap between BIM-based design planning and specialist consultants, and supporting complete life-cycle analysis in parallel with planning. The project resulted in the development of a tool that allows BIM models to be input and can then enhance "simple" 3D elements to produce complex 6D BIM elements.

The data structure of these BIM elements is based on (inter)national standards (IFC, bsDD, ASI property server)[2]. Data that go beyond geometrical and representational information, and are essential for consideration of costs, deadlines and sustainability aspects, are automatically added using predefined BIM elements, so that life-cycle assessment data and costs, and specifications can be compiled.

[1] Project partners: IBO – Österreichisches Institut für Bauen und Ökologie GmbH (Austrian Institute of Building and Ecology, project management), ib-data GmbH, baubook GmbH, Güssing Energy Technologies GmbH (GET), AEE – Institute for Sustainable Technologies (AEE INTEC), A-NULL Development GmbH

[2] Industry Foundation Classes, building smart Data Dictionary, ASI property server: open standards for digital description of building models



BIMTERMINAL: WORKFLOW IN 4 STEPS

- Input IFC model(s) into BIMterminal
- Input catalogue(s) with formulae into BIMterminal or activate in BIMterminal
- Evaluate IFC elements using formulae
- Analyse results and compile report

Outcome of the project

- Identification of the properties required for life-cycle analysis, including a manual for planners and functional specifications for software companies
- Catalogue with 6D BIM structural elements and building service equipment that can be used as sample elements and adapted to specific projects
- Adaptation of specific sectoral planning tools to allow integration of the 6D BIM data model
- Prototype of the BIMterminal with a functional user interface, API interfaces and reference catalogue

One key aspect of the project was compiling a reference catalogue with predefined elements that comply with BIM standards. This catalogue of reference elements was based on the example constructions from the IBO catalogue of passive house building elements. These are available online in the baubook database, complete with building engineering details and ecological data. These elements were fed into the building management software ABK through an XML interface, then enhanced with cost data and tender ratings from the standardised performance descriptions. For use in the BIMterminal, the data from the catalogue of elements were converted into formulae, so that they can be correlated with the 3D elements.

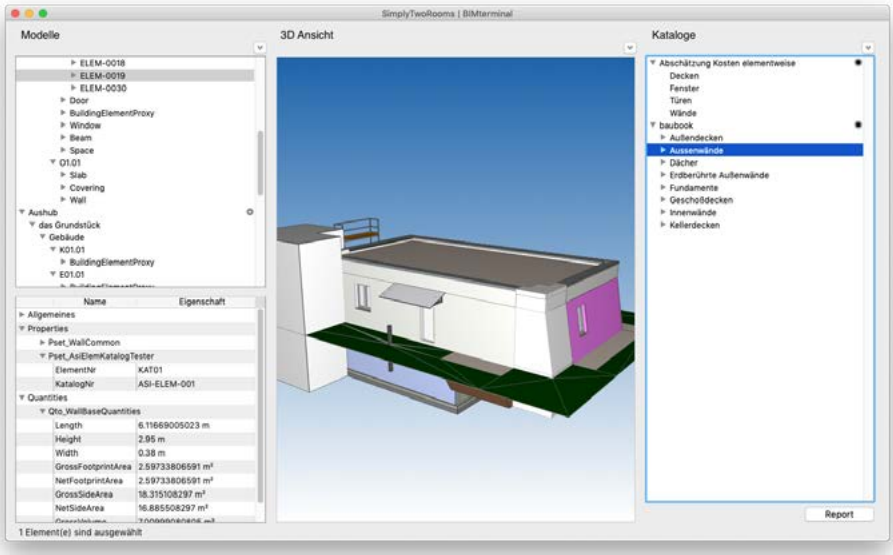
BIMterminal – the tool

The BIMterminal functions as a tool for collaboration between organisations. The project included the development of a prototype for a computer program that allows the analysis of IFC4 files and their geometrical and alphanumeric data. The software links the data with the catalogues of formulae and uses these to derive the life-cycle assessment values, life-cycle costs and tender specifications in the form of reports.

The BIMterminal makes it possible for planners to allow for ecological improvements and life-cycle considerations right from the start of a BIM process. The tool is primarily designed to support SMEs and simplify the first steps into the complex world of BIM planning.

The prototype, produced by A-NULL Development GmbH, will be available on an open source basis.

https://bimterminal.com/



The user interface is divided into three sections (left to right): Data browser with various different data views for the contents of the model / 3D geometrical images based on the IFC files / Catalogues with set of formulae for correlation and analysis
Image: A-NULL Development GmbH

Innovative citizen participation: "Social safari", photo: Maria Reiner right: Cover of "Smarter labs guidelines"

SMARTER LABS

Experimenting and learning in smart urban development

Like many other cities in Europe, Graz faces a constant series of major social, ecological and economic challenges. Coping with complex processes of change requires modern approaches to urban development. These include the testing and application of new procedures for projects, planning and administration, and increased integration of collaborative and participative elements.

In "urban labs", "living labs" and "city labs" local authorities collaborate with other urban stakeholders to exploit the intellectual, creative and social potential of the inhabitants of a city in shared learning processes and to test innovative solutions and approaches. This participative approach is increasingly used in Smart City projects too.

As part of the EU project "SmarterLabs"[1], the City of Graz (Urban planning department/EU projects unit) tested this innovative concept in collaboration with experts from Belgium, The Netherlands and Switzerland.

Transferability of "smart" solutions

The focus was on complex urban development processes which were seen as "urban labs" designed to develop an intelligent, energy-efficient, low-carbon and resource-friendly city with a high quality of life. The experts were also looking for solutions that could extend "smart" pilot projects across the whole city, involving target groups that are otherwise difficult to reach.

In Graz the priority was a citizen participation process to redesign a central square (Griesplatz). Various innovative methods ("social safaris", "pop-up" actions, art initiatives etc.) were used in addition to traditional formats (online surveys etc.). This was conducted as a transdisciplinary research activity, with the City of Graz working closely with the Regional Centre of Expertise (RCE) Graz-Styria, a centre for sustainable development at the University of Graz.

Based on the "lessons learned" in the projects by the three partner cities, guidelines were developed ("SmarterLabs Guidelines") for working with city labs, which were launched in The Netherlands in March 2019.

www.smarterlabs.eu

Discussion workshop in the Gries lab, photo: City of Graz/Drage

[1] Funded by the European "Joint Programming Initiative Urban Europe" (Grant agreement no. 854919), International project consortium: ICIS – University of Maastricht, Holland (project management), City of Maastricht, Maastricht Bereikbaar, Antea Group; VUB Vrije Universiteit Brussel – COSMOPOLIS, Brussels Environment Council; University of Graz – RCE Graz-Styria – Regional Centre for Sustainability, City of Graz; University of Applied Sciences and Arts of Southern Switzerland (SUPSI), City of Bellinzona, Pro Velo Ticino

CAMPAGNE-REICHENAU INNSBRUCK

Collaborative planning process for a "zero emission urban region"

Campagne-Reichenau is an area of approximately 84,000 m² on the eastern side of Innsbruck where a Smart City urban district will be developed with around 1,100 new apartments, numerous local providers of supplies and services, as well as sports facilities and a community building. This is the first time in Innsbruck that a "collaborative planning process" has been used to develop a new suburb on the basis of a city council resolution.

