# Draft Project plan for the CEN Workshop on "Evaluation of Process Intensification of Biorefining Processes for Economic and Sustainability Viability – EvaPIBioref"

**Requests to participate in the Workshop and/or comments on the project plan are to be submitted by**
**2023-09-30 to syad.akkoub@din.de**[1]

Recipients of this project plan are kindly requested to name all patent rights known to them to be relevant to the Workshop and to make available all supporting documents.

**Berlin, 2023-08-29 (Version 1.0)**

[1] Applications for participating in the Workshop and comments on the project plan that are not received by the deadline do not need to be taken into consideration. Once constituted, the Workshop will decide whether or not to consider the comments received in good time.

# Contents

# 1 Status of the project plan

**Draft project plan** for public commenting (Version 1.0)

This draft project plan is intended to inform the public of a new Workshop. Any interested party can take part in this Workshop and/or comment on this draft project plan. Please send any requests to participate or comments by e-mail to **syad.akkoub@din.de.**

All those who have applied for participation or have commented on the project plan by the deadline will be invited to the kick-off meeting of the Workshop on **2023-10-05**.

# 2 Workshop proposer and Workshop participants

## 2.1 Workshop proposer

| Person or organisation | Short description and interest in the subject |
|---|---|
| Jochen Michels, DECHEMA e.V. | DECHEMA is the expert network for chemical engineering and biotechnology in Germany. As a non-profit professional society we represent these fields in science, industry, politics and the general public.<br><br>DECHEMA is the coordinator of the BioSPRINT project. Is aim is to apply process intensification (PI) in the context of biorefining operations, to improve e.g. the efficiency of the purification and conversion of sugars from the hemicelluloses fraction of lignocellulosic biomass and to enable their transformation into new bio-based resins for substituting fossil based polymers in a range of applications. BioSPRINT is supported by the BBI JU under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887226. |

## 2.2 Other potential participants

This CWA will be developed in a Workshop (temporary body) that is open to any interested party. The participation of other experts would be helpful and is desired. It is recommended that:

- Science and research
- Large companies performing biomass processing using biorefining concepts
- SME (Small and Medium sized enterprises) like consultants, plant engineering companies or companies refining biomass fractions

take part in the development of this CWA.

## 2.3 Participants at the kick-off meeting

The following persons or organisations already signed up to the kick-off meeting prior to the publication of the draft project plan.

| Person | Organisation |
|---|---|
| Workshop proposer: Jochen Michels | DECHEMA e.V |
| Andrea Minigher | AEP Polymers SRL |
| Juan Enriquez | ADSL Dynamic & Security Computations SL |
| Panayiotis Klitou | EBOS Technologies Ltd |
| Ireen Gebauer | Fraunhofer Center for Chemical-Biotechnological Processes CBP, Fraunhofer Gesellschaft |
| Nils Rettenmaier | Institut für Energie- und Umweltforschung Heidelberg GmbH |
| Ana Maria Lopez | IRIS Technology Solutions, Sociedad Limitada |
| Mili Fele | Kemijski Inštitut |
| Mladen Crnomarkovic | Maturus Optimi BV |
| Markku Ohenoja | Environmental and Chemical Engineering, Faculty of Technology, University of Oulu |
| Elke Fliedner | Prefere Resins Germany GmbH |
| Fernando José Russo Abegão | Process Intensification Group, School Engineering, Faculty of Science, Agriculture and Engineering, University of Newcastle upon Tyne |
| Kamelia Boodhoo | Process Intensification Group, School of Engineering, Merz Court, University of Newcastle upon Tyne |
| David McCann | UPM-Kymmene Oyj |
| Workshop secretariat: Syad Akkoub | Workshop secretariat: DIN |

## 2.4 Registered Workshop participants

*List all participants at the kick-off meeting who have adopted the project plan here or as Annex. Participants are not named as Workshop participants until the project plan has been adopted.*

The following persons or organisations have registered as Workshop participants at the kick-off meeting and will actively participate in the development of the CWA.

| | |
|---|---|
| Workshop Chair | Workshop Chair |

| | |
|---|---|
| Workshop Vice-Chair | Workshop Vice-Chair |
| | |
| | |
| Workshop secretariat: | Workshop secretariat |

# 3 Workshop objectives and scope

## 3.1 Background

The objective of process intensification (PI) in the context of biorefining operations is to lead to a reduction in operation costs, feedstock and energy resources, greenhouse gas emissions and higher yields, while increasing operation safety, by concentrating on technologies which can intensify processing methods and create an integrated biorefinery concept. PI methods in general and specifically for biorefining operations have not featured strongly in the vast standards literature. However, examining the Standards and Guidance Documents prepared or under consideration by the CEN/CENELEC Technical Committees, it is possible to identify a significant number where they will impact the bioeconomy from the equipment, process, safety and /or environmental aspects.

