Proposal title:

"Advanced direct biogas fuel processor for robust and cost-effective decentralised hydrogen production" BioRobur[Plus]

Topic:	FCH-02-2-2016. Development of compact reformers for distributed bio-hydrogen production
Funding scheme:	Collaborative project
Start date of project:	1 January 2017
Duration:	42 months

Deliverable: D7.2 Dissemination plan issued published on web site

Organisation name of lead contractor for this deliverable: POLITO

Author: Prof. Debora Fino

Disemmination level: PU

Tables of content

1. Summary

The current document "*D7.2: Dissemination plan issued published on web site*" is part of the work package 7 (WP7) and aims to provide an overview of the BioRobur^{plus} project Dissemination Plan, which summarizes the consortium's strategy and concrete actions related to the dissemination of the project and its results. It has been also developed for amplifying the project's impact across its lifetime. Initially organized during the proposal submission stage, the Project Dissemination Plan will be evolving through a continuous feedback and assessment loop, in order to adapt to the needs of the project as a whole, as well as those of the involved parties as separate entities.

The BioRobur^{plus} project will demonstrate the capacity of bio-hydrogen production from biogas in a cost competitive and sustainable manner thereby replacing traditional industrial routes with a novel approach by exploiting all possible energy integration means, as well as innovative structured catalysts and control means to achieve not only cost-competitiveness but also durability and environmental viability.

The BioRobur^{plus} concept is being developed within the FCH-JU H2020 financing program (Grant: 736272). It aims at realizing a TRL6 Demoplant delivering delivering 50 Nm^3/h (i.e. 107 kg/d) of H_2 at 99.9% purity and 1.5 bar from different biogas types in a cost-effective manner.
The outcome of the present project could be extremely important for the future of the European industry and its suppliers in the field of energy sustainable development and strategies because it will, by introducing a breakthrough technology for the hydrogen production, strengthen their competitiveness at the international level and create employment in a vital sector across Europe.

2. Introduction

This is the second deliverable referred to the dissemination activities of BioRobur^{plus} project, which falls within the framework of WP7: "*Dissemination & training*" and aims at providing an overview of the consortium's considerations with regards to the management, planning and coordination of the activities, towards ensuring an efficient mechanism for maximizing the project's impact. The main objective of this deliverable is to present the plan for dissemination issued published on web site of the results of BioRobur^{plus} project. All partners have been contributed with their dissemination intentions. A commonly agreed Dissemination Plan is necessary in order to ensure the effective communication of knowledge by all partners, and the establishment of a common strategy, that is supported and amplified by the entire consortium. The information on dissemination activities results were included in the periodic coordination and management reports delivered in WP1.

An initial consideration of the main actions and target groups was realized as early as the proposal submission stage, while a more concrete plan is currently presented in the present document, developed within the activities of WP7, aiming to put in action the original plan defined during the

proposal submission stage, and to further make any necessary amendments and updates, following the project's progress and external opportunities, along the project development and lifetime.

According to WP7, the communication and dissemination plan should be oriented to:

- Organize dissemination activities (participation to conferences and organization of fairs, seminars, workshops, journal publications and website).
- Transfer of knowledge from the project partners to end users.
- Providing knowledge about the technologies developed during the project to potential customers and endusers outside of the BioRobur^{plus} consortium but also to all involved partners.
- Define dissemination routes and agreements for the project results, based on market analysis for the BioRobur^{plus} technologies.
- Duly protect the knowledge and innovation generated, considering the possibility to apply for patenting at European level.

3. BioroburPlus website

A website is a central part of any communication plan for a business, institution, or entity trying to broadcast a message destined to reach the wider public. In this regard, a project website has been created for the BioRobur^{plus} project (http://www.bioroburplus.org/), with the task of disseminating information about the projects objectives, participants and results in a way that is comprehensible to a wider public audience.
A flat design with a simple chromatic template has been chosen in order to create a modern atmosphere. In order to make the navigation accessible from any device and to optimise the position in search engines, a responsive design has been chosen.

3.1 Contents and sections

- Home

This page aims at attracting the attention of the visitor and diminish the bounce rate of the website.
The visitor is invited to learn more about the project. Here the visitor can find the project overview, which contains information about the research and the objectives of the project.
The image at the bottom illustrates the final plant, as it hopefully will be at the end of the project and the final application.

- Partners

This page shows all the partners who are involved in the project. Every partner has a short description of its activities and their project role.

- Contents

Discover the scientific publications developed within BioRobur^{plus} project

- Dissemination

Activities already performed.

