Technology Collaboration Programme
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Bioenergy News

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IEA Bioenergy
Technology Collaboration Programme

CONTENTS

Contribution of sustainable biomass and bioenergy in industry transitions towards a circular economy

Executive summary from the IEA Bioenergy eWorkshop, 19-20 October 2020

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The IEA Technology Collaboration Programme on Bioenergy (IEA Bioenergy) held its biannual workshop on 19-20 October 2020 in conjunction with its Executive Committee meeting (ExCo86). The workshop was originally scheduled to be in Lyon (France), but due to COVID-19 restrictions it was held in virtual form. The workshop on 'Contribution of sustainable biomass and bioenergy in industry transitions towards a circular economy' was prepared in close collaboration with ADEME, the French Agency for the Ecological Transition.

The workshop consisted of three separate two-hour sessions around the role of biomass in different sectors/applications:

1. Medium and high temperature heat in industry
2. Energy intensive industries – steel and cement sectors
3. Chemical industries

Each session was concluded with a short panel discussion on challenges for such industry transitions and what is needed in terms of policies and market conditions to increase the role of biomass in these sectors. The workshop sessions each had between 200 and 250 participants.

Important role of biomass in reducing the climate impact of industries

According to IEA's Sustainable Development Scenario (up to 2070), about one third of global CO2 emission reductions, relative to baseline trends, will need to come from industry. Broadly speaking, options to reduce the climate impact of industries are efficiency measures, carbon capture and utilisation/storage (CCUS), electrification, hydrogen and the use of biomass. The share of bioenergy in industry is expected to double in the coming decades up to 15% of its final energy consumption.

About half of global industry CO2 emissions are currently in China. China aims to reach carbon neutrality by 2060. Clean energy, including bioenergy, will play an increasing role in China's efforts to reduce greenhouse gas emissions. There is considerable opportunity to expand the use of biomass in China. Opportunities to combine bioenergy with CCUS will also be explored.

Biomass for medium and high temperature process heat

So far, the application of bioenergy in industry is mainly performed in industries that can use their own biomass process residues to cover (some of) their own heat demand. Anaerobic digestion of process residues in food industries is an interesting way to replace natural gas consumption, although current uses of these process residues (e.g. as animal feed) are to be considered, as well as the management and distribution of digestate as a co-product of anaerobic digestion. With the increasing motivation in industry to reduce their carbon footprint, several other industry sectors are also shifting towards biomass based heat generation in cases where there are suitable biomass resources and technologies available nearby. Several fuel technology combinations are commercially available for producing biobased heat in industry, and there are many successful examples of biobased industrial heat. The heat demand in small and medium sized industries can often be better matched with the biomass resources that may be locally available. The optimal combination is very site specific and needs to be carefully assessed.

Biomass projects are usually not considered as 'payback projects', but are part of the general management strategy of companies to move towards net zero carbon emissions.

Biomass in energy intensive industries

Cement and steel industries represent more than 50% of global direct CO2 emissions in industry. It is important to remember that CO2 emissions in these industries are not only generated through fuel combustion, but are also linked to the industrial process itself, e.g. iron ore reduction in steel industries or limestone calcination in cement industries.

Steelmaking is a highly carbon-intensive process due to its extensive use of coal as both

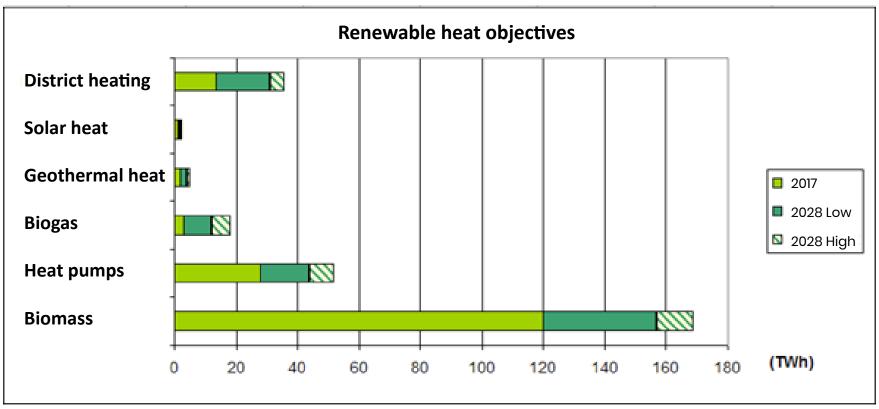


Figure 1: Renewable heat objectives in France (source: ADEME)

an energy source and a reductant. Around 20% of pulverized coal injection (PCI) could be replaced with biocoal (from slow pyrolysis) in blast furnaces with existing technologies. Lignin could also have great potential to reduce coal consumption. The economy of biocarbon usage as a PCI substitute is becoming a viable option with rising CO2 emission trading costs. There are also opportunities to convert blast furnace gas (containing CO and CO2) into low carbon fuels or chemicals.

The cement sector already uses different types of substitution fuels (particularly waste) for its energy needs, some of which can contain a certain fraction of biogenic carbon. The sector will need to move beyond traditional waste in terms of substitution fuels, as most waste fuels still contain a high fraction of fossil carbon. Moreover, energy related emissions represent only one third of the emissions from the cement industry; two third is related to the limestone calcination process. CCUS will be a crucial technology to reduce the climate impact of this sector.

