MACROFUELS

MacroFuels

WP7 – Dissemination and communication

Project Meeting – 29th Nov 2017, DTI

TEKNOLOGISK INSTITUT · ECN · FOOD & BIOBASED RESEARCH WAGENINGEN UR · avantium · SAMS · SIOEN INDUSTRIES

ERM · AARHUS UNIVERSITY DEPARTMENT OF BIOSCIENCE · EURIDA Research Management · matis · FERMENTATIONEXPERTS AS – for your health

Presentation Overview

- Activities performed during the first project phase
- Results achieved
- Project Phase 2 – Focus on exploitation

Goals 1st Period

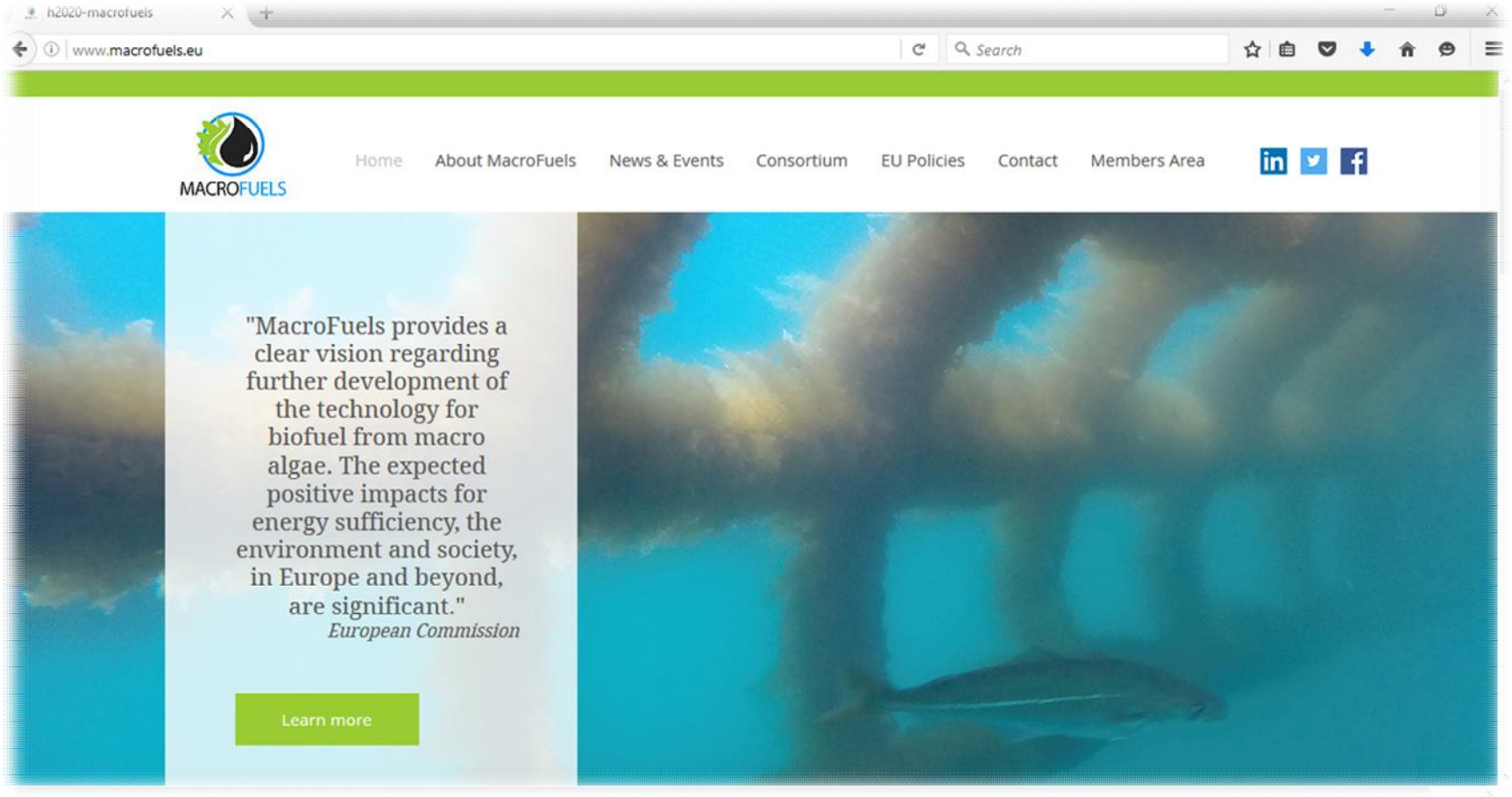
- Raise awareness and keep the target community informed
- Implement the general dissemination and press strategy
- Build a basis for policy input
- Prepare stakeholder involvement and public engagement

Period M1-M18

MACROFUELS

Main results – An Overview

Project Visibility



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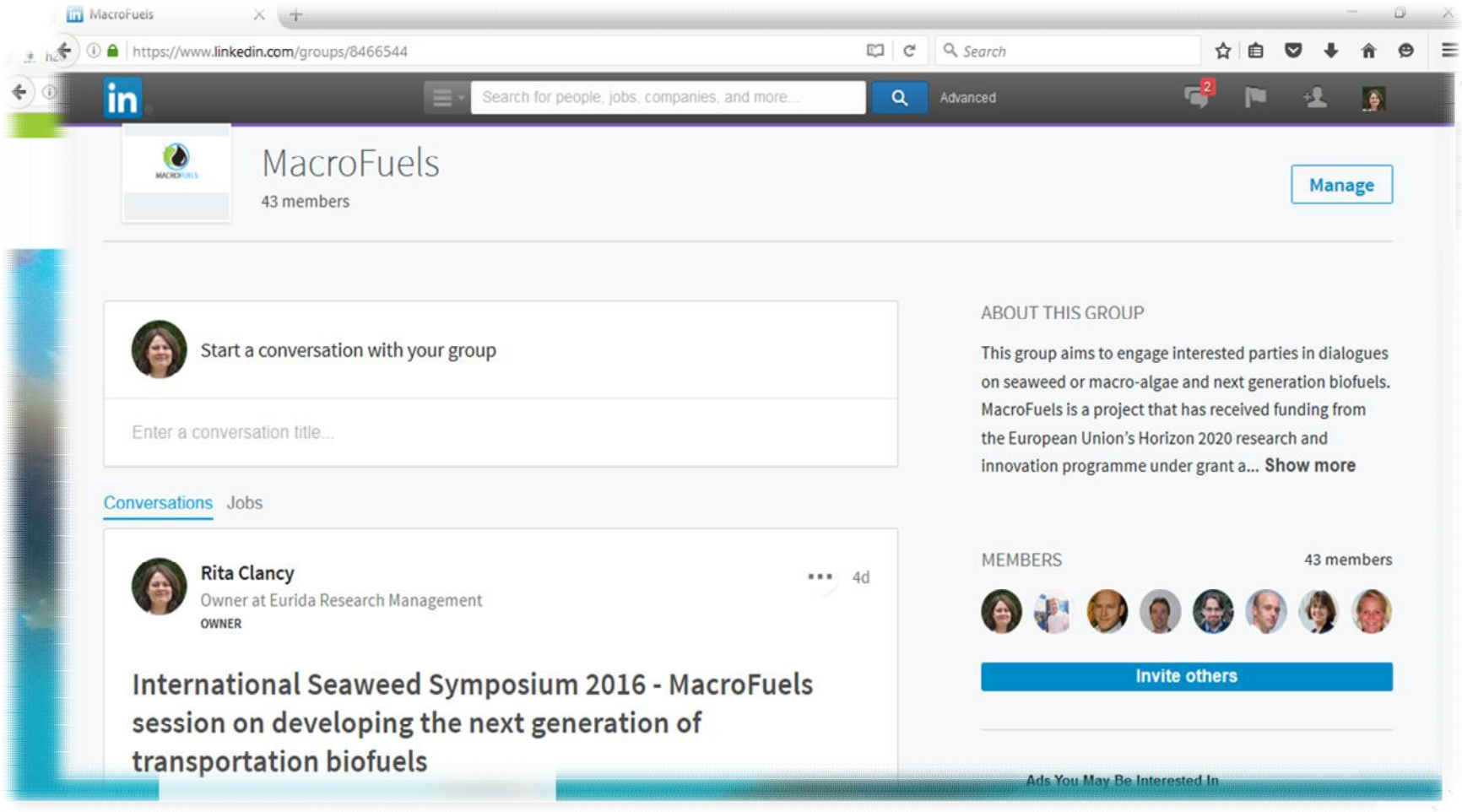