The aim is for Campagne-Reichenau to serve as an example of best practice for the creation of sustainable and inexpensive homes to a passive-house standard. The plans are designed not only to optimise the energy and economic potential of the building envelopes but also to consider intelligent urban planning, sustainable transport links and mobility options, and the utilities and waste management structures of the Smart City district.[1]

Construction of the first section began in late autumn 2019. This consists of four buildings with a total of 307 apartments[2]. The plans include a sustainable energy supply system for all three construction areas. The buildings will be heated by water/water-heat pump systems (using low-temperature heating systems for each construction area that release warmth through floor heating). The roofs will be fitted with photovoltaic systems designed to maximise the available potential. PV power will supply the electricity needs for ventilation and heat pumps, and part of the general demand for electricity. Energy will also be supplied by local hydropower.

www.info-campagne.at/de/campagne-reichenau/campagne-reichenau/29-0.html

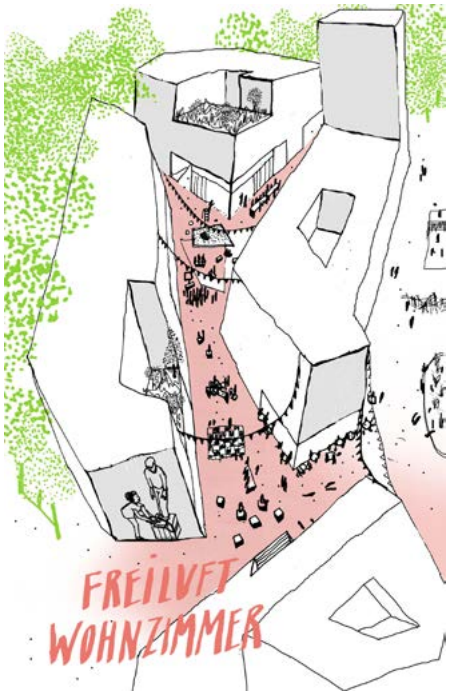


Illustration of construction area 1, after completion, Hannah Kordes for Bogenfeld Architektur

Sustainable district development

The long-term objective is to develop the area into a "zero-emission urban region" and to integrate it with the urban planning concepts of the City of Innsbruck, and the Tyrol Energy Strategy 2050. Key aspects of this include the reduction of greenhouse gas emissions, climate change adaptations, social sustainability, maximum energy efficiency, ecological quality and the use of renewable energy sources as an important component of the energy supply system.

Graphic image of construction area 1, after completion; Image: Expressiv Elmir Smajic Wien for Bogenfeld Architektur

[1] Project partners: Innsbrucker Immobilien GmbH & CoKG (consortium leader), NEUE HEIMAT TIROL gemeinnützige WohnungsGmbH, Innsbrucker Kommunalbetriebe AG, University of Innsbruck – Department of Structural Engineering & Material Sciences and Department of Infrastructure

[2] Two of the buildings are being constructed by Innsbrucker Immobiliengesellschaft (IIG) and Neue Heimat Tirol (NHT), respectively.

THE DECARBONISATION OF INDUSTRY

ON THE PATH TOWARDS CLIMATE-NEUTRAL MANUFACTURING

Industry is responsible for 30% of final energy consumption in Austria, contributing 94 TWh. Energy-intensive industry, which makes up 61% of the final energy consumption by the country's manufacturing sector, has a particularly marked impact. If the target of "climate neutrality by 2040" in Austria is to be met, industry will have to reduce its energy consumption and process-related greenhouse gas emissions significantly. Although great progress has already been made in recent years, further innovations and the development of new infrastructure are required for the extensive decarbonisation of industry.

Research and innovations promoting greater process efficiency, the transition to renewable energy and carbon-based applications are not only helping to drive decarbonisation forward – they are also preserving the technological and competitive edge for Austrian industry, securing jobs in the country and reducing its dependency on imported fossil fuels.

Photo: voestalpine AG

HERBERT EIBENSTEINER

CEO voestalpine AG

"The global climate targets are posing major challenges to industrial companies, energy suppliers and politicians and are calling for new technological solutions. As one of the pioneers in its sector in terms of environmental protection, voestalpine is pursuing a consistent, long-term climate protection strategy and has been researching several different technologies for decarbonising its steelmaking in parallel for many years now. The European research initiative 'Mission Innovation' is making a key contribution to the development of process and system innovations – from the raw material through to the high-tech end product – as well as to sustainable energy management. However, transforming energy-intensive industries is not just a question of what is technically possible. The right general political framework is also required because the technologies of the future will only be viable and competitive if renewable energy sources are available in sufficient quantities and at affordable prices."

Photo: AIT_Wolf

WOLFGANG HRIBERNIK

Head of Center for Energy at AIT Austrian Institute of Technology GmbH
Network Coordinator at NEFI – New Energy for Industry

"Our aim is clear – we want to achieve the decarbonisation of Austrian industry with technologies made in Austria and use our expertise to strengthen Austria's role as a technology pioneer on the international stage. However, the rapid implementation and sustainable transformation of our energy system requires the consistent expansion of renewables, grid infrastructure and storage facilities to provide the necessary flexibility. In the next step, therefore, we should create international lighthouses with large-scale demonstration projects by industrial companies, technology developers and research institutions and demonstrate what the energy system of tomorrow will look like and how it will work. Key technologies such as power electronics, heat pumps, storage systems and automation engineering will play a key role in this process."

ULRIKE RABMER-KOLLER

Vice-President of the Austrian Economic Chambers (WKO)
General Manager/Owner of the Rabmer Group

Photo: WKO/Caro Strasnik

"The economy and innovation are a key part of the solution if we are to meet climate and environment targets. Economic growth, prosperity and sustainability are not mutually exclusive. If we are to manage on less fossil fuels, huge efforts will be required in terms of research, development and innovation. This will mean establishing framework conditions that mobilise both public and private investment and strengthen companies' innovative power. Achieving climate-neutrality will require breakthrough technologies as well as a level playing field internationally. 'Mission Innovation 2030' offers Austrian companies opportunities in the global competition that they need to take. The problem-solving expertise of our greentech companies is creating a win-win situation: as well as making a crucial contribution to hitting the climate targets, it is also boosting the Austrian economy."

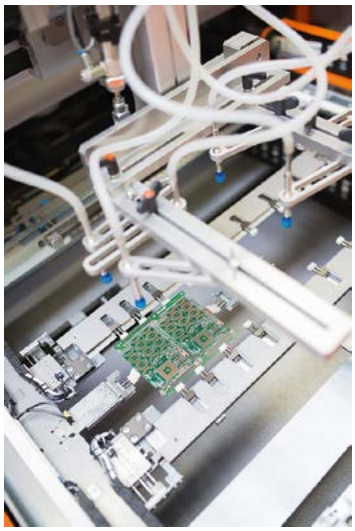
Photo: AEE INTEC

CHRISTOPH BRUNNER

CEO AEE – Institute for Sustainable Technologies (AEE INTEC)

"Three-quarters of the energy consumed by Austrian industry is process heat, and half of this is required at low to medium temperatures. Only 18% currently comes from renewable energy sources. If you combine the facts, the high percentage of heat required at low and medium temperatures and the significant amount of energy consumed by Austrian industry, with a comparatively low percentage of renewable energy sources, it becomes clear that implementing projects in industry will go a long way towards meeting the emissions targets. In the future, best-practice examples will play a decisive role in the expansion of renewable heating technologies. The risk entailed in investing in these technologies of the future has to be cushioned as far as possible by government subsidies and private financing models."

Using artificial intelligence and virtual reality applications, the Digital Energy Twin is designed to further optimise process-related energy consumption and integrate renewable energy into the manufacturing process at AT&S in the best possible way.
All photos: AT&S



DIGITAL ENERGY TWIN

Smart control of industrial energy-related processes and their supply system

This flagship project uses the "digital twin" method to optimise the operation and design of industrial energy supply systems. Using this approach, detailed models for selected energy-related processes and renewable supply technologies for industry are developed, validated and simplified. Alongside AEE INTEC as coordinator and AT&S as industry partner, one German and ten Austrian partners from the fields of digital research, energy research and industry are working on the project.[1]

Optimising energy consumption in the circuit board industry

Manufacturing modern circuit boards requires highly specialised processes and facilities and thus an energy system of significant complexity. The world's leading circuit board manufacturer AT&S is working hard to optimise its energy consumption throughout its production process. In the past financial year, a range of measures enabled energy savings amounting to 12 gigawatt hours or 9.3 kilotons of CO_2.