Biomass in chemical industries

From an industrial point of view, biomass has complex characteristics, in terms of cost, availability, variability and specificity. At the moment fossil resources are more managed in synergy through refining processes, while the concept of biorefining is less developed for biobased resources. More inter-sector integration and clustering will be needed for biobased industries. Next to techno-economics, new business models using biobased resources also need to include sustainability requirements on feedstock sourcing. The required scale of specific biobased chemicals production can be in balance with local biomass availability; for larger initiatives trading of sustainable biomass will be required. There are interesting developments of forest based industries to broaden their production to biofuels and biobased chemicals, as they have long experience in sustainable biomass feedstock supply. Other chemical industries have less experience in dealing with biomass sourcing. New biobased industries often rely on input of hydrogen and there are important initiatives towards green hydrogen, which also further improve the carbon footprint of these biobased products.

Overall challenges and needs in terms of policies and market conditions

The main challenge to increase the role of biomass in industry sectors is the cost difference between biobased energy / products and fossil based energy / products (if carbon cost is not accounted for), particularly in these times when fossil prices are at record low levels. Cost competitiveness of industries is key and they often operate in international markets. So putting high requirements on local industry can lead to carbon leakage if (part of) production is shifted abroad. Overall, a meaningful and global CO2 price for fossil resources would be needed. In the absence of a global carbon price regime, other policy options need to be implemented, such

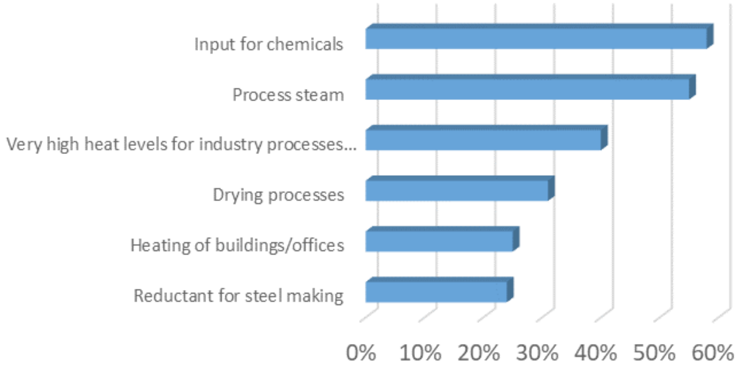


Figure 2: Result of audience poll on most promising applications of biomass in industry (based on SLIDO poll, multiple selections possible – 113 participants answered)

as public procurement of products with low life cycle emissions; carbon border tax adjustment or carbon contracts for difference. According to different stages of development (also for biobased products), support for research, development and demonstration projects and de-risking measures for pre-commercial investments would be required. It is also important to recognize and reward additional environmental services (not only renewable energy), e.g. reduction of waste, avoidance of methane emissions, etc. Overall, stable policies are important, as well as the removal of hindering regulations for certain biobased applications (e.g. restrictions for transport and processing of biobased waste).

Availability and access to biomass are crucial to increase the role of biomass in industry transitions. If industries can't rely on their own process residues, this requires mobilizing biobased resources – also taking into account potential other uses – and setting up sustainable biomass supply chains. Medium scale industries can often match their biomass demand to regionally available biomass. Energy intensive industries need to look more widely for their feedstock sourcing and consider combinations with other solutions (e.g. electrification, hydrogen, CCUS) to further reduce their carbon footprint. There may be a willingness of consumers to pay a premium for green, biobased products. This will need to be based on strong and credible green labels (LCA based). Brand owners can also create a market pull, by requiring inputs with low carbon footprint to reduce their own carbon footprint.

The PowerPoint presentations can be downloaded from IEA Bioenergy's website here

Figure 3: Process steam generation from wood chips and composting residues for potato processing in the Netherlands (source: Attero)

IEA Bioenergy
Technology Collaboration Programme

From the Secretariat

Pearse Buckley
ExCo Secretary

ExCo86, Virtual Meeting

The IEA Bioenergy ExCo86 meeting had been planned to be held in Lyon, France on 20 - 22 October 2020. However, due to the ongoing disruption to travel and in-person gatherings caused by Covid-19, the Executive Committee approved a virtual meeting in lieu of an in-person meeting. ExCo86 was held as a Virtual Meeting in three separate sessions with Jim Spaeth as Chair, Paul Bennett as Vice-chair andPearse Buckley as Secretary.

Changes to Executive Committee

A new Member for Canada was Mr Oshada Mendis: a new Alternate Member for India was Shri Sushil T. Williams: a new Member for South Africa was Mr David Mahuma.

Progress with current Initiatives

Task 41 Project 10: The contribution of Advanced Renewable Transport Fuels to transport decarbonisation in 2030 and beyond
The report has been published here, and a webinar was held on 17 November 2020, which can be viewed here. The main message, which is reflected in all countries investigated, is that a set of different measures are required, including reduced transport demand and improved vehicle efficiency, and that biofuels are a significant contributor.

Inter-Task project – The role of bioenergy in a WB2/SDG world
A first report 'Roles of bioenergy in energy system pathways towards a well below 2° Celsius (WB2) world' has been published and is available here. Key messages included the near and long term complementarity of bioenergy in an energy system that varied in both space and time, the dependence of near-term progress on the transition from fossil fuels and the positive contribution of bioenergy to sustainable land use. Despite the impact of Covid-19, the project is expected to be completed on time in the 4th quarter of 2021.

