

Belenus Project Impacts Expected: Capex, Opex and Plant Lifetime Total Gains

PROJECT FACTS

Duration: 48 months

Start date: 01-03-2019

End date: 28-02-2023

Composition: 15 partners from 7 countries

6 key scientific centres

9 key industries

Overall budget: 4.9 M€

EU contribution: 4.9 M€

Program: H2020-EU.3.3.2. - Low-cost, low-carbon energy supply

Topic: LC-SC3-RES-11-2018 - Developing solutions to reduce the cost and increase performance of renewable technologies

Funding scheme: RIA - Research and Innovation action

Call for proposal: H2020-LC-SC3-2018-RES-two-stages

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815147.



Lowering Costs by Improving Efficiencies in Biomass Fueled Boilers. New Materials and Coatings to Reduce Corrosion



LOWERING COSTS BY IMPROVING EFFICIENCIES IN BIOMASS FUELED BOILERS: NEW MATERIALS AND COATINGS TO REDUCE CORROSION

Department of Studies and Corporate Image. UCM



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WHAT IS BELENUS?

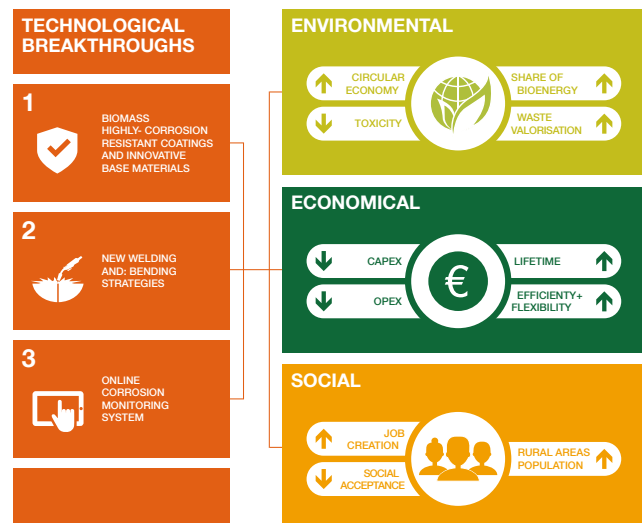
BELENUS project started in March 2019 and is being developed by a European consortium composed of fourteen partners from six European countries: Spain, Portugal, Germany, Sweden, Finland, United Kingdom and France.

This consortium consists of a multidisciplinary team with extensive experience in strategic fields within bioenergy sector, which will innovate developments capable of pushing the technology forward into the market. The project is led by Universidad Complutense de Madrid and is receiving funding from the European Commission (EC) under Horizon “2020” framework programme.

BELENUS will improve materials against corrosion and new assembly strategies in the biomass plants which will reduce the cost of electricity production.

WHICH ARE THE PROJECT'S TARGETS?

The primary goal of BELENUS is to lower bioenergy CAPEX and OPEX by an average of 1.03% and 40% respectively. This will be addressed by preventing or mitigating corrosion as the main limiting factor, through a holistic approach to prevent corrosion in the boiler:



WHAT IS THE FOLLOWED METHODOLOGY?

To assure effective management, the BELENUS project is divided into 9 work packages.

001	WP1 - FORESIGHT & DEFINITION OF REQUIREMENTS
	To coordinate key decision making, including specific biomass and coating selection as well as harmonization of test procedures by creating a unified test protocol.
002	WP2 - BIOMASS CORROSION RESISTANT COATINGS: DEPOSITION AND OPTIMISATION
	To develop and optimize new biomass corrosion resistant coatings including modified slurry aluminide coatings, thick HVOF and/or HVOF thermal spray, and overlay laser and welding coatings.
003	WP3 - LAB SCALE TESTING, CHARACTERISATION AND MONITORING
	a. To carry out lab testing under fireside atmospheres as well as steam side conditions at atmospheric and supercritical pressures, also including erosion resistance and mechanical properties. b. To develop a fireside corrosion monitoring system by implementing ceramic-based electrochemical sensors.
004	WP4 - PILOT SCALE TESTING AND CHARACTERISATION
	a. To characterize the selected biomass types. b. To obtain gas and ashes compositions while burning biomass. c. To test the coating/material systems in 2 biomass pilot plants (0.5 kWth and 10 kWth).
005	WP5 - NEW WELDING AND STRUCTURAL INTEGRITY STRATEGIES: ASSEMBLY OF BOILER STRUCTURES
	To define and develop innovative welding, bending and joining strategies for coated boiler parts through the study of the influence of these processes in coated boiler structures enabling the generation of assembled structures for further execution of mechanical and corrosion testing.
006	WP6 - MODELLING AND VALIDATION OF MATERIAL LIFE PREDICTION & COST AND LIFE CYCLE ANALYSIS
	a. To develop a methodology for lifetime prediction; b. To carry cost and life cycle analysis of the best coating-materials systems; c. To calculate the OPEX and CAPEX reduction based on material cost savings and lifetime increase.
007	WP7 - TESTING AND MONITORING AT OPERATION PLANT CONDITIONS UNDER SMALL AND MEDIUM-SCALE CHP PARAMETERS
	To validate BELENUS coating/material and corrosion monitoring systems by testing in operating biomass plants.
008	WP8 - DISSEMINATION, EXPLOITATION, IP AND SOCIAL ASSESMENT
	a. To disseminate and communicate the project's outputs to all target audiences to maximize visibility. b. To define an exploitation plan to ensure market penetration. c. To assess social acceptance.
009	WP9 - PROJECT MANAGEMENT
	To coordinate and manage all project-related actions in order to guarantee its successful execution and the adequate advance of the project in terms of schedule, resources, scope and expected impacts.



WHICH IMPACTS ARE EXPECTED?

- To develop new material systems, based on coatings deposited on established or under development ferritic/martensitic steels and austenitic steels, with SH wall thickness losses lower than 0.1 mm per year.
- To increase the durability of the tube joints in the boiler by 20% by carrying them out through new welding strategies adapted to the new materials and coatings.
- To achieve reliable monitoring of high temperature corrosion up to 8,400 hours by developing an innovative on-line sensor to anticipate plant component failures and, thus, increasing the maintenance intervals.
- To achieve a 1.03% reduction of CAPEX by obtaining individual gains with the novel solutions proposed in the project: 0.94% with the new surface engineering: biomass corrosion highly resistant coatings on creep resistance materials and 0.09% with the new strategies of welding and bending for coated tubes.
- To reduce the total OPEX of the plant a 40% by obtaining individual gains with the novel solutions proposed in the project: 30% with the new surface engineering: biomass corrosion highly resistant coatings on creep resistance materials, 6% with the new strategies of welding and bending for coated tubes and 4% with new online corrosion monitoring system specifically designed for biomass CHP plants.
- To increase efficiency up to 40-42% in small and medium-scale CHP biomass plants by reaching super-critical conditions at 580-625°C due to the new BELENUS solution capacity in preventing or mitigating corrosion.
- To raise the plant lifetime by: a) increasing 5 % of the operational hours of boiler components and SH tubes, reaching more than 8,400 hours per year, saving up to 11 days of annual maintenance (meaning a potentially increase of income of approx. 1.1M€ in power generation); b) increasing 5 years (25%) the total plant lifetime through the new corrosion protection systems.
- To reduce fuel costs by 10-15% by employing waste biomass and also consumption by increasing efficiency.
- To increase the flexibility of the plant by allowing the use of different types of biomass.
- To increase and improve “co-firing” of biomass and coal in existing coal plants with some adjustments as a cost-effective option.