

Austria Delivers Energy Innovation for Buildings and Communities

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Austria has been very successful in the buildings sector, by developing and testing Passivhaus and integrated positive-energy building components and technologies involving many demonstration projects. These have already received wide-spread international recognition. To further exploit these innovation capabilities, it is necessary to build upon these strengths.

The Austrian Climate and Energy Strategy '#mission2030', published in 2018, has established the areas to be addressed on the path towards decarbonisation and has set goals for 2030 and 2050. In this regard, Austria is targeting greenhouse gas emissions reductions of 36% by 2030 (relative to the 2005 level) and to increase the share of renewable energy of gross final consumption by up to 45% to 50% from the current share of 33.5%. Austria's latest coalition deal by the first Conservative-Green government includes plans to make the whole country climate neutral by 2040, set-up binding carbon budget goals and produce 100% of domestic electricity with renewable energy by 2030. In the built environment for example, priority will be given to urban densification, renovation of the building stock, and awarding housing subsidies linked to ambitious environmental criteria. Evidently, the transformation into an efficient and clean energy system must include the entire energy value chain, including generation, transport, distribution, conversion and consumption. To meet the transformation in a pro-active way and to exploit the economic opportunities, Austria's Energy Research and Innovation Strategy (2017) aims to align its innovative forces – from small and medium-sized

enterprises (SMEs) and clean tech start-ups to international industry and research centres.

Prioritising research and development activities requires developing an integrated view of the overall energy system, as well as for the buildings sector. In launching the buildings-centred programme 'Building of Tomorrow' in 1999, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) addressed a highly future-oriented issue at an early stage. This lays the foundation and strategic development of nearly-zero energy buildings, passive houses up to plus-energy buildings and quarters. Almost 450 projects including 74 demonstration projects [1] have been supported over 15 years to build and strengthen the position of Austria as an innovation leader in sustainable buildings. Awareness raising, community building and transfer of results from the programme serve as international best practice as accompanying measures [2].

International collaboration in energy research and development

To stimulate research and innovation in the buildings sector – a sector which historically tends to be conservative and cautious about new technologies and business models – a multitude of national priorities, funding programmes and accompanying measures combined with participation in international research collaborations help to ensure the development and implementation of new, innovative solutions. Membership in the global Mission Innovation initiative and the active participation in 21 (out of a total of 38) Technology Collaboration Programmes of the International Energy Agency (IEA TCPs) are successful examples of Austria's international collaboration activities.

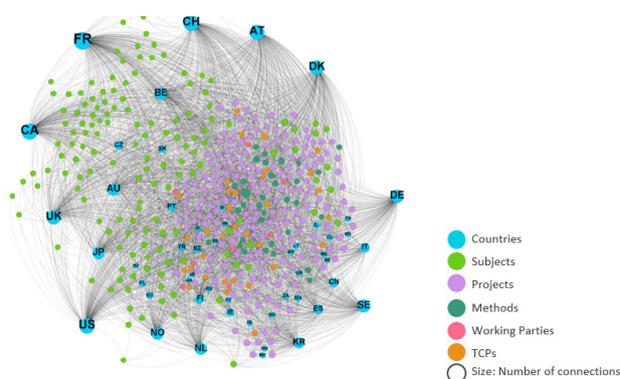
Another element in the active participation of Austria in transnational programmes aiming to support the transformation of cities and urban areas into more sustainable, resilient, and liveable places is the

Joint Programming Initiative (JPI) Urban Europe [3]. Launched in 2010, JPI Urban Europe addresses global urban challenges on intra- and interdisciplinary levels and serves as a knowledge hub for urban transitions. It predominantly connects public authorities with research organisations and businesses, creating experimental zones and long-term research infrastructures in a broad sense. Since then, a total of 75 projects with a total budget of €100 million EUR have been funded in Europe, with the successful participation of Austria in 45 projects. Under Austria's presidency, a programme dedicated to initiate 100 European positive-energy districts was set up as part of the SET-Plan (Strategic Energy Technology Plan). A key aspect of this activity is the possibility to draw on JPI Urban Europe's programme-management structures and experiences.

R&D programmes and activities in Austria

Based on results of the Building of Tomorrow programme and including a system-integrated perspective, 'City of Tomorrow' [4], launched by the BMK in 2013, aims to research and develop new technologies and solutions for future cities and urban developments. Following a mission-oriented approach, the focus is on the reduction of energy consumption and the use of renewable energy in buildings, neighbourhoods and quarters, while at the same time increasing the attractiveness for residents and improving the economic efficiency. The City of Tomorrow programme is dealing with three thematic areas as follows :

(1) Digital planning, building and operating: Forward-thinking strategies and solutions designed to optimise



International collaboration within the framework of the International Energy Agency Technology Collaboration Programmes.

construction processes by means of new digital technologies are at the core of this thematic area. Interlinking the entire value-creation chain digitally not only offers considerable potential to reduce energy consumption and material resources, but also improve the quality of planning, construction and operation of buildings [5].

(2) Positive-energy districts: The focus is on innovative technologies and concepts for energy generation, distribution, conversion and storage, and also on the optimisation of consumption in buildings and districts, as well as technologies and efficiency in new construction and renovation. Energy flexibility is expected to play a crucial role, provided that buildings are changed from energy consumers into distributed power stations, helping to balance thermal and electrical energy processes across all sectors.

