ConnectHeat
Community engagement for clean heat

D4.2 – IMPLEMENTATION OF PILOT CASES – CANARY ISLANDS (ES)

CANARY ISLANDS INSTITUTE OF TECHNOLOGY (ITC)

The LIFE21-CET-ENERCOM-CONNECTHEAT project has received funding from the European Union's LIFE Programme under grant agreement N°101076258

D4.2 – IMPLEMENTATION OF PILOT CASES – BELGIUM

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Summary

San Bartolomé de Tirajana has a population of 52,936 inhabitants, but due to the tourist character of the municipality, which determines the existence of a large floating population, its real population is higher, receiving more than 52,000 visitors per day. It is the largest municipality on the island of Gran Canaria and covers a large part of the south coast, where 7 of the 14 tourist centres are located. It is the municipality with the highest concentration of tourist establishments in Gran Canaria, accounting for 67.5% of the tourist offer.

The tourism sector in the Canary Islands has been a pioneer in the integration of renewable energies, including the implementation of technologies and the improvement of energy efficiency in the sector has been uneven. The higher category hotel establishments are more professional in their energy management, while extra-hotel and lower category hotel establishments have greater technical and economic difficulties in making progress in their decarbonisation. The tourism sector faces the challenge of reducing its carbon footprint in order to respond to an increasingly demanding market in this regard. distinct, the sharp increase in operating costs, particularly energy costs (+28.9% in 2022 vs 2021), poses a high risk of loss of tourist activity, which switches to residential use. The loss of economic activity in this business segment has a direct impact on the Canary Islands' economy, given that tourism is the region's economic engine and its contribution to the economy claimed 35.5% of GDP and 39.7% of total employment (Impactur Canarias, 2022).

Tourist areas, especially older ones, are specialized by the coexistence of high-category hotels, extra-hotel and lower category hotel establishments and residential buildings in densely built-up urban areas. The uniqueness of the tourist offer in the Canary Islands means that heating swimming pools during the winter months required a significant energy consumption and also a technological challenge, but on the other hand it is the only centralised installation in most non-hotel complexes and residential buildings. Spanish regulations require that both the production of domestic hot water (DHW) and the heating of outdoor swimming pools be associated with renewable heat generation with a minimum contribution of 70% and 100% small. The analysis of the local context has shown that the extra-hotel establishments, lower category hotels and citizens face significant barriers to accessing high-efficiency technologies and renewable energies due to the difficulty of making the necessary investments and the scarcity of available space on roofs and plots for the integration of renewable energies. These barriers make it difficult and, in many cases, impossible to comply with current regulations.

ITC has developed a methodology for assessing heating and cooling demand in the tourism sector based on GIS tools. The results show that energy demand for heating and cooling (H&C) in the municipality of San Bartolomé de Tirajana is 221.2 GWh/year, with outdoor swimming pool heating accounting for 59.4% of the total H&C demand. H&C density maps have been drawn up and areas of potential interest for the deployment of District Heating and Cooling networks (DH&C) have been identified.

There are not DH&C networks, except tourist areas represent a great opportunity for the development of such projects. DH&C networks operators concerned point to the lack of specific regulations to encourage investment in DH&C systems, the lack of leadership from Public Authorities and the scarcity of abundant, low-cost renewable resources to make projects viable. It should be noted that 76% of DH networks in Spain use forest biomass as their main fuel, and it is not possible to replicate this technological configuration in the Canary Islands.

***ConnectHeat-Playa del Inglés* community energy project** aims to establish a Renewable Energy Community (REC) to promote the construction of a DH&C system as a key element in the decarbonisation of the tourist centre of Playa del Inglés. The DH&C network will enable the aggregation of thermal demands from different consumers, optimise synergies, recover waste heat and efficiently manage the generation of H&C, as the scale factor facilitates the integration of high-efficiency technologies and renewable energies. The long-term goal is for the Energy Community model to be replicated throughout the rest of the territory to guarantee emission-free buildings and affordable energy solutions for citizens and SMEs, strengthening the resilience of tourist areas to external factors such as energy cost volatility and extreme weather events.

One of the first steps in the development of the project has been to promote the creation of a **Stakeholder Advisory Group (SAG).** The main members of the SAG who have been the project since its beginnings are: Las Palmas Federation of Hostelry Business and Tourism (FEHT), the Municipality of San Bartolomé de Tirajana, Gran Canaria Island Government, the sustainable tourism and development research group of University of Las Palmas de Gran Canaria (TIDES) and Canary Islands Institute of Technology (ITC).

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The analysis and exchange of information between SAG members has made it possible to identify local needs and expectations regarding the development of RECs in the local environment and to determine that the target groups for the pilot project are SMEs, owners and communities of extra-hotel establishments, lower category hotels and citizens (owners and communities of residential buildings). The Renewable Energy Community will work to implement a DH&C system designed as an integrative project that generates economic, social and environmental benefits for the partners or members of the REC, but also for the urban area where the network is located.

The collaboration of Las Palmas Federation of Hostelry Business and Tourism (FEHT) and the Municipality of San Bartolomé de Tirajana has been a key element to identifying areas of potential interest for the development of a pilot case. Areas with planned urban regeneration, road works, availability of nearby available plots, older thermal generation technologies and, in general, areas in where SMEs, multi-dwelling buildings and at least one four-star hotel are located, connected by a public road through which the DH&C network can be located, have been located and equipped. The activities carried out and the support of the SAG have made it possible to identify an area of action (pilot case) to promote the development of the project. In the selected area of action, the tourist offer is diverse and includes 15 extra-hotel establishments ranging from 1 to 4 stars, representing 1090 accommodation places, and 8 residential buildings with 149 dwellings.

The ConnectHeat **Community Energy Board (CEB)** is made up of 4 tourism SMEs, 1 community of owners of a 24-unit residential building both located in the pilot case, and Las Palmas Federation of Hostelry Business and Tourism (FEHT). The aim of the CEB is to establish itself as a **Renewable Energy Community (REC)** to promote a project for the generation and distribution of renewable H&C and the generation of renewable electricity for collective self-consumption. The REC will promote the participation of citizens and SMEs located in the area where the DH network will be located, comprising 7 residential buildings consisting of 125 dwellings and 11 extra-hotel establishments. Local and Regional Public Authorities (Municipality of San Bartolomé de Tirajana and Gran Canaria Island Government) have expressed their support for the project and value their participation as REC's members. The 5 high-category hotels and 1 shopping centre located in the same area, as large companies, will not participate in the governance of the community project, but the REC will be able to carry out cooperative operations with them in order to integrate waste heat and thus increase the energy efficiency of the DH network. ITC has led the community energy project since its beginning and will continue to advise the REC, except its legal status prevents it from lasting as a REC's member.

The technological configuration of the *ConnectHeat-Playa del Inglés* community energy project meets the objectives and guidelines agreed upon by the members of the Community Energy Board (CEB) and the Stakeholder Advisory Group (SAG) to ensure that the project is viable and technically acceptable:

- 100% renewable heat generation.
- Maximise local renewable energy resources.
- Robust design, proven technologies and security of energy supply.
- Independence from fossil fuel imports to prevent energy price escalations.
- Competitive cost: the price of renewable heat distributed through the DH system must be lower than or equal to the price currently paid (0.04€/kWh).
- Integration into urban environments: Eliminate noise from individual air-water heat pumps and air-dissipating heat systems.
- Creation of synergies with other energy carriers.
- Creation of green and local jobs.

The **project's technological configuration** prioritises the use of local renewable energy sources: seawater for renewable heating and cooling, and solar radiation for renewable electricity and heat. Water-water heat pumps with a capacity of 791 kW will be used, connected to very low enthalpy coastal geothermal boreholes to generate 3177 MWh/year of renewable heat, which will be distributed through an 1100-mettre-long 5th generation DH network (5GDH), with flow and return temperatures of 42°C and 25°C respectively. The installation of an 84 kW photovoltaic plant is planned, whose solar production will be used multiple for the operation of the 5GDH system.

The technological configuration described above means that 86.0% of the energy distributed by the DH network is renewable and that the efficiency of the system is even higher depending on the residual heat recovery capacity of hotels and shops.

The project will enable:

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- reducing the carbon footprint and energy costs of citizens and SMEs and facilitating energy and urban rehabilitation
- boosting the local economy by generating green jobs in both the construction and operation phases and promoting regional economic development by attracting new investments
- promoting the transfer of technical knowledge, looking strengthening job skills
- positioning the region and the tourism sector as a benchmark for sustainability and promoting social cohesion
- reduced energy poverty by offering affordable and stable energy prices for citizens and SMEs. The decline in tourist activity has a negative effect on the Canary Islands' economy and on vulnerable citizens, as tourism is motivated by its knock-on effect on the rest of the productive fabric, so that for every 100€ of added value generated directly by tourist demand, 44.9€ is motivated to other activities and, similarly, for every 100 jobs created in the tourism sector, 38 are generated motivated in other activities.
- reducing polluting emissions from the use of efficient and renewable technologies and improving air quality in the territory, which reduce the risk of cardiovascular and cardiovascular diseases among the local population, especially among the most vulnerable groups, by reducing emissions of gases such as sulphur dioxide (SO2) and nitrogen oxides (NOx).
- Strengthen local resilience by reducing dependence on external energy sources and ensuring energy security.

ConnectHeat-Playa del Inglés community energy project will adopt the legal form of a **non-profit consumer and user cooperative.** Cooperative societies are made up of individuals and legal entities that join together, on a voluntary basis, to carry out business activities aimed at meeting their economic and social needs, with variable capital and a democratic structure and management. Democratic governance based on the principle of **'one member, one vote'** effective autonomy in internal decision-making. The participation model will guarantee the principles of inclusion and equity among members.

The financing model combines public economic incentives and contributions from REC's members to cover both the initial investment and operating costs. The investment required to implement the project is 1,588,317€ and the forced incomes from the renewable heat and electricity sales business lines in the first year of the project is 138,101.5€. The economic feasibility analysis determines a Net Present Value (NPV) for a period of 25 years of 463,754.1€, while the Internal Rate of Return (IRR) stands at 16.8% and the payback period is 8.69 years. The Levelized Cost Of Heat (LCOH) is 0.034€/kWh, which makes the project a competitive alternative to current heat generation solutions.

Existing regulatory barriers, the lack of standardised business models for the operation of RECs in the thermal sector and the lack of previous experience with DH&C networks in the region have led to the project being planned in phases:

- In the **short term**, the main objective is to legally establish the *ConnectHeat-Playa del Inglés* Renewable Energy Community and to draw up the technical projects necessary to obtain the awarded and concessions required for the execution of the project. To this end, the CEB has applied for *non-competitive grants for the creation and operation of energy communities, within the framework of the Sustainable Energy Strategy for the Canary Islands (Programme 2, Line 2), funded by the European financing instrument 'Next Generation EU', within the framework of the Recovery, Transformation and Resilience Plan (Component 7, Investment 2),* BOC 171, Regional Ministry of Ecological Transition and Energy, Government of the Canary Islands.