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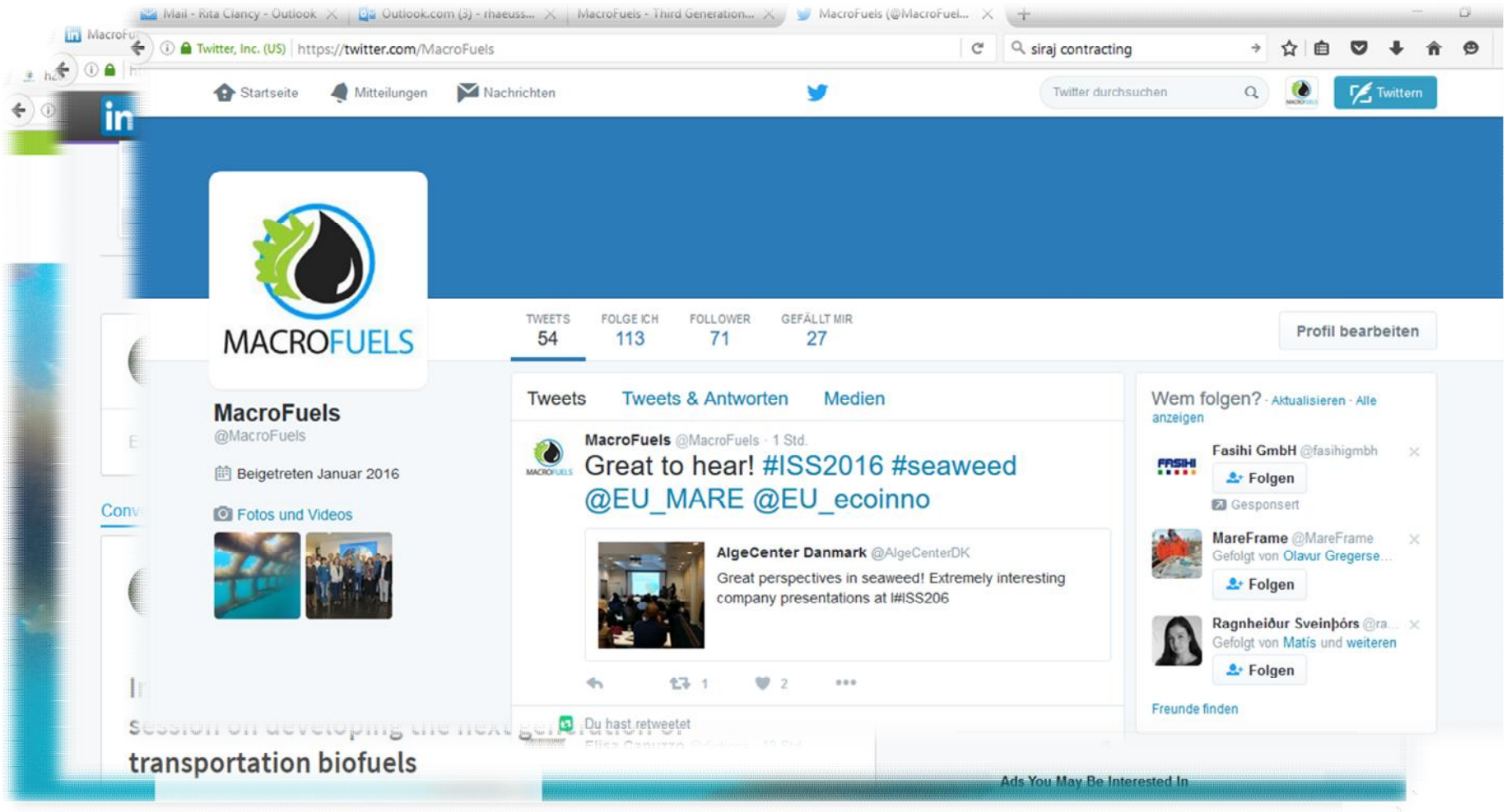

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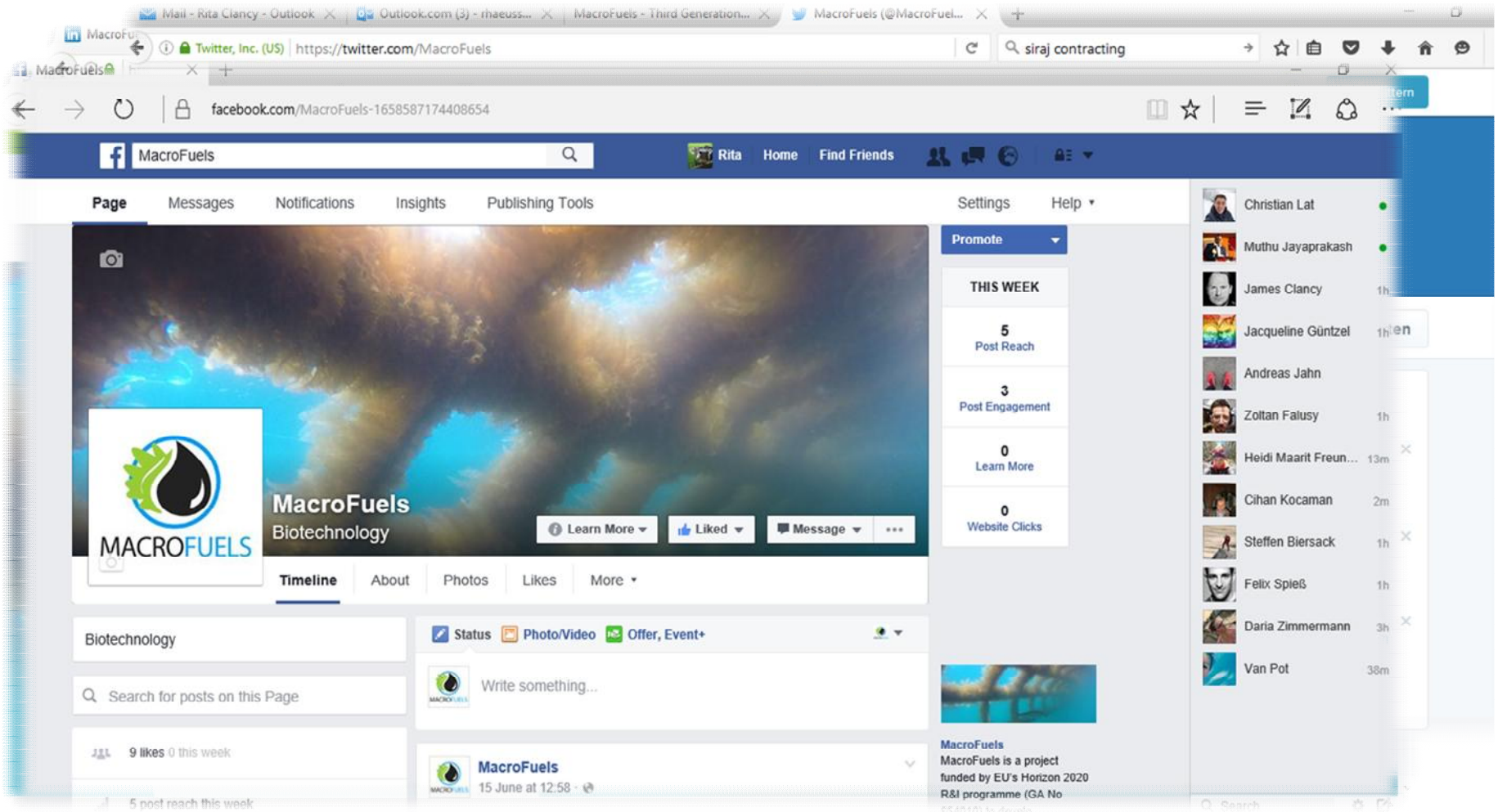


Project Visibility

Project Visibility

MACROFUELS

MacroFuels in a Nutshell

MacroFuels aims to produce advanced biofuels from macroalgae, commonly known as seaweed. The targeted biofuels are ethanol, butanol, furanics and biogas. The project will achieve a breakthrough in biofuel production from macroalgae by:

- Increasing biomass supply by developing a rotating crop scheme for cultivation of seaweed, using native, highly productive brown, red and green seaweeds, in combination with the use of advanced textile substrates resulting in a year round biomass yield.
- Improving the pre-treatment and storage of seaweed and to yield fermentable and convertible sugars at economically relevant concentrations (10-30%)
- Increasing bio-ethanol and bio-butanol production to economically viable concentrations by developing novel fermenting organisms which metabolize all sugars at 90% efficiency
- Increasing biogas yield to convert 90% of the available carbon in residues by adapting the organisms to seaweed
- Developing thermochemical conversion processes of sugars to furan-based fuels
- Performing an integral techno-economic, sustainability and risk assessment of the entire seaweed to biofuel chain

MacroFuels will develop technologies for the production of fuels which are suitable as liquid fuels of precursors thereof for the heavy transport sector as well as potentially for the aviation sector. MacroFuels will furthermore expand the biomass available for the production of biomass available for the production of advanced biofuels. Seaweed does not need fresh water, arable land or fertilizers to grow, which provides environmental benefits, and, in addition, has a high carbon dioxide reduction potential as well as reduces the demand for natural resources on land. The technology offers many novel opportunities for employment along the entire value chain.

Benefits and Impacts

The progress that will be achieved by MacroFuels will have significant impact on various economic fields, and - most importantly - paves the way towards a sustainable solution that is not competing with arable land or food, in contrast to 1st and 2nd generation biofuels derived from food-based crops and residuals. Thus, MacroFuels aims to make a substantial contribution towards renewable energy from photosynthesis and towards the goal set by the European Union of 10% of the transport fuel of every EU country to come from renewable sources such as biofuels by 2020.

Advanced technologies and decreased production costs for third-generation biofuels will offer many novel opportunities for employment along the entire value chain. MacroFuels estimates that about 15.000 jobs can be created based on the EU target of 2.5% biofuels, which corresponds to 5000 km² of cultivated seaweed area.

✓ MacroFuels converts seaweeds more efficiently to biofuels via breakthroughs in pre-treatment (water reduction of more than 50% and total elimination of process steps are among our ambitious goals), via wet, sugar preservative storage methods, and by improving the ethanol and butanol productivity up to economic levels.

✓ MacroFuels enables a favourable energy balance as well as significant potential for cost reduction, which will permit our targeted fuels to eventually compete favourably with fossil or 1st and 2nd generation biofuels.

✓ MacroFuels stimulates stakeholder dialogues and international collaboration by bringing together experts that are involved in international activities on seaweed-derived biofuels, and by entering dialogues with stakeholders to understand their interests and concerns. Although the objective is unique, MacroFuels will not be an isolated effort. Indeed, the links with other projects and networks ensure that MacroFuels will be up to date on the latest trends and support maximising the project's impacts.

✓ MacroFuels improves innovation capacity by integrating prior state-of-the-art, know-how and experience along the entire seaweed to biofuels chain. Bringing together key players in the seaweed to biofuels area will accelerate innovation and market deployment and broaden the business-case for companies.

Economic viability and sustainability

MacroFuels will determine the economic viability of the seaweed to biofuel production cha by using accurate verified experimental data, obtained under relevant conditions. The d from the assessment will be used in a feedback loop to further inform the experiments, t ensuring that the chances of commercial implementation are maximised.

