

PLAS CARB

INNOVATIVE PLASMA BASED TRANSFORMATION
OF FOOD WASTE INTO HIGH VALUE GRAPHITIC
CARBON AND RENEWABLE HYDROGEN

WELCOME TO THE 1ST ISSUE OF THE PLASCARB NEWSLETTER!

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This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No 603488 Project duration: 1 December 2013 - 30 November 2016

INTERVIEW WITH THE COORDINATOR:

Mr. Neville Slack, from Centre for Process Innovation



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Could you explain what PlasCarb is about?

PlasCarb is a 3 year EU funded project which takes biogas produced by the Anaerobic Digestion of food waste (predominantly a mixture of methane and carbon dioxide) and via an innovative low energy microwave plasma reactor converts this to graphitic carbon and renewable hydrogen. As part of the project the quality and economic value of the carbon and renewable hydrogen will be monitored and optimised using high quality research and industrial process engineering. Life cycle analysis will ensure that the approach is sustainable.

What drove you to put the consortium together and go for this project?

CPI is a UK technology innovation centre and part of the UK governments High Value Manufacturing Catapult (a network of various technology centres). Our technology areas include Printable Electronics, Formulation, Nanotechnology and Graphene applications, together with that CPI has been heavily involved in the regional development of hydrogen and fuel cell technology. Therefore this project fits very well with CPI's strengths and future strategy. Also a number of the partners were known to CPI and it was thought that we could bring together all the required expertise to create an exciting and important project which I hope we have.

How would you sum up PlasCarb project's first year in business?

A lot has been achieved in the 1st year of the project. At the beginning of any project involving a number of different partners from various countries there are the problems of everyone getting to know each other, everyone's own skills and expertise the ability to work together and finally trying to bring all these together. Speaking as the project coordinator I think we have successfully achieved all these. Oh and yes on top of all this having specific work to do in terms of Work Package deliverables and milestones. Within these projects good communication is critical and this has been addressed in a number of ways for example we have developed a collaboration server in which partners can add information/data, review and generally use this as the focal point for any project information. We hold monthly tele-conferences which is useful to keeping the project moving forward as well as addressing any potential issues etc. We have face-to-face project meetings every six months together with any necessary technical meetings which we consider benefits the project. In general anything which I feel helps us to deliver on what we need to do, and on time and to budget.

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PLASCARB'S OBJECTIVES

The primary project objective is to research and develop at a pilot scale an integrated process to **transform mixed food waste into RH_2 and high value forms of carbon** that will be economically viable for future market uptake.



- To generate representative biogas from an AD process with a feedstock rate of 1800 tonnes mixed food waste p.a., noting seasonal $CH_4:CO_2$ variations and impurity levels versus seasonal input variations over 12 month period.
- To define and validate a microwave plasma process design for biogas previously generated from the anaerobic digestion of food waste.
- To define and validate gas/solid and gas/gas separation unit operations.
- To develop a methodology whereby the appropriate size, shape and form of Carbon is generated by the integrated process.
- To integrate and optimise the outputs of the previous process.



- To integrate a working pilot scale PlasCarb plant, including one AD unit processing 1800 tonnes pa of mixed food waste and at least one 12kW microwave plasma reactor to process a proportion of the biogas generated.
- To operate an integrated plant continuously for a period of at least one month transforming over 150 tonnes of mixed food waste into over 25 thousand m^3 of biogas.
- To optimise the project results and the economics of all aspects of the technology to enable future market uptake.



- To verify the full environmental, economic & social viability of PlasCarb using a recognised LCA approach based on ISO14040/44 (2006).



PLASCARB'S PROJECT TEAM



THIS YEAR'S ACHIEVEMENTS

PlasCarb Project Kick-Off Meeting, 12 January 2014

The PlasCarb project was launched with a kick-off meeting held at CPI, Printable Electronics facility, Sedgefield, UK on 9-10 January 2014.

Representatives from all eight project partners attended the kick-off meeting. As the whole project consortium met for the first time, the entire project was discussed as well as the detailed implementation plans.



Project Website was launched, 9 February 2014

The PlasCarb consortium launched the official website for PlasCarb to get familiar with the project and follow our activities.

First Consortium Meeting, 4-5 June 2014


The first consortium meeting of the PlasCarb project was organized in Bordeaux, France on 4-5 June 2014. During this two-day meeting project partners discussed the project achievements, key deliverables submitted in the first six months and the challenges of the upcoming period.

