Case study of algae production integration into wastewater treatment: the Climate-KIC MAB2.0 project

Miklós Gyalai-Korpos, Lambertus A.M. van den Broek, Andrea Ramirez, Jonathan Moncada, Aurora Seco, José Ferrer, Ana Ruiz-Martínez, Fabian Abiusi, Hans Reith, Jordan Seira, et al.

Case study of algae production integration into wastewater treatment: the Climate-KIC MAB2.0 project

Miklós Gyalai-Korpos[1], Lambertus A.M. van den Broek[2], Andrea Ramirez[3], Jonathan Moncada[3], Aurora Seco[4], José Ferrer[5], Ana Ruiz-Martínez[5], Fabian Abiusi[6], Hans Reith[6], Jordan Seira[7], Diana Garcia-Bernet[7], Jean-Philippe Steyer[7], Magdolna Makó[8], István Erdélyi[8]

1. PANNON Pro Innovations Ltd. Hungary., H-1021 Budapest, Hűvösvölgyi út 62., Hungary
2. Wageningen Food & Biobased Research, Bornse Weilanden 9, 6708 WG Wageningen, The Netherlands
3. Copernicus Institute of Sustainable Development, Utrecht University, 3584CS Utrecht, The Netherlands
4. CALAGUA – Unidad Mixta UV-UPV, Departament d'Enginyeria Química, Universitat de València, Avinguda de la Universitat s/n. 46100 Burjassot, Valencia, Spain
5. CALAGUA – Unidad Mixta UV-UPV, Institut Universitari d'Investigació d'Enginyeria de l'Aigua i Medi Ambient – IIAMA, Universitat Politècnica de Valencia, Camí de Vera s/n, 46022 Valencia, Spain
6. Wageningen University, Bioprocess Engineering. P.O. Box 8129, 6700 EV Wageningen, The Netherlands
7. INRA, UR0050, Laboratoire de Biotechnologie de l'Environnement, 102 Avenue des Etangs, F-11100, Narbonne, France
8. Budapest Sewage Works Ltd., H-1087 Budapest, Asztalos Sándor út 4., Hungary

INTRODUCTION

Turning waste and emissions into a biological resource is the main goal of the Climate-KIC co-funded Microalgae Biorefinery 2.0 project (MAB2.0). It aims to demonstrate the integration of algae production into wastewater treatment and to provide a compelling narrative for the wastewater sector to make this happen in large scale in other settings too. The tool for this is an offer compiled from the project outputs in form of a consultancy and engineering service.

The project investigates the integration in its complexity. Next to technological aspects such as strain selection, mixotrophic growth, membrane integration, harvest options and algae quality assessment, it also attempts to draw up economically sound scale-up scenarios and business models, as well as evaluating the legal framework and environmental impacts through a LCA. Each element of the activities aims to underpin the business offer, either by enhancing the value proposition or improving the economics.

PROJECT

Why wastewater treatment?

It is an industry able to provide streams for growth of algae which otherwise are problematic and not valorised: nutrients, CO_2 and heat/electricity.

With the advent of circular economy we ask ourselves: why only clean water and why not valorise waste into products?

Why do we need innovation and new assessment protocols?

It is not a sterile, laboratory system with pre-defined parameters – input parameters can have fluctuation, suboptimal composition and toxic/inhibitory components.

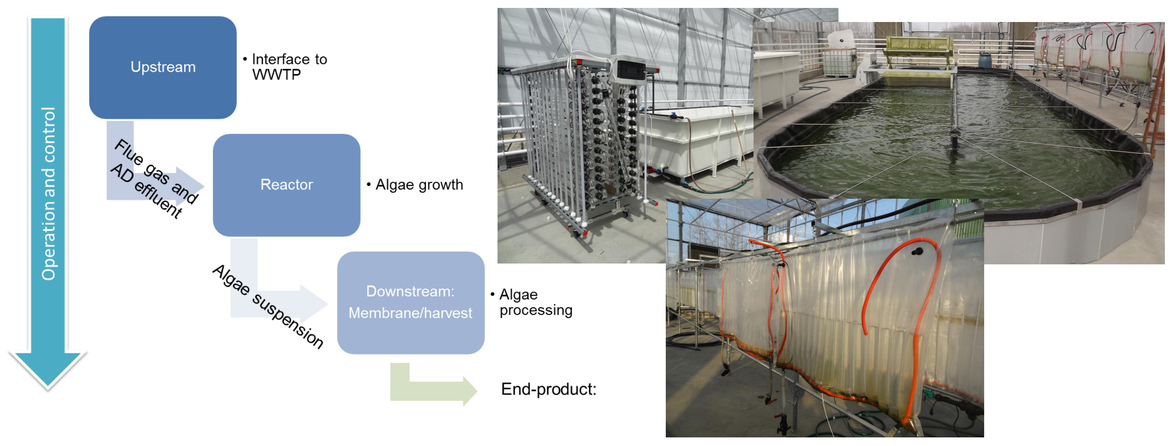
How to make it happen?

