



# **BELENUS**

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

Starting date of the project: 01/03/2019

Duration: 48 months + extension

## **Deliverable: D8.6**

### **First BELENUS Workshop**

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Responsible Workpackage Leader: Gustavo García Martín, Universidad Complutense de Madrid

Responsible Task Leader: Gustavo García Martín, UCM

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*H2020-LC-SC3-11-2018*

*Building a Low-Carbon, Climate Resilient Future: Secure, Clean and Efficient Energy*

## BELENUS

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Dissemination level		
PU	Public	X
PP	Restricted to other program 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)	

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## Executive Summary

Finally, the first BELENUS workshop took place on 4<sup>th</sup> October 2022 in Helsinki (Finland), after an important delay (~2 years) due to the COVID pandemic. The workshop focused on gathering the main results from the different activities developed by the partners and was in line with the main principle of dissemination defined in the BELENUS GA agreement. It was announced for energy industries, biomass companies research & investigation centres, groups, and universities, fundamentally, not only by direct contacts but also using social media, web pages and LinkedIn. It was offered to browse the workshop online to make it easier to access the event. A Microsoft Teams link was distributed for that purpose. A very high-quality contented program was prepared by the partners with the assistance of the International Advisory Board. The event was divided into different thematic areas and complemented by a discussion session under the topic, “new perspectives in biomass technology”. A guided visit to the VTT centre researcher was the icing on the cake of an intensive and profitable workshop.

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## 1. Content of Deliverable

The main aim of this deliverable is to provide an overview of the different presentations and activities carried out during the first BELENUS workshop. This deliverable relies on the dissemination actions from WP8 and has been delayed 27 months from the originally planned date due to the COVID lock-down.

## 2. First BELENUS workshop

### 2.1. Location and information channels distribution

BELENUS consortium prepared a one-day workshop within the framework of BELENUS "Lowering Costs by Improving Efficiencies in Biomass Fueled Boilers: New Materials and Coatings to Reduce Corrosion".

The workshop was held at [VTT](#), Espoo, Finland on the 4th of October 2022. VTT, hosted the event, which is a BELENUS partner and one of Europe's leading research institutions, Figure 1.

The venue:

[Teknologian tutkimuskeskus VTT Oy - Google Maps](#)

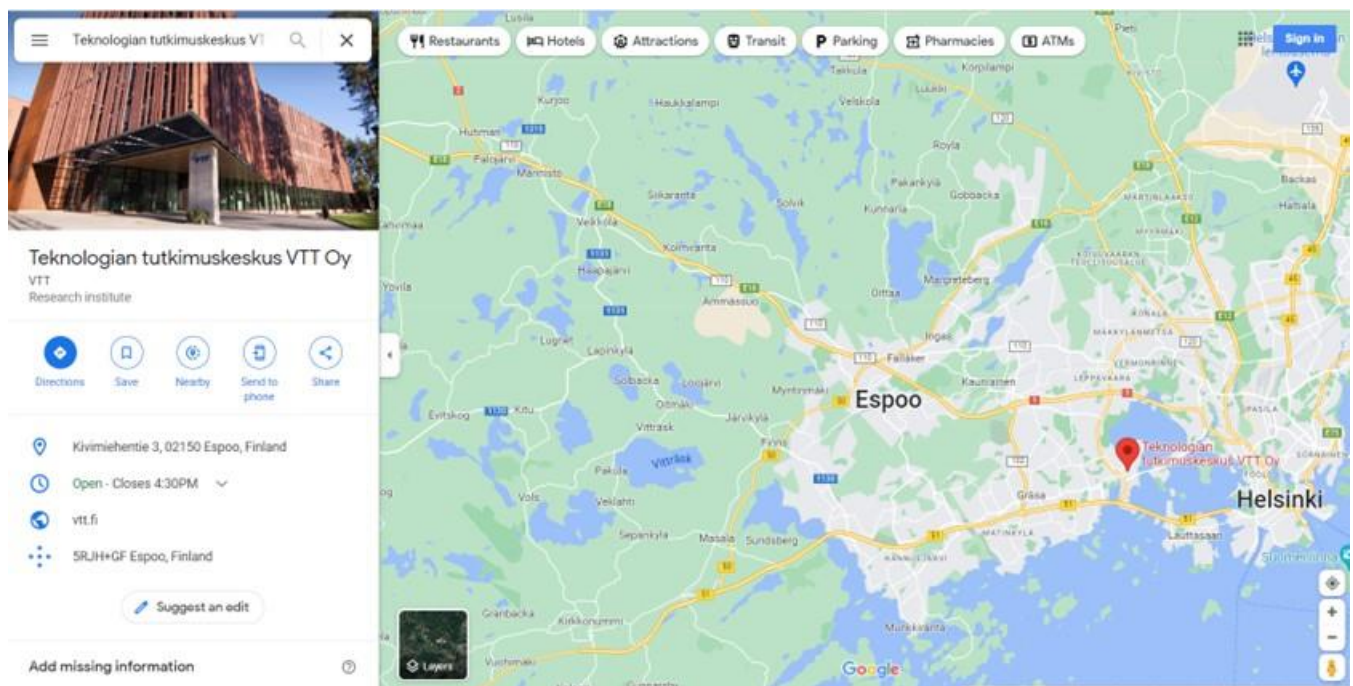


Figure 1: The venue: Kivimiehentie 3, 02150 Espoo, Finland. Teknologian Tutkimuskeskus VTT Oy. [Teknologian tutkimuskeskus VTT Oy - Google Maps](#)

The agenda and MTeams link invitation, figures 2 and 3, were shared with companies, universities, research centres, etc. by email. All partners collaborated on its distribution, automatically forwarding mail to other potential participants.

