

Master slides ASCR

Stand: 11.03.2022

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Ideas & Research programm

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Cities need energy

According to current forecasts, around **70% of people will be living in cities or in “urban areas”** by 2050 – and the trend is clearly increasing. Vienna is no exception. It is the fifth largest city in the EU, and expected to exceed the two million inhabitant mark as early as 2027.

In the context of rapidly increasing urbanisation, **climate change and finite resources** will pose major challenges for politics, administration and the economy. Growing metropolises need more and more energy.

ASCR – a Vienna Idea

Aspern Smart City Research GmbH (ASCR), since it was founded in 2013, has been researching the **development of solutions for the future of energy** in urban areas.

Europe's most extensive and innovative energy research project will provide the answers to key energy policy questions from all domains of the energy system – on an interdisciplinary basis and using real data from the aspern Seestadt urban development area.

The basic aim of the ASCR is to develop marketable, scalable and economical solutions to make the energy system more efficient and more climate-friendly.

Both the city and its residents – and not least the shareholders of ASCR – should benefit from the ASCR's specific application research.

Welcome to Phase 2

The research activities of the first project phase (2013-2018) resulted in a total of 15 prototype solutions developed in the areas of intelligent buildings and grid infrastructure and 11 patents registered.

The second research phase “ASCR 2023” began in 2019. The spectrum of research activities ranges from the intelligent integration of buildings into the supply grids and energy markets, through new approaches for providing thermal energy for decentralised heating and cooling, to energy-efficient charging of electric cars.



Where the focus lies

Smart Grid

Digitalisation of the power grids

Smart Building

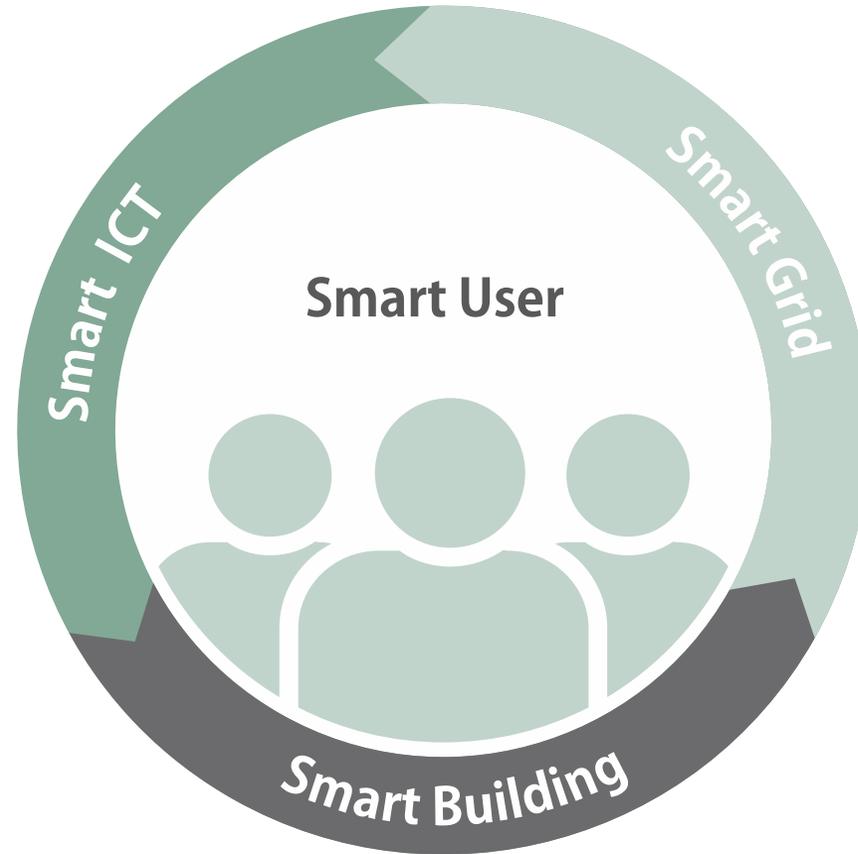
Energy-efficient and resource-conserving operation

Smart ICT

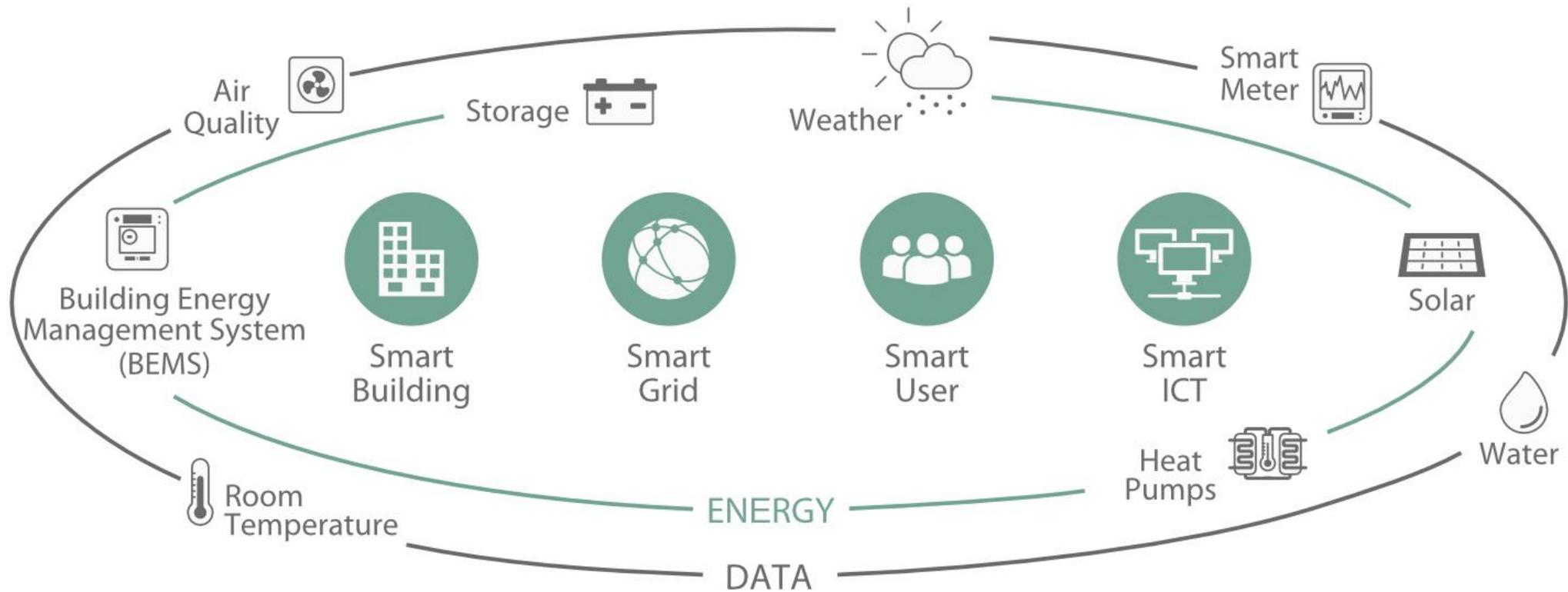
Intelligent and secure handling of sensitive data

Smart User

Sustainably involving the population



Integration of Energy- and Datanetwork



Wien – the smart city

Ambitious targets of the Smart City Vienna framework strategy



Quality of life

Vienna keeps inhabitants' quality of life at the highest level, and social inclusion continues to be central to policy-making. In 2050, Vienna will be the city with the highest quality of life and life satisfaction in Europe.



