



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

Edition: June 2020

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 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 the project members.

The best is yet to come! Enjoy reading!

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

*Gustavo García Martín
Editor
Universidad Complutense de Madrid*



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Special Topic: New welding and structural integrity strategies.

Partners involved

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

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Importance of the topic

Welding is considered as the main technology for assembly and repair of boiler structures which incorporate thousands of welds, for which no alternative is foreseen. It goes hand in hand with a significant thermal influence and the final properties will be strongly influenced by the whole assembly procedure. Creep rupture strength of weldments will differ significantly compared to substrates. The weld strength reduction factor (SRF) is of great importance to estimate loss in creep strength. Especially during the development of new components and residual lifetime, evaluation the SRF is of great interest also for industries^{1,2}. In addition, coated structures will be affected by welding. Therefore, **the influence of welding procedures on the compound structure and the integrity of coated boiler components will be studied.**

Current state of the art

A boiler consists of various tube and pipe structures in normalized and tempered condition but also in deformed state, such as cold or hot bend Figure 1 and Figure 2. Welding goes hand in hand with a significant thermal influence on the materials and the final properties will be strongly influenced by the whole assembly procedure.



Figure 2: tube and pipe structures

State-of-the-art boiler fabrication procedures alter the microstructure of the base metal, mainly degrade coatings and affect properties either due to the forming and/or the thermal exposure.

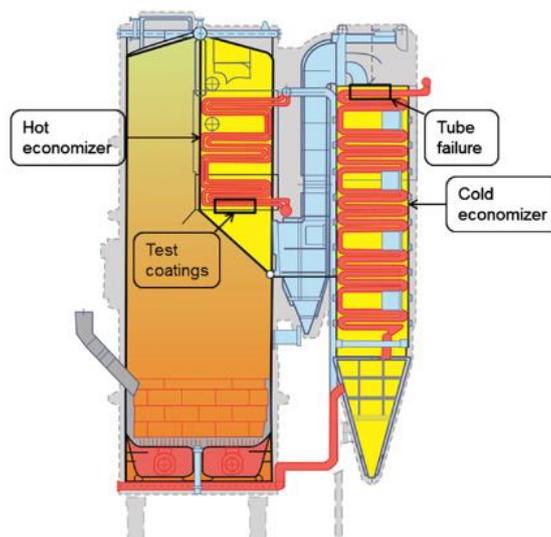


Figure 1: Schematic drawing of the circulating fluidised boiler with testing areas

Cold and hot bending are considered major production steps to bring tubular boiler structures into the desired shape. Fusion welding is the most important joining process in the erection and maintenance of boilers for thermal power plants. According to the state of the art, these joining strategies have been only applied on the commonly used base materials, with coated tubular structures having several loopholes^{3,4,5}.

¹ H. Cerjak, P. Mayr: Creep resistant steels, Chapter: creep strength of welded joints of ferritic steels, Woodhead, 2008, ISBN 978-1-84569-178-3.

² P. Mayr, H. Cerjak: The impact of welding on the creep properties of advanced 9-12% Cr steels, Transactions of the Indian institute of metals, 63, 2010, 131-135

³ K. E. Dawson, "Dissimilar Metal Welds", Doctoral thesis, University of Liverpool, 2012

⁴ P. Mayr, "Evolution of microstructure and mechanical properties of the heat affected zone in B containing 9% chromium steels" Doctoral thesis, Graz University of Technology, 2007.

⁵ H. Cerjak, "Welding of steam turbine components", Study report of the COST 505 Welding Group, Directorate General Science, Research and Development, Brussels, 1992.



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The BELENUS approach

An innovative and all-embracing development of a holistic welding strategy in combination with a bending strategy before and/or afterwards will be developed in BELENUS.

The influence of welding procedures on the compound structure and the integrity of coated boiler components will be studied. Hot and cold bending of coated pipes and tubes will also be investigated together with associated heat treatments. As an outcome, optimised joining strategies will be available. Assembly of boiler components can either be carried out before or after the coating processing.

Assembled structures including welds and/or bends for further corrosion and mechanical testing will be generated within BELENUS. Optimisations of heat input during welding and weld seam preparation will be performed to reduce the dilution of coatings in the base material and to enhance the adaptation of the coated areas, respectively. In addition, optimisation of bending ratios/angles will be carried out. An all-embracing development of a holistic welding strategy will be performed considering as possible strategies: (i) overlay welding to increase wall thickness, (ii) welding using high corrosion resistant filler metal, (iii) welding with reduced dilution, and (iv) welding with reduced coated area and “post weld re-coating”. In addition, the optimisation of bending ratios/angles will be considered.

BELENUS will study and test the following:

- ✓ Development of advanced hot and cold bending strategy of coated tubes with their heat treatments.
- ✓ Definition of integrity criteria of coated boiler structures after bending and welding.
- ✓ Development of welding strategy and description of guidelines for component assembly.
- ✓ The weld strength reduction factor SRF will be determined.
- ✓ Optimized prototype structures will be tested in operating plants

Possible Impact

BELENUS will bring novel strategies for welding and bending not only advanced base materials (such as Super VM12 and MarBN), but also coated tubes, which meet the current needs.

The proposed innovative coating/substrate systems, along with a new innovative and all-embracing holistic welding strategy in combination with bending will produce high integrity coated components. They will enhance the efficiency and high overall electrical conversion performance of the biomass plant.