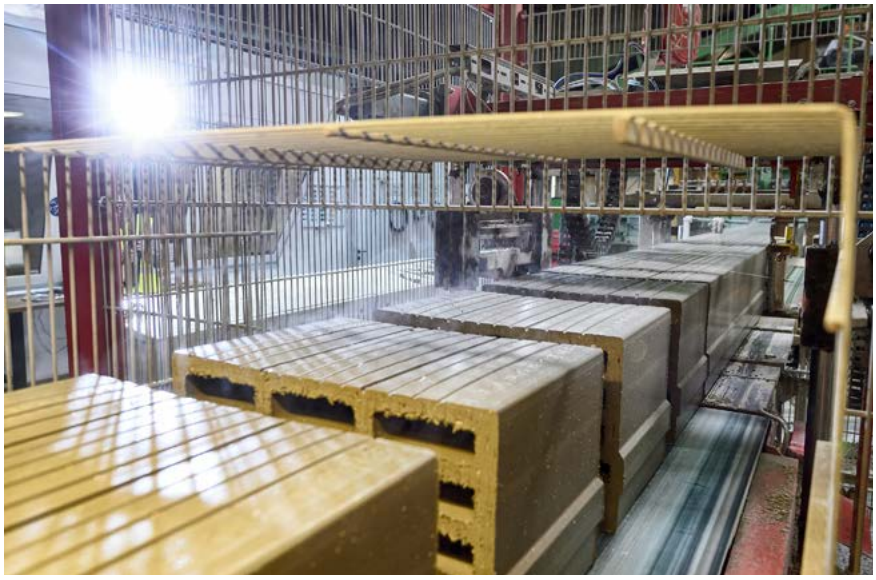
The "Digital Energy Twin" project is intended to identify and exploit more opportunities for optimisation along the production and energy supply chain as the company aims to further increase flexibility in its manufacturing. Real production data is transferred to the factory's digital twin, where it is modelled and validated before the results are sent back to the production line. Artificial intelligence and virtual reality applications are also used alongside a combination of physical and data-driven models. The Digital Energy Twin is designed to further optimise process-related energy consumption and integrate renewable energy sources into the process in the best possible way.

The aim is to develop a flexible, modular software tool that reduces the costs and investment risks of renewable energy systems in industry and helps to increase the percentage that these systems represent.

https://www.aee-intec.at/digital-energy-twin-optimierter-betrieb-und-optimiertes-design-von-industriellen-energiesystemen-p246

[1] Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC, project coordinator), AT&S Austria Technologie & Systemtechnik AG, FH Vorarlberg University of Applied Sciences – Digital Factory Vorarlberg Research Centre / Research Centre Energy / Research Centre for User Centred Technologies / VR Lab, FH Salzburg University of Applied Sciences – Information Technology & System Management, Graz University of Technology – Institutes for Software Technology / Interactive Systems and Data Science, University of Leoben – Chair of Energy Network Technology, Eberle Automatische Systeme GmbH & Co KG, Enertec Naftz & Partner GmbH & Co KG, Schmoll Maschinen GmbH, ENEXSA GmbH, Bravestone Information-Technology GmbH

Photo: Wienerberger AG/Johann Zinner



TORETECH

Energy efficiency in brick production

Substantial energy savings have been made in brick production in recent years through the use of new technologies. The Austrian company Wienerberger is an innovative leader and is continually improving its offering of energy-efficient, highly insulating bricks and sustainable systems solutions. Wienerberger has cut specific energy consumption in its production activities significantly, achieving reductions of 23% in bricks and 17% in roof tiles between 2010 and 2019. However, the manufacture of heavy clay products is still energy-intensive. Besides crushing raw materials, a lot of energy is required to dry and fire the bricks.

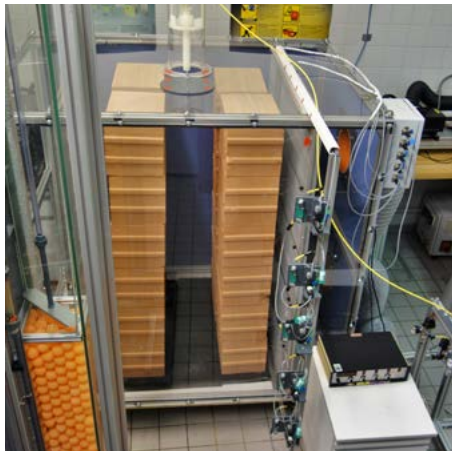
The company is currently developing TOREtech, an innovative energy concept for its tunnel furnaces, together with partners[1] from science and research. The aim is to further reduce primary energy consumption in brick production using energy-efficient process technology and an innovative gas burner developed specifically for this kind of furnace.

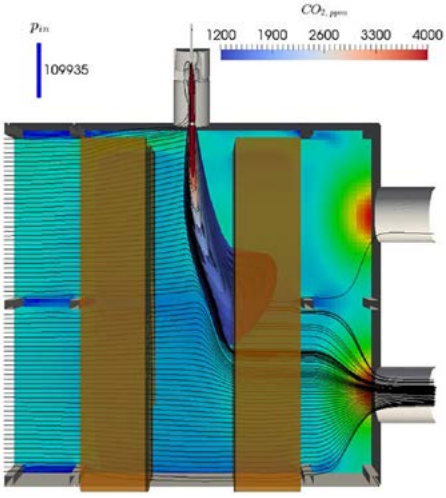
New combustion technology

A jet pump pure gas burner concept is being developed as part of the project. Pure gas burners only work with the hot furnace atmosphere already contained in the combustion chamber of the tunnel furnace and do not need any air added from outside, thus reducing energy consumption. This innovative concept combines the pure gas burner with a jet pump using natural gas. The development of the new technology is supported by numerical flow simulations and is currently being analysed at two test stands.

Wienerberger expects that its gas burner innovation will demonstrate at least 10% more thermal efficiency and that it will therefore be possible to further reduce gas consumption and CO_2 emissions from the brick furnaces in a sustainable way.

www.wienerberger.com





[1] Project partners: Wienerberger AG (project management), TU Wien (Vienna University of Technology) – Institutes for Process Engineering / Thermal Process Engineering and Simulation / Chemical Process Engineering and Energy Technology, DrS3 - Strömungsberechnung und Simulation e.U.

TOREtech cold test stand, Chamber cross-section
Both illustrations: TU Wien (Vienna University of Technology)

Drilling a pilot hole,
photo: City of Baden, Gerfried Koch

NÖM dairy in Baden near Vienna, photo: NÖM, Mario Pampel

SANBA

Industrial waste heat for the energy supply of a future urban district

Local anergy networks are pipeline networks that distribute low-temperature water (from 4 to 30° C) between individual buildings or groups of buildings. The water can be used for direct cooling as well as for heating and cooling using heat pumps. Anergy networks present new opportunities for decentralised energy supply. Forming local energy communities allows local renewable energy sources to be integrated and flexibility to be increased.

With SANBA, the AIT Austrian Institute of Technology[1] is developing a network of this kind for the Martinek military camp in Baden, near Vienna, which were abandoned in 2014. A new multi-use urban district with residential, commercial and office buildings could be constructed on the 40-hectare site, which is owned by the Ministry of Defence. The listed buildings will need to be renovated regardless of their future use. The central idea for the rehabilitation is to provide the district with industrial low-temperature waste heat produced by processes at the nearby NÖM dairy. Further sources of energy available locally such as geothermal energy, photovoltaics and solar thermal energy are key components in the anergy network.

Simulations for three different usage scenarios (the use of the historical buildings only or the use of additional buildings too) are being carried out so that a local low-temperature heating and cooling network on this site can be planned efficiently. The results of the project will show whether the concept is technically and economically feasible and whether it should be pursued. Initial drilling work for a 150-metre-deep borehole heat exchanger was carried out in January 2020 on the NÖM site in Baden. Engineers are now studying the properties of the subsurface to see whether it is suitable for a heat and refrigeration storage system.

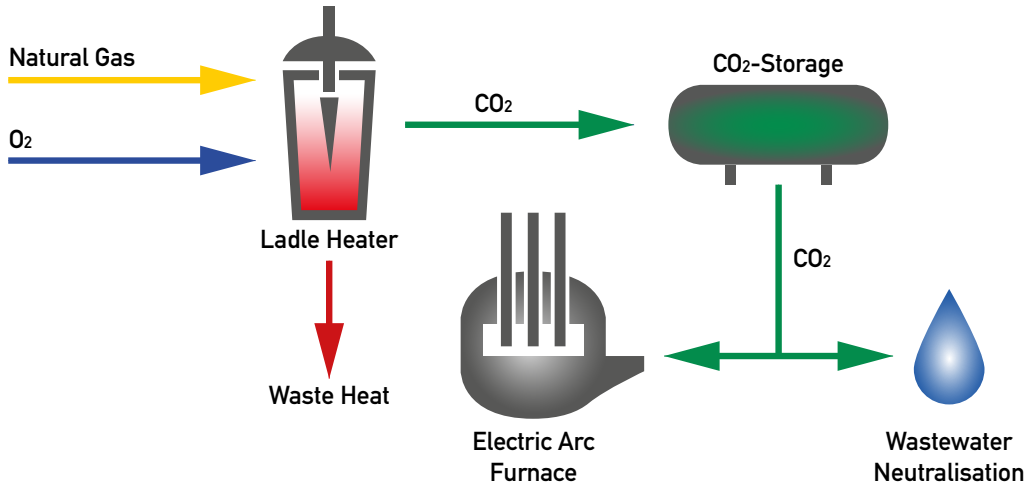
SANBA will deliver important insights to support the planning and implementation of anergy networks in Austria, especially as part of renovation projects.