- In the **medium to long term**, the objective is to apply for the *national programme of incentives for unique pilot projects in energy communities (CE IMPLEMENTA)* managed by the Institute for Energy Diversification and Saving (IDAE). The programme's incentives allow for a reduction of up to 60% in the cost of the community project, which would make its implementation viable.

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1. Description

San Bartolomé de Tirajana has a census population of 52,936 inhabitants but due to the basically tourist character of the municipality, which determines the existence of a lot of floating population, its real population is superior receiving daily more than 52,000 visitors. It is the largest municipality on the island of Gran Canaria (333.13 km2) and covers much of its southern coastline where 7 of the 14 tourist centers of the island are located, which concentrate 67.5% of the total number of tourist places offered. The location of the tourist centers stands out for the benign climate, with average temperatures ranging from 17.5 ° C (January) to 23.8 ° C (August) and high global solar radiation values on horizontal surface that average 5.5 kWh / m2.day and determine an important solar resource.

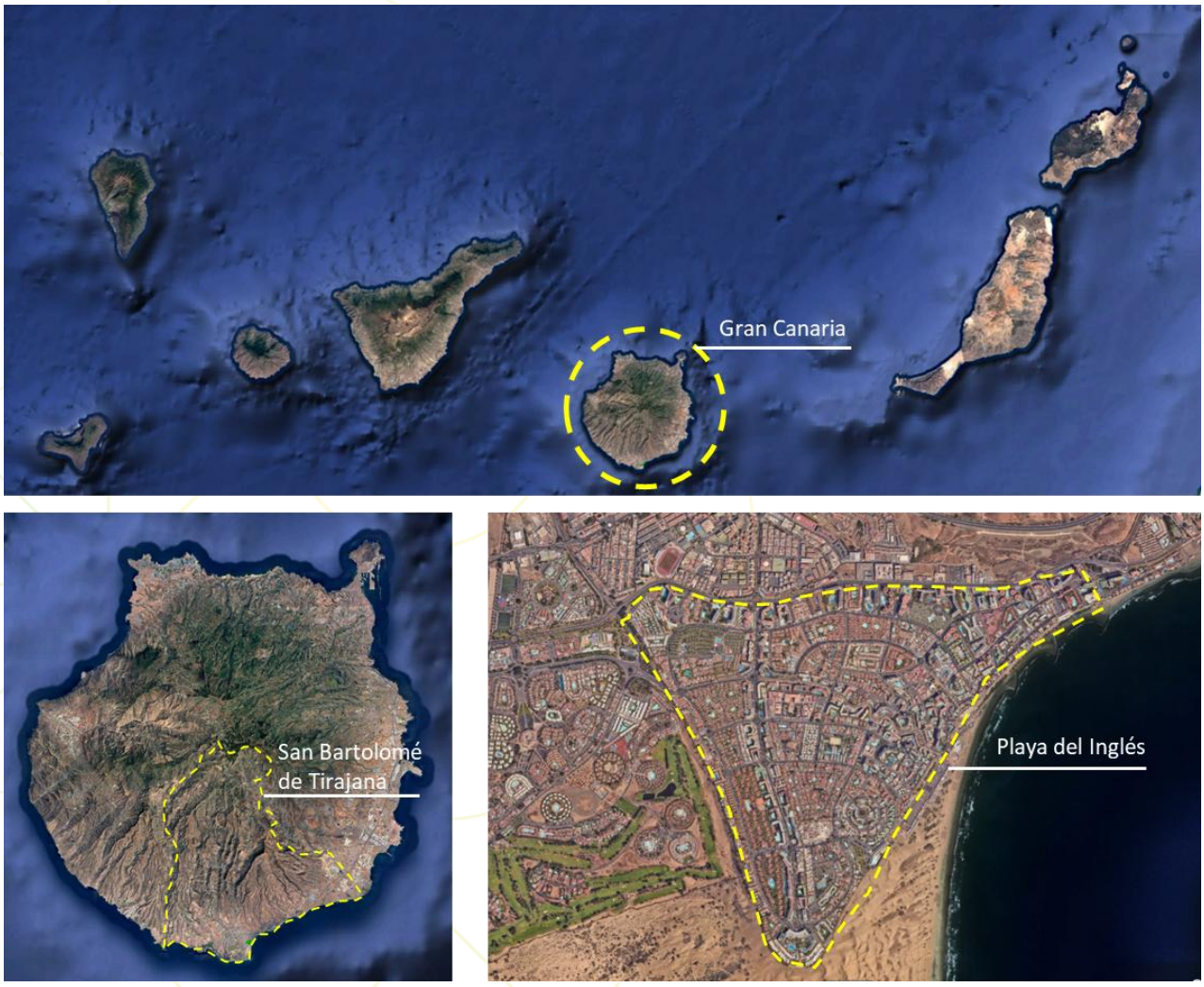

Figure1. Location of the ConnectHeat-Playa del Inglés pilot case

The tourism sector has been a pioneer in the integration of renewable energies; solar thermal energy and solar photovoltaic energy together with very low enthalpy geothermal energy have established themselves as the most widely deployed renewable energy sources in the sector and there is a trend towards the electrification of thermal demand with the use of heat pumps in a widespread way. However, the deployment of renewable energy in the sector is uneven; hotel establishments of higher category stand out with a greater professionalization in their energy management while extra-hotel establishments and hoteliers of lower category have a greater technical and economic difficulty to advance in their decarbonization.

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The tourism sector faces the challenge of reducing its carbon footprint to respond to an increasingly demanding market in this regard and, on the other hand, the marked increase in operating costs, especially energy costs (+28.9% 2022 vs 2021), represents a high risk of loss of extra-hotel activity that generally changes to residential use, which gives rise to conflicts given the conflicting interests of both activities. The loss of economic activity of this business segment has a direct impact on the Canarian economy given that tourism is the economic engine of the region and its contribution to the economy represents 35.5% of GDP and represents 39.7% of total employment (Impactur Canarias, 2022).

The uniqueness of the tourist offer in the Canary Islands determines that the climatization of swimming pools during the winter period supposes an important energy consumption and also a technological challenge but on the other hand it is the only centralized installation in most of the extrahotel complexes and residential buildings. Spanish regulations require that both the production of Agua Caliente Sanitaria (ACS) and the air conditioning of outdoor pools are associated with renewable heat generation with a minimum contribution of 70% and 100% respectively, regulations that must be complied with when making a renovation of facilities or buildings. The analysis of the local context has shown that the non-hotel sector and citizens face significant barriers to access to the use of high-efficiency technologies and renewable energies due to the difficulty in undertaking the necessary investments and the scarcity of available covers. These barriers make it difficult and in many cases prevent compliance with existing regulations.

The urban tourist areas, especially the older ones, are characterized by the coexistence of high-class hotels, extra-hotel complexes and residential buildings in urban areas filled with urbanism. There are no heat and/or cold networks although these consolidated urban tourist areas represent a great opportunity for the development of these projects. The companies operating DH&C systems consulted point to the lack of specific regulation that incentivizes investments in urban air conditioning networks, the lack of leadership of public administrations in projects and the scarcity of an abundant and low-cost renewable resource to make projects viable. It should be noted that 76% of heat networks in Spain use forest biomass as their main fuel and it is not possible to replicate this technological configuration in the Canary Islands.

The ITC has developed a methodology for the assessment of heating and cooling demand in the tourism sector based on GIS tools. The results determine that the energy demand for the generation of heat and / or cold in the municipality of San Bartolomé de Tirajana is 221.2 GWh / year, being decisive the weight of the air conditioning of outdoor pools that represents 59.4% of the total. **Heat and/or cold demand density maps** have been developed and areas of potential interest for the deployment of heat and/or cold networks or District Heating and Cooling systems (DH&C) have been identified.

Figure2. Map of heat demand density in the tourist centers of San Bartolomé de Tirajana

The ***ConnectHeat-Playa del Inglés*** **community energy generation project** aims to constitute a Renewable Energy Community (REC) to promote the construction of a DH&C system as a key element in the decarbonization of the tourist core of Playa del Inglés, which allows the aggregation of thermal demands of different consumers, optimize synergies, recover waste heat and effectively manage heat and / or cold generation since the scale factor facilitates

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the integration of high efficiency technologies and renewable energies. The project proposes to establish an Energy Community model that can be replicated in the rest of the territory to guarantee emission-free buildings and affordable energy solutions for citizens and SMEs that strengthen the resilience of tourism areas to external factors such as the volatility of energy costs and extreme weather events.

One of the first steps for the development of the project has been to promote the creation of an **Advisory Committee composed of the main agents of the tourism sector, Stakeholder Advisory Group (SAG).** The SAG members who have accompanied the project since its inception are: the Federation of Businessmen of the Hospitality and Tourism of Las Palmas (FEHT), the City of San Bartolomé de Tirajana, the Cabildo de Gran Canaria, the research group in Tourism and Sustainable Development of the University of Las Palmas de Gran Canaria (TIDES) and the Technological Institute of the Canary Islands (ITC). The analysis and exchange of information among the members of the SAG has made it possible to identify local needs and expectations regarding the development of CERs in the local environment and to determine that the target groups of the actions of the pilot project are SMEs, the owners and communities of owners of non-hotel complexes and the owners and communities of owners of residential buildings. The constituted Energy Community will work to implement a DH&C system designed as an integrative project that generates economic, social and environmental benefits to the partners or members of the CER but also to the urban area where the network is deployed and in which all the agents that make up the tourist offer and the citizens are present.

The collaboration of the *Federation of Businessmen of the Hospitality and Tourism of Las Palmas* and the *City of San Bartolomé de Tirajana* has been key to identify areas of potential interest for the development of a pilot case of reference in the tourism sector. The areas with planned urban regeneration activity have been analyzed and evaluated, with interventions in roads, with availability of nearby free plots, with greater age of thermal generation technologies and in general areas in which SMEs coexist, multi-housing buildings and at least one four-star hotel connected by a public road through which the heat and / or cold network can be deployed.

The activities carried out and the support of the SAG Advisory Committee have made it possible to identify an area of action (pilot case) to promote the development of the project. In the selected area of action, the tourist offer is diverse and includes 15 extra-hotel establishments of 1 to 4 stars that represent 1090 lodging places and 8 residential buildings with 149 homes. All buildings have outdoor swimming pools and the total area of swimming pools is 1084.6 m2. The energy demand for heating and cooling including the production of Agua Caliente Sanitaria (ACS) is 4177.8 MWh/year. These buildings were built between 1964 and 1984, 52% of these buildings being older than 55 years.