Inter-Task project – Bioenergy for high temperature heat in industry
Four case studies have been completed and are available here. These include low grade biomass producing steam in a potato processing industry, gasification of paper rejects to displace natural gas, fast pyrolysis bio-oil providing process steam in a dairy and a waste-to-energy plant providing steam in a paper mill. Many technology combinations are available and further potential exists in process industries using steam. The policy report will include an overview of the potential. The project will be completed in September 2021.

Inter-Task project – Renewable Gas-deployment, markets and sustainable trade
Following an initial delay, in part due to Covid-19, the project is now up and running. It will look at the status of renewable gas and will include non-biological renewable technologies. The project will also look at sustainable trade potential, including aspects such as gas pipelines and green liquid natural gas. It is expected that the work will have progressed to be in a position to make a contribution to the EUBCE Conference in April 2021.

Task 41 Project 11 – Renewable Gas- Hydrogen in the grid
This project is linked to the Inter-Task project on Renewable Gas-deployment, markets and sustainable trade. The budgets and timeline have been agreed, the latter being adjusted due to the impact of Covid-19. Literature input is continuing. The project will compile data on strategies for greening the grid with hydrogen in selected countries, including within the European Union, Germany, Denmark, The Netherlands, Sweden, Australia, Japan and the United States. Due to unavoidable delays the project would not be completed until the end of May 2021.

Inter-Task project– BECCUS
Prior to ExCo86 the ExCo approved an Inter-Task project on BECCUS by written procedure. This project will complement an ongoing collaborative project on BECCUS with four additional case studies: BECCUS in cement production; BECCUS in bioethanol production; Biopower flexibility and CO2 removal; and Carbon accounting in BECCUS supply chains. The case studies will be carried out in quarter 1 to quarter 3 of 2021, the project being completed in quarter 4 of 2021 with a synthesis report.

Inter-Task project– Lessons Learned - Biofuels
This Inter-Task project on 'Lessons Learned – Biofuels' was approved by ExCo prior to ExCo86 by written procedure. The project will evaluate the reasons for the past and ongoing boom and bust cycles of biofuel technologies development, demonstration and deployment. It aims to answer two main questions: what is required to re-stimulate vigorous biofuels development and scale-up? what are the key factors for the success of sustainable advanced biofuel projects. The project will be completed in November 2021.

Communication Strategy

The Communications Team has continued with regular online meetings to oversee communications' activities. A new TCP logo and visual identity was launched on 20 May 2020 and has been incorporated into the TCP website and publications. Three IEA Bioenergy webinars have been presented since ExCo85 and these can be viewed along with all previous webinars here. Because of the success of the webinar series and the number of reports that are being produced, consideration is being given to increasing the frequency of the webinars. Report launches have been accompanied by social media campaigns, with postings on Twitter and LinkedIn and, on occasion, with a press release.

Collaboration with other International Organizations

Collaboration with the IEA, other IEA TCPs and International Organisations has continued. There is ongoing collaboration with the Advanced Motor Fuels (AMF) TCP, particularly through Task 39. Collaboration with the Global Bioenergy Partnership (GBEP) is continuing through Task 39, but also through Tasks 40 and 45. With the International Renewable Energy Agency (IRENA), IEA Bioenergy is looking at a number of areas where deeper engagement can be developed. Collaboration with the Biofuture Platform, particularly in the context of the Clean Energy Ministerial (CEM) is continuing and opportunities are being explored with Mission Innovation (MI).

New Chair for IEA Bioenergy in 2021

AT ExCo86 Paul Bennett from SCION in New Zealand was elected as the Chair of IEA Bioenergy for 2021.

Further information:

IEA bioenergy.com

Task Focus:

IEA Bioenergy Task 44 - Flexible Bioenergy and System Integration

The global energy system is currently in transition, driven by reductions in the generation costs of wind and solar energy, and political efforts to shift into a low-carbon society by cutting greenhouse gas (GHG) emissions. The past decade saw drastic cuts both in the cost of wind (~70%) and in photovoltaics (~90%). As a result, the cost of wind and solar power has already reached the cost of conventional power and heat generation options in many locations globally (Lazard, 2019). As the trend is likely to continue, this will eventually lead to high shares of wind and solar power in the energy system.

The availability of wind and solar varies depending on weather conditions and the time of day, and therefore they are often categorised as variable renewable energy (VRE) sources. They are also controllable only to a certain degree, and therefore high shares of VRE in the power market can lead to frequent start-ups and faster ramps for existing thermal power generators that were not originally designed for flexible operation. High VRE penetration also quickly erodes the capacity factors of baseload units, and renders these capital-intensive plants unprofitable and/or unusable. In addition, oversupply from both pre-existing capacity and VRE additions tends to depress wholesale market prices, as can be currently observed in a number of power markets. Low prices can trigger the retirement of pre-existing generation capacity and thus raise the important question of how to maintain the stability and reliability of the future energy system.