Valorisation of the side- and waste-streams

Side- and waste-streams will be valorised by screening them for high value marketable com nents and identifying the most viable products. We will further assess the proteins liberat during the entire process for their use to augment feed supply in the EU, as well as the mine streams for use as inorganic fertilizer in terms of primary, secondary and trace elements. T assessment will result in a potential value and market of these streams.

Fuel assessment under realistic conditions

Fuel assessment under operating conditions will be performed by utilising the DTI fuel asse ment facilities. Fuel mixtures will be prepared and tested in the relevant engines to asse the suitability of these fuels under different realistic transport conditions.

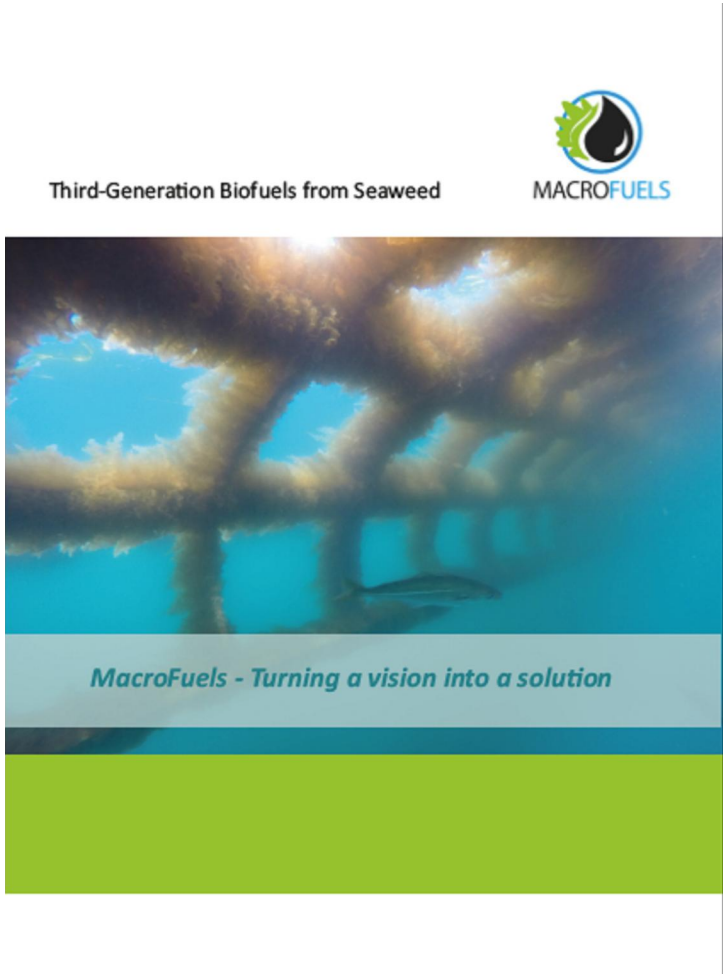
Techno-economic and sustainability assessment

As part of MacroFuels, a multi-criteria assessment of the sustainability of substituting conv tional, fossil-based transportation fuels and currently available biofuels with seawe derived fuels will be performed. The sustainability assessment will take into account econor environmental, social, health and safety, and risk aspects and will consider the entire va chain of the transportation fuels using a life cycle comparison approach.

Follow us: www.macrofuels.eu

This flyer is part of the MacroFuels project.
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement n.o. 654010.

Project Visibility



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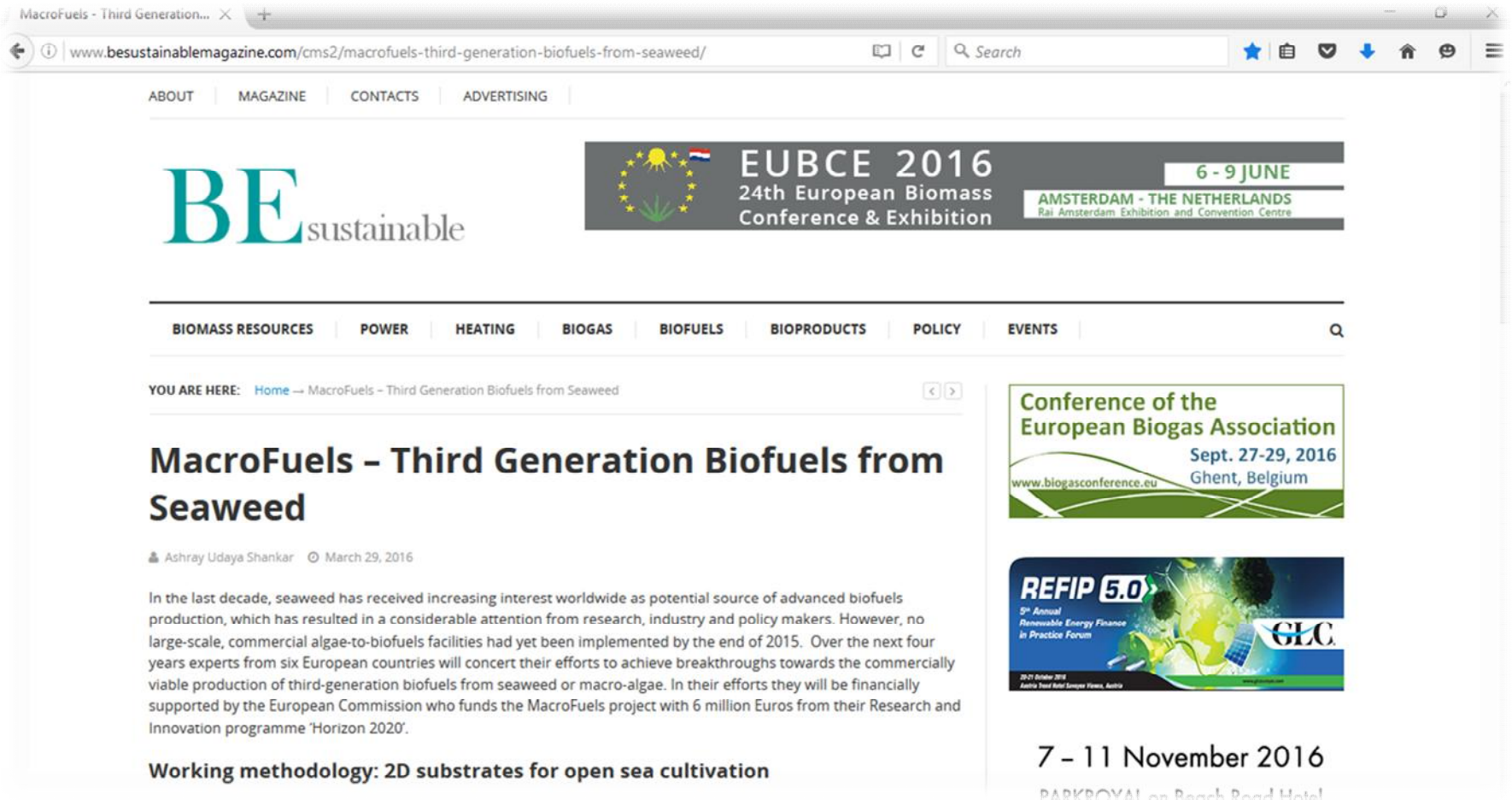
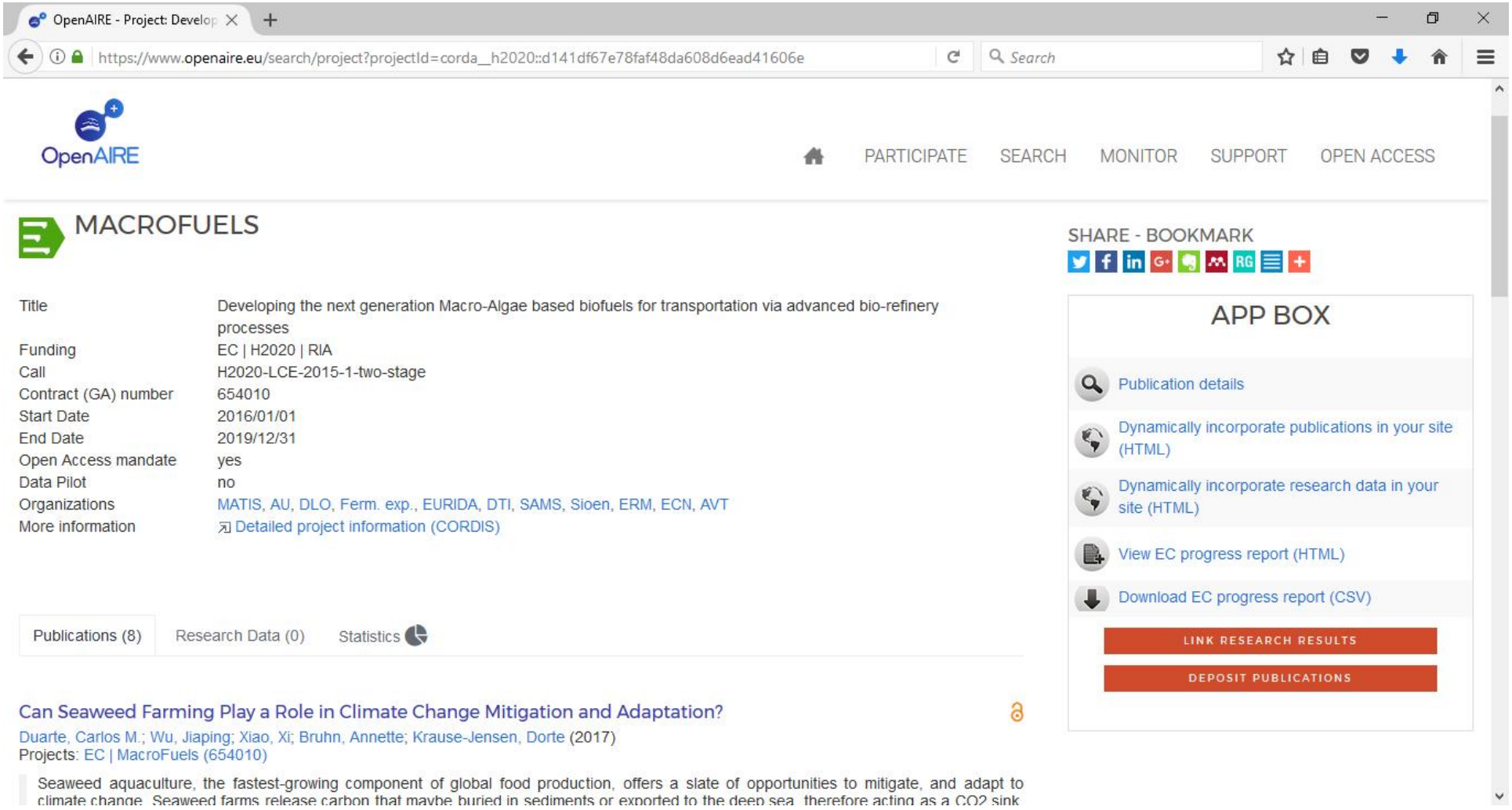
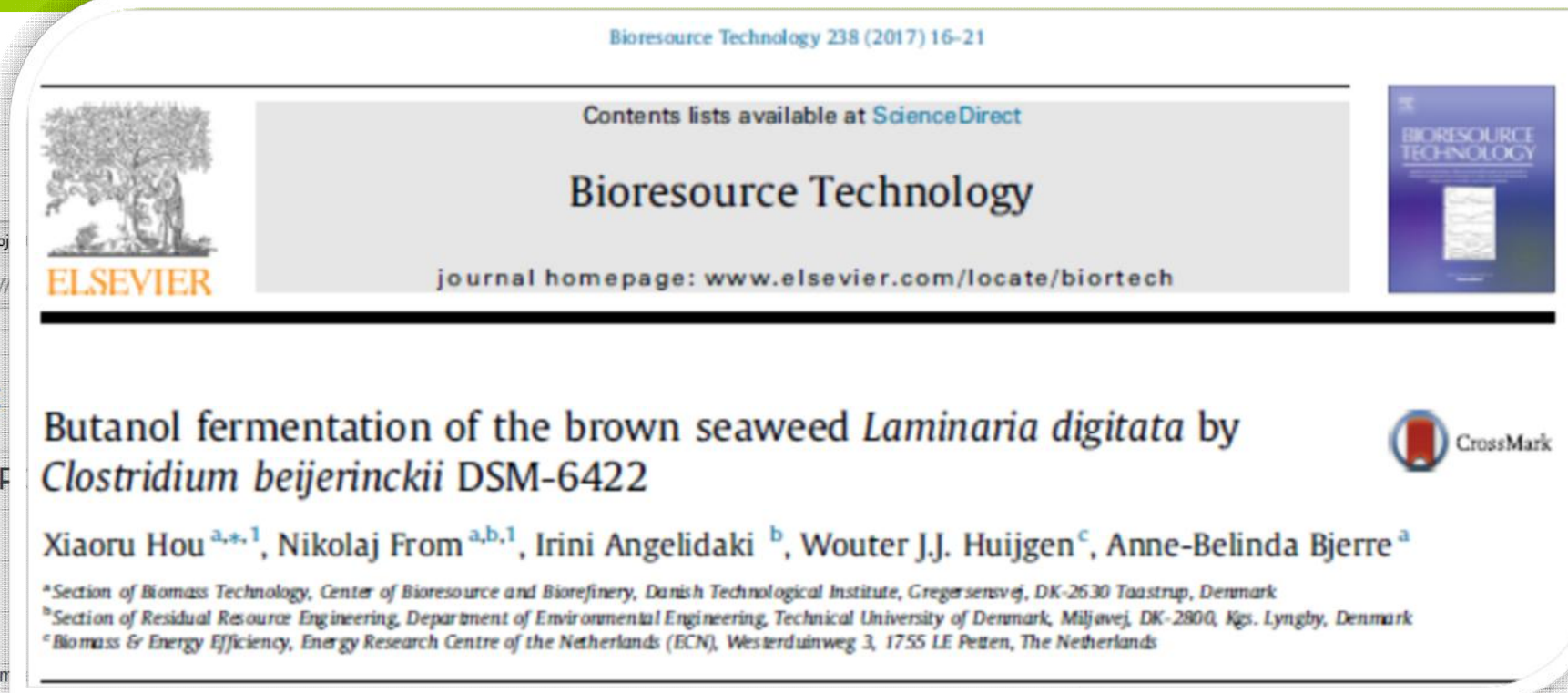


