

# Final report

## 1. Project details

<b>Project title</b>	IEA teknologinetwork -Task 39 Commercializing liquid biofuels og Task 42 Bio-refining in a future bioeconomy
<b>File no.</b>	64018-0598
<b>Name of the funding scheme</b>	EUDP
<b>Project managing company / institution</b>	Københavns Universitet
<b>CVR number</b> (central business register)	29979812
<b>Project partners</b>	Danmarks Tekniske Universitet
<b>Submission date</b>	17 May 2022

## 2. Summary

### 2.1 Executive summary:

This project covered participation in the International Energy Agency (IEA) technology networks named Commercialization of liquid biofuels (Task 39) and Biorefining in a future bioeconomy (Task 42).

The networks have global outreach and the purpose is to share ideas and knowledge on emerging technologies and infrastructures, providing an overview of regulation and environmental issues of relevance for the application of biofuel and biorefinery technologies and providing a common knowledge platform for industry, academia and government. Furthermore, the networks are important for the general work of the International energy Agency as they provide information for their techno-economic reports and analysis.

The Danish participants covers industry and academia and the activities normally include meetings, workshops, analytical reports and databases on technology facilities. However, in the past triennia the work have been substantially impeded by COVID-19 induced restrictions to meeting activities.

We have however, been actively collaborating in the tasks with focus on topics important for Danish biofuel and biorefinery technologies as they enable an international exposure of Danish knowledge and Danish industries.

## 2.2 Executive summary (dansk):

Projektet omhandlede deltagelse i teknologinetværk inden for biobrændstoffer (Task 39) og bioraffinaderier (Task 42) under det Internationale Energy Agentur (IEA). Netværkene har et globalt udsyn og deres formål er at dele ideer og viden om anvendelsen af teknologier til biobrændstoffer og bioraffinaderier, relateret infrastruktur, miljø og bæredygtighed samt national og international regulering og lovgivning inden for teknologiernes områder. Netværkene muliggør med en fælles kontakt- og formidlings-platform for industri, universiteter og myndigheder. En anden vigtig rolle for netværkene er at de bidrager med information og viden til IEA's teknisk-økonomiske analyser som er af stor betydning for energipolitik både nationalt og internationalt.

De danske deltagere dækker industri og universiteter og aktiviteterne inkluderer normalvis møder, workshops, analytiske rapporter og databaser over teknologi faciliteter. Dog er arbejdet i den seneste treårige periode blevet væsentligt hæmmet af COVID-19-inducerede restriktioner for mødeaktiviteter.

Vi har dog aktivt samarbejdet i opgaverne med fokus på emner, der er vigtige for dansk biobrændsel og bioraffinadertechnologier, da de muliggør en international eksponering af dansk viden og dansk industri.

## 3. Project objectives

The project objectives were to strengthen the Danish and international development of sustainable liquid biofuels and biorefineries, through international collaboration and knowledge exchange in the IEA bioenergy task 39 and 42. A quite extensive meeting activity with focus on documentation of recent advances, marked penetration, legislation, taxation, subsidy regimes, and especially novel biofuel/biorefinery breakthroughs is the key of these collaborations. The objective is to share knowledge within the tasks and thereby strengthen implementation of technologies across borders. Often the outcome of this work comes in the form of detailed reports authored by a subset of the task members. These reports are published by the IEA Bioenergy, and thus have a broad international audience. Furthermore, the reports are often presented at various national and international conferences and workshops further disseminating the findings.

Denmark has participated actively in both networks for a number of years and has, among other things, hosted several meetings in both Tasks 39 and 42, most recently for Task 39 in 2016. The work has been anchored at Danish universities, which have been responsible for coordination and contact with other Danish stakeholders. It can also be emphasized that in connection with a joint meeting between Task 39 and 42 in 2012, a major conference (Advanced Biofuels in a Biorefinery Approach) was arranged, with more than 220 participants from 28 countries. It was the purpose and ambition to continue this along the same lines, however due to the covid crisis this has not been possible. Other activities include the report Task 39 report Biofuels for the Marine Sector published in 2017 and prepared by the University of Copenhagen. The report has not only given a strong exposure to Danish knowledge, but has also helped to increase the contact between the biofuel sector and Danish companies such as Maersk and MAN. Therefore, contributions to similar reports have been a priority. The IEA reports are available to the public, they are of high quality and widely used among universities, industry and public authorities.

Both tasks include an ongoing collection of data in the field in close collaboration with stakeholders in the participating countries. Close contact between the national representatives and stakeholders covering both SMEs, larger companies, authorities, interest groups and universities is therefore key. Even though it has been significantly impeded due to the covid crisis.

### 3.1 Task 39

Task 39 is a network of 15-20 participating countries. The purpose of Task 39 is to provide participants as well as actors and public authorities in their countries with information that will support the development and use of biofuels in the transport sector. The tasks for the participants in Task 39 are to provide information and analyzes of political, market and implementation aspects, which will help to promote the commercialization of 2<sup>nd</sup> generation biofuels. In addition, work must help to stimulate continued research and development work towards a cost-effective production of 2<sup>nd</sup> generation biofuels, including bioethanol, drop-in fuels and biofuels for the marine sector. A special focus of our work in Task 39 were preparation of extensive report on the status of marine biofuels, as Denmark has a leading position within this field.