In addition, BELENUS is a cross-cutting project with potential in other renewable energy markets. Biomass produced energy can also be combined with other intermittent renewal energy sources such as wind and

solar. In particular, solar concentration power (CSP) plants, with and without storage, can benefit from hybridisation with biomass fuelled plants as they use conventional power generation equipment (*Figure 3⁶*) with benefits that are synergistic, including significant advantages such as reduced capital costs by sharing equipment between multiple energy sources, increasing dispatchability by combining intermittent with dispatchable energy sources, higher reliability, opportunity for flexible operation, synergies between technologies enhanced by design and operation optimization,

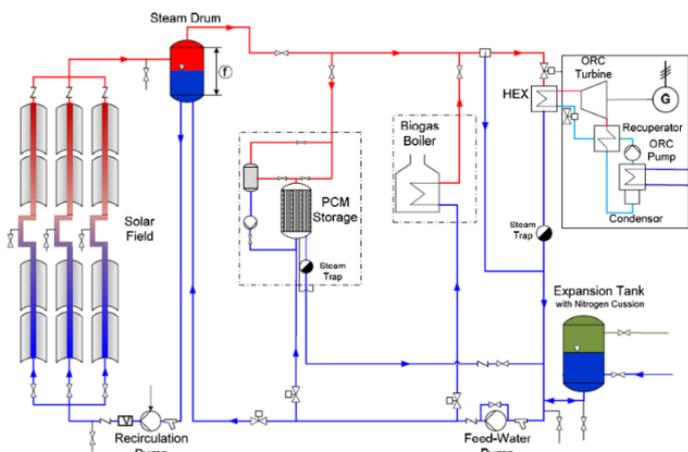


Figure 3: Hybrid mini power plant layout

⁶ Soares, J. and A.C. Oliveira, Numerical simulation of a hybrid concentrated solar power/biomass mini power plant. Applied Thermal Engineering, 2017. 111: p. 1378-1386.



among others. BELENUS innovation will foster construction of these hybrid plants.

Sectorial Breaking News

Date	Headline	Source
23 February 2019	Seneca Sustainable Energy biomass plant receives final operating permit	Bioenergy Insight
18 March 2020	New biomass-fired thermoelectric plant to be built in Brazil	Bioenergy Insight
16 April 2020	Sugimat to supply Europe's largest olive oil producer with biomass boiler	O&G Links
20 May 2020	Concerns over EU plans to minimise use of 'whole trees' in bioenergy production	Bioenergy Insight
22 May 2020	European Commission approves €550 million state aid scheme to generate electricity from biomass in Denmark	Bioenergy Insight
15 June 2020	US corrections facility receives first biomass system grant	Renewables Now
30 June 2020	Round-up of renewable energy PPA news (June 17-29)	Renewables Now

Remarkable Upcoming Events.

1. 15th Global Summit and Expo on Biomass and Bioenergy.

We invite all the participants from all over the world to attend '15th Global Summit & Expo on Biomass and Bioenergy' Webinar during September 21st-22nd, 2020 which includes prompt keynote presentations, Oral talks, Poster presentations and Exhibitions.

Biomass and Bioenergy Conference 2020 is the learning of how renewable energy resource

derived from the carbonaceous waste of various human and natural activities. It is derived from numerous sources, including the by-products from the timber industry, agricultural crops, raw material from the forest, major parts of household waste and wood. As an energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Conversion of biomass to biofuel can be achieved by different methods which are broadly classified into thermal, chemical, and biochemical methods.



2. 20th Congress for Wood Energy

From 22th to 30th September 2020 the 20th Conference on Wood Energy is taking place. After years of at times very tough negotiations, the EU



institutions have finally agreed on the content of the new Renewable Energy Directive, known as RED II. The decisions taken will have a tangible impact on our sector too. Our conference aims to provide positive stimuli to ensure that wood energy is once again firmly embedded in future climate and energy strategies! Due to the current developments within COVID-19, the organisers have decided to convert the 20th anniversary of the Wood Energy Congress into a digital event format. This year's motto is: Wood energy goes digital!



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3. Biomass Trade Summit Europe 2020

ACI's 5th Biomass Trade Summit will be taking place in Amsterdam, The Netherlands, on 9th-10th September 2020.

The event will bring together senior executives and experts from the biomass trading industry, biomass producers, energy companies, policy makers, consultants, technology innovators and leading market analysts to discuss the latest challenges and developments within the industry.

The two day event will give you an insight into the industry's latest policy and regulations, recent developments in biomass technologies, biomass planning and logistics management, quality controlling and costs effective ways of transport. ACI's 5th Biomass Trade Summit will also showcase latest policy and regulations, criteria and certification for sustainable biomass production. The event topics will provide a solid background for the two days discussion on best solutions for sustainable biomass trade in Europe.

Biomass Trade Summit Europe 2020



4. ICESB 2020: 14. International Conference on Environmental Science and Biotechnology

The International Research Conference is a federated organization dedicated to bringing together a significant number of diverse scholarly events for presentation within the conference program. Events will run over a span of time during the conference depending on the number and length of the presentations. With its high quality, it provides an exceptional value for students, academics and industry researchers.

ICESB 2020: 14. International Conference on Environmental Science and Biotechnology
November 02-03, 2020 in San Francisco, United States



ICESB 2020: 14. International Conference on Environmental Science and Biotechnology aims to bring together leading academic scientists, researchers and research scholars to exchange and share their experiences and research results on all aspects of Environmental Science and Biotechnology. It also provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Environmental Science and Biotechnology

Stay in contact with us. 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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