Innovative Water Recovery Solutions

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Visit iWAYS on YouTube:

THE ORIGIN OF iWAYS

> "iWAYS proves that when research and industry join forces, we can turn big challenges into **real, replicable solutions."**

Luca Montorsi, University of Modena and Reggio Emilia, iWAYS Coordinator

The idea for iWAYS was born when engineers working on a previous EU project called ETEKINA noticed something unexpected. While installing Heat Pipe Heat Exchangers (HPHEs) to recover energy from hot industrial exhaust gases, they observed that the process also led to the condensation of a surprising amount of water vapour. What began as a strategy for thermal efficiency revealed an untapped opportunity: in addition to recovering heat, these systems could also reclaim clean water—and potentially even more.

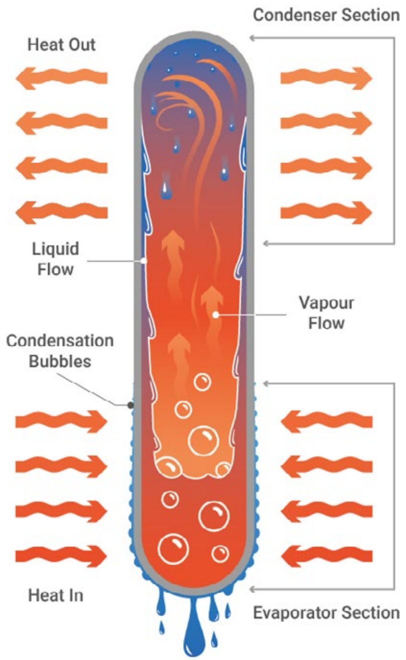
This realisation inspired a new vision: a suite of technologies capable of recovering heat, water, and valuable materials such as acids and particulates from exhaust streams. To pursue this goal, iWAYS was launched on 1 December 2020 under the Horizon 2020 programme. The project brought together 19 partners from across Europe, combining research expertise with industrial leadership to create solutions that reduce resource consumption and emissions in some of the most demanding manufacturing sectors.

Over the following years, the team developed a set of modular, retrofittable technologies designed for real-world conditions. After extensive lab testing and scale-up, three full-scale Heat Pipe Condensing Economisers (HPCEs) were installed in 2024 and 2025 at demonstration sites in Italy, Spain, and Sweden, representing the ceramics, steel, and chemical industries respectively. These units capture both heat and condensed water directly from flue gases—without disrupting core production processes.

With these systems now in operation, iWAYS marks a significant step toward more circular industrial practices. The ability to recover resources that would otherwise be lost to the atmosphere supports a shift toward cleaner, more efficient manufacturing. The project shows how a simple engineering observation can lead to innovation that addresses both, environmental challenges and industrial competitiveness.

Heat Pipe Condensing Economiser (HPCE):

EFFICIENT BY DESIGN



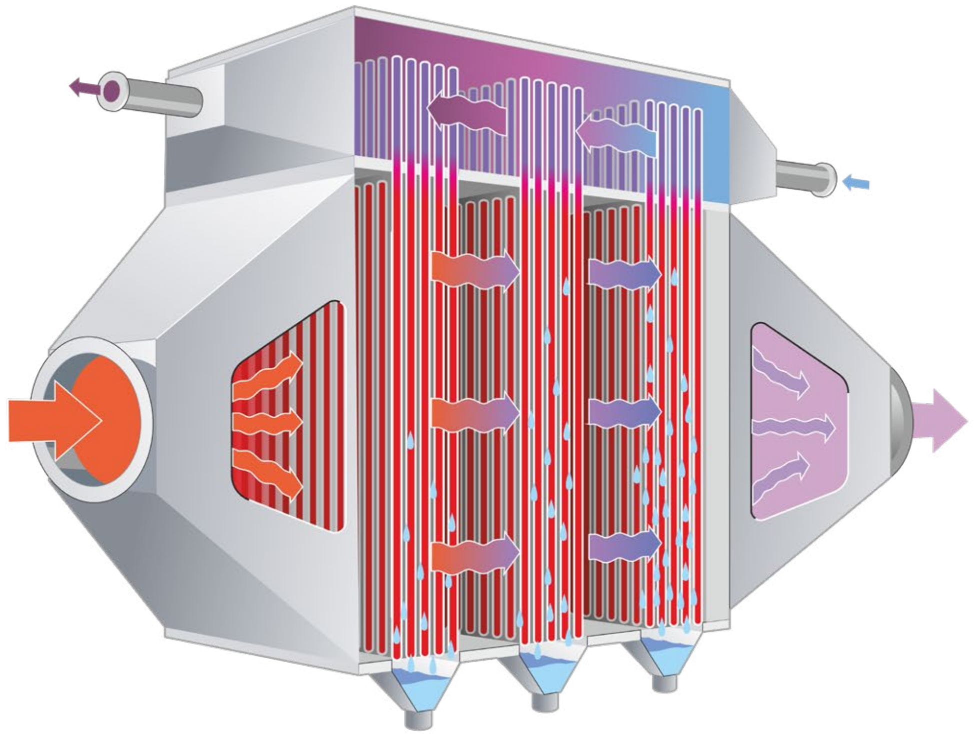
The Heat Pipe Condensing Economiser (HPCE) is the core innovation of iWAYS. It's a highly efficient device designed to recover both heat and water from hot, humid exhaust gases that are normally released into the atmosphere.