Project Visibility

Project Publications





Bioresource Technology 238 (2017) 16-21

Contents lists available at ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

Butanol fermentation of the brown seaweed *Laminaria digitata* by *Clostridium beijerinckii* DSM-6422

Xiaoru Hou [a,*,1], Nikolaj From [a,b,1], Irini Angelidaki [b], Wouter J.J. Huijgen [c], Anne-Belinda Bjerre [a]

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OpenAIRE - Proj

https://

OpenAIRE

MACF

Title

Funding	
Call	
Contract (GA) num	
Start Date	
End Date	2019/12/31
Open Access mandate	yes
Data Pilot	no
Organizations	MATIS, AU, DLO, Ferm. exp., EURIDA, DTI, SAMS, Sioen, ERM, ECN, AVT
More information	Detailed project information (CORDIS)

Dynamically incorporate publications in your site (HTML)

Dynamically incorporate research data in your site (HTML)

View EC progress report (HTML)

Download EC progress report (CSV)

LINK RESEARCH RESULTS

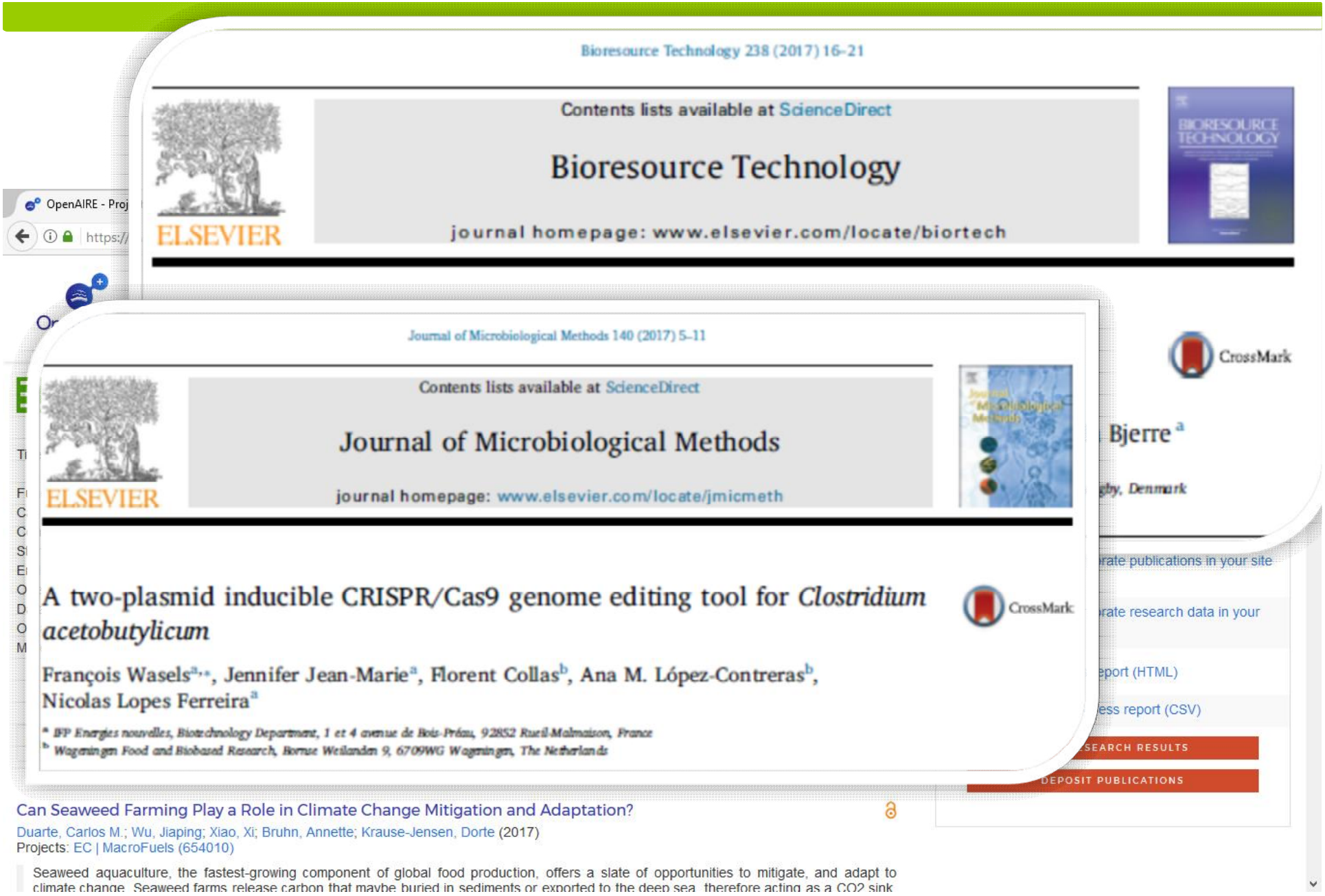
DEPOSIT PUBLICATIONS

Publications (8) | Research Data (0) | Statistics

Can Seaweed Farming Play a Role in Climate Change Mitigation and Adaptation?