[1] Project partners: AIT Austrian Institute of Technology GmbH (project coordinator), NÖM AG, TU Wien (Vienna University of Technology) – Institute for Energy Systems and Thermodynamics, ENFOS. e.U. – Energy and Forest, Research and Service, Institute of Building Research and Innovation ZT-GmbH, City of Baden (Energy unit), University of Leoben, Chair of Energy Network Technology, geothermal GmbH, BauConsult Energy GmbH

Project consultants: The Austrian Ministry of Defence, represented by the Military Real Estate Management Centre (MIMZ), Austrian Federal Monuments Office

SANBA and **OxySteel** (page 27) are projects of the flagship region NEFI – New Energy for Industry, an innovative network with 100 partners from companies, research institutes and public institutions for developing and trialling key technologies for the decarbonisation of industry.
www.nefi.at

Source: Montanuniversitaet Leoben



OXYSTEEL

New process design for the steel industry

Technologies to increase energy efficiency and reduce CO_2-emissions in electro-steel plants are being researched and tested in the OxySteel project being led by the Montanuniversitaet Leoben.[1] Steel scrap is melted down in electric arc furnaces and then processed into high-quality steel products. The melting of recycled scrap requires the use of less energy and results in lower CO_2-emissions compared with the conversion of iron ore to iron in a blast furnace. The project team is developing an innovative process design integrating oxyfuel combustion and CO_2-separation (carbon capture and utilisation, or CCU) into the production process.

Oxyfuel combustion can be used in electric steel plants to pre-heat ladles as well as in heat treatment. Replacing the combustion air with pure oxygen leads to a higher adiabatic flame temperature, lower exhaust gas losses and reduced nitrogen emissions.

The Messer Oxipyr oxyfuel burners have been fitted with special measurement sensors to achieve optimal control of the combustion process. These oxygen burners are designed to be up to 50% more energy efficient and produce a flue gas with a high concentration of CO_2.

Trial runs in steel plants

The new technologies are being trialled at Breitenfeld Edelstahl AG's steel mill in Styria, where five conventional ladle heaters will be replaced by three new furnaces fitted with oxygen burners. Some of the CO_2 produced in the process is used for environmentally friendly wastewater neutralisation in the plant. The researchers expect annual energy savings of 12 GWh due to the implementation of OxySteel. This is the equivalent of around 10% of the annual natural gas requirement of a small town in Styria. In addition, the potential for Demand Side Management in steel production is analysed. To this end, the operational flexibilities are being assessed and used to calculate the potential for network services.

[1] Project partners: Montanuniversitaet Leoben – Chair of Energy Network Technology (project management), Breitenfeld Edelstahl AG, Messer Austria GmbH

Photo: Breitenfeld Edelstahl AG, Stefan Nadrag

DIGITAL TRANSFORMATION

SMART TECHNOLOGIES AS AN ENABLER OF ENERGY INNOVATION

The use of digital technologies is bringing about major change in all areas of the economy and all aspects of our lives. On the one hand, digitalisation is presenting huge opportunities for growth, employment and prosperity; on the other, it poses a significant challenge. The digital transformation is calling for new workflows, production methods and innovative business models in all sectors of the economy. Digitalisation has a key role to play on the path towards decarbonising the energy systems, mobility and industry.

As part of the energy transition and the continuing integration of renewable energy sources, balancing electricity supply and demand will become a core task. Information and communication technologies (ICT) can help to log supply and demand in real time and, in combination with power storage systems and power-to-X measures, can improve how they are coordinated and controlled. This will allow power grids to be stabilised and distribution losses to be reduced as so-called smart grids are created. In the long term, connecting up the sectors of power, heat, industry and mobility will become a key focus of ICT-driven optimisation measures in order to establish an integrated, future-proof energy system based on renewable energy sources.

Photo: Uwe Strasser/Wienerberger AG

SOLVEIG MENARD-GALLI

CPO Wienerberger AG

"Wienerberger has cut specific energy consumption in its production activities significantly. Between 2010 and 2019, we achieved reductions of 23% in bricks and 17% in roof tiles. One of the ways we met this target was by implementing optimised production processes that would not have been possible without digitalisation. Wienerberger has set itself the objective of not only switching to low-carbon energy carriers as quickly as possible but also shaping the digital transformation of our industry by harnessing new technologies consistently. Sustainable system solutions for our customers are also part of this approach: we are working continuously to help our customers make their own positive contribution to combating climate change, be this through highly insulating bricks, smart pipeline systems or complete solutions for the building envelope."

Photo: Green Energy Lab

SUSANNE SUPPER

Cluster Manager, Green Energy Lab

"Digitalisation is a key concept in the integrated energy system and, together with the OpenDataPlatform, is at the heart of Green Energy Lab's project activities. The data platform gathers highly accurate energy data and enables fluctuations and peak loads in energy generation and consumption to be forecast and balanced out with the aid of special IT algorithms combined with sociological research. A trial is currently being run in Lower Austria, and the forecast models that are developed will be applied at individual household level as well as scaled up so that they can be used for entire regions. The medium-term aim is to feed in data from Green Energy Lab's other projects as well and create a virtual map that precisely illustrates the energy flows in Green Energy Lab's flagship region [Burgenland, Lower Austria, Styria, Vienna] and to make this available to our innovation stakeholders."

CHRISTIAN PURRER AND MARTIN GRAF

Management Board, Energie Steiermark AG

"The energy industry believes that digitalisation offers the potential for positive development opportunities, both to take account of customers' new requirements and lifestyles and to really be able to leverage the latent potential in energy efficiency and sustainability. It's also about networking with other sectors and issues, i.e. venturing into new, innovative areas of business. This calls for a new way of thinking, a new pace, a new dialogue and new, highly complex IT solutions. And the same applies on the supply side, in terms of switching over to smart meters, smart grids and new storage technologies. This will result in more transparency and autonomy and will give consumers a more active role in managing and saving energy."

Photo: Energie Steiermark

Photo: Christian Husar

ANGELA BERGER

CEO, Technology Platform Smart Grids Austria

"Digitalisation is becoming increasingly important for the energy sector too, and companies are tackling the issue with care. Turning flexibility into something that can be exploited, and the automation required for this, is creating a lot of new services and enabling energy customers to become active players themselves. Smart grid solutions form the basis for an energy and mobility transformation that will be efficient from the perspective of the whole economy. This is the only way that the challenges such as decentral production, integrating e-mobility and increased system volatility without affecting system stability can be overcome without substantially expanding the existing infrastructure at significant cost. Interoperability is a key factor in the digitalisation of the energy system. Austria has established itself as a pioneer in this area in particular and will be stepping up its activities further in the next few years."

Photo: GettyImages-963088232 | shutterstock.com/prochasson freder

CLEAN ENERGY FOR TOURISM (CE4T)

Optimised energy control technology in Salzburg's ski resorts

Innovative technologies and products for decarbonising ski resorts are being developed and tested in Salzburg in the CE4T[1] flagship project. State-of-the-art energy control technology and specially developed optimisation algorithms are being used to coordinate different energy-intensive processes with one another and exploit areas of flexibility. The central innovative approach of this far-reaching project comprises integrative, systemic optimisation measures in three areas: the ski resort itself, its energy system and the electricity market.

Energy efficiency and the use of renewable energy sources are important issues in winter tourism in Austria, an energy-intensive sector. Snowmaking on the ski slopes consumes a lot of energy, with up to 15 MWh per hectare required just for the initial snowmaking (30 cm) at the start of the winter season. The peak loads that this involves pose a major challenge for integrating renewable energy sources and the grids. Technologies and solutions for balancing out these peak loads could facilitate the integration of renewable energy sources and pave the way towards a clean energy future.