Resources

Vienna is reducing local greenhouse gas emissions per capita (50% by 2030), local final energy consumption (30% by 2030) and its consumption-based material footprint (30% by 2030).



Innovation

In 2030, Vienna is the “Innovation Leader” thanks to its cutting-edge research, strong economy and education, as well as being the digitalisation capital of Europe.

The appropriate framework

The work of ASCR takes place in the context of central climate policy descisions.



UN-Klimakonferenz von Paris 2015

- Begrenzung des Temperaturanstiegs auf 2 Grad, Bemühung um Begrenzung auf 1,5 Grad



EU „2030 Climate and Energy Policy Framework“

- Senkung der Treibhausgasemissionen um mindestens 55% (gegenüber Stand 1990)

EU-Kommission: Klima und Energiepolitischer Rahmen

- Erhöhung des Anteils erneuerbarer Energiequellen auf mindestens 32%
- Steigerung der Energieeffizienz um mindestens 3,5% bis 2030



Österreichisches Regierungsprogramm 2020–2024

- Klimaneutralität in Österreich bis 2040
- Erneuerbaren-Ausbau-Gesetz und Energieeffizienzgesetz: Stromerzeugung zu 100% aus erneuerbarer Energie
- Ausbauziele für alle erneuerbare Technologien

Bundling know-how

The shareholders

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A successful model for cooperation

The research company Aspern Smart City Research GmbH & Co KG (ASCR) was founded in 2013 by Siemens AG Austria, Wien Energie GmbH, Wiener Netze GmbH and the City of Vienna (Vienna Business Agency and Vienna 3420 Holding GmbH).



Interdisciplinarity is key to success

Complex challenges can only be overcome by working together.

The unique selling proposition of ASCR lies in the interaction of all shareholders.

With expertise from a wide variety of specialist areas, more than 100 researchers from the shareholders work under realistic conditions of use and with real data on the development and integration of new solutions. The research takes place in the form of cross-domain technology streams, in order to do justice to the complexity of the use cases and to ensure a holistic view.

ASCR takes on the coordination of the various research and development efforts of the shareholders and other partners, as well as the bundling and documentation of know-how and work results.

Urban development in tune with the times

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Welcome to **aspersn** Seestadt

aspersn Seestadt is one of the largest city development regions of Europe.

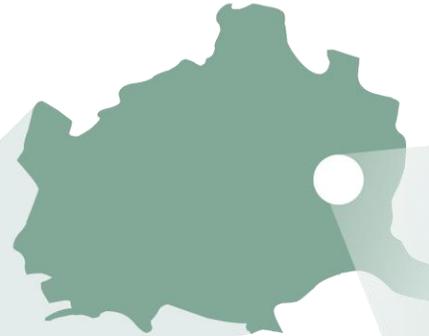
By 2028, an urban subdivision will be constructed in the north-east of Vienna – in the city's dynamic 22nd district. In it, there will be space for life in its entirety.

In several stages, high-quality living spaces for more than 25,000 people, as well as several thousand jobs, will be created. A sustainable district that combines a high quality of life with dynamic economic power is growing out of the foundation of innovative concepts.

The ASCR has found perfect research conditions here and in recent years has elected to set up its unique research environment in this location.

Welcome to aspern Seestadt

2.4 million m² surface area
50% green and open spaces
> 10,000 flats for > 25,000 people
> 10,000 jobs
> 5 billion EUR total investment



Research domain

Smart Building

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Smart Building Talking Buildings

ASCR researches buildings as producers of renewable energy in the domain of “Smart Building”, identifies potential savings that also offer a high level of comfort for residents, as well as the lowest possible construction and maintenance costs over the entire life cycle of the building.

In the new research phase, buildings outside of aspern Seestadt were also included in the research environment.



Talking buildings

in aspern Seestadt



Talking buildings

in aspern Seestadt, Vienna and Lower Austria

- D5B** Student Hall of Residence
- D12** Residential Building
- D18A** School Campus
- J14C** SeeHUB Garage
- C4** Technology Centre
- H3** School Campus North
- 3.** Grasbergergasse
- 10.** Rosiwalgasse
- 14.** Käthe-Dorsch-Gasse
- 22.** Kirschblütenpark
- 21.** Hospital Floridsdorf
- 22.** Uno City
- NÖ** Primary School Ebreichsdorf
- NÖ** Primary School Unterwaltersdorf
- NÖ** Primary School Guntramsdorf

