

Heat Pump Awards 2026

Application submission

AIGUATERM

UNIVERSITAT POLITÈCNICA DE VALÈNCIA | Innovation Award

1. Application overview

Award category	Innovation
Title of the project	AIGUATERM
Organisation Name	UNIVERSITAT POLITÈCNICA DE VALÈNCIA
Exact address of the project	Camí de Vera s/n Building 5N, 46022 València.
Funding	Public
Organisations involved in the project	Universitat Politècnica de València (UPV) (Public Research University - Project Lead) EMIVASA - Empresa Mixta Valenciana de Aguas, S.A. (Valencia Municipal Water Utility) Instituto Tecnológico de la Energía (ITE) (Energy Technology Institute) Geminis Tools S.L. (TIC & Sustainability Consultancy)
Project ending date	25/03/2026
Project website	https://www.itaca.upv.es/aiguaterm/
Sector of application	Commercial; Public buildings

2. Applicant & EHPA contact details

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EHPA member involved	Universitat Politècnica de València (UPV)
Role of EHPA member	UPV leads the conceptual definition, assessment and results analysis of the ECHO system, including KPI definition, energy scenario analysis, and the development of the integration and management concept for thermal energy storage systems.

3. Project description and benefits

Project description (goal, problem addressed, and solution provided by the heat pump)

Cities rely on multiple infrastructures for their daily operation—sewer networks, groundwater drainage systems, metro pumping facilities or, in some cases, secondary water networks. These systems continuously transport or manage water and therefore represent an often-overlooked source of thermal energy. Aiguaterm explores how existing urban infrastructure can be

transformed into a renewable heat source and sink for heat pumps, adding an energy function without compromising its original purpose. The concept has been demonstrated in València, where the city operates a low-pressure non-potable water network for irrigation, street cleaning and other municipal uses. A full-scale pilot at the Universitat Politècnica de València integrates a reversible 5–22 kW water-to-water heat pump, a plate heat exchanger and two 3,000-litre buffer tanks through a hydraulic bypass. The system provides heating and cooling to a real university classroom, achieving COP values between 4 and 6, with negligible hydraulic impact (~0.01 bar pressure loss) and no detected deterioration in water quality. Beyond the pilot, EPANET and GIS analyses assessed 154 km of network, identifying 315 public buildings with potential for connection and demonstrating the urban scalability of the concept.

Expected or achieved benefits

- High Reversible Efficiency: Reaches equivalent energy COPs of 4.44–4.63 in heating and monitored EERs of 2.8–3.3 (up to 3.29 filtered) in cooling.
- Electricity Savings: Reduces HVAC electricity consumption by 55% compared to conventional aerothermal systems.
- Low Infrastructure Impact: Induces negligible pressure drops (~0.01 bar) and zero water quality degradation, fully preserving irrigation use.
- High Urban Scalability: Reuses existing underground networks without boreholes or outdoor units, identifying 315 connectable municipal buildings in Valencia.

Obstacles/barriers encountered during development

- T1. Mismatch between irrigation and HVAC schedules: Irrigation flow occurs mostly at night or early morning, whereas building climate demand occurs during daytime classroom hours. Resolution: Integrated two 3,000 L buffer storage tanks (6,000 L total) to decouple water extraction from immediate HVAC operation.
- 2. High network pressure and raw water impurities: Operating network pressures reached up to 6 bar (exceeding the heat pump's 3 bar limit) and untreated well water carries suspended solids. Resolution: Installed an intermediate plate heat exchanger to hydraulically isolate the heat pump from raw water pressure and impurities.
- 3. Sensor and instrumentation commissioning errors: Initial pressure sensors operated out of range, and primary flowmeter Q1 suffered a factory calibration error. Resolution: Replaced pressure sensors with higher-range models and re-calibrated flowmeter communication to secure fully traceable monitoring.
- 4. Additional civil works and site layout: The only viable connection point to the campus pipeline was located at the far side of Building 5N. Resolution: Extended PE100 piping along the basement ceiling with minor budget and schedule adjustments.

Why should this project win an award?

AIGUATERM offers an innovative approach to decarbonising heating and cooling by combining a mature and reliable technology—the heat pump—with thermal resources already available within cities.