It was also posted on social media, the project web page and LinkedIn. BELENUS LinkedIn with more than 500 connections was also a worldwide showcase, Figure 4.

AGENDA WORKSHOP: 4th-Of-OCTOBER-2022	
9:00	Greetings from VTT, Dr. Taina Lahtinen, Research Area Vice President, Knowledge Driven Design, Sustainable Products and Materials II
9:10	Belenus-project overview-Dr. F. Javier Pérez-Trujillo, UCM
9:25	Biomass-fuels <ul style="list-style-type: none"> <li>Material related challenges in biomass combustion (Dr Hanna Kinnunen, Valmet Technologies Oy) (9.25)</li> <li>Materials selection for a new biomass fired boiler; Owner's point of view (Dr Katri Ekholm, Helen Ltd) (9.45)</li> <li>Biomass characterization of fuels used in Belenus Project (Dr. Manuel Benito González, CIEMAT, Spain) (10.05)</li> </ul>
10:25	Coffee-break
11:00	Biomass-corrosion-resistant-coatings <ul style="list-style-type: none"> <li>Advances in Anti-Corrosion Coatings and their medium-term corrosion behavior in biomass atmosphere (Dr Pauline Audigie, INTA, Spain) (11.00)</li> <li>Coating processes for improvement of corrosion resistance (Dr Francisco Gonçalves, TEGOM, Portugal) (11.20)</li> <li>New FeCrAl materials for boiler environments (Dr Johanna Nockert, KTH, Sweden) (11.40)</li> <li>Laboratory investigation of bulk/coatings in simulated biomass environment (Dr. Vincent, Chalmers University of Technology, Germany) (12.00)</li> </ul>
12:20	Modelling materials, new welding and bending strategies <ul style="list-style-type: none"> <li>Predicting oxide phases and oxidation kinetics observed in the laboratory investigation (Dr Torbjörn Jonsson, Chalmers University of Technology, Sweden) (12.20)</li> <li>Tensile Properties Investigation of Coated and Uncoated 12%Cr-Steel: Use a Thermophysical Simulation System (Dr Fabian Dittrich, Technical University of Munich, Germany) (12.40)</li> <li>HAZ Simulation, Melting and Bending Investigation of Coated and Uncoated 12%Cr-Steel (Dr Peter Mayr, Technical University of Munich, Germany) (13.00)</li> <li>Lifetime prediction approach applying experimental and modelling data from the Belenus project (Dr. Janne Pakarinen, VTT (13.20))</li> </ul>
13:40	Lunch
14:40	Visit-VTT facilities
15:40	Pre-validation (pilot-scale) and testing at real plant conditions <ul style="list-style-type: none"> <li>Fireside Corrosion Probes and Trial-Coated Tube Exposures in Biomass Fired Power Plant Boilers, Dr Colin Davis, UNIPER, United Kingdom) (15.40)</li> <li>Preventive Maintenance: On-line Corrosion Monitoring System (Dr Francisco Javier Pérez Trujillo, UCM) (16.00)</li> <li>Biomass Pilot Plant testing: Fluidized bubbling bed conditions influence (Dr Alberto Bahillo, CIEMAT) (16.20)</li> <li>Investigating the erosive wear of boiler tubes from an operator's view (Dr Simon Beckmann, RWE, Germany) (16.40)</li> </ul>
17:00	Coffee-break
17:15	Discussion-session: new perspectives in biomass technology <p>Set of central questions which are discussed by the group II</p>
18:00	Closure-of-the-workshop

**Reunión** Asistente para programación Insertar Formato de texto Revisar Ayuda

Desahcer Acciones OneNote Responder

Eliminar Copiar a Mi calendario → Reenviar ✓ Aceptar Provisional Rechazar Proponer una Nueva hora ⌚

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ⓘ Aceptada el 28/09/2022 14:05.  
Esta reunión se ha ajustado para reflejar su zona horaria actual. Inicialmente, se creó en la siguiente zona horaria: (UTC+0)


## Belenus Workshop - Teams link

Organizador ☐ Pakarinen Janne <Janne.Pakarinen@vt.fi>

Hora martes, 4 de octubre de 2022 8:00-17:00

Ubicación Microsoft Teams Meeting

Respuesta ☒ Aceptada [Cambiar respuesta](#)

 BELENUS\_Workshop\_Agenda\_updated.pdf  
425 KB

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**Join on your computer, mobile app or room device**  
[Click here to join the meeting](#)

Meeting ID: 362 415 152 881  
Passcode: hSMCfe  
[Download Teams](#) | [Join on the web](#)

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**Or call in (audio only)**  
+358 9 23106506, 700952453# Finland, Helsinki  
Phone Conference ID: 700 952 453#  
[Find a local number](#) | [Reset PIN](#)