In the selected area of action there are also 5 hotel establishments of 3, 4 and 5 stars that represent 1573 lodging places and 1 shopping center. Hotels and the mall are a potential source of waste heat derived from the air conditioning of spaces and the operation of refrigeration chambers, which can be vehiculated through the heat network.

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Figure3. Location of the ConnectHeat-Playa del Inglés pilot case

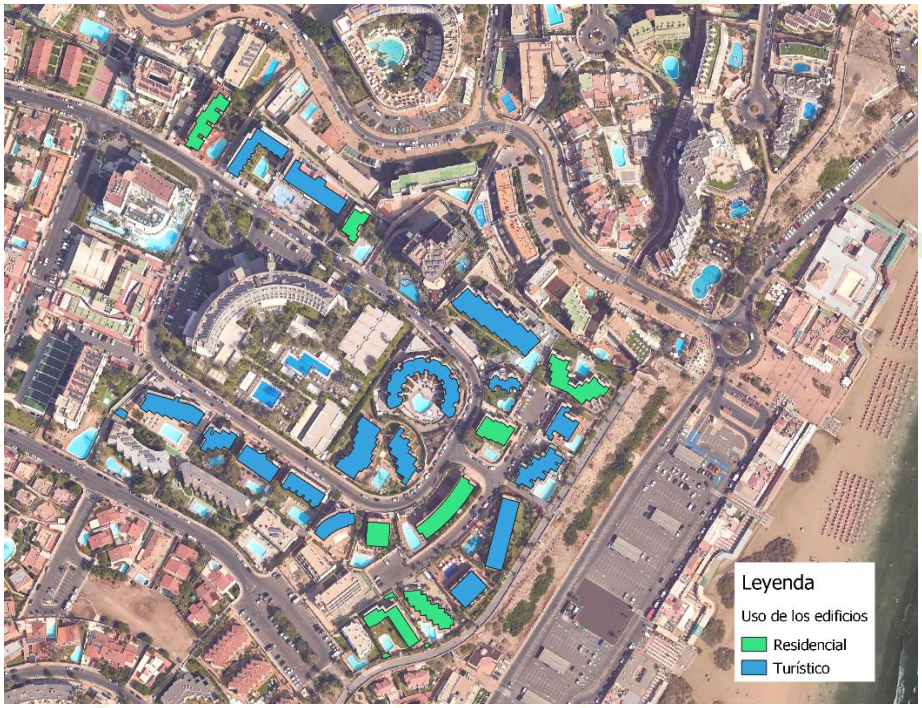

Figure4. Classification of buildings in the area of action

The activities carried out in the ConnectHeat project have made it possible to identify a working group consisting of 4 tourism SMEs and 1 Community of Owners of a residential building of 24 homes located in the area of action and the Federation of Hospitality and Tourism Entrepreneurs of Las Palmas, FEHT, which constitute the ***Community Energy Board (CEB)*** **of the project**.

The objective of the CEB is to establish itself as a Renewable Energy Community (REC) to promote a project for the generation and distribution of renewable heat and cold and for the generation of renewable electricity in the form of collective self-consumption. The CER will promote the participation of citizens and SMEs located in the area of deployment of the heat network, 7 residential buildings representing 125 homes and 11 extra-hotel complexes. The local and regional Public Administration (Ayuntamiento de San Bartolomé de Tirajana and Cabildo de Gran Canaria), have shown their support for the project and value their participation as partners of the CER. The 5 hotels and 1 shopping center located in the area of action of the heat network, categorized as Large Companies, will not participate in the governance of the community project but the CER will be able to carry out cooperative operations with them in order to integrate waste heat and thus increase the energy efficiency of the heat network. The ITC has led the community energy project since its inception and will continue to advise the motor group although its legal status prevents it from participating as a partner of the CER.

The analysis of available local resources and recorded energy demand have determined that a community energy project for the generation of renewable heat and its distribution through a **low-temperature heat network or 5th generation (5GDH)** is planned. The renewable heat will be used for the heating of swimming pools and the preheating of the Sanitary Hot Water (ACS) in non-hotel establishments and residential buildings. This configuration makes it possible to recover the waste heat derived from the air conditioning of spaces and the operation of refrigeration chambers in hotels and shopping centers in the area of action. In a second phase and depending on the progress of the reforms in the thermal installations of the buildings, the urban air conditioning network will be complemented with a renewable cold distribution network for the air conditioning of spaces configuring a 5GDH&C network.

The technological configuration of the project prioritises the use of local renewable energy sources; seawater for the production of renewable heat and cold and solar radiation for the production of renewable electricity and heat. **Water-to-water heat pumps with a capacity of 791 kW connected to very low enthalpy geothermal coastal**

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surveys will be used to generate 3177 MWh/year of renewable heat, which will be distributed through a 5th generation (5G) heat network of 1100 meters in length, with drive and return temperatures of 42°C and 25°C respectively. It is planned to install an 84 kW photovoltaic plant whose solar production will be used entirely for the operation of the 5GDH system.

The project will allow;

- reduce the carbon footprint and energy costs of citizens and SMEs and facilitate energy and urban rehabilitation
- boosting the local economy by generating green jobs both in the construction and operation phases and promoting regional economic development by attracting new investments
- fostering the transfer of know-how in the territory, which strengthens labour skills
- position the territory and the tourism sector as a benchmark in sustainability and promote social cohesion
- reduce energy poverty by providing affordable and stable energy prices for citizens and SMEs. There is a segment of the business sector with little capacity to address the necessary investments that determine compliance with decarbonisation requirements and market requirements, posing a potential risk to the continuity of its economic activity. The in of the activity has a negative effect on the Canarian economy and on the vulnerable population since the tourist activity is characterized by its capacity to carry over the rest of the productive fabric, so that for every € 100 of added value generated directly by the tourist demand, € 44.9 is contributed in other activities indirectly and in the same way, for every 100 jobs created in the tourism sector 38 are generated indirectly in other activities.
- reduce pollutant emissions from the use of efficient and renewable technologies and improve air quality in the territory, which reduces the risks of respiratory and cardiovascular diseases among the local population, especially in the most vulnerable groups by reducing emissions of gases such as sulphur dioxide (SO2) and nitrogen oxides (NOx).
- strengthen local resilience by reducing dependence on external energy sources and ensuring energy security

The ConnectHeat-Playa *del Inglés* community energy project will adopt the legal status of **a not-for-profit Consumer and User Cooperative.** Cooperative societies are made up of natural and legal persons who are associated, under the regime of free accession and voluntary withdrawal, for the performance of business activities aimed at meeting their economic and social needs, with variable capital and democratic structure and management. Democratic governance based on the principle of "one partner, one vote" ensures autonomy in internal decision-making. The participation model shall ensure the principles of inclusion and equity among partners.

The governing bodies of CER *ConnectHeat-Playa del Inglés* shall be the **Governing Council** and the **General Assembly.** The Governing Council is the administrative body in charge of managing and representing the EC and the General Assembly is the supreme decision-making body where strategic decisions are made, such as the approval of statutes, annual accounts and election of positions, meeting at least once a year. With the aim of increasing the share of renewable generation and encouraging the expansion of RAC, a model for leasing roofs of nearby buildings for the installation of photovoltaic plants has been defined. This scheme not only encourages citizen participation but also strengthens renewable generation capacity at the local level. On the other hand, in addition to energy activities, CER *ConnectHeat-Playa del Inglés* provides for the development of social and environmental impact initiatives, including energy efficiency workshops and actions to support sustainability.

The financing model combines public support and contributions from partners to cover both the initial investment and operational costs. The investment required for the execution of the project is € 1,588,317 and the forecast of income derived from the business lines of sale of renewable heat and electricity in the first year of the project is

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€ 138,101.5. **The economic viability analysis determines that a Net Present Value (NPV) for a 25-year period of €463,754.1 while the Internal Rate of Return (IRR) stands at 16.8% and the capital return period is 8.69 years.** The LCOH (Levelized Cost Of Heat) is 0.034 €/kWh, which places the project as a competitive alternative to current heat generation solutions.

The existing regulatory barriers, the lack of standardized business models for the operation of CER in the thermal field and the absence of previous experiences of DH&C systems in the region have determined that the project is proposed in phases:

- **In the short term,** the main objective is to legally establish the *ConnectHeat-Playa del Inglés* Renewable Energy Community and develop the technical projects necessary to obtain the permits and demanial concessions necessary for its execution of the project. To this end, the CEB has applied *for the Call for grants in non-competitive competition for the creation and operation of energy communities, within the framework of the Sustainable Energy Strategy in the Canary Islands (Programme 2, Line 2), under the European financing instrument «Next Generation EU» funds, within the framework of the Recovery, Transformation and Resilience Plan (Component 7, Investment 2), BOC 171, Ministry of Ecological Transition and Energy, Government of the Canary Islands.*
- **In the medium-long term,** the objective is to attend the call of the *National Incentive Program for singular pilot projects of energy communities (CE IMPLEMENTA)* managed by the Institute for Energy Diversification and Saving (IDAE). The incentives of the programme make it possible to reduce the cost of the investment of the Community project by up to 60%, which would make its implementation economically viable.

2. Technical feasibility

The technological configuration of the *ConnectHeat-Playa del Inglés* community energy project responds to the objectives and slogans agreed by the members of the Community Energy Board (CEB) and the Stakeholder Advisory Group (SAG) to make the project viable and widely accepted:

- 100% renewable heat generation.
- Maximize local renewable energy resources.
- Robust design, proven technologies and security of energy supply.
- Independence of fossil fuel imports to prevent energy price escalations.
- Competitive cost: the price of renewable heat distributed through the 5GDH system must be less than or equal to the price they currently pay (€0.04/kWh).
- Integration in urban environments: Eliminate noise from individual air-water heat pumps and heat hovercraft systems.
- Creating synergies with other energy carriers.
- Green and local job creation.

To meet these objectives, a hybridization of technological solutions for the generation of renewable heat / cold and electricity has been proposed:

- Very low enthalpy geothermal
- Water-to-water heat pumps
- Photovoltaic solar energy limited to available anthropized spaces
- Solar thermal energy to control heat grid losses
- Waste heat recovery from HVAC and refrigeration equipment in hotels and shopping malls.
- 5th generation 5GDH heat network (40oC)~

The *ConnectHeat-Playa del Inglés* community energy project proposes the construction of a **5G heat network with centralized generation and high-efficiency water-to-water heat pumps connected to the very low-enthalpy geothermal resource and photovoltaic plants whose renewable electricity generation compensates for the electricity consumption of heat pumps.**

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2.1. Energy demand analysis

To characterize the profile of heat demand in the area of action has been carried out a campaign of measures of electricity consumption of air-water heat pumps for the air conditioning of pools of non-hotel establishments selected according to the age of the equipment.