### 3.2 Task 42

The aim of Task 42 'Biorefining in a Circular Economy' is to facilitate the commercialisation and market deployment of environmentally sound, socially acceptable, and cost-competitive biorefinery systems and technologies, and to advise policy and industrial decision makers accordingly. Task 42 provides an international platform for collaboration and information exchange between industry, SMEs, GOs, NGOs, RTOs and universities concerning biorefinery research, development, demonstration and policy analysis. This includes the development of networks, dissemination of information, and provision of science-based technology analysis, as well as support and advice to policy makers, involvement of industry, and encouragement of membership by countries with a strong biorefinery infrastructure and appropriate policies. Gaps and barriers to deployment will be addressed to successfully promote sustainable biorefinery systems market implementation.

## 4. Project implementation

The project encountered two changes in project leader and corresponding change of hosting institute (from KU-IGN to KU-PLEN, and back to KU-IGN) which to a certain extent affected the workflow. Further, the covid crisis significantly hindered the work in the tasks. Most significantly, as the task meeting activities were reduced considerably. Consequentially, the knowledge sharing among task members were considerably reduced, which in turn have reduced the amount of relevant news to be shared with Danish stakeholders. Therefore, we have not seen a relevance in newsletters, and have instead shared news, publications, meeting invites, and presentations through online measures. A website have been established (in the beginning of the triennium), but we did not experience any traffic. Therefore we changed our focus to use professional social media platforms especially LinkedIn, and have seen good response. Further, we have other professional networks to communicate the activities when possible. Another secondary effect of the covid crisis is that a significant part of the budget have not been used, due to almost no travel activity.

A common business meeting for both task 39 and task 42 were planned to be held in Copenhagen in April of 2021, with a combination of normal task meetings, a common task 39 and task 42 meeting, and a meeting for Danish stakeholders. Due to the covid crisis, this meeting was first postponed and thereafter cancelled.

### 4.1 Task 39

Due to the covid crisis, the activities on the task was significantly reduced. Instead of having two 2-days meetings per year with additional conference attendances with ample time for networking activities and extended presentations, we only had two 2-hour meetings, with a few follow-up meetings on specific topics (with one

normal physical meeting just before the pandemic). The consequence have been clear. A lot less communication on broader topics, and therefore also significantly reduced dissemination to Danish stakeholders. Furthermore, the one-day conference for Danish stakeholders, which were planned to be co-organised with a Task meeting in Copenhagen were cancelled. As a substitute, we have tried to organise a common Nordic meeting with our Norwegian and Swedish task 39-colleagues, which for now have been postponed.

On the positive side, we used a great amount of time and effort to coordinate, author and edit an extensive report on marine biofuels, entitled "*Progress towards biofuels for marine shipping - Status and identification of barriers for utilization of advanced biofuels in the marine sector*". This report uncovered the largest barriers for the commercialization of biofuels for the marine sector, with the underlying prospect that identification of the current barriers will excel concrete actions from various stakeholders advancing the employment of sustainable biofuels in the maritime sector. The report have been well received, and we have/and will in the future present the work at different conferences and workshops. These presentations have mostly been online, and therefore we have been able to invite broadly, including Danish stakeholders. E.g. more than 800 participants signed up for the presentation of the report given at the IEA Biofuels end-of-triennium symposium, and we have experienced good feedback also from Danish stakeholders. When we, as Danish Task members were chosen by the Task/task leadership to head the work on the Marine biofuels report, it is founded in the fact that Denmark has large historical and present interest in the Marine sector. Also, among the most progressive companies in de-carbonising the marine sector we see Danish stakeholders. First and foremost Mærsk. Thereby, we have represented Danish interests by producing this report. As we see the report aim (identifying barriers for marine biofuel exploitation), as the first step of overcoming these barriers. E.g. by educating decision makers.

We have also completed the triannual country report, giving the status of liquid biofuels in Denmark, including a walk-through of the most innovative Danish companies within the area. This report was also presented at a task meeting. Furthermore, we have added to the "implementation agenda report" published by the Task 39. Also in this report Danish advances within the sector were described. Also, the international database of biofuel demonstration plants and "first-of-a-kind" plants have been updated, so that all Danish activities are covered. Lastly, we have engaged in discussion and corrections of all reports published by the task, where we have had Danish interest in mind.

## 4.2 Task 42

Similar to what happened in Task 39, the activities of the Task 42 were also significantly reduced due to the covid crisis. All physical meetings were replaced by online meetings. This has also affected the Task 39+42 meeting planned to take place in Copenhagen in April 2021, which was cancelled. As a consequence, there was a reduced dissemination to Danish stakeholders.