Using areas of flexibility in the energy system

Optimising and managing the various areas of flexibility within the ski resorts (e.g. the pumps, snow machines, PV systems, e-charging stations, etc.) is designed to increase energy efficiency and take some of the pressure off the power grids. The expansion and integration of renewable energy sources is to be given further momentum by storing surplus energy in Salzburg AG's storage power plants (e.g. at the Dießbach pumped-storage power plant) in the off-season and getting other local industries (e.g. hotels, spas) involved.

[1] Project partners: Salzburg AG (Consortium Leader), Ski resorts: Oberpinzgauer Fremdenverkehrsförderungs- und Bergbahnen AG, Hinterglemmer Bergbahnen GmbH, Saalbacher Bergbahnen GmbH, Schmittenhöhebahn AG, Gletscherbahnen Kaprun AG, Rauriser Hochalmbahnen AG, Bergbahnen Fieberbrunn GmbH, Leoganger Bergbahnen GmbH, BBSH Bergbahnen Saalbach-Hinterglemm GmbH

Research partners: AIT Austrian Institute of Technology GmbH, University of Leoben – Chair of Energy Network Technology

Technology partners: World-Direct eBusiness solutions GmbH, BEST - Bioenergy and Sustainable Technologies GmbH, Faradis GmbH, sattler energie consulting GmbH

Hybrid snowcat (photo: Nikolaus Faistauer),
Valley station with photovoltaic facade (Hasenauer.Architekten ZT GmbH),
Reservoir for snowmaking (photo: Salzburg AG),
Dießbach matrix pumps for energy storage (photo: Salzburg AG)

Integrated energy management

Energy monitoring and related technologies (hardware and software) are already available on the market. However, unlike in industry, for example, there is currently no solution for comprehensive energy management for ski resorts that integrates the many energy-intensive processes such as snowmaking, powering the ski lifts, grooming the slopes, running the restaurants and providing mobility. CE4T aims to optimise the whole system by integrating the electricity supply system and the electricity market as well.

The project develops and implements tried-and-tested optimisation algorithms, related interfaces and an ICT framework to maximise energy efficiency, integrate renewable energy sources and make use of opportunities for flexibility in the ski resorts' energy requirements. The plan is for the solutions to be transferable to other areas within Austria's tourist industry as well as to other countries and other energy-intensive industries.

www.nefi.at/ce4t-clean-energy-for-tourism/

CE4T is a project of the flagship region NEFI – New Energy for Industry, an innovative network made up of research institutes, technology providers and companies for developing and trialling key technologies for the decarbonisation of industry.
www.nefi.at

LarGo!
Large-Scale Smart Grid Application Roll-Out

LARGO

Secure roll-out of smart grid applications in distribution networks

The intelligent deployment of smart grid applications in a power grid, photo: AIT/krischanz.zeiller

The onward march of digitalisation in power grids is changing the role that information and communication technologies play in distribution networks. Rather than just new hardware and network technologies being installed, various software applications are also being deployed that process field data or perform control functions in real time. These applications are becoming increasingly necessary in order to guarantee power grid stability. The new systems and their software have to be maintained continuously and kept up to date.

Rolling out and updating smart grid software poses a major challenge. Distribution networks are critical pieces of infrastructure, where outages can incur substantial costs. Before any new software applications are introduced or existing software is updated, therefore, a comprehensive analysis of the overall system must be carried out so that the infrastructure is put under as little strain as possible in the event of errors or faults during introduction.

Making today's smart grids future-proof

As part of the LarGo! project, a consortium[1] led by the Center for Energy at the AIT Austrian Institute of Technology is coming up with key solutions to the operational challenges in the grid management of today and tomorrow.

LarGo! enables smart grid applications to be rolled out securely and robustly by developing a seamless, application-specific deployment process[2] that makes new software applications easier to introduce in the operation of distribution networks and energy management systems in buildings.

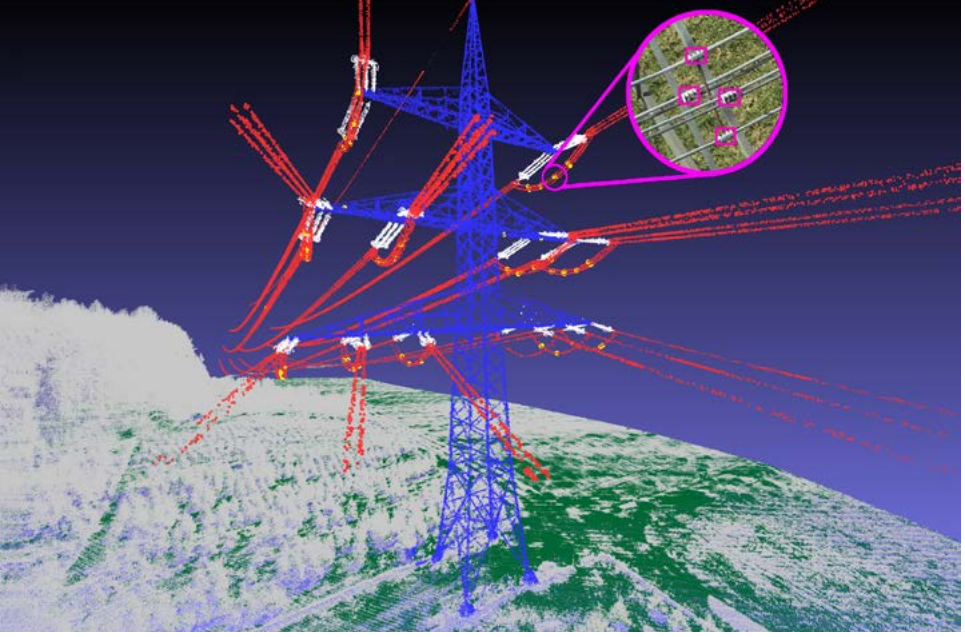
The project is also working to analyse the technical side-effects of roll-outs or software updates via the shared communication infrastructure. Solutions for secure smart grid roll-outs are being developed with the aid of comprehensive system simulations, hardware-in-the-loop experiments and field tests.

www.largo-project.eu

LarGo! is a project being funded as part of ERA-Net Smart Grids Plus with support from HORIZON 2020, the European Union's research and innovation programme.
www.eranet-smartenergysystems.eu

[1] Project partners: AIT Austrian Institute of Technology GmbH (project management), Siemens AG Austria, Wiener Netze GmbH, OFFIS e.V. (Germany), Fraunhofer Institute for Solar Energy Systems ISE (Germany), KTH – Royal Institute of Technology (Sweden)

[2] Deployment processes are semi- or fully automated processes to install and configure software on PCs and servers.



Automatic inventory system for clamping connections for thermal inspections, illustration: Siemens AG Austria

VOLTAIR

Measurement system for the automated inspection of power grids

In the research project VOLTAIR, Siemens is developing a special sensor system for the automated monitoring of power grids in cooperation with Graz University of Technology[1]. The key is the interaction between an unmanned aerial vehicle (UAV), a specially coordinated sensor system and underlying automatic evaluation and analysis methods. To ensure that power grids are reliable and will not fail, the components of their infrastructure have to be inspected regularly. These inspections and flyovers, which are carried out by trained personnel, are very expensive and time-consuming, making UAVs, or drones, an increasingly popular alternative nowadays.

Rendering the invisible visible

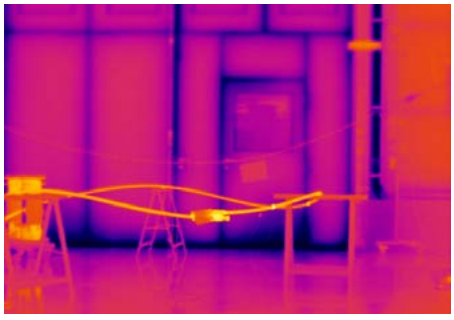
The research project is studying ways to inspect power lines, transformers, switchgear and substations in both high- and medium-voltage applications. Special ultraviolet (UV) and thermal imaging (IR) cameras can detect faults in power grids such as corona discharge and hotspots. Until now, however, no solution has been able to automatically evaluate and distil the data collected or to georeference it and integrate it into grid operators' processes.

The VOLTAIR project has developed and implemented components for a special UAV measuring system as well as methods for automatically analysing images and identifying problematic areas using UV and IR. The automatic image analysis processes the sensor data collected and automatically detects and localizes anomalies in the high- and medium-voltage infrastructure that were previously invisible to the human eye.