Figure5. Installation of network analyzers

TRNSYS is a powerful calculation tool that allows simulating the behavior of transient systems in which the dependence on climate data is non-linear https://www.trnsys.com/. With this tool, a model has been developed that characterizes the thermal demand for outdoor pool heating (25.5oC) and for the production of domestic hot water. The dynamic simulation of the annual energy demand allows to have a demand profile with periods of less than one hour with which it is possible to optimize the generation power of the heat distribution network. TRNSYS dynamic simulation models have made it possible to obtain hourly heat demand profiles for each of the buildings connected to the network.

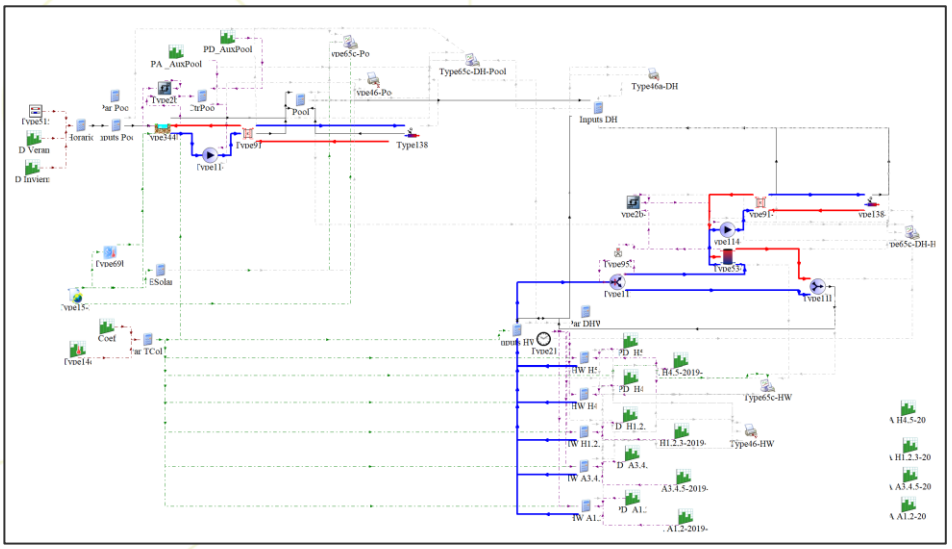

Figure6. TRSNSYS model to characterize the heat demand profile

The experimentally recorded data, the operation profile, the electrical power and the energy consumption of the heat pumps analyzed have allowed validating the TRNSYS model developed and extrapolating the data to evaluate the thermal power of global demand.

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The results obtained determine that the heat demand of the 23 transfer substations (23 buildings connected to the heat network) for the air conditioning of outdoor pools that total a total water sheet area of 1804.6 m2 and for the preheating of domestic hot water up to 40oC reaches a value of 3134 MWh/year of which 2900 MWh/year are destined for the air conditioning of pools, 93%, and 233 MWh/year are destined for the preheating of ACS, 7.4%, with a maximum demand power of 721 kW and 165 kW respectively.

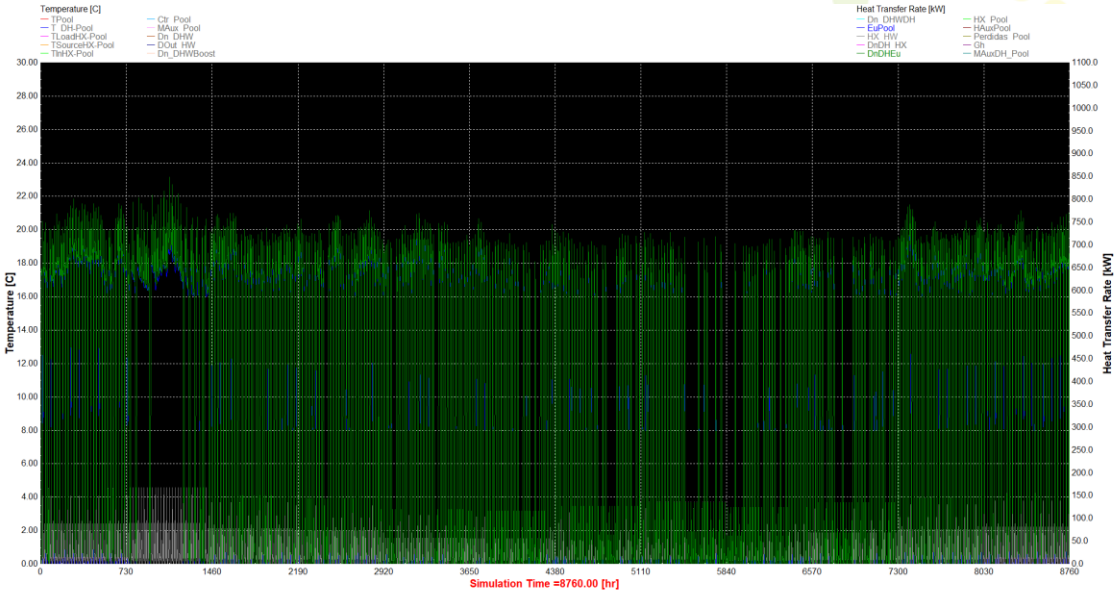

Figure7. Installation of network analyzers

2.2. Technological configuration

Renewable heat generation will be centralized using reversible water-water heat pumps connected to a very low-enthalpy open-loop geothermal probe. This configuration uses seawater extracted from a geothermal coastal survey as a means of transferring heat between the subsoil and the heat pumps, ensuring a stable heat source at an average annual temperature of approximately 21oC. In open-loop geothermal systems, seawater is extracted from a catchment well, its thermal energy is used and returned to a second discharge well with a maximum temperature increase/decrease between extraction and discharge of 5oC. Previous experiences in nearby areas determine that the permeability of the land is high, being able to obtain capacity in the range of 75-150 m^3/ h. In the area of action there are plots located within the limit of easement of coasts in which it would be possible to carry out a research survey to confirm the existence of capacity.

Heat pumps are based on the operation of a thermodynamic cycle in which the refrigerant gas changes state and is subjected to compression and expansion cycles that determine a transfer of thermal energy between a heat source at low temperature and another at higher temperature. In reversible heat pumps, a four-way valve makes it possible to modify the direction of circulation of the cooling fluid so that the equipment functions as a refrigeration machine.

In the case of the study, heat pumps will operate only in heat mode because most of the buildings connected to the network do not have centralized space air conditioning facilities. However, it is foreseeable that the demand for cold will become more important and for this reason a technological configuration has been planned to provide this service.

The heat transfer process to the grid is as follows:

a) Heat mode:

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- Geothermal **extraction and heat exchange:** Seawater permeates through the walls of the geothermal survey at an average annual temperature of 21°C and is pumped into a heat exchanger to transfer its thermal energy.
- **Expansion:** In the heat pump the cooling fluid passes through an expansion valve that decreases its pressure and cools it to a temperature lower than that of the external source (geothermal sounding).
- **Evaporator**: The energy from the geothermal probe is transferred to the heat pump evaporator and the coolant evaporates.
- **Compression:** In this phase the compressor increases the pressure of the refrigerant gas causing an increase in temperature.
- **Capacitor:** In the condenser the refrigerant gas yields heat and cools by changing to liquid state and returns to the expansion stage where it drastically loses pressure and temperature and the cycle starts again.
- **DH Drive Circuit:** The heat transferred in the condenser is transferred to the heat network that distributes it to the exchange substations of each building.
- DH return **circuit:** From the exchange substations of each building, the heating fluid is recovered to raise its temperature again to the operating temperature of the network.

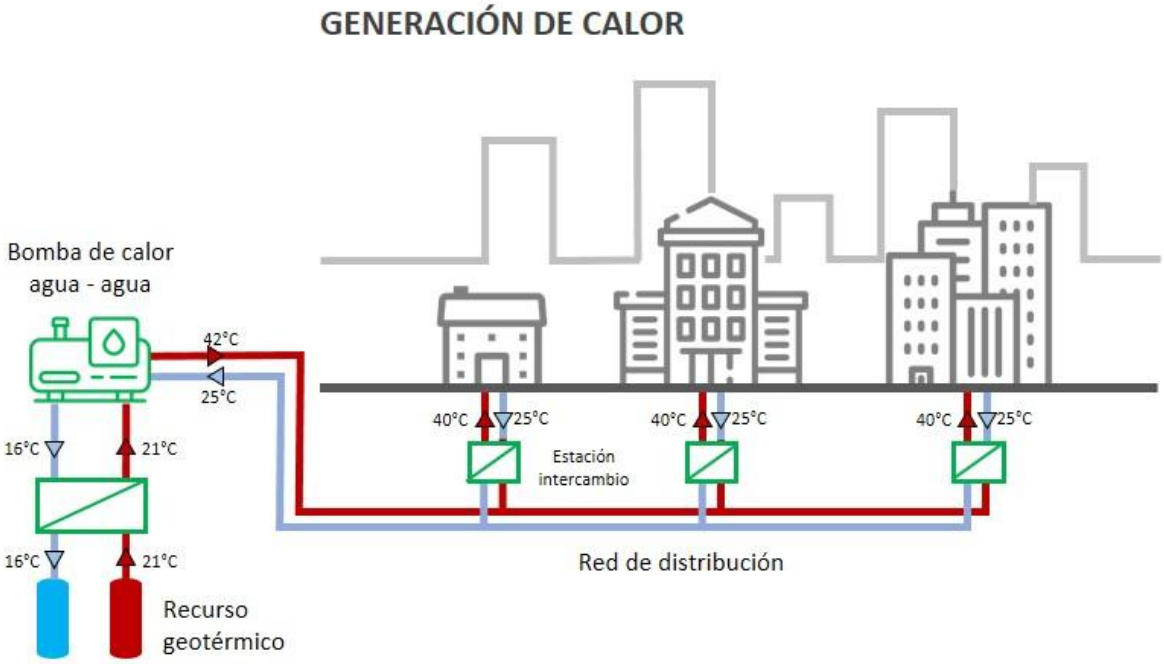

Figure8. Geothermal heat pumps in heat mode

b) Cold mode:

The operation is practically reversed, the insertion of deflection valves allows the role of the condenser and the evaporator to be reversed while keeping the direction of rotation of the compressor unchanged. In this case the geothermal heat source functions as a stable heat source at a temperature below room temperature.