Duarte, Carlos M.; Wu, Jiaping; Xiao, Xi; Bruhn, Annette; Krause-Jensen, Dorte (2017)
Projects: EC | MacroFuels (654010)

Seaweed aquaculture, the fastest-growing component of global food production, offers a slate of opportunities to mitigate, and adapt to climate change. Seaweed farms release carbon that maybe buried in sediments or exported to the deep sea, therefore acting as a CO2 sink



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Journal of Microbiological Methods 140 (2017) 5–11

Contents lists available at ScienceDirect

Journal of Microbiological Methods

journal homepage: www.elsevier.com/locate/jmicmeth

A two-plasmid inducible CRISPR/Cas9 genome editing tool for *Clostridium acetobutylicum*

François Wasels[a,*], Jennifer Jean-Marie[a], Florent Collas[b], Ana M. López-Contreras[b], Nicolas Lopes Ferreira[a]

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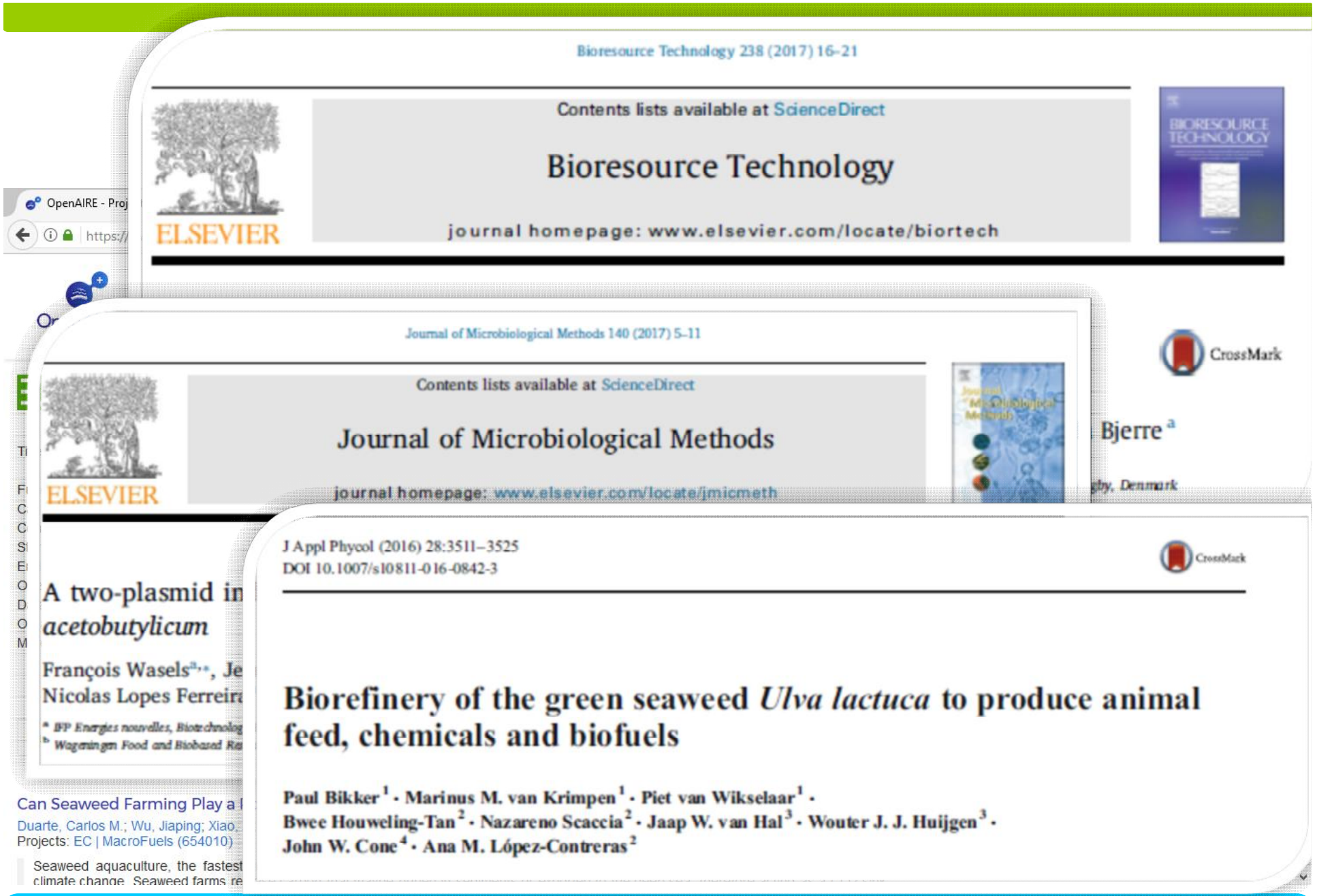
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A two-plasmid in
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François Wasels[a,*], Je
Nicolas Lopes Ferreir
J Appl Phycol (2016) 28:3511–3525
DOI 10.1007/s10811-016-0842-3
CrossMark
Biorefinery of the green seaweed Ulva lactuca to produce animal feed, chemicals and biofuels
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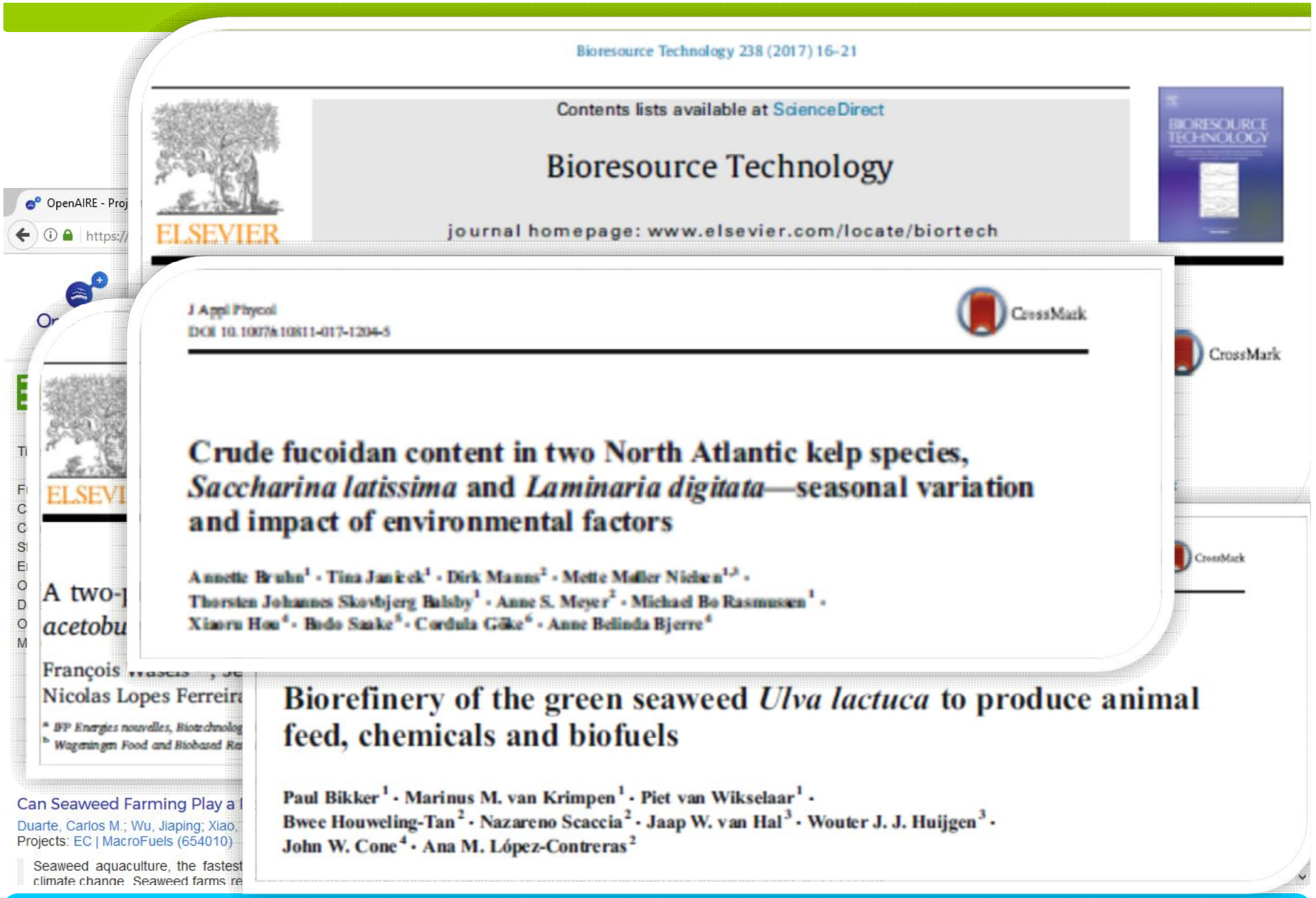
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Crude fucoidan content in two North Atlantic kelp species, Saccharina latissima and Laminaria digitata—seasonal variation and impact of environmental factors
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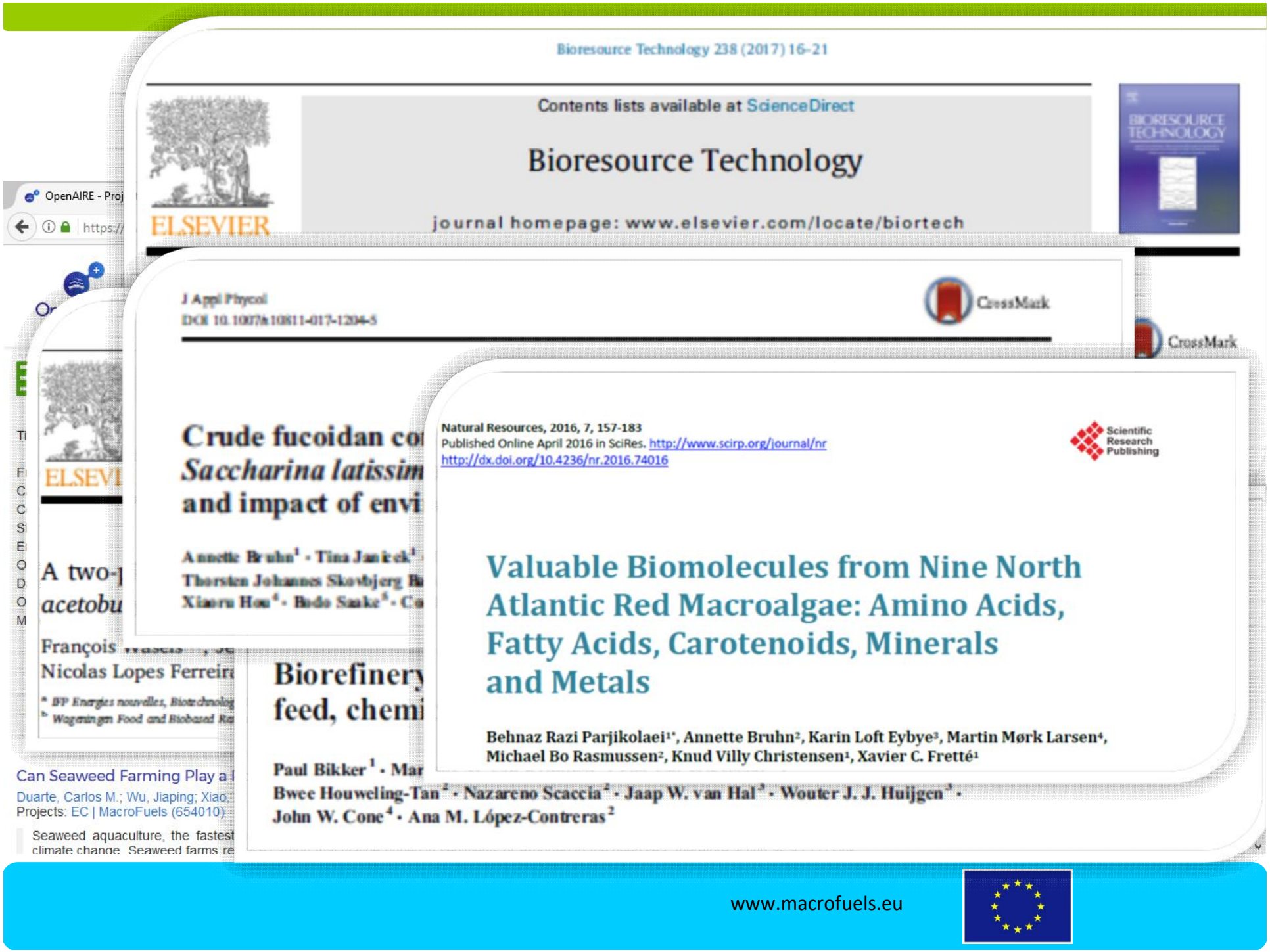