Research domain

Smart Grid

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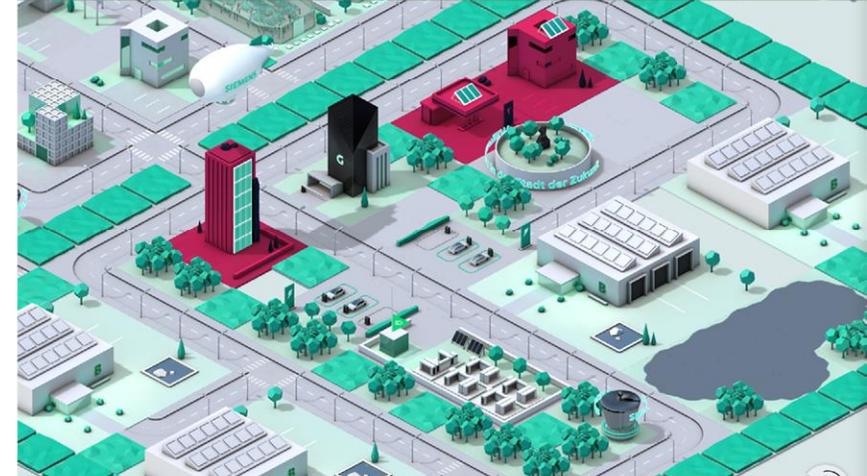
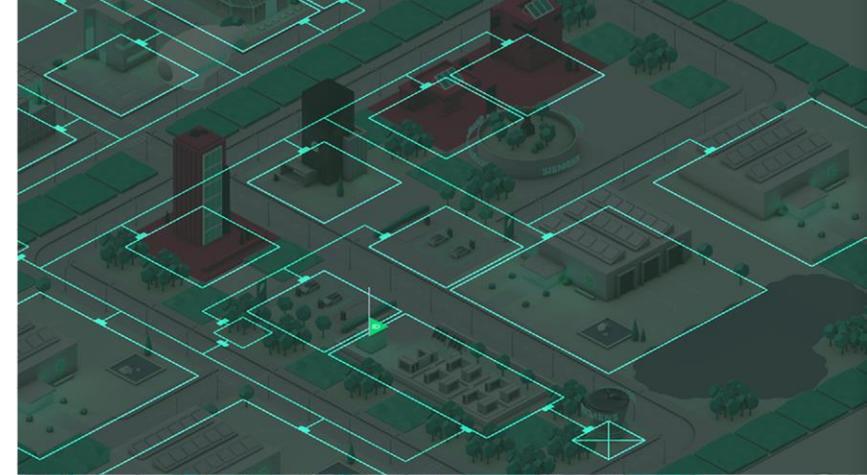
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Smart Grid The path to intelligent grids

To be able to plan and operate the existing grid infrastructure efficiently and safely in the future in accordance with the requirements of all participants and components of the energy system, the cities of the future will need “smart” grids.

Only through the optimal mix of cost-efficient grid expansion and timely, bidirectional communication can the current changes in consumption, caused by volatility due to the decentralised generation of renewable energies, modern storage options, and new uses such as e-mobility, be taken into account.



Smart Grid The path to intelligent grids

The ASCR is implementing the change from the current, passive grid, to an actively managed, “intelligent” distribution grid in the following phases

1. **Sensor installation**
2. **Software solutions unlock the full potential of the grid**
3. **Optimal interaction in the smart grid**

Equipment

- 12 power grid stations with 24 transformers of different types
- > 100 EGSs (enhanced grid sensors)
- > 500 Smart meters in the researched buildings
- 5 grid storage systems



Research domain

Smart ICT

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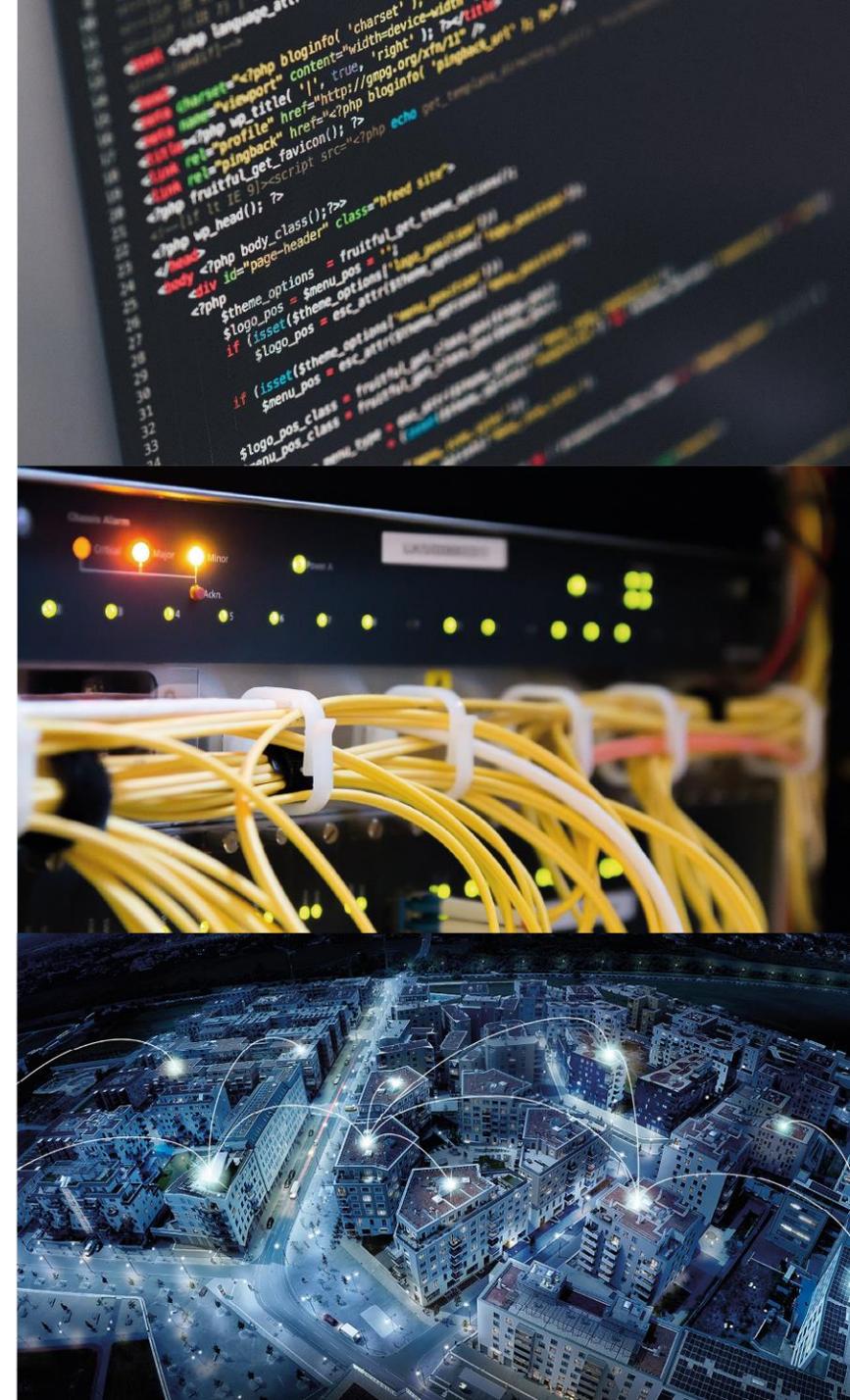
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Smart ICT Networked research and self-learning systems

Information and Communication Technology (ICT) plays a central role in the intelligent development of a city.

For optimal functioning, the various participants in the energy system (smart grid, smart building, smart user) need to get the right data at the right time.

This is the only way to make sensible decisions regarding the production, consumption, storage or trading of energy.



Smart ICT Networked research and self-learning systems

Determined building and grid data (e.g. room temperature or network load) as well as external data (e.g. weather data) enable the analysis and optimisation of interactions amongst the grid, buildings and the residents' energy consumption.

