

# 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

(Workshop with international contributions)

Image: Kensa's Shared Ground Loop Array, decentralized approach to Fifth Generation District Heating

## Organizers:



## Participants and contributors:



Figure 1. “Shared geothermal loops” in blocks (Kensa).

### 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

#### Introduction to the 4<sup>th</sup> Technical Workshop

##### 5<sup>th</sup> generation heating and cooling (5GDHC) networks

The Geothermal Energy Working Group (GTG) of the Catalan Efficient Energy Cluster (CEEC), the Cartographic and Geological Institute of Catalonia (ICGC) and the Catalan Energy Institute (ICAEN) are organizing a new edition of the Technical Workshop "GeoEnergia a Catalunya" with the aim of promoting and generate awareness about the potential of geothermal energy as a high-efficiency energy resource in the new framework of the Energy Transition.

This year 2023, the workshop will focus on the concept of modern **5<sup>th</sup> generation District Heating and Cooling (5GDHC) networks** based on geothermal heat pumps together with other renewable sources (thermal and/or electrical) and will show the potential of their deployment in Catalonia to address the decarbonization of urban environments and meet the 2030-2050 targets. The 5GDHC networks are the most energy-efficient type of district energy systems up to date and have been deployed for years in Europe (Germany, Denmark, Great Britain, Switzerland, etc.) and the USA. A paradigm shift is needed in the thermal energy supply in Catalonia, from the present model, which is currently dominated by individual installations comprising fossil fuel fired boilers (mainly natural gas, and to a lower extent LPGs and diesel), towards a mixed model based on collective and shared installations in the form of modern, efficient and intelligent district heating and cooling networks with decentralized production.

Within the current climate change context, cooling demand in buildings is expected to increase in the forthcoming years due to progressively higher temperatures and longer summer periods. Likewise, winter heating needs will decline as winters become shorter and the amount of cold days decreases. Under this scenario, energy efficiency will be key to cost containment. In this sense, highly efficient thermal equipment such as electrically driven heat pumps will become increasingly important in district energy systems. This implies moving from a model based on centralized hot water production at 80 – 90 °C, with a high level of heat losses in its distribution, to a new high-efficiency model where water distribution is carried out at room temperature (10 – 20 °C) and the production of cooling, heating and DHW is decentralized and with 100% electric systems using water-to-water heat pumps (ground source heat pumps). In this new model, priority is given to heat recovery/exchange between buildings, so simultaneous heating and cooling demands are favored by this type of network. When the network requires a net heating or cooling supply, shallow geothermal energy becomes an ideal energy resource: it is a clean, stable, renewable and available in the subsoil throughout the territory 365 days a year and 24 hours a day.

5GDHC networks supplied by shallow geothermal energy are an innovative model of decentralized heating and cooling production. A common configuration consists of a non-insulated 2-pipe grid where water flows close to ambient temperature (10 – 20°C). The return branch is thermally balanced with the ground thanks to a shared geothermal heat exchanger field. Each user is connected to the network with its own heat pump, exchanging heat according to its needs. The geothermal heat exchanger field can be typically an open loop (groundwater) or a closed loop (borehole heat exchangers) system. Other renewable thermal or electrical sources (e.g. thermal/photovoltaic solar energy) can also be connected (Figures 2 and 3).

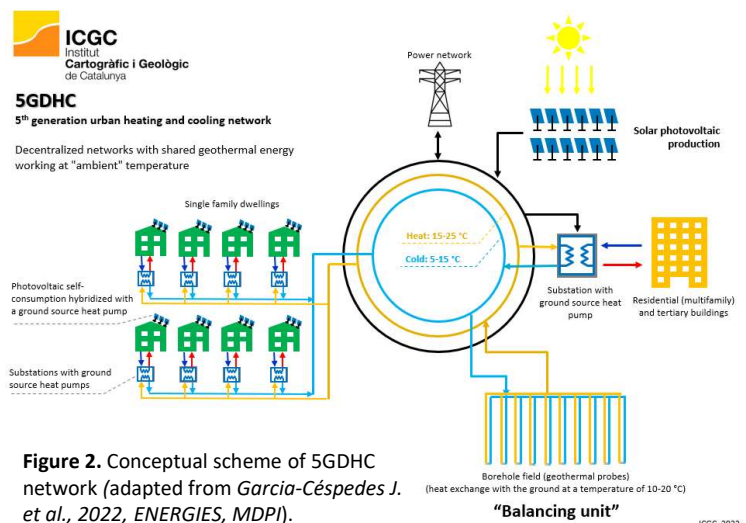


Figure 2. Conceptual scheme of 5GDHC network (adapted from Garcia-Céspedes J. et al., 2022, ENERGIES, MDPI).