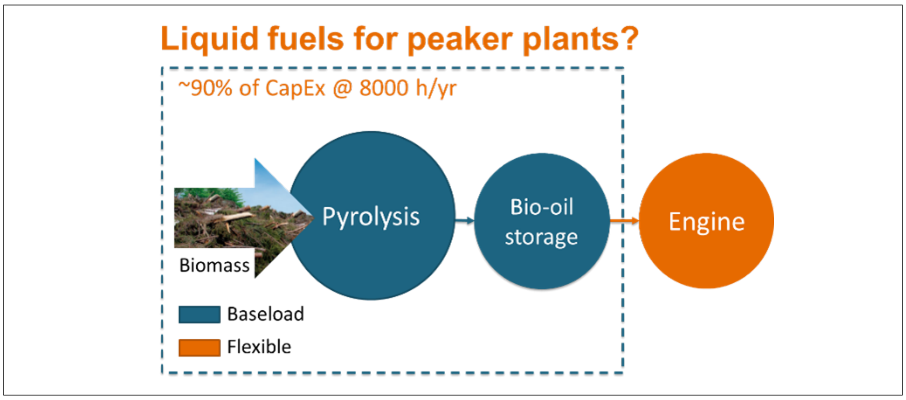
The share of VRE is expected to grow in many countries over the world, contributing to an increased variability of the energy system. Variability itself is nothing new in energy generation and all power systems have to cope with a certain degree of variability. However, as the share of VRE continues to grow, it will eventually raise important questions like how to guarantee an uninterrupted supply of electricity in a system dominated by wind and solar?; how to control long-term imbalances in supply and demand?; and how to seamlessly integrate wind and solar into a future non-fossil energy system?

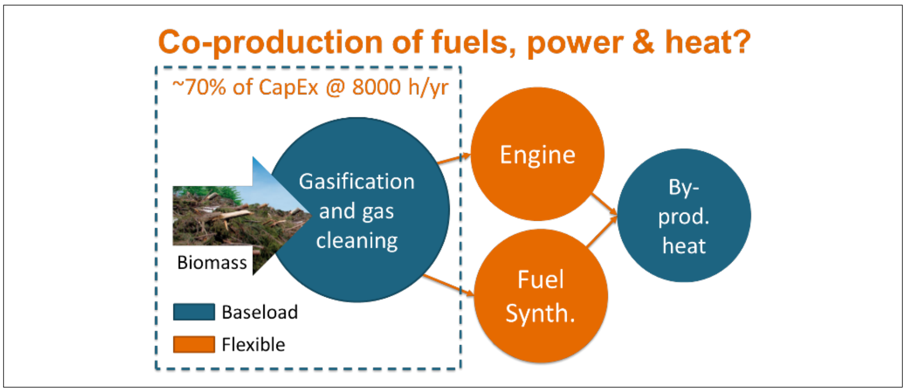
The IEA proposes flexibility as a remedy (IEA, 2018). As the share of VRE is rapidly increasing, security of electricity supply can be guaranteed through market reforms, grid investments and increased flexibility. Indeed, flexibility has quickly become a hot topic in the energy sector where the attention has focussed heavily on energy storage. On a global level, the majority of flexibility is provided via natural gas (29%), hydro (28%) and coal (23%). In the WEO2018 New Policies –scenario, power plants will remain as the corner stones of flexibility, although the role of transfer connections increases to 11%, batteries to 4% and demand response to 3%.

A large increase in wind power capacity is likely to disrupt the role of thermal capacity in the Nordic countries (Arasto et al., 2017). According to VTT calculations, the share of baseload generation in the Nordic system is 30 GWe before significant introduction of wind power; but as the share of wind power increases to 50% of annual energy supply, the need for baseload capacity is completely eroded (see Figure 3). At the same time, the need for capacity running between 4500 and 8000 full load hours (FLHs) increases to 20 gigawatts, need for capacity running 1000-4500 FLHs increases to 15 GWe and even another 15 GWe of capacity that runs less than 1000 FLHs is required. When we also consider the Nordic countries' ambitious decarbonisation goals, it is clear that this capacity cannot be based on thermal plants runFFining on fossil fuels.

The role of bioenergy in the integration of wind and solar has been discussed surprisingly little, given that bioenergy's contribution to renewable primary energy supply remains at a very significant 70% and even in renewable power generation it commands a 25% share. However, if biomass power plants are going to play a strong role also in the future, they need to become more flexible. In the short and medium term, this means faster start-ups and lower minimum loads, so that losses during times of low electricity price can be minimised. In addition to thermal plants, biogas systems can offer short-term flexibility via adaption of feeding systems, gas storage and power generation capacities (Thrän et al 2015).

In the longer term, economic challenges can become the main bottleneck for flexible bioenergy. The diminishing full load hours are going to disrupt the operational logic behind traditional power boilers. The challenge is to develop





Figures 1-2: Possible future bioenergy concepts for the provision of flexibility in an energy system dominated by generation from wind and solar. On the upper figure a pyrolysis plant that produces bio-oil as a back-up fuel for a fast-response power plant. On the bottom figure, a gasification plant flexibly producing either biofuels or electricity based on their relative value at any given time.

attractive business cases for new power plant-shaving annual FLHs between 1000 and 4500 hours. One answer could be provided by flexible biorefinery concepts, where intermittent electricity generation is combined with baseload production of biofuels. Possible examples of such concepts could be the production of pyrolysis oil for fast-response energy power plants, or flexible polygeneration of biofuels and electricity in biomass gasification plants. But also upgrading biogas to biomethane, which can be fed into the natural gas grid for eventual use in gas engines or turbines to provide low-GHG flexibility.

Such flexible bioenergy concepts could respond quickly to increasing electricity prices (supply deficit) and help to maintain security of electricity supply without the need to resort to fossil fuels. When the value of electricity temporarily decreases, electricity generation is put on hold, but plants continue to operate co-producing biofuels and heat. In this way, base load operation could be ensured for the majority of the investment.

