

All-gas

Newsletter

11/2017

All-gas main facts

The **All-gas** Project demonstrates the sustainable large-scale production of biofuels based on the low-cost cultivation of microalgae. The complete process chain is designed for a cultivation area of up to 10 hectares, making wastewater treatment energy self-sufficient, and recycling the nitrogen and phosphorus from wastewater into microalgae biomass.

The Project (n° ENER/FP7/268208) is co-financed with € 7,1 million by the EU Commission within the FP 7 programme: "*ENERGY.2010.3.4-1: Bio-fuels from algae*".

Project participants

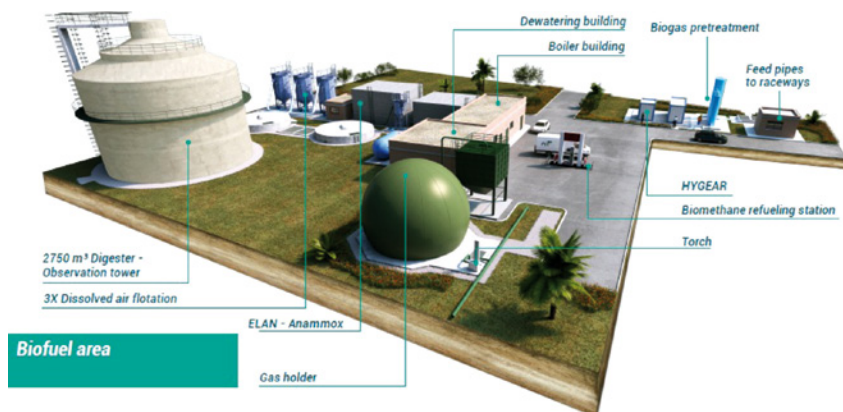
Aqualia (Spain) as coordinator,
BDI-Bio Energy International (Austria),
Fraunhofer-UMSICHT (Germany),
HyGear (The Netherlands),
University of Southampton (UK).



More info:

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From dream to design to DEMO!



A long road has been covered before we could say "GO DEMO !" This final stage of the All-gas project was started in May 2016, with construction ending in December 2017. During this time, the full process chain at demonstration scale has been implemented, consisting of:

- A cultivation area composed by 4 raceways ponds with a surface area of 5 200 m² each in which an average of 100 ton/ha-year biomass can be produced.
- A separation and thickening system based on dissolved air flotation (3 units). At this stage the algae broth is concentrated 100 times at very low energy requirement.
- 2 750 m³ anaerobic digester in which more than 250 L of biogas per kg volatile solid can be produced. Close to 40 cars can be run for 18 000 km each on the biomethane resulting from conversion of the algae biomass.
- A complete biogas to biomethane upgrading plant coupled to a filling station.

Once all the functional tests of the process units are concluded, large-scale microalgae cultivation and biogas production can start. This last phase of the project demonstrates that all the steps given above satisfy the expectations, and provides an alternative and sustainable response to the reuse of urban waste water, transforming it into a resource for the circular economy.



aqualia



BDI



Fraunhofer



HYGEAR



UNIVERSITY OF
Southampton

HyGear Plant installed in Chiclana



Within the All-gas project HyGear, an SME based in Arnhem, The Netherlands, has designed and assembled the biogas upgrading system that will selectively remove the carbon dioxide from the biogas obtained from the algae digestion. The system produces biomethane with adjustable purity levels with yields up to 99%, to be used for fueling cars of Aqualia and the local community. The system has been tested extensively at the premises of HyGear and was then connected to the wastewater treatment plant in Chiclana in summer 2017.

All-gas car reached 30 000 km in one year



Since June 2016 the first All-gas car has almost run around the world using the biogas produced from the microalgae grown in Chiclana and travelling an average of 80 km per day. In December 2016 VW decided to transfer to SEAT, the Spanish company of the VW group, the role of main fleet vehicle provider, which will validate the biomethane quality in long-term tests.



7 years of RTD activities

The pyramids were built stone by stone.

During the last 7 years the activities in Research and Technology Development have grown step by step from laboratory to pilot and finally to prototype scale. The chosen approach for the All-gas project has consolidated different findings that have helped to design and operate the successive phases of the whole process chain: algae growth, harvesting, digestion and biogas conditioning.

Thanks to the laboratory results obtained by University of Southampton, anaerobic pre-treatment with UASB reactors was implemented for the cultivation of microalgae in the pilot (scenario 1). Good results were obtained from this process with abundant biogas production, both from pre-treatment and algae digestion, but the mean biomass productivity leveled at 65 tons Dry matter/ha year, even with the addition of CO₂.



Therefore, in 2014, a new and simpler approach was tested using the raw wastewater directly after screening (scenario 2). This option allowed to exceed the target biomass yield of 100 tons dry matter/ ha year, and made the biomass easier to digest. The transformation of biomass to energy was tested by BDI BioEnergy. While lipid extraction to biodiesel was not good enough, the mesophilic digestion produced a methane yield above 250 L CH₄/kg VS_{added}.

As a result of all the tested options, important progress in microalgae cultivation and biogas production has been achieved, as recognized with the patent record of the All-gas project: EP13178678.2, EP13382470.6, EP12785713, EP14382399.5 and EP15382087.3.

As main conclusion, it is now possible, with a positive energy balance, to transform wastewater into algae biofuel, and power about 20 cars per ha (for a yearly distance of 18 000 km) - four times more than conventional biofuels such as sugar ethanol or palm oil diesel. This will be confirmed with the operation of the DEMO plant. The Life Cycle Analysis will be validated once more by Fraunhofer-Umsicht, updating the earlier numbers from the prototype.

Dissemination: All-gas around the world

- **Madrid (SPAIN) 28/02 - 03/03/2017**
SIGA 2017, 1st Trade Fair for Innovative Water Management Solutions
- **Madrid (SPAIN) 24-25/04/2017**
Global Water Summit 2017
- **Nice (FRANCE) 26-27/04/2017**
7th European Algae Industry Summit (ACI)
- **Florianopolis (BRASIL) 29/05 - 02/06/2017**
14th IWA LET 2017
- **Córdoba (SPAIN) 28/06/2017**
25th Anniversary of the LIFE Programme. Technical Workshop on N and P Removal in Wastewater
- **Almería (SPAIN) (UAL) 13-15/09/2017**
ECOST Training School (European Cooperation in Science & Technology)
- **Porto (PORTUGAL) 27-28/09/2017**
EIP Water Conference
- **Las Palmas de Gran Canaria (SPAIN) 05-08/10/2017**
11th International Trade Fair CANAGUA & ENERGÍA
- **Basel (SWITZERLAND) 18-19/10/2017**
European Nutrient Event (ESPP)
- **Évora (PORTUGAL) 21-24/11/2017**
ENEG 2017 – 22nd Annual Meeting of Portuguese Utilities
- **Berlin (GERMANY) 05-07/12/2017**
AlgaEurope 2017