

Guide

Energy Research Programme

Call 2017

A funding programme of the Climate and Energy Fund
of the Austrian Federal Government



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Foreword

Research enhances competitiveness. The Austrian Climate and Energy Fund has a track record of promoting innovation, from the first idea through to the implementation of marketable solutions. The figures speak for themselves: Some 370 million euros of funding have been awarded to a total of over 800 energy and mobility research projects since 2007.

The Energy Research Programme of the Climate and Energy Fund aims to strengthen the links between science and industry in order to create growth and jobs and to enhance the attractiveness of Austria as a place of innovation.

We pave the way for more cost-effective energy and mobility technologies enabling faster market penetration. This requires the development of a wide range of technologies for different options. The great potential of technological innovation can only be realised effectively, however, if it also gains broad acceptance by the general public. Thus, the Climate and Energy Fund makes every effort to involve the people in this innovation process.

We invite you to submit your innovative projects and play your part in shaping Austria's future.



Theresia Vogel
Managing Director Climate and Energy Fund



Ingmar Höbarth
Managing Director Climate and Energy Fund

1.0 Key Facts at a Glance

The Energy Research Programme was launched by the Austrian Climate and Energy Fund to support energy and mobility technology innovations in those areas in which Austria demonstrates clear strengths, offers internationally recognised high levels of expertise and can make an effective contribution to climate protection and security of supply.

The Call makes a budget of up to **16 million euros** of funding available from the Austrian Climate and Energy Fund.

Scope of the Call

The main focus of this Call is on research, development and market introduction of new materials as well as innovative technologies, processes and system solutions. Accompanying acceptance research studies are in principle eligible for funding as part of research and technology development projects.

The topic areas described in the table below identify areas that are in line with the objectives of this research and technology development programme and are thus of high relevance to this Call.

Call instruments

This Call provides funding instruments for research, environment and business and is carried out in cooperation with the Austrian Research Promotion Agency (FFG), austria wirtschaftsservice GmbH (aws) and Kommunal-kredit Public Consulting GmbH (KPC).

Research funding and financing instruments are available for “Cooperative Projects of Oriented Basic Research”, “Exploratory Projects”, “Individual Projects of Industrial Research”, “Cooperative R&D Projects”, “Flagship Projects” and “R&D Services”. Applications are submitted to and processed by the FFG.

NOTE: Exploratory Projects are exclusively designed to provide preparatory work for technological research, development and innovation projects (R&D&I). Their focus should be on assessing the viability of potential future technological R&D&I projects or supporting concept development for planned flagship projects or in preparation for European R&D&I projects.

Funding of investments in pilot and demonstration facilities is available for “Cooperative R&D Projects of Experimental Development” and “Flagship Projects” under the 2015 funding guidelines of the **National Environmental Fund** (UFI) in cooperation with KPC. The **market introduction of research results** is eligible for funding under the “study2market” and “mission2market” instruments. Applications are submitted to and processed by aws. More detailed information about the instruments and requirements can be found in Chapter 4.0.

The following are not eligible for funding under this Call: projects with a focus on aspects of standardisation, systems analysis¹ (e.g. modelling of energy scenarios, lifestyles, integrated spatial and energy planning), legal or political framework conditions (e.g. approval procedures) or regulations and the development of monitoring, quality management systems and planning tools (e.g. manuals, software tools, databases) unless expressly specified as a call topic in the relevant topic area.

¹ Research projects on aspects of climate change, its impact on Austria and potential adaptation measures are covered by the Austrian Climate Research Programme (ACRP) of the Climate and Energy Fund

| | |
|---|--|
| 1. Oriented Basic Research | |
| 2. Energy Systems and Networks | 2.1 Energy Networks 2.2 Energy-Efficient Products |
| 3. Industrial Energy Systems | |
| 4. Transport and Mobility System | 4.1 Mutual Optimisation of Combustion Engines and Alternative Fuels 4.2 Lightweight Construction 4.3 Participation in R&D Collaboration Programmes of the International Energy Agency (IEA) |
| 5. Conversion and Storage Technologies | 5.1 Bioenergy 5.2 Chemical Storage and Conversion Technologies 5.3 Electrochemical Energy Storage 5.4 Geothermal Energy 5.5 Photovoltaics 5.6 Solar Thermal Energy 5.7 Thermal Energy Storage 5.8 Heat Pumps and Chillers 5.9 Hydropower and Pumped Storage 5.10 Wind Power |

Submission

Applications for research funding must be submitted exclusively via eCall (<https://ecall.ffg.at>) to the FFG. The full set of proposal documents must be submitted in good time, at the latest by the respective submission deadline:

- Projects with a research funding volume of up to 2 million euros:
Wednesday, 20 September 2017, 12:00
- Flagship projects with a research funding volume over 2 million euros:
Friday, 23 February 2018, 12:00

Late submissions (after 12:00) will not be accepted and will be excluded from the selection process.

Applications for funding of investments in pilot and demonstration facilities under the 2015 funding guidelines of the **National Environmental Fund** (UFI) must be submitted online to KPC. All information about the procedure and funding criteria can be found at <https://www.umweltfoerderung.at/betriebe/forschungsprogramme-des-klima-und-energiefonds/navigator/forschung-innovation/forschungsprogramme-des-klima-und-energiefonds.html>.

Registrations for **mission2market** and submissions for the **study2market** instrument are to be sent to aws. For more information, see www.awsg.at/study2market.

Information and advice

An overview of the funding agencies, their functions and tasks as well as contact details can be found in Chapter 5.0.

PLEASE NOTE: If the formal requirements for a project submission in accordance with the conditions and criteria of the funding/financing instrument and the call are not met (see Chapter 4.0) and the deficiencies cannot be corrected, the application will fail the formal check. The respective application will without exception be excluded from the further procedure and will be formally rejected in accordance with the principle of equal treatment of all funding applicants.

A detailed check list specifying the conditions and criteria of the respective funding/financing instrument can be found at the beginning of the corresponding application forms (Project Description).

Funding may only be granted if it has an incentive effect. The Thematic RTI Guideline (Themen-FTI-RL) therefore requires all project partners to submit a declaration via eCall stating to what extent the funding is required to carry out the project or enables an extension of the project scope.

Submission options for specific topics

| Instrument | Cooperative Basic Research | Exploratory Project | Individual Project IR | Cooperative R&D Project | R&D Service | Flagship Project | |
|---|--|--|---|---|--|---|--|
| Brief description | Cooperative R&D project of oriented basic research | Pilot study for R&D project | Individual project of industrial research | Cooperative R&D project | Provision of a tendered service | Strategic cooperative R&D project over 2 million euros | |
| The following topics are available for funding under the individual instruments: | | | | | | | |
| 1. Oriented Basic Research | × | | | | | | |
| 2. Energy Systems and Networks | | × | × | × | | × | |
| 3. Industrial Energy Systems | | × | × | × | | × | |
| 4. Transport and Mobility System* | | × | | × | × | | |
| 5. Conversion and Storage Technologies | | × | × | × | | × | |
| Key data | | | | | | | |
| Max. funding volume (EUR) | 60,000 to 1 million | max. 200,000 | max. 1 million | 100,000 to max. 2 million | none | over 2 million | |
| Financing | none | none | none | none | max. 100 % | none | |
| Funding rate | max. 100 % | 50 to 80 % | 45 to 70 % | 35 to 85 % | none | 35 to 85 % | |
| Project duration | max. 3 years | max. 1 year | max. 3 years | max. 3 years | see Topic Area 6 | max. 4 years | |
| Cooperation required | yes | no | no | yes | no | yes | |
| Optional supplementary funding of environmental investments by KPC | no | no | no | yes | no | yes | |
| Budgets in euros (indicative) | 1 million | 9 million | | | | 6 million | |
| Submission deadline for all topic areas | 20 September 2017 12:00 | | | | | 23 Feb 2018 12:00 | |
| Application language | German | | | | | English | |
| Information on the web | www.ffg.at/ Kooperatives- Projekt-GLF | www.ffg.at/ FuE- Dienstleistung | www.ffg.at/ Sondierung | www.ffg.at/ Einzelprojekt-IF | www.ffg.at/ Kooperatives- FuE-Projekt | www.ffg.at/ Leitprojekt | |

* The funding instruments "Exploratory Project" and "Cooperative R&D Project" are only available for TA 4.1 "Mutual Optimisation of Combustion Engines and Alternative Fuels" and TA 4.2 "Lightweight Construction". The instrument "R&D Service" is only available for TA 4.3 "Participation in R&D Collaboration Programmes of the IEA".

2.0 Strategic Focus and Goals of the Programme

2.1 Programme guidelines

The Energy Research Programme of the Austrian Climate and Energy Fund contributes towards the provision of safe, sustainable and affordable energy and mobility solutions. The programme covers the entire energy value chain, from functionality through to primary energy.

The Energy Research Programme is based on the “ENERGY Research and Innovation Strategy” presented on 23 March 2017, “Towards an Integrated Roadmap” of the Strategic Energy Technology (SET) Plan of the European Commission and evaluations of previous calls.

