energy innovation austria

2/2020

Current developments
and examples
of sustainable energy
technologies

klima+ energie fonds

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Knowledge transfer for a climate-friendly future of energy

Austria's role in the global research network of the International Energy Agency (IEA)

Photo: stock.adobe.com

International research cooperation

for a clean, safe and affordable energy supply

For the past 45 years, numerous countries around the world have been collaborating on energy research under the umbrella of the International Energy Agency (IEA).

Set up in 1974 as an independent body of the OECD (Organisation for Economic Co-operation and Development), the IEA now has 30 members.* Austria, a founder member, is an active partner in the IEA's research and technology network via the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).

The IEA aims to help member states and other countries make their energy supply clean, safe and affordable. The IEA's Energy Technology Network provides a platform for the global exchange of expertise and new insights from energy research and thus supports the coordination of national energy and technology policies amongst member countries.

The IEA's activities focus on the following:

- Energy security: promoting diversification, efficiency and flexibility in all energy sectors
- Economic development: securing a stable energy supply for member states and promoting free markets to stimulate economic growth and eliminate fuel poverty
- Environmental awareness: expanding the international knowledge base of energy-related options for mitigating climate change
- Global commitment: working together with non-member states, particularly big energy producers and consumers, to find solutions to shared energy and environmental problems

"Austria has benefited a great deal by joining at an early stage and being a committed member of various IEA working groups. As a small country but an attractive partner in the global energy technology network, Austria benefits more than most from its membership. Researchers can learn a lot from the international dialogue, contribute their strengths and place themselves in a successful position. This also helps innovative companies to tap into new growth markets for clean energy technologies. All in all, Austrian involvement in the IEA's networks generate positive synergies with national, European and international initiatives and partnerships."

MICHAEL PAULA
HEAD OF THE DEPARTMENT OF ENERGY AND ENVIRONMENTAL TECHNOLOGIES AT THE FEDERAL MINISTRY FOR CLIMATE ACTION, ENVIRONMENT, ENERGY, MOBILITY, INNOVATION AND TECHNOLOGY

Photo: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)

* **IEA member states:** Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, South Korea, Spain, Sweden, Switzerland, Turkey, the United States, the United Kingdom. Associated countries: Brazil, China, India, Indonesia, Morocco, Singapore, Thailand.
Non-IEA countries can also join the agency's technology collaboration programmes.

Photo: stock.adobe.com

STRUCTURE OF THE IEA'S ENERGY TECHNOLOGY RESEARCH

The most important body for research and development (R&D) in the field of energy technologies is the **Committee on Energy Research and Technology (CERT)**, which formulates and supports the IEA's energy research strategies. The BMK is represented on this committee. The CERT instigates the IEA's research activities and steers the work being done under the Technology Collaboration Programmes (TCPs).

The various areas of energy research are grouped into four **working parties** (Renewable Energy Technologies, Energy End-Use Technologies, Fossil Fuels and Fusion Power), whose experts analyse and evaluate the work of the subject-specific TCPs and make recommendations to the CERT.

The Working Party on Renewable Energy Technologies looks after technology collaboration programmes in the following research fields: bioenergy, geothermal energy, marine energy, concentrating solar power, photovoltaics, solar heating and cooling, hydrogen, hydropower and wind power. The Working Party on Energy End-Use Technologies is supporting 14 technology collaboration programmes from the buildings, electricity, industry and transport sectors. The Working Party on Fossil Fuels covers the technology collaboration programmes for multiphase flow science, advanced oil extraction, the Clean Coal Centre and fluidised bed technology as well as a greenhouse gas research programme.

The research cooperation is carried out as part of the **Technology Collaboration Programmes (TCPs)**, multilateral programmes whose objectives and research priorities are set by the participating countries. The TCP network is supporting the work of 38 independent international groups of experts at present with the aim of driving forward research into pioneering energy technologies and their development and marketing. It promotes the exchange of ideas and strategic, techno-political knowledge, while also offering countries the opportunity to showcase their strengths to the rest of the world. Around 6,000 experts from 54 nations are currently working together in a total of 38 TCPs.

The actual research and development activities are carried out at project level in the **tasks** or **annexes**. A TCP often comprises up to ten ongoing projects.

The BMK is supporting Austria's involvement in the TCPs with the programme "IEA Research Cooperation". It entrusts the research work that forms part of the tasks and annexes to Austrian experts, research institutions and companies, which are selected in an annual tender process. Austria is also taking the overall lead on a number of new tasks. ●

