HEATSTACK

Project acronym:	**HEATSTACK**
Project full title:	**Production Ready Heat Exchangers and Fuel Cell Stacks for Fuel Cell mCHP**
Grant agreement no:	**700564**

Deliverable 8.4 - Project Logo, Brochure, Leaflets, etc.

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Dissemination Level		
PU	Public	☒
PP	Restricted to other programme participants (including the Commission Services)	☐
CO	Confidential, only for members of the consortium (including the Commission Services)	☐

Version History

Version	Date	Author	Organisation	Description
V0.1	23/06/2017	J. Hughes	PNO	First draft
V0.2	28/06/2017	J. Craven	PNO	Review (content) of first draft
V0.3	30/06/2017	O. Swanzy	PNO	Final internal review (quality)
V1.0	08/07/2020	J. Hughes	PNO	Addition of 3 statements, FCH logo and EC flag on this page.

Statement of originality:
This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

Disclaimer:
Any opinions expressed in this report are solely those of the authors and neither of the Fuel Cells and Hydrogen 2 Joint Undertaking, nor the European Commission or its representatives.

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1 Introduction

As defined in the Description of Action (DoA), the objective of Work Package (WP) 8 is to analyse, present and communicate the results of the HEATSTACK project throughout the EU. It is imperative that relevant project results are effectively and widely disseminated and communicated, to maximise the anticipated impact of the project and to realise the exploitation potential of the technologies advanced during the project and the new knowledge gained by the partners, in order to allow HEATSTACK's value to be exploited beyond the project partners. The full strategy is detailed in D8.1 – Dissemination and Exploitation Plan.

Dissemination focuses on disclosure and communication on promotion and as such they complement each other. Activities that contribute towards achieving the objectives of HEATSTACK's communication and dissemination strategy are the materials created (e.g. brochures) for dissemination and the channels used (e.g. project website) for communication.

The purpose of this document is to record the materials created for the HEATSTACK project, namely the project logo, brochure and leaflets. These materials are all used on the project website, which is a key communication channel that is detailed in D8.3 – Project Website. Any additional materials that are created during the project duration will be recorded in a revised version of this document.

2 Dissemination Materials

This section records the individual materials that have been created, with each detailed in separate subsections and further images available in the Annex.

2.1 Project Logo

The HEATSTACK brand was discussed at the project's Kick off Meeting in M1, with several designs for a logo put forward by the partners. The shortlisted options were put to a vote and the most popular one had the design finalised by PNO in M3 – this can be seen in Figure 1 (below). Examples of other logo designs that were created can be found in the Annex.

The logo represents heat (by changing in colour from blue at the bottom of the letters to red at the top), the fuel cell stacks (by having each part of the letters stacked upon one another) and sustainability (by the green leaves shooting out from the first letter 'A') to demonstrate the benefits of the technology.

This logo features on all dissemination materials created and on the project communication channels such as the website and social media.

Figure 1: HEATSTACK Logo

2.2 Project Brochure

The project brochure was discussed during the 2nd GA Meeting in M13 and was created with a dual purpose: (i) to summarise the project for those not familiar with it, and (ii) to capture the headline results from the first year of HEATSTACK. Therefore, a 2-page A4 format was chosen for the brochure, which allows further pages to be added in M24 and M36 for the headline achievements in years 2 and 3 of the project.

The first page headed by the project logo (see above), as well as the EU flag and Fuel Cells and Hydrogen Joint Undertaking logo in recognition of the funding received for the project. There is then a brief explanation of why fuel cells are such an important technology and how the HEATSTACK project is contributing to development and innovation in this area. The remainder of the first page is dedicated to summarising the partners that make up the consortium by having logos and a description of each. The first page can be seen in Figure 2 (below).

Figure 2: HEASTACK Brochure (first page)

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Why Fuel Cells?

Fuel cells have shown great promise for residential micro-Combined Heat and Power (mCHP) generation due to their high electrical efficiency and ability to run on conventional heating fuels, but high capital costs remain a key challenge to the advancement of this sector and mass market introduction in Europe.

About HEATSTACK

This 36-month project, funded through the FCH Joint Undertaking and Horizon 2020, focuses on reducing the cost of the 2 most expensive components within the fuel cell system – the fuel cell stack and heat exchanger – which together represent the majority of total system CAPEX. The project has partners in 5 EU countries.