The research and technology programme of the Austrian Climate and Energy Fund is aimed at:

- promoting targeted **(further) development of technologies and components including system integration** (integrated energy);
- generating **innovations for societal benefit** by placing a stronger focus on the human factor and people as users and parts of the energy system and by leveraging the innovative capacity of companies, research institutions and citizens for achieving societal objectives;
- maintaining and expanding Austria’s position as a location for industry and business by reducing the **energy and CO₂ intensity of our actions**;
- bridging the extended **timeframes involved in bringing energy technology developments into commercial use**, which – in some cases – far exceed business planning and costing schedules;
- reducing the high **technological and economic risks** involved in research and technology development not covered by the market;
- **reducing the cost** of innovative, highly efficient technologies with the goal of encouraging market penetration;
- **avoiding “stranded assets”** in future infrastructure investment decisions, such as power plants and networks or industrial production facilities.

2.2 Programme goals

The following three goals were set in order to meet the overall objectives of the Austrian Climate and Energy Fund in accordance with the programme strategy. Only project proposals which make a substantial contribution towards meeting these programme goals will receive a positive evaluation.

Goal 1: Grand Challenges: energy research at the centre of great societal challenges

Research, technology development and innovation can make a substantial contribution to meeting today’s major societal challenges: climate protection and resource efficiency economic development and prosperity, social cohesion, safety and security, health and demographic change.

Goal 2: Austria’s technology leadership opens up access to international markets

The energy research and innovation activities are aimed at establishing Austria as a technology leader in selected energy-relevant areas, giving Austrian businesses better access to global markets.

Goal 3: Energy research and innovation as a job motor for Austria as a business location

Ensuring successful location development and enhancing international competitiveness are key objectives for Austria’s economic perspective.

3.0 Topic Areas of the Call

The proposed project must have its key focus on one of the topic areas and/or topics described below but may also address more than one area. Projects must achieve significant **technological progress in at least one of the topic areas**. Unless expressly provided otherwise, the topic areas and topics are not restricted in terms of their application (mobility, power, heat etc.).

Funding can also be provided for **other than the applications and system variants listed below in individual cases**, provided that the project is of particular scientific, technical or economic significance, characterised by a high innovation potential and in compliance with the programme goals and evaluation criteria (see relevant Technical Guidelines).

Topic Area 1 Oriented Basic Research

“Oriented Basic Research” supports the development of future and emerging energy and mobility technologies which are not expected to be ready for the market until 2030.

The aim is to promote novel, unconventional approaches based on latest scientific and technological findings from key research areas such as mathematics, physics, chemistry, biology, materials and nanosciences that offer great innovation potential for energy conversion and usage and translate these findings into application-oriented research.

The focus is therefore on basic research in engineering and science disciplines with a strong orientation towards future applications in the energy and mobility sectors. The Call invites research projects that are defined as “oriented basic research” in the Frascati Manual (OECD 2002) or predominantly meet **Technology Readiness Level (TRL) 1**. For more detailed information, see Chapter 4.0 and the Technical Guidelines of the FFG. This generally includes all areas required for coping with the key challenge of **reducing greenhouse gas emissions at the interface between oriented basic research and potential future developments and innovations in the energy or mobility system**.

NOTE: This Call does not cover R&D projects focusing on production and processing methods for new advanced materials and new functions based on innovative surfaces and surface processes. Such projects can be submitted to the RTI Initiative “Production of the Future” of the Federal Ministry for Transport, Innovation and Technology (bmvit).

The following fields of research are of particular interest:

- **Materials research²**, e.g. (multifunctional) coatings, electronic materials, thermoelectric materials, dielectric elastomers, thin film materials, composite and hybrid materials, phase change materials, organic materials, ionic liquids, high-temperature materials, membrane and catalyst materials;
- **Optical technologies**, e.g. optoelectronics, plasmonics, photonic processes and tools, hybrid optics, meta-materials, innovative nanostructures;
- **Chemical energy conversion:** heterogeneous reactions, biophysical chemistry, molecular theory and spectroscopy, etc.;
- Development of **test methods** (in connection with research infrastructure) **for DC systems**, e.g. C-/P-Hardware- in-the-Loop (HiL), digital control for power electronics and rapid prototyping for product (time to market, energy density, reliability, efficiency) and technology development (wide bandgap, controller etc.) for new applications such as linking medium-voltage with high-voltage networks using a DC intermediate circuit (e.g. solid state transformer, hybrid transformer etc.) in the power grid and interfaces to other energy networks (hydrogen, heat etc.);
- Development of **methods and application of optimisation algorithms for coordinating the energy demand of industrial facilities and providing them with fluctuating energy from renewable sources**, including demand-side response approaches, optimal control, optimisation solutions, e.g. genetic algorithms, mixed-integer optimisation, neural networks, HiL applications, methods and optimisation for integrated energy and for (sub-)processes in industry.

² This Topic Area is aimed at the development of new materials. Testing of existing/known materials in application is covered by Topic Areas 2 to 5.

Topic Area 2 Energy Systems and Networks

TA 2 /2.1 Energy networks

Successful structural change in energy supply strongly depends on the interaction between energy generation, transport, storage and consumption in different sectors. A key focus is on integrated energy, i.e. the integration of power, heat and mobility for the optimal use and integration of renewable energy.

The following R&D areas are based on the results of the Smart Grids 2.0 strategy process initiated by the bmvit and the results of the "R&D Roadmap for District Heating and Cooling: Innovations from Austria" commissioned by the Austrian Climate and Energy Fund, which was completed in October 2015.

NOTE: R&D projects primarily focusing on urban energy systems and infrastructures for urban energy transition are not part of this Call. Such projects can be submitted to the bmvit funding programme "City of the Future" or the "Smart Cities Demo" programme of the Climate and Energy Fund. R&D projects primarily focusing on fundamental technological issues of information and communication technologies (ICT) are not part of this Call. Such projects can be submitted to the bmvit funding programme "ICT of the Future". R&D projects primarily focusing on protecting critical infrastructures, including network infrastructures, against attacks from outside are not part of this Call. Such projects can be submitted to the bmvit funding programme "KIRAS".

The following topics are of particular interest

- Further development of **network technologies, system components and sub-concepts:**
 - **Transformation and convergence of network infrastructures:** development of system architectures, safety and security standards, planning tools, operation and control solutions including integration of information and communication technologies (ICT), new protection technologies and safety concepts (security, safety, privacy and resilience, system convergence), power, heating and cooling networks, gas grids; power-to-heat, power-to-cold, microgrids, DC grids, renewable energy contribution to system services etc.;
 - **Processes, tools and basic technologies:** safety-relevant grid components, power electronic systems, hybrid systems (e.g. power electronic based transformer with supplementary functions), semiconductor technologies (new topologies for silicon [Si] and wide bandgap [WBG]), passive components, cooling technologies, integration of communication technologies in smart grid components etc.);
 - **Methods and concepts supporting the development process** – from design and assessment to validation – **of smart grid components and systems** to shorten the time to market, e.g. model-based design concepts for smart grid automation systems, information models for system, application, control and communication aspects, reliability modelling of power electronic systems etc.;
 - **Data-based analysis** (machine learning, big data) **of meter and sensor data** for network monitoring, state estimation and improvement of system efficiency as well as load modelling and forecasting; cross-domain linking of data sources for extended data analysis to increase system energy efficiency (e.g. traffic models, wind, sun, meteorology);
 - **Monitoring, diagnosis and control concepts** for intelligent energy networks (e.g. distributed approaches) and their components (e.g. fault modelling and detection);
 - **Validation and test approaches for smart grids/ power systems;**

- Further development of **power systems** taking special account of decentralised and cellular approaches:
 - **Cellular approaches**, subsidiary control processes, semi-automatic balancing mechanisms at different network levels, regionalisation of system services, fractal grid, regional storage;
 - **Use of flexibilities**/regional system services, grid and system-interactive access to flexibilities³: methods, components and systems (e.g. architectures, control approaches, ICT) for optimal integration of distributed generators, storage units and electric mobility in smart grid concepts and applications;
 - Innovative approaches and safe technologies for **market participation of prosumers** taking into account the network infrastructure (e.g. transactive energy, blockchain);
 - **Optimised operation, forecast and prediction models** taking into account demand response and proof of concept;
- Restructuring the **heat and gas networks**:
 - **Tapping suitable climate-friendly renewable resources in heat and gas networks** including novel integration concepts, control and operating strategies, (further) development of innovative production and (grid-interactive) storage technologies at the interface between energy networks (e.g. power-to-gas, micro-CHPs, heat pumps; (seasonal) storage (e.g. modular), etc.);
 - **Retrofitting strategies** for existing heat networks taking into account future requirements (e.g. distributed generators, load changes, temperature levels, integration with power and gas networks);
 - **Differentiated network management for heterogeneous input quality** (temperatures, gas mixes, pressure levels etc.) and bidirectional transport requirements and storage functions;
 - **Diversification of output products** according to customer requirements (green energy services, cold, mobility etc.).

TA 2 /2.2 Energy-Efficient Products

Increasing the energy efficiency of products makes a substantial contribution to achieving the climate and energy policy goals and brings opportunities for manufacturers, consumers and the general public.

The Ecodesign Directive of the European Union provides a framework for the energy-efficient and sustainable design (“ecodesign”) of energy-related products⁴.

