Indus3Es Project

New technologies for utilization of heat recovery in large industrial systems

Enjoy reading the final indus3es newsletter dealing with the latest project results and progresses achieved!

System demonstration at real environment: TECNALIA's latest results from the DEMO

Indus3Es demonstrated the operation of a minimum scalable AHT in a real industrial environment.

The knowledge of the absorption chillers ongoing development has been transferred to the AHT technology, implementing several innovations:

- The implementation of two adiabatic absorption operation modes:

Atomizing spray nozzles and a drip distribution system in which the liquid solution in the tray is exposed to the vapor – promoting adiabatic absorption. For demonstration and research purposes, the atomizing spray mode can be toggled on or off. Measurements from the Lab- and Breadboard-Scale high-pressure vessels have demonstrated that these modes perform as intended by increasing the maximum obtainable temperature within the absorber.

- Innovative motor-less non-condensable gases purge system:

Presence of non-condensable (NC) gases critically reduces the absorption process which is critical for the AHT. The innovative system for removal of NCs developed in Indus3Es continuously gathers and traps NCs in a dedicated vessel, which are then periodically and automatically discharged to the environment. This solution is simple, inexpensive, and efficient, compared to other known options.

- Indus3Es AHT behaviour automatic control:

The control system has been designed considering especially the "Characteristic Equation Method" approach. Apart from the desirable performance automatic adjustment procedures, an attention to anti-crystallization procedure has been considered, which is potentially riskier for AHTs, compared to absorption chillers. A tested control system have been also installed and operated for several months. This demonstrated the successful integration and automation of the technology and its innovations in a real industrial application.

Next to the AHT technology itself, concepts for the implementation of the AHT technology into modern industrial environments were developed. In the Indus3Es case all challenges of the implementation in a refinery with the high security requirements especially in explosive environments were overcame.

The AHT system has been installed at the power plant of the petrochemical facilities. In particular, 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 €.

With these results the calculated payback period would be concretely less than 10 years, really optimistic value for being the first prototype developed. By the "ready-to-market" costs, these indicators would result in a more attractive investment. The payback period would be about 5 years.

Scalability to other industries and processes of the Indus3Es technology: Repsol, Fertinagro and Tupras' final updates on the replicability of the system

"In the Indus3es project, the study and scaling of a heat recovery system has been carried out. This heat, until now, was not a useful heat. But with this project and with the designed and scaled of the absorption heat transformer, a solution was obtained.

With all this, Fertinagro Biotech positively evaluated being able to recover heat from a current that until now has not been used for the purposes of reducing energy costs and therefore economic.

The replicability of the study in Fertinagro Biotech has given the possibility of reducing natural gas consumption by a not too high percentage, because consumption is not high, but must be taken into account for future expansions and what can help reduce the energy consumption.

The concept of this project consolidates the idea of Fertinagro Biotech to support projects that can help reduce the carbon footprint of fertilizers and with it the products thus obtained".

"AHT technology has a great potential in heat upgrading in most industries. The waste heat source temperature range fits well with industry requirements, as well as the revalorized heat temperature range. Indus3es project has been very helpful to assess possible problems during its implementation and start-up, and we hope that full scale equipment can be an interesting option to any industry concerned with energy efficiency and CO2 emissions in the industry decarbonization scenario."

"Refinery industry is a highly energy intensive industry. Therefore, energy efficiency and energy integrity projects are crucial to minimize the energy consumption and increase the efficiency of refineries. Energy is both produced and consumed in order to maintain the refinery processes, which are mainly distillation, craking, hydrotreating. These processes consume energy in the form of steam, fuel oil, fuel gas or electricity. For instance, crude oil needs to be heated

up before entering the distillation process. On the other hand, products of distillation process such as gasoline and diesel are needed to be cooled down to the storage temperature before being stored. Therefore, the crude oil is heated up by distillation products in heat-exchangers for the sake of heat integrity. This way, less fuel gas is consumed in the pre-heating furnaces to heat-up the crude oil. There are similar cases in the power generation units of refineries. In power generation units, some waste heat sources are inevitably formed both in energy production and consumption phases. In the current state of the art, it is usually unfeasible to recycle such heat sources which are below 150 oC. At this point, AHT technology have great potential to enable reuse of such waste heats. After the successful demonstration of AHT system in power production unit at Tüpraş İzmit Refinery, investment options for AHT in refineries can be considered in much more explicit fashion".

The new article "The INDUS3ES technology and its impact on the market" jointly elaborated by CIRCE and CIAOTECH PNO is available on the website, enjoy reading it!

Read the article

For more info about the project visit the Indus3Es website at: www.indus3es.eu

Indus3Es Consortium

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Indus3Es is a project funded by the European Commission

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement n° 680738