The type of concepts discussed above, are just a couple of examples of the many ways bioenergy could be used to help integrated wind and solar. At Task 44, we are currently – in collaboration with many other IEA Bioenergy tasks – collecting and summarising information about different existing and novel bioenergy concepts that could contribute to increasing energy system flexibility without the use of fossil fuels. We do not only give insights in to best practice examples, but also consider a wide range of flexibility options in different levels of technical maturity, including short term flexibility by covering demand peaks with flexible plant operation and polygeneration, but also by integrating VRE into energy systems, when they cannot be used at the time or at the place of production. This also covers processes that can utilize electrolytic hydrogen in a flexible way. Finally, the conversion of biomass into chemical energy carriers, such as biomethane, methanol or many other hydrocarbons, pellets etc. can provide long-term flexibility, as they can be stored (even seasonally), transported or distributed using existing infrastructure and used in many types of energy conversion plants.

In addition to developing technological solutions, our task is also actively assessing the current status and role of bioenergy flexibility in a number of countries. Due to different biomass resource potentials, different policy targets for the energy transition and different energy infrastructures as well, our intermediate results show that those different frame conditions will also affect the priorisation of the different flexible bioenergy systems – from small scale biogas plants and biomass CHP systems for district heating to large scale biomass power plants and biorefineries. When this work is finalised, the results will hopefully contribute to a clearer picture on how bioenergy can continue to support the integration of wind and solar to the energy system.

This article was prepared by Ilkka Hannula and Daniela Thrän of Task 44.
For more information please visit

task44.ieabioenergy.com

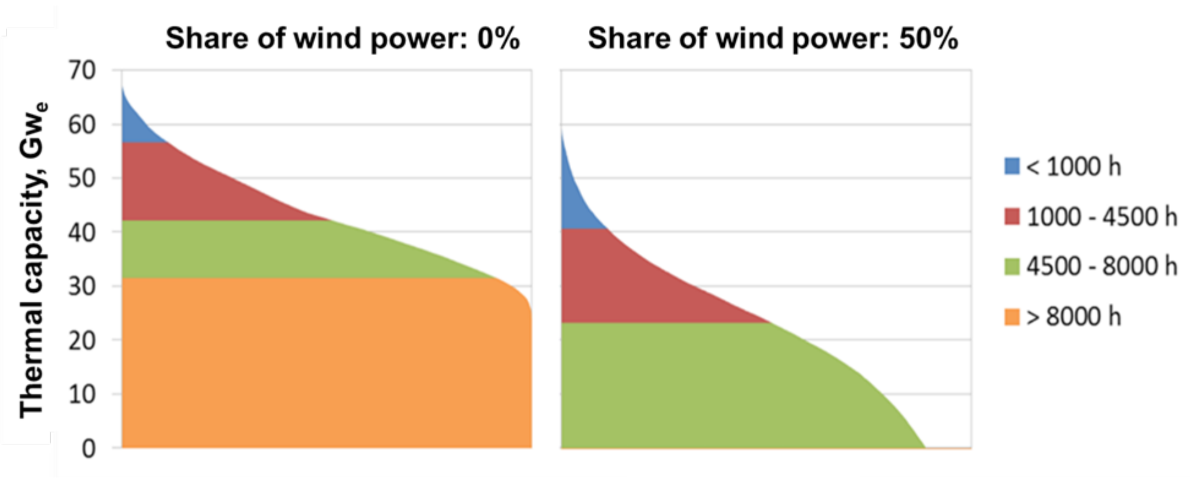


Figure 3: Full load hours of thermal generation capacity in the Nordic countries for two different shares of wind power (figure by J. Kiviluoma, VTT)

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Notice board

Task 33 Gasification of Biomass and Waste

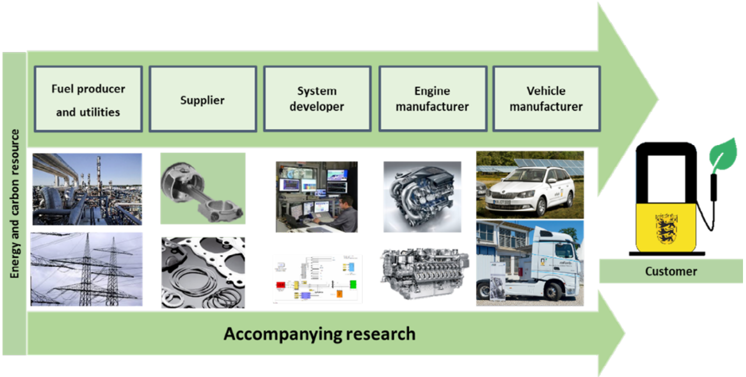
reFuels – Rethinking Fuels

In addition to measures such as the expansion of electric mobility, the use of regeneratively produced fuels is a promising contribution to CO2-neutral mobility. Particularly, shipping, air, and long distance transportation of heavy loads, will continue to require liquid fuels in the future. Renewable hydrocarbon fuels can be produced from various carbon sources from agriculture and forestry (Biomass-to-Liquid - BtL) as well as from CO2 and hydrogen produced by electrical energy from renewable sources (Power-to-Liquid - PtL). Also, the combination of both is possible to make full use of the biogenic carbon.

