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Project acronym	Project title	Project abstract	Main Coordinator
CO2inLoop	EXTENDED SECTOR COUPLING SYSTEMS OF DISTRICT HEATING AND COOLING TECHNOLOGY USING CO2 AS A HEAT TRANSFER MEDIUM	The work is intended to further expand the original approach of the CO2 grid as a heating and cooling grid. For this purpose, on the one hand, the flexibility potential is to be increased by adjusting the pressure and temperature level in the grid. Furthermore, new scenarios of sector coupling are to be examined. The SOFC technology is particularly interesting because CO2 occurs in a mixture of water vapour. The detailed simulation of the entire system enables statements about the transient system behaviour, which is necessary for the techno-economic evaluation of the sector coupling possibilities and new control algorithms. Furthermore, an error analysis based on a real-time simulation of the network should significantly increase the security of CO2 networks.	4ward Energy Research GmbH, Austria
PERFORM II	IMPROVING GEOTHERMAL SYSTEM PERFORMANCE THROUGH FILTER TECHNOLOGY DEVELOPMENT	The objective of PERFORM II is to develop a new filter technology to improve geothermal plants for a cost-effective and climate-neutral heat supply. To this end, operational issues such as scaling and corrosion and associated Naturally Occurring Radioactive Materials (NORM) must be mitigated. This will be achieved by laboratory experiments on filter material, examining filters' design, and designing and building a mini-plant for tests under plant operating conditions. The mini-plant will be portable and used for bypass experiments at two geothermal plants in the Netherlands and Germany. Finally, an assessment of the environmental footprint of the filter technology and an economic (market and cost) analysis will be combined with the technical results to produce a roadmap to upscale and commercialise this filter technology.	Hadi Dashtaki Hesari TNO: NederlandeOrganisatie voor toegepastnatuurwetenschappelijk onderzoek
MALEG	MACHINE LEARNING FOR ENHANCING GEOTHERMAL ENERGY PRODUCTION	The key target of this project is developing a new AI-based tool, "MALEG" (Machine Learning for Enhancing. Geothermal energy production) to study and quantify the impact of enhanced heat extraction from thermal waters on geothermal plants in terms of their two most significant aspects, the geochemical and economic characteristics. At the same time, the MALEG simulation tool will be developed for onsite operation and act as a “digital twin controller” for geothermal plants. This development will be accompanied by comprehensive geochemical sampling campaigns. The AI-based tool resulting in a digital twin will be part of the “MALEG demonstration system” and complemented by a field laboratory which constitutes a corresponding “hardware twin”. It is conceived to emulate a geothermal plant with process technology for geothermal brine treatment and mineral extraction.	Joachim Koschikowski Fraunhofer Institute for Solar Energy Systems
RECOIN	REAL-TIME CONTROL AND TUNING OF BOREHOLE HEAT EXCHANGER FIELDS FOR	Borehole heat exchanger (BHE) fields combine many individual BHEs for the comprehensive supply and storage of heat and cold. In the RECOIN project, a new type of control system is being developed that monitors the thus far largely uncontrolled operation of such fields, smartly regulates individual BHEs and adapts them for optimal overall system efficiency. The most important development of the project is flexible modelling, prediction and control procedure that will be	Peter Bayer, Prof. Dr. Martin Luther University Halle-Wittenberg