Measures need to be taken at the design stage, since this is where the energy use, environmental burden and the majority of costs incurred during the lifecycle are determined.

The following R&D areas are based on the “R&D Roadmap for Energy-Efficient Products” commissioned by the Climate and Energy Fund, which was completed in October 2015.

NOTE: R&D projects primarily focusing on fundamental technological issues of information and communication technologies (ICT) are not part of this Call. Such projects can be submitted to the bmvit funding programme “ICT of the Future”. R&D projects focusing on the development of lighting and daylight systems or building automation are not part of this Call. Such projects can be submitted to the bmvit funding programme “City of the Future”.

The call invites proposals for the technological (further) development and demonstration of energy-related products in the following areas:

- Highly efficient **cooling devices and systems** for industrial use (food wholesale and retail, food processing, catering and hotel industry, etc.):
 - **Natural refrigerants** based on hydrocarbons or CO₂;
 - **Alternative refrigeration technologies**, e.g. Stirling refrigeration process or magnetocaloric, thermo-electric and thermoacoustic cooling concepts;
 - Speed-controlled **compressors**;

³ Including system services provided by renewables, e.g. reactive power compensation by wind power plants, grid support from (run-of-river) hydropower stations, grid support from PV and PV storage systems, flexibilising overall energy system solutions with (B)PV as a key power source in building complexes and quarters.

⁴ Energy related products are products whose use in any way influences the consumption of energy. This includes devices that are operated with energy as also products which do not use energy themselves but influence energy consumption during their use.

- Innovative **control concepts** (incl. proactive maintenance management and energy use monitoring of devices), e.g. smart controllers for detecting opening hours or times of intensive use, integration of compressor and device control systems and innovative network concepts;
- **Alternative device concepts** replacing open front coolers, e.g. sensor controlled doors or automatic optimal positioning of items in the refrigerated section;
- **Digitally controlled hydraulic drives**, e.g. cascade use of valves and optimal control options;
- (Further) development of energy efficient and durable **electrical and electronic components** for application in energy-related products at competitive production costs in the following areas:
 - **Thermal management** of printed circuit boards for end-user technologies (lighting, mobile end devices etc.): materials research, new design concepts etc.;
 - **Integration of active and passive components** with the aim to substantially increase energy efficiency in specific applications;
 - Application of energy-efficient **semiconductor components** in new topologies (systems), especially in the areas of heating, ventilation and air-conditioning (HVAC) and lighting;
 - Increased efficiency of **switch-mode power supplies** through new, alternative concepts featuring higher efficiency and lower component costs;
 - **Electric (bearingless) motors**, e.g. fan motors, motors for industrial machines, e-bikes or vehicles;
 - (Further) development and application of self-powered electromechanical **sensors** in energy-related products based on ferroelectric materials and printed or large-area thin-film sensors;
 - **Smart (stand-by features) self-powered systems:** components and materials for energy-efficient (stand-by) systems, energy storage units and energy harvesting for (stand-by) systems.

Applicants are encouraged to involve future users in product development and to take into account environmentally friendly product disposal and recovery or recycling of the materials used in the product design.

Topic Area 3 Industrial Energy Systems

The primary aim is to reduce emissions from manufacturing processes while maintaining or even improving product quality. Research efforts should concentrate on the efficient design of production processes in terms of energy, resource and material consumption, managing the energy use of industrial facilities and energy supply from fluctuating energy sources through the development and deployment of new processes and materials and the development of the required processes and equipment. The focus is on processes (at component, process and multi-process level) based on chemical, thermal, mechanical and electrical energy along the entire process chain.

Of special interest are life cycle analyses and the development of visualisation specifications for self-control and motivation of staff working in energy-intensive industries as part of research and technology development projects.

The following R&D areas are based on the R&D roadmap “Energy Efficiency in Energy-Intensive Industries”, commissioned by the Austrian Climate and Energy Fund, which was completed in November 2014 and the intermediate results of the strategy process for the preparation of the R&D Roadmap “Managing Energy Use of Industrial Facilities and Energy Supply from Fluctuating Renewables”, which is currently being prepared for the Climate and Energy Fund.

NOTE: The development of industrial production processes is covered by the RTI Initiative “Production of the Future”. Relevant projects, i.e. projects not primarily focusing on increasing energy efficiency (in combination with resource efficiency) should thus be submitted to the above initiative. Please contact the FFG for advice in cases of doubt. R&D projects primarily focusing on Industry 4.0, biobased industry or recycling are not part of this Call. Such projects can be submitted to the bmvit funding programme “Production of the Future”.

The focus is on the following areas:

- **Materials research** for new or optimised production processes and for ensuring a consistently high product quality when introducing new energy- and resource-efficient production processes (e.g. efficient material use, recycling): secondary alloys, materials for additive manufacturing, fibre-reinforced materials, improved corrosion properties etc.;
- **Optimisation of existing and development of new energy- and resource-efficient production processes and products** using simulations and experiments, e.g. through modification of process parameters, substitution of materials and consumables, deployment of new or improved components or processes and reorganisation of production:
 - Innovative developments in **thermal processing technology** (in particular in the iron and steel, non-ferrous metal, light metal, cement, mineral extraction and processing industries): furnace and burner technologies, hardening and smelting processes, drying processes, heat treatment, joining technologies, direct induction etc.;
 - Development of alternative or optimised **chemical processes**: PAT methods, development of efficient continuous process and separation methods, energy-efficient reaction technology and process chemicals, shorter process chains, innovative reactor technologies (e.g. membrane technologies), catalysis etc.;
 - Efficient **manufacturing technologies**: net shape methods (SPS, MIM, additive manufacturing), surface technology, innovative casting methods, energy integration in production plants etc.;
 - Energy-efficient **process engineering in the pulp and paper, automotive, textile, food and beverage industries**;
- Development of new and adaptation of existing **production processes for energy-efficient manufacturing through optimised energy use**, including modelling and simulation of different (sub-)processes for time and load-dependent component integration, intelligent integration concepts, intelligent control and automation solutions for improving industrial (sub-) processes and units with interfaces to the distribution networks and energy markets;
- **Highly efficient electrical energy usage** on the load side:
 - Highly efficient **electric motors** and optimised systems (motor plus components such as gears, fans, pumps, compressors), variable speed control;
 - Electrical **plant engineering**;
 - **Optimised distributed generation systems for power, heating and cooling**: new plant, generator and thermoelectric concepts, load and fuel flexibility (e.g. use of special gases, biomass combustion), integration of storage systems, new materials and material technologies;
 - New **high-temperature superconductor** technologies in industrial applications, e.g. electric motors, automation components, DC induction heating etc.;
- **Storage systems for industrial applications**:
 - **Use of waste heat and (integrated) waste heat storage** (e.g. exhaust gas, waste water etc.) employing thermal storage systems, high-temperature heat pumps, ORC, thermoelectric systems, latent heat storage units, use of supercritical CO₂, finned tube heat exchangers etc.; waste heat storage for batch processes is of special interest;
 - Cost-efficient and flexible medium- and high-temperature storage at **temperature ranges > 100°C**;
 - **Combination of short and long-term storage** for steam production;
 - **Power-to-X**: power-to-hydrogen, high-temperature electrolysis, power-to-liquid, methanation etc.;
- **Low exergy systems** for the process-integrated use of renewable heat with a focus on the medium temperature range (100° to 250°C): development of hydraulic and system engineering concepts, computer-based tools for integral planning, evaluation and operation etc.;
- New approaches for the use of **secondary raw materials and fuels** (e.g. process gas, plastic waste etc.);
- **Production of efficient secondary energy sources** from industrial organic waste, e.g. by pyrolysis, hydrothermal methods, gasification, liquefaction, synthesis and product gases;

- Combined **technologies for the separation of air pollutants** (dust, nitrogen etc.) and increased efficiency in industrial production processes, such as e.g. exhaust gas condensation by means of heat pumps, open sorption technologies (“chemical heat pump”), catalytic denitrification, hot gas filtration etc.;
- Energy-efficient processes and technologies for **separation** (e.g. post-combustion or oxyfuel technology); **O₂ generation and (in-plant) recycling of greenhouse gases** from industrial production processes;
- Energy-efficient **water treatment**, e.g. heat recovery from waste water, water recovery, treatment, distribution and supply systems;
- Efficient **mechanical** milling, agglomeration, separation and mixing **processes**;
- Highly efficient **drive technologies** (motors for stationary applications, gear technology etc.);
- **Energy management⁵, process integration and process intensification** based on simulation and numerical optimisation with the aim to improve the energy efficiency of industrial processes and production sites or integrate them into the regional energy system;
- Use of innovative **measurement, sensor and control technology** for the energy optimisation of industrial processes.

Topic Area 4 Transport and Mobility System

Traffic is one of Austria’s largest emitters of greenhouse gases. In addition to continuing incremental improvements to established vehicle technologies, we need innovations which lead to efficient overall systems and significant ecological advantages to contribute to reaching agreed climate goals.

As vehicles with conventional drivetrains will continue to dominate the market in a transitional period, we need to develop highly optimised conventional drivetrains in order to significantly reduce CO₂ and pollutant emissions in the short term. If we are to reach the ambitious goals of the European Union after the Paris Climate Conference, a key challenge will be developing energy-efficient drive technologies, integrating them into the overall vehicle concept and reducing vehicle weight.