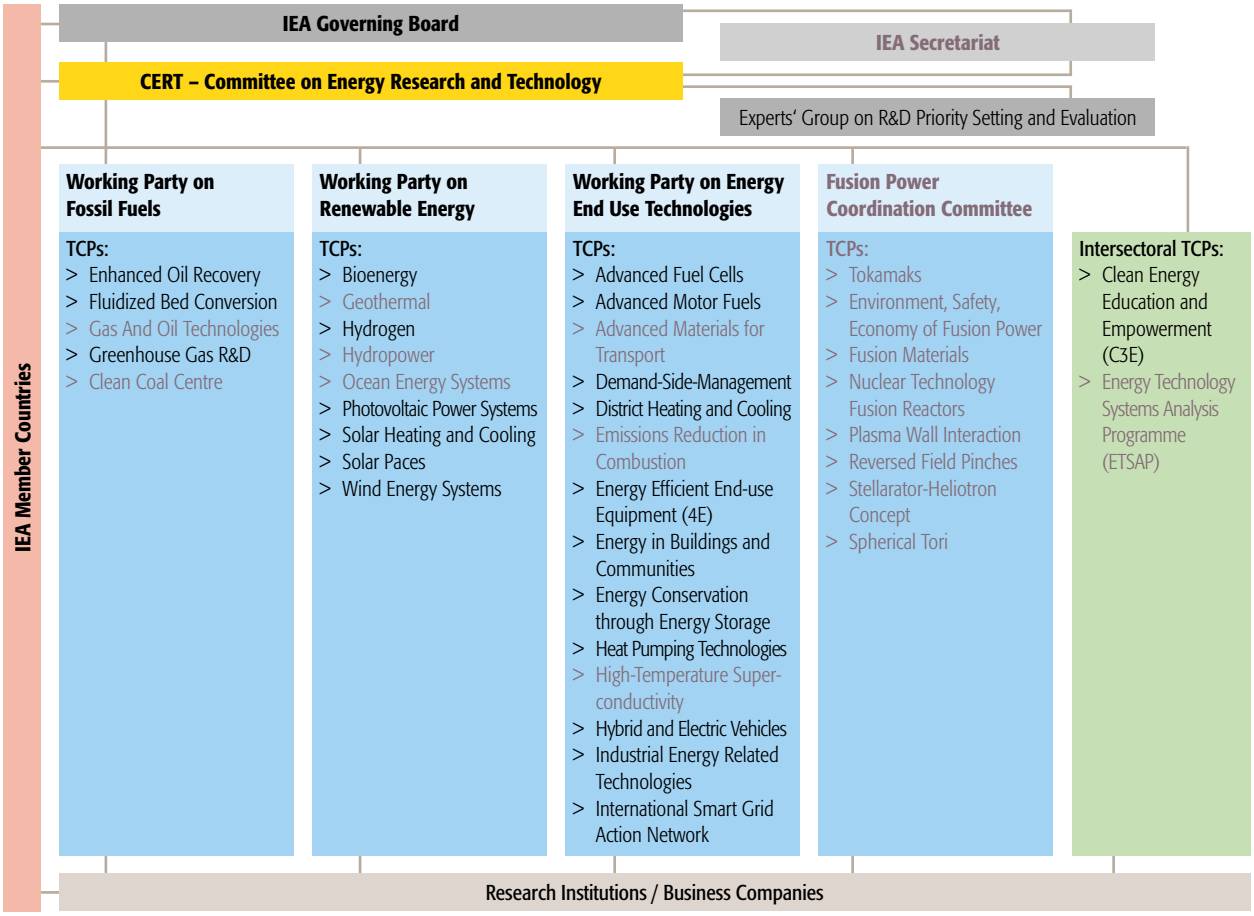
Austria´s participation as an active member

As part of the **Mapping of IEA TCPs** project, 185 IEA projects have been assessed and analysed in terms of methodological and subject-specific priority areas on behalf of the BMK. Austria has been involved in 88 of these activities, putting it seventh out of 49 participating countries. Of the activities, 48 relate to final energy consumption technologies and 35 to renewable energy sources. This makes Austria to one of the most intensively committed countries in the IEA's energy technology network, benefitting more than most from this worldwide collaboration. Austria is an agenda-setter and is using the IEA's network to showcase Austrian expertise on the international stage.

The country's IEA activities are spread across 21 TCPs, relating mainly to final energy consumption technologies (energy efficiency, transmission and energy storage) and renewable energy, and coincide with the priorities set at national level. Knowledge transfer enables international trends to be harnessed at an early stage to shape the strategy behind Austria's research and technology policy.

Active networking of Austrian energy technology providers in international research initiatives is crucial to the successful global positioning of Austrian areas of strength. Researchers and companies benefit from international cooperation as it often forms the basis for other projects further down the line. And research findings frequently open the door to EU-wide and global standardisation and quality assurance for new energy technologies and solutions. ●

Austrian involvement in the IEA's Technology Collaboration Programmes (TCPs)



Text in black denotes Austrian involvement

“Innovation is THE driving force behind the energy transition! Not only is this the view of the Climate and Energy Fund, it is also one shared by the International Energy Agency, the IEA. Austria’s approach – keeping an eye on the whole innovation process right through to market launch – is something that the IEA regards as a success factor. As a one-stop shop for the successful delivery of the energy transition, we thus feel confirmed in our activities. The IEA recommends providing the Fund with appropriate financial resources so that we can remain capable of achieving this mission. This is because investing in the kind of innovations that we make possible will enable the federal government’s ambitious climate target to be met and added value to be created in Austria.”

THERESIA VOGEL
MANAGING DIRECTOR OF THE CLIMATE AND ENERGY FUND

Photo: Climate and Energy Fund

Photos left and right: Climate and Energy Fund/Hans Ringhofer, centre: University of Leoben/Faculty for Process Engineering in Industrial Environmental Protection/Croce & Wir

IEA Country Report calls Austria a “strong innovator”

Austria comes out of the recently published IEA Country Report on Austrian energy and technology policy very well. In it, the IEA commends the strong partnership between private- and public-sector stakeholders in research and development. Spending some 0.04% of GDP on energy research from the public purse every year, Austria is in the top third in the IEA’s country comparison and is considered a “strong innovator”. Public-sector expenditure on energy research came to nearly EUR 150 million in 2019. The “Integrated National Energy and Climate Plan” (NECP) envisages a further gradual increase in energy research funding in the years to 2030.