At the heart of the HPCE are heat pipes—sealed metal tubes containing a small amount of fluid. As hot exhaust gases pass over one side of the HPCE, the fluid inside the heat pipes evaporates, absorbing thermal energy. This vapour then travels to the cooler end of the pipe, where it condenses, releasing the heat to preheat clean process water or air for reuse in the factory.

At the same time, the HPCE actively condenses water vapour from the exhaust gases. This water—often lost in conventional systems—is collected, treated if necessary, and reused within the industrial process. In many cases, it's clean enough to replace a significant portion of freshwater intake.

To ensure durability under harsh industrial conditions, the heat pipes are coated with a non-fluorinated superhydrophobic layer. This advanced coating prevents corrosion, reduces fouling, and improves condensate runoff—enhancing both efficiency and lifespan without relying on PFAS-based chemicals.

What makes the HPCE unique is its ability to handle acidic, corrosive, and particle-laden flue gases while remaining compact, modular, and easy to retrofit. It's a solution tailored to real industrial needs: saving energy, reducing water use, and recovering valuable materials—all in one integrated system.



> "The HPCE was designed to do more than recover heat—it turns industrial exhaust into a resource stream, capturing energy, water, and materials in one compact system."

Prof. Hussam Jouhara, Brunel University London, Inventor of the HPCE and iWAYS Technical Director

Water Treatment:

TAILORED TO EACH INDUSTRY

Each demo site in the iWAYS project includes a customised water treatment system designed to handle the specific composition of recovered condensate. Whether dealing with ceramic residues, fluorides, or acidic particles, the treatment processes—such as filtration, reverse osmosis, softening, or advanced nanofiltration—were adapted to meet the reuse standards of each industry.

This modular approach ensures that the condensed water recovered by the HPCE is not only captured but also purified and reused—closing the loop and reducing reliance on freshwater across sectors as diverse as ceramics, chemicals, and steel.

Decision Support System:

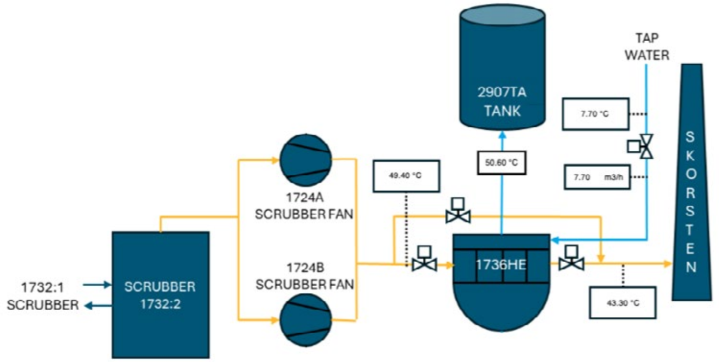
SMART RECOVERY IN REAL TIME

"Our DSS transforms streams of complex sensor data into **clear, actionable insights—** helping operators make instant improvements in both energy and water efficiency."

Edgar Rubion Soler, EURECAT

To help operators manage and optimise these complex recovery processes, iWAYS developed a cloud-based Decision Support System (DSS). This intelligent platform collects real-time data on system performance, including heat recovery rates, water quality, and process conditions. It then translates this into clear dashboards, alerts, and actionable insights.

By integrating information from both the HPCE and the water treatment system, the DSS supports efficient, stable, and safe operation. It enables predictive maintenance, ensures consistent resource recovery, and helps industries make data-driven decisions to maximise both environmental and economic benefits.



