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Project full title: Efficient Energy Integrated Solutions for Manufacturing Industries

Project Acronym: EFENIS

Deliverable no.: 7.2

Title of the deliverable: Base case for pinch-analysis, total site analysis and cooling water system analysis which will be used for evaluation of the methods to be developed during the project

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	**X**

In this report, methods and tools developed in the WPs 1-4 are implemented at a large-scale industrial production site in the coal-to-chemical industry. This enables the real-life validation of the project findings, results, and tools as well as the quantification of the benefits compared to standard procedures.

The cluster of the demo site comprises 7 units for coal gasification, transform, low temperature methanol washing, Methanol Reaction, Methanol distillation, sulphur recovery, and power plant. Energy and power targets are analyzed to provide the basis of the identified potentials for energy savings and additional energy integration measures.

Two sections have to been done in this deliverable:

Section 1:

Process and site utility system targets including steam, power, cooling water, etc., based on the novel integration methodology.

The site potential improvements might be from both utility systems and processes.

Utility system optimization contains steam mains selection and system configuration determination.

Process improvement is important for energy saving. Some operational parameters (temperature, pressure, etc.) could affect process energy and power demands. Key operational parameters have been identified to demonstrate the relationship between operating parameters and process utility demands.

Section 2: Cooling water system equipment.

LCCA (Life Cycle Cost Analysis) is used to visualize energy optimization possibilities. The LCCA method is based upon installing a larger cooling surface in order to reduce the energy consumption of the cooling tower or other users of energy in the system.

By keeping the heat load constant and increasing the design wet bulb in the cooling tower design more heat can be distributed from other users in the system to the tower. Active cooling was used as soon as the wet bulb temperature got close to the desired outlet temperature. The active cooling was a refrigerating compressor using large amount of energy. Every increase in the designed cooling tower wet bulb temperature could move the cooling load from the refrigeration compressor to the cooling tower with large energy optimisation overall.

As soon as the tower itself becomes a larger unit, energy consumption of the tower is getting more important. The fluctuations in the environment, e.g. changing temperatures during day, night and changing seasons, causes the operation conditions on the tower to change from the design operation. This leads to the disadvantage of the large tower, which is the energy consumption in off-design operation, which again can introduce an uncertainty in the energy optimization.

The work includes demonstration setup, including cooling towers, cooling circuit bottom pan, test engine, etc.

In summary, a forced draft open circuits cooling tower utilize two energy consuming components. A fan and a water pump. It has been showed that the fan power consumption for the cooling requirement can be optimized for an economical solution.

The demonstration will prove the benefit of the life cycle cost analysis tool. It is recognised, that unambiguous results, which can easily be comprehended in a meeting situation, are vital for the LCCA analysis tool to have an impact on future cooling tower sales.