Second Consortium Meeting, 19-20 November 2014

The second consortium meeting of the PlasCarb project was organized in Budapest, Hungary on 19-20 November 2014. During this two-day meeting, partners have shared their progresses, Work Package by Work Package. They have explained and better showed the processes utilized, and agreed on the next year's steps.




PLASCARB'S PARTNERS




cpi

CPI is coordinating the project and is also responsible for the technical aspects in the separation of biogas into methane and carbon dioxide, and separating of the graphitic carbon produced from the renewable hydrogen.




GAP Waste Management

GAP Waste Management provide and manage the collection and treatment of food waste through anaerobic digestion, to produce biogas used in the project at its plant in Gateshead (UK) that will be connected to the Plasma Reactor. The gas is being monitored by GAP for variations in quality and quantity as a result of the seasonality.




Abalonyx Innovative materials

Abalonyx has tested samples of PlasCarb graphene as additive to LFP-cathodes for Li-ion batteries. The PlasCarb materials shows very promising results. We are now preparing for further tests of samples of graphene tuned towards different properties such as smaller and larger flakes. We expect increased power density and cycle life as compared to state of the art battery materials.




uvasol

Uvasol is in charge of the Economic Optimisation of the project results, with the view of enabling future market update. It will develop an economically sustainable business strategy and a financial risk assessment.




GasPlas Zero Emissions

GasPlas is developing a novel microwave plasma reactor to process bio-methane into higher value products. The patented reactor technology is capable of sequestering carbon, from gaseous hydrocarbon feedstock's, and producing hydrogen rich gas and high quality graphitic carbon materials. The GasPlas process enables increased energy efficiency, milder process conditions and reduced process complexity in order to achieve the first scalable process of its kind.




CRPP CENTRE DE RECHERCHES POUR LA PLASMA

The analysis of the carbon outputs from the Plasma process using a full range of modern analytical techniques is the first focus of CNRS at their CRPP laboratories. A following aim is the process of the well-defined carbon using reductive dissolution and nanocarbon dispersions with surfactants in water, with the help of sonication. From the solutions and dispersions obtained at CRPP laboratories many applications of the carbon output will arise.



Fraunhofer IBP

The department Life Cycle Engineering from the Fraunhofer Institute for Building Physics (IBP) deals with the sustainability assessment of products, techniques and services. The main task in the PlasCarb project is to disclose an ecological benefit of the innovative food waste treatment approach in comparison to the state of the art technologies. Other tasks are the assessment of economic and social impacts. Fraunhofer IBP's knowledge and competence in sustainability analysis will help to include sustainable aspects during the development stage of the innovative PlasCarb technologies to create an eco-friendlier, profitable and social-beneficial food treatment approach.



GEONARDO STATE-OF-THE-ART AND BEYOND

Geonardo is responsible for exploitation and dissemination of the PlasCarb project results. It aims at maximizing the project's visibility, by publicizing the main achievements via international industry seminars, publications and a dedicated open access website.