- Private area

We created a private area of the BioRobur^{plus} website in order to allow consortium members to share easily and securely project related documents. A simple sitemap has been created, which makes the work more efficient. In the contents area we upload all deliverables, minutes of the meetings, presentations, templates and every document we want to share in the consortium.

3.2 Security

This private website is available for Members only and protect with an individual password. The website administrator can grant to every person of the consortium can access to the private area with secured credentials

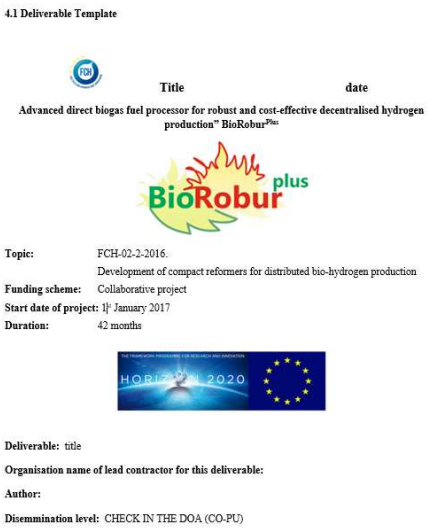
3.3 Updated and upgrades

The public website is updated by POLITO. This includes meetings, results, workshops, conferences, and any information that might be of interest for the stakeholders of the project. All the partners update the private website. These updates are done on a very frequent basis, as working documents are being uploaded and modified during the entire duration of the project.

4. Internal Knowledge Output template

4.1 Deliverable Template

The below template image, Fig. 1, is the first page of each Project's deliverable. All the useful information are included, i.e the logo, the start date, the call of the project, the Author and the title of the deliverable to rapidly identify the content of the document.


4.1 Deliverable Template

Title date

Advanced direct biogas fuel processor for robust and cost-effective decentralised hydrogen production" BioRobur^{Plus}

BioRobur plus

Topic: FCH-02-2-2016.
Development of compact reformers for distributed bio-hydrogen production
Funding scheme: Collaborative project
Start date of project: 1st January 2017
Duration: 42 months

HORIZON 2020

Deliverable: title
Organisation name of lead contractor for this deliverable:
Author:
Dissemination level: CHECK IN THE DOA (CO-PU)

Fig.1 First page template for deliverable document

4.2 Meeting Template

Identically to deliverable template, the below format depicted in Fig. 2 is the initial slide of each presentation delivered during the prenary Genale Assembly meeting and it part of the coordinated image of the consortium.

Fig.2 First slide template for presentation document

5. The BioRobur[Plus] dissemination strategy and actions.

Dissemination is an integral part of the BioRobur[Plus] project's activities aiming to spread awareness upon the progress and results of the project, presenting and enhancing in this way. The dissemination plan aims to raise awareness about the capacity of bio-hydrogen production from biogas in a cost competitive and sustainable manner.

A well-structured strategy is necessary in order to ensure that the dissemination activities will be realized across a wide set of events, scientific papers, national and international workshop and conferences participations and that an effective targeting of users will be achieved. Furthermore, actions are required to be evenly and rationally distributed across the development of the project, in order to successfully disseminate and exploit the project's results, technical and social impact, along its entire duration.

To this end, a draft of a dissemination plan has been developed during the early months of the project, in order to be followed by the consortium partners, predominantly aiming at ensuring:

• Timely, constant and openly communication of the project scope, work plan and project results to stakeholders;

• Distinct strategy using targeted messages, means and language to engage the target audience;

• The use of medium and means to reach the target audience;

• Definition of key metrics to evaluate efforts.

The BioRobur[Plus] Dissemination Plan uses different strategies to deploy an integrated dissemination approach according to which the project maps and reaches via online tools (such as the project website, webinars, social media webpages) as well as offline channels (such as conferences, workshops, fairs, open weeks).

5.1 Target stakeholders & Audience

In order to build an effective Dissemination Plan, the consortium has identified whom it wants to address. In the DoA of the BioRobur[plus] project, it has already been defined seven target groups to whom most activities need to be addressed. Depending on the category, a specific audience will be targeted for the dissemination of the outputs and the accordingly suitable media will be used.