Its main innovation lies in using existing urban infrastructure without affecting its original function, reducing the need for major new infrastructure and limiting additional investment. In Valencia, the project demonstrates this concept by using a secondary non-potable water network as a heat source and sink.

The same approach can be extended to other water-related urban infrastructures, providing cities with a practical, low-impact and highly replicable pathway for the energy transition.

4. Technical specifications

Capacity of unit(s)	5-22 kW
Energy sources used	Operational Power: Electricity. Thermal Energy Source/Sink: Water from an urban secondary non-potable network.
Coefficient of Performance (COP)	HEATING MODE (COP): • Achieved Figure: Equivalent energy COP of 4.44–4.63. • Outdoor Air Temperature (Text): Daily fluctuation between 7.0 °C and 20.0 °C (8.0 °C–16.0 °C during operation). • Secondary Network Water Temp (T1, T2): Stable between 15.0 °C and 18.0 °C. • System Setpoints: Classroom indoor setpoint of 21.0 °C; Heat pump hot water supply setpoint of 40.0 °C. COOLING MODE (EER): • Achieved Figure: Energy EER between 2.80 and 3.30. • Outdoor Air Temperature (Text): Daily fluctuation between 21.4 °C and 38.1 °C (28.0 °C–37.5 °C during operation). • Secondary Network Water Temp (T1, T2): Stable between 19.0 °C and 27.0 °C. • System Setpoints: Classroom indoor setpoint of 24.0 °C; Heat pump chilled water supply setpoint of 10.0 °C–14.0 °C.
Service provided	The Heat pump is used for heating and cooling.
Refrigerant type	R410A

Heat pump details (compressor technology, heat exchanger, system configuration)

HEAT PUMP DETAILS: • Model & Capacity: Single Ecoforest ecoGEO B4 5–22 HTR reversible water-to-water heat pump delivering 5 kW to 22 kW in heating and cooling modes (R410A refrigerant). • Compressor Technology: Inverter-driven variable-speed hermetic Copeland scroll compressor with continuous capacity modulation from 15% to 100%. • Heat Exchanger Type & Materials: Internal Alfa Laval brazed plate heat exchangers constructed with AISI 316 stainless steel plates (serving as evaporator, condenser, and HTR). • System Configuration: Single-stage reversible vapor-compression refrigeration cycle equipped with an integrated 4-way valve for active heating/cooling, and an integrated High Temperature Recovery (HTR) system.

5. Renewable energy integration and grid response

Integration of renewable energy sources

Renewable energy is integrated through two sources: the municipal non-potable water network, used as a stable low-temperature heat source/sink for the water-to-water heat pump, and on-site solar PV, which offsets part of the heat pump's electricity demand. Using water at relatively stable temperatures (16–25 °C) instead of outdoor air improves operating conditions, increasing efficiency and reducing climate-control electricity consumption by around 55%.

Response to energy demand / smart grid integration

1. Response to Energy Demand: • Inverter Modulation: Scroll compressor modulates continuously (15%–100%) to match classroom thermal load in real time. • Thermal Buffer: 6,000 L storage tanks decouple heat extraction from immediate HVAC demand, absorbing load spikes.

2. Smart Grid & Load Management: • SG Ready Control: Heat pump controller supports SG1–SG4 modes for off-peak thermal storage and peak load shedding. • IoT Automation: Modbus TCP/PLC enables schedule-based operation (08:00–20:00) and Building Energy Management System (BEMS) integration. • Solar PV Alignment: Daytime operation maximizes self-consumption of rooftop solar generation.

6. Innovation, monitoring and replicability

General (all awards)

Why the project is innovative *(all awards)*

• Mature Technology, Innovative Integration: The project utilizes a mature, commercial water-to-water (geothermal) heat pump technology, but introduces an innovative solution by harnessing an existing municipal infrastructure—the secondary non-potable water grid—as its renewable thermal energy source and sink. • Key Value: By recovering energy from local groundwater already circulating beneath the city for irrigation, it eliminates expensive geothermal drilling and bulky outdoor aerothermal units, achieving high efficiency without disrupting primary water service or quality.