Bio-based feedstocks encompass a multitude of materials from agricultural and forest residues to industrial and municipal wastes. Lignocellulose is one type of feedstock which emanates from forestry and agricultural waste and constitutes non-edible biomass. Therefore, it is of particular importance for the bio-economy as the sustainable source of raw materials for the production of bio-based chemicals and materials as well as advanced biofuels. In Europe alone, lignocellulosic biomass has an estimated annual potential of technical availability of 1372 million tonnes, which could be sustainably used by 2030, doubling the current usage. However, in order to reach the goal of 25 % bio-based chemicals in 2030 (2015: 14 %), a major increase of the usage and processing efficiency of lignocellulosic biomass for sourcing the chemical industry would be required.

Processes are well established to valorise only two of the three major components in lignocellulose, i.e. cellulose (for fibres) and lignin (for energy). Hemicelluloses, which typically account for 20-30 % (w/w), are often not efficiently segregated, purified, converted and transformed into useful and application-ready compounds, and thus are relatively under-exploited. This results in less efficient use of the lignocellulosic raw material and high volume waste fractions, making current products from lignocellulosic biorefineries uneconomical and less sustainable.

As an example, PI is used to produce valuable polymers from hemicelluloses by intensifying four process steps

1. Upstream purification and concentration of sugars in the hemicelluloses stream

2. Catalytic conversion of the mixed sugar fraction to furans

3. Downstream purification of furan monomers

4. Polymerisation of the monomers to resole and novolac-type resins as well as Mannich polyols

## 3.2 Scope

The workshop will agree on a standard procedure for evaluating if the use of process intensification measures for biorefining processes is economically and sustainably viable.

The following tasks must be considered in the procedure. Flowsheeting of the conventional process for the detailed analysis of its mass/energy balances. A knowledge-based engineering approach is used for selecting and integrating of process intensification modules (PIM) into the flowsheeting. Simulations of PIMs integrated processes are performed for the process optimization followed by necessary experimental validations. These steps are accompanied by the assessment of the environmental performance (containing LCA), the techno-economic assessment and the social impact assessment.

The planned Workshop is intended to be used by biorefinery plant manufacturers, its owners and operators as well as process design engineers. Since conventional refining of plant biomass often needs to process diluted aqueous

product streams still containing lots of by-products and impurities, energy- and cost-intensive upstream and downstream processes are essential for product recovery. Thus, the aim of this CEN Workshop is to develop an evaluation procedure to assess whether PI measures are sustainably and economically meaningful against the conventional processes.

## 3.3 Related activities

The subject of the planned CWA is not at present the subject of a standard. However, there are committees, standards and/or other technical specifications that deal with related subjects and thus need to be taken into account - and involved, where necessary - during this Workshop:

**Standards**

- CWA 17484: 2020: Anaerobic digestion plants — Feasibility assessment methodology for integrating a Volatile Fatty Acid Platform Technology
- ISO/WD TS 14076: Eco-Technoeconomic Analyses: Principles, requirements and guidelines
- VDI 2776 (E), Blatt 2: Process engineering plants - Modular plants - Designing modular plants
- EN ISO 10991:2009: Micro process engineering
- VDI 4075, Blatt 1:2014-10 - Cleaner production (PIUS) - Basic principles and area of application
- VDI 6310 Blatt 1:2016-01 - Classification and quality criteria of biorefineries
- EN 16214-1+A1:2019-00 - Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 1: Terminology
- ISO 14067:2018: Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- EN ISO 14040:2006-07: Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006 + Amd 1:2020)
- EN ISO 14044:2006-10: Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006 + Amd 1:2017 + Amd 2:2020)
- EN ISO 14046:2016-07: Environmental management - Water footprint - Principles, requirements and guidelines (ISO 14046:2014)
- CEN/TS 16214-2 Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 2: Conformity assessment including chain of custody and mass balance
- EN 16214-3+A1 Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 3: Biodiversity and environmental aspects related to nature protection purposes
- EN 16214-4 Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis approach