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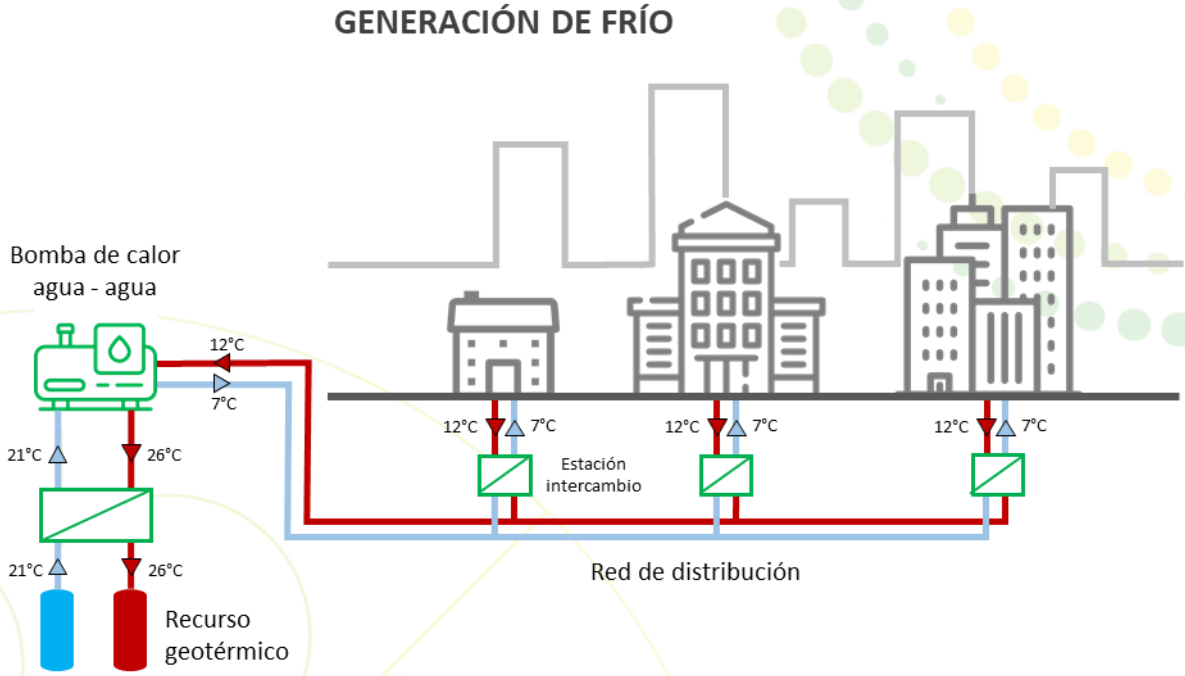

Figure9. Geothermal heat pumps in cooling mode

Geothermal heat pumps are of great interest because of the important benefits they offer:

1. High energy efficiency: By taking advantage of the thermal stability of groundwater, they achieve a higher coefficient of performance (COP).
2. Reduction of operating costs: Although the initial investment is high, the operating costs are lower than those of 23 individual air-water heat pumps.
3. Silent operation: Water-to-water heat pumps are quieter than existing individual air-to-water heat pumps.
4. Flexibility of application: They are suitable for both heating and cooling even with simultaneous generation in some hybrid designs.
5. Reduction of environmental impact: They reduce dependence on fossil fuels and use local renewable energy sources.

The low-temperature heat network that will connect the buildings will have a supply temperature of 42oC and a return temperature of 25oC. These operating temperatures have been selected both to service the heating of swimming pools and to allow the recovery of waste heat from the refrigeration equipment of hotels and commercial buildings that could be connected to the network.

To determine the technical configuration of the network, the demand profiles have been implemented in the nPro software https://www.npro.energy/, which is a web planning tool for the design of DH&C. The tool allows the planning by districts and the evaluation of different technological configurations as well as the realization of technical and economic feasibility studies of heat and cold networks. The results determine a heat network with a total length of 1100 meters, of which 800 meters correspond to the distribution network and 300 meters to the connections with the heat transfer substations of each building. The grid sizing takes into account the soil temperature profile to determine thermal losses. The soil temperature remains very stable throughout the year varying between 20 °C and 25 °C and thermal losses amount to 43.4 MWh/year that are added to the heat demand of buildings. The total volume of water contained in the DH system taking into account both the drive and return circuits is 5,1 m^3. The results show that the required geothermal extraction power is 657 kW and the generation capacity of water-to-water heat pumps is 791 kW (4018 hours at full load). The commercial equipment analyzed reached a COP of 5.9 in the operational conditions described and the electricity consumption of the water-water heat pumps plus that of the pumping system to distribute heat through the DH system is 556.5 MWh/year.

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In conventional DH systems a linear thermal demand density greater than 1.5 MWh/m indicates that the construction of a heat network can be economically viable, in the case of study a density of 2.9 MWh/year is reached.

Technical characteristics of the CER *ConnectHeat-Playa del Inglés* 5GDH system	
Generation capacity	791 kW
Geothermal extraction	657 kW
Annual heat generation	3177 MWh/year
Linear heat demand density	2.9 MWh/m
Length	1100 m
Drive temperature	42oC
Return temperature	25oC
Electricity consumption of the mains pumping system	19.5 MWh/year
Electricity consumption of the generation system	537 MWh/year
Volume of water contained in the network	5.1 m^3

Table1. Technical characteristics of the CER ConnectHeat-Playa del Inglés heat network

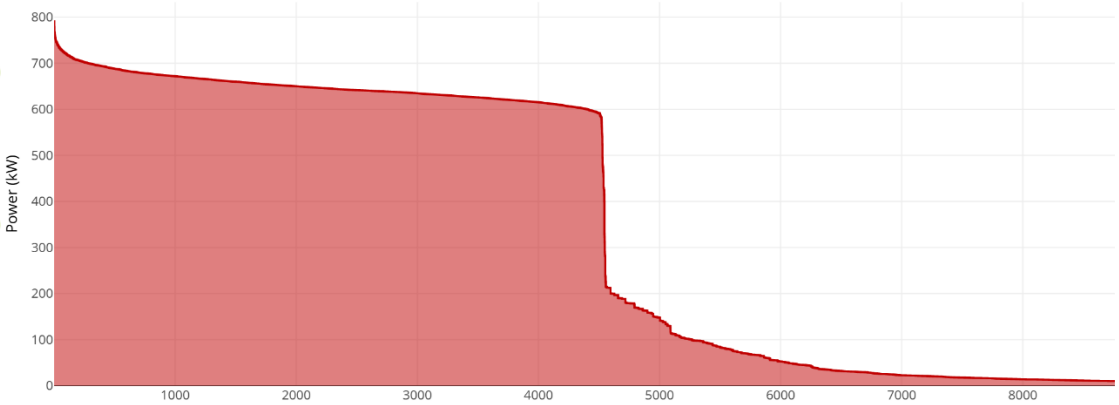

Figure10. Heat demand profile. Monotonous curve

The analysis of the electricity consumption of heat pumps shows that much of the consumption is required at night, an obstacle to the solar self-consumption of the DH system but an opportunity for the Energy Community to share photovoltaic generation among its partners. The CER will promote photovoltaic projects on roofs of nearby buildings in the form of collective self-consumption as established *by Royal Decree 244/2019 regulating the administrative, technical and economic conditions of self-consumption of electrical energy* up to 350 kW of installed photovoltaic power that would ensure 100% renewable heat generation. This power target may be lower depending on the recovery of waste heat that can be used by the network.

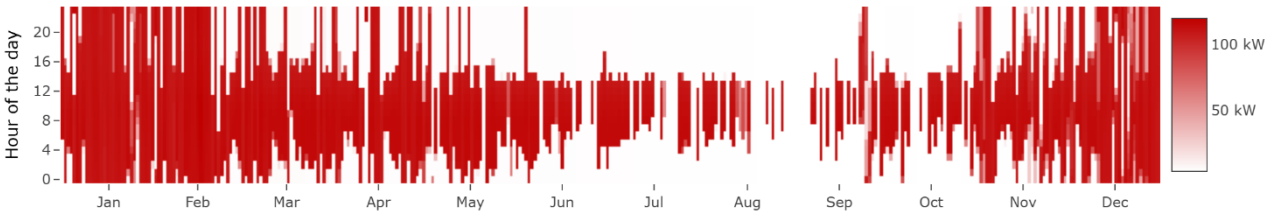

Figure11. Time distribution of electricity consumption

During the technical visits carried out in the initial phase of the project, the roof area available for the installation of photovoltaic plants was evaluated, noting that the availability is limited. Therefore, in a first phase of action, the implementation of a photovoltaic plant of 84 kW and 137 MWh / year of renewable generation is planned. The solar self-consumption of this photovoltaic plant will be 82.7%, which means reducing the electricity consumption of the heat network to 443.2 MWh/year.

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Technical characteristics of the first photovoltaic project of the CER *ConnectHeat-Playa del Inglés*	
Installed power	84 kW
Occupied area	400 m2
Renewable generation	137.0 MWh/year
Solar self-consumption	113.4 MWh/year (82.7%)
Network injection	23.6 MWh/year
Solar Autarchy	20,3%

Table2. Technical characteristics of the first photovoltaic project of the CER ConnectHeat-Playa del Inglés

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3. Costs and Benefits

3.1. Economic viability

The investment planned for the execution of the project is **1,588,317 euros** that are mainly destined to the generation hub (heat pumps, photovoltaic plant, geothermal probes and generation room) and represents 50.2% of the investment cost. The construction of the heat network accounts for 25.9% of the total investment and the transfer substations that connect the buildings with the DH system account for 12.1%.

For the analysis of the economic viability of the project, the dynamic model of Net Present Value (NPV) is used. The analysis considers the effect of inflation on income and expenditure by estimating a value of 2.4%, as an average of the Bank of Spain's forecasts for the financial years 2025 (2.5%), 2026 (1.7%) and 2027 (2.4%) and inflation in 2024 (2.9%). The annual increase in the price of electricity has been estimated at 3.28%, considering the price of electricity for non-residential consumers in Spain in the period 2017-2024 (Eurostat source).

The discount rate has been estimated at 8.6%, considering an opportunity cost of 3.05% as the average rate of government debt issued in May 2025 plus a project risk premium estimated at 3.0% and inflation of 2.4%.

The operating costs of the heat network in the first year of the project amount to €54,565.6, of which €42,994.4 are due to energy consumption and €11,571.2 are due to maintenance costs.

The forecast of revenues derived from the business lines of sale of renewable heat and electricity in the first year of the project is 138,101.5€:

- Heat: The price of energy supplied through the heat network (energyterm)has been set at €0.04/kWh, which is the average cost of generating heat for the heating of swimming pools that non-hotel establishments and residential buildings currently pay. The expected revenues for this concept are 128,368.6€/year. The established fee for access to thermal capacity (powerterm)is 9€/kW and the expected revenues for this concept are 7802,8€/year.
- Electricity: It is estimated that the sale price of surplus generation injected into the electricity grid is €0.08/kWh. The expected revenue from the sale of the surplus is € 1930.0/year.

