

# Indus3Es – Industrial Energy and Environment Efficiency

## Project

[www.indus3es.eu](http://www.indus3es.eu)

Large quantities of waste heat are continuously rejected from industries. Most of this waste energy, however, is of low-quality and is not practical or economical to recover it with current technologies.

The **Indus3Es project**, funded in the frame of Horizon 2020 TOPIC EE2015-18-: New technologies for utilization of heat recovery in large industrial systems, considering the whole energy cycle from heat production to transformation, delivery and end use - will develop an innovative Absorption Heat Transformer (AHT) focused on low temperature waste heat recovery (below 130°C, referred to a recovered waste heat source temperature). Indus3Es SYSTEM is aimed to recover and revalue non-recovered low-exergy surplus heat in energy intensive industrial processes. Indus3Es System will upgrade low temperature waste heat streams to process heat streams at higher temperature levels and then use them in internal industrial process, reducing primary energy consumption of the industry.

The consortium of the Indus3Es Project consists of 10 partners: 4 Research Organisations (TECNALIA, TU Berlin, CIRCE and Technion), 3 SMEs (Bs Nova, Aiguasol and PNO) and 3 large industries (Tupras, Repsol and Fertinagro). The Research organisations in charge of the main fundamental research activities related to the envisaged developments are highly experienced on absorption technology and heat transformers systems; the companies will bring the business spirit and industrial knowledge, while the large companies will be key to ensure a successful demonstration and replication of the project results. **TECNALIA**, one of the main Research & Technology Organizations (RTO) in Europe, is the **Coordinator of the project**.

## Objectives

The main objective is to develop an economically viable solution for industry, appropriate for existing plants and adaptable to various industrial processes. The developed system will be demonstrated in real environment in Tüpras, the main petrochemical industry in Turkey, enabling to analyze besides integration aspects, operational and business issues. Indus3Es System will be defined and optimized for different specificities in different sectors and industrial processes, for which up-scaling of the demonstrated technology and replication studies will be performed. Market potential evaluation and business analysis will be developed by industrial partners in order to guarantee a successful exploitation of the system in a near future.

### ✓ Economic Impacts

The successful development of the Indus3Es project will make possible to offer to the market a competitive sustainable solution for reducing significantly the energy use in the industry. This system has the potential of saving up to %20 of energy consumption and an increase of energy efficiency by %25. There are industries where these values will be even higher but some others in which expected savings may be lower. See the chart below for possible waste heat revalued potential:

The waste heat from European industrial production have a potential value of up to 4.250 M€ for the European industrial sector (having a process efficiency of %70).

Studies will be carried out through the project to maximize the future commercialization and exploitation of the developed technology and system. Payback is expected to be between 2 and 4 years, depending the process, fulfilling industry requirements in terms of economic feasibility. Nevertheless each process will require a specific solution, thus, a tailor-made design will need to be prepared. During the project the AHT technology will be demonstrated in a real environment, under working conditions of a Tüpras' refinery.

### ✓ Environmental Impacts

The Project is focused on energy intensive industries which have a large influence on the environment. The development of the AHT technology can contribute to the EU objective of reducing by %20 the energy consumption with further reduction in greenhouse gases emissions and also would have a positive effect on the reduction of primary energy consumption.

Therefore, the Indus3Es project will have environmental impact on:

- EU's decarbonisation ambitions
- Breakthrough solutions for advanced low-carbon industry-processing
- Improving the competitiveness of EU industries by developing ready -to-market penetration of AHT systems
- Eliminating current barriers for waste heat recovery
- Making AHT more attractive through significant reduction of operational, maintenance and installation costs

### ✓ Technological Impacts

#### Brief on Absorption Heat Transformer (AHT) technology

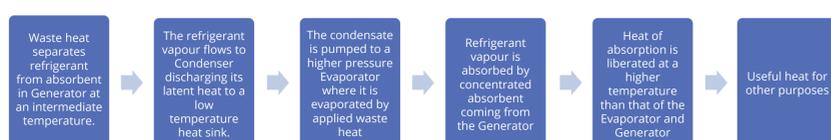
The technology in focus in the Indus3Es project is the absorption heat transformer technology. The single effect heat transformer technology is effectively a single effect absorption chiller working in reverse mode. It consists primarily of one condenser, one evaporator one absorber and one generator.

Single effect heat transformers can increase the temperature of approximately %50 of the waste heat by up to 50 K (depending on the available heat sink).

In contrast to absorption chiller, in a heat transformer absorber and evaporator operate at high pressure than condenser and generator. Waste heat is fed into the evaporator and generator and upgraded/revalued heat at an increased temperature level is extracted from the absorber.

#### AHT and Indus3Es

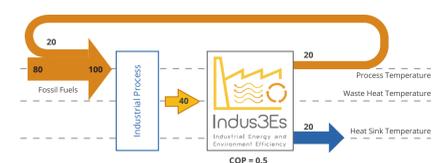
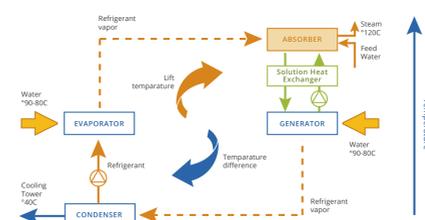
In the Indus3Es project the heat source is waste heat.



Indus3Es System will be able to recuperate low-temperature waste heat from industrial processes which is currently useless.

Indus3Es system is capable of raising temperature of low-grade heat (in the range of 100-70°C) by about 50 K, yielding a COP of 0.5 approximately.

The AHT's useful effect of temperature boosting is obtained by the absorbent solution's thermo-physical properties in the Absorber. The thermodynamic cycle is activated by waste heat fed into the Evaporator and Generator.



## Indus3Es final results

The AHT system has been successfully installed at the power plant of the Tüpraş petrochemical facilities. The waste-heat source for the activation of the AHT system comes from the oily condensate flash steam tank. In order to recover the heat from the oily condensate flash steam, demineralized water sent to the boilers, which is considered constant throughout the year and equal to 65 °C, is first preheated by this waste source which is at about 100 °C. The remainder of the waste-heat is used for powering the AHT, resulting in a stream at about 140 °C, which upgrades the demin-water circuit to 135 °C before this is sent to the boilers.

According to the first monitoring results the installation of the AHT could suppose, for 20 years using phase up to following consumption and economic savings:

- Total Primary Energy Savings: 70,622,152 kWh primary energy;
- Total CO2 emission savings: 9,974 tones CO2;
- Total Economic Savings: 1,752,047 €.