Monitoring approach (performance, cost, and carbon targets) *(all awards)*

Installed Sensor Infrastructure: Temperature Sensors: Continuous monitoring of water temperatures across all key process points (secondary water network connection, 6,000 L thermal storage tanks, intermediate plate heat exchanger, heat pump source circuit, and space-conditioning loop), as well as indoor, basement, and outdoor ambient temperatures. Flowmeters: Industrial ultrasonic and electromagnetic flowmeters continuously measure volumetric flow rates across all hydraulic loops. Pressure Transmitters: Differential pressure sensors track line pressures and pressure drops across heat exchangers and the network bypass. Electrical and Thermal Meters: Digital power meters measure active electrical energy consumption for the heat pump compressor, circulation pumps, and classroom fan-coil units, while thermal calorimeters measure thermal power delivered or extracted. Data Processing Pipeline and Architecture: Data Acquisition (PLC): A central industrial PLC gathers raw sensor signals via industrial communication protocols. Preprocessing (Node-RED): A Node-RED integration layer organizes variables, converts units, and calculates real-time thermal power and performance metrics. Data Storage (InfluxDB): Cleaned time-series records are logged in an InfluxDB database optimized for IoT data. Visualization and Control (WebIQ and Grafana): WebIQ provides real-time SCADA supervision and system control, while Grafana dashboards display historical analytics and performance indicators.

For Innovation Award

Technology/technique developed solely for this project *(Innovation Award only)*

Yes. While the main equipment consists of mature commercial technologies, AIGUATERM developed project-specific integration and planning solutions.

Urban infrastructure valorisation and GIS planning tool: A dedicated methodology and GIS-based tool were developed to identify and prioritise buildings that can use existing urban water infrastructure as a thermal source, combining spatial, hydraulic and building-demand data.

Low-impact hydraulic integration: A specific bypass configuration was designed to connect

building HVAC systems to the pressurised secondary water network without disrupting its primary service or affecting water quality.

The project's innovation therefore lies in enabling existing urban infrastructure to provide an additional energy function with minimal intervention and using proven heat-pump technology.

Differentiation from state-of-the-art solutions & market maturity *(Innovation Award only)*

AIGUATERM differs from current state-of-the-art solutions by using an existing municipal non-potable water network as a stable thermal source and sink for heat pumps. Rather than developing a new heat pump technology, the project applies a mature and reliable solution to a previously underused urban energy resource, reducing the need for new large-scale infrastructure and avoiding the limitations associated with outdoor-air conditions or deep geothermal drilling.

The project is currently at validated pilot stage. A full-scale demonstrator at UPV has been operated and monitored under real conditions, confirming the technical and energy feasibility of the concept. The next step is to assess its replication and deployment potential in other suitable urban infrastructures and locations.

Regional benefits (energy savings, emissions, jobs, infrastructure) *(Innovation Award only)*

AIGUATERM provides direct regional benefits by valorising an existing local urban infrastructure as a renewable thermal resource for building heating and cooling. By using the municipal non-potable water network as a heat source and sink, the system reduces dependence on other energy sources and lowers electricity consumption and associated CO₂ emissions.

The project also demonstrates that existing urban infrastructure can provide an additional energy function without requiring major new networks or deep geothermal drilling. This creates a practical pathway for reducing the energy demand of public buildings while making better use of resources already available within the region.

Commercial potential *(Innovation Award only)*

AIGUATERM has a specific commercial potential that depends on the availability of suitable urban infrastructure. Not all European cities operate a secondary water network like Valencia, so direct replication is not universal.

However, the project demonstrates a broader and transferable concept: using existing urban water infrastructure as a heat source or sink for heat pumps. This can create new business opportunities for water utilities, allowing them to offer additional energy services linked to their existing assets without affecting their primary function.

The main commercial potential therefore lies in energy integration, site-specific engineering solutions, and the development of new thermal energy services based on existing urban infrastructure.

For Large Heat Pump or Building Solutions Award

Why the project serves as a model for others *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Potential for expansion to other locations/industries *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Barriers to replication elsewhere *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Business opportunities for expansion, licensing, or commercial production *(Large Heat Pump or Building Solutions Award)*

No answer provided.