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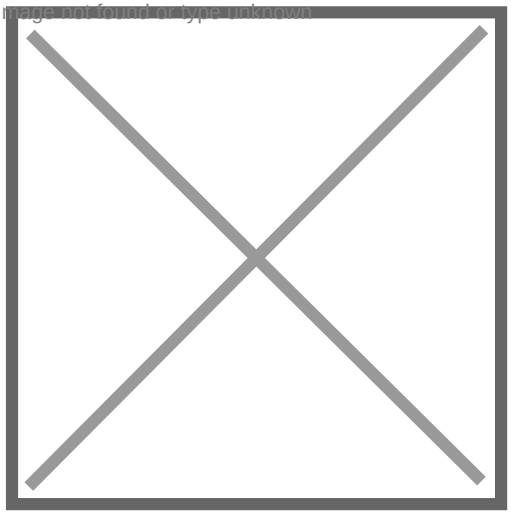

CE-SPIRE-07-2020

intelWATT

Full Title: intelligent Water Treatment Technologies for water preservation combined with simultaneous energy production and material recovery in energy intensive industries

Aim:

In the past, industrial infrastructures were developed within a context of unconstrained water resource availability. This is no longer the case. Unsustainable uses of water resources and population dynamics along with climate change affect this critical resource, which is becoming scarce. The EU-funded intelWATT project will develop innovative, cost-efficient, smart separation technologies applied in energy- and water-intensive industries. Three case studies in electricity production, mining and electroplating facilities will demonstrate water preservation along with energy production and material recovery.

IntelWATT aims to develop innovative, cost efficient, smart separation technologies applied in energy and water intensive industries. The goal of the project is to demonstrate 3 TRL7 case studies that will achieve water preservation along with energy production and material recovery. The proposed solutions will also target at zero liquid discharge while implementing maximum water reuse. Tailor made sensors and automated decision making mechanisms will optimize the process conditions in real time. The case studies will be implemented in crucial EU and global industrial applications.

-Case study 1: Demonstration prototype for CTBD treatment. The development of efficient, cost effective, smart solutions for water management in a thermoelectric power plant, aiming at minimization of the cooling tower blow down (>99% recovery) trough developing a pilot unit of 100 m3/day treatment capacity installed in the

premise of the Greek Public Power Corporation's (PPC) unit V (natural gas combined circle facility, Megalopolis, Greece) based on a closed loop, near zero liquid discharge approach.

-Case study 2: Demonstration of a symbiotic concept between industries: sustainable production of energy and water. In this context, an integrated pilot unit (100 m3/day) comprised by Reverse Electrodialysis (RED) and solar powered membrane distillation (MD) systems.

-Case study 3: The application of a novel, hybrid high recovery RO (HRRO) / Ion exchange (IX) resin prototype will demonstrate the recovery of valuable electrolytes and fresh water preservation in a plastic electroplating facility. The process is aiming towards recovering up to 95 % of Chromium and Copper and 50% of Nickel, while preserving 65% of fresh water.

Implement smart sensor technology for online monitoring, real time process adaptation and deep learning, with customizable intelligent industrial process software module based on an agnostic protocol connectivity cloud infrastructure.

Concept:
intelWATT's starting point results from the convergence of research outcomes carried out by both the RTOs and industrial partners. For this purpose, following key technologies have been identified to have a strong potential for boosting fresh water preservation in energy intensive processes: The consortium aims to improve the state of the art in these technologies in order to bring these solutions up to the level of demonstration on real environment (TRL7-8). The project methodology is structured in three main pillars originating from the detailed characterization of the three selected case studies water streams; Pillar 1:This pillar includes the detailed characterization of the selected applications' water process streams, as well as the requirements determination of all basic process components such as smart sensors, communication protocols, membrane and resin performance, energy requirement, general and safety related specifications of the prototypes etc.

Finally, specifications for all demonstration prototypes will be attributed, while indicative requirements include water efficiency characteristics, energy consumption thresholds etc. Pillar 2: This pillar includes the customization of membranes, modules and resins to be evaluated at lab scale. The preparation of experimental setups for each unit operation involved in intelWATT at laboratory scale and the incorporation the smart monitoring. In parallel, module geometries, materials and configurations will be improved so to reduce fouling and increase service life. The optimization of process parameters and materials will be also addressed in this pillar. Extensive testing and characterization of several build-to-order crucial components (membranes, IX) and modules (spiral wound, tubular, hollow fibers etc.) with regard to their fouling characteristics, performance stability and efficiency will be performed. In addition, the precision, response time and reliability of the developed sensors will be evaluated and optimized. Pillar 3: This pillar includes the design, construction, commissioning and operation of three TRL7 prototypes – a CTBD treatment system, a HRRO/IX combination and a hybrid RED/MD/MCr pilot unit – that will be located at the premises of PPC, BIA and ACSA-Sorigue respectively. Extensive demonstration activities will take place in order to evaluate the performance of the proposed technologies at operational environment as well as to optimize the processes' conditions. Investigation of corrosion phenomena will also be considered during the demonstration by the dedicated online smart sensor.

Start date:
01/10/2020

End date:
31/03/2024