(3) Innovative greening technologies: New technologies and approaches for the 'green city' [6] help to adapt urban systems to global warming and permanently improve living conditions in cities. Within the framework of 'City of Tomorrow', pioneering technologies for vertical, building-integrated greening are being developed and demonstrated.

Since 2013, City of Tomorrow has launched seven annual calls addressing specific (sub-)areas and priorities within the thematic areas described above. At present, more than 170 research projects have been funded and €45 million EUR granted. One of these is the project 'Digital Twin' [7], which aims to couple an office building in the operation phase with its digital twin, improving the energy management of nearly zero-energy buildings in real-time. Overall, the total energy consumption should be significantly reduced while improving the occupant comfort considerably. In view of the climate crisis, the demand for energy-efficient solutions for air-conditioning will increase, mainly in office buildings. Thermally activated building systems (TABS) are one innovative approach to regulate a building's indoor temperature [8]. In this way, the building's mass is used for renewable energy storage, such as solar thermal energy, geothermal energy and heat pumps, which are powered by electricity provided by wind or photovoltaic systems.

In addition to small-scale research and innovation programmes in Austria, the RTI initiative 'Flagship Region Energy' [9] puts an emphasis on large-scale demonstration and real-life test cases of energy research. A total of €120 million EUR has been invested

into three flagship regions up to 2021 – addressing topics such as smart grids, affordable heating and cooling in buildings, as well as renewable and clean hydrogen. More than 200 partners from business, industry and research are collaboratively working on the future of energy. Fostering innovation and supporting Austrian companies in testing energy technologies is met by combining a number of research and market instruments. Strategically, Austrian technology providers should maintain their leading position in an international competitive market environment and continue to expand.

The aim of the national Smart Cities stakeholder platform [10] is building strong relationships between Austrian cities, enhancing their collaboration in tackling urban challenges and engaging with the wider public. Initiated by the BMK, the platform facilitates dialogue on questions regarding quality of living in urban areas, innovative urban technologies and public acceptance as well as integrated planning on a city level and what lessons can be learned. The policy dialogue also supports the definition and setting of priorities for national funding programmes taking into account public services requirements and needs.

Mission ground control: we have launched

Putting innovation and outcomes at the centre of future economic growth, new thinking is required: In line with the economist Mariana Mazzucato, mission-oriented policy is the key instrument to reframe Europe’s approach to tackling grand societal challenges to make them more practical and systemic, so that research and innovation investments can help attain specific, targeted and concrete goals [11]. The European Commission has acknowledged the importance of climate-neutral and smart cities, as they are centres of economic activity, knowledge generation, innovation and new technologies. With the launch of Horizon Europe in January 2021, such a mission-oriented policy has been put into practice.

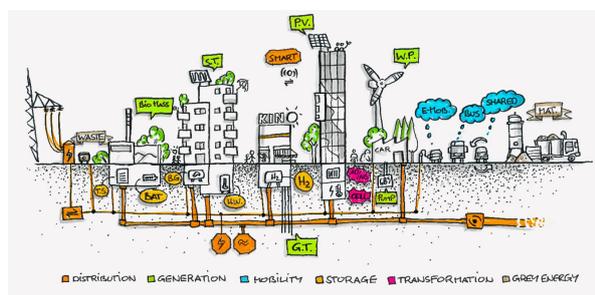
In the past, Austria has been very successful in: developing funding programmes and instruments tailored to thematic challenges and needs; actively participating in European and international collaboration initiatives; adapting to changing research and innovation landscapes. In the future, it will not only be important to strengthen the advantage of Austria’s innovation potential, but also to push the development and implementation of innovative energy solutions and



From zero energy buildings to positive-energy districts within the Building of Tomorrow programme.

to make it easier for new products and services to enter the domestic and global markets.

Innovation laboratories help to achieve this aim by supporting long-term testing and innovation processes. They initiate, coordinate and accompany various RTI projects and ensure their long-term effectiveness. Within innovation labs, the goals, strategies and measures in a specific thematic field are developed and the dissemination of research results promoted, both in the national and international environments. So far, two innovations labs have been established in Austria. The dedicated Innovation Lab GRÜNSTATTGRAU [12] coordinates all greening relevant activities in Austria, promoting collaboration and synergies among partners and supporting the implementation of cutting-edge innovation and demonstration projects. The Innovation Lab act4energy [13] focuses on the development of innovative, inter-sectoral system solutions for integrated energy infrastructures. In close cooperation



A mission-oriented approach for research and technology development: positive-energy districts and neighbourhoods (PEDs) as a mission in the City of Tomorrow programme taking into account urban technologies, system integration and the growing relevance of digitalisation.

Demonstration project of façade-integrated greening systems applied in an inner-city school in Vienna [14].



with GRÜNSTATTGRAU they also aim to increase synergies between rooftop greening and photovoltaic systems. Further laboratories are expected to be established as innovation challenges are defined and specific needs identified – for example, the digitalisation of the building process and the interoperability of smart energy systems, technologies and components.

By 2040, Austria is set to become climate-neutral, which is ten years ahead of the European Union goal for climate-neutrality. Although recent decades have seen tremendous progress in improving the energy efficiency of buildings and the liveability of cities, the built environment still offers a huge potential for saving energy and deploying energy-efficient technologies. These range from sustainable construction materials to renewable space heating and cooling, hot water, through to lighting of buildings. It is the aim of policy to foster innovation in these areas, share best practices and support financial mechanisms to achieve a positive impact on the environment, and economic growth.

Isabella Warisch is the EBC Executive Committee Member for Austria.

Further information

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