The IEA recommends that Austria provide additional funding to its energy research and multi-year budgets that matches its ambitious climate and energy targets in order to guarantee planning security. The report praises the country’s systemic approach in the case of research programmes and its consideration of the entire innovation process, from research to market launch. However, Austria should make sure that subsidies with a focus on innovation are available at every stage of technology development. The IEA rates Austria’s commitment to international cooperation and its exemplary work disseminating research findings very highly. ●

More women in the energy sector

The transition to a clean energy future can only succeed if diverse talent and potential are harnessed to develop and implement new ideas and innovative solutions for a low-carbon economy. On average, only 25% of those working in the global energy industry are women. In Austria, the proportion of women employed in this sector stands at 18% overall and a mere 7% in the case of leadership positions. Women are also underrepresented in the energy research programmes, with only 14% of projects having a female lead. There is an urgent need to motivate women to gain qualifications in science, technology, engineering and mathematics and to provide targeted support to their career opportunities in the energy industry.

The IEA's technology collaboration programme **Clean Energy Education & Empowerment (C3E TCP)** is looking at strategies, policies and measures to increase the support of women in the energy sector and specifically in energy research. This international partnership is geared towards compiling best practices and showcasing role models for women in leadership positions and is supporting the creation of networks and activities designed to raise awareness. Austria has been a member of the C3E TCP since 2018. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/c3e/

National research funding programme: TALENTS

The BMK has pursued various measures to support women in technical and scientific lines of work for many years now. The "Talents" programme and the "FEMtech Initiative" offer support relating to equal opportunities and aim to put women on an equal footing with men in research work. Amongst other things, these programmes fund internships for schoolgirls and female students and support organisations looking to employ, encourage and retain women in technical and scientific roles. With these initiatives, the BMK is helping to create an attractive environment for female researchers and support talented and innovative women from Austria. ●

www.ffg.at/programm/talente

Photo: Wien Energie GmbH

"Preconceptions of role models are consolidated at an early age and are hard to break down later on. The energy technology sector, in particular, is still male-dominated. Wien Energie is creating tangible incentives such as our trainee programme and specific measures designed to encourage women in order to inspire them to find out more about this kind of work, even from an early age. Wien Energie has already laid the groundwork at management level, and the measures we have implemented have already begun to bear fruit: nearly 40% of our divisions are now led by women. After all, being innovative requires specialist expertise and diversity amongst your staff!"

GUDRUN SENK
AUTHORISED REPRESENTATIVE, HEAD OF ASSET DEVELOPMENT, IMPLEMENTATION & MANAGEMENT AND RESEARCH, WIEN ENERGIE GMBH

Photo: Andrei Merkulov/stock.adobe.com

Heat pumps

Efficient power supply technology

Heat pumps are a versatile, renewable energy technology that allows the heat from the air, water and soil as well as industrial waste heat to be harnessed. Their areas of application include the environmentally friendly heating and cooling of buildings, the optimised supply of heat and refrigeration via thermal networks and the efficient use of energy in industrial and commercial companies. The technology has the potential to play a significant role in improving energy efficiency, increasing the percentage of renewable energy in the energy supply mix and reducing greenhouse gas emissions.

International collaboration on researching, developing, trialling and launching this technology on the market is being stepped up as part of the IEA technology collaboration programme **Heat Pump Technologies (HPT TCP)**. The research is focusing on areas including efficient and competitive technologies for heating, cooling and air-conditioning, flexible system solutions, development opportunities in the field of digitalisation and opening up new markets and applications in the automotive, industrial and consumer goods sectors. Disseminating the latest research findings is an important aspect.

In industry, the use of heat pumps allows to integrate unused flows of waste heat. This helps to significantly reduce primary energy consumption and CO_2 emissions in industrial processes. The **IEA HPT Annex 48: Industrial Heat Pumps** project was geared towards overcoming existing obstacles preventing the technology from being used in industry in order to facilitate its launch onto the market. As well as economic considerations, these barriers also include technical and structural hurdles such as production safety risks and a shortage of real-life experience.

For the project, over 300 examples of industrial heat pumps in action were logged and analysed in total in the participating countries – Japan, Austria, France, Switzerland, the UK and Denmark. About 70 of these applications were running at Austrian industrial companies, a sizeable number that helps to position Austria as a pioneer and to showcase efficient solutions by Austrian companies and heat pump manufacturers as well as innovative research projects. An online information platform and training documents for potential users are helping to spread the word about the project's findings. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/hpp/iea-hpp-annex-48.php

Photo: Dmytro Shchetynin/Unsplash

ThermaFLEX demonstrator – High Temperature Heat Pump

At the end of 2018, ThermaFLEX was launched as a major research and implementation project for CO_2-free district heating in Austria. 27 project partners (energy suppliers, infrastructure operators, know-how and technology providers and research institutions) cooperate under the leadership of AEE INTEC in the development and implementation of concrete solutions for the flexibilization of district heating networks. The focus is on exemplary demonstrators in district heating supply areas of small, medium and large major Austrian cities. In cooperation with Wien Energie and other research partners*, the ThermaFLEX demonstration project "High Temperature Heat Pump" is performed. In this demonstration project the approach of so-called sector coupling, i.e. the merging of various previously separate infrastructures, is followed. In the waste incineration plant Wien-Spittelau, waste heat from the flue gas condensation (latent energy) of the incineration plant will be used as energy source for a high-temperature heat pump. Taking into account the findings from the evaluation of different operating strategies, a direct feed into the primary district heating network of the City of Vienna shall be realized. The thermal capacity of the planned heat pump is about 15 MW. ●

https://thermaflex.greenenergylab.at/e4a_demonstrator/demo-5/

* Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC) (project lead), Wien Energie GmbH, AIT Austrian Institute of Technology GmbH, TU Wien – Institute of Energy Systems and Electrical Drives

The project is carried out as part of the Green Energy Lab innovation laboratory.

