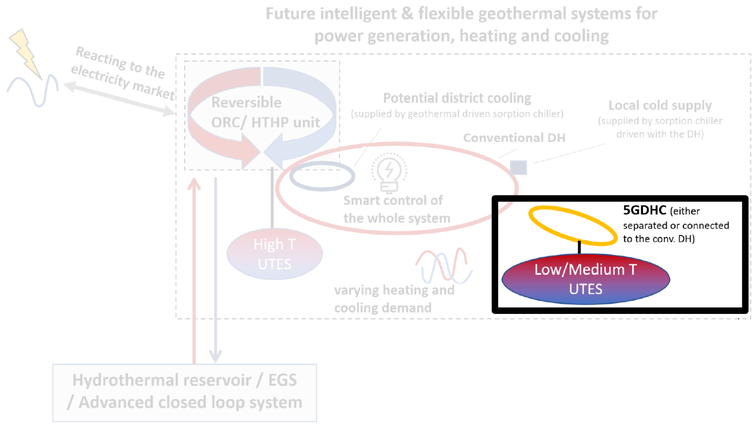
FlexGeo

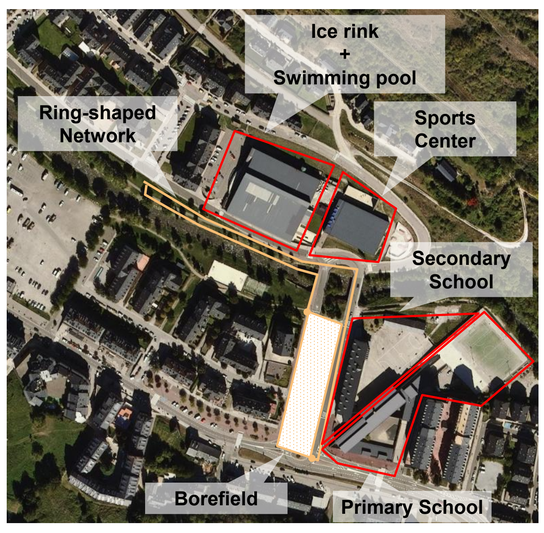
Shaping the future of flexible geothermal energy

Future smart & flexible geothermal systems



- Fifth-generation networks (5GDHC) represent the most versatile and efficient form of district heating and cooling networks nowadays and shows an organic synergy with shallow geothermal energy.
- 5GDHC networks represent a concept where multiple energy fluxes in the very low temperature range (5 – 30 ºC) can be integrated. This comprises energy supply from various renewable sources and waste heat from the industry and the buildings themselves.
- Under this scheme, the ground is able to operate as a heat source (heating) or sink (cooling), but also as a thermal energy storage (UTES) system.

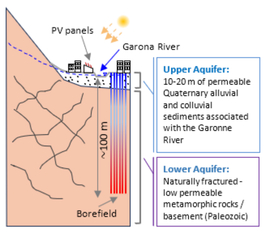
The use-case in Vielha

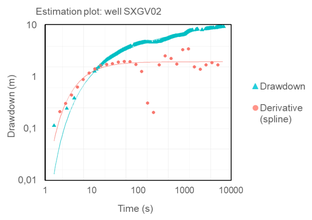


- A use case placed in Vielha (Catalonia, Spain) is analyzed in the context of FlexGeo project. It is conceived as a retrofit project that would substitute current heating systems (based on gas- and gasoil-fired boilers) by heat pumps. Four public buildings have been identified so far as the most suitable candidates (possibly extendable to other buildings in the future).
- This project, promoted by the local government (**Conselh Genearu d'Aran**) aims to demonstrate how local and renewable resources can be used in a smart way to reduce dependency on fossil fuels, decarbonizing heating and cooling and contributing to a truly local and circular economy.
- So far, a field campaign has been carried out in order to characterize the heating and cooling demands of the identified buildings, as well as the potential use of the ground resource in the form of a borehole thermal energy storage (BTES) system.

Site characterization

- 2 boreholes for geological investigation ("SXGV02" and "SXGV04").





Upper Aquifer: around 10 m of thickness of gravel, clay and sands.
Lower Aquifer: up to 103 m depth of claystones and shales with different Rock Quality Designation-fracture intensity (RQD) index (between 10 to 80%)

Hydraulic pumping test (7h) and recovery (8h) in the SXGV02 piezometer performed on March 21st, 2024.

- Flow rate: 0.11 l/s
- Total drawdown: 9.4 m

Results from the **interpretation of the pumping test phase** (Theis and recovery phase (Jacob) for the lower aquifer:

- Transmissivity: 0.47 – 0.61 m^2/d
- Permeability: 0.007 – 0.096 m/d
- Storage Coefficient: 0.077

- 2 boreholes for thermal properties characterization ("SXGV01" and "SXGV03")

3 types of temperature recording:

- Temperature sensor at the source during the TRT
- Multi-sensor temperature string at different depths each 10 m (DTRT)
- Continuous temperature recording using a hybrid composite Fiber Optic cable (ADTRT)