Figure 3. Concept of 5GDHC networks (Termonet, DK).



# 4<sup>th</sup> TECHNICAL WORKSHOP “GeoEnergia a Catalunya”




## Decarbonizing the urban heating and cooling sector in Catalonia




28<sup>th</sup> of March 2023, 9 am – 2 pm (GMT+1). EIC HQ. Via Laietana, 39, 5<sup>th</sup> floor. (Pompeu Fabra Auditorium)

### 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

#### Technical workshop with International contributions

This year 2023, the Workshop GeoEnergia organised jointly by the GTG-CEEC, ICGC and ICAEN, will be held on Tuesday 28<sup>th</sup> of March at the Pompeu Fabra Auditorium at the headquarters of the EIC (Catalan Industrial Engineers Association) and will have an in-person format. The workshop will feature 6 high-level international speakers to provide an overview of the application and experience of 5GDHC networks in Europe and their potential in Catalonia. Speakers will include: Marco Wirtz (nPro Energy GmbH, RWTH Aachen University), Søren Skjold (Geodrilling.dk, Termonet DK), Søren Erbs (VIA University, Termonet DK), Lisa Treseder (Kensa Group), Francesco Milani (ARCbcn) and Jesús Teixidor (SUNO Ingeniería de Servicios Energéticos). In addition, there will be a final round table with the participation of representatives from ICAEN, IREC, the Local Energy Agency from Barcelona and INCASÒL, moderated by QUADRIFOLI Ingenieros.

Ponentes	Perfil profesional
	<p><b>Marco Wirtz</b> is an Energy Engineer from RWTH Aachen University in Germany. He is a research assistant at the Institute for Energy Efficient Buildings and Indoor Climate at Aachen University and is currently finishing his PhD about novel planning and simulation methods for 5GDHC networks. He has published several research articles about the design, simulation, and optimization of 5GDHC networks. In 2022, he founded the startup nPro Energy, which develops and offers the web-based planning software nPro (<a href="https://www.npro.energy/">https://www.npro.energy/</a>). The nPro software helps to design district energy systems, especially 5GDHC networks. As part of his PhD, he also conducted a survey on currently existing 5GDHC networks in Europe, mostly in Germany and Switzerland. On his website (<a href="https://mwirtz.com/">https://mwirtz.com/</a>) a detailed compilation of his research and dissemination activities is presented.</p>
	<p><b>Søren Erbs Poulsen</b> holds a PhD in Hydrogeology from the University of Aarhus (Denmark) and is the Head of the Energy and Climate Research programme at VIA University College in Horsens (Denmark). Søren's research activity is oriented towards the exploration of the technical and commercial potential of room temperature geothermal DHC networks (thermonet/5GDHC) in national and international R&amp;D projects. He is also a co-founder of the national association for thermal networks <a href="https://www.termonet.dk/">Termonet Danmark</a>.</p>
	<p><b>Søren Skjold Andersen</b> graduated from the University of Southern Denmark (Syddansk Universitet) in Denmark. Søren has been dedicated to Geothermal energy since 2011. He is currently the director of the <a href="https://www.geodrilling.dk/">GeoDrilling.dk</a> company. In addition to daily operations, it has been involved in a wide range of activities aimed at market development, such as collecting operational data from operating geothermal plants and contributing to a change in the Geothermal ordering, thus favoring the implementation vertical geothermal wells. He has participated in different research projects in collaboration with Danish and foreign academic institutions. He was a co-founder of the non-profit <a href="https://www.termonet.dk/">Termonet Danmark</a> association, of which he is currently chairman of the board. The aim of the association is to develop and spread knowledge about thermonet.</p>