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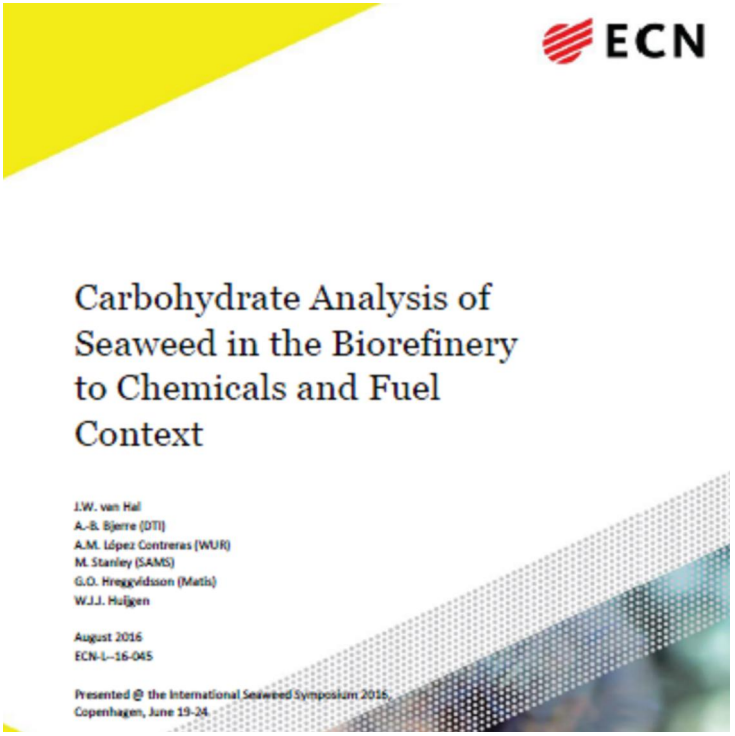
Project Presentations



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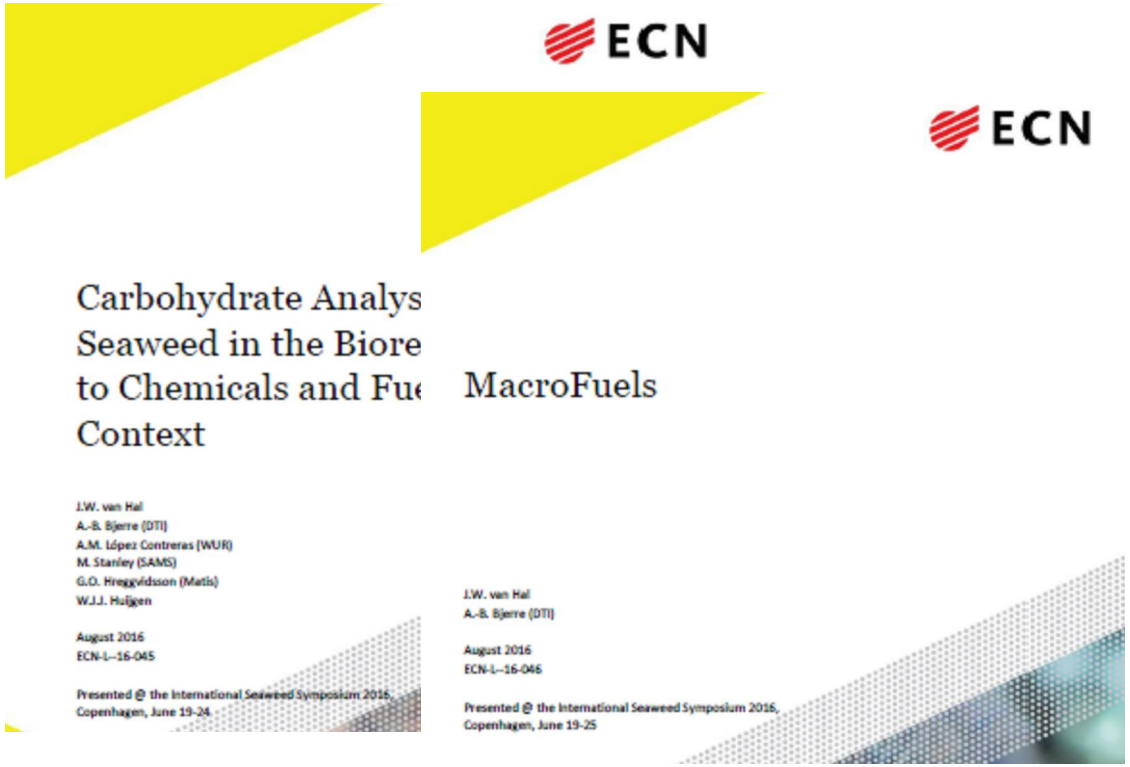

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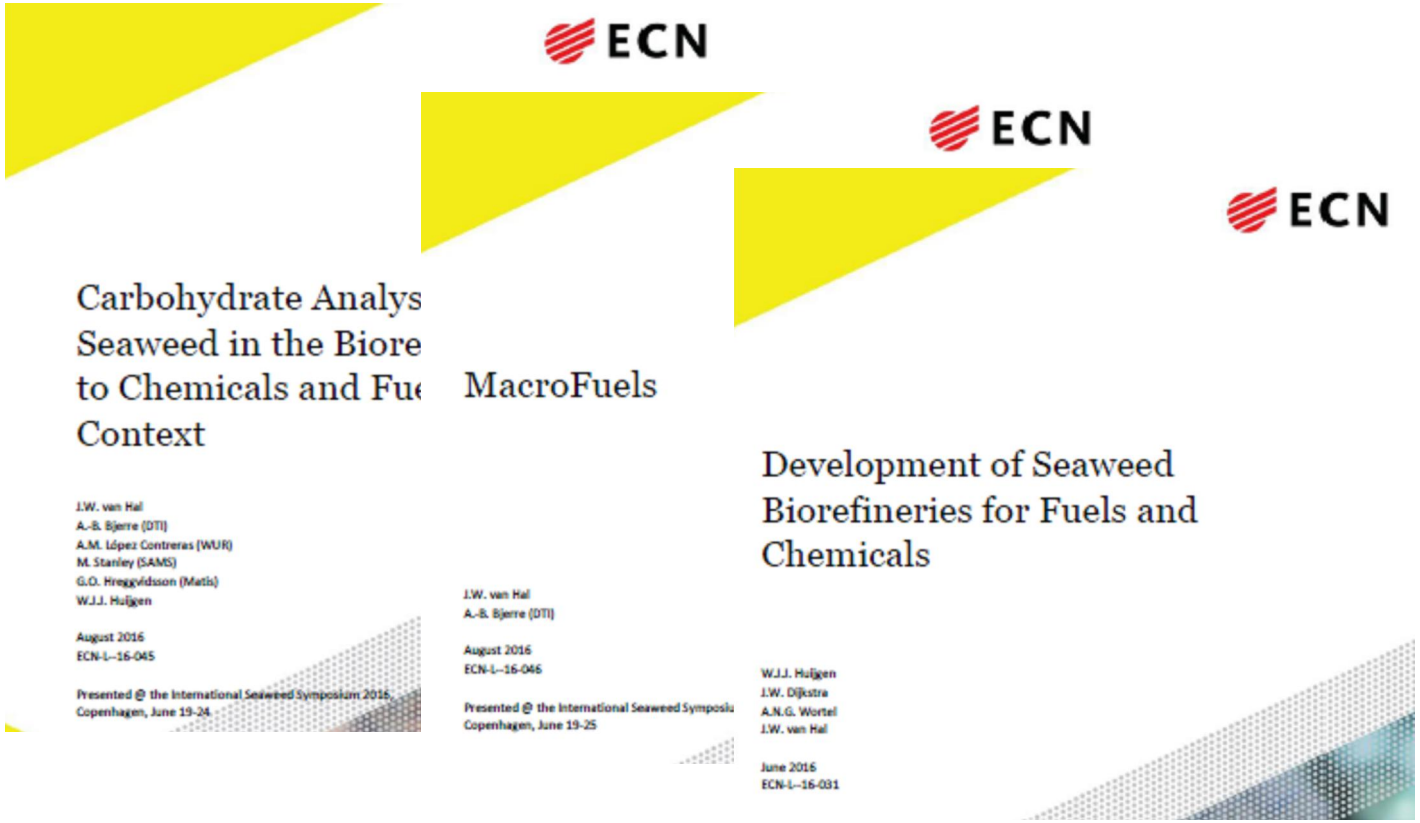