On the other hand, this time has been used to prepare a Denmark country report, which covered topics such as the current status and expected evolution of total primary energy supply and contribution bioenergy in Denmark; Biomass use for non-energetic purposes; Bioenergy policies and status of implementation; Research focus related to bioenergy & biorefining; Biorefining related funding; Commercial biorefineries; Regional initiatives; Demo and Pilot plants; Major innovation activities and Major stakeholders. This report was presented at a task meeting and was also published in the IEA Task 42 webpage (<https://task42.ieabioenergy.com/publications/>). Efforts were also done to prepare a new proposal to continue the Task 42 activities during the next triennium 2022-2024. After contacting the national ExCo Members, Denmark committed to continue participating in Task 42 during the next triennium, with an active R&D contribution especially in the area of Green biorefineries. Finally, we have contributed to other publications on biorefineries prepared by Task 42 members.

## 5. Project results

The Corona situation significantly influenced the execution of the project, and the project only succeeded fully in parts of its aim and purpose. The project has resulted in international networking, publications, organisation and contribution to (online) conferences and workshops. The project ended up not prioritising newsletters, as there amount of relevant information from task were reduced considerably (covid crisis), instead news reports etc. were shared to Danish stakeholders through physical and online professional network (to a large extent LinkedIn). We are very happy with our involvement in the Report on marine biofuels, as well as our large dissemination effort of the same work.

### 5.1 Publications and presentations

Simonsen T. I., Weiss N. D., van Dyk S., van Thuijl E., Thomsen S. T. Edited by Thomsen S. T., 2021, Progress towards biofuels for marine shipping - Status and identification of barriers for utilization of advanced biofuels in the marine sector. <https://www.ieabioenergy.com/blog/publications/progress-towards-biofuels-for-marine-shipping/>

Contribution to: Ebadian M., Saddler J., McMillan J.D., Implementation Agendas: Compare-and-Contrast Transport Biofuels Policies (2019-2021 Update), 2022, <https://task39.sites.olt.ubc.ca/files/2022/02/Final-Draft-Task-39-Implementation-Agendas-Report-2019-2021-Update.pdf>

Contribution to IEA Bioenergy Task 39 Newsletter Issue 53: Biofuels Production and Consumption in Denmark: Status, Advances and Challenges, <https://task39.sites.olt.ubc.ca/files/2019/12/IEA-Bioenergy-Task-39-Newsletter-Issue-53-1.pdf>

Presentation at the IEA Bioenergy triannual online conference 2021, 29 November - 9 December 2021, at the session: Emerging biofuels markets and the importance of LCA and certification, Thomsen S. T., [https://www.ieabioenergyconference2021.org/agenda\\_session/lca-policy-and-certification-related-to-renewable-and-low-carbon-transport-fuels/](https://www.ieabioenergyconference2021.org/agenda_session/lca-policy-and-certification-related-to-renewable-and-low-carbon-transport-fuels/) (online event free for all attendees including Danish stakeholders)

Presentation at Bio4Fuels Workshop: Biofuels for Marine Shipping, organised by Norwegian University of life sciences, 7 April 2022, <https://www.nmbu.no/en/services/centers/bio4fuels/events/node/44950> (online event free for all attendees including Danish stakeholders)

Updating the Danish section on "Database on facilities for the production of advanced liquid and gaseous biofuels for transport", <https://demoplants.best-research.eu/>

Denmark Country Report status July 2021. IEA Bioenergy Task 42. <https://task42.ieabioenergy.com/publications/denmark-country-report-status-july-2021/>

## 6. Utilisation of project results

Even though the collaboration in the Task were significantly impeded by the covid crisis and especially collaboration and knowledge sharing were difficult, there were still a production of publications from Tasks 39 and 42 that lived up to the expectations. Both Tasks have during the last triennia published a ranged of reports that add considerable to state of the art, public opinion, and knowledge within stakeholders and decision makers.

From a Danish perspective, Task 39 has especially worked within the topics of marine fuels, fuels based on agricultural residues, and on clear sustainability parameters/criteria, as these are some of the key aspects Danish stakeholders request; while Task 42 has worked within topics of biorefineries, with especial focus on green biorefineries, and protein recovery. Accordingly, it is beneficial that Denmark participate in and contribute to the global network of IEA Bioenergy from an educational, an industrial, a scientific, as well as a political viewpoint.

## 7. Project conclusion and perspective

This participation in the IEA Bioenergy Tasks, and thereby also this project, does not lead to tangible conclusions. However, participation in task 39 has:

- A much needed report on Marine biofuels, an area where Danish stakeholders such as Mærsk are front-runners internationally.
- Strengthened scientific collaboration between University of Copenhagen and international universities and research institutions.
- An international focus on Danish companies and R&D efforts through chapters in the Task Newsletter and the implementation report (as well as in presentations).
- Resulted in access to a number of publications, conferences and insights relevant to the Danish bioenergy sector either directly from task activities or indirectly through contacts, data or network facilitated through task participation.
- Disseminated information directly to the Danish bioenergy sector and stakeholders through social media platforms.

While participation in task 42 has led to:

- Increased access to information, publications and data relevant to the Danish biorefinery sector.
- Facilitated new contacts and network, and strengthened scientific collaboration between the Technical University of Denmark and international universities and research institutions.
- Disseminated information to the Danish biorefinery sector and stakeholders through social media platforms.
- Better positioning of the Danish efforts in the international IEA networks.