VTT

Figure 3: Online invitation for the workshop

## BELENUS

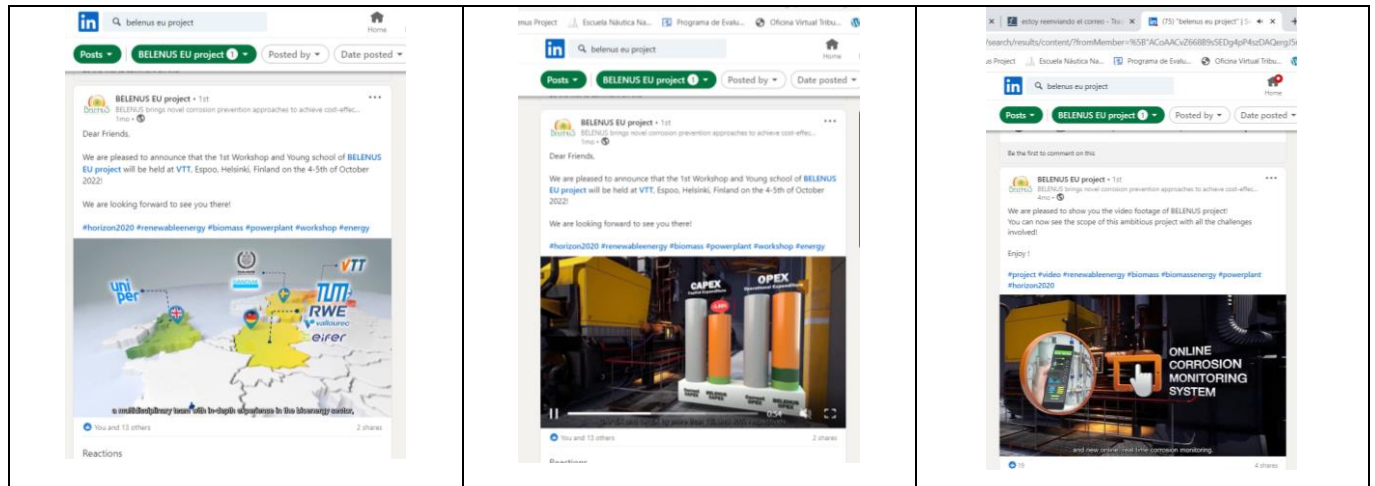


Figure 4: Belenus workshop announcement on LinkedIn

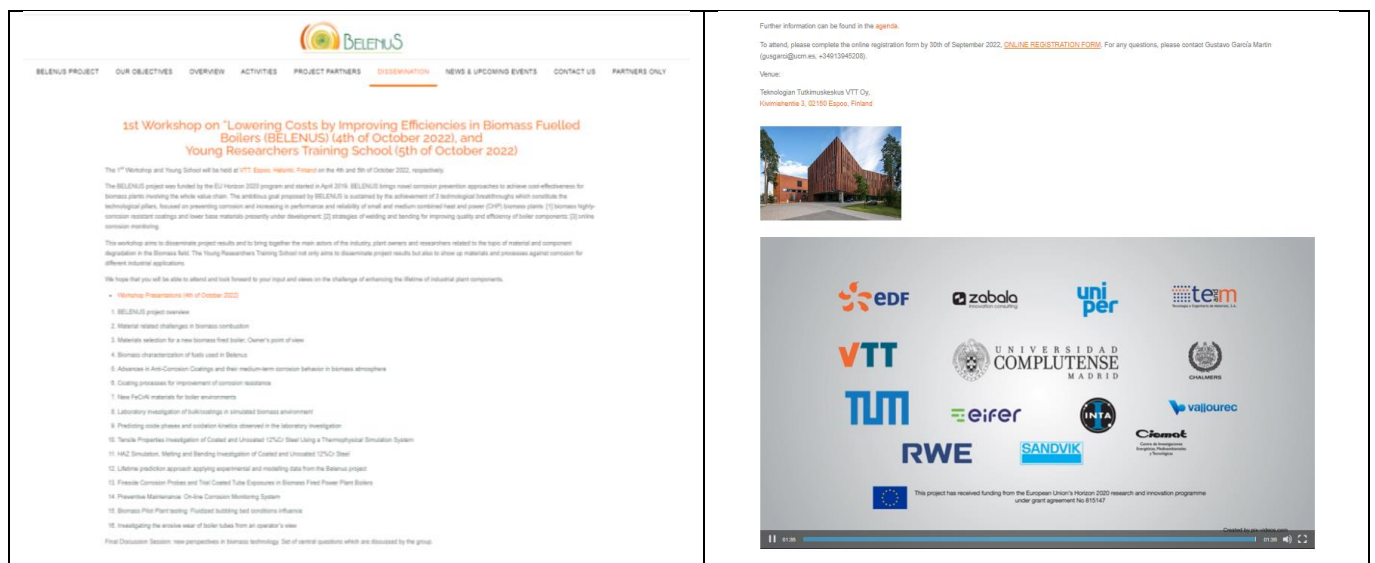


Figure 5: Belenus workshop feature on the project web page.

## 2.2. Agenda content

The presentations were compiled in four separated thematic sessions, (i) Biomass Fuels, (ii) Biomass corrosion resistance coatings, (iii) Modelling materials, new welding and bending strategies, (iv) Pre-validation (pilot scale) and testing at real plant conditions, Table 1.