Through adaptive self-learning algorithms, the models and consequently the building and internal grid control mechanisms are refined independently and become, so to speak, more intelligent “on their own”.

In this way, facility management can continuously optimise its operations and reduce costs.

Equipment

Self-learning algorithms

Big data systems 1.5 million measured values per day

Research do

Smart User

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Smart User **A focus on people**

Human behavior is a deciding factor when it comes to climate protection. CO2 reduction and optimisation of consumption.

Accordingly, users and their behavior are essential components of ASCR's research. They form the interface between the technology being researched and its application in practice. Ultimately, how much energy a building needs and when depends on their usage habits.

Residents are currently in the research program. Schoolchildren, students, teachers, office workers and e-car drivers are the focus of the research. The research is carried out jointly with everyone involved. Surveys are analysed and processed for a better energy future.

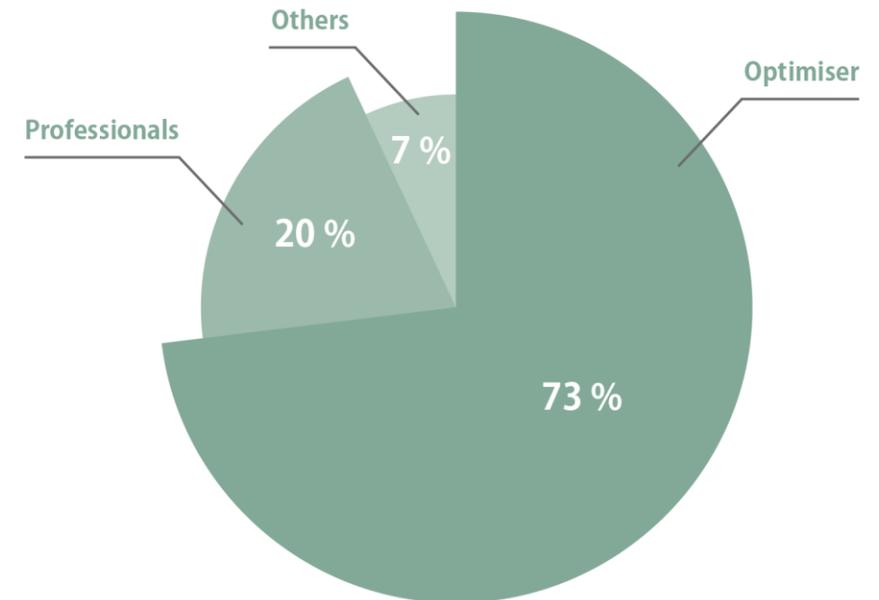


Smart User **A focus on people**

In 2015, 111 households gave their consent for all energy data and space-comfort-related parameters to be recorded and used for scientific purposes. Thanks to this support, ASCR is able research the future of energy in urban spaces and develop solutions for cities and their residents.

In order to achieve this and to provide information about the project and energy use, the participating residents of D12 were divided into different user groups on the basis of several surveys

Various project activities and accompanying measures – such as the open house, the research newsletter or the “energy representative” – were developed out of this.



 **Optimiser**
„I have very little time, my everyday life is very busy.“

 **Professionals**
„I want to be in control of everything that goes on in my household.“

Others: Due to the small number of cases statistically not meaningful.

Research structure

Technology Stream and Use Case

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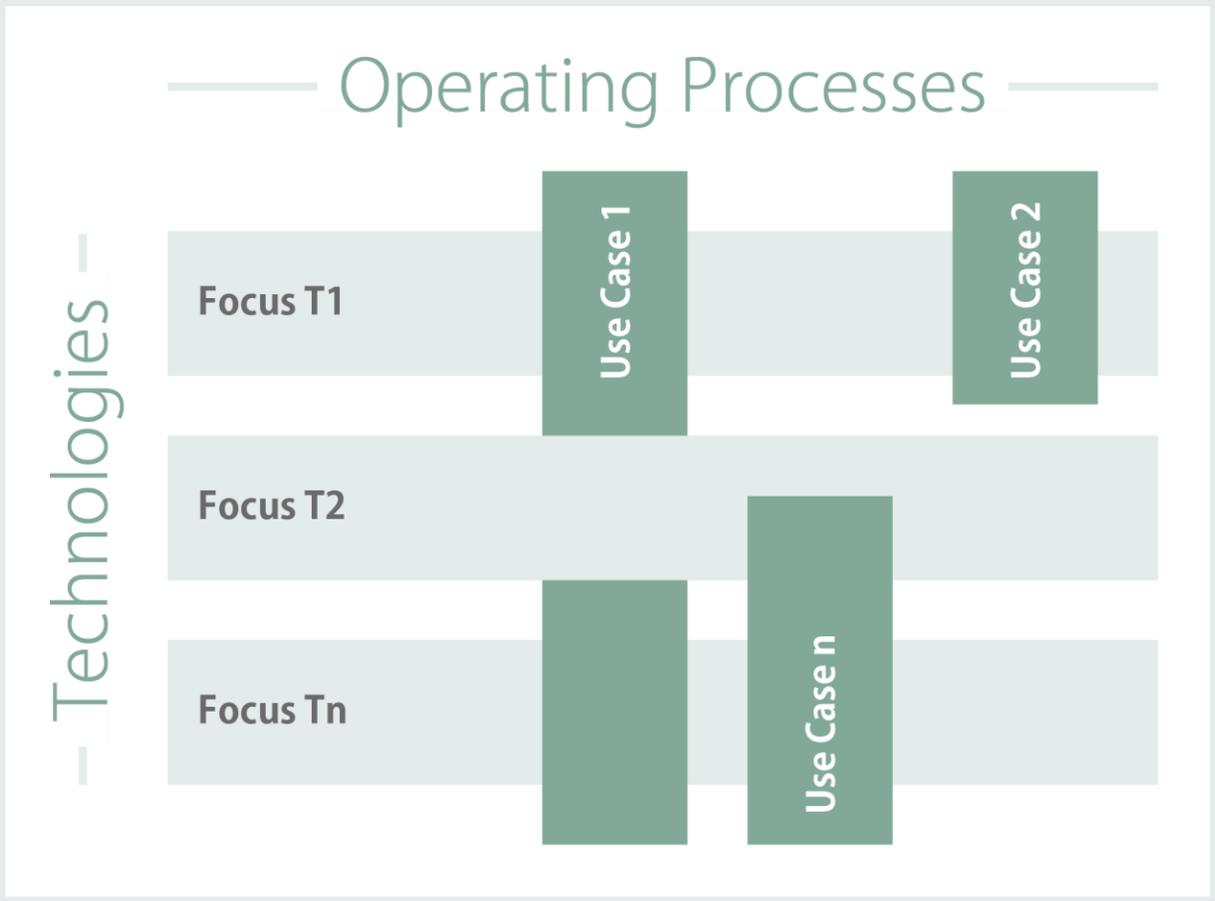
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Technology Stream and Use Case



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Focus

- Optimised Operating Processes
→ Efficiency
- Operational Benefit
- Business Model (Services)



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Focus

- Core Technologies
- Requirements of Business Units
- Broad Market Opportunities

Research Structure Technology Stream and Use Case

The aim of ASCR's research and development programme is to integrate suitable basic technologies, as well as new methods and tools, into operational processes.