Tubacex

STEEL TUBE MANUFACTURING

Watch on YouTube

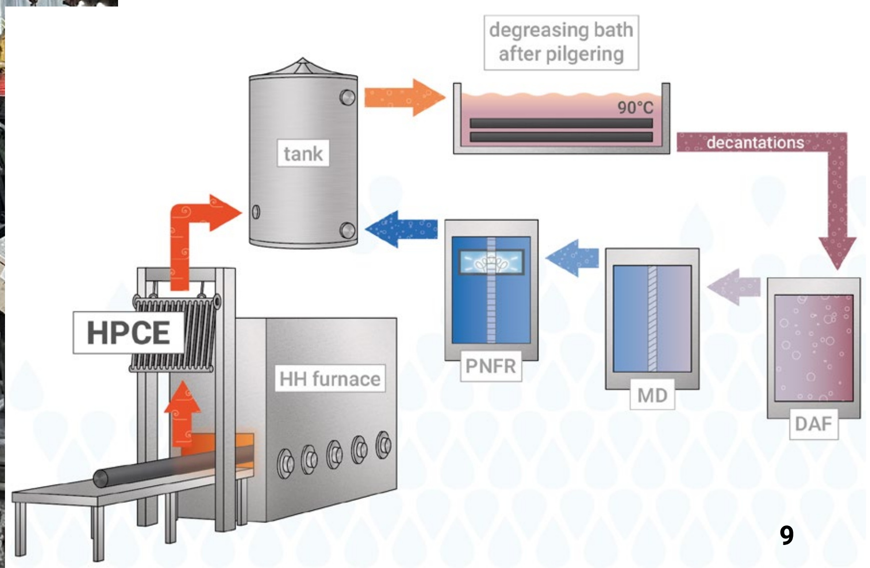
Tubacex, a leading manufacturer of stainless-steel tubes, installed a full-scale radiative Heat Pipe Condensing Economiser (HPCE) at its Spanish facility in May 2025. Suspended above the oven's exhaust line, the HPCE captures rising heat recovering up to 30% of thermal energy from flue gases. The recovered heat is reused to warm water for the degreasing bath—a key process in steel tube production—cutting gas consumption and supporting Tubacex's drive toward more sustainable operations.

To ensure that recovered water meets the strict quality requirements of steel manufacturing, it is treated using a multi-stage purification system. The on-site setup includes Photocatalytic Nanofiltration Reactors (PNFR), Membrane Distillation (MD), and Dissolved Air Flotation (DAF). These advanced technologies remove contaminants and enable the purified water to be safely reused in the plant's cleaning processes, significantly reducing the need for freshwater intake.

Installation was carefully planned around the plant's 24/7 production cycle, taking place during scheduled maintenance windows to avoid disruptions. Now in its validation phase, the system is expected to deliver measurable environmental and economic benefits.

> "We expect the HPCE to produce significant **savings in gas consumption and water use.** It's a big step forward for sustainable steelmaking."

Gorka Bilbatua,
Project Manager at Tubacex



SUCCESS STORY 2

Alufluor AB

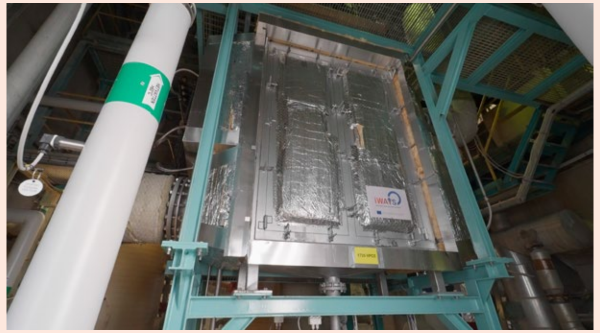
CHEMICAL INDUSTRY

Watch on YouTube

Alufluor AB, a leading aluminium fluoride producer in Sweden, became the first iWAYS partner to commission and operate a full-scale Heat Pipe Condensing Economiser (HPCE). Installed in August 2024, the system now captures around 500 kW of thermal energy from the plant's acidic exhaust gases and reuses it to heat all washing water on-site. This marks a transformative shift for Alufluor, enabling the plant to recover heat, water, and material from emissions that were previously wasted.