Dr. Tarja Laitainen, vicepresident of the research area, greeted attendees with their presence on-site and welcomed those who were online before commencing the workshop.



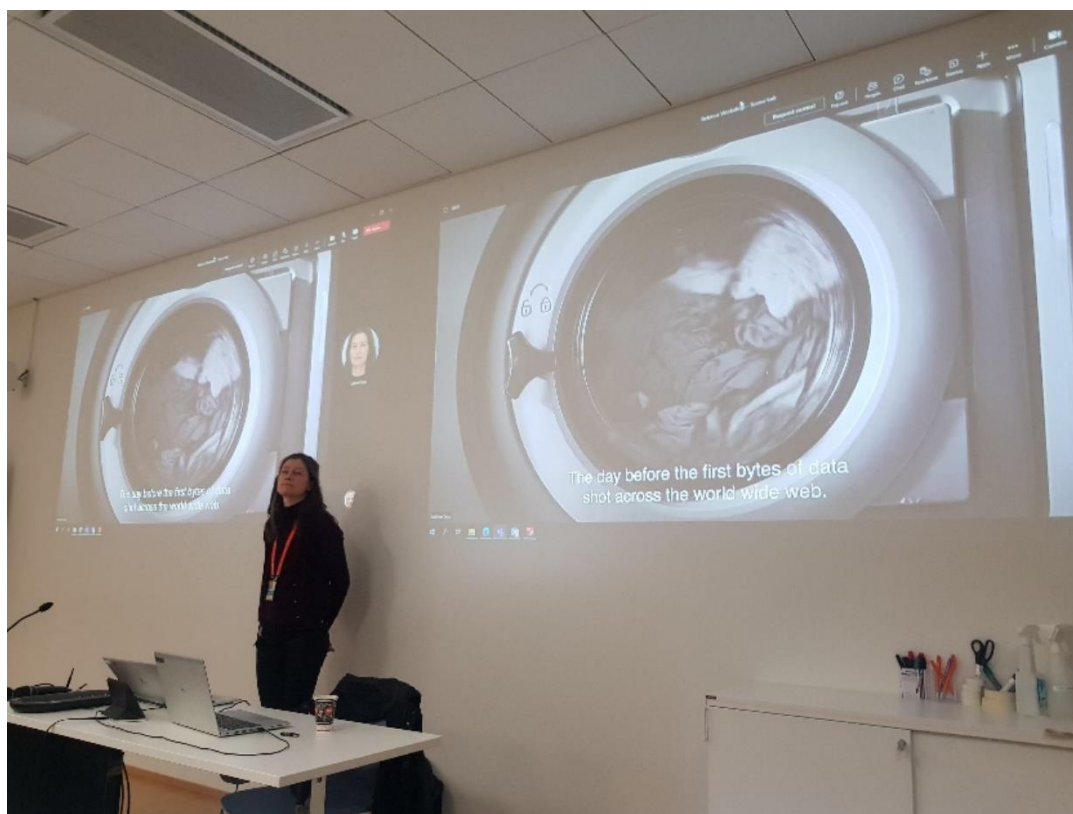


Figure 6: Vice-president of VTT research area, Dr. Tarja Laitainen

Professor Francisco Javier Pérez Trujillo gave an overview of the project before the technical speeches and discussions.



Figure 7: Overview of Belenus project, Francisco Javier Pérez Trujillo, Universidad Complutense de Madrid.

Table 1 shows the program detail of the workshop.

Table 1: Workshop programme.