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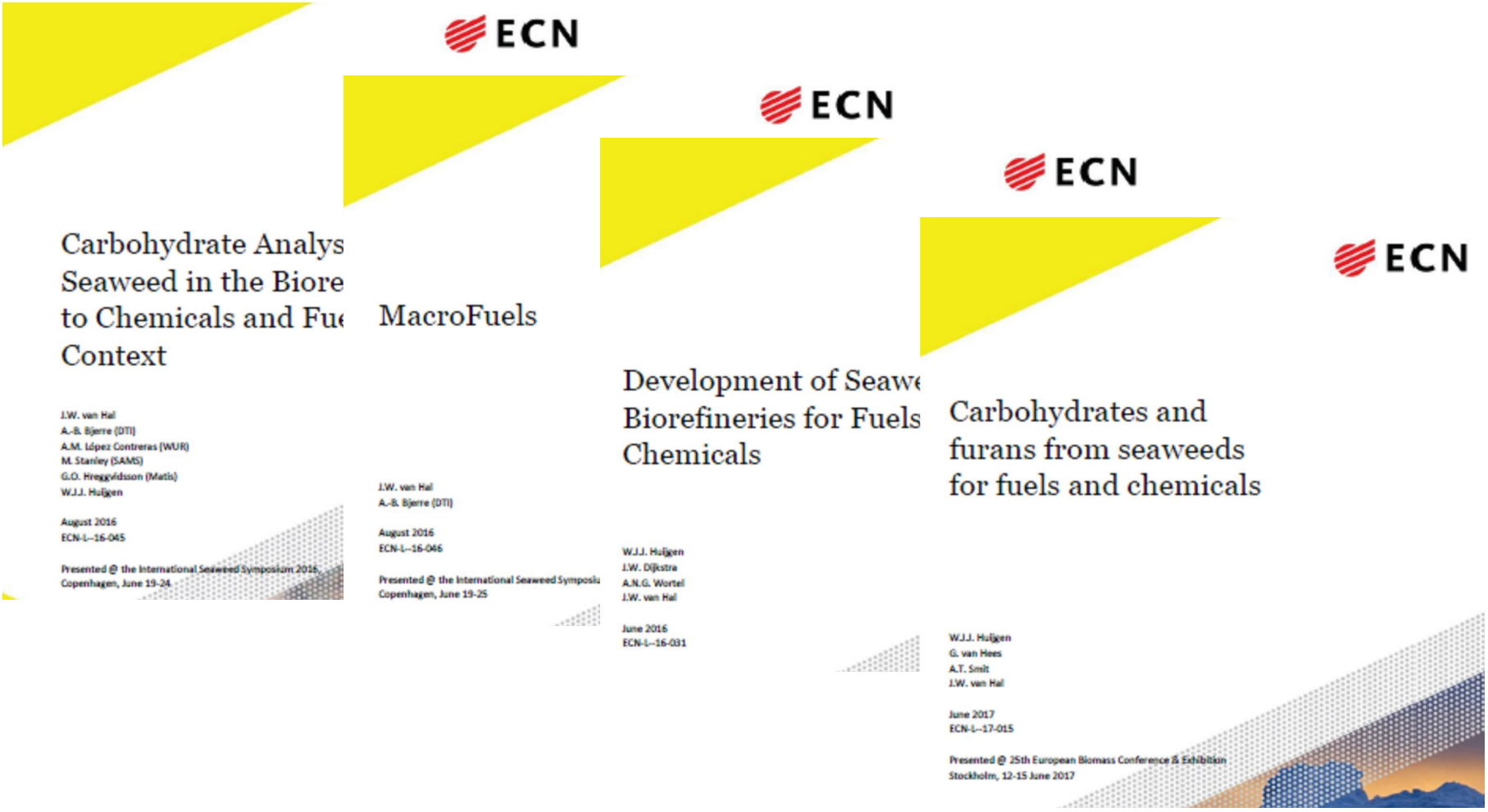

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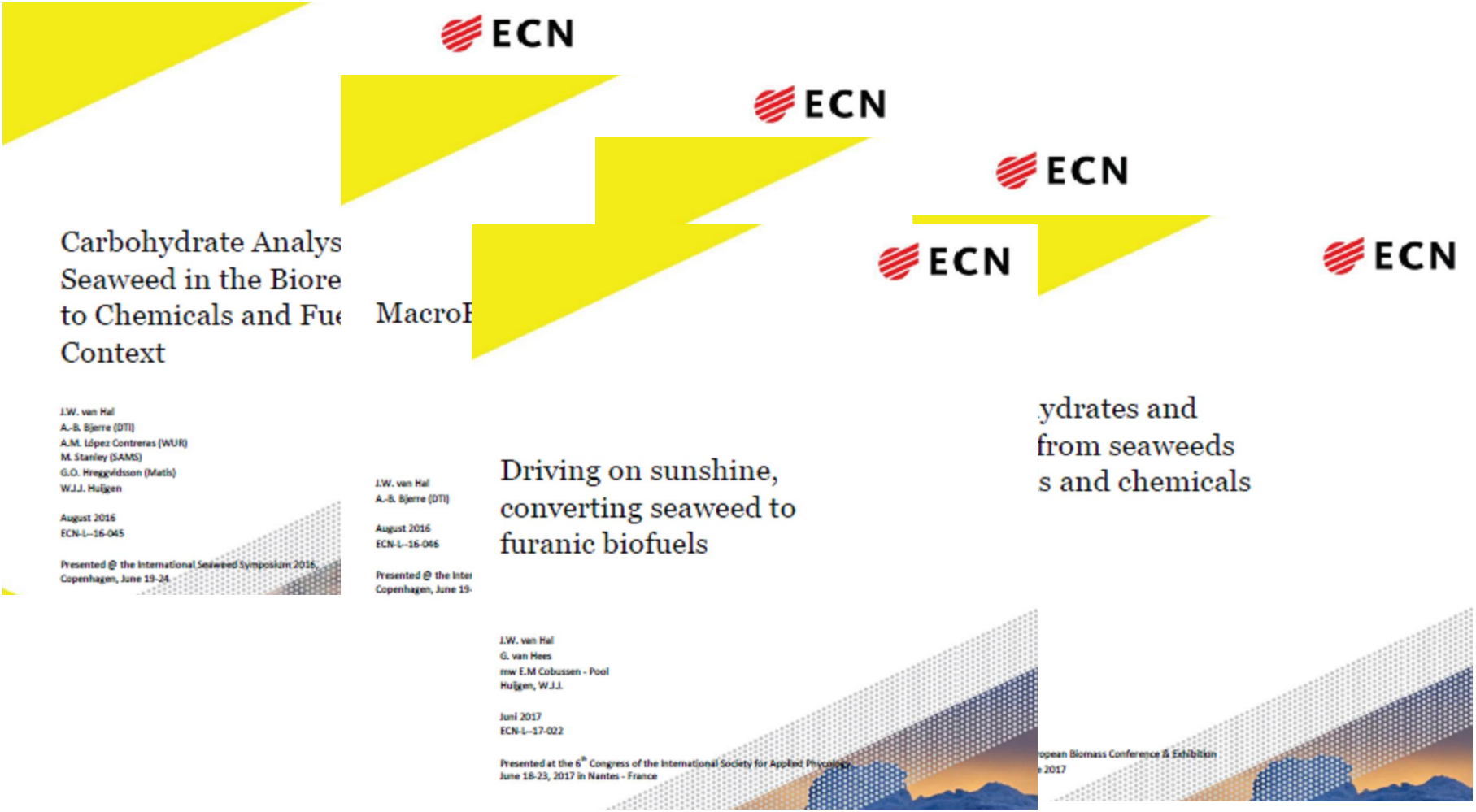

Conference Participations

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MacroFuels @ EXPO 2017

MacroFuels Citizen Events

WP7 – Phase 2: Focus on exploitation

SIOEN, EURIDA

Are we ready to commercially produce seaweed based biofuels in sufficient quantities today? If not, why?

WP7: Exploitation aspects

Today seaweed based biofuel production in Europe is not possible due to:

- Immature seaweed cultivation in EU
- Immature biorefinery technologies
- Price of seaweed based biofuels
- Lack of cultivation concessions (i.e. km2 scale)
- NIMBY
- ..

First initiatives are likely to start in S.E. Asia. Why?

1) Maturity of seaweed cultivation in SE Asia
2) EU: typically browns => 25 kg ww /m2.year
   S.E. Asia: typically reds => 6 x 40 = 240 kg ww /m2.year
3) More space for concessions
4) Less NIMBY
5) Cheaper labor
6) …

Europe can provide technologies and financing

How much surface area do we need to produce enough seaweed

to replace 1% of refined petroleum products by seaweed based biofuels?