In order to achieve maximum reduction in greenhouse gas emissions, this Call focuses on developments concerning the mutual optimisation of the combustion engine using alternative fuels. Alternative fuels are meant to include all energy sources with the exception of petrol and diesel fuels. Funding is available both for developments of the combustion engine and for the optimisation and adaptation of alternative fuels to the combustion engine.

Reducing vehicle weight is key to increasing energy efficiency and reducing greenhouse gas emissions. The second focus of this Call is therefore on light-weight vehicle design irrespective of the drive technology used.

The third focus addresses the significance of international research cooperation for the development of energy efficient, low emission vehicle technologies. Austria has a strong automotive supply industry and is therefore highly dependent on the application of energy efficient and/or low emission components developed in Austria, and research institutions also need international partners for the implementation of their research results and engineering services. As automotive manufacturers outside Europe in particular focus on low or zero-emission drives and fuels, this Call also provides funding for participation in research collaborations of the International Energy Agency (IEA).

Research will address all types of two- and four-wheel road vehicles as well as off-road applications. Evaluation criteria include significant increases in energy efficiency and strong reductions in greenhouse gas emissions. These must go far beyond incremental developments to existing technologies and demonstrate a high degree of innovation.

Project submissions are exclusively limited to the following topic areas.

⁵ Applicants are asked to avoid duplication of activities carried out under the “klima:aktiv - Energy Efficient Enterprises” initiative and to make use of synergies. The development of manuals, management systems or planning tools is not part of this Call.

NOTE: R&D projects focusing on alternative drives are not part of this Call. Such projects can be submitted to the bmvit funding programme "Mobility of the Future" or the "Austrian Electromobility Flagship Projects" programme of the Climate and Energy Fund. The only exception is TA 4/4.3 "Participation in R&D Collaboration Programmes of the IEA". Projects focusing on the further development of established vehicle technologies can be submitted to the FFG General Programmes.

TA 4 /4.1 Mutual Optimisation of Combustion Engines and Alternative Fuels

Further improvements of drivetrain components usually require a higher R&D effort than incremental improvements of combustion engines in order to meet the climate protection targets set out in this Call. The envisaged solutions must be able to be implemented economically assuming that costs will fall as production volumes rise.

Planned improvements of combustion engines and drivetrains cannot come at the expense of pollutant emissions and must go beyond compliance with emission limits which are due to be tightened in the foreseeable future.

With regard to the objectives set out above, R&D projects in this field may cover mutual optimisation of the combustion engine and alternative fuels for all components in a conventional vehicle drivetrain (including highly efficient, extremely compact and affordable drivetrain components and subsystems), in particular:

- Adaptation and optimisation of the combustion engine and fuel system for the use of alternative fuels;
- Innovative control systems of the combustion engine for the use of alternative fuels;

- Optimisation of auxiliary systems for the use of alternative fuels;
- Technical optimisation of the fuel for use in mobility applications.

This topic area does not include control and development of alternative drives.

Admissible instrument: Exploratory Project, Cooperative R&D Project of Industrial Research or Experimental Development

TA 4 /4.2 Lightweight Construction

This topic area addresses projects designed to reduce the overall weight of the vehicle and its drive components in order to significantly increase energy efficiency and reduce greenhouse gas emissions. The proposed projects may focus on developing and testing new materials and material combinations, on developing and applying virtual development and testing methods, on shaping new materials (including structural optimisation and bionics) and on developing vehicle bodies and parts from the individual components using appropriate joining techniques. A key requirement is that the development of methods and materials is aimed at application in the overall vehicle and/or vehicle components rather than focusing on generic structural and materials research without relation to mobility applications.

Efficient manufacturing processes are vital if lightweight construction developments are to be successfully positioned in the market and must therefore be taken into account in terms of economic feasibility.

Life cycle assessments, including recycling, are an important factor for consideration when using new materials in overall vehicle structures and must be included in the project proposal.

Funding is available for projects in the following areas:

- Application of **light metals, plastics, bionic materials and composites** for use in vehicles (including characterisation in terms of computability);
- Innovative **lightweight design concepts** in vehicle construction and their simulation for the development process;
- Innovative **forming, joining and machining processes** for optimised component design;
- Use and combination of innovative materials for the development of **lightweight components**;
- **Component integration** for lightweight drivetrain and body design.

Admissible instrument: Exploratory Project, Cooperative R&D Project of Industrial Research or Experimental Development

TA 4 /4.3 Participation in R&D Collaboration Programmes of the International Energy Agency (IEA)

Participation in Tasks/Annexes of the mobility-related IEA Technology Collaboration Programmes (TCPs) "Hybrid and Electric Vehicles" (HEV) and "Advanced Motor Fuels" (AMF)

International research collaborations are of great significance for Austria's automotive industry, fuel industry and transport research as the Austrian automotive supply industry strongly relies on cooperation with major vehicle manufacturers in this highly globalised sector, which are the only ones in a position to implement the newly developed technologies. The International Energy Agency's (IEA) R&D collaboration programmes in the field of alternative drives and fuels are of particular relevance since they open up collaboration opportunities with partners outside Europe. The **Technology Collaboration Programme on Hybrid and Electric Vehicles (HEV-TCP)** aims to realise the great potential of electric mobility to reduce energy consumption and emissions from road transport. The primary goal of the **Technology Collaboration Programme on Advanced Motor Fuels (AMF-TCP)** is to facilitate the market introduction of advanced motor fuels and related vehicle technologies. This TCP provides an effective platform for fuel analyses and GHG emission measurements in engines.

The Call invites proposals for Austrian participation in multilateral working group projects carried out as part of these Technology Collaboration Programmes, i.e. Tasks in the HEV-TCP and Annexes in the AMF-TCP.

A list of current Tasks/Annexes can be found on the relevant websites (<http://www.ieahev.org> and <http://www.iea-amf.org>). For information about emerging R&D collaborations in new Tasks of the HEV-TCP and new Annexes of the AMF-TCP, please contact the Austrian delegate to the Executive Committee of the relevant TCP (andreas.dorda@bmvit.gv.at or astrid.wolfbeisser@a3ps.at) by 6 September 2017 at the latest. This Call provides funding for participation in Tasks/Annexes of the HEV-TCP and the AMF-TCP.

The projects submitted must meet the following requirements:

- **Positive evaluation by the Executive Committee (ExCo):** The proposed Task/Annex must have received a positive evaluation at an ExCo meeting. Applicants must provide at least a draft work and time schedule, including the allocation of tasks between the individual partners. NOTE: the complete original documents (work and time schedule of Task or Annex, at least in draft form) must be annexed to the application.
- **Decision about participation in Task/Annex by the bmvit:** The bmvit decides on the financing of Austrian participations in Tasks/Annexes based on the programme objectives. Participation in non-financed Tasks/Annexes is still possible at own expense, but should be coordinated with the relevant ExCo delegate. The application formalities (letter of acceptance to IEA Task or IEA Annex) are to be implemented in coordination with the Austrian ExCo delegate. A copy of the documents must be sent to the FFG via eCall.
- **Funding will be provided for only one application per Task/Annex; in the event of competing applications, the applicant with the highest evaluation will be financed.** Several partners may jointly submit an application based on a clear allocation of tasks.

Integral parts of the application:

- The international project (Task or Annex) must be described in the tender (brief description, objectives and planned results, status, participating institutions and their tasks, Austrian share in project, project manager, planned duration of Task/Annex).
- Added value provided by the project: The application must show in a clear and comprehensible way that the project submitted provides an added value over current or completed projects.
- Work packages: The application must include a clear and comprehensible description of the project based on work packages, including objectives, description, methodology, milestones and results.
- Professional expertise: Evidence must be provided of the bidder's expertise (and that of their partners, if any) in terms of scientific excellence and national networking.
- Costs: The application must include a transparent and detailed cost plan, with costs broken down by work packages. Any participation fees in the form of Task or Annex contributions will be defrayed in addition to the maximum cost limit and must be listed separately, giving the period for which the Task/Annex contribution is payable. The fixed annual contributions (Common Funds) for the TCPs will be paid directly by the bmvit and must not be included in the application. The tender must include a detailed travel schedule (specifications) and a realistic estimate of travel expenses.
- Written confirmation by the Austrian delegate that the applicant's participation in the particular Task/Annex is desired.

Instrument: R&D Service

Project duration: until the end of the relevant Task/Annex

Budget per Task/Annex: max. 40,000 euros per year (excl. Task/Annex contribution)

Topic Area 5 Conversion and Storage Technologies

The development and implementation of system solutions in the energy sector require different conversion and storage technologies to be combined into an integrated energy system including buildings, urban and industrial systems, energy grids and the transport and mobility system. Individual technologies will need to be further developed and optimised in order to be able to adjust them to specific requirements and create cost-efficient integrated system solutions.

NOTE: This Call does not cover R&D projects focusing on the development of technologies for urban energy systems. Such projects can be submitted to the bmvit funding programme "City of the Future".