The measuring system has been trialled in field tests under both controlled and real-life conditions. During an UAV flight there were UV anomalies detected in a substation near Gleisdorf in Styria that were then compared with a measurement taken at ground level. The aim is to increase the measuring speed to up to 30 km/h for subsequent runs in order to cover a cost-effective number of kilometres per day during inspections.

www.tugraz.at/institute/hspt/aktuelles/forschungsprojekt-voltair/

[1] Project partners: Siemens AG Austria (project management), Graz University of Technology – Institute of High Voltage Engineering and System Performance



Top to bottom:
UAV test flight, photo: Siemens AG Austria
Measurements in the laboratory, photo: Graz University of Technology
Sensor head in the test environment, photo: Siemens AG Austria

GREEN HYDROGEN

HELPING TO SHAPE THE FUTURE OF ENERGY

Green hydrogen is a climate-neutral energy carrier and raw material that can play a valuable part in the decarbonisation of our economy, particularly in the industrial and transport sectors. As a means of storing surplus energy, hydrogen can help to integrate renewable energy sources into the energy supply system and to couple the electricity, water, industry and mobility sectors. In Austria there are numerous innovative technologies, concepts and solutions for producing and using green hydrogen currently being researched, tested and demonstrated.

The Austrian federal government has outlined a national hydrogen strategy as part of its policy programme. There will be a strong focus on green hydrogen in research and technology development, particularly for the industry and transport sectors, with the aim of making Austria an innovation leader and the number one nation in hydrogen. The Austrian Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) believes that the main area of application for H_2 and fuel cells lies in heavy vehicles and special purpose vehicles.

Photo: Fronius International GmbH

ELISABETH ENGELBRECHTSMÜLLER-STRAUSS

CEO Fronius International GmbH

"At Fronius we believe that green hydrogen will be an important part of the future of energy. It is crucial that we think about every sector, such as energy production, mobility and heat recovery, in a holistic way. This is exactly the approach we take at Fronius Solhub, where we integrate solar power, hydrogen and refuelling to provide an innovative complete solution. It enables companies, commercial operators and communities to produce solar hydrogen locally to refuel their own vehicles and making use of both, waste heat and storage of seasonally produced energy. With localised production of green hydrogen we can make an enormous contribution to decarbonisation, sustainable energy supply, security of supply, and reduced dependence on imports."

Photo: VERBUND AG

RUDOLF ZAUNER

Head of Hydrogen Center VERBUND AG

"Green hydrogen will make a significant contribution to a sustainable energy future: as a gas for use in industrial processes, as an energy carrier for the mobility sector, and as a storage medium. VERBUND is working on several different hydrogen projects, with the aim of extending the supply chain from green power to green hydrogen. It is evident that the appropriate regulatory frameworks still need to be established to facilitate a breakthrough in green hydrogen. However, as hydrogen can also be transported long distances, we are currently testing concepts for importing green hydrogen in large volumes into Austria. "Green Hydrogen@Blue Danube" is an initiative investigating the idea of producing hydrogen from wind and solar energy in south-eastern Europe and bringing it along the river Danube to Austria, where we need to find substitutes for large quantities of fossil fuels in order to achieve climate neutrality."

HORST STEINMÜLLER

Consortium coordinator, WIVA P&G – Hydrogen Initiative Energy Model Region Austria Power & Gas

Photo: JKU Linz

"To make progress towards the objective of a climate-neutral economy, we need to change the way we think – particularly with regard to increased sector coupling. Hydrogen and carbon-neutral gases and liquids will play an important role in this context. These products can be used in many ways, making a contribution to the sustainable development of our economic system: they can be stored, transported, and used for the production of electricity, heat and power in mobile and stationary applications. Over the next few years the WIVA P&G Model Region will demonstrate how Austrian technologies can contribute to the reduction of greenhouse gases in the domestic market, and then as top exports not only benefit the Austrian national economy but also make a substantial contribution to the global reduction of greenhouse gas emissions."

Photo: HyCentA Research GmbH

ALEXANDER TRATTNER

CEO and Research Director, HyCentA Research GmbH

"Research on hydrogen technologies has a long history in Austria and is centred on the facilities at Graz University of Technology (TU Graz). Building on the pioneering work on fuel cells by Prof. Karl Kordesch in the 1970s, today there are around 160 researchers working in this field at TU Graz. This includes the fuel cell laboratory, high temperature fuel cells and electrolysis, LEC – the large engine research centre, BEST – H_2 from biomass, and the HyCentA – Centre for H_2 technologies. At HyCentA we are conducting applications-oriented research and development in the production, distribution, storage and use of hydrogen. This is an outstanding experimental facility with the capacity to test high pressure, electrolysis and components, and the leading state-of-the-art fuel cell testing facility in Europe."

Photo: Fronius Solhub

HYTECHBASIS 4 WIVA

Further development of PEM electrolysis and fuel cell technology

Photo: Fronius Solhub

[1] Project partners: Fronius International GmbH (project management), Miba Sinter Holding GmbH & Co KG, Heraeus GmbH, HyCentA Research GmbH, Energy Institute at JKU Linz

HYTECHBASIS 4 WIVA and **UPHY I&II** (page 13) are part of the Hydrogen Initiative Energy Model Region Austria Power & Gas (WIVA P&G). The aim of this initiative is to demonstrate how the Austrian economy can be converted to a largely CO_2-neutral structure, with the production and use of renewable hydrogen as a key component of this transition for the energy, manufacturing and mobility sectors.
www.wiva.at

At HYTECHBASIS 4 WIVA[1] the focus is on further development and optimisation of PEM electrolysis stacks and systems for decentralised, consumer-oriented applications in the output range of around 50-500 kW, and of fuel cells. This technology is not yet sufficiently optimised and industrialised to offer any economically viable advantage for customers at present, without funding support. In addition to various technological developments and optimisations, further cost reductions are therefore also a key priority.

Pioneering technological development

By using innovative technologies in the field of catalyst-coated membranes and new production processes for bipolar plates made of titanium, the aim is to make fundamental advances in the technology for PEM electrolysis. By integrating optimised auxiliary equipment, the project team aims to increase system efficiency and reduce costs.

Research is also under way into possible ways to optimise fuel cell technology. The focus is partly on new approaches in the field of balance-of-plant components for the process technology of fuel cells. Investigations are also being conducted into new components for electrical connectors (galvanically insulated DC-AC inverters), to allow direct current to be fed into the public alternating current network.

The results from HYTECHBASIS will be integrated and applied in the Fronius Solhub. Solhub is an innovative system solution for local production, use and storage of green hydrogen. The system is used for refuelling H_2 vehicles, for storage and reconversion of solar hydrogen and for the efficient recovery and use of waste heat. This makes it possible to store seasonal PV surplus power from summer through to winter and to make extra energy available on low-sunshine days.

www.fronius.com

UPHY I&II

Upscaling of green hydrogen for industry and mobility

The goal of the project is to produce green hydrogen (H_2) through electrolysis at industrial scale for use in industry and mobility. It is intended to be used as fuel for public buses in the Vienna region, as well as for industrial use in the H_2 hub of the refinery, for uses such as the hydrogenation of CO_2 from waste gas flows to produce sustainable fuels.

Supplying the industrial and mobility markets with green H_2 is expected to achieve considerable synergies in the efficient utilisation of the necessary investments. Furthermore, the flexibility of the system, which consists of multiple H_2 consumers plus a highly responsive H_2 production system, should be leveraged to support a cost-optimised electricity (participation in balancing power markets). The construction of a large electrolysis plant of up to 10 MW is planned for this purpose. This is a unique size for Austria that is intended to demonstrate not only lower production costs but also the lowest downtimes and highest plant availability for commercial use in industry and mobility. In addition to the electrolysis system itself, the entire value chain is to be built, including H_2 purification, H_2 trailer loading, trailer logistics (using 300 bar trailers in Austria for the first time) and a high-availability, energy-optimised bus fuelling station. The measuring technology developed in the preceding project UpHy I will be tested and optimised under real-world conditions to verify the level of H_2 quality required for H_2 mobility (as per ISO 14687-2) and calibrated metering at the fuelling station.