Digitalisation in industry

for energy-efficient, low-carbon processes

Across the world, the industrial sector consumes a great deal of energy and emits a lot of greenhouse gases. Austrian industry is no exception, accounting for some 30% of the country's energy consumption. Process-based greenhouse gas emissions from industry will have to be cut sharply if carbon-neutrality by 2040 is going to be achieved. The energy efficiency of industrial processes is being continuously improved thanks to new technologies and methods. The aim is increasingly to integrate renewable energy sources into production lines and to balance the energy requirements of industrial facilities with energy supplies from fluctuating renewable sources.

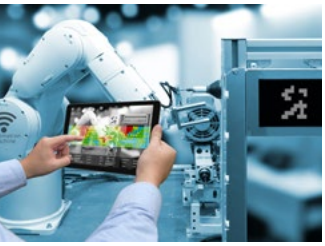


Photo: fotolia.de

As part of the IEA's technology collaboration programme **Industrial Energy Technologies and Systems (IETS TCP)**, international cooperation between research disciplines relevant to industry is being stepped up in order to drive forward its decarbonisation. The focus is on exchanging information and knowledge between experts from industry, research institutes and politics as well as on networking within industrial sectors and on cross-sectional technologies.

OPPORTUNITIES THROUGH DIGITAL TRANSFORMATION

The possibilities for employing digital technologies in industry and the opportunities they present are a key area of research. Digitalisation measures can help to make industrial processes more productive and flexible as well as increase efficiency, cut costs, save energy and incorporate more renewable energy.

The **IEA IETS Annex 18** project was launched in 2018 to research how **digitalisation, artificial intelligence and related technologies can be used in industry.** To this end, an international network of scientists, research laboratories, IT providers and process industry stakeholders is being established and an information architecture is being created to enable knowledge and data to be exchanged. The activities are intended to help reduce energy consumption and greenhouse gas emissions in energy-intensive branches of industry. Austria is an active member of this international research partnership. ●

https://iea-industry.org/annexes/digitalization-artificial-intelligence-and-related-technologies-for-energy-efficiency-and-ghg-emissions-reduction-in-industry/

Working on behalf of the Climate and Energy Fund, a team of Austrian experts (from TU Wien, AIT Austrian Institute of Technology and the University of Leoben) authored a **white paper entitled "Digitalisation in Industry – an Austrian Perspective".** The paper was produced as Austrian part of the Industrial Energy-related Technologies and Systems (IETS) technology collaboration programme being run by Smart Industrial Concept (SIC!), a cooperative doctoral school. It describes the "Big (Digital) Picture" by explaining key terms relevant to digitalisation in industry and where they fit in the overall context.

An overview of Austrian competence centres and digitalisation projects currently under way in Austrian industry sheds light on the present situation in the country. There is also a study of 15 relevant techniques, technologies and applications from digitalisation in industry. Amongst other things, the analysis covers digitalisation methods such as digital twinning, predictive maintenance, blockchains, data-driven modelling and supply chains.

The findings show that digitalisation measures can improve the development, operation and maintenance of industrial facilities and reduce emissions and energy consumption and that they will have a significant influence on the industry of the future.

www.energieforschung.at/projekte/1040/iea-iets-annex-xviii-digitalisierung-kuenstliche-intelligenz-und-verwandte-technologien-fuer-energieeffizienz-und-thg-emissionsreduktionen-in-der-industrie-task-1-assessment-study

Photo: AT&S

EDCSproof – Energy Demand Control System

Integrating renewable energy sources into the power grid will increase supply fluctuations, requiring ever more flexible consumers in energy-intensive branches of industry in particular. Today's production processes are rarely designed to support flexible operation, with most industrial energy supply systems based on conventional automation and process control systems. At present, only a handful of electrical and thermal storage systems and energy converters (power-to-heat, heat pumps that utilise waste heat) are in use.

This means that these systems are not being run optimally in terms of their CO_2 emissions, maximising their own consumption of renewable energy sources and minimising their operating costs. Quantities of waste heat that, technically speaking, could be harnessed by high-temperature heat pumps at up to 150°C, often remain unused.

As part of the EDCSproof* project, a concept for the future is being developed that is designed to enable industrial energy supply systems to be decarbonised, focusing on the online, predictive, integrated and reconfigurable control of energy supply. The concept has the following objectives:

> Integrating renewable energy sources by using (thermal) energy storage systems
> Increasing efficiency by optimising control of the overall system
> Harnessing waste heat by using high-temperature heat pumps
> Being part of the power grid as a flexible consumer (demand-side management, taking account of dynamic tariffing)

A benchmark energy system that includes the use of energy storage systems and heat pumps will be devised based on the energy systems and the production and operating data from three real-life industrial sites run by the Austrian companies Wiesbauer and Fischer Brot. The concept will then be fine-tuned in the laboratory. Scalability and potential uses in various branches of industry are to be studied in a technical/economic and ecological assessment. The project aims to develop an energy concept spanning all sectors and with a broad field of application, which is to be implemented at the project partners' sites and will be capable of being applied to a large majority of Austria's industrial companies. ●

www.nefi.at/edcsproof/

Photo: Pixabay

* Project partners: AIT Austrian Institute of Technology GmbH/Center for Energy (project management), TU Wien – Institute for Energy Systems and Thermodynamics/ Institute of Mechanics and Mechatronics, University of Leoben – Chair of Energy Network Technology, Wiesbauer Holding AG (Vienna), Wiesbauer Gourmet (Reidling, Lower Austria), Fischer Brot GmbH (Linz, Upper Austria), ILF Consulting Engineers Austria GmbH, evon GmbH, kleinkraft OG

The project is carried out as part of the NEFI – New Energy for Industry flagship region.