These categories and associated dissemination strategies are detailed below:

Table 1. Target audiences for each communication tools to be used during the project lifetime

Planned/Actual Dates	Type	Type of audience	Countries addressed	Size of audience	Partner responsible/involved
M3/M3	Web Site Public	General Public	World	>500	POLITO/ALL
M3/M3	Web site Private	Partners	Partners Countries	<100	POLITO/ALL
Every 6 months /M0-M6 and M12 held	Internal meeting and reports	Partners	Partners Countries	<100	POLITO/ALL
According to plan	Deliverable reports and prototypes	Partners	Partners Countries	<100	ALL
Whenever key results are attained	Public reports and newsletters	General Public	Europe	>5000	POLITO/ALL
To Be Defined	Scientific papers on International journal and books	Academic & industrial R&D community	World	>500	POLITO, KIT, IRCE, CPERI
To Be Defined	National and International Workshops and Conferences participation (as speaker)	Academic & industrial R&D community	World	>500	ALL
To Be Defined	Regional/National/International Exhibitions	General Public	World	>500	ALL
To Be Defined	Seminars for PhD students	Partners & academic community	World	<100	ALL
M32	Dissemination and training event	Academic & industrial R&D	World	<100	ALL
M36-42	Technology Implementation Plan issued including market analysis	General Public	World	<100	HST/ALL

5.2 Timeline

The objective of the dissemination plan is to identify and organize the activities to be performed in order to enhance the influence of the project and to communicate the right information to the right audience. Although a number of activities are planned during the first 18 months of the project, the most significant activities will take place when a MVP is available and the results from the project will go to the real life industrial needs.

The dissemination activities are to be performed according to the following logical schedule:

1) Initial awareness phase (month 0-6): establishment of dissemination plan including analysis of relevant information resources in terms of identification of dissemination opportunities, development of the graphical identity of the project, i.e. project website design, project templates for documents.

2) Targeted dissemination phase (month 7-18): the consortium will enrich the website and create social media webpages for the project, attend selected events, organize workshops, publish results via press releases, newspapers and other publications and cooperate with similar projects.

3) Pre-launch phase (month 19-42): this phase will be focused on informing the target audience of BioRobur^{Plus} exploitable outputs.

5.3 Dissemination activites, channels and tools

An effective communication, dissemination and exploitation plan requires the active participation of the entire consortium. To this end, periodic updates will be realized where partners will be asked to provide their inputs with regards to their realized and/or planned activities, having in due regards high impact events and journal publications which should be pursued. The collection of inputs will be realized on a semester basis, last feedback (04.07.2018) from partners the planned dissemination actions at webpage/social media/workshops/conferences for the initial awareness phase (month 0-18).

All partners recognize the importance of spreading awareness on the developments of the BioRobur^{plus} project and will contribute to maximize use of all existing dissemination channels.

Electronic and printed dissemination material: Appealing and accessible dissemination material such as logos, posters, banners, videos, leaflets and newsletters will be developed to structure the "visual identity" of BioRobur^{plus}. Printable material with information for different target groups will be provided to all partners to distribute at conference and stakeholders venues, while electronic copies will be used for online publications, articles and other references such as local and international press. Additionally, a dissemination pack for the project legacy will be created and used by all partners as an advertising tool for the work performed by each partner within the project in events performed after the end of the project.

Regular Press Releases, Newsletters and Other Publications: All partners will be responsible for publishing project results in local and international press. These publications could be in the form of papers in scientific journals and conferences, press releases or newsletters in magazines and newspapers, etc. It is worth mentioning that special emphasis will be placed on publishing project related information in Open Access journals, which provide to the readers online access to scientific information free of charge. The WP7 leader/coordinator will intervene in case of results, which have been classified as publishable, do not receive the necessary dissemination. BioRobur^{plus} partners are planning some publications in wide range of high impact journals and publications for all publications, full open access will be ensured.

Table 2. List of dissemination media to be used to disseminate the project and the respective responsible partner

BioRobur^{plus} dissemination tools\Targets (Nr. of expected items)	Broad public	Students	Resear-chers	Component manufacturers	End users
Project webpage (1)	X	X			X
FAQ (20)	X	X			
Project folders, leaflets (9)	X	X		X	X
Scientific and specialised journals (8)		X	X	X	X
Open access journals (8)	X	X	X	X	X
Technology news, servers (6)	X	X	X	X	X
Presentations at conferences/fairs (12)		X	X	X	
Project workshop, final training event (2)		X	X	X	X
Press releases (6)	X	X			X
E-mail newsletters (9)		X	X	X	X
Video presentation (1)	X				

Organization and participation at workshops and relevant events: The presence of the project, its main objectives, major results and offered services; shall be shown in numerous suitable events for dissemination. In addition, understanding the importance of face-to-face communication and physical trials, POLITO will organize a workshop addressing and tailoring each part of the day to a specific audience. BioRobur^{plus} partners will also take part in relevant events organized by other similar platforms groups e.g., EU funded clusters.