**Technical committees**

- CEN/CLC/JTC 14 Energy management and energy efficiency in the framework of energy transition
- ISO/TC 207 Environmental management
- ISO/TC 322 Sustainable Finance

- CEN/TC 19 Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin
- CEN/TC 233 Biotechnology
- CEN/TC 383 Sustainably produced biomass for energy applications
- CEN/TC 335 Solid biofuels
- CEN/TC 411 Bio-based products
- CEN/WS KEY-BIOWASTE

# 4 Workshop programme

## 4.1 General

The kick-off meeting is planned to take place on 2023-10-05 online. A draft for public commenting will be published for 30 days.

A total of up to 6 Workshop meetings (kick-off meeting and Workshop meetings) and web conferences will be held, during which the content of the CWA(s) will be presented, discussed and approved.

The CWA will be drawn up in **English** (language of meetings, minutes, etc.). The CWA will be written in **English**.

## 4.2 Workshop schedule

**Table 1: Workshop schedule (preliminary)**

| CEN/CENELEC Workshop | M01 | M02 | M03 | M04 | M05 | M06 | M07 | M08 | M09 | M10 | M11 | M12 | … |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Initiation** | | | | | | | | | | | | | |
| 1. Proposal form submission and TC response | | | | | | | | | | | | | |
| 2. Project plan development | | | | | | | | | | | | | |
| 3. Open commenting period on draft project plan (mandatory) | | | | | | | | | | | | | |
| **Operation** | | | | | | | | | | | | | |
| 4. Kick-off meeting | | | | | | | | | | | | | |
| 5. CWA(s) development | | | | | | | | | | | | | |
| 6. Open commenting period on draft CWA(s) (optional) | | | | | | | | | | | | | |
| 7. CWA(s) finalised and approved by Workshop participants | | | | | | | | | | | | | |
| **Publication** | | | | | | | | | | | | | |
| 8. CWA(s) publication | | | | | | | | | | | | | |
| **Dissemination (see 7)** | | | | | | | | | | | | | |
| **Milestones** | | | K | V | | | V | | | V/A | | P D | |

**B** CEN/CENELEC BT meeting deciding on establishment of a CEN/CENELEC Workshop
**K** Kick-off
**M** Workshop meeting
**V** Virtual Workshop meeting
**A** Adoption of CWA
**P** Publication of CWA
**D** Online distribution of CWA

### 4.3 Work already delivered

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## 5 Resource planning

The CEN Workshop is financed by the European research project Biosprint (Biorefining of sugars via Process Intensification). This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 887226.

All costs related to the participation of interested parties in the Workshop's activities have to be borne by themselves. The copyright of the final CEN Workshop Agreement will be at CEN. The final document will include the following paragraph: "Results incorporated in this CEN Workshop Agreement received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement number 887226 (Biosprint)".

## 6 Workshop structure and rules of cooperation

### 6.1 Participation in the Workshop

The Workshop will be constituted during the course of the kick-off meeting. By approving this project plan, the interested parties declare their willingness to participate in the Workshop and will be formally named as Workshop participants, with the associated rights and duties. Participants at the kick-off meeting who do not approve the project plan are not given the status of a Workshop participant and are thus excluded from further decisions made during the kick-off meeting and from any other decisions regarding the Workshop.

As a rule, the request to participate in the Workshop is closed once it is constituted. The current Workshop participants shall decide whether any additional members will be accepted or not.

Any new participant in the Workshop at a later date is decided on by the participants making up the Workshop at that time. It is particularly important to consider these aspects:

a. expansion would be conducive to shortening the duration of the Workshop or to avoiding or averting an impending delay in the planned duration of the Workshop;
b. the expansion would not result in the Workshop taking longer to complete;
c. the new Workshop participant would not address any new or complementary issues beyond the scope defined and approved in the project plan;
d. the new Workshop participant would bring complementary expertise into the Workshop in order to incorporate the latest scientific findings and state-of-the-art knowledge;
e. the new Workshop participant would actively participate in the drafting of the manuscript by submitting concrete, not abstract, proposals and contributions;
f. the new Workshop participant would ensure wider application of the CWA.