Photo: fotolia.de

Storage technologies

for the energy system of the future

Electrical and thermal storage systems are key technologies for an energy system based on renewable, fluctuating sources such as wind and solar power. They allow both short-term and seasonal fluctuations to be balanced and provide grids with flexibility, putting them in a position to make a significant contribution to system stability, security and supply quality. Storage technologies and their various areas of application require further research, development and trials if they are to be able to perform central functions in an integrated energy system in the future.

The IEA's technology collaboration programme **Energy Conservation through Energy Storage (ECES TCP)** has set out to research, develop, implement and integrate new energy storage technologies. As energy storage is an interdisciplinary topic, expertise from all areas of energy supply (energy production, final consumption and distribution) must be pooled centrally. The aim is to optimise the energy efficiency of energy systems and promote the use of more renewable energy sources by using storage systems. There is both a technical and an economic need for innovations. Research and development work is geared towards reducing investment costs, extending service lives, increasing efficiency and improving safety for storage systems as well as giving them a compact design. Suitable framework conditions and business models also need to be developed.

As part of the TCP ECES, research activities on the development, distribution and market introduction of storage systems are carried out and numerous coordination activities are organized. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/eces/

Giga_TES giga-scale reservoir

The Austrian flagship project Giga_TES (Giga-Scale Thermal Energy Storage for Renewable Districts) is conducting research into concepts for giga-scale storage systems that supply districts with renewable heating and developing suitable materials, components and system technologies for giga-scale thermal storage systems. Led by AEE INTEC,* leading Austrian producers of materials and components, energy providers and stakeholders in the construction industry are collaborating with national and international research centres.

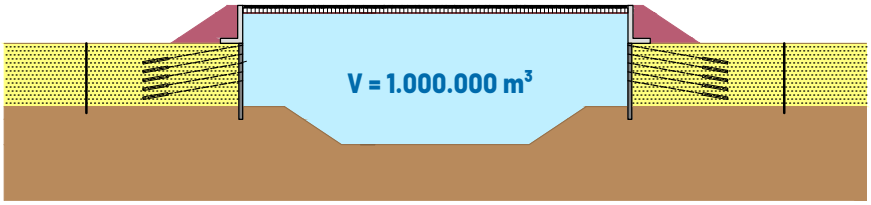


Fig.: ste.p ZT GmbH

In the energy system of the future, giga-scale storage systems will require ten times more storage volume than the heat accumulators of today. To be able to supply district heating networks with renewable energy, large quantities of renewable and waste heat will have to be stored and the heating networks will have to offer a high degree of flexibility. In towns and cities, giga-scale storage systems of this kind will be built underground. Their vertical construction method and large volume will place high demands on the materials and designs used. Issues related to the construction of the storage systems, geology and geophysics, materials, how to combine giga-scale storage and the district heating network, operational behaviour, economic aspects and acceptance by the public are being studied at three locations in Austria and for various sizes of storage systems (volumes of between 100,000 and 2,000,000 m³). The findings will underpin a set of design guidelines for planning and building storage systems like these in Austria. The results obtained to date are highly complex and include, for example, completely new ways of designing and constructing walls and covers, new polymer materials for water- and vapour-tight layers that measurements have shown to significantly extend service lives as well as new simulation methods for components and systems. ●

www.gigates.at

* Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC) (project management), agru Kunststofftechnik GmbH, Bilfinger VAM Anlagentechnik GmbH, Gabriel-Chemie GmbH, Geologie und Grundwasser GmbH, GVT Verfahrenstechnik GmbH, Ingenieurbüro ste.p ZT-GmbH, Lenzing Plastics GmbH & Co KG, Metawell GmbH, PORR Bau GmbH, S.O.L.I.D. Gesellschaft für Solarinstallation und Design m.b.H., Salzburg AG für Energie, Verkehr und Telekommunikation, Smart Minerals GmbH, WIEN ENERGIE GmbH, University of Innsbruck, Johannes Kepler University Linz, SOLITES, PlanEnergi

Photo: fotolia.de

Flexible heating networks

District heating systems are well suited to incorporating renewable energy and utilising waste heat. They facilitate coupling with other energy sectors and energy infrastructures and can become a key component of a CO_2-free energy system. The existing systems will need to be developed further in order to leverage this potential. Flexible storage capacities and smart control strategies have an important role to play in this regard as they allow to compensate imbalances between energy generation and final energy consumption caused by a fluctuating supply from renewable sources.

The technology collaboration programme **District Heating and Cooling including Combined Heat and Power (DHC TCP)** is researching the design, performance capacity and operation of district heating and cooling networks including combined heat and power systems in order to come up with forward-looking solutions for the energy-efficient, environmentally friendly supply of heat and cooling. With Austrian involvement, i. a. work programmes to incorporate district heating and cooling into integrated energy systems are being carried out. **Annex TS2: Implementation of Low-Temperature District Heating Systems** is studying how heat can be supplied from low-temperature heat sources in the operation of smart energy systems. In **Annex TS3: Hybrid Energy Networks** new options for district heating and cooling networks are being developed, including integrating high-efficiency heat pumps and storage systems. This integrated approach is based on leveraging synergy effects between electricity distribution networks, district heating and cooling networks and gas grids and creating hybrid energy infrastructures. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/dhc-chp/

Heat exchanger in the sewer with dry weather channel, suitable from DIN 400, source: Rabmer Greentec GmbH, technology partner UHRIG

ThermaFLEX demonstrator
Using waste heat from sewage in Vienna's Liesing district

As demonstrator within the flagship project ThermaFLEX led by AEE INTEC, Wien Energie is working in cooperation with research partners* on the realization of a demonstration plant for the utilization of waste heat from sewage in Wien-Liesing. For low-temperature systems and urban development areas, the decentralized use of thermal energy from sewage represents a new and innovative form of heat recovery. The technical concept is based on the use of sewage from the main sewer (heat source) and heat transfer at a low temperature level (8-20°C). In a further step, heat pumps with a total heat output of around 1.3 MW_{th} are used to raise the temperature.