The path to get there goes via use cases and technology streams:

- In Technology Streams (TS), technological solutions are developed that support use cases, or which even enable them in the first place. This is done on a domain-specific, domain-independent or cross-domain basis.
- As a specific cases of application, use cases (UCs) bring the solutions developed in the technology streams to implementation. Each use case is treated as an independent project and within the framework specified by the respective research domain.

Research structure

Technology Streams

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Overview Technology Streams

The technology-related research and development by ASCR takes place within so-called Technology Streams (TS).

It focuses on solutions in the areas of digitalisation and decentralisation of the energy system and also asks how these contribute to innovations through use in concrete use cases (UC).

T1 Methods for User- and Process Integration	T2 „Plug & Play“ Functionalities	T3 Methods for Optimisation and Forecasting	T4 Edge Computing and Cloud Connectivity	T5 Energy Conversion and Power Management	T6 Urban Data Analytics
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Research structure

Use Cases

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Übersicht Use Cases

UC1 Smart Grid Implementation Wiener Netze	UC2 Smart Grid Rollout Wiener Netze	UC3 Process Integration of SCADI Wiener Netze	UC4 Energy Data Provider Wiener Netze	UC5a Heating and Cooling Solutions Wien Energie	UC5b Underfloor-cooling Wien Energie	UC5c Waste Heat Recovery Wien Energie	UC5d Building Integrated PV Wien Energie	UC5e Demand-oriented Lighting Wien Energie
UC7 Smart Sensor Data Wien Energie	UC8 Renewable Energy Communities Wien Energie	UC9 Hydrogen and Methanation Wien Energie	UC10 Distributed Flexibilities Wien Energie	UC11 Smart Charging Wien Energie	UC12 Optimised Energy Demand within Buildings Siemens	UC14 Smart Maintenance Siemens	UC15 Digital Building Twin Siemens	UC16 Digital Building Commissioning and CAFM Siemens

Context UC and TS

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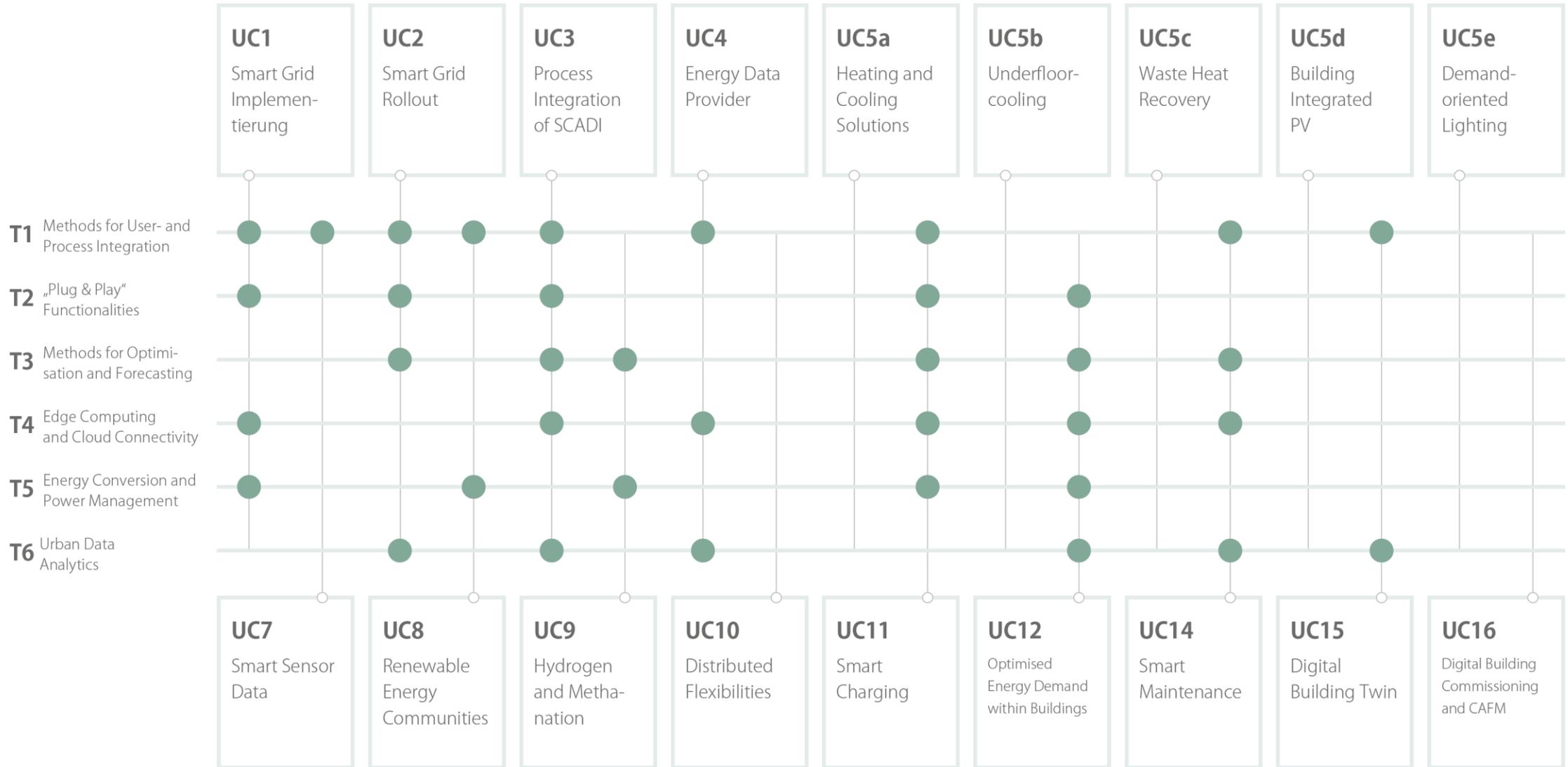