A final dissemination event with a media production

Owing to the fundamental and applied research of the BioRobur^{plus} project, another valuable dissemination tool will be the organization of seminars for PhD students in the Universities of the Partner involved in the project. Besides, several PhD students themselves will be directly involved in the project and this research will be an integral part of their formation. A final dissemination and training event will be held by the end of the project (M32). The event will be recorded and all the presentations will be uploaded as YouTube video in BioRobur^{plus} public website easy to download for training pourposes and will be also available after the end of the project.

6. Use and exploitation foreground.

(Part of this paragraph is aleady present in the deliverable 7.1)

The expected results of this project could be extremely important for the future of European energy industry, introducing an innovative technology for hydrogen production, strengthening its competitiveness at international level and creating employment in a vital sector of green and environmental friendly energy across Europe. Exploitation and dissemination activities will therefore proceed in parallel ways from the first year of the project as shown in fig.3. Starting from these pathways, to enable correct and effective dissemination and begin the exploitation phase, specific actions will be tailored along the project, adapting material to be produced and participation in events according to the specific development stage of the project. Concerning exploitation, the partnership has already a clear idea of how to commercially exploit the project results, and during the project this exploitation path will be fine tuned and adapted to users' feedback, in order to arrive at a final exploitation plan including commercial agreements.

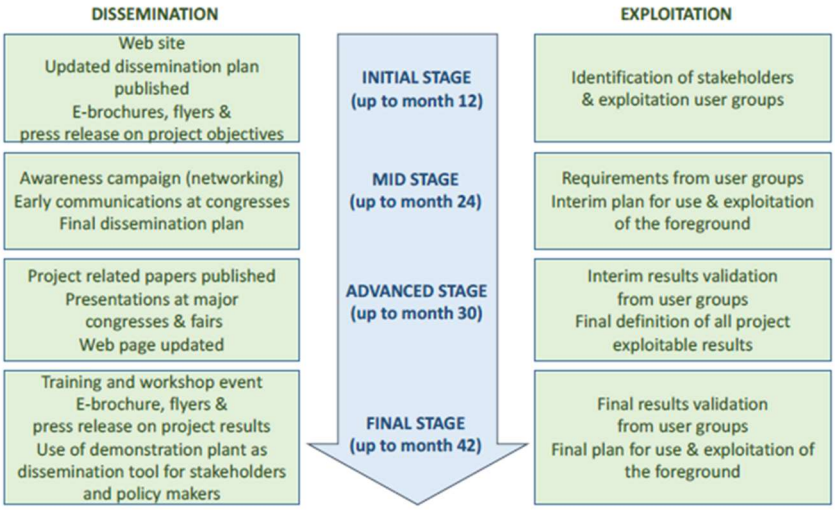


Fig. 3. Dissemination & exploitation pathways

The BioRobur^{plus} key SMEs (HST, MET and ENGICER) and large companies (ACEA and JM) offers an effective route for the exploitation of the project results into the bio-energy and waste management fields, including catalytic and support materials for reformers industries.

The nature of the research has the potential of allowing, in case of success, a rapid growth of at least one of the SMEs involved. Extensive use of modelling and virtual engineering will be an essential step in component and pilot line manufacturing development as well as in critical process choices, by providing a simulation tool for any of critical stages of the devised BioRobur^{plus} system, the manufacturing process of its components and their integration. This will allow integration of existing software, already in use, facilitating a quick industrial exploitation of results. Conversely, at an academic level, the three universities involved (POLITO, KIT, SUPSI), together with the three research centers of excellence (IRCE, DBI, CPERI), will surely produce a significant amount of fundamental discoveries that, if not strictly essential for future industrial exploitation, will be published in the highest impact factor journal as usually done by the groups involved. This will provide indirect benefits to the worldwide scientific community and to the reputation of the European research in this area of science and technology. The substantial reputation of the academic partners involved will allow easy dissemination into the academic community. Owing to the applied research focus of the BioRobur^{plus} project another valuable dissemination tool will be the organization of a variety of seminars for both technician and plant operators and PhD students. A training event is programmed by the end of the project. Besides, several PhD students themselves will be involved and trained in the project. Owing to the fact that, regulatory issues are one of the most critical potential barriers for the implementation of the BioRobur^{plus} technology, the most important dissemination activity to accelerate market development will perhaps be having as many stakeholders, policy makers, students and generic public as guests of ACEA during the execution of the demo campaign. A video will be shot and will be published on YouTube for a broad audience.

The high risk/high impact nature of the research have the potential of allowing, in case of success, a rapid growth of at least one of the SMEs involved.