The concept is specially designed to utilize waste heat from sewage pipes with a minimum flow rate of 15 litres/sec for feeding in district heating systems with flow temperatures between 70 and 90°C. The functionality of the demonstration plant is to be tested for more than 6 months under different operating conditions including operation on reduced electricity tariffs during parts of the day. It is planned that the plant will be commissioned in 2021 and will then regularly feed into a secondary district heating network in Vienna. Based on the performance of the system (e.g. efficiency of heat pumps and heat exchangers) and the resulting operating costs, a technical and economic guideline for the optimized planning, implementation and operation of such systems will be developed. ●

https://thermaflex.greenenergylab.at/e4a_demonstrator/demo-6/

* Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC) (project lead), Wien Energie GmbH, AIT Austrian Institute of Technology GmbH, TU Wien – Institute of Energy Systems and Electrical Drives, Graz University of Technology – Institute of Thermal Engineering

The project is carried out as part of the Green Energy Lab innovation laboratory. See also p. 7 for information on the ThermaFLEX flagship project.

Kapfenberg's plus-energy rehabilitation, photo: AEE INTEC

Energy flexibility in buildings

In the future, the high percentage of renewable energy sources used to feed into power grids and heating networks will bring about a transition from energy produced purely in line with requirements ("generation on demand") to requirements or consumption aligned with production ("consumption on demand"). This transformation is a necessary step in order to make targeted use of the fluctuating supply of renewable energy from wind and solar power, ease the load on the grids and reduce the need for storage systems.

PV facility Wolfurt Mähdle primary school, Vorarlberg, photo: AEE INTEC/Armin Knotzer

Energy-flexible buildings will be able to play a key role in stabilising both power grids and heating networks in the future. Being "energy-flexible" means that a building is capable of adapting its energy consumption and production in line with its local climatic conditions, the needs of its users and the requirements of the grid by means of smart regulation and control. Smart technologies and solutions allow loads to be regulated on the demand side in line with how much of its energy demand the building is covering itself and/or the requirements of the surrounding grids and networks.

EVALUATING ENERGY FLEXIBILITY

The project **EBC Annex 67: Energy Flexible Buildings** has been carried out as part of the IEA's **Energy in Buildings and Communities (EBC TCP)** technology collaboration programme. With Austrian involvement, a method to describe and evaluate the energy flexibility of buildings has been tested. The methodology treats energy flexibility as a certain amount of energy that a building can shift in response to external influences without discomforting those inside it or modifying its utilities management system. Rather than being a set value determined by its structure, the energy flexibility of a building thus varies depending on the framework conditions such

> **"The increasing global energy demand, the foreseen reduction of available fossil fuels and the increasing evidence of global warming have led to a high interest in renewable energy sources. However, renewable energy sources, such as wind and solar power, have an intrinsic variability that can seriously affect the stability of the energy systems if they account for a high percentage of the total generation. The energy flexibility of buildings is - by IEA, EU and many others - considered as a part of the solution to alleviate the upcoming challenges in the future demand-respond energy systems, (electrical, district heating and gas grids)."**

Photo: Danish Technical Institute

SØREN ØSTERGAARD JENSEN,
SENIOR PROJECT MANAGER AT THE DANISH TECHNICAL INSTITUTE
AND OPERATING AGENT FOR THE IEA'S EBC ANNEX 67

Kapfenberg's plus-energy rehabilitation, photo: AEE INTEC/Armin Knotzer

as the climate, building standard, control system, etc. as well as an external control signal, which triggers a response from the system. The potential energy flexibility that a building can harness is determined by the heat accumulation capacity of the various components, the number and size of the hot water storage systems, the electrical equipment and consumers contained in the building and the control systems used.

Whether this potential can be fully exploited largely depends on the building technology installed and its design and structure from a building engineering perspective and is determined early on, during the planning phase. Simulations run on different types of buildings reveal that, although existing buildings have a significant impact on high peak loads that can be shifted at short notice, the load on power grids and heating networks can only be reduced for several hours at a time if energy-efficient renovation work – right up to plus-energy standard – is carried out.

"SMART READINESS" OF BUILDINGS

The new EU Buildings Directive (amended 2018) includes a "Smart Readiness Indicator" (SRI) to assess the "smart-capability" of buildings. Next-generation buildings will be required to have the potential to need very little energy, cover what energy demand they do have from local renewable energy sources as far as possible and consume energy in line with local production. The control, regulation and management of these coordinated energy flows (dovetailed with power grids and heating networks) will form a key element of these new buildings. As part of the IEA's "EBC Annex 67" project, a position paper has been produced that is intended to contribute to the description of a building's "smartness" in the new EU Directive. The EU Commission will shortly be unveiling a rating scheme including a definition of the SRI for buildings and the methodology for calculating it. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/ebc/iea-ebc-annex-67.php
http://www.annex67.org/publications/deliverables/