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Use Cases

Technology Streams



Context UC and Testbed

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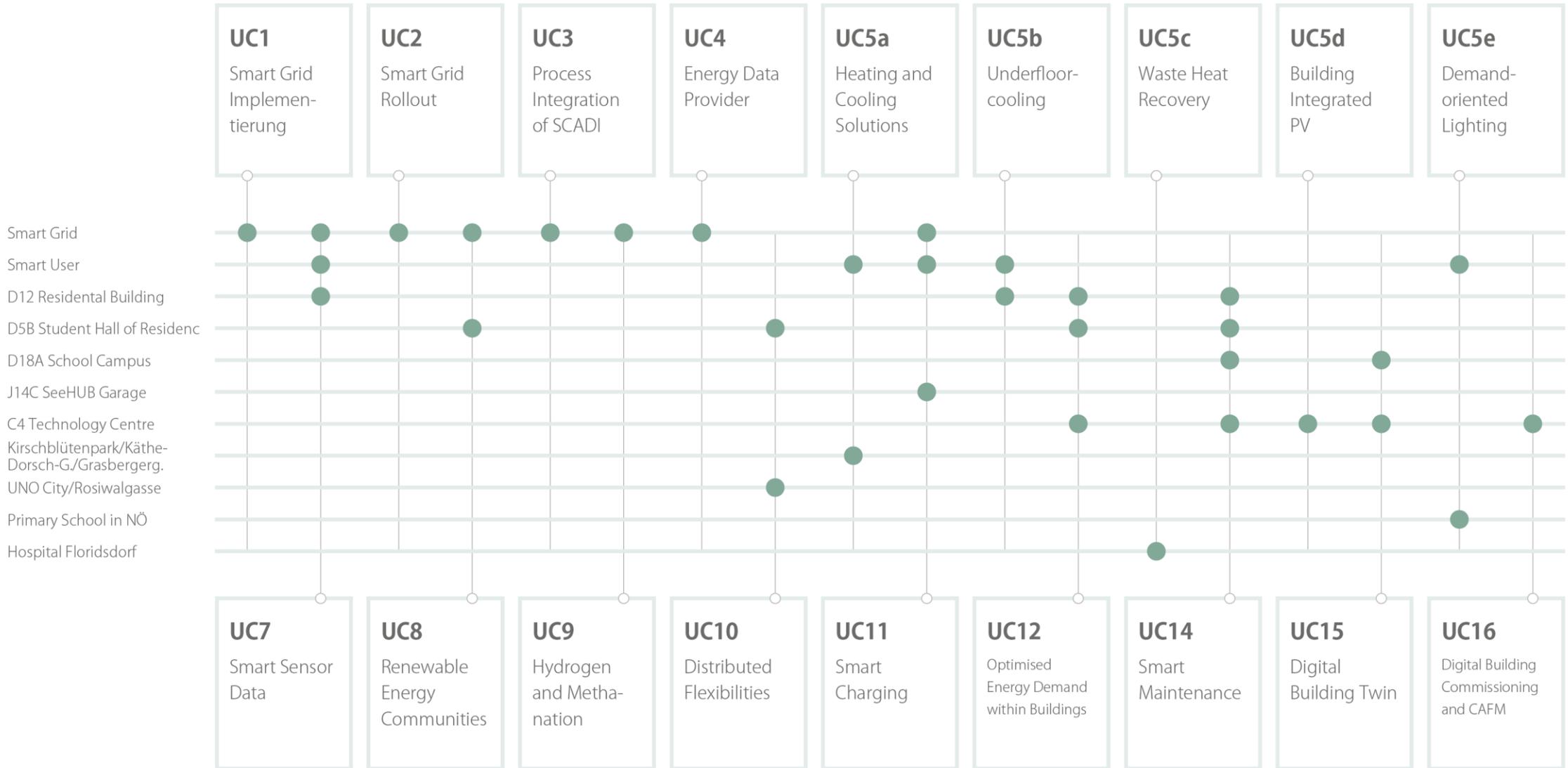


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Use Cases

Testbeds



Research cooperation

Funding projects

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Cooperative arrangements, synergies and cost efficiency

As a research project with shareholders and partners of the public sector, high demands are placed on the cost-effectiveness of ASCR.

In order to make optimal use of synergies, ASCR also conducts research within the framework of national or European funding projects.

Together with cooperation partners such as the Vienna University of Technology or the Austrian Institute of Technology (AIT), the special expertise of the ASCR is also applied to specific research questions.

Cooperative arrangements, synergies and cost efficiency

 <p>SCDA Smart Cities Demo Aspern</p>	 <p>FACDS Flexible AC Distribution Systems</p>	 <p>iNIS integrated Network Information System</p>
 <p>PHOENIX</p>	 <p>POSYCO Power System Cognification</p>	 <p>SATO OF BUILDING ENERGY</p>

Added value for the city/residents

Results

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Results

- A modern **building energy management system (BEMS)** that controls renewable energy-based generation and storage components that have been optimally tailored to each other, creates massive **savings in CO2** emissions. With appropriate framework conditions (e.g. usability of sun/groundwater), urban buildings can be operated thermally self-sufficient and enjoy a high proportion of self-generated energy.
- If the concept of the **virtual power station (DEMS)** is implemented, energy suppliers and grid operators will have a system that can capitalise on hitherto unused **flexibility in urban buildings**.
- Future-proof city power grids require the use of **active grid management**. The **interacting system applications** for grid planning and grid operations developed in the ASCR can allow the commercially viable deployment of smart grids to become a reality.
- The systems developed make our test buildings “**smart-grid-ready**”. With consistent implementation of these concepts, in future urban development, high peak demand in operations and therefore expensive grid expansions will be avoided.