#### AGENDA WORKSHOP:4th OF OCTOBER 2022

9:00	<b>Greetings from VTT</b> , <i>Dr Tarja Laitinen, Research Area Vice President, Knowledge Driven Design, Sustainable Products and Materials.</i>
9:10	<b>BELENUS project overview</b> <i>Dr. F. Javier Pérez Trujillo, UCM</i>
09:25	<b>Biomass fuels</b> <ul style="list-style-type: none"> <li>• <i>Material related challenges in biomass combustion (Dr Hanna Kinnunen, Valmet Technologies Oy) (9.25)</i></li> <li>• <i>Materials selection for a new biomass fired boiler; Owner's point of view (Dr Katri Ekholm, Helen Ltd (9.45)</i></li> <li>• <i>Biomass characterization of fuels used in Belenus Project (Dr. Manuel Benito González, CIEMAT, Spain) (10.05)</i></li> </ul>
10:25	Coffee break
11:00	<b>Biomass corrosion-resistant coatings</b> <ul style="list-style-type: none"> <li>• <i>Advances in Anti-Corrosion Coatings and their medium-term corrosion behavior in biomass atmosphere (Dr Pauline Audigie, INTA, Spain) (11.00)</i></li> <li>• <i>Coating processes for improvement of corrosion resistance (Dr Francisco Gonçalves, TEandM, Portugal) (11.20)</i></li> <li>• <i>New FeCrAl materials for boiler environments (Dr Johanna Nockert, Kanthal, Sweden) (11.40)</i></li> <li>• <i>Laboratory investigation of bulk/coatings in simulated biomass environment (Dr. Vincent, Chalmers University of Technology, Germany) (12.00)</i></li> </ul>
12:20	<b>Modelling materials, new welding and bending strategies.</b> <ul style="list-style-type: none"> <li>• <i>Predicting oxide phases and oxidation kinetics observed in the laboratory investigation (Dr Torbjörn Jonsson, Chalmers University of Technology, Sweden) (12.20)</i></li> <li>• <i>Tensile Properties Investigation of Coated and Uncoated 12%Cr Steel Using a Thermophysical Simulation System (Dr Fabian Dittrich, Technical University of Munich, Germany) (12.40)</i></li> <li>• <i>HAZ Simulation, Melting and Bending Investigation of Coated and Uncoated 12%Cr Steel" (Dr Peter Mayr, Technical University of Munich, Germany) (13.00)</i></li> <li>• <i>Lifetime prediction approach applying experimental and modelling data from the Belenus project (Dr. Janne Pakarinen, VTT (13.20)</i></li> </ul>
13:40	Lunch
14:40	<b>Visit VTT facilities</b>
15:40	<b>Pre-validation (pilot scale) and testing at real plant conditions</b> <ul style="list-style-type: none"> <li>• <i>Fireside Corrosion Probes and Trial Coated Tube Exposures in Biomass Fired Power Plant Boilers, Dr Colin Davis, UNIPER, United Kingdom). (15.40)</i></li> <li>• <i>Preventive Maintenance: On-line Corrosion Monitoring System (Dr Francisco Javier Pérez Trujillo, UCM (16.00)</i></li> <li>• <i>Biomass Pilot Plant testing: Fluidized bubbling bed conditions influence (Dr Alberto Bahillo, CIEMAT) (16.20)</i></li> <li>• <i>Investigating the erosive wear of boiler tubes from an operator's view (Dr Simon Heckmann, RWE, Germany) (16.40)</i></li> </ul>
17:00	Coffee break
17:15	<b>Discussion session: new perspectives in biomass technology</b> <i>Set of central questions which are discussed by the group.</i>
18:00	<b>Closure of the workshop</b>

The following photographs are illustrating different moments of the event. In figures 7 and 8, Dr Hanna Kinnunen and Dr Katri Ekholm, from industry external, featured companies needs and insights.



Figure 8: Presentation entitled *Material related challenges in biomass combustion*, Dr Hanna Kinnunen from Valmet Technologies Oy,



Figure 9: Presentation entitled *Materials selection for a new biomass fired boiler*; Owner's point of view, Dr Katri Ekholm, from Helen Ltd

Highly interesting works were presented during the workshop by the partners, some of them are shown below:



Figure 10: Presentation entitled *New FeCrAl materials for boiler environments*, Dr Johanna Nockert, Kanthal, Sweden

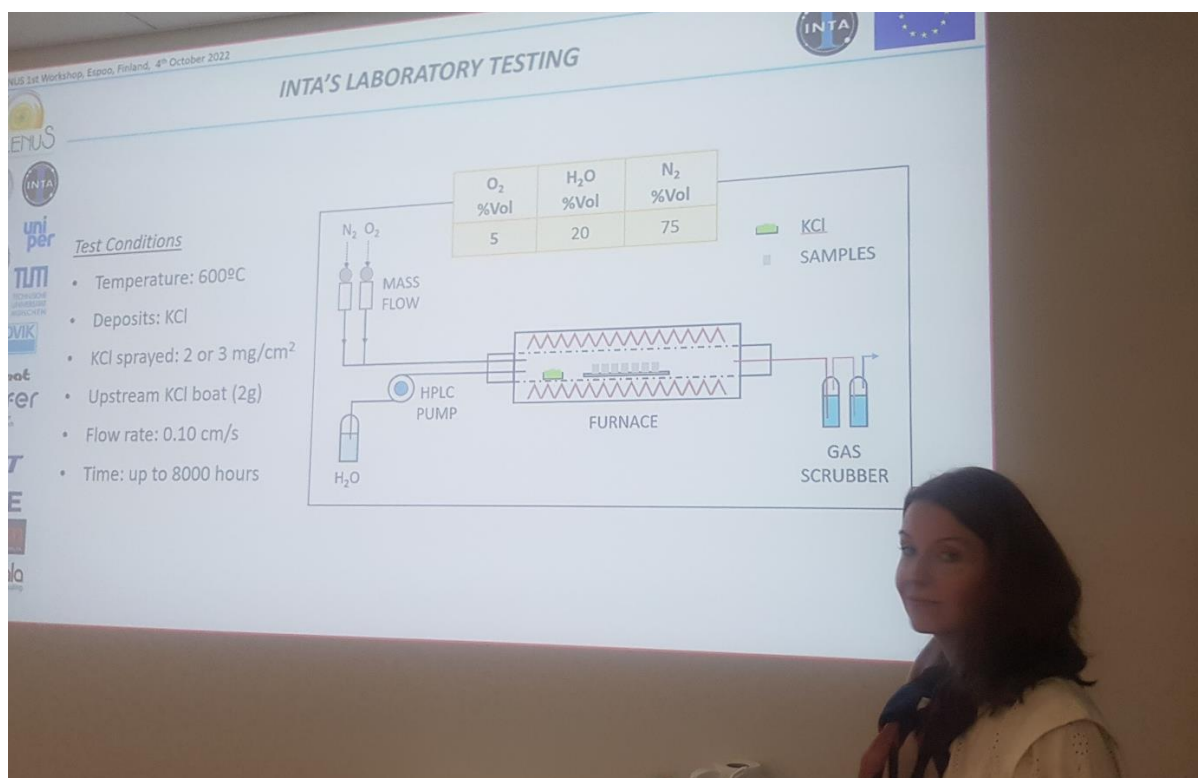


Figure 11: Presentation entitled *Advances in Anti-Corrosion Coatings and their medium-term corrosion behavior in biomass atmosphere* (Dr Pauline Audigie, INTA, Spain)