In the economic viability analysis, a single fee for connection to the heat network of consumer and prosumers partners is counted in the first year, which represents an income of €24,504. It is also contemplated that the energy savings of the project be monetized in the Energy Saving Certificate System (CAE) of the Ministry for the Ecological Transition and the Demographic Challenge. The average price received by the initial owners of the savings is between 115 €/MWh and 140 €/MWh (CAE*Report - April 2025)*but it is expected that by the end of 2025 the financial equivalence will increase to 189.2 €/MWh and that the upward trend will continue in 2026 and 2027. The monetisation of the CAEs is accounted for in the economic viability analysis as an income of €97,438 in year 2.

In the economic feasibility analysis it is also considered that CER *ConnectHeat-Playa del Inglés* participates *in the National Incentive Program for singular pilot projects of energy communities (CE IMPLEMENTA)* managed by the Institute for Energy Diversification and Saving (IDAE) and obtains financial aid of 60% of the cost of the total investment of the project, which is the average value of the economic incentives approved in the last two calls. Under these conditions the initial investment is reduced to € 635,326.8

The Net Present Value (NPV) provides an estimate of the absolute net profitability of the project and for a period of 25 years reaches a value of **€463,754.1** while the Internal Rate of Return (IRR) stands at **16.8%** and the period of return of capital is **8.6 years.** The estimated LCOH (Levelized Cost Of Heat) is 0.034 €/kWh, which places the project as a competitive alternative to current generation solutions.

	Current technology scenario
Investment	1,588,317€
Planned expenditure 1st year	€54 565.6
Projected income 1st year	162,605,5€
CE Program Incentives Implements	€952,990.2 (60%)

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CAEs incentives	97.438€
Discount rate	8,6%
NPV	463.754,1€
TIR	16,8%
Payback	8.6 years
LCOH	€0.034/kWh

Table3. Results of the economic feasibility analysis

3.2. Renewable coverage and reduction of CO2 emissions

The technological configuration described determines that **86.0% of the energy distributed by the heat network is renewable** and that the efficiency of the system is even greater depending on the waste heat recovery capacity of hotel establishments and businesses. Energy *Efficiency Directive (EU) 2023/1791 sets out* criteria and a compliance timeline for DH&C systems to be considered efficient. Some of the established milestones are:

- *until 31 December 2027, a system using at least 50 % renewable energy, 50 % waste heat, 75 % cogenerated heat or 50 % of a combination of these types of energy and heat;*
- *from 1 January 2045, any system using at least 75 % renewable energy, 75 % waste heat or 75 % renewable energy and waste heat;*
- *from 1 January 2050, any system using exclusively renewable energy, exclusively waste heat or exclusively a combination of renewable energy and waste heat.*

The technological configuration of the 5GDH system of the CER *ConnectHeat-Playa del Inglés* meets the criteria established until 2050 to be considered an efficient DH&C system and in any case the CER will continue to promote photovoltaic projects in roofs of nearby buildings in the form of collective self-consumption and promoting the recovery of waste heat with the aim of achieving the objective of 100% renewable heat generation.

In the current scenario, the technology primarily used for the heating of swimming pools is the air-water heat pump and for the production of ACS, individual generation systems predominate, basically electric thermoses. The electricity consumption derived from the pool heating and preheating services of the ACS up to 40oC of the 23 non-hotel establishments and residential buildings in the area of operation amounts to 958.6 MWh/year and is responsible for the emission of 743.9 tCO_2 and the consumption of 2870 MWh/year of primary energy.

The heat network powered by the CER *ConnectHeat-Playa del Inglés* will provide these 2 services hybridizing renewable and high-efficiency technologies that reduce electricity **consumption to 443.2 MWh/year.** This implies that primary energy consumption decreases to 1327.2 MWh/year, while **CO2 emissions are reduced by 53.8% to 344.0 tCO_2**.

The results show that the aggregation of heat and cold demands in clusters connected by DH&C systems is a key strategy in the decarbonization of tourist centers, it is found that in the ConnectHeat-Playa *del Inglés* pilot case it is possible to reduce electricity consumption by half and CO2 emissions by 53.8%. Taking into account that the tourist accommodation sector is responsible for 14.0% of electricity consumption in the Canary Islands, promoting these actions implies obtaining economic, environmental and social benefits for the entire region. In addition, the proposed DH system will not only reduce the carbon footprint in the area of action but will enable and / or facilitate full compliance with the energy efficiency requirements of the current regulations that individually would not be viable both due to the lack of available covers and the technical and economic impossibility of undertaking a geothermal project individually.

	Current technology scenario	Heat network of the CER *ConnectHeat-Playa del Inglés*
Heat demand	3134 MWh/year	3177 MWh/year
Electricity consumption	958,6 MWh/year	443.6 MWh/year
Renewable coverage	69,4%	86,0%

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Primary energy consumption	2870.1 MWh/year	1327.2 MWh/year
CO2 emissions	743,9 tCO_2/year	344.0 tCO_2/year
Reduction of CO2 emissions	-	53,8%

Table4. Renewable coverage and reduction of CO2 emissions

3.3. SWOT analysis

SWOT analysis provides a comprehensive view of the project's strategic positioning by providing insight into its potential to generate long-term environmental, economic and social benefits, while identifying areas that require proactive risk management and optimization. This assessment serves as a basis for ensuring the viability and resilience of the project in a dynamic energy environment.

Strengths

- Energy independence: the availability of local renewable energy resources and the use of highly efficient technologies ensure less exposure to price volatility in energy markets.
- Environmental Impact: Annual savings in non-renewable primary energy consumption and CO2 emissions position the project as a key strategy for the decarbonization of urban tourist areas. It fosters synergies between network partners and the energy and environmental benefits deriving from collective generation. Improved branding/sustainable label.
- Economic Feasibility: The *ConnectHeat-Playa del Inglés* community power generation project shows good financial sustainability with a 25-year NPV of €463,754.1 and an IRR of 16.8%.
- Social benefits: The project improves the good energy practices of citizens and SMEs, strengthens access to energy at affordable and stable prices and combats energy poverty as there is a segment of the business sector with little capacity to address the necessary investments that determine compliance with decarbonisation requirements and market demands, which poses a potential risk of residentialisation and completion of its economic activity.
- Job Creation: It generates green and local employment opportunities during the construction and operation phases, strengthens the local economy and attracts investments.
- Technological innovation: The uniqueness and innovative nature of the project as well as its potential replicability in other tourist centers determine that the *ConnectHeat-Playa del Inglés* project is a key pilot case for the decarbonization of the sector and the technological transfer from hotels (large companies) to citizens and SMEs.

Weaknesses

- High Initial Investment: Assuming that the CE Implementa National Economic Incentive Program will contribute 60% of the investment cost, the CER must find formulas to finance the remaining 40%, green loans, issuance of participations, etc...
- Complexity of the project: Access to the geothermal resource as well as the execution of the works of the heat network on public roads require the obtaining of licenses and demanial concessions that could involve delays and / or modifications in the project. The complexity of the project makes it unfeasible for RES partners to develop and manage the heat network themselves, so it is necessary to identify a technological partner with technical capacity and experience to assume these tasks and define a solid governance model by establishing clear agreements between both parties. The technology partner can be an Energy Services Company that acts either as an energy supplier through an HPAs heat purchase agreement (Heat Purchase Agreements) or as a shareholder of an investee company created with the aim of developing and operating the project in which CER was the majority shareholder.

Opportunities

- Alignment with energy policies: The project is in line with European and national initiatives on decarbonisation and energy transition and institutional support and access to preferential financing is expected.
- Replicability: The project is a scalable model for the development of CERs in other national and European tourist centers.

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- Benefits against the generation of individual heat and cold: The aggregation of demand and the generation of heat and cold in a centralized way give access to multiple advantages such as: greater efficiency in generation; lower acquisition and operation costs; increased competitiveness of energy prices; increasing available space and reducing noise in buildings.
- Diversification of services: Rising energy costs and increasing demand for renewable solutions create a favourable environment for expanding RES services by integrating energy storage, sustainable mobility or energy efficiency actions.
- Local urban planning: There are different instruments that urge the renovation of consolidated tourist centers such as Playa del Inglés. At regional level, Regulation*No 2/2013 of 29 May 2013 on the renovation and modernisation of tourism in the Canary Islands provides* incentives for building and bed increases for hotel complexes that are renovated provided that they meet requirements for architectural quality and energy efficiency that are higher than those laid down in the legislation. On the other hand, the Improvement and Modernization Plan of Playa del Inglés is under preparation.

Threats

- Adaptation of thermal installations in buildings: Heat exchange substations must be installed in the buildings of the consuming partners and their thermal installations must gradually evolve towards centralized systems of production of ACS and air conditioning of spaces. The RAC should provide technical advice and the regional administration should incentivise the renovation of thermal installations to facilitate the operation of the DH system.
- Political and legislative risks: Changes in the regulatory framework in the energy field or the reduction of economic incentives for RES negatively affect the development of the project.
- Area close to protected ground: The area of deployment of the heat network is close to the *Maspalomas Dunes Special Nature Reserve,* an area of special protection, not intended for urban development and subject to strict regulation to protect the environment, natural resources and biodiversity, which makes the location of the heat generation hub difficult.
- Shortage of available decks: Densely urbanized area with few buildings with roofs available for photovoltaic integration.

4. Community model

4.1. Organisational and management structure

Spanish law does not establish a specific legal figure for RES and they can take any of the forms provided for in the legal system provided that their corporate purpose is in accordance with the definition of RES and that it is guaranteed that they are compatible with the requirements established (Article 22, Directive 2018/2001, RED II): *A renewable energy community is a legal entity based on open and voluntary participation, autonomous and effectively controlled by partners or members that are located in the vicinity of renewable energy projects owned and developed by that legal entity, whose partners or members are natural persons, SMEs or local authorities, including municipalities and whose primary purpose is to provide environmental, economic or social benefits to its partners or members or the local areas where they operate, rather than financial gains.*

The Spanish legal figures that best fit the definition of CER are Associations and Cooperatives.

- Partnerships have democratic governance but are not specifically designed to manage business activities, which could create uncertainty in complex energy projects. Their structure is oriented towards obtaining social, non-economic purposes and they are limited in the collection of resources, depending to a large extent on grants or donations, which can affect the financial sustainability of the CER. It is the figure usually adopted by smaller RES operating in the field of residential collective photovoltaic self-consumption.

- Cooperatives are designed to conduct business activities in a manner compatible with meeting social and environmental objectives by ensuring an equitable distribution of economic, social and environmental benefits among their members or their reinvestment in the community. Decision-making follows the principle of "one partner, one vote", ensuring democratic governance even in complex economic projects. They allow a more efficient management of resources and can issue shares to attract external financing.