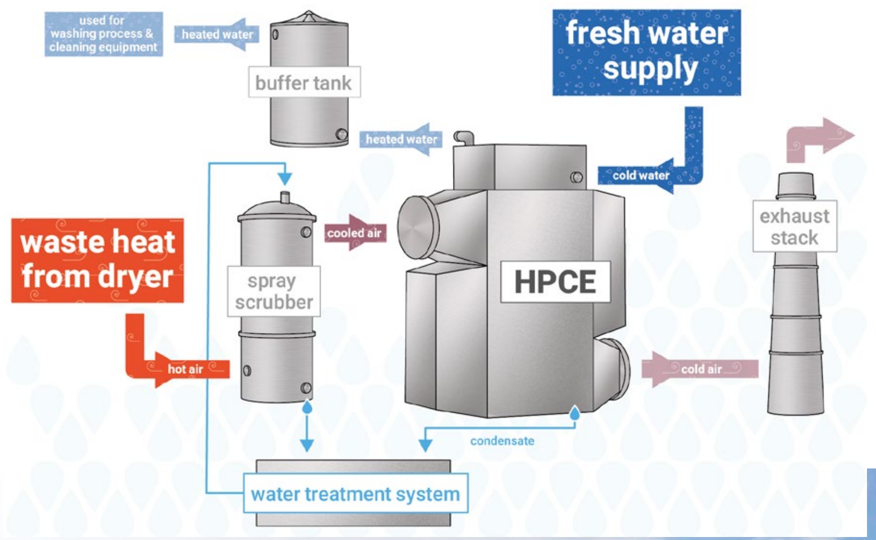
The installation involved significant engineering adaptations, including reinforced rooftop structures and extensive new pipework. Thanks to the HPCE's robust, modular design and resistance to corrosive gas streams, the technology integrates safely within highly regulated chemical environments. In addition to heat, the system condenses and collects water vapour, which is then treated and reused in the production process—further reducing reliance on external water sources.

The Alufluor demo highlights the adaptability of the iWAYS system to complex chemical processes, proving that circular resource recovery—including heat, water, and material—is viable even under the most demanding industrial conditions. With the system in continuous operation since 2024, performance data are being collected to validate its environmental and economic impact, supporting future replication across the chemical sector.



> "This is one of those rare moments where disruptive innovation leads to a substantial breakthrough. We're proud to lead by example and show that **circular resource recovery** in the chemical industry is happening."

Hanna Sjöberg, CEO of Alufluor AB



SUCCESS STORY 3

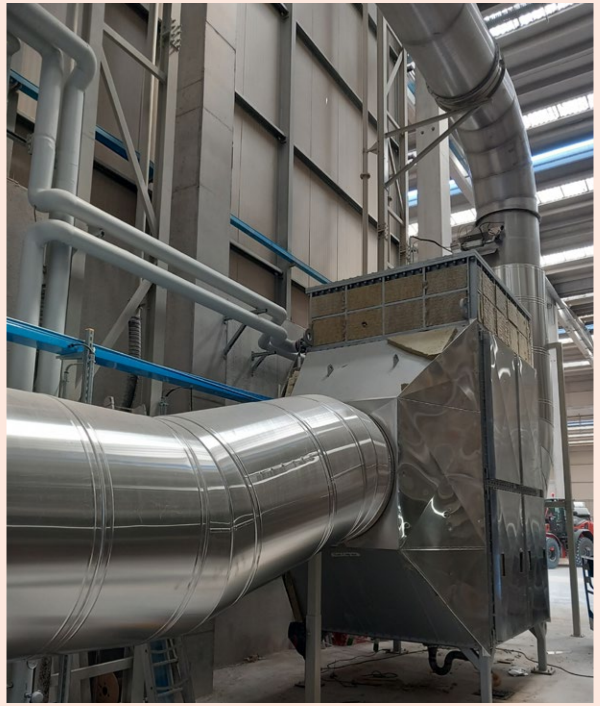
Ceramiche Keope

CERAMIC PRODUCTION LINE

Ceramiche Keope, a division of Atlas Concorde, one of Italy's leading ceramic tile manufacturers, installed a full-scale Heat Pipe Condensing Economiser (HPCE) in spring 2025 on its production line. Positioned downstream of a spray dryer, the HPCE captures heat and condenses water vapour from hot exhaust gases that would otherwise be released into the atmosphere. The system was integrated directly into the existing process with minimal disruption, showcasing its suitability for retrofit applications.