The insights from the industrial operation and optimisation of the green H_2 value chain, in combination with the newly developed measuring technology, are the basis for a successful rollout of the efficient use of green H_2 in industry and mobility in the future. In close cooperation between Austria's leading energy companies, OMV and VERBUND, the planning for implementation of the investments was completed in the project UpHy I. The innovative concepts for the H_2 logistics were coordinated with qualified partners. HyCentA Research GmbH and VF-Service GmbH developed new high-quality and calibratable metering technology. The Energy Institute of the Johannes Kepler University Linz is analysing how future H_2 mobility developments in Austria will effect the economy, society and the environment.

Declarations of intent were signed for the sale of the H2 in the mobility market, although the binding purchase amounts are contingent on receiving the promised subsidies for the bus fleets. The partnership with WIVA P&G has facilitated the integration of the project into the Austria Power & Gas Hydrogen Model Region initiative.

www.wiva.at

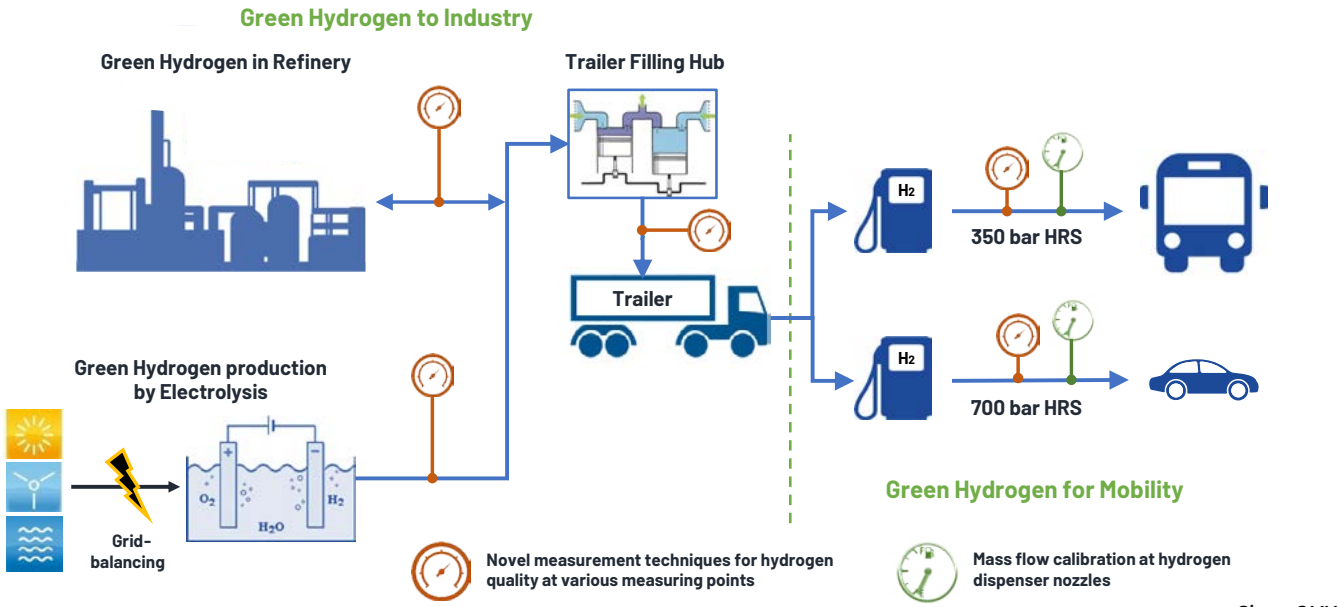


Chart: OMV

KEYTECH4EV

Electric mobility with a fuel cell-battery hybrid

Demonstration vehicle,
photo left: AVL List GmbH/Doris Sporer
Photo below: Climate and Energy Fund/
APA-Fotoservice/Ferlin-Fiedler

Under the KeyTech4EV initiative, a consortium[1] led by AVL developed a highly-efficient, cost-optimised and CO_2-free powertrain concept for e-vehicles. The innovative approach being explored in this project is to combine hydrogen fuel cells and battery technology. Early in 2020, the project partners presented a demonstration vehicle with a hybrid drive system which uses fuel cells and a battery. This technology is of particular interest for heavy vehicles such as trucks and buses as well as for special purpose vehicles. This is also where the BMK has placed its strategic focus.

Hydrogen tank, Photo: AVL List GmbH

Innovative combination of two technologies

The best technology available at present consists of vehicles with large fuel cell systems and very small buffer batteries, or vehicles with purely battery-driven electrical systems. Preliminary studies have shown that a fuel-cell/battery hybrid could reduce powertrain costs significantly compared with the systems currently in use, while also outperforming them in aspects such as efficiency and driving performance. In addition, the fuel-cell/battery hybrid offers a long range and shorter recharging time.

This technology was developed by AVL in collaboration with three component and subsystem manufacturers, and various research partners. All the core technologies at system and vehicle level were then integrated and validated by AVL. KeyTech4EV is making an important contribution to the development of a national and European value chain for fuel cell technology.

The heart of the Keytech4EV powertrain is a 70 kW fuel cell, which is designed for maximum speed and climbing power (gradeability). This is combined with a battery with about 10 kWh capacity for maximum efficiency, excellent acceleration and good driving performance.

The use of a standard mid-sized vehicle for the project should demonstrate the following:

- Energy efficiency equivalent to fuel (gasoline) consumption of 2.5 L/100 km for a C/D mid-sized vehicle
- Reduction in powertrain costs
- No CO_2 emissions
- Range > 500 km
- Driving performance similar to comparable series production vehicles

www.iesta.at/keytech4ev/

[1] Project partners: AVL List GmbH (project management), MAGNA STEYR Engineering AG & Co KG, ElringKlinger AG, HOERBIGER Wien GmbH, HyCentA Research GmbH, IESTA – Institute for Advanced Energy Systems & Transport Applications, Graz University of Technology – Institute of Chemical Engineering and Environmental Technology, Vienna University of Technology – Institute of Mechanics and Mechatronics

Selecting suitable membrane modules for the MD-technology plant at AEE INTEC, photo: bLENDpunkt-Martin Schönbauer

AMMONIA-TO-POWER

Energy recovery from ammonium-rich waste materials

"Ammonia to Power"(A2P)[1] is an innovative concept for the efficient capture, utilisation and energy recovery of ammonia. Ammonium (NH_4) occurs (in the form of nitrogen salts) in a large number of waste product streams, e.g. industrial wastewater from manufacturing plants, municipal sewage and in wastewater from digestate residues. If wastewater run-off contains large quantities of ammonium, this has a detrimental impact on the environment, so this is reduced through a series of specialised treatment stages. Due to a lack of appropriate recovery technologies, this also destroys the associated base ammonia (NH_3) and the hydrogen – a valuable energy carrier – bonded within it.

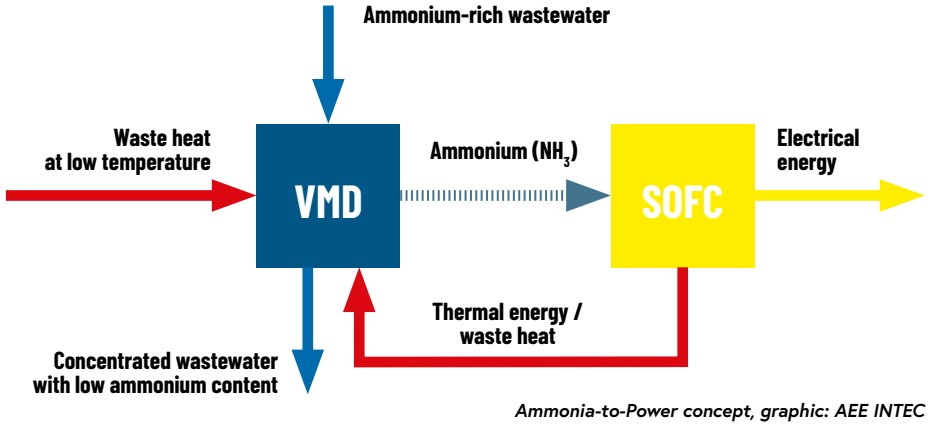
Vacuum membrane distillation and SOFC fuel cells

The ammonia-to-power concept aims to combine vacuum-membrane distillation (VMD) for separating the ammonia (in the form of gas) with a solid oxide fuel cell (SOFC). This combined technology should make it possible to extract the "free" ammonia available in various wastewater flows and then to recover its energy by using it in an ammonia fuel cell. This enables energy to be converted into electricity and heat.