Ponentes	Perfil profesional
	<p><b>Lisa Treseder</b> is Business Development Manager at Kensa Utilities UK, a British company of the Kensa group <a href="https://www.kensaheatpumps.com/">https://www.kensaheatpumps.com/</a>, specializing in the manufacture of ground source heat pumps and promoting 5<sup>th</sup> generation heat network installations in the United Kingdom following the concept of 'Shared Ground Loop Arrays'. Other projects include the installation of shared geothermal systems in social housing blocks in <a href="https://www.enfield.gov.uk/">Enfield Council London</a> for the energy multinational ENGIE, or the EU co-funded <a href="https://www.heatthestreets.com/">Heat the Streets</a> project which aims to demonstrate the feasibility of shared ownership 5<sup>th</sup> generation heat networks in a pilot case of 100 dwellings in Cornwall, in the Southwest of England.</p>
	<p><b>Francesco Milani</b> is an Industrial Engineer by UPC and KTH (Stockholm), working as a Project Manager of Innovation in ARCBcn since 2021. He is the Technical Coordinator of the HYPERGRYD project, a Horizon 2020 project whose objective is to develop solutions that allow thermal grids to integrate thermal renewables and to enable its link to electrical grids. ARCBcn is one of the leading engineering companies in Catalonia and a benchmark in sustainable construction and energy efficiency. It has developed numerous projects related to geothermal energy in Catalonia (such as Vall de Núria) and to heating and cooling networks (such as @Districlima). The company also coordinates the HYSTORE project (Horizon Europe) which develops and validates an innovative set of concepts and services based on thermal storage strategies and technologies.</p>
	<p><b>Jesús Teixidor</b> is an Industrial Engineer by the UdG and co-founder partner of the cooperative <a href="https://www.sunoenegia.com/">SUNO Ingeniería de Serveis Energètics</a> with more than 10 years of experience in the sector of thermal and electrical installations and renewable energies. SUNO is an engineering company specializing in thermal energy distribution network solutions and thermal system modeling. Since 2020 it has been in charge of the technical management of the municipal heat network of Sant Pere de Torelló. This 2023, the company has submitted a proposal for a 5<sup>th</sup> generation network in the call for the programme of incentives for singular pilot projects CE IMPLEMENTA for the Energy Community Balenyà Sostenible, SCCL.</p>

There will be a coffee break for networking and to talk to the speakers. There will be simultaneous translation service English-Catalan-English. See the programme on the following page. Free registration for CEEC members and invited guests. **Attention:** limited places for the rest of the attendees, which will be assigned by order of registration (registration fee for non-members: 19 €). Join us!

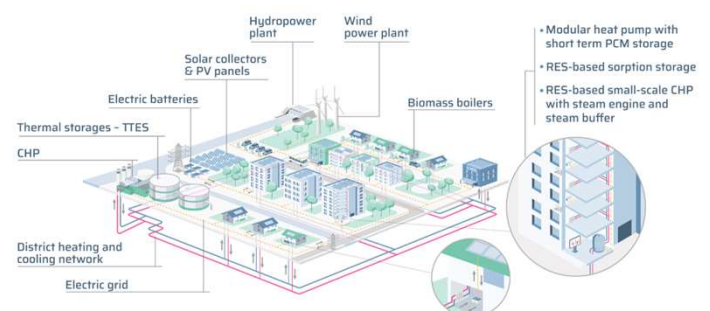


Figure 4. Project Hypergrid (UE).

# 4<sup>th</sup> TECHNICAL WORKSHOP “GeoEnergia a Catalunya”

## Decarbonizing the urban heating and cooling sector in Catalonia

28<sup>th</sup> of March 2023, 9 am – 2 pm (GMT+1). EIC HQ. Via Laietana, 39, 5<sup>th</sup> floor. (Pompeu Fabra Auditorium)