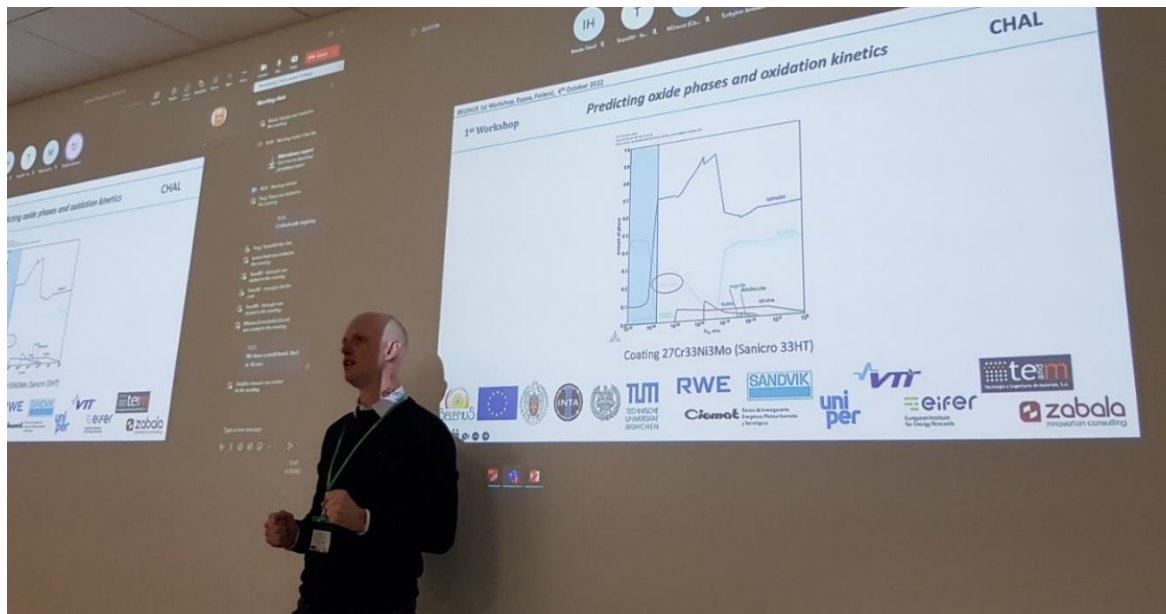


Figure 12: Presentation entitled *Predicting oxide phases and oxidation kinetics* observed in the laboratory investigation, Dr Torbjörn Jonsson, Chalmers University of Technology, Sweden