The waste heat that results from the process can also be used, e.g. as drive energy for the membrane distillation process.

The aim of the project is to develop an optimised MD plant on a laboratory scale with a suitable membrane module for extracting ammonia, and to identify the optimal operating parameters. The ideal operating parameters will also be defined for the SOFC fuel cells. These will be used to develop a 5 kW SOFC CHP system, fuelled purely by ammonia. For two specific applications (a municipal effluent treatment plant and a motorway rest area) a technical concept is being developed for a real-scale installation. The project is also conducting techno-economic evaluations for this new technology.

www.aee-intec.at/ammonia-to-power-p216



Ammonia-to-Power concept, graphic: AEE INTEC

[1] Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC, project management), Graz University of Technology – Institute of Thermal Engineering, AVL List GmbH

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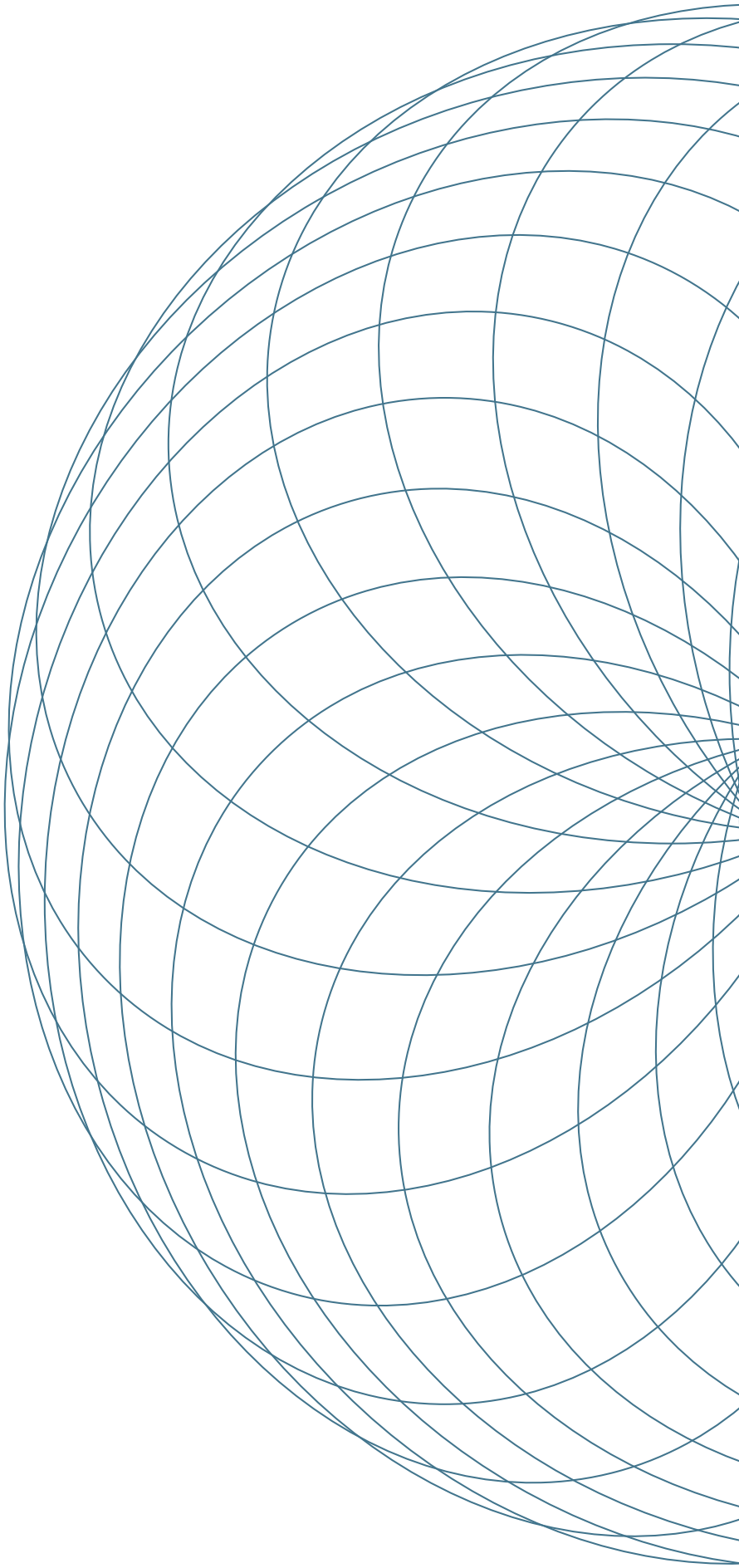

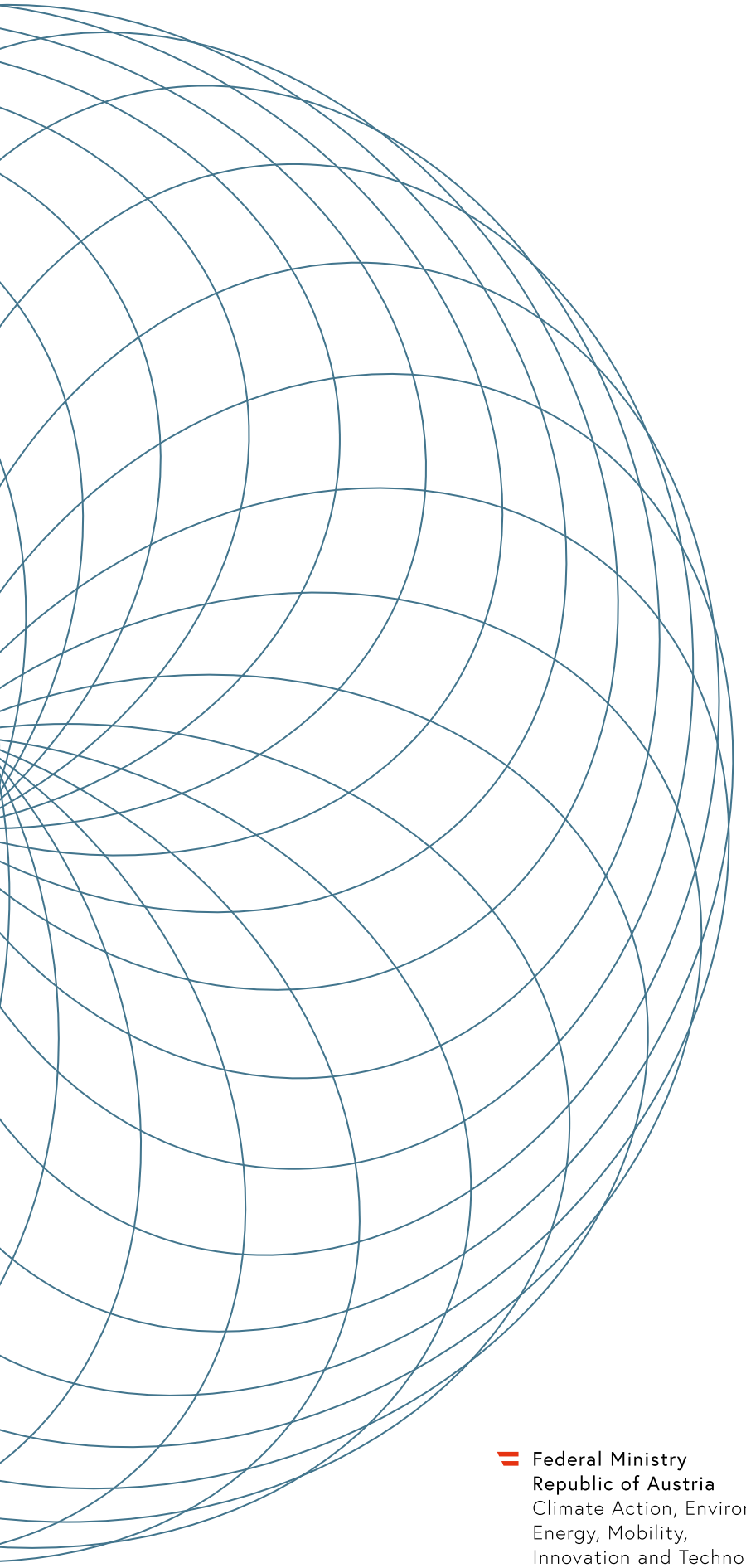

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