

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

*Edition: February 2022*

Dear Readers,

Every 4 months a newsletter will be shared with all stakeholders and the 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 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 impacts, and information and where to meet us in person at important events. In this edition of the newsletter, you will learn about BELENUS in general and advances on the project.

The best is yet to come! Enjoy reading!

*Francisco Javier Pérez Trujillo  
Coordinator of BELENUS  
Universidad Complutense de Madrid*

*Gustavo García Martín & Mickael Lambrecht  
Editors  
Universidad Complutense de Madrid*



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

## Special Topic: Control test for butt-welded joints

### Partners involved

[VAL](#), France  
[INTA](#), Spain  
[TEandM](#), Portugal  
[SMT](#), Sweden  
[UNIPER](#), United Kingdom

[CHAL](#), Sweden  
[EIFER](#), Germany  
[EDF](#), France  
[UCM](#), Spain

### Importance of the topic

Increased renewable energy demands have driven the development energy conversion technologies with high efficiency and low environmental impact. Indeed, biomass-fired power plants rise as a high potential solution, with its flexibility in various sectors, and have proven its use producing over 96% of all renewable heat in the past 18 years and generating 637 TWh of electricity in 2018.



Combined Heat and Power plants (CHP) also referred to as cogeneration facilities produce both heat and electricity with an average conversion efficiency of 30%. Moreover, biomass coming from industrial wastes, forests, crops, or algae present the greatest energy resource with plenty of applications, and help developing circular economy.

Nevertheless, fireside corrosion of superheaters, mainly due to potassium chloride (KCl), hydrogen chloride (HCl) and sulphur dioxide (SO<sub>2</sub>) limit the production of biomass-based energy and the behaviour of high temperature alloys must have a high properties to stand against the combustion process. That is what the BELENUS project stands for, aiming to find new solutions of corrosion-resistant alloys.

### Current state of the art



Supporting the strong added value of biomass power plants in the renewable energy market, an enhancement of its structural properties is investigated by BELENUS project, with the research and development of new alloys and coatings standing against high temperature combustion and aggressive gases. Indeed, feedstocks can be composed of eucalyptus, industrial wood waste, bagasse, wheat straw, rice husk or municipal solid waste which differs in compositions and the resulted products formed by their combustion is uncertain and not homogeneous at long exposures.



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

Biomass thermochemical conversion release potassium into flue gas at high temperatures forming aerosols, which can be adsorbed at the heat exchanger surfaces leading to corrosion. Phase transformation of the alloys at the interface are playing the major role and research have been conducted to enhance their properties by depositing several coatings. Therefore, some results already showed the importance of some elements such as nickel or chromium in the coating, improving its resistance. Nevertheless, some elements don't have a good behavior with all types of salt and a focus is made on their dissolution properties when in contact with different ashes. For example, protective scales can be dissolved by potassium chloride to form potassium chromate or sulphation reactions can releasing chloride gas leading to unprotective active oxidation. Moreover, chromium volatilization occurs in chlorine environment. Thus, the solutions proposed are to use Ni-based superalloys or ferritic-martensitic alloys with coatings and to find a balance between the formation of protective phase changes leading to low-active layers, and the dangerous diffusion and dissolution of elements in gases environment.

### Advances on the project

To operate in a CHP plant, the containers must withstand harsh environments during a large period and thus are constrained to mechanical forces. Moreover, coatings applied on alloys must be coherent and their mechanical resistance will determine the lifespan of a plant. Thus, the selected alloys and coatings were submitted to a bend test, which is simple and inexpensively qualitative that evaluates both the ductility and soundness of a material. It is often used as a quality control test for butt-welded joints, having the advantage of simplicity of both test piece and equipment. Moreover, heat treatment dependence to allow microstructural transformation will be studied. Indeed, all the coating-deposition processes will be evaluated, and their respective behavior will permit to choose the best candidates for CHP plants.



### Testing and validation – Perspectives of BELENUS



To validate the coated alloys, delamination, spallation, cracking, or fracture occurring on the samples will be determinant for their use in a real CHP plant. Indeed, the structural behavior of a system must withstand high pressure and mechanical constraints.