Finally, a report on “Final PUEF including potential future penetration of the BioRobur^{plus} technology in spin-off fields, including a publishable version.” (deliverable D6.8) will be published by the end of the project and made largely available. All project outcomes will acknowledge the support of FCH-JU. The dissemination of the project’s achievements should never jeopardize the potential protection of generated intellectual property (e.g. patent, product design) and further industrial application. Therefore, before any dissemination activity (publication, presentation) strict rules of prior notice to all partners will be applied. The Exploitation Manager will follow all the above described approval processes and will act as an internal approval body for any dissemination action organized by the partners.

In case of success, all dissemination activities will, however, not be confined to the project duration,

but will continue after the conclusion of the project with the view to promote exploitation of BioRobur^{plus} results in the medium and long term.

Exploitation/Innovation Steering Committee and Manager

Along with the successful development of the new BioRobur^{plus} components and overall system, an Exploitation Steering Committee is established to decide on the exploitation policy of the project results. This Committee is mainly composed of the industrial partners and its main task is the design of the step-by-step promotion of the technology. The research institutes and academic partners are responsible for the dissemination of results and technology (scientific publications, conferences, etc.).

The **Exploitation, Innovation and IPR Manager** for the project, chairing the Exploitation Steering Committee is **Dr. Massimiliano Antonini** from HST, owing to his strong technical and marketing knowledge of industrial products and appliances in the field, derived from more than a decade of professional experience. Besides, promoting creativity is a key issue in the company he is manager of. His role is to coordinate all the aspects that have an influence on the exploitation of the results. For this purpose, the exploitation manager cooperate with technical and commercial staff of all the partners. He coordinates all exploitation related issues within the Consortium (patents, licenses, diffusion activities, etc.) and he is in charge of coordinating possible negotiations concerning exploitation issues between the Consortium and external parties. The consortium agreement is particularly address the exploitation of the results as well as patenting/licensing issues. Inspiration are drawn from current FCH JU and EU references in the field (e.g. DESCA format). Other typical activities will be:

i) patentability of project results;
ii) assessment of dissemination plan in view of results patentability;
iii) IPR ownership and definition of specific agreements;
iv) standardization/homogenization with EU practice;
v) lead, with the coordinator, the risk assessment and contingency planning activities (WP1, Task 1.2), *etc*.

Specific efforts will be made to provide fast communication of any innovation results as soon as its intellectual property will be secured, to increase the worldwide awareness about the BioRobur^{plus} technologies. Among many others, a suitable media will be the www.innovationplace.eu platform.

The ultimate driver of the exploitation strategy will be the business case and market penetration scenario (Expected Impact). In case of success of the project, the partnership plans to exploit the plant to produce hydrogen for a fueling station by realizing the integrated platform.

The Exploitation manager will also foster catching of the early innovation and exploitation opportunities for some of the BioRobur^{plus} system components, identified by the partnership and listed in Table 3 below.

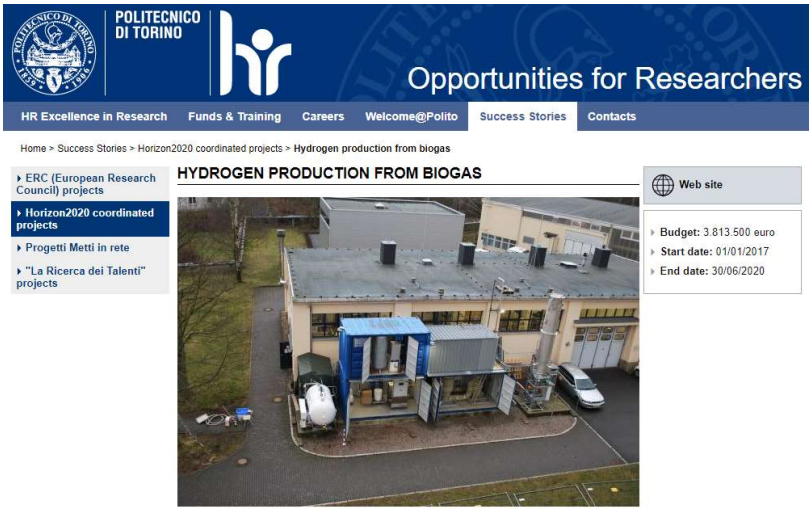
Table 3. Provisional list of main exploitation opportunities of the BioRobur^{plus} project