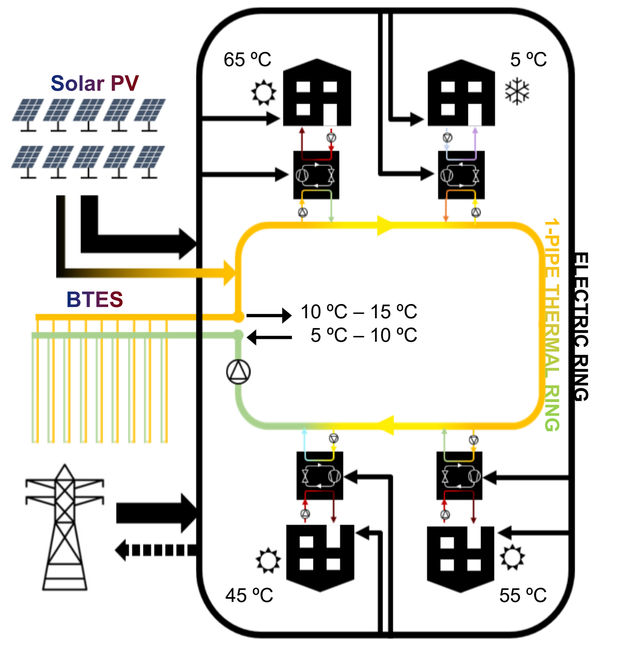
	Method	SXGV01	SXGV03
Undisturbed Ground Temperature [ºC]	TRT	10.2	10.2
Ground Thermal Conductivity [W/mK]	TRT	3.70	3.94
	DTRT	3.96	3.85
	ADTRT	3.74	-
Ground Thermal Diffusivity [m^2/d]	TRT	0.126	0.137
Inferred groundwater velocity [m/d]*	DTRT	0.12	0.13
	ADTRT	0.13	-

Project Partners

ICGC Institut Cartogràfic i Geològic de Catalunya · LIÈGE université · ethink Energy Research · orcan The Efficiency Company · DBC diadikasia · AMBIENTEITALIA we know green · Conselh Generau d'Aran · TU WIEN Technische Universität Wien Vienna University of Technology · ETH zürich · National Technical University of Athens

Proposed 5GDHC network + BTES + PV solar

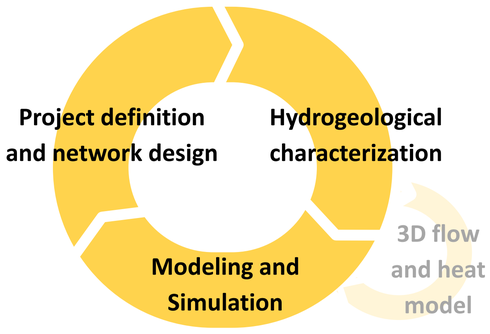
- A 1-pipe 5GDHC network is proposed, based on a borefield for heat exchange/storage (BTES), hybridized with solar photovoltaics (PV), to provide electricity, heating and cooling to the set of identified buildings, which comprise different supply temperatures and electrical/heating/cooling yearly profiles.
- Under this concept, **flexibility is promoted** through the management of surplus solar PV, which can be done through 3 different strategies:
  - Direct use.
  - Direct revenue (injection to the grid).
  - **Indirect use and revenue** (injection to the ground, improving electricity savings through heat pump enhanced efficiency)

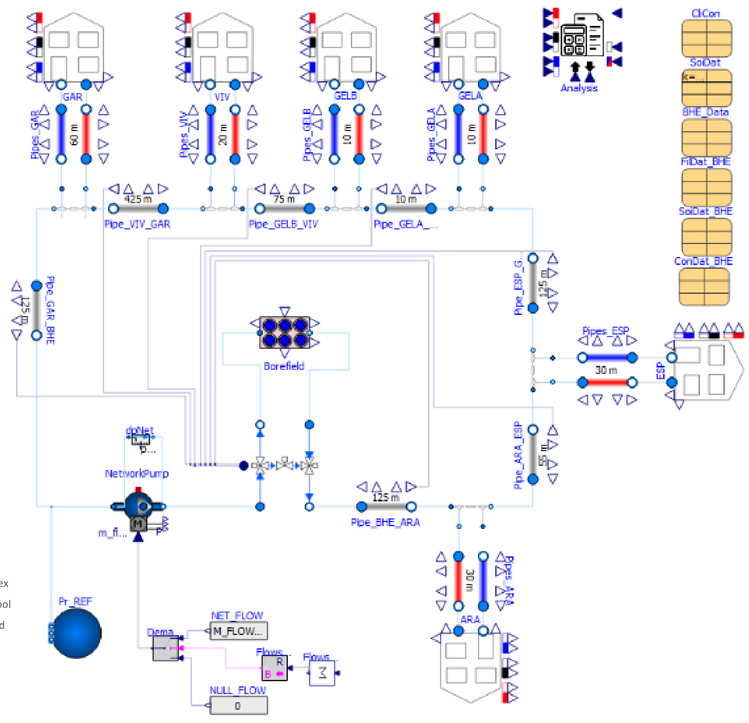


- The use of local biomass will be considered as a possibility (it is an abundant local resource) although this would imply a mix of network concepts (4G/5G).

Dynamic modelling and simulation

- The analysis of the optimum configuration (including operation control strategy) is carried out through a dynamic model of the use-case. The model is built under Modelica environment:
  - OMEdit (OpenModelica)
  - Modelica Standard Library (v4,0,0)
  - Modelica Buildings Library (v.10.0.0)





Get actively involved & talk to us

- FlexGeo aims at a very active stakeholder interaction by establishing an observer board
- We are seeking several case-studies across Europe to assess the FlexGeo technologies and our modelling toolbox
- Potential travel reimbursement for external stakeholder to participate in project events and workshop
- In addition, several side-events at both the European Geothermal Congress 2025 and the ORC conferences 2025 and 2027 are planned

Register for the project newsletter

Project website

Dr. Ignasi Herms

Ignasi.herms@icgc.cat

LinkedIn

Dr. Guillem Piris

G.piris@aran.org

LinkedIn

Dr. Jordi García-Céspedes

Jordi.garcia@icgc.cat

LinkedIn

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