In the application oriented initiative "reFuels – Rethinking Fuels", seven KIT institutes are working on the efficient production, use, and evaluation of regenerative fuels in cooperation withthe federal State of Baden-Württemberg and 22 partnersfrom the automotive, automotive supply, and mineral oil industries. The aim is to enable vehicles – including the existing fleet – to run with regenerative fuels already in the short term.

The project is based on a synthesis gas platform available at KIT: The bioliq® pilot plant, in which biogenic resources are used to produce gasoline via fast pyrolysis, entrained flow gasification, and methanol/DME synthesis. The Energy Lab 2.0 is a unique plant network that combines state-of-the-art technologies for the production, storage and use of electrical, thermal, and chemical energy, including the production of chemical energy carriers by water electrolysis for hydrogen production, carbon dioxide capture, power-to-methane, and Fischer-Tropsch synthesis.

EnergyLab2.0 Source: Gabi Zachmann, KIT



Consortium structure of refuels

bioliq® synthesis plant

For the refuels project, 2 tonnes each of renewable gasoline and diesel are produced, which are blended to a fuel mix with conventional fuels to achieve a significant share of avoided fossil CO2 emissions in the short term. In the longer term, these fuels should also meet the existing standards as stand-alone fuels. First application in a small vehicle fleet and test engines showed that the emissions of the fuel blends mostly meet the regulations; differences need to be understood and are being investigated in more detail. For gasoline production, the bioliq HP Entrained Flow Gasifier provided ~500h of syngas supply in 4 campaigns of the synthesis plant in 2019 and 2020. A first batch of 800 L fuel distillate from bioliqmethanol/DME-to-gasoline process was blended to 30% gasoline standard fuels by Haltermann-Carless company, and is currently being tested on test engines and cars by KIT and three partners from the automotive industry for evaluation of emissions and performance. The results will be considered to formulate an optimized second batch of 800 L at the beginning of 2021. The heavy fraction from gasoline distillation is rich in aromatic components demanding hydrotreatment in case of fuel applications. Tests have been carried out at lab scale for catalyst screening and suitable process conditions. At the pilot installations of Verfahrenstechnik Schwedt larger amounts in the order of 100 L were hydrotreated to provide sufficient fuel for testing.

Available and still developed technologies are combined in scenarios, which are evaluated in terms of production costs including carbon sourcing and integration into Germany´s energy system.

As a case study, a conceptual design of a 50,000 t/a demo plant was developed by EDL Company for diesel fuel production to be realized for a PtL-plant at a refinery site (MiRO). CO2 recovered from the refinery´s FCC unit is converted with H2 from 100 MW PEM electrolysis via pathways of different TRL (methanisation + dry gas reforming, RWGS, Co-SOEC). While the diesel fraction is intended for direct fuel blending, the other liquid hydrocarbon products are further processed in the refinery. Between the high TRL methanisation + dry gas reforming concept and the lower TRL Co-SOEC the energetic efficiency differs by approximately 10 percentage points. The results of the scenario and life cycle assessments on fuel production and use are currently being discussed with representatives of civil society, such as trade unions, employers, consumer and environmental associations to develop narratives for further development of framework conditions and opportunities for a successful implementation of reFuels.

http://www.refuels.de/english/index.php

Charcoal as carbon sink

SYNCRAFT's climate positive power plant can be seen as a man-made reproduction of the natural CO2-cycle. https://en.syncraft.at/

In a SYNCRAFT wood power plant, electricity and heat are generated in addition to the charcoal. Instead of the entire carbon dioxide, as in a climate neutral power plant, only two thirds of the greenhouse gas are released back into the atmosphere. One third remains in the charcoal and is thus removed from the air for the long term. The premium charcoal from the power plant can be used in many different ways: In the animal feed or cosmetics industry, as an alternative to fossil coal or groundwater-polluting fertilizers or as a component in "green" asphalt and much more.

Therefore, the EBI European Biochar Industry Consortium e.V. is involved in supporting the development of biochar applications and promoting their long-term success. http://www.biochar-industry.com/

Task 34 Direct Thermochemical Liquefaction

Direct Thermochemical Liquefaction (DTL) is using heat to break down the polymers in solid biomass to form a liquid that can be used as an energy carrier or chemical feedstock. IEA Bioenergy Task 34 focusses on the technologies around this principle and published a short brochure to explain the background, structure different approaches, provide a state of the art overview, and characterize products/ applications. This brochure is accessible following this link: https://task34.ieabioenergy.com/dtl-brochure/

The increasing uptake of fast pyrolysis and HTL technology in the bioenergy market is summarized in a new report from Task 34 'Direct Thermochemical Liquefaction' showcasing 20 industrial DTL projects for biofuel production of today. This report is accessible following this link: https://task34.ieabioenergy.com/dtl-commercialization-report/

Task 36 Material and Energy Valorisation of Waste in a Circular Economy

Since the new triennium started in May 2019, Task 36 has organized 5 workshops/ webinars, 3 of them in the last few months. In June this year, the members of the US Department of Energy (USDOE) and Office of Energy Efficiency and Renewable Energy (EERE) within the framework of IEA Bioenergy Task 36 organized a workshop where **the potential for a more diverse range of products from processes using waste as a feedstock** was investigated. The workshop included the participation of three keynote speakers and all the participants attending the event had the opportunity to take part in facilitated break out sessions where they were asked to discuss specific questions related to the presentations. The report has been published here.