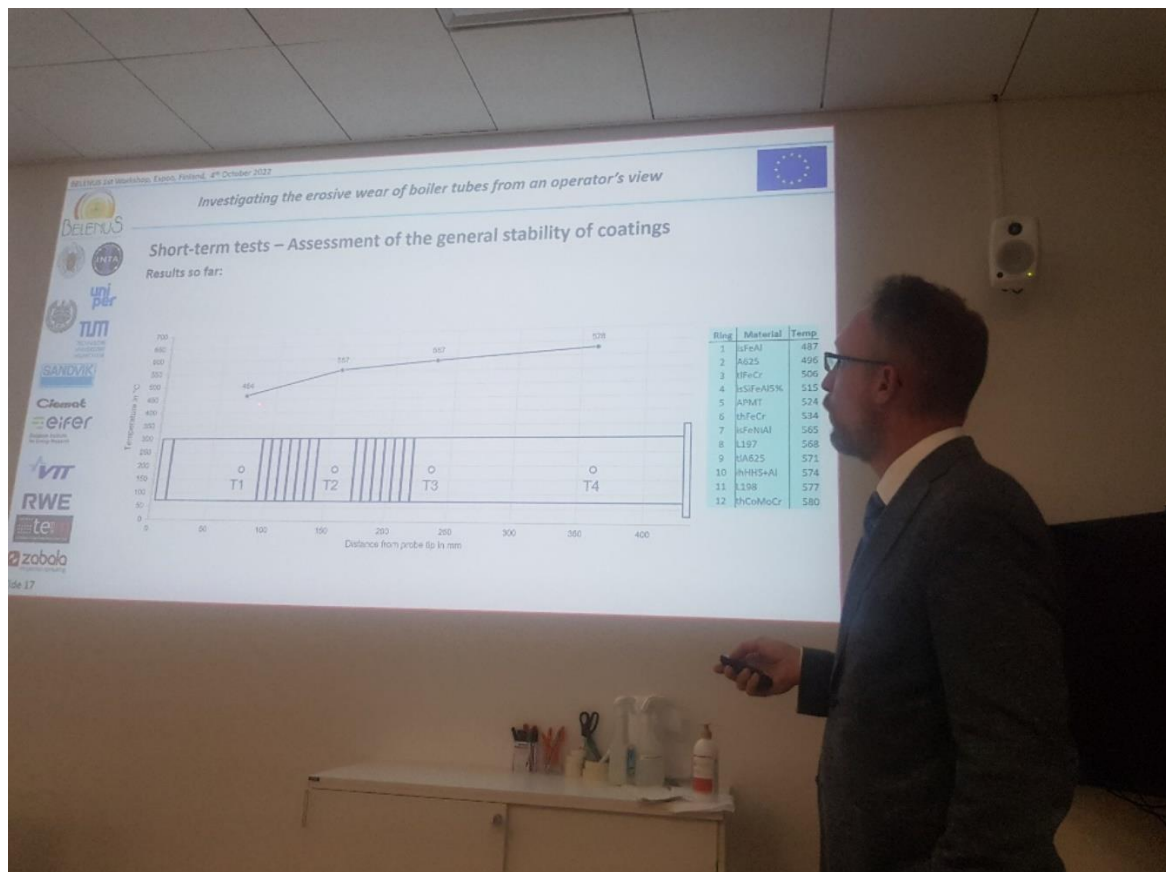


Figure 13: Presentation entitled *Investigating the erosive wear of boiler tubes from an operator's view*, Dr Simon Heckmann, RWE, Germany

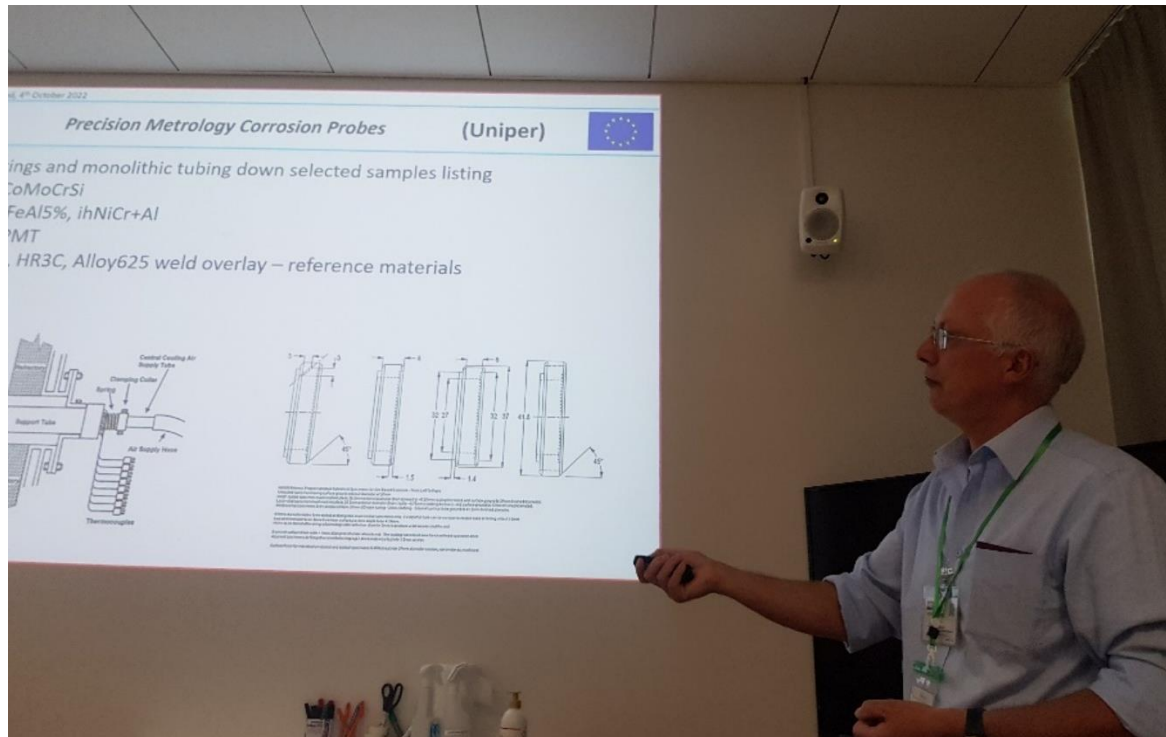


Figure 14: Presentation entitled *Fireside Corrosion Probes and Trial Coated Tube Exposures in Biomass Fired Power Plant Boilers*, Dr Colin Davis, UNIPER, United Kingdom