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HECTAPUS	HEATING COOLING TRANSITION AND ACCELERATION WITH PHASE CHANGE ENERGY UTILISATION STORAGE	The “HECTAPUS” project investigates the potential for the use of Phase Change Materials (PCM) storage for accelerating the heating and cooling transition. Among the thermal energy storage technologies, PCM is a promising technology for short-term storage of heat or cold for periods of hours to days. The phase change of a medium, e.g. ice to water, absorbs a large amount of energy with a small temperature change. Thermal storage with the use of PCM of high energy density is a space-efficient storage solution. It can decrease the required seasonal storage volume when used together with underground thermal energy storage (UTES) systems. However, the combination of latent heat storage with UTES is limited in number. This project will investigate the technical and economic performance of many case studies for integration with UTES via heat pump technologies.	Justin NingWei Chiu KTH Royal Institute of Technology
SORPTES	PILOT TESTING SORPTION BASED THERMAL ENERGY STORAGE	One of the main obstacles to the energy transition is the mismatch between supply and demand. The project develops a modular, compact, loss-free, thermo-chemical heat storage system. This project uses the knowledge from previous projects (f.i. EU-MERITS, SWeKOS 2) in which a product is developed up to TRL 5. The storage product is a 30 kWh, 15 kW system for 500 €/kWh. Due to the absorption processes, it is capable of storing energy as well as producing heat or cold. Initial pilot testing of 3 systems, development of a pilot production line, system control and integration and pilot testing in a real-life environment of 8 systems results in a thermal energy storage system ready at TRL 8. This product accelerates the transition of heating and cooling towards renewable, environmentally friendly systems. The balance between industry, consultancies and University increases the chance for success.	Tim Rutten ARES bv
DEPLOI	DEMONSTRATE PRODUCTION ENHANCEMENT THROUGH LOW COST DIRECTIONAL STEEL SHOT DRILLING FOR DISTRICT HEATING	The DEPLOI project concerns the Directional Steel Shot Drilling technology with which long multilateral structures can be drilled in shallow and deep geothermal reservoirs. The structures improve the reservoir contact such that production is boosted by a factor of 2.5 while well construction cost only increases by 20%. The technology has been demonstrated in the drill test facilities of the TNO Rijswijk Center of Sustainable GeoEnergy (RCSG) and is ready for field trials. The project includes constructing a prototype drilling service unit to be tested in two trials: in Switzerland (shallow Hagerbach test site in limestone) and the Netherlands (1600 m vertical depth in sandstone). The University of Calgary, Canada, is to model the drilling assemblies and monitor the drilling in real-time. TNO does the Final Acceptance Testing at the RCSG.	Jan Jette Blange Canopus Drilling Solutions Geothermal BV, Netherlands
DEEPLIGHT		The long-term goal of the DEEPLIGHT new game-changing drilling system is to improve the economics of geothermal heat production, thereby delivering a cost-efficient base load for carbon-neutral heat networks. This new drilling system is based on Electric Pulsed Power (EPP) technology and a new way of casing placement while drilling. The novel EPP drilling technology will be capable of drilling much deeper wells with larger diameters than current drilling technology. Because there is no mechanical contact for torque and weight on the bit for rock breaking, no heavy equipment is needed, and no trips for bit replacements are required. EPP drilling with integrated casing placement will improve the economics of geothermal projects and boost the development of the sustainable heat sector.	TNO, Netherlands