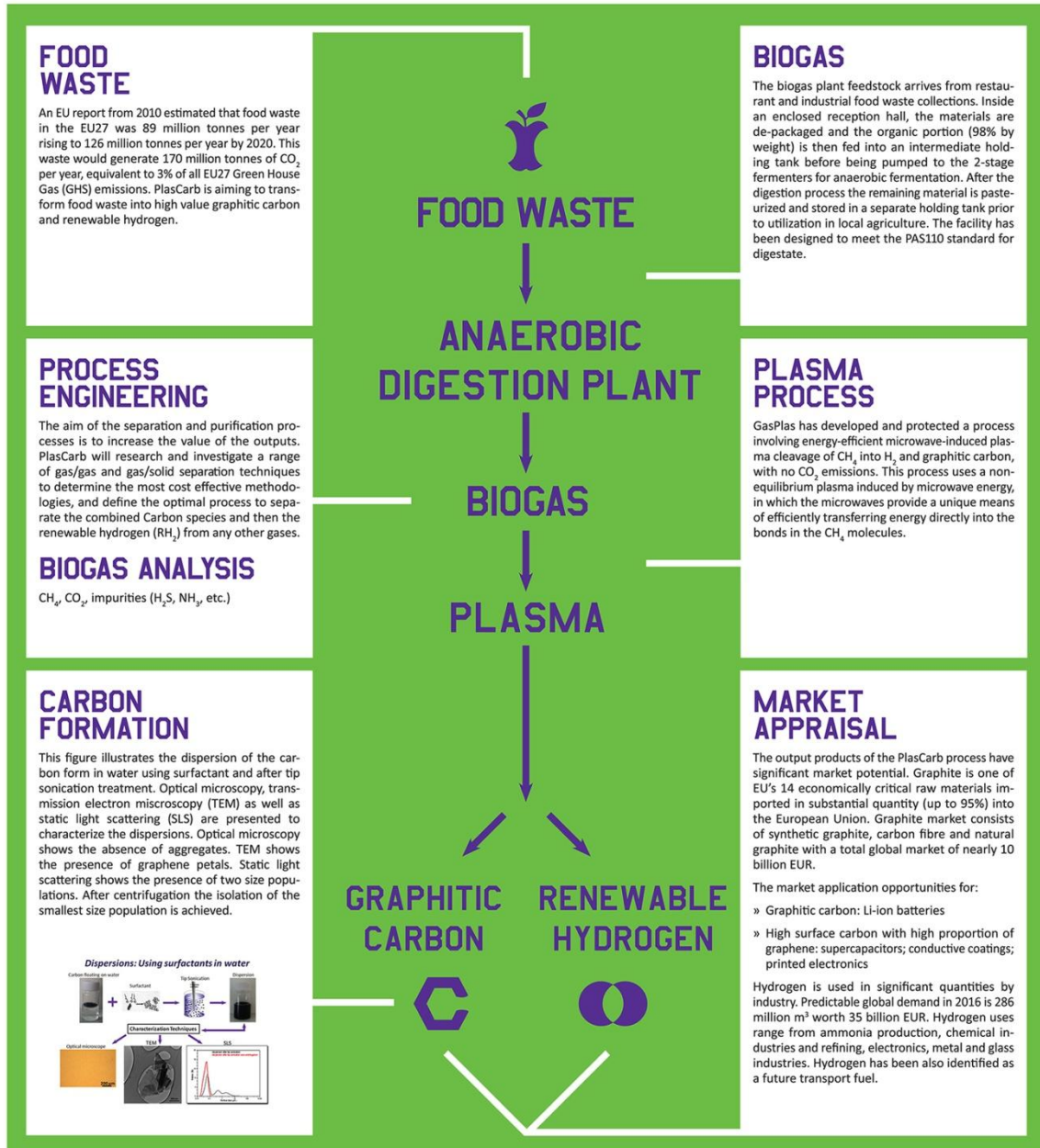
SCIENTIFIC ACHIEVEMENTS SO FAR



Innovative plasma based transformation of food waste into high value graphitic carbon and renewable hydrogen.

PlasCarb is a 3-year collaborative project which started on 1st December 2013 and co-funded under the European Union's Seventh Framework Programme (FP7). The project will transform biogas generated by Anaerobic Digestion of food waste using an innovative low energy microwave plasma process to split biogas (methane and carbon dioxide) into high value graphitic carbon and renewable hydrogen.

The PlasCarb consortium is composed of eight partners from five European countries, whose complimentary expertise will enable the required results to be successfully delivered. The project is coordinated by Centre for Process Innovation Limited (UK) and includes: GasPlas AS (NO); CNRS (FR); Fraunhofer IBP (DE); Uvasol Ltd. (UK); GAP Waste Management (UK); Geonardo Ltd. (HU); Abalonyx AS (NO).



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PARTNERSHIP



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SHOWCASING PLASCARB

PlasCarb project at the Life Cycle Assessment (LCA) Workshop

On 6th February 2014, Peter Brandstetter from the Fraunhofer IBP introduced PlasCarb at the [Life Cycle Assessment \(LCA\) Workshop](#) organized by the “DRAGON” project in Austria.

Representatives of 12 EU projects funded under FP7 presented at the workshop and discussed their approaches to LCA, the benefit of LCA for their projects and the data sources and software used. “Life Cycle Assessment”, (LCA) also known as “Life Cycle Analysis”, is an important topic within all currently running FP7 projects dealing with “resource efficiency”. The term “life cycle” refers to the notion that all the stages of a product’s life from cradle-to-grave are considered. The principal aim of LCA is to compare the comprehensive environmental effects assigned to particular products or services in order to improve processes, support policy and provide a sound basis for an environmental-friendly decision-making process. Presentations of the workshop are available on the website of the DRAGON project: <http://www.dragonproject.eu/en/events/>

PlasCarb at SUSCO Budapest 2014

On October 2-3 2014, PlasCarb was presented at [SUSCO Budapest 2014](#), an international conference on sustainable development held at the Millenáris Center on the Buda side of Budapest.

