HEAT PIPE TECHNOLOGY FOR THERMAL ENERGY RECOVERY IN INDUSTRIAL APPLICATIONS

Rendicontazione

Informazioni relative al progetto

ETEKINA

ID dell'accordo di sovvenzione: 768772

Sito web del progetto

DOI
10.3030/768772

Progetto chiuso

Data della firma CE
13 Settembre 2017

Data di avvio
1 Ottobre 2017

Data di completamento
31 Marzo 2022

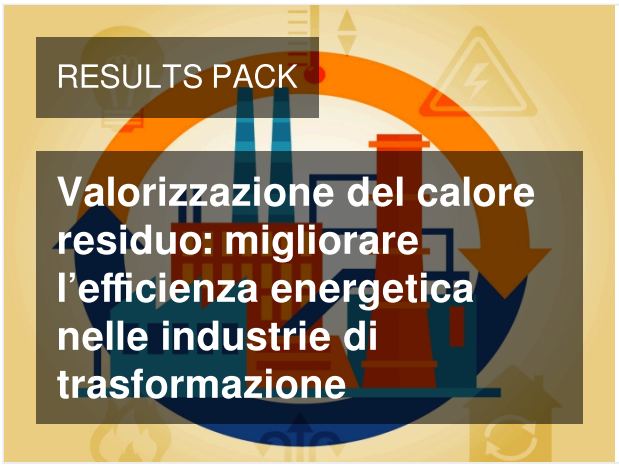
Finanziato da
SOCIETAL CHALLENGES - Secure, clean and efficient energy

Costo totale
€ 5 539 612,25

Contributo UE
€ 4 617 677,13

Coordinato da
IKERLAN S. COOP
Spain

Questo progetto è apparso in...



17 Novembre 2021

Periodic Reporting for period 3 - ETEKINA (HEAT PIPE TECHNOLOGY FOR THERMAL ENERGY RECOVERY IN INDUSTRIAL APPLICATIONS)

Periodo di rendicontazione: 2020-10-01 al 2022-03-31

Sintesi del contesto e degli obiettivi generali del progetto

Waste heat is a common challenge in industries requiring high temperatures. With the help of heat exchangers, waste heat can be recovered and channelled to other processes within the same facility. But corrosive exhaust gases and high temperatures pose critical challenges to engineers when they try to extract thermal energy from flue gases. In 2017, ten companies and institutes from across Europe joined forces within ETEKINA project to develop and test a new type of heat pipe heat exchanger (HPHE) for energy-intensive industries. Heat pipes are hermetically sealed metal tubes that contain a working fluid. They transfer thermal energy passively from a hot to a cold stream by a boiling condensation cycle inside the tube. In this way, heat from the hot area can be transferred efficiently to a cold part of the pipe.

In the ETEKINA project, engineers have arranged many such heat pipes and created a heat exchanger design according to the specific needs of each of the production plants involved in the project: three factories producing aluminium, steel, and ceramics, respectively.

The hot production steam passes at the bottom of a container to heat the liquid inside the many tubes working together in parallel. At the other end of the heat exchanger cool air, water or thermal oil flows along, absorbing the heat of the condenser sections. This heated air or water can now be transported to parts of the production line where it can be re-used to preheat combustion air, treat automotive parts, or dry clay for example. The heat pipe heat exchanger concept developed during this project is highly scalable and can be adapted to any type of industrial exhaust in a wide range of temperatures for different heat sinks (hot air, hot water, pressurised water, thermal oil etc.). The estimated lifetime of an ETEKINA HPHE is 10 – 20 years.

Lavoro eseguito dall'inizio del progetto fino alla fine del periodo coperto dalla relazione e principali risultati finora ottenuti

At the beginning of ETEKINA project there were very few HPHE industrial applications worldwide and in most of them waste heat was generally recovered from clean, high-temperature waste heat sources in large capacity systems. ETEKINA project has approached new applications in order to increase the re-use of otherwise wasted energy in non-ferrous, steel and ceramic sectors. In 2021 three individually designed HPHEs were installed in the three factories and the systems have been monitored until the end of the project. More than 40% of the waste heat stream is being recovered in all three factories. The energy recovered in the three industrial settings is now used to reduce the industrial plants' energy consumption, thus reducing their greenhouse gas emissions in accordance with new regulations.

The waste heat recovery system of the use case 1 (non-ferrous sector representative) was designed and implemented at Fagor Ederlan S.Coop facilities (Spain). Afterwards, the HPHE was integrated on it and the commissioning of the overall system was done. The waste heat recovery system has been running for 6 months up to now and primary energy savings of 184.5 MWh and a reduction of 33 TN CO2 eq have been measured during that monitoring period.

The waste heat recovery system of the use case 2 (steel sector representative) was designed and implemented at Metal Ravne facilities (Slovenia). Afterwards, the multi sinks HPHE was integrated on it and the commissioning of the overall system was done. The waste heat recovery system has been running for 5 months up to now and primary energy savings of 534 MWh and a reduction of 106 TN CO2 eq have been measured during that monitoring period. Because a muti sink HPHE was installed in use case 2, savings of 364 MWh of water have also been monitored.