TA 5 /5.1 Bioenergy

The aim is to (further) develop new technologies and innovative approaches turning biogenic raw, residual and waste materials into competitive alternatives to fossil fuels. The Call focuses on innovative energy and cost-efficient processes, new products and materials for the domestic and foreign markets. The application should include a description of the type, availability and potential of the biomass to be used.

NOTE: This Call does not cover R&D projects focusing on zero-emission small-scale combustion systems, biomass-based hybrid packages for heat and hot water supply of buildings and microgrids as well as micro and small-scale combined heat and power systems. Such projects can be submitted to the transnational funding programme "ERA-NET Bioenergy" carried out in cooperation with the bmvit and the Climate and Energy Fund.

Funding is provided for new technological developments or substantial improvements to existing technologies, including but not limited to:

- **Biomass preparation and pretreatment:** Mechanical (sorting etc.) and thermal (pyrolysis, steam explosion, hydrothermal carbonisation (HTC), hydrothermal liquefaction (HTL) etc.) pretreatment and preparation of biomass, biogenic waste and residual materials as well as residues with a high biogenic fraction;
- High-efficiency low-emission **biomass combustion systems:**
 - Marketable **secondary technologies** for emission reduction;
 - Increase in electrical efficiency (increased steam parameters), plant availability (increased service life of components) and part-load capability of **medium and large-scale biomass CHPs;**
 - Biomass for **industrial (high-temperature) processes** (oxygen enrichment etc.);
- (Further) development and demonstration of **biomass gasification** systems:
 - **Flex-fuel biomass gasification;**
 - **New gasification concepts** (e.g. CO₂ as gasification medium);
 - **Integration of biomass gasification in industrial processes** (paper industry, construction materials industry etc.);
 - Technologies for dry processing of **synthesis** gas and synthesis demonstration (Fischer-Tropsch (FT), mixed alcohols, bio-H₂, bio-SNG etc.);
 - **2nd generation polygeneration systems** (production of H₂, hythane, CH₄);
 - Demonstration of **biomass integrated gasification combined cycles** (IGCC);
 - **Hybrid systems** (use of H₂ from excess power to increase carbon conversion);
 - Optimisation of **biogas and bioconversion systems:** methods for the production of synthesis gases and bio-H₂, use of solid oxide electrolysers (SOEC) to increase carbon conversion, solids separation and recirculation to increase the efficiency of existing plants;
- **Highly innovative systems**, e.g. aqueous phase reforming (APR), chemical looping reforming (CLR), microbial bio-electrochemical systems (MES);
- **Cross-cutting** technological topics:
 - Innovative **control methods** (“smart control solutions”) for optimising resource-efficient bioenergy plants by reducing process fluctuations caused by external factors (e.g. different fuel quality), increasing the degree of automation or extending the power range for part-load operation;
 - **Modelling and simulation as development and prediction tools** with the aim to reduce development costs and time to market.

TA 5 /5.2 Chemical Storage and Conversion Technologies

The aim is to prepare the market for chemical storage and conversion technologies for stationary and mobile applications. The Call focuses on increasing power density and lifetime, optimising system operation, reducing the production costs of components and systems and optimising the production of hydrogen and methane along the entire process chain, from CO₂ separation and electrolysis through to methanation and power generation.

The following R&D areas are based on the “RTI Roadmap Power-to-Gas for Austria” commissioned by the bmvit, which was completed in November 2014.

NOTE: R&D projects focusing on the adaptation of stationary fuel cells to urban energy systems can be submitted to the bmvit funding programme “City of the Future”.

Technology developments for the mobile application of fuel cells and hydrogen technologies are covered by regular calls under the bmvit R&D funding programme “Mobility of the Future”.

The following areas are of particular interest:

- optimised cost-efficient **materials with enhanced energy efficiency, long-term stability and reliability**, especially for high-temperature applications (SOFC and SOEC) with the aim to increase operating temperature and reduce degradation, e.g. increase in active surface areas and catalytic properties of electrodes, reduced thicknesses of new noble metal-free catalysts and improved membranes, corrosion resistance of stack materials, (further) development of light-metal hydrides and covalent hydrogen storage materials, metal-organic framework compounds for hydrogen storage;
- Efficient and flexible **electrolysers** (PEM high-pressure electrolysis, alkaline electrolysis, high-temperature electrolysis etc.), e.g. through robust electrolysis stacks, efficient electrochemical reactions, upscaling and smart connection of individual systems;
- Efficient **methanation** (biological, chemical, catalytic)
- (Further) development of the **fuel cell stack**, e.g. low- and high-temperature PEM, SOFC, MCFC, DMFC etc.
- Improved **fuel cell components** (optimised electrolytes, (nano) membranes, sensors, inverters, interconnectors and ion-conducting materials etc.)
- Efficient and cost-effective **systems**, upscaling, system control strategies and system integration;
- (Further) development and application of **simulation tools, measurement and testing systems and (high dynamic) test rigs** for PEM FC as well as SOFC systems and components;
- Accelerated **ageing tests** for FC systems and in-situ analysis of damage mechanisms in polymer electrolyte membrane fuel cells (PEMFC).
- Next-generation **converter systems** (gallium nitride, silicon carbide, new topologies etc.) for optimal battery integration into electrical systems;
- **Control systems** with standardised interfaces for flexible, safe and secure (cyber security) integration of different products (batteries and converters) into the energy supply system;
- Methods and approaches for comprehensive assessment and improvement of **performance, safety, security and reliability** of electrochemical storage systems at component and system level;
- **Monitoring and diagnosis concepts** for battery management systems for safe operation of battery storage systems;
- **Recycling** (closing of material cycles, use of sustainable materials and components) and **re-use** of (lithium) batteries, including development of measurement and testing systems for condition assessment of used batteries.

NOTE: This Call does not cover R&D projects focusing on the development of electrochemical storage systems for use in vehicles. Such projects can be submitted to the bmvit funding programme "Mobility of the Future".

TA 5 / 5.3 Electrochemical Storage Systems

The general aim is to increase the power and energy density and service life of electrochemical storage systems and to reduce the manufacturing costs of components and systems with a focus on the following topics:

- Next-generation **lithium systems** (5V systems, lithium-air etc.) and **post-lithium systems** (magnesium-ion systems, zinc-air batteries etc.) including the development of safety and monitoring concepts (e.g. in-cell sensors);

TA 5 / 5.4 Geothermal Energy

Research funding is available for the advancement of technologies for the cost-efficient exploration, generation and use of heat and power from geothermal reservoirs for applications in thermal grids as well as in trade and industry. Another focus is on exploration risk assessment and seismic exploration of potential sites with a view to prospecting and exploiting hydrothermal reservoirs in Austria.

The following R&D areas are based on the study "Geo-Energy 2050: Potential of Deep Geothermal Energy for District Heating and Power Production" commissioned by the Austrian Climate and Energy Fund, which was completed in June 2014.

NOTE: The Call does not cover R&D projects focusing on the use of shallow geothermal energy (i.e. from depths down to 400 m).

The following topics are of particular interest:

- Collection, evaluation and interpretation (for the general public) of (existing) **geophysical and seismic data**, definition of geothermal aquifers, depths, thicknesses, temperature levels and fault zones of these aquifers;
- Processes and methods for the **numerical modelling and simulation** of geothermal reservoirs and use of mathematical-physical methods for analysing, predicting and optimising the geothermal system and its individual components (exploration, drilling, reservoir management etc.) in order to quantify the exploration, drilling and operation risks;
- **Materials research** for the development and expansion of geothermal wells, prospection and exploitation of geothermal reservoirs and plant operation taking into account the impact of high temperatures, high pressure and high corrosiveness;
- (Further) development of **system components and exploration technologies** such as seismic methods, drilling technologies, innovative exploration methods or the development and optimisation of components designed for geothermal applications (e.g. pumps, filters, measurement systems, pipes) involving high temperatures, pressures and corrosive conditions as well as reliable and energy-efficient low-maintenance operation;
- Adaptation and optimisation of technologies and systems for **electricity generation in geothermal power plants** (organic Rankine cycle [ORC] and Kalina cycle plants) and adaptation to the geothermal conditions in Austria (temperatures below 100°C, maximum discharge rates of 100l/s) and the development of suitable recooling concepts.

TA 5 / 5.5 Photovoltaics

Reducing costs is the key to further expansion of photovoltaics (PV). Funding is available for research and development projects which contribute to cost reductions through enhanced efficiency, efficient manufacturing processes, new process steps, materials, scalability or standardisation as well as extended component service life. Consideration of disposal and recycling aspects of PV modules is encouraged.

The following R&D topics are based on the “Technology Roadmap for Photovoltaics in Austria” commissioned by the bmvit, which was completed in June 2016.