Results

- The integration of electricity storage systems in the grid infrastructure helps grid operators to dampen volatile loads and guarantee their usual high supply quality. It would seem that only through the **communal use of electricity storage systems** by other users (e.g. energy generators or distribution companies) can operations be economically feasible. Regulatory framework conditions will therefore have to be tailored to this.
- New analysis methods and data visualisation options forms the basis for new operational management processes and business models **for energy suppliers, grid operators and building owners.**
- Motivation of smart users for the energy transition, building design (including comfort during the summer) and technical equipment must be of high quality.
- Load shifts in households have only proven themselves to be possible to a limited degree. Energy supply in a smart city requires closer **cooperation between property developers, the housing sector, energy suppliers and technology providers.**

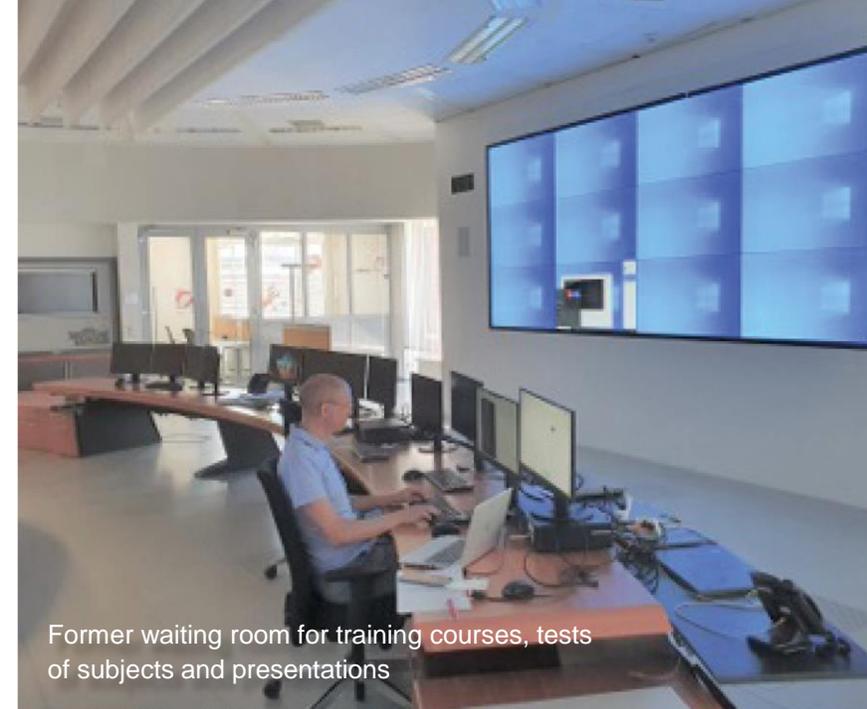
Smart Grid Lab

Starting point

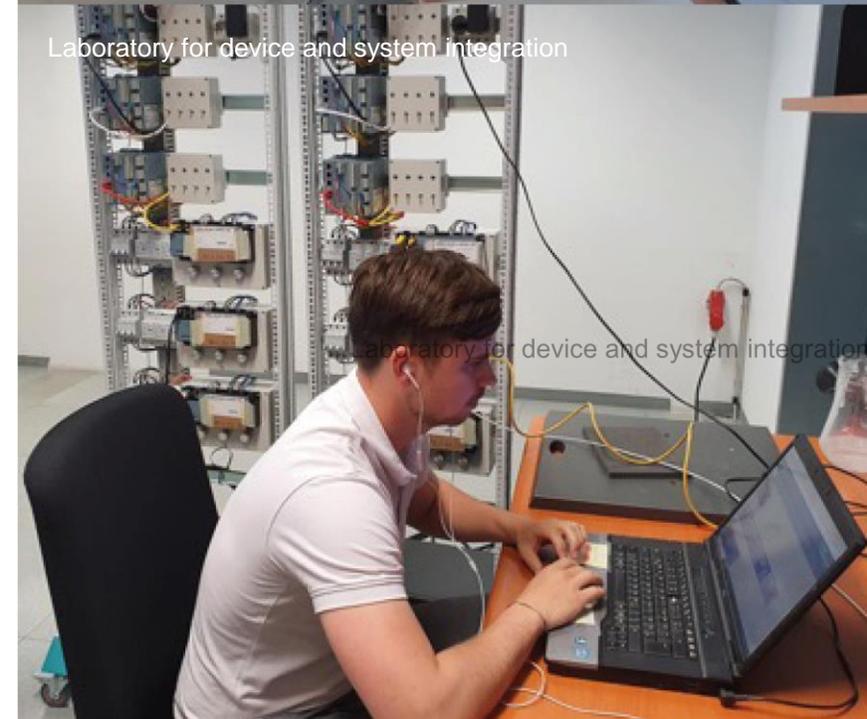
- The Aspern demonstrator for automated workflows will be transferred to Wiener Netze
- The demonstrator forms the nucleus of a digitalisation laboratory that will gradually be expanded

Objectives

- Testing and optimisation of the results from Aspern with an interdisciplinary team in a real working environment
- Gathering experience with new technologies
- Development of migration strategies
- Development of Vienna-specific multivendor concepts as a basis for management to use in decision-making
- Training employees in the use of new technologies and solutions



Former waiting room for training courses, tests of subjects and presentations



Laboratory for device and system integration

Award-winning

Awards and Honours

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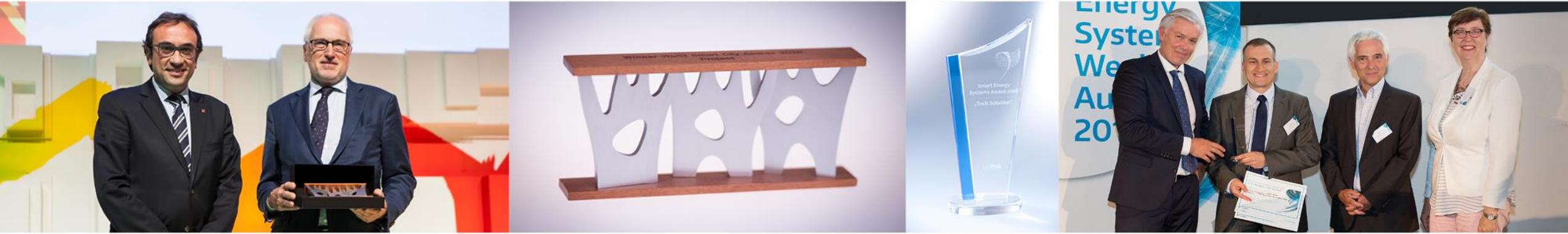
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Awards und Auszeichnungen



World Smart City Award 2016

The holistic approach of ASCR of involving all components in the energy system – buildings, power grid, users, and information and communication technologies – and thus working on an efficient and low-CO2 energy future, won over the international jury as the best-implemented project.

Smart Energy Systems Award 2018 – „Tech Solution“

The building management system used by ASCR optimises a building’s energy costs and provides flexibility for energy markets. For this, it was awarded the “Smart Energy Systems Award” in the “Tech Solution” category.