Senior Flexonics UK, based in Crumlin (Wales), provide expertise in the design, development and manufacturing of heat exchange solutions for the energy generation market and for the diesel engine market. The manufacturing facility in Olomouc (Czech Republic) covers 3630m² and is equipped to for the production of Turbo Oil Drain and Turbo Oil Feed tubes for passenger car engine manufacturers, and volume production of Cathode Air Pre-heaters (CAPH) working at up to 950°C and a 1000°C peak.

The Centre for Hydrogen & Fuel Cell Research, part of the University of Birmingham's School of Chemical Engineering, is internationally recognised for its dynamism and expertise in Fuel Cell Technologies. It focuses on R&D, applications and demonstrations of Hydrogen and Fuel Cell systems; it has numerous publications and patents in Fuel Cell Technologies, as well as state of the art facilities.

ICI Caldaie is a leading company of the CHP sector thanks to the continuous R&D of highly reliable heating generators keeping up with the technological evolution, which has allowed the firm to transfer the know-how acquired in the planning and realization of industrial steam generators, a sector in which the firm occupies a leading position.

Vaillant is one of the market leaders and technological pace-setters within the heating, ventilation and air-conditioning industry. Their product portfolio encompasses highly-efficient CHP appliances based on gas engines for the use in single- or multi-family homes that represent today's most efficient gas technology.

Sunfire develops and produces high-temperature fuel cell (SOFC) and electrolyser (SOEC) systems, which address a multitude of problems in energy systems. Sunfire's SOC technology has been perfected to achieve the optimal balance between high reliability, low manufacturing costs, high electrical efficiencies and reversible operation.

The PNO Group is a pan-European innovation consultancy active across 12 European countries. Working across all principle industry sectors, PNO has developed extensive expertise in establishing, managing and contributing to complex international technology transfer consortia, communities, processes and projects.

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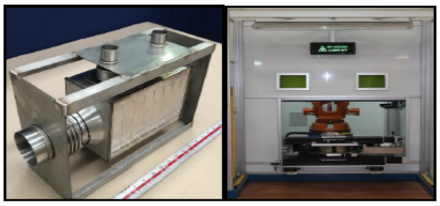
The second page of the brochure focuses on the headline results achieved in the first year, with sections containing text and images on Cathode Air Pre-Heater development from Senior Flexonics and ICI, fuel cell stack and process development by Sunfire, materials research and testing undertaken by the University of Birmingham and field testing results generated by Vaillant. The second page is shown in Figure 3 (below).

Figure 3: HEATSTACK brochure (second page)

Year 1 Project achievements

- Senior Flexonics has a production-ready CAPH using AluChrom that gives robustness, cost effectiveness and industry leading low levels of Chromium leakage.
- Significant investment has been made in equipment and tooling to achieve process efficiency.
- Simulation has allowed the development of a design that can be used in different applications, which functions at different temperatures, pressures and flow rates, within the boundary condition range of ICI Caldaie's specifications.



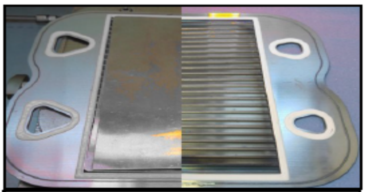


Image: thin layer (left wet, right dry)

- Printing of glasses was chosen by Sunfire out of 6 alternatives as the method with the best value for industrial stack production.
- Devices needed for printing have been designed and built.
- 2 printing slurries have been developed during the project.
- The first printing tests showed good results for thin layers.

- A denuder technique was employed by the University of Birmingham to quantitatively analyse the chromium vaporisation from Inconel 625 & AluChrom 318.
- The Cr evaporation rate for the AluChrom 318 is approximate one order of magnitude lower than that for the Inconel 625.
- The formation of a dense and continuous alumina scale on alloy surface could effectively reduce the high temperature Cr leakage in the long term.
- The low cost, low Cr evaporation, and excellent high temperature corrosion resistance offered by AluChrom 318 make it highly suitable for CAPH application.

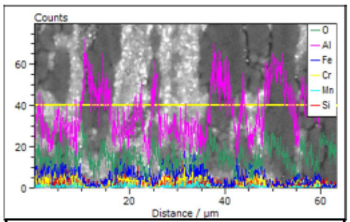


Figure: EDX line scan from steel through the oxide scale of AluChrom 318 after 1000 hours exposure at 850 °C in air containing 3% H_2O (6.0 L/min).