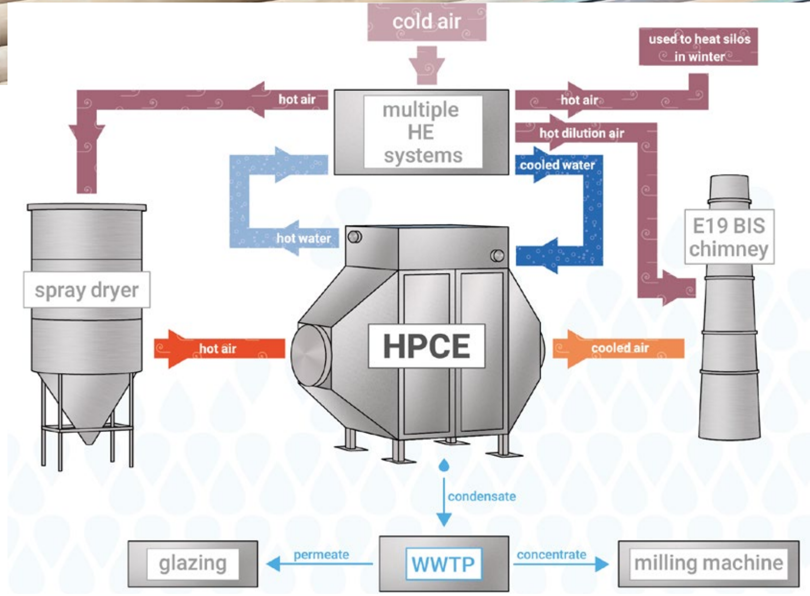
In addition to recovering thermal energy, the HPCE produces a flow of condensed water. To ensure this recovered water meets the quality standards required for reuse in ceramic production, it is routed through a compact on-site treatment unit. The treatment process includes ultrafiltration and nanofiltration, effectively removing fine particles and contaminants.

This combined setup enables Ceramiche Keope to reuse clean water and recover valuable heat in a single process. It reduces both freshwater intake and fossil fuel consumption, demonstrating how circular resource use can be implemented efficiently in energy-intensive industrial environments.



"After our positive experience with ETEKINA, we saw real potential in going a step further. With iWAYS, we're not just recovering heat—we're **recovering water** too."

Marco Manfredini, Technical Lead Manager, Gruppo Concorde S.p.A.



Commercial Perspectives

A MANAGER'S GUIDE

If you're considering how iWAYS technologies could benefit your factory, this quick guide outlines the key steps to get started. From assessing your exhaust streams to implementation and optimisation, here's what a manager needs to know to integrate an iWAYS system efficiently and effectively.

STEP 1: Identify Waste Streams

Begin by mapping where hot, humid exhaust gases are released in your process—kilns, dryers, evaporators, or furnaces are common sources. Gather basic data on temperature, flow rate, humidity, and any chemical content. This step helps assess potential for heat, water, and material recovery.

STEP 2: Request a Feasibility Assessment

Contact the iWAYS consortium or licensed providers to carry out a technical and economic feasibility study. This initial analysis estimates how much heat, water, and material could be recovered, along with projected Return of Investment (ROI).

STEP 3: Develop a Custom Design Plan

Based on your site conditions, engineers will design a tailored system using the HPCE, water treatment units, and process integration layout. This phase also defines how the Decision Support System (DSS) will monitor and manage the system once operational.

STEP 4: Secure Investment & Funding

Build an internal business case using data from the feasibility and design phases. Most iWAYS systems achieve payback within 3–5 years through energy and water savings. Additional funding may be available through national or EU green innovation grants, especially for decarbonisation, water reuse, or circular economy projects.

STEP 5: Install, Train & Monitor

Installation is typically non-disruptive and modular. Operators are trained to use the built-in Decision Support System (DSS), which monitors system performance in real time. This ensures optimisation of recovery processes and alerts you to maintenance needs or performance drift.

STEP 6: Start Recovering Value

Once commissioned, the system begins delivering measurable reductions in fossil fuel use, water consumption, and emissions. You'll also benefit from operational dashboards, sustainability reporting data, and long-term maintenance support.

Estimated costs to integrate an iWAYS system:

PHASE	SCOPE	ESTIMATED COST
Feasibility Study	Site audit, recovery potential, ROI model	€5,000 – €20,000
Detailed Design & Engineering	Custom system design, planning	€25,000 – €80,000
Equipment & Installation	HPCE, water treatment units, DSS setup	€250,000 – €600,000+
Total Estimated Investment	Varies by plant size & complexity	€280,000 – €700,000+

iWAYS

innovative water recovery solutions

Partnership

UNIMORE Università degli Studi di Modena e Reggio Emilia | Brunel University London | AICE jtc Universitat Jaume I | acea infrastructure Simam | ESCI European Science Communication Institute

econotherm Waste Heat Recycling Technology | Water Europe Technology & Innovation | incotec Innovación Eficiente | Ceramiche Keope Made in Italy a division of atlas concorde | alufluor

eurecat Centre Tecnològic de Catalunya | Hellenic Republic National and Kapodistrian University of Athens Est. 1837 | LEI Lithuanian Energy Institute | ICRA Institut Català de Recerca de l'Aigua | TUBACEX Group

KREAN creative engineering | ΕΘΝΙΚΟΝ ΜΕΤΣΟΒΙΟΝ ΠΟΛΥΤΕΧΝΕΙΟΝ | IAMAS Earth Friendly Technologies | Politechnika Wrocławska

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www.iways.eu

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