A look into the world of research

Das ASCR Demo Center

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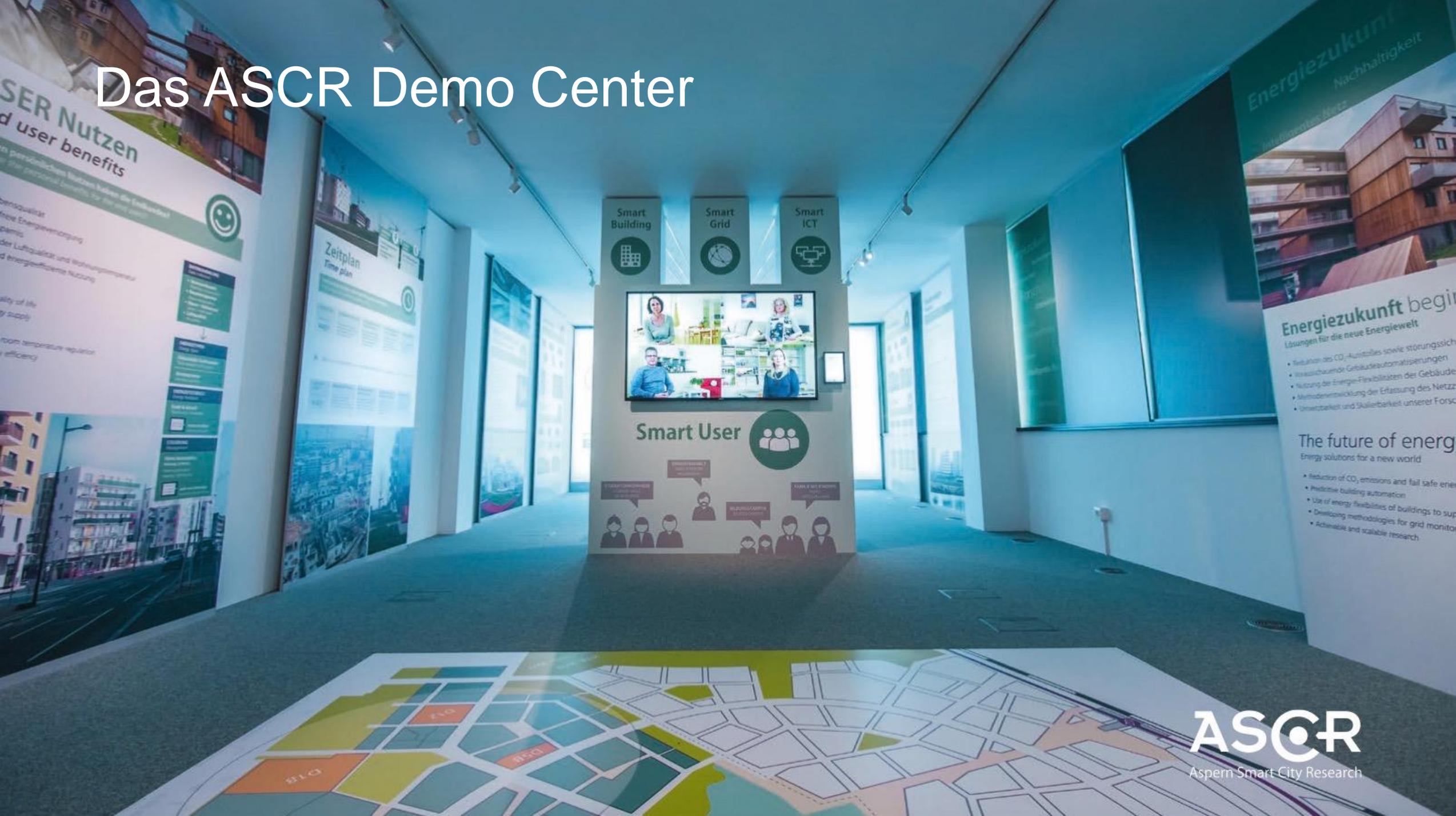
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Das ASCR Demo Center



ASCR Nutzen
User benefits

Qualität
Energieversorgung
Luftqualität und Wohnumgebung
Energieeffiziente Nutzung

Quality of life
Energy supply
Room temperature regulation
Energy efficiency

Zeitplan
Time plan

Smart Building

Smart Grid

Smart ICT



Smart User



Energiezukunft
Nachhaltigkeit

Energiezukunft beginnt
Lösungen für die neue Energiewelt

- Reduktion des CO₂-Ausstoßes sowie störungssichere, vorausschauende Gebäudeautomatisierungen
- Nutzung der Energie-Flexibilitäten der Gebäude
- Methodikentwicklung der Erfassung des Netzes
- Skalierbarkeit und Skalierbarkeit unserer Forschung

The future of energy
Energy solutions for a new world

- Reduction of CO₂ emissions and fail safe energy
- Predictive building automation
- Use of energy flexibilities of buildings to support
- Developing methodologies for grid monitoring
- Achievable and scalable research

Das ASCR Demo Center

The innovation district aspern Seestadt and ASCR's research are internationally renowned. The ASCR Demo Center in the SeeHUB provides visitors with **insight into the energy world of tomorrow**. In 2019, over 1,100 visitors visited the Demo Center, – including groups from Austria, Europe and all over the world, even Princess Maha Chakri Sirindhorn of Thailand.

- The **interactive showroom** allows you to experience efficient generation, storage, distribution and consumption of energy in the urban environment.
- The presentations are tailored to the interests and previous knowledge of the visitors, the content of the installations and animations can be controlled via tablet and examined **in more depth as desired**. In this way, the tour is just as informative and exciting for a group of energy experts as it is for interested laypeople.
- To provide a low access threshold and easier international availability, you can also access the Demo Centre **virtually** as a 360° video.

Das virtuelle ASCR Demo Center



Energiezukunft hat begonnen

Solutions for the new Energyworld

- Reduzieren CO₂-Emissionen durch energieeffiziente Energieerzeugung
- Erhöhen den Energieverbrauch der Gebäude durch intelligente
- Beschleunigung der Erreichung der Klimaziele und für den Klimaschutz
- Umwandlung von Gebäuden in Energieerzeuger

The future of energy has begun

- Reduce CO₂ emissions and for safe energy
- Increase energy efficiency
- Accelerate the achievement of climate goals and for the environment
- Convert buildings into energy producers



Innovationen gefragt

„Ziel muss es sein, die Lebensqualität der Menschen zu erhöhen und gleichzeitig Umweltbewusstsein, Wirtschaft und innovative Technologien zu verbinden.“

Innovation demanded!

„Our goal is to improve the quality of life for everyone while simultaneously connecting environmental awareness, the economy and innovative technologies.“

Contact information

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Thank you

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List of abbreviations

UC	Use Cases
TK	Technical coordination
PO	Programm Office
TB	Testbed = Testfeld
HKLS	Heating, Ventilation, Air Conditioning and Sanitary
MSR	Measurement technology, control technology, regulation technology
Infra	Infrastructure
FTE	Full-Time-Equivalent

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