All Workshop participants who voted for the publication of the CWA or its draft will be named as authors in the European Foreword, including the organisations which they represent. All Workshop participants who voted against the publication of the CWA, or who have abstained, will not be named in the European Foreword.

### 6.2 Workshop responsibilities

The Workshop Chair is responsible for content management and any decision-making and voting procedures. The Workshop Chair is supported by the Workshop Vice-Chair and the responsible Workshop secretariat, whereby the Workshop secretariat will always remain neutral regarding the content of the CWA(s). Furthermore, the Workshop secretariat shall ensure that CEN-CENELEC's rules of procedure, rules of presentation, and the principles governing the publication of CWA(s) have been observed. Should a Workshop Chair no longer be able to carry out her/his duties, the Workshop secretariat shall initiate the election of a new Workshop Chair. The list below covers the main tasks of the Workshop Chair. It is not intended to be exhaustive.

- Content related contact point for the Workshop
- Presides at Workshop meetings
- Ensures that the development of the CWA respects the principles and content of the adopted project plan
- Manages the consensus building process, decides when the Workshop participants have reached agreement on the final CWA, on the basis of the comments received

- Ensures due information exchange with the Workshop secretariat
- Represents the Workshop and its results to exterior

The Workshop secretariat, provided by a CEN/CENELEC national member, is responsible for organising and leading the kick-off meeting, in consultation with the Workshop proposer. Further Workshop meetings and/or web conferences shall be organised by the Workshop secretariat in consultation with the Workshop Chair. The list below covers the main tasks of the Workshop secretariat. It is not intended to be exhaustive.

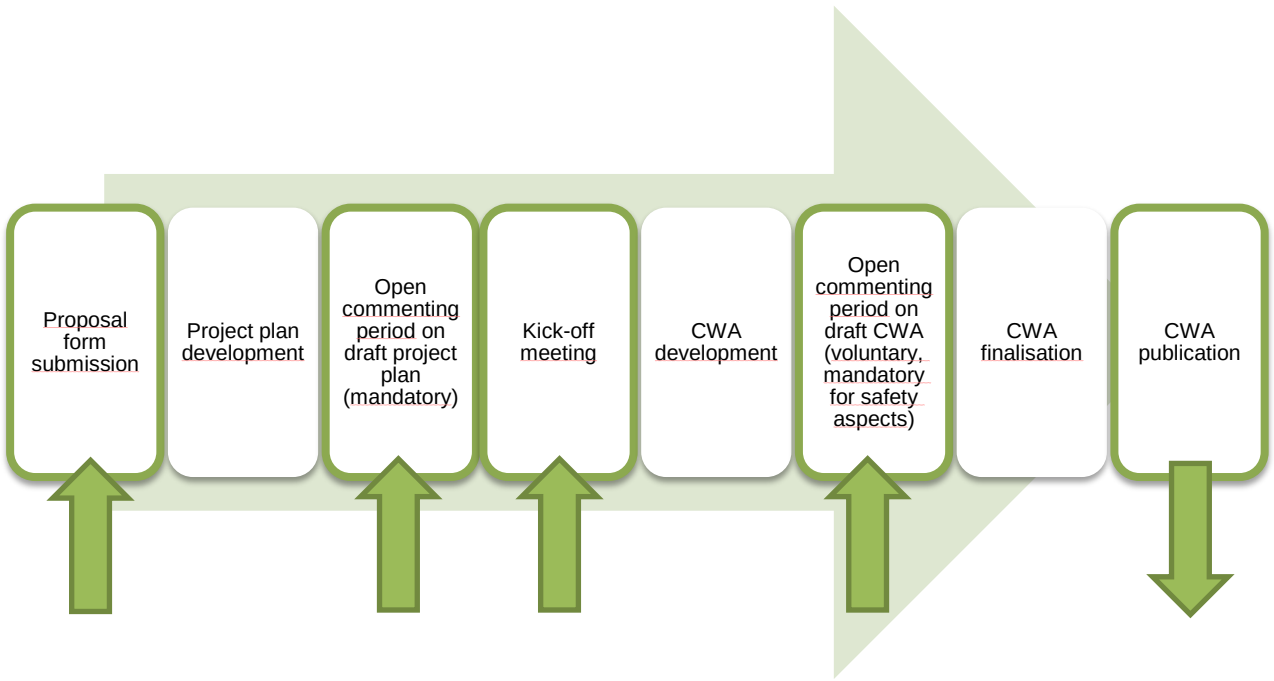
- Administrative and organisational contact point for the Workshop
- Ensures that the development of the CWA respects the principles and content of the adopted project plan and of the requirements of the CEN-CENELEC Guide 29
- Formally registers Workshop participants and maintains record of participating organisations and individuals
- Offers infrastructure and manage documents and their distribution through an electronic platform
- Prepares agenda and distribute information on meetings and meeting minutes as well as follow-up actions of the Workshop
- Initiates and manage CWA approval process upon decision by the Workshop Chair
- Interface with CEN-CENELEC Management Centre (CCMC) and Workshop Chair regarding strategic directions, problems arising, and external relationships
- Advises on CEN-CENELEC rules and bring any major problems encountered (if any) in the development of the CWA to the attention of CEN-CENELEC Management Centre (CCMC)
- Administrates the connection with relevant CEN or CENELEC/TCs