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They are contemplated in the legislation as economic entities that can operate in specific markets, such as energy, with a clear and defined legal framework (Law 4/2022, of 31 October, on Cooperative Societies of the Canary Islands).

The ConnectHeat-Playa *del Inglés* community energy project will adopt the legal status of ***a not-for-profit Consumer and User Cooperative.*** *Cooperative* societies are made up of natural and legal persons who are associated, under the regime of free accession and voluntary withdrawal, for the performance of business activities aimed at meeting their economic and social needs, with variable capital and democratic structure and management. The organisational and management structure shall take into account the provisions of Law 4/2022 of 31 October 2022 on Cooperative Societies of the Canary Islands.

The corporate purpose of the *ConnectHeat-Playa del Inglés* Energy Community will be the supply of renewable heat, cold and electricity generated in facilities owned by the Energy Community, for the use and consumption of the partners and of those who live with them, with the ultimate aim of providing environmental, economic or social benefits to their partners or members or to the local areas where they operate, instead of financial gains.

For the development of the corporate purpose, the cooperative may carry out the following activities:

- The generation and distribution of heat and cold from renewable energy sources or waste heat recovery.
- The generation of electricity from renewable energy sources.
- The aggregation of demand, storage, distribution of products and the provision of related services including research, design, engineering, development, construction, operation, maintenance and disposal activities, analysis services, engineering studies or energy, technical, legal and economic consultancy necessary to develop such services and facilities, whether owned or operated by third parties. The Cooperative may develop its corporate purpose directly or indirectly, including through participation with other companies.
- To seek in the best conditions of quality, information and price, goods and services related to energy saving for the consumption or use of the partners and, where appropriate, of those who live with them habitually.
- Carry out all the necessary activities to promote the information, training and defense of a new energy model that promotes a transformative and fair energy transition based on energy efficiency and the distributed development of renewable energies, as well as to favor the defense of the rights and the participation of consumers and users in this energy model.
- Constitute and manage a **Renewable Energy Community,** in accordance with the definition established in *Royal Decree-Law 23/2020 of 23 June 2020 approving measures in the field of energy and in other areas for economic reactivation, by amending several articles of Law 24/2013 of 26 December 2013 on the Electricity Sector, and/or,* where appropriate, any other applicable local, regional, national or supranational regulations, provisions or regulations.

The CER *ConnectHeat-Playa del Inglés* will have **a democratic governance based on the principle of "one partner, one vote",** which ensures autonomy in internal decision-making. The participation model shall ensure the principles of inclusion and equity among partners.

The **Articles of Association of the CER *ConnectHeat-Playa del Inglés*** will set the minimum share capital and the minimum mandatory contribution to the share capital to acquire the status of member, which may be different for the different types of members in proportion to the commitment or potential use that each member assumes of the cooperative activity. The Articles of Association shall also lay down the criteria for determining the compulsory contribution to be made by new members who are incorporated after the establishment of the CER. The Articles of Association shall regulate the functioning and operation of the CER, the rules of discipline and the rights and duties of the members. The main purpose of the RAC will be to provide renewable heat/cold and electricity to its members, although it will be able to carry out cooperative operations with non-member third parties, within its scope of action. The cooperative society shall be established by public deed and shall be entered in the **Register of Cooperative Societies of the Canary Islands ,** acquiring legal personality.

Within the scope of the ConnectHeat-Playa *del Inglés* CER, 3 types of partners will be established:

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1. **Consumer partner:** Member of the CER *ConnectHeat-Playa del Inglés,* connected to the heat network that benefits from renewable heat generated at a fair and stable price in exchange for a monthly economic fee.
2. **Prosumer partner :** Member of the CER *ConnectHeat-Playa del Inglés* that in addition to consuming energy, actively participates in community generation through its own or shared facilities. Your active participation will allow you to access the benefits defined in the Statutes of the CER.
3. **Partner:** Members of the CER *ConnectHeat-Playa* who are not energy consumers and therefore cannot participate in the cooperative activity but contribute to obtaining the corporate purpose of the CER by making contributions to capital, transfer of facilities and / or technical or strategic support.

The governing bodies of CER *ConnectHeat-Playa del Inglés* shall be the **Governing Council** and the **General Assembly.** The Governing Board is the administrative body in charge of managing and representing the CER and the General Assembly is the supreme decision-making body where strategic decisions are made, such as the approval of statutes, annual accounts and election of positions, meeting at least once a year. The intervention is the audit body of the CER and exercises this function in accordance with the statutes and Law 4/2022, of 31 October, on Cooperative Societies of the Canary Islands. The statutes or, failing that, the General Assembly, shall regulate the organization and internal functioning of the Governing Council, as well as that of the commissions and committees that may be created and the powers of the delegated counsellors.

	Main functions	Characteristics
General Assembly:	- To approve the statutes, their amendments and the internal regulations. - Elect, renew and dismiss the members of the Governing Council and other bodies. - Approve the annual accounts, the distribution of surpluses and the compulsory quotas. - Decide on strategic issues, such as major investments, merger, division or dissolution of the cooperative.	- Each member has the right to one vote, regardless of its contribution to the capital. - It meets on an ordinary basis at least once a year, and on an extraordinary basis when necessary. - Decisions are taken by a majority, as set out in the statutes.
Governing Council:	- Exercise the legal representation of the cooperative. - Direct economic and administrative activities. Propose strategic policies and implement the decisions of the General Assembly. - Ensure compliance with the statutes and applicable regulations.	- The articles of association shall establish the composition of the governing board, the number of which may not be less than three: Chair, Vice-Chair and Secretariat. - Its members are elected by the General Assembly from among the members, by secret ballot and by the largest number of votes, for a term of not less than 3 years, and not more than 6. - Agreements must be adopted by more than half of the votes validly expressed.
Intervention:	- Review the annual accounts and ensure their transparency. - To report to the General Assembly on the economic situation of the cooperative. - Monitor the correct application of surpluses and the legality of operations.	- They shall be elected by the General Assembly by secret ballot and by a simple majority of the members of the EC. - The statutes shall lay down the number of persons involved, which may not exceed 3. - In EC with less than 10 members it will not be mandatory to constitute an intervention body, unless required by the statutes or the Assembly decides. Instead, external audits may be used if approved by partners.

Table5. Governing bodies of the CER-ConnectHeat-Playa del Inglés

CER *ConnectHeat-Playa del Inglés* shall aim **to provide environmental, economic or social benefits to its partners or to the area where the renewable heat network is deployed.** In the case of obtaining economic benefits, these will be destined to the Compulsory Reserve Fund (at least 20%) and the Education and Promotion of Cooperatives

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Fund (at least 5%), while the remaining 75% will be available to the General Assembly that can allocate them to reserve funds for the development of renewable energy projects, to training campaigns and recruitment of new partners or to the participation of salaried workers in the cooperative results.

4.2. Business model

The *ConnectHeat-Playa del Inglés* community energy project will generate renewable heat, cold and electricity that it will distribute among its partners through a heat network owned by the Energy Community and through the electricity grid through collective self-consumption. The business model assesses the financial sustainability of the community energy project by looking at the investments, expenditures and expected revenues.

The **share capital of the CER *ConnectHeat-Playa del Inglés*** will consist of the compulsory and voluntary contributions of the members:

- Mandatory contributions to share capital: The Articles of Association shall fix the minimum mandatory contribution to the members' share capital, which may be different for the different classes of members or in proportion to the commitment or potential use that each member makes of the cooperative activity. The Articles of Association shall establish whether the compulsory contributions to the share capital give rise to the accrual of interest and shall regulate the reimbursement of contributions to the share capital in the event of withdrawal.
- Mandatory contributions to the share capital of new members: The General Assembly shall fix the amount of the minimum mandatory contribution of new members and the conditions and deadlines required. The amount of these contributions may not exceed for each type of partner the discounted value resulting from applying the consumer price index (CPI) for each year to the highest contribution for each type of partner.
- Voluntary contributions to share capital: The General Assembly may agree on the admission of voluntary contributions to the share capital by the members. The agreement shall lay down the maximum overall amount and the conditions.
- Compulsory extraordinary contributions to share capital: The General Assembly, by a two-thirds majority of the votes present and represented, may agree on the requirement for new mandatory contributions, setting their amount, term and conditions. Members who have paid voluntary contributions made previously may apply them, in whole or in part, to meet the new mandatory contributions required. They are of a one-off nature and are intended for the implementation of new renewable energy projects and/or exceptional situations that put the financial stability of RES at risk.

The **CER *ConnectHeat-Playa del Inglés* will work to seek the necessary funding** to execute its renewable energy projects. The most interesting options available are:

- Public funding: The short-medium term objective is to participate in the *National Incentives Program to singular pilot projects of energy communities (CE IMPLEMENTA)* managed by the Institute for Energy Diversification and Saving (IDAE). The aid provided for the boost to CER would reduce the investment cost of the Community renewable heat generation and distribution project by up to 60%. On the other hand, the CER plans to monetize the energy savings of the project in the Energy Saving Certificate System (CAE) of the Ministry for the Ecological Transition and the Demographic Challenge (Government of Spain).
- Private funding: Through green loans, publicly guaranteed funds or through a commercial agreement with a technology partner that acts either as an energy supplier through an HPAs heat purchase agreement (Heat Purchase Agreements) or as a shareholder of an investee company created with the objective of developing and operating the project, in which CER *ConnectHeat-Playa del Inglés* was the majority shareholder.
- Other funding: The General Assembly may authorize the issuance of equity securities, which may be considered transferable value, through which the subscriber makes an economic contribution for a certain time acquiring the right to the corresponding remuneration that, according to the conditions established in the issuance, may be in the form of fixed, variable or mixed interest.

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- Crowfunding: The General Assembly can authorize the search for collective financing online, regardless of usual financial intermediaries such as banks, to obtain the economic impulse through donations whose motivation can be altruistic and / or in exchange for some type of reward related to the project.

The **cost structure of the CER *ConnectHeat-Playa del Inglés*** is as follows:

- Start-up costs: They are prior to the constitution of the CER *ConnectHeat-Playa del Inglés* and include the hiring of expert advisory services, the elaboration of technical projects, the expenses of constitution and formalization of the CER and the realization of dissemination campaigns and recruitment of partners.
- Operational expenditure: They are associated with the operation and maintenance of the renewable generation equipment and facilities owned by the CER *ConnectHeat-Playa del Inglés*, the insurance of the facilities, the amortization of the investment, the administrative management and the dynamization of the Energy Community.
- Financial expenditure: Associated with the financial interests derived, where appropriate, from obtaining a bank loan.

