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

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Dear Readers,

every 4 months a newsletter will be shared with all stakeholders and scientific community that are involved and or interested in the field of bioenergy, including plant developers, plant operators, and technology suppliers, as well as governmental bodies. Furthermore, members from the general public who are interested in one or more of the topics related to BELENUS, such as bioenergy and materials engineering, will also gain from our quaternary newsletters.

These newsletters will cover project progress, special topics, news, relevant information and where to meet us in person at important events. In this first edition of the newsletter, you will learn about BELENUS in general and the project members.

The best is yet to come! Enjoy reading!

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BELENUS as a whole

BELENUS brings novel corrosion prevention approaches to achieve cost-effectiveness for biomass plants involving the whole value chain. BELENUS will reduce bioenergy costs through new high-resistant coating/ materials systems along with a reliable monitoring device, succeeding in raising the plant efficiency by increasing the operating temperature resulting in fuel saving. The lifetime of critical components of biomass fired boilers will also be increased and BELENUS will tackle new CHP biomass plants as well as existing plants.

Project objectives and Methodology

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, in particular in superheater tubes: a) new surface engineering: biomass corrosion highly resistant coatings on high creep strength materials; b) new strategies of welding and bending for coated tubes improving the quality and efficiency of boiler components; and c) new online corrosion monitoring for biomass CHP plants. In addition, the BELENUS solution will impact on other Levelized Cost of Electricity (LCOE) parameters improving plant efficiency (up to 42%) by raising the operating temperature, increasing a 5% the operational hours of the plant and the plant life time by 5 years, and further reducing the fuel expenditure by allowing the use of different types of lower cost biomass.

This main goal will be addressed with a set of specific objectives as follows:

1) 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.
2) 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.
3) 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.
4) 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.
5) 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.
6) 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.
7) 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.
8) To reduce fuel costs by 10-15% by employing waste biomass and also consumption by increasing efficiency.
9) To increase the flexibility of the plant by allowing the use of different types of biomass

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10) To increase and improve "co-firing" of biomass and coal in existing coal plants with some adjustments as a cost-effective option.

With the aim of satisfying the main and specific objectives, the project has created an "overall approach" that will be implemented by a rigorous Work Plan broken down into 9 Work Packages (WP). The approach entails a direct transfer of the results obtained during the project into new commercial biomass plants. The overall structure of the project is shown below.

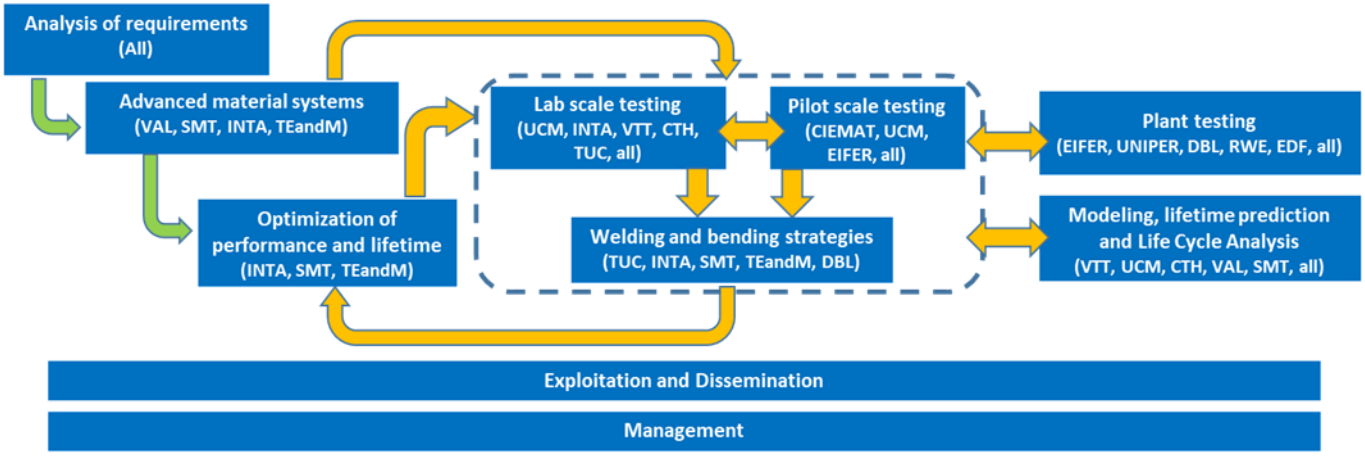

Figure 1. Overall methodology of BELENUS.