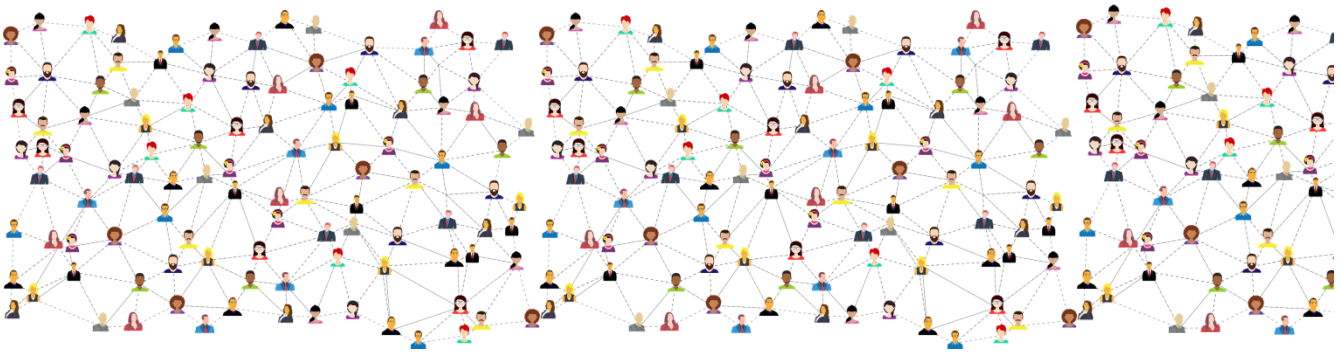
### 6.3 Decision making process

Each Workshop participant is entitled to vote and has one vote. If an organisation sends several experts to the Workshop, that organisation has only one vote, regardless of how many Workshop participants it sends. Transferring voting rights to other Workshop participants is not permitted. During voting procedures, decisions are passed by simple majority; abstentions do not count.

If Workshop participants cannot be present in the meetings when the CWA or its draft is adopted, an alternative means of including them in the voting procedure shall be used.

## 7 Dissemination and participation strategy





### Proposal form submission

The Workshop proposal will be disseminated to the following relevant stakeholders and bodies for consultation:

- standards committee, working group etc.
- publisher of technical rules
- others

### Open commenting period on draft project plan

The project plan will be disseminated to the following relevant stakeholders and bodies for commenting:

- standards committee, working group etc.
- publisher of technical rules
- others

In addition to the CCMC website, the project plan and the date of the kick-off meeting will be advertised on the project website to raise awareness. Interested parties are requested to contribute either through commenting of the project plan (short term) or through Workshop participation (long term).

### Open commenting period on draft CWA

The draft CWA will be disseminated to the following relevant stakeholders and bodies for commenting:

- standards committee, working group etc.
- publisher of technical rules
- others

In addition to the CCMC website, the draft CWA will be advertised on the project website to raise awareness. Interested parties are requested to contribute through commenting of the draft CWA (short term).

### CWA publication

The final CWA will be disseminated to the following relevant stakeholders and bodies:

- standards committee, working group etc.
- publisher of technical rules
- others

In addition to the CCMC website, the final CWA will be advertised on:

- social media, such as
  - LinkedIn
- EC Newsroom
- Others such as EC Newsroom

## 8 Contacts

- Workshop Chair:

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- Workshop proposer

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