### 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

Programme<sup>(\*)</sup>: Tuesday 28<sup>th</sup> March 2023

9:00 - 9:15 am	Check-in
9:15 - 9:30 am	Welcome by: Mr. Narcís Armengol, Dean of the Catalan Industrial Engineers Association; Ms. Marta Morera, Director of ICAEN; Ms. Miriam Moysset, Director of ICGC; Mr. Joaquim Daura, President of the CEEC. <small>Language: CATALAN</small>
9:30 - 9:35 am	<b>Potencial de la Geotèrmita a Catalunya: Introduction to the Workshop</b> Ignasi Herms, Cap de l'Àrea de Recursos Geològics de l'ICGC <small>Language: CATALAN-ENGLISH</small>
9:35 - 10:05 am	<b>Thermonet, a new paradigm for district heating, from 4GDH to 5GDHC</b> Soren Skjold Andersen (Termonet, Denmark) <small>Language: ENGLISH</small>
10:05 - 10:35 am	<b>The COOLGEOHEAT project: Geothermal 5th generation district heating and cooling (Geo5GDHC/thermonet) in Denmark</b> Dr.Søren Erbs Poulsen (VIA University Denmark) <small>Language: ENGLISH</small>
10:35 - 11:05 am	<b>The use of 5GDHC networks and the central role of Shallow Geothermal Energy. Experiences from Germany.</b> Marco Wirtz (nPro Energy GmbH, RWTH Aachen University) <small>Language: ENGLISH</small>
11:05 - 11:20 am	Questions to the speakers
11:20 - 11:50 am	Coffee break. Networking
11:50 am - 12:20 pm	<b>Ground Source Heat Pumps with Shared Ground Loop Arrays. Experiences from the UK</b> Lisa Treseder (Kensa Utilities UK) <small>Language: ENGLISH</small>
12:20 - 12:35 pm	<b>Project EU HYPERGRYD</b> Francesco Milani (ARCbcn Enginyers Consultors) <small>Language: CATALAN</small>
12:35 - 12:50 pm	<b>Potencial de les xarxes de distribució d'energia tèrmica 5GDHC amb geotèrmita en Comunitats Energètiques a Catalunya</b> Jesús Teixidor (SUNO Ingeniería de Servicios Energéticos) <small>Language: CATALAN</small>
12:50 - 1:05 pm	Questions to the speakers
1:05 - 1:45 pm	Round table. Debate. <b>Descarbonització del sector domèstic a Catalunya. Podrien ser les xarxes de climatització de 5GDHC renovables com a part de les solucions per assolir la descarbonització al territori?</b> Moderator: Mr. Àlex Olives, QUADRIFOLI Ingenieros (GTG - CEEC) Speakers: • Sr. Juan Ramón Morante, Director de l'IREC • Sr. Manel Torrent, Director tècnic Consorci Agència Local d'Energia de Barcelona • Sr. Joan Palau, Subdirector d'Enginyeria i Recursos Geològics, de l'ICGC • Sr. Fernando Aranda, Coordinació Tècnica Innovació i eficiència energètica de l'INCASÒL • Sr. Jaume Margarit, Cap de l'Àrea de projectes energètics sectorials de l'ICAEN <small>Language: CATALAN</small>
1:45 - 2:00 pm	Closing act <small>Language: CATALAN - ENGLISH</small>

Registration on CEEC's website

<https://www.clusterenergia.cat/events/xarxes-de-climatitzacio-urbanes-descentralitzades-de-fred-i-calor-de-5a-generacio-amb-geotermia-i-altres-fonts-renovables/>



(\*) There will be a simultaneous English-Catalan-English translation service for the attendees.



# 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

Image: Kensa's Shared Ground Loop Array, decentralized approach to Fifth Generation District Heating

## Decarbonizing the urban heating and cooling sector in Catalonia

28<sup>th</sup> March 2023, 9 am – 2 pm (GMT+1). EIC Headquarters.  
Via Laietana, 39, 5<sup>th</sup> floor. (Pompeu Fabra Auditorium)

### Registration on CEEC's website

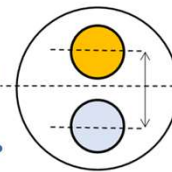
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GeoEnergia Conference: 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

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# 4<sup>th</sup> TECHNICAL WORKSHOP “GeoEnergia a Catalunya”

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### 5<sup>th</sup> generation decentralized urban cooling and heating networks with geothermal energy and other renewable sources

#### Geothermal Energy Working Group from CEEC



Schlaich Dauss



AJUNTAMENT DE SantCugat



COAMB Col·legi d'Ambientòlegs de Catalunya



AGÈNCIA D'ENERGIA DE BARCELONA



Consell de Col·legis d'Aparelladors, Arquitectes tècnics i Enginyers d'Edificació de Catalunya



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