In September a new and interesting Task 36 report about **Trends and Drivers in Alternative Thermal Conversion of Waste** was published. On the occasion of the launch of the report, IEA Bioenergy and Task 36 organized a webinar where the main results of the report performed by Karlsruhe Institute of Technology (KIT) were presented. Click here to view the webinar and access the workshop report here.

A webinar on **Waste-to-energy fly ash valorisation** was organized by SINTEF Energy Research within the framework of IEA Bioenergy Task 36 in October this year. During the webinar, seven companies presented their fly ash treatment solutions, all offering (different degrees) of valorisation and/or-reuse. The webinar reached 120 participants connected simultaneously. Click here to view the webinar and access the presentations. Click here to read the report.

Task 39 Commercializing Conventional and Advanced Transport Biofuels from Biomass and Other Renewable Feedstocks

Task 39 members contributed to IEA Bioenergy InterTask project entitled, "The Role of Renewable Transport Fuels in Decarbonizing Road Transport". This project, led by Task 39 member Dina Bacovsky, was completed in late November, 2020 and is now available on the IEA Bioenergy website (click here). Task 39 members contributed to three chapters including, (1) The role of policy on the production and use of emerging biofuels; (2) The availability and costs of sustainable bioenergy feedstocks; and (3) GHG emissions of emerging biofuels pathways and assisted with finalizing the report.

Task 39's Newsletter issue #55 was published in October 2020 and included a feature article entitled, "Sweden targets world's highest biofuel blending". The newsletter also included a summary of the various topics covered within Task 39's virtual business meeting held in June, 2020. As well as highlighting recent publications and some of the Task's information dissemination activities, the newsletter summarized recent reports and news articles of interest to biofuels stakeholders. The newsletter is available at Task 39's website: http://task39.ieabioenergy.com/newsletters/

The Task also co-organized a webinar with the BC-SMART Low-Carbon-Intensive-Fuels Consortium, entitled, **"Crystal ball gazing: How do we decarbonize long distance transport during/ after COVID?"** The webinar was moderated by a representative of the oil refining sector and included presenters from the aviation, marine, rail and low carbon feedstock sectors. It was attended by about 180 participants and proved a successful model for further Task 39 outreach activities during these Covid mediated times.

Task 40 - Deployment of Biobased Value Chains

June 2020 saw the publication of the report "Deployment of BECCS/U Value Chains – Technological Pathways, Policy Options and Business Models", which is the first deliverable from an ongoing IEA Bioenergy inter-task project called **"Deployment of BECCS/U Value Chains"** which is led by Task 40 and with Task 36 and Task 45 as partners. The report was also presented in a well-attended IEA Bioenergy Webinar on 16 June.

Also in June, we published the Task 40 newsletter, the next one is already in progress and will be available at the end of December on the Task 40 website.

After being on hold since February 2019, the works on the strategic inter-task Project **"Renewable Gas - Deployment, Markets and Sustainable Trade"** eventually started in September 2020 with the 2nd (online) kick-off meeting.

The new Task 40 project **"Circular bioeconomy synergies"** will kick-start the discussion on key findings regarding current and future synergies for forestry, agricultural, secondary and third generation raw materials. In addition, the impact of changing carbon economics due to market measures and changing reference systems/price drivers will be elaborated. The kick-off meeting was in September 2020 and the project runs until September 2021.

On September 23, there has been the kick-off meeting of the **"Lessons learned biofuels"** project. It is a strategic inter-task collaboration between the IEA Bioenergy Tasks 39, 40 and 45 (Task 39 lead). IEA Bioenergy Task 40 is mainly in charge of work package 4 dealing with the issue of sustainable biomass supply chains for international markets.

On the 19-20 October, IEA Bioenergy organized an online workshop on "Contribution of sustainable biomass and bioenergy in Industry Transitions towards a circular economy". As part of a session on the role of biomass in supplying medium and high temperature process heat for industry, Olle Olsson gave a presentation of Task 40´s ongoing work in the IEA Bioenergy inter-task project on **industrial process heat**. Slides and a recording from the presentation are available here.

Task 42 Biorefining in a Circular Economy

Sweden as a new member in Task 42

Since this triennium Sweden is a member of IEA Bioenergy Task 42 Biorefining in a Circular Economy. Sweden has a large interest in biorefinery development and not least development and deployment of industrial biorefinery concepts utilising lignocellulosic residues from the forestry and/or agricultural sector. In Task 42, Sweden is represented by PhD Johanna Mossberg, Vice President Biorefinery and Energy at RISE (Research Institutes of Sweden). Johanna holds an in-depth knowledge of environmental improvement assessment of industrial production and biorefinery concepts, analysis of industrial transition and industrial collaboration between the pulp and paper industry and the chemical process industry, barriers, drivers and the role of public policy. Monitoring the biorefinery developments in Sweden, some current highlights are:

Things are moving in the innovations system around Örnsköldsvik (the city in northern Sweden where both RISE Processum and Sekab are located together with many others aiming to push biorefinery development). In the second half of this year a large additional support was given to RISE from the owners (the Swedish state) through investment in biorefinery research infrastructure to accelerate development and deployment. This additional ~35 MEuro has a strong bearing on Örnsköldsvik, and now lately also the technology development company Sekab announced that it intends to apply for funding for a first full-scale facility in Örnsköldsvik for its patented CulluApp technology (https://www.sekab.com/en/press-releases/sekab-is-investing-in-its-own-technology-wants-to-build-a-production-plant-for-green-chemicals-and-biofuels/). In addition, LiquidWind has also announced that they have finally found a location for their first facility and that it will also be Örnsköldvsik based on cooperation with Övik Energi (read the news here).