The following R&D topics are of particular interest:

- **Material and technology development** such as robust and efficient thin-film PV (e.g. CIGS and CZTS), innovative nanostructures, novel high-potential materials (e.g. OPV, perovskite, metal oxides, thin-film silicon, graphene etc.) and highly efficient tandem cell architectures;
- Cost-efficient **manufacturing technologies and production processes for innovative PV modules**, (e.g. films, coatings, spray processes, inkjet printing, high-performance lasers, flash-curing systems) including upscaling and pilot production;
- **Components (modules, encapsulation, power electronic systems, cabling, connector systems etc.)** which help reduce system losses, increase system voltage, efficiency and lifetime and optimise system design;
- **System optimisation in terms of performance and functionality** (including intelligent systems, innovative system applications and topologies as well as interactions with buildings and grids, electronics and intelligent modules, loads or storage systems);
- **Quality assurance methods and tools** at component and system level, e.g. simulation and early detection of faults and failures, analysis of ageing mechanisms and their interactions (e.g. potential-induced degradation (PID)), fire protection, monitoring of performance parameters in terms of geographical, topographical, climatic or ambient impact, innovative measurement and testing methods (e.g. electrical, optical and electro-optical methods);

- **Forecasting and prediction models:** yield prediction and nowcasting of solar radiation using different measurement instruments (sky cams etc.), development of data acquisition and processing systems and prediction models, business cases and deployment scenarios.

TA 5 / 5.6 Solar Thermal Energy

The funding priorities are focused on reducing cost through mass production and easy installation as well as increasing efficiency in solar thermal energy production.

The following R&D areas are based on the “Roadmap: Solar Heat 2025” commissioned by the Ministry for Transport, Innovation and Technology (bmvit), the Ministry of Agriculture, Forestry, Environment and Water Management (bmlufw) and the Ministry of Science, Research and Economy (bmfwf), which was published in December 2014.

NOTE: R&D projects primarily focusing on multi-functional solar facades are not part of this Call. Such projects can be submitted to the bmvit funding programme “City of the Future”.

The Call addresses (further) development and demonstration in the following fields:

- **Low-cost collectors with production costs below 30 euros/m²:** new materials and material combinations and manufacturing processes;
- **PVT collectors** (glazed or unglazed) for intelligent hybrid systems, which can switch between power and heat generation depending on the heat and power demand and/or state of charge and electricity prices; PVT collectors for heat and power generation and night radiative cooling;

- Cost-efficient **medium and high-temperature collectors** for application in industry, district heating or new medium-scale power station concepts (hybrid CHP plants);
- Standardised system solutions **for large-scale solar thermal systems (> 0.5 MW)** offering a better price-performance ratio, e.g. (self-supporting) collector fields, aerodynamic collector geometries, optimised hydraulics, innovative control systems, calculation and simulation tools for designing systems with guaranteed performance.

The installation of solar thermal pilot systems with a collector area of over 50 m² or 100 m² as well as measurement methods for performance and quality analysis are funded under the “Large-Scale Solar Thermal Plants Subsidy Scheme” of the Climate and Energy Fund and are not part of this Call.

TA 5 / 5.7 Thermal Energy Storage

Research and development projects should focus on innovative thermal energy storage units which provide higher energy densities and functionality than conventional storage technologies and enable new applications in thermal networks and industrial waste heat use for both heating and cooling. Research activities should include the areas of materials development, measurement and sensor technology, component and system design and environmental compatibility.

The Call focuses on large-scale water storage, high-temperature solid and liquid storage, power-to-heat-to-power and compact heat/cold storage. The Call addresses new thermal storage concepts for a broad temperature range (0–350 °C), concepts for scalable charging and discharging and measurement concepts for thermokinetic characterisation. The performance of benefit and life cycle analyses is encouraged.

NOTE: Storage systems for heating and/or cooling applications in residential or service buildings (e.g. small-scale water storage, low-temperature solid storage) are not part of this Call. Such projects can be submitted to the bmvit funding programme “City of the Future”.

R&D projects primarily focusing on the thermal management of vehicle components and the vehicle interior (heating, ventilation, cooling) are not part of this Call. Such projects can be submitted to the bmvit funding programme “Mobility of the Future”, which invites proposals for projects in the fields of vehicle air-conditioning taking into account passenger comfort and the potential and limits of batteries, utilisation of waste heat, thermal insulation, latent heat storage, thermoelectric energy recovery, CFD optimisation of HVAC components, thermal battery management and system optimisation of thermally relevant auxiliaries. The relevant call is open until 20 September 2017.

The following topics are of particular interest:

- **Storage materials:** thermal, chemical, physical and kinetic properties such as conductivity, moisture absorption, storage density, process capability, strength, cycle stability and ageing as well as cost reduction;
- **Sensors and measurement methods** for quantifying storage capacity, state of charge and process relevant parameters (state of matter, moisture, mass and volume flow rates etc.) and calorimetric methods for characterising materials properties under conditions relevant to practical application;
- **Component development** aimed at reducing conversion losses, reactor and process engineering (e.g. improving heat transfer through sorption reactors) for open and closed sorption concepts;
- **System designs** for new applications (e.g. mobile heating and cooling systems with sorptive or latent heat storage materials);

- **System implementation:** integration of thermal storage units into thermal processes (industry, CHPs, solar thermal plants) and thermal grids as well as development of operating strategies, especially for temperature levels above 100°C;
- Innovative **system control** (predictive or adaptive control in combination with heat demand analysis), integration of grid management into distributed storage management, operation control for seasonal storage applications.

TA 5 / 5.8 Heat Pumps and Chillers

Heat pump technology is influenced by all European guidelines aimed at enhancing energy efficiency, increasing the share of renewable energy sources and reducing greenhouse gas emissions.

In order to enhance the competitiveness of heat pumps in the future, it is necessary to reduce the system costs for applications in district heating/cooling networks and in industry in general.

The following R&D areas are based on the “Austrian Technology Roadmap for Heat Pumps” commissioned by the bmvit, which was completed in June 2016.

NOTE: Heat pump systems for application in residential or service buildings are not part of this Call. Such projects can be submitted to the bmvit funding programme “City of the Future”.

Funding is available for the development of new materials and working substances, the development and optimisation of components and systems as well as technological solutions for effective integration of these technologies into smart grids, in particular:

- **Heat pumps in electricity networks:** definition, specification and transmission protocols for the interface between heat pump and power grid, development of forecast-based control systems and implementation of controllers, development of forecasting models and integration in deployment optimisation tools;

- **Heat pumps in thermal networks:** development of heat pumps for decentralised temperature raising for temperatures up to 65°C and/or integration of low-temperature heat (e.g. optimal dimensioning, modular assemblies), modulation capability for fast response to load changes, increased seasonal performance factor, cost reduction, novel integration concepts and control strategies;
- **High-temperature heat pumps for industrial applications:** new refrigerants and refrigeration cycle concepts for higher temperature levels (up to 200°C), new heat exchangers, e.g. for direct use of condensed gases (flue gas, exhaust air, drying processes etc.), compressors and lubrication methods for high evaporation temperatures, improved dimensioning and modular assemblies for use in industrial environments, operational optimisation including efficient part-load operation and optimised process integration.
- **Provision of flexibility** (e.g. grid services such as primary reserves or cold starts): new generation of turbines and pumps with variable speeds (0 % to 100 % load), modularisation of plant components, power electronics and electronic converters, modelling and simulation of interactions between hydropower plant and grid etc.;
- **Increase in hydropower production** through modernisation, new hydropower plants and multi-functional application of hydropower: improving the thermal and electromagnetic design of generators based on simulation and validation, computer-based methods for modelling the interaction between water and turbine structure (virtual test rigs), new methods and tools for lifetime prediction and quality assurance at component level;
- **Increase in the application range of pumped storage power plants** (small-scale systems between 1 to 20 MW, systems for low head hydropower [10 to 30 metres] for use at sea coasts, systems for high-head hydropower [up to 1400 metres] for use, e.g. in abandoned underground tunnels; pump storage systems which can transport greater density in addition to water and can thus be operated in a space-saving manner): standardisation of components and technologies, new turbine design for upgrade of pump storage facilities and low-head turbine solutions etc.;
- (Component) development and demonstration of **controllable micro-hydropower plants** in the distribution network;
- Maximal **sustainable hydropower expansion:** substitution of mineral oil products for turbine lubrication (e.g. biodegradable lubricants, lubricant-free bearings), use of residual water for energy production.

TA 5 / 5.9 Hydropower and Pumped Storage

Austria has a long tradition of using hydropower. Hydropower forms a cornerstone of the country's renewable energy policy and supplies over half of the national power requirements. Hydropower plays an important role in the energy mix covering both base load as well as providing a buffer during periods of peak load.

In contrast to conventional hydropower, exploiting the power of the sea is still in the demonstration phase. As a technology provider, Austrian industry has the opportunity to grow export markets in this field. The R&D focus areas listed below are based on the "Hydro Equipment Technology Roadmap" issued by the Hydro Equipment Association in 2013.

The following research areas are of particular interest:

- **Materials development**, e.g. for wear-free generators and corrosion- and erosion-resistant materials for hydropower and marine energy installations;

TA 5 / 5.10 Wind Power

Research funding is focused on developing technology for wind power plants for use on land and at sea. Research and technology development projects which also consider the potential of decreasing the ecological footprint of plant engineering (construction, operations, repowering, removal, recycling and materials selection) are encouraged.

In principle, funding is available for studies accompanying larger R&D projects that examine the social acceptance of technological developments. These studies should be formulated as best practice measures and help drive wind power expansion in Austria.

NOTE: Micro and small-scale wind power plants for use on buildings are not part of this Call. Such projects can be submitted to the bmvit funding programme "City of the Future".