Exploitable results/partners	Impact area / related stakeholders
Ceramic support structures as catalyst carriers with enhanced heat and mass transport properties (SUPSI, ENGICER, KIT)	Catalytic reactors at higher temperatures in chemical industry, fuel reforming, refineries.
Cellular ceramic components for the combustion zone of porous burners with enhanced properties (heat and mass transport properties, as well as especially radiative properties like extinction and scattering). (ENGICER, SUPSI, KIT)	Interesting for all manufacturers of porous burners with applications in industrial thermo-processing equipment.
Multifunctional catalytic wall-flow monoliths for exhaust gas treatment (JM, POLITO, CPERI)	The development of new catalytic wall-flow monoliths with different catalytic functionalities at opposite channel wall sides can be exploited in the leading market of automotive exhaust gas treatment to drive e.g. soot combustion and nitrogen oxide conversion at once.
Off-gas burner for extremely low as well as varying calorific value gases (KIT, ENGICER, SUPSI)	Chemical industry, hydrogen production and fuel cell systems, incineration systems, landfill gas utilization.
Combination of thermally driven chemical/physical absorption with PSA technology for hydrogen purification or with other technologies for biogas to biomethane upgrading. (POLITO, HST)	Improved efficiency gas-purification systems, allowing better thermal integration in gas production systems and lower investment and operating costs.
Improved catalysts for oxidative steam reforming at high temperatures with improved sulfur tolerance and reduced carbon formation. (IRCE, JM, APTL)	Fuel reforming for chemical industry and for hydrogen production or fuel cell systems.
Improved catalytic reactors for oxidative steam reforming at high temperatures with improved sulfur tolerance and reduced carbon formation. (IRCE, JM, APTL, DBI, SUPSI, ENGICER)	Fuel reforming for chemical industry and for hydrogen production or fuel cell systems.
Pre-normative standards for the development of fuel processor components (DBI, HST, KIT)	The advent of the direct biogas reforming technology, so far not yet arrived at a commercialization, will likely entail the need of specific regulation and standards. This project with its strong standardization efforts, a large partnership with wide geographical delocalization, and the major role played

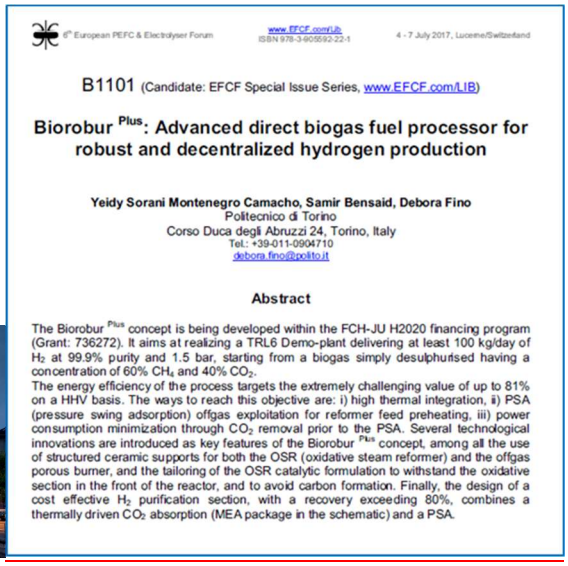
	by LCA and HAZOP in device development, is a perfect environment to develop pre-normative concepts.
New laboratory test-rigs for standardized testing of the innovative recuperative burners (HST, DBI, KIT)	HST and DBI are already known in the field for their test-rig development. Together with KIT they may come out with new lab scale test rigs for high precision assessment of the recuperative burner performance. The increasing application opportunities of recuperative burners will induce more R&D on this equipment. Hence, the market for dedicated test rigs is expected to grow.
Ideation of new research projects (POLITO, KIT, SUPSI, APTL, IRCE)	This challenging and stimulating research field, where interdisciplinary research approaches are mandatory, offers an ideal background for the generation of new ideas for new products and processes to be explored in future research projects.
Multimedia training course on solar fuels (POLITO)	This highly multidisciplinary R&D field appears to be an optimal area for PhD and master courses. The interactive CD ROM and streaming material produced by the end of the project WP7 could become an exploitable item.

7. Dissemination perfomed at M18.

- **POLITO:** POLITO'S WEB SITE
  http://www.researchers.polito.it/en/success_stories/horizon2020_coordinated_projects/hydrogen_production_from_biogas



- **POLITO:** Congress participation, Oral presentation:
  6th European PEFC & Electrolyser Forum 2017 (4th-7th July 2017 in LUCERNE, Switzerland).
  http://www.efcf.com/Agenda.pdf



6th European PEFC & Electrolyser Forum — www.EFCF.com/LIB — ISBN 978-3-905592-22-1 — 4 - 7 July 2017, Lucerne/Switzerland

B1101 (Candidate: EFCF Special Issue Series, www.EFCF.com/LIB)