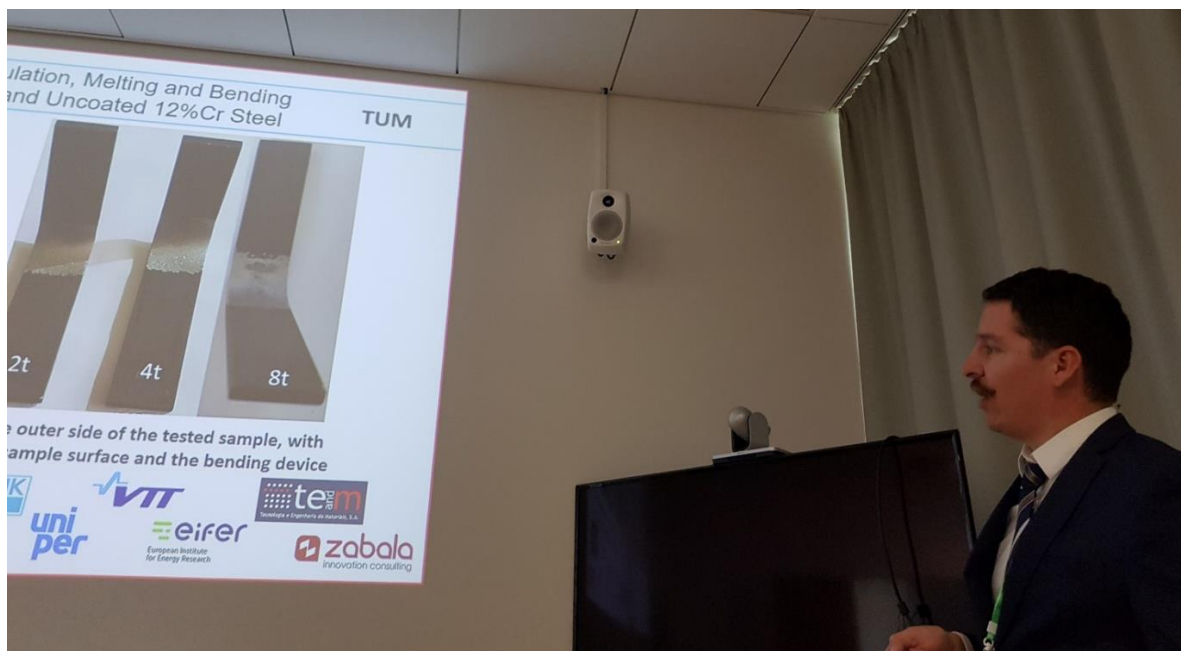


Figure 15: Presentation entitled *Tensile Properties Investigation of Coated and Uncoated 12%Cr Steel Using a Thermophysical Simulation System* (Dr Fabian Dittrich, Technical University of Munich, Germany)

There were several coffee breaks and time for exchanging views with colleagues during the event.





Figure 16: Time for a coffee break



Figure 17: Visiting VTT facilities

Before closing the event, a discussion session among industry, academic and research experts was carried out under the title “new perspectives in biomass technology”.



*Figure 18: Final discussion among participants*

The profitable event ended up with a picture of all participants:



*Figure 19: Closure picture of the speakers and attendees of the workshop.*

### **2.3. Workshop participants**

An online registration form was created by VTT. It was a very efficient and convenient process to list all participants. It was available for the event a few months in advance.



## BELENUS

The screenshot shows the '3. READY' step of the registration process. It includes a 'Thank you!' message, a confirmation of registration, and two buttons: 'Open printable confirmation' and 'Save to calendar'. Below this is a European Union logo and a statement about funding from the Horizon 2020 programme.

**Event information**

Event name	BELENUS Workshop & Young school
Event organiser	Janne Pakarinen
Event organiser's e-mail address	<a href="mailto:janne.pakarinen@vtt.fi">janne.pakarinen@vtt.fi</a>
Starts	4.10.2022 0:00
Ends	5.10.2022 0:00
Venue	VTT
Address	Kivimiehentie 3, Espoo ( <a href="#">On the map</a> )
The registration deadline is	1.10.2022 0:00

**Your information**

I will participate	Yes
First name	Gustavo
Last name	Garcia Martin
E-mail address	<a href="mailto:gusgarcia@ucm.es">gusgarcia@ucm.es</a>
Organisation	Universidad Complutense de Madrid
Mobile phone number	+34610466139
I will participate:	Workshop 4.10. Young school 5.10.
Special diet	No
Time of registration	7.7.2022 14:36

[Edit your information](#)

Figure 20: Online registration form Belenus workshop.

The participation of the workshop had roughly 35 participants counting on the on-site visitors and fluctuating online participants. Most of the attendees belonged to institutions of Belenus consortium. The following Figure depicts the participant distribution.

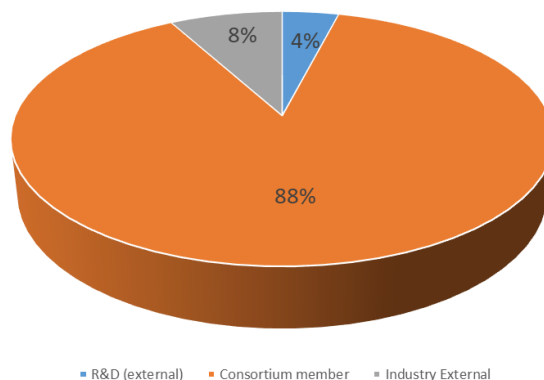


Figure 21: Workshop participants.

### 3. Conclusions

The first workshop of Belenus realized in Finland was a very fruitful event. It had a very high-quality presentations, interactive sessions and an exchange of knowledge among all participants.

#### 4. Degree of Progress

The first BELENUS workshop is completed. it was heavily impacted by the Covid-19 pandemic, explaining the delay in featuring this activity and delivering this report. With the issue of this deliverable D8.6 is considered to be completed.

## 5. Dissemination Level

Public

## 6. References