MATCHING - MATERIAL INNOVATIONS FOR THE OPTIMIZATION OF COOLING IN POWER PLANTS

B&W SPIG CORPORATION TECHNOLOGIES

MATChING - Material innovations for the optimization of cooling in power plants

SPIG UNICO - A unique online continuous monitoring system

3M

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INTRODUCTION

SPIG role within EU MATChING project

New Advanced High Efficiency Filling Pack as well New Hybrid Module with innovative inner coating, will be tested and validated in SPIG test facilities before their installation in full scale Cooling Tower (Demo Module) that will be built in geothermal plant in Italy. Technical Department will be in charge for development of Demo Module detailed design/sizing.

MATChING project focuses on selection and demonstration of technological solutions to improve the performance of cooling systems for geothermal and fossil fuelled power plants, through the use of new nano-technologies and advanced materials, with the final aim to reduce the overall amount of fresh water abstraction.

Freshwater saving will contribute to preservation of water bodies especially in water scarcity countries and to the reduction of energy footprint.

Besides surface and groundwater pollution will be avoided reducing the use of chemicals for bio fouling mitigation in water cooling circuits and the subsequent production of wastewater.

MATChING project results will impact on overall sustainability of cooling systems in power plants, acting on the three pillars of the sustainability concept: People, Profit and Planet. People, in terms of social aspects improvements; Profit, in term of cost reduction and economic benefits; Planet, in terms of environmental impact.

SOLUTION DESCRIPTION

In MATChING the cooling system technology provider SPIG, will demonstrate the application to a Wet Cooling Section of a new Filling media and advanced coatings for dry section modules:

- (1) New Filling Media. PVC film filling are extensively used by SPIG in conventional power plant installation

(industrial and sea water CTs) and a with limited suspended solids concentrations. Research will be focused on developing special geometries specific for geothermal fluid to allow to maximize the thermal efficiency and improve fouling resistance. A PVC film (advanced flute design) and a 3D splash plastic filling will be developed and tested for wet module. Hanged and/or bottom supported filling will be checked. These advanced filling media will be able to guarantee an extremely large surface for heat exchange and water evaporation. The evaporated water will be either cooled and remain as droplets while another part will form a film around the elements of each module. The heat exchange packs is formed by modular multi-layer non-deformable elements with grids structure, which resists to the working temperatures, keeping it unchanged with its no-clogging characteristics. The wide dimension of vertical channels allows the pollutants to be easily washed.

- (2) Coatings for dry section modules. Different material solutions combining base materials with coatings will be preliminary tested in SPIG laboratories prior to the full scale test in the demo plant. Carbon steel tube as per ASTM A214 and aluminum tube AL6060 will be investigated as base materials. At least two types of coatings will be evaluated, particularly the focus will be on silica polymer nano-coating and epoxy-polyurethane resin coating

BENEFITS

The application of SPIG Hybrid CT technology will lead to a overall extension of power plant operative life (10%), an increase of about 5% in revenues, and a reduction of 15% of the O&M costs linked to gaseous emission treatment. Considering to refurbish the 30% of EU-28 power plants (~300MW) within 2030 would lead to a revenue increase of 12M€/year and an overall reduction of O&M cost of 0.8M€/year. Taking into account an overall CAPEX of ~60M€ for the refurbishment of 15 plants, the payback period would be around 4-5 years.

Insights

An improved approach for a sustainable management of water resources is crucial to reach European requirements defined in the European Union's targets and the European Commission's

Resource Efficient Europe Roadmap 2050, indicating that by 2020 "Water abstraction should stay below 20% of available renewable water resources". Power generation is a sector requiring great amounts of water: cooling water for energy production accounts in fact, for 45% of total water abstraction in European Union second behind agriculture. Despite slowly decreasing of cooling water abstractions in Europe over the last 10-15 years, the annual rate of efficiency improvement in industrial water use (~1%) is not sufficient to close the gap between the water demand and the water availability. Only 40% of this gap is expected to be covered by the business-as-usual approach: to meet EU requirements, additional innovation actions are needed.

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