Biorobur [Plus]: Advanced direct biogas fuel processor for robust and decentralized hydrogen production

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Abstract

The Biorobur [Plus] concept is being developed within the FCH-JU H2020 financing program (Grant: 736272). It aims at realizing a TRL6 Demo-plant delivering at least 100 kg/day of H_2 at 99.9% purity and 1.5 bar, starting from a biogas simply desulphurised having a concentration of 60% CH_4 and 40% CO_2.
The energy efficiency of the process targets the extremely challenging value of up to 81% on a HHV basis. The ways to reach this objective are: i) high thermal integration, ii) PSA (pressure swing adsorption) offgas exploitation for reformer feed preheating, iii) power consumption minimization through CO_2 removal prior to the PSA. Several technological innovations are introduced as key features of the Biorobur [Plus] concept, among all the use of structured ceramic supports for both the OSR (oxidative steam reformer) and the offgas porous burner, and the tailoring of the OSR catalytic formulation to withstand the oxidative section in the front of the reactor, and to avoid carbon formation. Finally, the design of a cost effective H_2 purification section, with a recovery exceeding 80%, combines a thermally driven CO_2 absorption (MEA package in the schematic) and a PSA.

- **POLITO**: Congress participation, Poster presentation:
  10th World Congress of Chemical Engineering (WCCE10),
  1st-5th October 2017, Barcelona, Spain
  http://www.wcce10.org/
  http://www.wcce10.org/images/site/POSTER_SESSION_WCCE.PDF

10th World Congress of Chemical Engineering, Barcelona, Spain

BioRobur^{Plus} project: Advanced direct biogas fuel processor for robust and decentralized hydrogen production

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Concept and objectives

The BioRobur^{plus} project will develop a pre-commercial oxidative steam reformer (OSR) for green hydrogen production from biogas. The TRL6 demo-plant will deliver at least 50 Nm^3/h (107 kg/day) of H_2 at 99.9% purity and 1.5 bar, starting from a biogas simply desulphurised having a concentration of 60% CH_4 and 40% CO_2.

The concept is based on structured catalysts (Fig. 1), which were successfully developed in the finishing BioRobur FCH JU project.

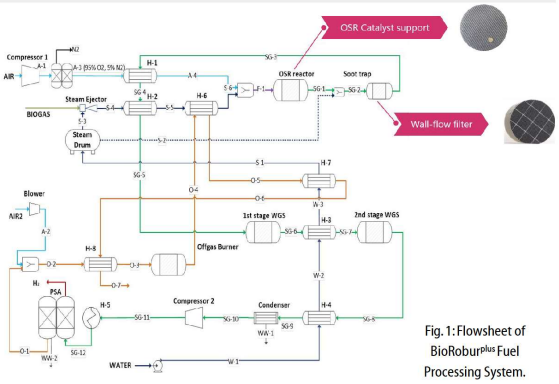

Fig. 1: Flowsheet of BioRobur^{plus} Fuel Processing System.

The BioRobur^{plus} project will exploit this OSR component in the overall fuel processor illustrated in Fig. 1, following new developments and concepts:

01 A tailored purification system to drive H2 separation from CO_2 and N_2 with minimal power consumption and exploitation of low temperature heat recovered from the processor.

02 A recuperative burner based on cellular ceramics capable of exploiting the low enthalpy H_2 purification off-gas to provide a crucial sensible heat input to the feed of the OSR reactor.

03 New OSR catalysts (Fig. 1) designed to match the operating conditions of the reformer (>700°C inlet temperature; reduced air feed; increased S/C ratio) entailed by the above described heat recovery measures.

04 An innovative and effective process architecture enabling high conversion efficiencies (Fig. 1).

Acknowledgments

The authors would like to thank the European commission for the financial support of this work in the EU Framework Program Horizon 2020 project BioRobur^{plus} under grant agreement n° 736272.

BioRobur^{plus} challenges

- Innovative and suitable supports for OSR catalyst.
- Catalysts with low degradation and good coking resistance.
- H_2 production from different biogas types in a cost-effective manner.
- An energy efficiency of 81% on a HHV basis.
- A start-up time after stand-by < 15 min.
- A cold-start up time of no more than 2 h.
- A dedicated TRL6 demo campaign (>4400 h).
- An average life plant of 10 years.
- A CAPEX costs of about 2,000 €/Nm^3/h.
- A materials cost < €250,000.
- Reformer outlet CO concentration below 8% on a dry-basis.
- An overall CO_2 footprint lower than 50%.

Expected Results and Conclusions

A robust biogas OSR plant for the production of 50 Nm^3/h of hydrogen with an energy efficiency of 81% will be developed .