WP7: Exploitation aspects

Some calculations …

Worldwide consumption of refined petroleum products (2016)	= 94 million barrels per day = 5 billion tons per year
Global biofuel production (2016, ethanol and biodiesel)	= 82 million tons per year

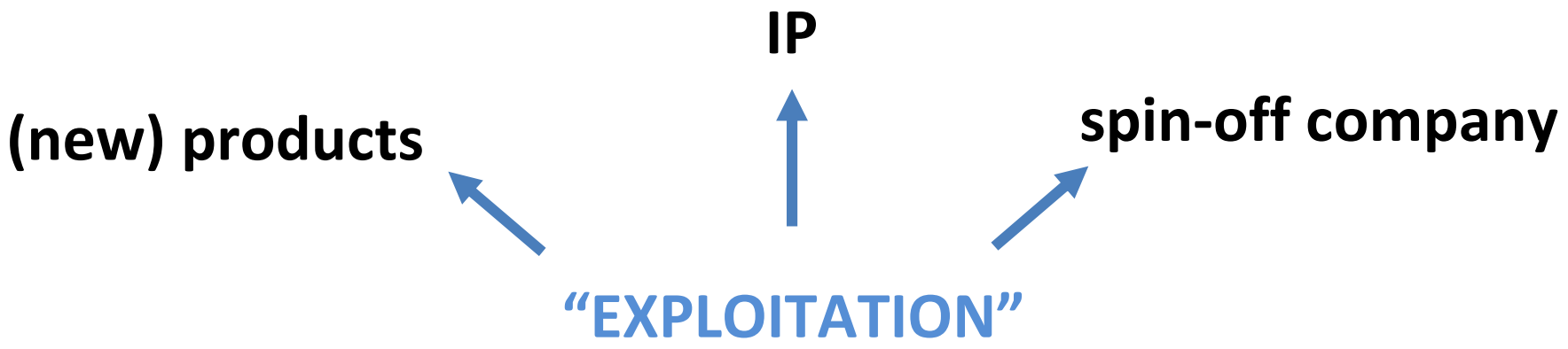
If we replace **appr. 1%** of this land-based biofuel production by seaweed based biofuel
⇒1 million ton per year

⇒27 mio tons ww of seaweed (is exactly the annual seaweed production in 2016)
(assuming 2kg sugar for 1 kg of biofuel and 60% sugar content in seaweeds)

⇒1100 km2 of cultivation space required (assuming 25 kg/m2), or
⇒113 km2 of cultivation space required (assuming 240 kg/m2)

(If we want to replace all 94 million barrels per day by seaweed based biofuels we need 565,000 km2 (assuming 240 kg/m2) = 750 km x 750 km)

WP7: Exploitation aspects



WP7: Exploitation aspects

New IP/products developed during first 2 years of MacroFuels:

WP1:

WP2:

WP3:

WP4:

WP5:

WP7: Exploitation aspects

Is there an interest for an **Exploitation Strategy Seminar** (ESS)?

An ESS seminar takes 1 day and is typically organized during a GA meeting

During this day an exploitation expert (typically a professor) supports the consortium in identifying exploitable results by means of highly interactive exercises.

For more info see:
http://sserr.meta-group.com/Services/Pagine/Exploitation-Strategy-Seminars.aspx

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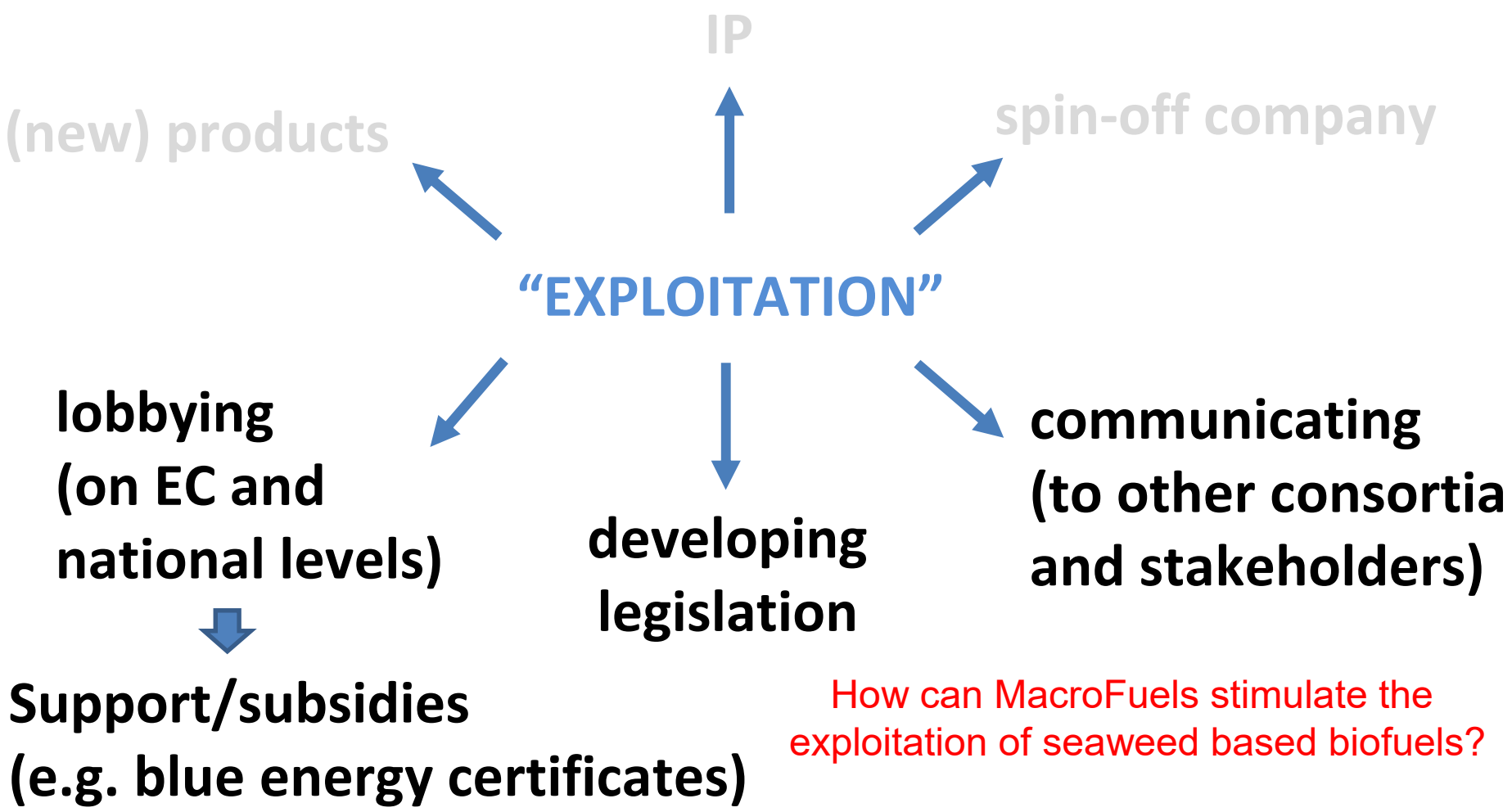
Who are our stakeholders?

WP7: Exploitation aspects



How can MacroFuels stimulate the exploitation of seaweed based biofuels?

WP7: Exploitation aspects

How can MacroFuels stimulate exploitation in these areas:

1) Contribute to Legislation and future strategies/policies:

- Direct interaction with EC and other legislation bodies
- Knowledge exchange with multipliers (associations and existing initiatives)
- Pre-legislative participation and input most promising

What has MacroFuels done so far or what partner activities can we build upon?

- Personal communication with MEP Nils Torvalds
- Contact established with Thomas Schleker, DG RTD, Policy Officer 'Renewable Energy Sources'
- Contacts established with Dutch policy making bodies for targeted input on future policies (Jaap van Hal, ECN)
- Contribution to Scottish 'Seaweed Cultivation Policy Statement' (Michele Stanley, SAMS)

WP7: Exploitation aspects

How can MacroFuels stimulate exploitation:

2) Networking & Lobbying

- Direct interaction and intensified knowledge exchange with national and international stakeholders
- Propose ideas how to stimulate seaweed based fuels (e.g. via blue energy certificates)
- Interaction with related EU projects (seaweed, ocean safety, multi-use of the marine space, etc.)

What MacroFuels has done so far:

- Organise a stakeholder round table on multi-use approaches of the ocean space (e.g. integrated solutions seaweed farm-wind park) – Early 2018 in cooperation with Noordzee Borderij, Grow Project on Offshore Wind Energy)
- Initiate dialogues with SOMOS project and Maritime Spatial Planning EU Platform about future joint activities on safety and licensing issues

WP7: Exploitation aspects

How can MacroFuels stimulate exploitation:

3) Communication via exploiting ‘MacroFuels’ knowledge

- White papers, fact sheets and/or policy briefs on:
  - Sustainable seaweed farming and its potential for other marine sectors
  - Integrated solutions leading to ‘Offshore Energy Platforms (based on results from stakeholder round tables)
  - Social impacts from large-scale seaweed farms (building on WP6)
  - Ecological impacts of large-scale seaweed farming
  - Boosting the blue economy via realising the seaweed-to-biofuels value chain (building on results from WP6)
  - Seaweed based biofuels vs terrestrial plants biofuels

- Intensify knowledge transfer to relevant national and EU stakeholder platforms

WP7: Exploitation aspects

Next Steps (input and actions from all partners needed)

In progress:

- MacroFuels Conference as event for multiple stakeholders planned for May 2018 @ SAMS, a.o. with
  - ✓ Boat trips to the seaweed farm
  - ✓ Harvesting demonstration
  - ✓ Meeting with policy makers and local communities

Needed:

- Make contacts with national/regional/local bodies and policy makers
- Provide info on (inter)national legislation and policies
- Identify stakeholders for cooperation and involvement
- Look out for existing initiatives that we can create synergies with
- Use own events and initiatives for liaising with stakeholders
- Suggest topics for White Papers and Knowledge Sheets

Roadmap for technical and non-technical activities

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< lobbying and communicating to develop awareness, legislation, etc. >

< MF activities > < MF II activities > < Upscaling activities > < Seaweed based biofuels commercially available

2017 2020 2025 2030

Exploitation = YOU !

If we will successfully perform the actions mentioned,
MacroFuels will be a BIG success !

- New papers
- New patents/licenses
- New products/applications
- New projects (MF II)
- New processes to be adopted
- …

Acknowledgement

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