The **revenue structure of the *CER ConnectHeat-Playa del Inglés*** which is not part of the share capital and therefore not reimbursable is as follows:

- The membership fees, the amount of which will be fixed by the Articles of Association or the General Assembly and may be different for the different classes of members. The amount of access fees for new members may not exceed twenty-five percent of the current fees.
- Payments by partners for access to renewable energy, heat, cold and electricity services, which will be subject to the conditions set by the General Assembly.
- Revenue from the discharge of surpluses into the electricity grid.
- Revenue from the sale of cooperative services to non-member third parties.

Although it will be for the General Assembly to decide on the tariff structure, in order to assess the economic viability of the project, a tariff structure has been proposed based on the type of energy consumed (heat and electricity) and the type of partner (consumer or prosumer).

- **Renewable heat/cold supply**: Only the figure of consumer partner is considered. Since the network will distribute heat at 40oC for pool heating and the surface area of the pools does not vary significantly between the network partners, energy packages will not be established according to power ranges. The access fee to the heat network will be paid in a single payment of € 500. The heat transfer substations of the buildings and their connection to the heat grid are covered by the overall investment of the project and will be owned by the RAC. The tariff model will be defined by a fixed term depending on the contracted power and a variable term that will count the energy consumed.
  - Fixed term: The cost established according to the contracted thermal power is 9€/kW.year.
  - Variable term: The cost established by the consumption of renewable heat is 0.04 €/kWh which is the average cost of heat generation for the heating of swimming pools that non-hotel establishments and residential buildings currently pay.

  In the area of action of the heat network are located 5 hotel establishments of 3, 4 and 5 stars and 1 shopping center with which the CER *ConnectHeat-Playa del Inglés* can carry out cooperative operations (non-member third parties). In these cases, the network will be able to supply cold at 25oC and recover waste heat, although with the information currently available it is not possible to quantify the surplus heat recoverable. In any case, it is considered that hotels and shops will be interested in accessing the 5GDH system and for this reason in the initial economic feasibility study only the initial access fee to the service that has been established in € 2000 / connection has been computed.
- **Renewable electricity supply:** The CER *ConnectHeat-Playa del Inglés aims in the* medium-long term to achieve a photovoltaic power of 350 kW so that solar production exceeds the electricity consumption of heat pumps and ensures 100% renewable heat production. The lack of available roofs in the area of action

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means that in a first phase only an 84 kW photovoltaic plant will be included, the production of which will be entirely self-consumed by the heat generation hub. The RES will give access to the supply of renewable electricity to its partners to the extent that it can incorporate greater photovoltaic power. The access will be divided into energy packages designed to meet both the figure of the consumer partner and that of prosumer partner and if it is residential or SME.

- Consumer partner: The energy packages are established according to the contracted power giving access to renewable electricity without having to have an own photovoltaic installation.
  - Residential: Energy packages of 1 kW are established. The cost will be 6,25 €/month.
  - SMEs: Energy packages of 5 kW are established. The cost will be 25 €/month.
- Prosumer partner: The energy packages are associated with a single initial investment with the possibility of transferring part of the renewable production and receiving economic compensation. The compensation mechanism will be based on the total energy transferred at a rate of €0.10/kWh.
  - Residential: An initial investment of 1800 €/kW (3 – 5 kW) is established.
  - SMEs: An initial investment of 1300 €/kW (10 – 50 kW) is established.

4.3. Project Roadmap

The formation of an Energy Community requires a structured approach that guarantees its technical, economic and legal viability as well as cohesion among its partners. It is necessary to create the framework, inform people and organize them in a model that allows them to participate actively in the energy transition, to be able to carry out the necessary learning and make their decisions in the key of environmental, social and economic sustainability.

The *ConnectHeat-Playa del Inglés* community energy project has been completing different stages, starting with the assessment of the local energy context and identification of available resources, the realization of promotion campaigns and dissemination of information among the main actors involved, the design of specific training seminars, the definition of a transformative renewable generation project that provides multiple economic, social and environmental benefits for the partners and for the area where the heat network is deployed, the recruitment of partners and the identification of a motor group of natural and legal persons interested in constituting a Renewable Energy Community to promote the community project and that make up the Community Energy Board (CEB). The CEB is made up of 4 tourist SMEs, 1 Community of Owners of a residential building with 24 homes and the Federation of Hospitality and Tourism Entrepreneurs of Las Palmas, FEHT.

The community power generation project is open to the participation of other citizens and SMEs located in the area of deployment of the heat network: 7 residential buildings representing 125 homes and 11 extra-hotel complexes. The 5 hotels and 1 shopping center located in the area of action, categorized as Large Companies, will not participate in the governance of the community project but the CER will promote cooperative operations with them in order to integrate waste heat into the heat network, thus increasing the energy efficiency of the project and facilitating the decarbonization of the area of action. The local and regional Public Administration (Ayuntamiento de San Bartolomé de Tirajana and Cabildo de Gran Canaria) have supported the community energy project with advice and information on available public spaces, permits and licenses necessary for the transfer of spaces and / or equipment and currently value their participation as non-consuming partners. The ITC has led the community energy project since its inception and will continue to advise the motor group although its legal status prevents it from participating as a partner of the CER.

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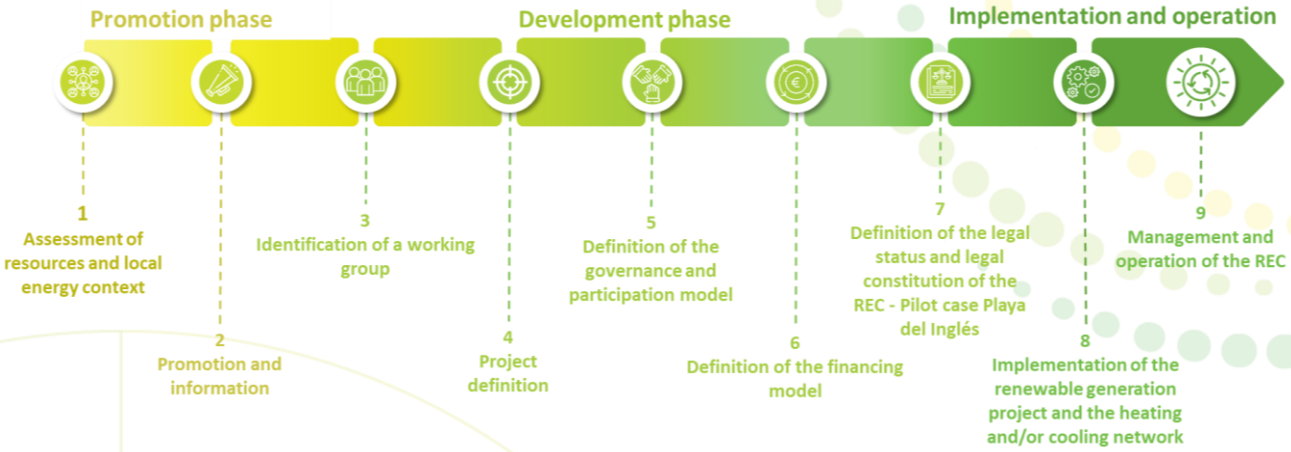

Figure12. CER ConnectHeat-Playa del Inglés Roadmap

The CEB has requested a grant from the *ORDER of 26 August 2024 establishing the regulatory bases and the call for grants on a non-competitive basis for the creation and operation of energy communities, within the framework of the Sustainable Energy Strategy in the Canary Islands (Programme 2, Line 2), under the European financing instrument 'Next Generation EU' funds, within the framework of the Recovery, Transformation and Resilience Plan (Component 7, Investment 2).* The aid requested will be allocated entirely to the costs of legal advice, the process of constitution of the CER and the elaboration of the technical projects necessary to request the demanial concession of access to the public roads through which the heat network passes and the demanial concession of the public plot located in the Servidumbre de Protección de Costas where the execution of the geothermal surveys is proposed.

The CEB is currently working on the definition of the governance and participation model based on democratic principles, specifying the roles and rights of the different types of partners (consumers, prosumers and collaborators) and on the search for public and private funding to implement the project. The short-medium term objective is to obtain the necessary access permits and demanial concessions to attend the *National Incentive Program to singular pilot projects of energy communities (CE IMPLEMENTA)* managed by the Institute for Energy Diversification and Saving (IDAE). The planned aid would reduce the investment cost of the Community project by up to 60%.

The CER *ConnectHeat-Playa del Inglés* will also promote photovoltaic generation projects in the form of collective self-consumption (RD 244/2019 and RD 18/2022) in roofs of buildings located a maximum of 2 kilometers away from the heat generation hub. In this way, citizen participation in the community generation project is actively encouraged and the renewable contribution to heat generation is increased.

In addition to the activities in the energy field associated with the generation of renewable heat and electricity, CER *ConnectHeat-Playa del Inglés* also plans to develop and promote social and environmental activities such as workshops on energy efficiency and responsible use of resources or advice for the replication of the community generation project in other areas.

4.4. Risks

The implementation of the *ConnectHeat-Playa del Inglés* community power generation project faces various risks that can affect its technical feasibility and economic sustainability.

From the legislative and territorial point of view, the project is affected by urban planning that is not consistent with the carbon footprint of the activity that takes place in the territory and this makes it difficult to find plots and / or public spaces that allow the installation of the renewable heat generation hub. It also makes it difficult to

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obtain demanial concessions to act on the public road in which the heat network is deployed or to access public roofs for the installation of photovoltaic generation plants.

In the technological field, the *ConnectHeat-Playa del Inglés* community energy project has the advantage that SMEs and citizens of the area of action have been using aerothermal heat pumps supported with solar thermal and / or photovoltaic energy systems for the air conditioning of their pools for years, there are solar heat generation plants with more than 20 years of age that continue in operation. There are no geothermal projects of very low enthalpy in the area of action but there are success stories of its use in hotels on the islands and there are Energy Services Companies (ESEs) and local engineering and installation companies with technical capacity and resources to execute these projects. However, there is no experience in the execution and operation of heat networks in the Canary Islands and the ESEs that operate most of the heat networks in Spain use a business model that in principle is not compatible with the philosophy of a community power generation project.

From a geological point of view there is a risk associated with the availability of the geothermal resource of very low enthalpy in the area planned for the execution of the drilling. Although the plot of action is within the limit of coastal servitude and previous experiences in nearby areas determine that the permeability of the land is high, the volcanic nature of the Canary Islands determines that the hydrogeological characteristics of the land vary significantly between geographically close areas. The presence of basaltic castings in the subsoil of the drilling area would make it impossible to access the geothermal resource.

Another risk factor is the change in energy policies that may change priorities in the support of Energy Communities projects and would compromise the economic viability of the project or changes in the local and regional public administration that could hinder or delay the approval of licenses and / or demanial concessions.

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