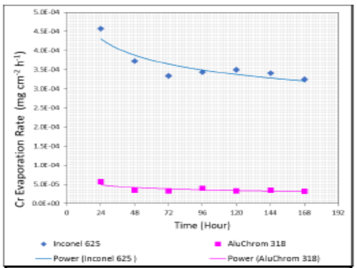
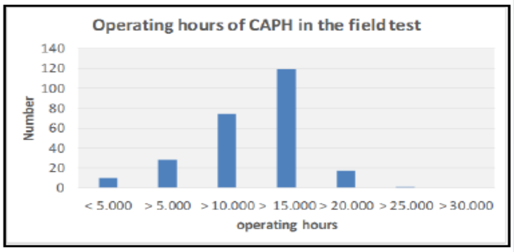


Figure: Rate of Cr evaporation as a function of time for Inconel 625 and AluChrom 318 at 850 °C in air containing 3% H_2O (6.0 L/min).

- The results for operating hours from Vaillant's field testing are positive for HEATSTACK.
- This field testing (from 2013 to April 2017) totals over 3.4 million operating hours.
- The maximum single CAPH operating time with Inconel so far is 28,600 hours.
- The maximum single CAPH operating time with Aluchrome so far is 19,700 hours.



The brochure has been made available for download by the public on the HEATSTACK website:
http://www.heatstack.eu/wp-content/uploads/2016/04/HEATSTACK-Brochure-Year-1.pdf

2.3 Project Leaflet

A project leaflet has been created in the form of a factsheet that covers all of the key achievements in year 1, which provides more detail on the bullet point achievements listed in the brochure with additional images to demonstrate the progress made during the first year of HEATSTACK. The leaflet follows the same order as the brochure for the content and this will allow future versions on the project achievements in years 2 and 3 to be created in M24 and M36. The first page of the leaflet is displayed in Figure 4 (below) and the full version is available on the HEATSTACK website:

http://www.heatstack.eu/wp-content/uploads/2016/04/HEATSTACK-Year-1-Project-Summary-1.pdf

Figure 4: HEATSTACK Leaflet (page 1)

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HEATSTACK Year 1 Project Summary

The first year of the HEATSTACK project was recently completed and there are a number of key achievements and results that we can publicise.

Project coordinator Senior Flexonics has developed a production-ready CAPH using AluChrom that gives robustness, cost effectiveness and industry leading low levels of Chromium leakage. Simulation has allowed the development of a design that can be used in different applications, which functions at different temperatures, pressures and flow rates, within the boundary condition range of ICI Caldaie's specifications. Here are a couple of images of this new design:

Senior Flexonics have also made significant investment during the year 1 of HEATSTACK in new equipment and tooling in order to achieve process efficiency that will benefit future production. Here are a images of a new machine:

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3 Annex

The logos contained here are examples of designs created but ultimately rejected by the consortium.

Figure 5: HEATSTACK Logo – design A

Figure 6: HEATSTACK Logo – design B

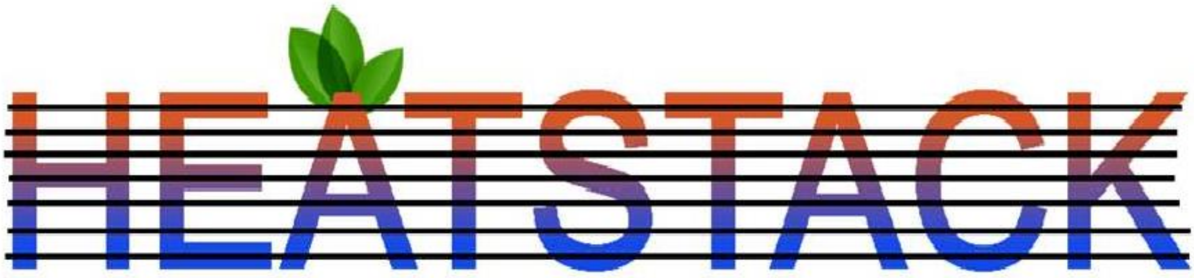

Figure 7: HEATSTACK Logo – design C

Figure 8: HEATSTACK Logo – design D

Figure 9: HEATSTACK Logo – design E

Figure 10: HEATSTACK Logo – design F

Figure 11: HEATSTACK Logo – design G

Figure 12: HEATSTACK Logo – design H