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GOES	GEOTHERMAL-BASED OPTIMIZED ENERGY SYSTEMS	The current design of energy systems lacks standardization and transferability. Similar challenges were successfully addressed in other industries via a platform-based design (PBD) approach. Applying the PBD approach to energy systems has a significant impact potential. It will enable rapid and transferable innovations and implementations at different scales for energy system transformations from the subsurface to the city scale. The holistic approach will lead to the cost-optimal integration of geothermal energy in existing and new urban areas. And most importantly, it leads to a significant CO2 emission reduction in the heating and cooling supply. The PBD defines the interfaces between the scales and standardises the information exchange between different levels of abstraction and thus enables the effective implementation of Geothermal-based Optimised Energy Systems (GOES)	Robin Mutschler Swiss Federal Laboratories for Materials Science and Technology
FLXenabler	FLEXIBLE HEATING AND COOLING AND GEOTHERMAL ENERGY STORAGE AS AN ENABLER FOR DECARBONISED INTEGRATED ENERGY SYSTEMS	A retrofit of the fossil-fuel-dominated heating sector will need new sources of energy supply. At the same time, a significant amount of end-user flexibility will be required in the future to enable an increased share of variable renewable energy sources in the power grid. The main objective of FLXenabler is to develop an implementable framework for flexible, fossil-free heating and cooling supply; and to demonstrate the impact of sector coupling and integration of heat pumps, geothermal resources, and thermal energy storage in accelerating the transition into a fully decarbonised energy system in Europe and the U.S. The project will address flexibility utilisation in decarbonised heating and cooling systems at the national, district and community level and assess the impact of flexibility at community and district levels in the energy system and decarbonisation goals on a national scale.	Hanne Kauko SINTEF Energy Research, Norway
GeoCoHorT	GEOTHERMAL COMMUNITY HEAT TECHNOLOGY AND TRANSFER	The objective of this project is to demonstrate a small-scale 4th generation district heating (4GDH) in Limerick, Ireland, comprising a cluster of buildings and employing a district loop positioned to turn to geo-sourced heat-pumping. The target geo-source is groundwater communicating with the River Shannon to establish a heat-extraction system for the river and associated estuary. This geo-target will provide both efficiency and noise-reduction benefits to the district and a method of combating climate-change-warming of the estuary. As part of the objectives, using wind power or other intermittent energy sources to aliment the heat pumps will be studied to contribute to grid stabilisation. The 4GDH micro-district system will be modelled and designed to be coupled with the geo-fluid loop to optimise heat extraction from low-temperature sources	Valentina Zaccaria Mälardalen University, Sweden
DEMO FTES	DEVELOPMENT, MONITORING, AND CONTROL OF FRACTURE THERMAL ENERGY STORAGE IN CRYSTALLINE ROCK FORMATIONS	The DEMO FTES project will experimentally measure the thermal efficiency and capacity of fracture thermal energy storage (FTES) at the laboratory scale and in an approximately 10 m scale multi-month field test. FTES is a method of seasonal underground thermal energy storage (UTES) where an efficient heat exchanger connecting multiple wells is created using carefully designed hydraulic fractures. The technique would allow for inexpensive, high-capacity thermal storage in much larger geographical areas than current technology allows, offering a path to significantly reduce energy usage and greenhouse gas emissions from the heating and cooling of buildings. Laboratory testing is planned at the Geo-Energy lab at EPFL Lausanne, while the field test is planned at an existing highly instrumented testbed at the Sanford Underground Research Facility (SURF) in the U.S.Main Coordinator.	Jeffrey Burghardt Pacific Northwest National Laboratory, Operated by Battelle for the US Department of Energy

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G2C	GALLERIES 2 CALORIES	G2C aims to facilitate and demonstrate the use of legacy mine workings as recycled heat storage and transport networks providing at a regional scale managed sustainable low carbon, low cost, local, sustainable heat sources. Internationally legacy mining communities are often economically or environmentally disadvantaged, and through establishing how to make use of these systems to balance surface heat and cooling needs using the mine workings we will offer a way forwards for these communities to benefit from the current energy transition. The project seeks to move the technology to a TRL6, creating a demonstration field test site in Scotland with an injection and extraction borehole and monitoring. The consortia comprising international academics, and local regulatory authorities and SMEs, led by Town Rock Energy, will develop.	David Townsend TownRock Energy, UK, Scotland
THE CHANGE	THE COOLING AND HEATING TRANSITION ACCELERATION VIA NETWORK GEOTHERMAL ENERGY	5th generation geothermal district heating and cooling (Geo5GDHC) systems have the potential to significantly decarbonise heating and cooling provided in urban areas by making use of optimised building systems and by re-using waste heat within buildings and within the network. With underground thermal energy storage (UTES), the ability to use intermittent renewable energy sources is maximised, reducing or eliminating the use of fossil fuel-generated electricity. A significant challenge is gaps in existing models and design/analysis tools. This project is aimed at demonstrating Geo5GDHC systems and developing new models, design algorithms, and design tools to facilitate the rapid design of resource-efficient and sustainable distribution systems that take advantage of sector-coupling and incorporate UTE.	Saqib Javed Lund University, Lund, Sweden
S-GeoHeat	SHALLOW-GEOTHERMAL SOURCED LOW-TEMPERATURE DISTRICT HEATING	This project will focus on directly utilising shallow-geothermal energy sources via low-temperature District Heating (DH) systems (without ground source heat pump units). Technical and economic analyses will be carried out for two case studies having geothermal sources, one at the temperature level of 53 – 56 °C and the other at 28 – 38 °C. The latter will be heated to a higher temperature by integrating industrial waste heat from a nearby cement factory. The key activities will base on building retrofitting strategies to be considered with blockchain-based performance measures of the indoor heating systems together with the optimal operation of the DH system and the heat production site. Accordingly, the developed and demonstrated solutions throughout the project will form the basis for future studies on the direct and digitalised use of shallow geothermal sources.	Hakan ibrahim Tol

Call Text and Guideline for Applicants

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