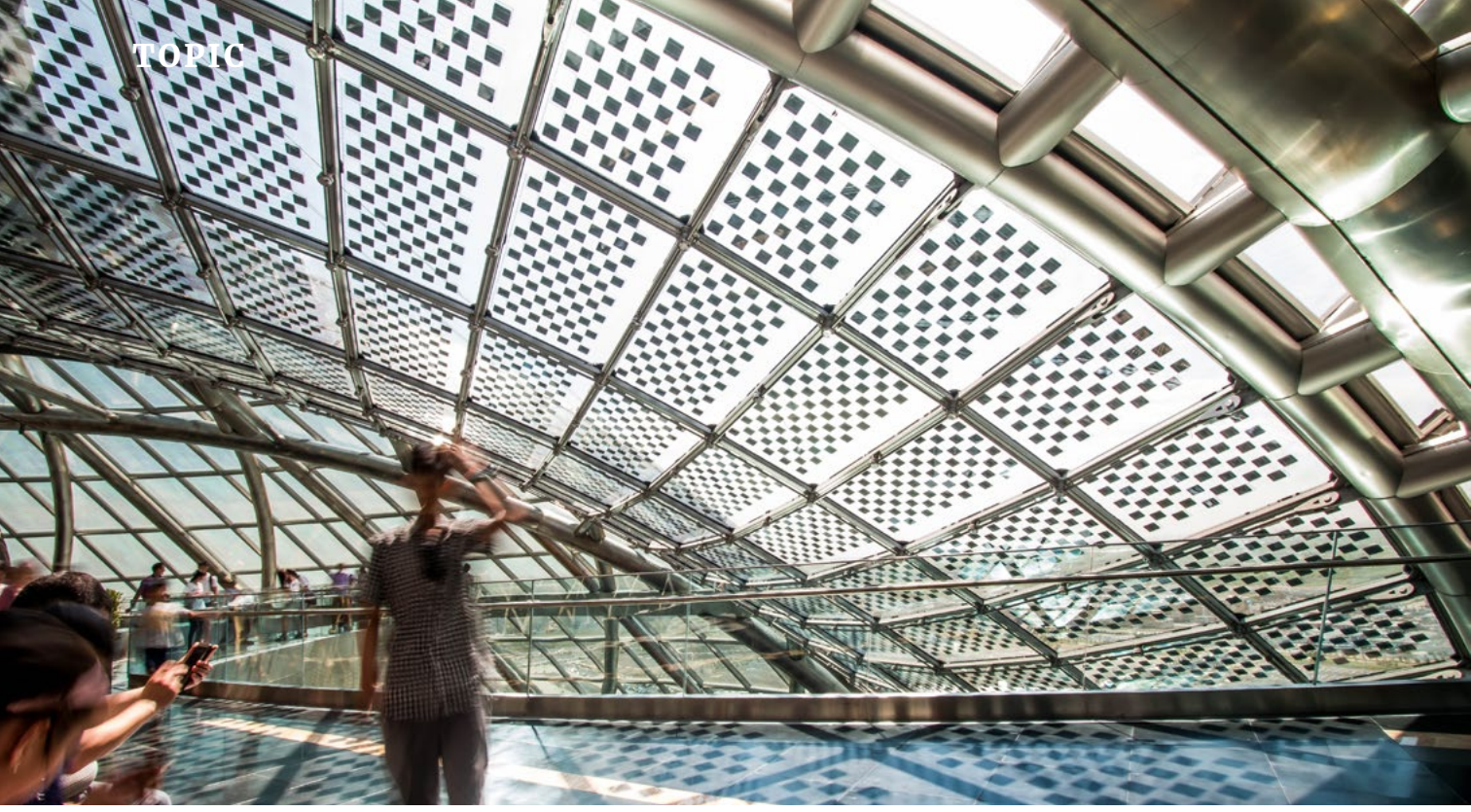
SRI Austria

Formulating national specifications for the Smart Readiness Indicator (SRI) formed part of the project "SRI Austria – Rating Scheme and Opportunities for Smart Buildings", which was completed in 2019. In dialogue with the IEA's EBC Annex 67, the experts from the EU Directorate-General for Energy and national stakeholders, a consortium headed by AEE INTEC* formulated a proposal for the SRI for buildings in Austria. This serves as a basis for decision-making and supporting the implementation of the SRI at national policy level as well as its potential incorporation into the process for issuing energy passports. On this basis, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Austrian Institute of Construction Engineering (OIB) are currently working on national implementation, which is optional for member states. ●

https://nachhaltigwirtschaften.at/de/sdz/projekte/sri-austria.php

* Project partners: AEE – Institute for Sustainable Technologies (AEE INTEC) (project management), 17&4 Organisationsberatung GmbH, University of Applied Sciences Technikum Wien, Technology Platform Smart Grids Austria

Wood/PV facade at the Höhere Bundeslehranstalt für Forstwirtschaft in Bruck a.d. Mur, photo: AEE INTEC/Armin Knotzer



Expo2017 Sphere, photo: ertex solar/Dieter Moor

Photovoltaics

Solar power in the energy system of the future

Alongside hydropower, wind power and bioenergy, photovoltaics will play a key role in an energy scenario based on renewable energy sources. Assuming that, in the long term, the energy system will see large-scale electrification and all major industrial processes and the mobility system will switch to electricity, photovoltaics has the potential to meet some 15% of Austria's electricity demand by 2030, rising to around 27% by 2050.* The space this will require is already available on existing roofs and facades. If this potential is to be leveraged, however, the power system will have to be made more flexible across the board.