The BENELUS consortium brings together **14 partners from 6 different countries (2 from Germany, 4 from Spain, 2 from Sweden, 1 utility from France (EDF) linked to EIFER, 2 from UK, 1 from Finland and 1 from Portugal)** (see Figure 2). The consortium provides a multi-stakeholder approach, from the laboratory to the plant, as clearly emerges from the participants list, covering the whole value chain of biomass fuel plants:

- 7 R&D centres and universities, with a large multi-disciplinary expertise involved in technology development related to anticorrosion solutions, modelling and to the energy sector (UCM, INTA, CIEMAT, VTT, CTH, TUC, and EIFER).
- 2 plant owners: RWE and UNIPER bringing biomass plant operation expertise from different feedstock. EDF will also participate as plant owner under the figure of linked third party of EIFER.
- A boiler designer and manufacturer: DBL, a leader in Engineering, Procurement & Construction projects 2 material developers and production companies: specialized in tube manufacturing (SMT and VAL)
- A SME dedicated to coating development and production (TEandM)
- A technology consulting and social innovation expert SME: ZAB

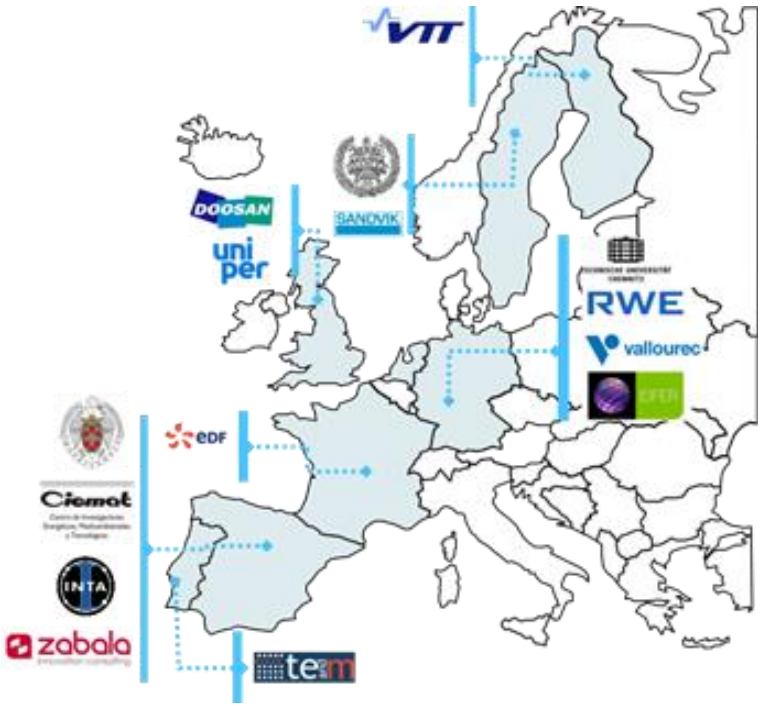

Figure 2. Consortium partner map.

The consortium has been built with great care, looking for a group of excellent partners that brings together the necessary knowledge, competence, experience and critical mass which will ensure achievement of the

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objectives. Geographically speaking, the plant owners and countries provide the necessary variety of biomass types. BELENUS impact at European and international level is guaranteed due to the previous experiences in EC projects as well as each partner's network, which will ensure the results dissemination, promotion and exploitation. In short, BELENUS is formed by a well-balanced set of partners, with proven experience and differentiated roles, which complement each other and ensures the objectives achievement as well as the impact of the project results at European level. The impact of this proposal in technology adopters, components manufacturers and end-users will be particularly important for their ability to build a research ecosystem based on the development of more cost-competitive small and medium biomass CHP plants, succeeding in reducing the cost and bringing it to a mature and competitive level compared to other energy technologies. This will lead to a relevant impact in the current and future bioenergy market.

Figure 3. BELENUS consortium.

Visit our website

BELENUS website www.belenus-project.eu is available since the early beginning of the project. It is the relevant source to show the scope and objectives of the project up and outstanding results. Find out more interesting information about the project and the impact of the results achieved, including all dissemination activities carried out.

If you have any questions feel free to drop us a line at *contact@belenus-project.eu* and remember you can follow us on *Twitter* & *LinkedIn*.

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