The waste heat recovery system of the use case 3 (ceramic sector representative) was designed and implemented at Atlas Concorde facilities (Italy). Afterwards, the HPHE was integrated on it and the commissioning of the overall system was done. The waste heat recovery system has been running for 5 months up to now and primary energy savings slightly lower than 1 GWh and a reduction of almost 200 TN CO2 eq have been measured during that monitoring period.

Lowering waste energy was not the only objective of the project. Equally important was the commercial viability of the technology and a technology readiness level TRL7 has been achieved. One of the main outcomes of the ETEKINA project is an innovative fouling tolerable, high temperature resistant and cost effective with multiple contingency built-in HPHE heat recovery solution that ECONOTHERN has already included in their catalogue adding descriptions of the ETEKINA success cases. Calculations show that the Return of Investment (RoI) of the ETEKINA prototypes are extremely interesting for a commercial exploitation. Under market conditions, the HPHE of the aluminium foundry and the ceramics plant both reach a RoI of approximately 3 years, while the heat exchanger of the steel producers achieved a RoI of only nine months.

Progressi oltre lo stato dell'arte e potenziale impatto previsto (incluso l'impatto socioeconomico e le implicazioni sociali più ampie del progetto fino ad ora)

Different studies show that there is an incredible potential market for waste heat recovery in large industrial systems and thus it is expected that the results from ETEKINA project will facilitate the market penetration of new HPHE technology based waste heat recovery applications. A tool was developed to analyse the replicability of ETEKINA heat recovery solution in other scenarios. The tool provides a first approach of the thermal, geometric and economic values that could be obtained by the application of Heat Pipe Based Heat Exchanger Technologies based on the available streams' characteristics defined by the user. For a real implementation, a detailed design will be required, and technical and design considerations will have to be consulted with the technology supplier.

There is also a positive political framework to introduce to the market the ETEKINA solution as energy intensive industries (EII) will be asked to be carbon neutral by 2050. If the results obtained in the three demo cases of ETEKINA would be extrapolated to similar industrial plants existing in Europe, an extremely significant impact in Europe-s energy savings could be expected with consequent CO2 emissions savings. The latter would impact directly on the welfare of the European citizen.

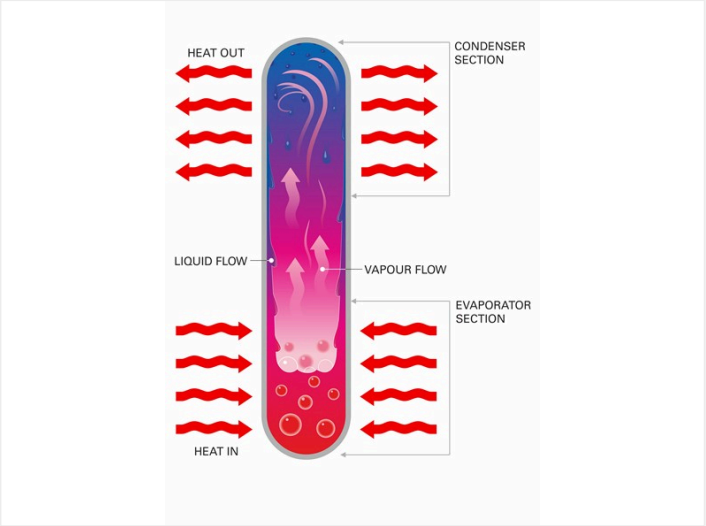
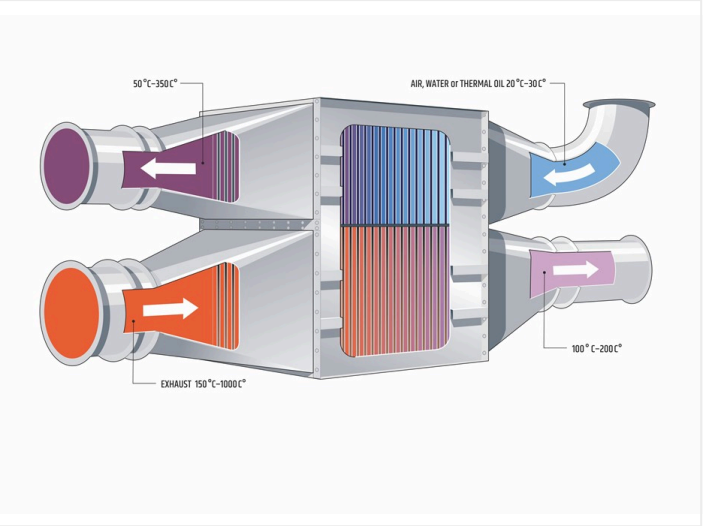


Diagram of the principle of a heat pipe



Heat Pipe Heat Exchanger (HPHE) based on a combination of multiple heat pipes

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Permalink: https://cordis.europa.eu/project/id/768772/reporting/it