The Climate and Energy Fund supports R&D in the following areas with the aim of reducing specific costs while increasing the availability and environmental sustainability of wind power plants:

- **Materials**, e.g. lightweight design, hybrid materials, plastic components, materials and composites for modular design, optimised casting materials, optimised surface coatings for corrosion protection as well as avoidance of ice formation etc.;
- **Drivetrain concepts and configurations**, increased reliability of gears and bearings, concepts for grid support and provision of system services including effects on drive train loading;
- **Electronic components and elements**, e.g. generators, power electronics, sensors;
- **Rotor blades**: improved aerodynamic and aeroacoustic properties, weight reduction, innovative control concepts;
- Innovative and cost-efficient **foundation and tower concepts** for on-shore and off-shore wind power plants, e.g. corrosion protection, further development in view of increasing plant sizes (e.g. lattice towers);
- (Cross-company) **standardisation** of components, assemblies and interfaces with the aim of reducing production costs;
- Optimisation and cost reduction of **construction and logistics processes** as well as **maintenance and operation** (e.g. condition monitoring systems for plants or components and/or innovative information and communication technologies for control, remote diagnosis and repair);
- **Transfer of findings from other technology areas**, e.g. aerospace, bionics;
- Technological adjustment and optimisation of wind power plants to **site-specific conditions in Austria**, e.g. aviation safety requirements (lighting), wind power in (pre-)alpine areas (e.g. ice throw) or in forested areas.

4.0 Administrative Instructions

4.1 Specific requirements

This Call is based on the general requirements specified in the Technical Guidelines for the relevant funding instruments. An overview can be found in Chapter 4.2.1. The following sections describe additional requirements for the instruments “Cooperative Projects of Oriented Basic Research”, “Flagship Projects” and “R&D Services”, which apply exclusively to this Call.

4.1.1 Cooperative Projects of Oriented Basic Research

Topic Area 1 “Oriented Basic Research” focuses on basic research in engineering and science disciplines with an enhanced orientation towards future applications in the energy field. The Call invites research projects that are defined as “oriented basic research” in the Frascati Manual (OECD 2002):

“Oriented basic research may be distinguished from pure basic research as follows:

- Pure basic research is carried out for the advancement of knowledge, without seeking long-term economic or social benefits or making any effort to apply the results to practical problems or to transfer the results to sectors responsible for their application.
- Oriented basic research is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognised or expected, current or future problems or possibilities.”

This Topic Area deliberately does not focus on applied/ industrial research or experimental development as is the case in Topic Areas 2 to 5. For definitions and differences between industrial research and experimental development see the Technical Guidelines for Cooperative R&D Projects.

Funding requirements

The Climate and Energy Fund has defined the following criteria and conditions in order to safeguard the character of **oriented basic research** in line with the goals of this Topic Area:

- A project qualifies as oriented basic research if more than half of the eligible project costs can be classified as Technology Readiness Level 1 and the remaining research activities do not exceed Technology Readiness Level 3 throughout the project duration.
- The planned results must be relevant for a broad range of applications in the field of energy conversion, energy storage and energy efficiency. Evidence of this potential relevance for application can be provided as follows:
 - **Submission of at least 1 Letter of Intent (LOI) of a company based in Austria upon application.** LOIs can be informal but must clearly state that:
 - the company in question is interested in the research activities and research results since these are of relevance for their own business and innovation activities. The company may, but is not required to, expand their commitment to support the project. A company may, for example, issue an LOI stating that they are willing to contribute their own experiences and expertise to the project in kick-off meetings, interim reviews or even during the project and, thus, strengthen the character of oriented basic research of research institutions and increase research efficiency in terms of potential future application.
 - The LOIs must be duly signed and submitted via eCall.
 - A larger number of LOIs will illustrate the high potential application relevance of the research topic.

- **Companies are eligible to participate as project partners, but do not receive funding.** Their participation must be justified in the proposal. The extent of their involvement can be specified in the funding agreement. For details please refer to the Technical Guidelines for Cooperative Projects of Oriented Basic Research.
- The projects must be characterised by high complexity and development risks.
- The projects must be characterised by high R&D efficiency and effectiveness.
- The funding of **literature analyses is limited to max. 10 % of total eligible costs.**
- The funding of **dissemination activities** is limited to **scientific publications and presentations** of (interim) research results to potential future Austrian partners from industry (not limited to companies that have contributed LOIs for the application) and science.
- **Events and publications addressed to the general public and the preparation and maintenance of project websites are not eligible for funding.**

4.1.2 Flagship Projects

Expression of interest

The Climate and Energy Fund requires consortia intending to submit a flagship project to submit an expression of interest by 20 September 2017 (energieforschung@ffg.at).

The expression of interest is in no way legally binding and will be treated confidentially. It will not be submitted to a jury and is not used for the preselection of projects. A template for the expression of interest is available at: https://www.ffg.at/sites/default/files/allgemeine_downloads/thematische%20programme/Energie/eoi_leitprojekte_energieforschung_2017.doc

Obligatory preliminary meeting

In order to clarify stipulations and requirements, the submission of a flagship project requires an obligatory preliminary meeting with the Climate and Energy Fund and the FFG at the latest 1 month prior to the submission deadline. For more information, see the Technical Guidelines.

4.1.3 R&D Services

Please note that the financing of R&D Services forms an exemption as stated in Sec. 10 (13) of the 2006 Public Procurement Act (BVerG) and is, thus, subject to a tendering process. The Climate and Energy Fund is the contracting entity for the R&D Services instrument. The FFG funding agency acts in the name and for the account of the Climate and Energy Fund.

By submitting a tender, the tenderer accepts the content of the present Guide and all other relevant call documents in their entirety.

If a (sub-)contractor is mentioned in several tenders, the respective tenders will be excluded from the tendering process if it can be assumed that this multiple participation leads to a restriction or distortion of competition.

Supplementary information

Requests for supplementary information about the R&D Services shall be sent exclusively by e-mail to the FFG (energieforschung@ffg.at) at the latest 21 days prior to the submission deadline, specifying the sender address (e-mail). The Climate and Energy Fund and the FFG will answer the requests as soon as possible, but at the latest 11 days prior to the submission deadline. The questions and answers will be published on the websites of the Climate and Energy Fund and the FFG. Requests for information cannot be sent after this date. The Climate and Energy Fund and the FFG will not comment on the evaluation of the tenders submitted during the tendering process.

4.2 Submission

4.2.1 Research funding from the FFG

Projects must be submitted exclusively via eCall at <https://ecall.ffg.at>. The project description (scientific application) and the cost plan (spreadsheet part of the application) must be attached to the electronic application using the eCall upload function.

Applicants are requested to use the relevant templates. The funding conditions, submission details and funding criteria are described in the corresponding Technical Guidelines.

Call documents – research funding (download: <https://www.ffg.at/4-Ausschreibung-Energieforschung>)

| | |
|---|---|
| Cooperative Basic Research | <ul style="list-style-type: none"> - Technical Guidelines for Cooperative Basic Research - Project Description for Cooperative Basic Research |
| Exploratory Projects | <ul style="list-style-type: none"> - Technical Guidelines for Exploratory Projects - Project Description for Exploratory Projects - Declaration of Cooperation for Exploratory Projects - Declaration of SME Status (if required)** |
| Individual Projects IR* | <ul style="list-style-type: none"> - Technical Guidelines for Individual Projects IR - Project Description for Individual Projects IR - Declaration of SME Status (if required)** |
| Cooperative R&D Projects IR or ED* | <ul style="list-style-type: none"> - Technical Guidelines for Cooperative R&D Projects - Project Description for Cooperative R&D Projects - Declaration of SME Status (if required)** |
| Flagship Projects | <ul style="list-style-type: none"> - Technical Guidelines for Flagship Projects - Project Description for Flagship Projects - Declaration of SME Status (if required)** |
| R&D Services | <ul style="list-style-type: none"> - Technical Guidelines for R&D Services - Tender - Affidavit (eCall) - Declaration of Commitment (eCall) - Model Contract |
| General cost regulations | <ul style="list-style-type: none"> - Cost Guidelines 2.0 (guidelines for the accounting of project costs) |

*) IR: Industrial Research, ED: Experimental Development

**) If no data is contained in the Austrian Business Compass (e.g. for associations, start-ups), a Declaration of SME Status must be provided upon submission of the application. Applicants are requested to use the template provided by the FFG to categorise their enterprise for the last three years (as far as possible) according to the SME definition.

4.2.2 Supplementary environmental funding from Kommunalkredit Public Consulting

Cooperative R&D Projects for Experimental Development and Flagship Projects funded by the Austrian Climate and Energy Fund may also receive funding for demonstration and pilot facilities in cooperation with KPC under the 2015 funding guidelines of the National Environmental Fund (UFI).

More detailed information on eligibility for funding see <http://www.umweltfoerderung.at/betriebe/forschungsprogramme-des-klima-und-energiefonds/navigator/forschung-innovation/forschungsprogramme-des-klimaund-energiefonds.html>

NOTE: If the funded measure qualifies as an energy saving measure in terms of end consumption according to the Federal Energy Efficiency Act (EEffG) it will be credited to the Climate and Energy Fund as a strategic measure according to Sec. 5 (1) (17) EEEffG in proportion to the funding granted. Obligated third parties may claim the eligible measures (in whole or in part) only for the part of the project costs exceeding the funding granted by the Climate and Energy Fund. This applies in particular if the measures are transferred by the funding recipient to the third party for the purpose of crediting them towards individual obligations according to Sec. 10 EEEffG.