MAB2.0 aims to create a technology and business case for wastewater treatment plants to integrate algae production into their operation by an industrial symbiosis approach. Partnership involves both supply and demand sides of innovation.

PILOT LOCATION

Pilot location is the North Budapest Wastewater Treatment Plant of the Budapest Sewage Works Ltd.:

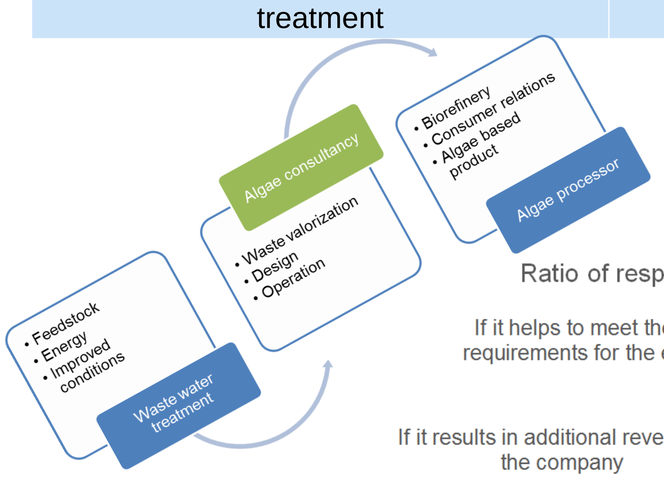
- It has the most modern laboratory in the sewage sector
- Plant has a daily capacity of 200 000 m^3 (600 000 PE) with 3 MW biogas CHP
- Liquid fraction after digested sludge dewatering is used for algae production
- Glass house for algae with 200 m^2 ground area to test solutions

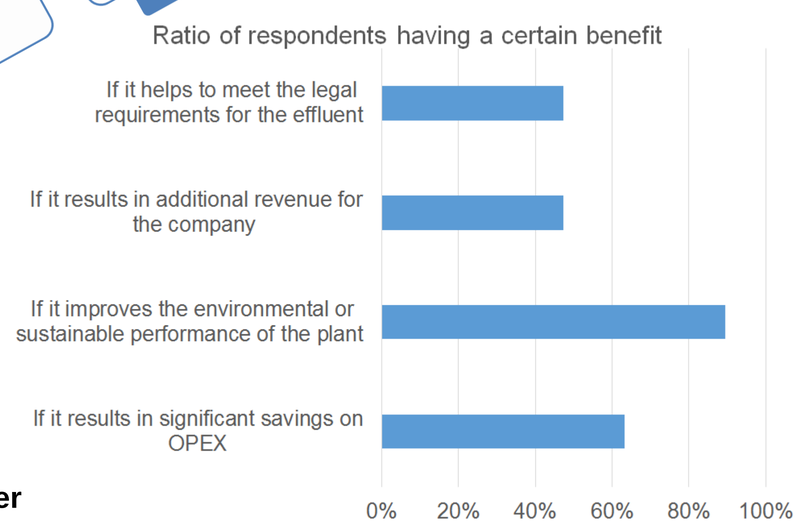


BUSINESS OFFER

86% of the respondents of the project survey targeting wastewater professionals would be interested in an algae based solution and business model that can valorise high nutrient content of leachate. Business offer is also reinforced by personal visits.

Needs	Benefits
Strains best adapted to the circumstances of the wastewater treatment plant	Quality improvement of the leachate by reduction of the nutrient content
Reliable algae production technology and control even in an industrial environment	Fixing CO_2 emissions
Good integration into wastewater treatment	Showing commitment to sustainability and enhancing 'green' image





Keys of the service offer

- Whole process advisory and planning – with on-site evaluation and lab testing
- Strain selection and other testing protocols
- Customized design schemes (interface, reactors, membrane and harvest)
- Scenario analyses: techno-economic, legal and market aspects
- Working as advisory and engineering company in EPC („Engineering, Procurement, Construction") model

CONCLUSIONS

- Strong case-by-case factor in business model: different design, lack of data…
- Tailor made design is necessary to use existing infrastructures in the best way
- As out of the core of WWTPs, advisory to operate the system must be offered
- Regulations can limit use of algae in some sectors, circular economy may help to position waste related products better and support processes
- Combination of business thinking, legal/IP competences, industrial needs and academic know-how is essential

Experiences underline the need of innovation in the sector, as in case of all site visits there was interest and we could engage in technical discussions.

The project is supported by Climate-KIC, one of the Knowledge and Innovation Communities (KICs) created and sponsored by the European Institute of Innovation and Technology (EIT), the EU body tasked with creating sustainable European growth while dealing with the global challenges of our time.

MAB 2.0 is a 3-year innovation project (2015-2017). The project partners are PANNON Pro Innovations Ltd., Utrecht University, Wageningen University, Budapest Sewage Works Ltd., Wageningen Food & Biobased Research, INRA-LBE Narbonne, Universitat de València and Universitat Politècnica de València.