**WP6 Environmental, economic and social assessment** (**AAU**, BBE, BZEOS, C6F, NSF, SES, SINTEF) (M1-M36) @all please confirm participation and roles as from the text below.

A long-term sustainable transition from existing fossil-based towards novel biobased polymers involves both technical solutions and societal involvement. The triple-bottom line sustainability (Environmental, Social, Economic) of the new polymer must be ensured. The WP sets therefore two objectives:

O6.1 Provide new insights on the sustainability of the novel algal-based-biopolymers in a life cycle perspective at early stage, to guide the technological development towards impact minimization.

O6.2 To anticipate the wider societal implications of the introduction of the novel biopolymers and provide guide to the technology developers to maximize societal acceptance and intake in existing and future value chains.

**Tasks.**

T6.1. Life cycle analysis and Life Cycle Costing (LCA/LCC) (**AAU**, C6F, NSF, SES, SINTEF; ALGAIA) (M6-M34)

## Targets O6.1 The Life Cycle Assessment (LCA) of the emerging technologies for producing algal-based biopolymers will be performed. The LCA will evaluate not only the process requirements of energy and materials, and related environmental impacts and costs in a life cycle perspective. The LCA will be supported by primary data on seaweed culivaiton (SES, C6F, ALGAIA) and processing (SINTEF, + other?) in the design of the foreground system, and by secondary data from established LCA databases (ecoinvent v3.9 or higher) to model the background system. Specific focus will be paid on modelling of future conditions surrounding the technology (e.g., future low-carbon electricity mix) as well as future (and not yet achieved) possible configurations of the technology int its upscaled stage. The prospective modelling of the upscaled technologies will be done combining different techniques such as learning curves, detailed process modelling, and scenarios depending on the uncertain variable under analysis. For the Life Cycle costing, integration of value added data from Input-Output databases (Exiobase) will be perfoermed.

T6.2 Sustainable supply of feedstock and end-of-life assessments (**BZEOS**, AAU, BBE) (M6-M24)

Targets O6.1 and O6.2. Quantitative analysis of time series data from statistical agencies (e.g., FAOSTAT) will be used by AAU to gain insight in the current rate and production amount, as well as forecasted availability of algal feedstock both harvested and cultivated, and to understand the constraints and potential for scalability at a global scale. @BBE can contribute here?

@BZEOS: something about testing how biodegradable are the materials.

As the end-of-life treatment of biobased polymers is uncertain and outside the direct control of the producer, a set of model scenarios will be developed by AAU and will feed in the LCA. Datasets on different end-of-life treatment options for polymers and waste types (incineration, composting, anaerobic digestion) will be modify to reflect the chemical-physical properties of the polymers and used to feed the LCA (Task 6.1)

T6.2 Circularity, carbon and nutrient balances (**AAU**, C6F, NSF ,SES, SINTEF, ALGAIA) (M6-M24)

Targets O6.1 New algal-based biopolymers will need to be integrated in a circular economy and it is thus paramount to ensure circular carbon and nutrient flows (N, P, K). Based on data from T1.1 and T1.3 carbon and nutrient mass balances will be calcuated across the entire life cycle (cradel to cradle) usinf mass flow analysis (MFA) approach. To estimate degree of circularity, selected micro-scale indicators of circularity among those recommended in current regulations in the context of bioeconomy and the bioeconomy monitoring system (circular material use, recycling rates, cascade use of resources, circular material rate, recycling rate of municipal waste or biowaste generated or recovered by source) wil be applied to estimate the degree of circularity of the technology on carbon and nutrients.

T6.4 Assessment of social impacts and societal engagement in transitioning towards biobased polymers (**AAU**, Other???) (M6-M30)

Targets O6.2 The societal approach will support the implementation of novel technical solutions by anchoring the projects objectives and findings across disciplines, sectors, and civil society. Ensuring that the development of the new polymer technologies is meaningful to end-users and hereby contributes to positive societal impact. The activities will focus on investigations and interventions on how biobased polymers can be integrated in existing and future values chain. Activities will be based on SSH methods an will include a mapping of stakeholders across civil society, market, and state, followed by the collection of qualitative data on opportunities and challenges on changing practice towards biobased polymer via interviews with stakeholders (max 20). Finally, a social impact assessment at the strategic level will be performed. The expected outcome is the identification of possible synergies among stakeholders, information on societal impact and willingness to change towards biobased polymers, and identification of societal impacts, willingness, and possible engagement.

T6.5 Technical-economic evaluation of pilot-scale processes (@BZEOS? @SINTEF?, AAU, @BBE?) (MX-MX)

Targets O6.2

@SINTEF, BZEOS, @BBE, Others? Any help here appreciated.

**Milestones.**

MSX Screening LCA and LCC completed and available to partners (M12)

@ALL add one or two milestones. We might then group them together.

MSX Interview with stakeholders completed and transcribed (M18)

**Deliverables**

D6.1 Sustainability assessment and circularity of novel algal-based polymers (scientific paper or report) (M34) (Public) (AAU)

D6.2 Wider societal perspective and techno-economic assessment (report). (Public). (M30) (AAU)