4.2.3 Business funding from aws

The “mission2market” and “study2market” instruments of the Climate and Energy Fund provide funding for small and medium-sized enterprises (SMEs) active in the fields of energy, mobility and building technologies.

Applications are to be submitted directly to:
Austria Wirtschaftsservice (aws), Walcherstrasse 11,
1020 Vienna. **Applications can be submitted on an ongoing basis.**

Target group

Small or medium-sized commercial enterprises (SMEs as defined in EU Competition Law).

mission2market

“mission2market” supports companies and start-ups in the fields of market analysis, business models and search for strategic industrial partners. Up to 3 analysis modules are available for each company.

www.awsg.at/mission2market

study2market

The “study2market” instrument of the Climate and Energy Fund is designed to support the transfer of research results into the market by co-funding preparatory studies for investment projects. Funding is provided for external consulting costs up to a maximum of 50 % or 100,000 euros.

www.awsg.at/study2market

The aws funding instruments for the support of business investments are available on an ongoing basis.

4.3 Confidentiality of project data

The FFG is under a legal obligation to maintain secrecy concerning company and project information pursuant to Sec. 9 (4) of the Austrian Research Promotion Agency Act (FFG-G, Federal Law Gazette BGBl. I No. 73/2004). External experts who are involved in the assessment of projects are also subject to confidentiality obligations.

Project contents and results may only be published with the consent of the funding recipient. For more detailed information see Chapter 4.4 et seq.

Personal data can be used in accordance with Secs. 7 to 11 of the Data Protection Act (DSG 2000 Federal Law Gazette, BGBl. I No. 165/1999):

- for the conclusion and performance of the funding contract,
- for fulfilling duties assigned by law,
- for control purposes.

This use may mean that the data must be transferred or disclosed in particular to bodies and authorised representatives of the Federal Audit Office, the Federal Ministry of Finance and the EU. There is also the possibility to obtain information from the transparency portal according to Sec. 32 (5) of the Transparency Database Act (TDBG 2012).

4.4 Scientific integrity

The FFG is a member of the Austrian Agency for Scientific Integrity (OeAWI), thus ensuring compliance with the rules of good scientific practice.

If a lack of scientific integrity or misconduct is suspected in the course of the evaluation process or project reviews, the relevant documents may be forwarded to the OeAWI Commission for Scientific Integrity, which will then decide whether to initiate an independent investigation procedure and, if necessary, will undertake the necessary investigations.

If the investigation reveals a lack of scientific integrity or misconduct (e.g. plagiarism), the application must be rejected for formal reasons. If funding has already been granted, the funding must be reduced, retained or reclaimed.

4.5 Legal basis

The following guidelines provide the legal basis for the 4th Call of the RTI Initiative “Energy Research Programme”:

- Guideline for the Promotion of Industrial/Technical Research, Technology Development and Innovation (RTI Guideline 2015), Thematic RTI Guideline pursuant to Section 11 (1–5) of the Research and Technology Promotion Act (FTFG) of the Federal Minister for Transport, Innovation and Technology (file no. BMVIT-609.986/0011-III/I2/2014) and of the Federal Minister for Science, Research and Economics (file no. BMWFW-97.005/0003-C1/9/2014);
- Funding Guidelines 2015 of the National Environmental Fund (UFI Guideline 2015) pursuant to Sections 13 and 23 et seq. (UFG), Federal Law Gazette No. 185/1993 as amended.

The company size shall be established in accordance with the corresponding SME definition specified in EU competition law (from 1 January 2005: definition of small and medium-sized enterprises in accordance with Commission Recommendation 2003/361/EC dated 6 May 2003, [OJ L 124 of 20 May 2003, pp. 36–41]).

All EU provisions shall be applicable as amended.

4.6 Data protection and publication of funding decision

In the event of a positive funding decision, the Climate and Energy Fund reserves the right to publish the name of the funding applicants, the funding decision, the rate and amount of funding as well as the title and a brief description of the project.

All project applications submitted will only be forwarded to the persons responsible for the management of this RTI Initiative as well as to the programme owner. All persons involved are bound by strict confidentiality rules.

4.7 Open access – notes on publication

The projects funded under this Call and their results will be made available to the public in compliance with the Recommendation of the European Commission (2012/417/EU) on Open Access. The open access provisions do not apply to confidential information (e.g. related to patent applications or personal data).

Visibility and easy availability of innovative results are essential to increase the impact of the programme. Where possible, all project results achieved under this RTI Initiative will thus be published and made available online www.energieforschung.at by the Climate and Energy Fund in accordance with the principle of open access.

To be able to present the project results in a clear and comprehensible manner, instructions for public relations on projects funded and carried out under the “Energy Research Programme – Call 2017” are made available in a “Guide for Project Reporting and Public Relations”, which also forms an integral part of the agreement.

4.8 Protection of intellectual property

Funding recipients who develop their own marketable products, trademarks, logos, designs and ideas in the course of a project should think carefully about protecting their intellectual property before presenting their innovations to the public. The Austrian Patent Office provides free advice and help in finding suitable protection strategies which can be implemented in a fast, simple and cost-efficient manner, such as the provisional patent application PRIO.

More information at www.patentamt.at

5.0 Contact and Advice

5.1 Programme mandate and responsibility

Climate and Energy Fund

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www.klimafonds.gv.at

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5.2 Programme management

Austrian Research Promotion Agency (FFG)

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DI Maria Bürgermeister-Mähr

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The assignment of the topic areas to the individual FFG experts is shown in the following table:

| | | |
|---|--|---|
| 1. Oriented Basic Research | | Aichberger |
| 2. Energy Systems and Networks | 2.1 Energy Networks 2.2 Energy-Efficient Products | Peyker Schwertner, Bockstefl |
| 3. Industrial Energy Systems | | Aichberger, Peyker |
| 4. Transport and Mobility System | 4.1 Mutual Optimisation of Combustion Engines and Alternative Fuels 4.2 Lightweight Construction 4.3 Participation in R&D Collaboration Programmes of the International Energy Agency (IEA) | Klepik Klepik Bürgermeister-Mähr |
| 5. Conversion and Storage Technologies | 5.1 Bioenergy 5.2 Chemical Storage and Conversion Technologies 5.3 Electrochemical Energy Storage 5.4 Geothermal Energy 5.5 Photovoltaics 5.6 Solar Thermal Energy 5.7 Thermal Energy Storage 5.8 Heat Pumps and Chillers 5.9 Hydropower and Pumped Storage 5.10 Wind Power | Bürgermeister-Mähr Bürgermeister-Mähr Bürgermeister-Mähr Aichberger Binder Aichberger Aichberger Aichberger Aichberger Bodisch |

For questions concerning cost plans, please contact the FFG Project Controlling and Audit Department:

Ulrike Henninger

Telephone: +43 5 77 55-6088

Email: ulrike.henninger@ffg.at

Mag.^a (FH) Christa Jakes

Telephone: +43 5 77 55-6073

Email: christa.jakes@ffg.at

For funding of investments in demonstration projects please contact

Kommunalkredit Public Consulting GmbH

Türkenstraße 9, 1092 Vienna

www.public-consulting.at

Katharina Meidinger, MSc

Telephone: +43 1 316 31-356

Email: k.meidinger@kommunalkredit.at

Funding agency for research-to-market instruments

Austria Wirtschaftsservice GmbH (aws)

Walcherstraße 11, 1020 Vienna

www.awsg.at/study2market

Contact and advice

“study2market”

Mag. Alfred Melamed

Telephone: +43 1 501 75-324

Email: a.melamed@awsg.at

Dr. Wilhelm Hantsch-Linhart

Telephone: +43 1 501 75-311

Email: w.hantsch@awsg.at

Contact and advice

“mission2market”

DI Dr. Jürgen Pretschuh

Telephone: +43 1 501 75-585

Email: j.pretschuh@awsg.at

5.3 Additional funding options

Additional funding options in the field of energy can be found here:

<https://www.ffg.at/content/das-nationale-angebot-f-r-die-energie-und-umweltforschung>

Additional funding options in the field of information and communication technologies can be found here:

<https://www.ffg.at/content/das-nationale-angebot-f-r-die-informations-und-kommunikationstechnologien>

Additional funding options in the field of mobility can be found here:

<https://www.ffg.at/programme/mobilitaet-der-zukunft>

Additional funding options in the field of production can be found here:

<https://www.ffg.at/programme/produktion>

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Owner, publisher and media owner:

Climate and Energy Fund

Gumpendorfer Strasse 5/22, 1060 Vienna

Programme Coordinator:

Mag.^a Elvira Lutter

Programme Management:

Austrian Research Promotion Agency (FFG),

Kommunalkredit Public Consulting (KPC)

Austria Wirtschaftsservice (aws)

Graphic Design:

angineering.net

Place of production:

Vienna, June 2017

