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DELIVERABLE D5.4

Assembled CHP system

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Document Control Sheet

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TABLE OF CONTENT

LIST OF FIGURES

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1 EXECUTIVE SUMMARY

Within the framework of BLAZE project, a small CHP pilot system, able to process a syngas stream from a biomass gasification unit and to produce electricity up to 25 kW_e using SOFC technology, has to be designed and built.

In particular, the BLAZE pilot plant will integrate an already existing 100 kW_{th} gasifier, a 25 kW_e SOFC large stack module (LSM), with a gas cleaning and conditioning section.

This deliverable shows the assembled gas cleaning and conditioning section integrated with the SOFC LSM. After shipment the system will be integrated with the gasification unit located at the premises of Walter Tosto (WT) in Italy as part of Task 5.7.

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2 INTRODUCTION

2.1 Objectives and scope of the document

The BLAZE project aims to realize a CHP system able to convert biomass into electrical and thermal energy, aiming to achieve high efficiency. In particular, the pilot plant combines an already existing 100 kW_{th} pilot scale gasification unit with hot gas pre-treatment and conditioning and an SOFC large stack module, in combination with an innovative implementation of a turbo fan unit and a novel anode off-gas recirculation concept.

In a previous deliverable (D5.3) the design book of the BLAZE CHP plant was presented. The scope of this deliverable is to present the hot gas pre-treatment and conditioning and SOFC large stack module assembled and placed in a container.

2.2 Content of the deliverable

This deliverable presents the BLAZE CHP prototype system in chapter 3.

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3 HOT GAS CONDITIONING SYSTEM AND LSM READY

The CHP prototype is built inside a 40 ft high cube sea container and consists of the following sections:

1. a Gas Upgrading section, containing all high temperature components required for the proper operation of the SOFC module, such as: sorbents for gas impurities, tar reformer, heat exchangers etc.;

2. a large stack module (LSM) with a nominal power output of 25 kWe, and;

3. a steam driven turbofan.

The following pictures show the exterior and the interior of the CHP housing. The exterior of the container is shown in Figure 1 and Figure 2; a detailed view of the containers' interior is given in Figure 4 to Figure 11.

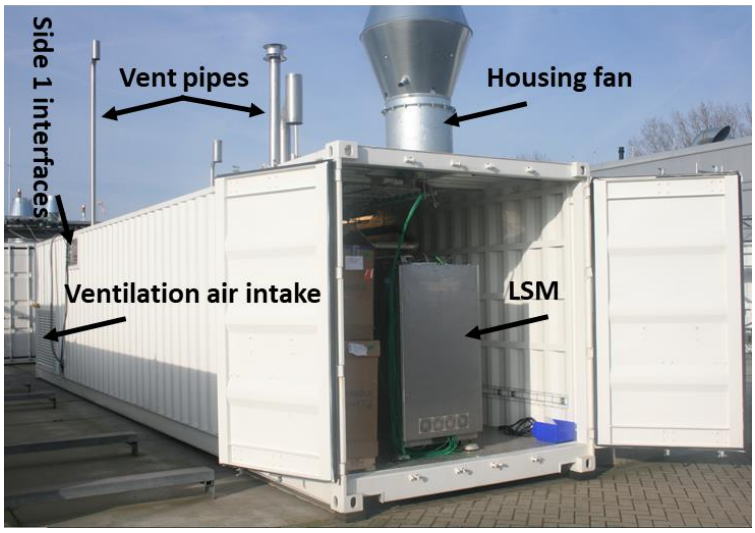

Figure 1: The outside of the housing showing the vent pipes and the "side 1 interface" panel

Figure 2: Opposite exterior of the housing showing "side 2 interface" panel

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Figure 3: High temperature interface valves. These will disconnect the GCU from the Gasifier.

Figure 4: High temperature sorbent vessels (left) and tar reformer (right) to remove gas impurities. Band heaters provide equal heat transfer to the vessel

Figure 5: 3D printed module of the turbofan. The model is used to fit the actual design.

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Figure 6: Close up of the LSM unit with the hot ventilation air exhaust

Figure 7: Close up of the LSM hot air heaters (left) and the fuel heater (right)

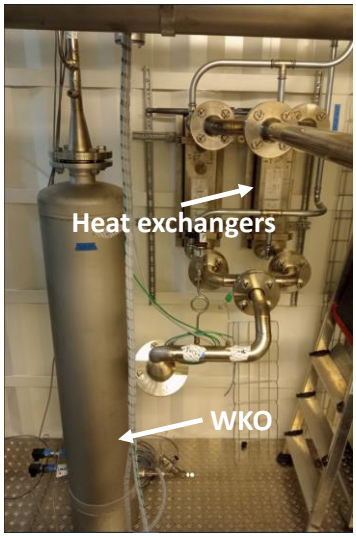

Figure 8: Anode off gas cooler. Before recirculation, the gas is cooled down and water is taken out.

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Figure 9: Utilities connected to "Side 2 interface" panel. These provide gas to flush the system and air to operate the pneumatic valves

Figure 10: Closeup of steam and fuel piping

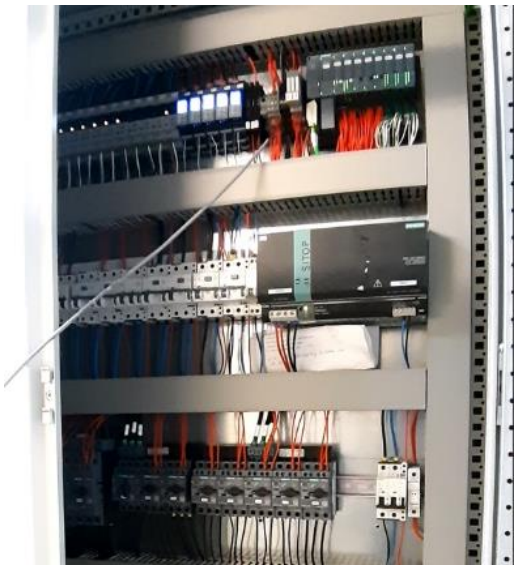

Figure 11: part of electrical cabinet

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4 CONCLUSIONS

This deliverable shows the 25 kW_e CHP system built at HyGear facilities in the Netherlands. The designed and constructed prototype will be tested at WT in Italy. Figure 12 shows the acknowledgement sign added to the prototype housing.

Figure 12: Acknowledgement sign added to the prototype housing

5 List of Abbreviations

CHP	Combined heat and power
SOFC	Solid oxide fuel cell
GCU	Gas cleaning unit
PFD	Process flow diagram

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