The event, organized by the Antal József Knowledge Centre, was a unique opportunity to learn more about the state of the art of sustainable development projects and organizations in Hungary and in the wider Central Eastern European area. At its first edition, SUSCO Budapest offered the wide public a conference featuring international experts, policy-makers, civil and private sector representatives, and an exhibition with organisations and companies working on innovation tools in the sustainable development field.



PlasCarb project at the Chemontubes 2014 Conference

[ChemOnTubes](#) is an international conference on the chemistry of graphene and carbon nanotubes. ChemOnTubes 2014 (March 30th- April 3rd 2014) was located in Riva del Garda in Italy and was organized jointly by the electrochemistry group at the Ciamician Chemistry Department of the University of Bologna and the Graphene and Nanotubes team of the Research Center Paul Pascal (CRPP) of CNRS and the University of Bordeaux. It was the fifth international scientific meeting around the chemistry of graphene and carbon nanotubes.

130 participants gave life to this “chemistry – certified „event. Through their series of oral and poster presentations everyone could be informed about the latest results on chemistry at large on graphene, carbon nanotubes and other related nanoforms at fields such as functionalization, dispersion and sorting electrochemistry.





PlasCarb project presented at CarboRaman School

The FP7 PlasCarb project was presented at [CarboRaman](#), a thematic CNRS school dedicated to the study by Raman spectroscopy of carbonaceous material in all its forms. It took place from 12th to 17th of October 2014 at the Domaine de Chalès, Orléans, France.

The aim of CarboRaman was to promote exchanges and interdisciplinary approach of Raman spectroscopy and carbonaceous materials. The training was intended for researchers, engineers and PhD students from various fields (spectroscopists, chemists, physicists, geologists, etc.) wanting to learn the Raman methods, learn about carbon materials and expand their research to new areas.

PlasCarb in display at the “Research & Innovation for a circular economy in European Regions” Conference

On 15 October 2014, the FP7 PlasCarb project was proudly presented in Brussels at “Research & Innovation for a Circular Economy in European Regions”, a Conference organized by the Representation of the Region of Lazio, under the patronage of the Italian Presidency of the Council of the European Union. The aim of the conference was “to provide an overview on circular economy and to inform on the European policies which are supporting Research and Innovation in this field”.



Advances in Food Processing – Challenges for the Future

From 5-7th November 2014 the international Conference Advances in Food Processing – Challenges for the Future organised by ITAL and Fraunhofer IVV and organized by Elsevier took place in Sao Paulo, Brazil. One of the discussed topics there was the focus of new concepts, approaches and technologies to improve the sustainability of food processing and reduce food waste. PlasCarb was represented by Peter Brandstetter from the Fraunhofer Institute for Building Physics, [Department Life Cycle Engineering \(GaBi\)](#). Peter held an oral presentation about the innovative PlasCarb approach and its advantages in comparison to the actual treatment methods. This presentation invited experts in food processing and treatment from all over the world to discuss the technology and its sustainable potential. The appearance on this conference was a good advertisement and dissemination activity for the PlasCarb project. For further information about the conference please visit the [homepage](#).



UPCOMING EVENTS

Graphene 2015

10 – 13 March 2015

Bilbao, Spain

This is the largest European conference and exhibition in Graphene and 2D Materials. The last edition attracted 800 participants from 49 countries. For the first time there was an exhibition of worldwide grapheme research centers, apart from grapheme producers, publishers, manufacturing equipment makers, grapheme application developers, networks and many others.

For more information, click [here](#)

Delivering Hydrogen & Fuel Cells to Market

17 March 2015

National Exhibition Centre – Birmingham, UK

Now in its 11th year, the event is attracting over 200 delegates from UK, Europe and further afield. A key aspect of the event is the facilitation of partnering meetings to provide forums for discussions, business opportunities and joint funding bids especially within the European Hydrogen and Fuel Cell community.

For more information, click [here](#)

Commercial Graphene Show

16-17 April 2015

Manchester Central Convention Complex, UK

The Commercial Graphene Show is set to cut through the hype and hot air and directly tackle the challenges associated with applying graphene in the commercial environment. This meeting exists to bring those pioneering graphene production and commercial application together to share insight and exchange ideas that will shape the way that graphene impacts industry.

For more information, click [here](#)

CARBON 2015

12-17 July 2015

Dresden, Germany

The conference provides the platform for researchers to present recent results, for discussions and the exchange of information from the various fields of Carbon. Particular emphasis will be given to an intensified exchange between academia and industry.

For more information, click [here](#)



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