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

## Sectorial Breaking News

Date	Headline	Source
Nov 5, 2021	Norwegian biotech co Arbaflame to build wood pellet factory in Romania	Renewables now
Dec 1, 2021	MHIENG to deliver compact CO2 capture system to biomass power plant	Bioenergy news
Dec 10, 2021	Heineken Cambodia breaks ground on biomass plant	Bioenergy news
Dec 20, 2021	Iona Capital finances UK CHP plant	Bioenergy news
Jan 5, 2022	Valmet to supply biomass boiler to Japanese power plant	Bioenergy news
Jan 18, 2022	Marubeni, Mitr Phol to pursue biofuel, renewable energy projects in Thailand	Bioenergy news
Jan 25, 2022	Taaleri to build EUR-20m biocoal plant in Finland	Renewables now

## Remarkable Upcoming Events.

### 1. European Biomass Conference and Exhibition (EUBCE)

- 9-12 May 2022
- Online

EUBCE is the largest biomass conference and exhibition in the world. Each year, EUBCE brings together the greatest minds and latest advancements in biomass, with the aim of accelerating research and market uptake across the globe. During the conference, over 2,000 experts from both academia and industry share and discuss ground-breaking ideas, technologies, applications, and solutions for the sourcing, production, and utility of biomass.



The scientific programme is coordinated by the Joint Research Centre of the European Commission.

This year, the event will be complemented by Circular Bio-based Europe Joint Undertaking (CBE JU)'s efficacy at identifying innovation, stimulating investment, and mobilising the bio-based industry sector.

This is an excellent opportunity to address even more stakeholders globally through the conference.



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

## 2. The 13th Biofuels International Conference & Expo

- 5-6 July 2022
- Brussels, Belgium

The 13th Biofuels International Conference & Expo will bring together leading producers, suppliers, regulators, and other engaged organizations over a two-day period. High-level speakers, experts in their field, will address a range of topical issues relating to the biofuels sector.

Brought to you by Biofuels International, the leading international biofuels magazine, this year's conference will be held in Brussels, Belgium and co-located with the International Biogas Congress & Expo as well as the renowned Biomass Congress & Expo, making this series of bio events our largest gathering yet of bio related companies, giving participants unrivalled coverage.

**biofuels** international  
CONFERENCE & EXPO

BRUSSELS | 5 - 6 JULY 2022

*Listen, learn and network*  
**international Biomass**  
CONGRESS & EXPO

BRUSSELS | 5 - 6 JULY 2022

*Bringing biomass markets closer*  
**international Biogas**  
CONGRESS & EXPO

BRUSSELS | 5 - 6 JULY 2022

*innovations in biogas*

## 3. 9th International Conference on Sustainable Solid Waste Management

- 15 - 18 June 2022
- Corfu, Greece



The Conference aims to address the significant issue of sustainable solid waste management through the promotion of safe practices & effective technologies. The Conference focuses mainly on modern solid waste technologies. It aims to stimulate the interest of scientists and citizens and inform them about the latest developments in the field of municipal solid waste management. **Separation at source, Biological Treatment, the treatment at central facilities, waste prevention, biowaste utilization, recycling promotion, Waste-to-energy technologies & energy recovery, smart technologies for waste management, sludge management, agricultural and livestock waste, management of specific waste streams** (construction & demolition waste, waste from electrical and electronic equipment, etc.), biotechnology, Best Available techniques, symbiosis networks, energy consumption and saving, carbon footprint and water footprint, zero-waste initiatives, plastics and bioplastics, marine litter constitute main conference subjects. Special attention will be drawn to the valorization prospects & the products from solid waste, such as: biofuels, compost, materials, etc. It is also our ambition to strengthen the link of the applied research with industry. Hazardous waste & Household hazardous waste also constitute target area of the conference. Emphasis will be placed on **circular economy** in all key action areas (**production, consumption, waste management, secondary raw materials, innovation, investment & monitoring**) and all priority sectors (food waste, plastics, biomass and bio-based-products, construction &





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

**demolition waste, critical raw materials), as well as waste management issues and resource efficiency in islands and generally isolated and remote areas.**

The Conference will provide an opportunity to bring together scientists & professionals from government departments, industries, Municipalities, private institutions, research & education institutions, being a forum for the exchange of the most recent ideas, techniques & experiences in all areas of solid waste management. A special full one-day workshop will also focus on representatives of local authorities and municipalities to promote integrated solid waste management schemes.

### **Stay in contact with us. Visit our website.**

BELENUS website [www.BELENUS-project.eu](http://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](mailto:contact@BELENUS-project.eu) and remember you can follow us on *LinkedIn*  and *Twitter* 



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