Research and technological development activities are being carried out on materials, catalysts and processes for chemical conversion, as well as their integration and prototyping in an efficient thermally optimized system.

The above innovations and the aforementioned scientific and technical objectives will be achieved by combined modelling and experimental research efforts, driven by combined LCA, HAZOP, REACH and multi-objective analyses on the overall energy system and its components (materials, chemicals, plants, …).

Coordination and Partnership

Prof. Debora Fino, the coordinator of BioRobur^{plus} project, will manage, in an industrially-oriented perspective, the work of 11 partners with complementary expertise:

- 3 universities (POLITO, KIT, SUPSI),
- 3 research centers (IRCE, CPERI, DBI),
- 3 SMEs (ENGICER, HST, MET) and
- 2 large companies (ACEA, JM).

Website: www.bioroburplus.org
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10th World Congress of Chemical Engineering, Barcelona, Spain, www.wcce10.org

- **POLITO**: Congress participation, ORAL presentation: https://waset.org/conference/2018/03/miami/ICC/fees

- **KIT: poster presentation** https://www.whec2018.com/main_frontend.php

- **ACEA:** ORAL PRESENTATION http://www.biogas-science2018.it/

POSTER PRESENTATION https://www.venicesymposium.it/

VENICE2018 7TH INTERNATIONAL SYMPOSIUM ON ENERGY FROM BIOMASS AND WASTE / 15-18 OCTOBER 2018

STRATEGIES FOR THE OPTIMISATION OF AN INDUSTRIAL ANAEROBIC DIGESTION PROCESS IN VIEW OF BIOROBURPLUS PROJECT

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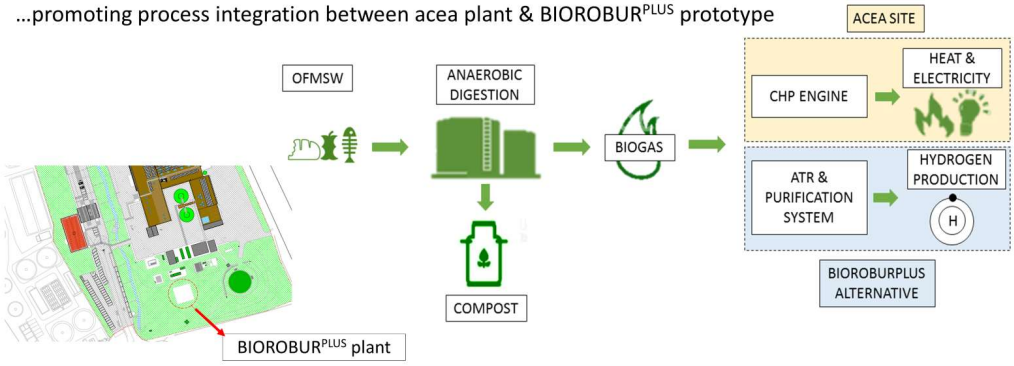
CONCEPT

BioRoburPlus project has the challenging aim of producing **bio-hydrogen** exploiting an auto-thermal reforming (ATR) process by means of a pioneering catalytic system. In fact, recent studies have been performed for converting biogas into biohydrogen for its further utilization as a substrate in **fuel cells**. The aim of this work is...

...promoting process integration between acea plant & BIOROBUR^{PLUS} prototype



CHALLENGES

Although the biogas plant ensures the simultaneous recovery of 3 MW of heat and electricity, the recording of biogas production shows many fluctuations over time, which necessarily have to be minimized in case of using biogas as a feedstock for the innovative prototypes.

BIOGAS FLUCTUATIONS

- INTRINSICAL ISSUE: biowaste variability
  - → NO MANIPULATION
- EXTRINSICAL ISUSE: technical & operating conditions
  - → Additional feeding on Sundays
  - → Adoption of an automatic feeding/discharging system
  - → A more precise TS content

CONCLUSION

Therefore, a **careful balance between strengths and weaknesses** (i.e. improved process management, constant methane yield vs higher safety/security risks) should be carefully evaluated for an eventual on-site implementation.

In addition, the assessment of the mass balance of the overall system may represent a key process indicator on the macroscopical scale, while the investigation of microbial community may boost upcoming developments for the bioreactor design on microscopical scale.

PARTNERSHIP

The work is constituted by 11 partners with complementary expertise:

- 3 universities(POLITO,KIT, SUPSI)
- 3 research centers (IRCE,CPERI,DBI)
- 3 SMEs (ENGICER,HST,MET)
- 2 large companies (ACEA,JM)

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