*Source: Technology Roadmap for Photovoltaics in Austria, BMVIT 2016

The IEA is forecasting that solar energy will make up 27% of the global electricity supply mix in 2050. Its **Photovoltaic Power Systems Programme (PVPS TCP)** is the world's biggest platform for photovoltaics research and has offered a space for applied research activities and market launch strategies for over 25 years. The focus during the 2018-2022 working period is on the role of photovoltaics (PV) in integrated energy systems. Key research topics include PV in buildings, PV in the transport sector and integrating a high percentage of PV power into grids. Austria is currently involved in seven of the eight ongoing tasks.

One of the areas that will become particularly prominent in future is **building-integrated photovoltaics (BiPV)**, a technology being researched as part of **IEA PVPS Task 15** under the leadership of Austria. PV facilities can be integrated into a building's concept as active components and act as its roof membrane, facade and sunshade. Austria has extensive expertise in this area. Austrian industry has already completed a large number of projects all around the world in partnership with researchers and is one of the leading players in this field. ●

https://nachhaltigwirtschaften.at/de/iea/technologieprogramme/pvps/

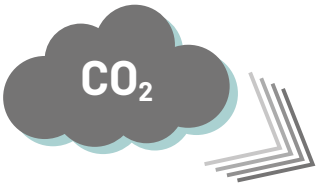
SonnenparkPLUS Wetzikon, arento AG, photo: ertex solar/Dieter Moor

TRENDS ON THE GLOBAL PV MARKET

The **IEA PVPS Snapshot Report 2020** provides an overview of the latest global trends on the photovoltaics market, in production and in the relevant framework conditions. After a year of stabilisation on the market, provisional market data indicate that the global PV market expanded somewhat in 2019 compared with 2018 and 2017. Across the world, 114.9 GW was installed and brought on stream last year.

The total installed capacity for photovoltaics stood at 627 GW. China's PV market shrank from 53.0 GW (2017) and 43.4 GW (2018) to 30.1 GW in 2019. In capacity terms, however, China remains out in front at 204.7 GW. The EU installed nearly 16 GW in 2019, with the rest of Europe adding some 5 GW. After years of a stagnating market, Spain led the field in the EU in 2019 with 4.4 GW, followed by Germany in second place with 3.9 GW and the Netherlands in third with 2.4 GW. With 224 MW, Austria came ninth out of the EU countries.

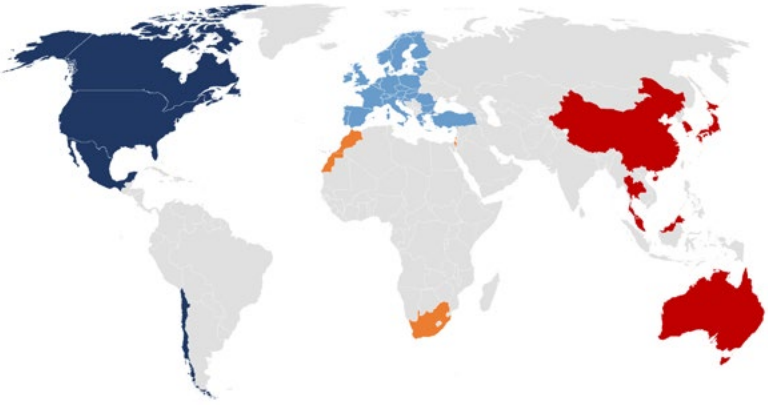
https://iea-pvps.org/snapshot-reports/snapshot-2020/



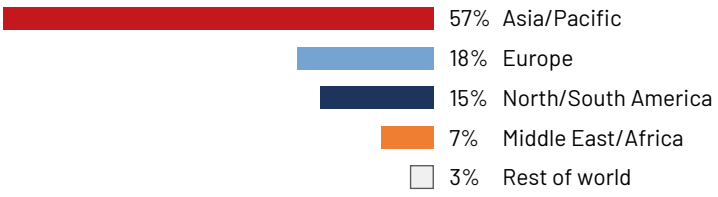
720 Mt of CO_2 emissions prevented in 2019

The top PV markets in 2019

USA 13.3 GW **EU 16.0 GW** **China 30.1 GW**



115 GW IN THE GLOBAL PV MARKET



Grafik: Snapshot of Global PV Markets 2020, https://iea-pvps.org/snapshot-reports/snapshot-2020/

Cover Power – Smart Glass Coatings for innovative BiPV Solutions

In the Cover Power project, which is being supported as part of SOLAR-ERAnet (project number: 863509), researchers at Joanneum Research Forschungsgesellschaft are developing innovative solutions for the surfaces of PV modules. How a photovoltaic solution looks largely depends on the glass used to cover the PV modules. Combining different types of coatings with different glass patterns is opening up new opportunities for designing innovative BiPV solutions.

Prototypes of BiPV modules are being developed that are based on glass-glass technology and c-Si solar cells (including bifacial cells) and feature innovative glass coatings on the outside of the cover glass. These module prototypes have the following properties:

- Flexible, innovative design in terms of colour and surface structure
- Minimum glare (less than 0.1% of mirror reflection)
- At least 150 W/m² (STC) achieved by using internally reflected light inside bifacial solar cells

There are plans to install the solar modules on a pilot facade. The new module prototypes are set to be trialled and evaluated in the third year of the project. ●

www.solar-era.net/index.php/download_file/view/695/200/

You can also visit us at:

www.energy-innovation-austria.at

INFORMATION

IEA Collaboration in Research:
https://nachhaltigwirtschaften.at/de/iea/

National R&D projects:

ThermaFLEX demonstrator
High Temperature Heat Pump
and
ThermaFLEX demonstrator
Using waste heat from wastewater in Vienna's Liesing district
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