Also, the decision makers in policy have listened to what researchers have argued for quite a while, that policy incentives for market creation is not enough to commercialise new technologies but that also other policy, e.g. for industrialisation, is needed (see for example) and has appointed an inquiry (led by the Swedish Energy Agency) to analyse what additional instruments may be needed to lead to further production of renewable fuels in Sweden. It is important in this context that the focus is on production with "new technology". https://bioenergitidningen.se/biodrivmedel-transport/produktion-av-biodrivmedel-ska-framjas

Task 43 Sustainable Biomass Supply Integration for Bioenergy within the Broader Bioeconomy

Variable production of biofuels may lead to increased food security

The use of biofuels is possible without jeopardizing food security. Under the right conditions, it can even lead to increased food security. This is one of the conclusions from an international panel of multi-disciplinary experts, including researchers from Wageningen University & Research. The findings are published in the Biofuels, Bioproducts, & Biorefining (Biofpr) Journal, an international source for scientific information on sustainable bio-based products and fuels. The paper is available at the Biofpr-website.

The experts used a survey, an expert panel, and literature review to study the effects of variable biofuel production. In the EU and other jurisdictions, biofuels are currently blended in a fixed proportion with conventional fuels. According to the experts, the production of bioethanol from sugars and starch or biodiesel from fats and oils can be increased during periods when these raw materials are abundantly available. During such times of plenty, prices for these commodities are depressed. Conversely, the production of biofuels can be reduced if the availability of the raw materials is low and the prices of these raw materials are high. Raw materials for biofuels can thus form a 'virtual feedstock reserve' that can be used for food production if there is a need for it. Dr Iris Vural Gursel, researcher at Wageningen Food & Biobased Research, is one of the authors of the article in Biofpr. She proposes that if biofuel production is adjusted in response to biomass feedstock availability and prices, this variable demand can offer a feedstock supply cushion to help meet needs for food, materials, and chemicals.

Positive effect on productivity

According to 58% of the experts participating in the survey, variable demand for biofuels can have a positive effect on agricultural productivity. A significant minority (28%) disagree. Some respondents noted that a positive effect is possible because variable demand for biofuels has a stabilizing effect on the crop market: it provides an additional channel for farmers to sell abundant crop yields, absorbing supplies that exceed demands for other uses. Since the primary feedstocks for biofuels are widely traded with existing logistics and infrastructure, this mechanism can function at multiple scales. Having an assured market provides increased security to growers and facilitates investments. Investments in improved seeds, equipment, and technology, in turn, increase farm operation efficiencies and productivity, generating effects for the agricultural sector that extend beyond the biofuel supply chain.

On the contrary, other experts expressed concerns that variable demand for biomass will lead to a drop in investment in the biofuel industry or could increase competition for scarce resources. One striking observation from survey respondents was that agricultural and environmental experts were more positive about the favorable effects than economists and chemists.

Effects on land use

A major concern surrounding the production of biofuels is that the land requirements for growing biofuel feedstocks will compete with other crops, to the detriment of food security and the environment. If biofuel crop production displaces other essential products, it could contribute to agricultural expansion and deforestation, or "indirect land-use change." However, researchers identified several studies, including some in Brazil, that show how policies on biofuel production can lead to more efficient and sustainable production methods, with a net positive impact on land use.

Appropriate policies needed

The findings of the expert panel show that there is a strong need for appropriate policy. As reported in the paper, biofuel policies should consider the availability of raw materials and their prices. The authors recommend that mechanism be established to allow temporary adjustments in biofuel production in order to prevent potential food crises. Such virtual buffer systems could help buffer fluctuations in the availability of raw materials.

Dr. Vural Gursel notes, "In particular, the experts agreed that low prices for agricultural products are bad for food security: farmers then invest too little in their farms because the margins on their products are simply too low – they do not have the money. This leads to lower yields in following years and, in the long run, can end up requiring more land. Variable demand for biomass is an interesting idea that may help prevent oversupply leading to too low prices. It then leads to more security for the farmer, who will be more likely to invest in improving productivity, in the end requiring less land for the same production."

Authors emphasize that more research is needed to convert the principle of variable biofuel production into effective policy. The paper concludes that "If, through research, it can be confirmed that variable production is not at the expense of food security but, on the contrary, can contribute to increased food security, then this is an important step towards sustainable biofuel production."

In addition to Wageningen UR, scientists and experts from AgriQuest, Biomass Research, Oak Ridge National Laboratory (USA), the University of Nebraska-Lincoln (USA), and the Netherlands Enterprise Agency, also contributed to this study.

IEA Bioenergy Webinar Series

The IEA Bioenergy Webinar Series is continuing with 30 completed. All of the webinars, including recording and presentation slide-deck, can be viewed at https://www.ieabioenergy.com/iea-publications/webinars/

Publications

Variable Demand as a Means to More Sustainable Biofuels and Biobased Materials

This paper describes how varying the biofuel demand could help address these concerns.

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Case Story: Green Methanol from Biogas in Denmark

Global methanol production currently amounts to about 80 million metric tonnes per year and is generally produced from natural gas or coal.

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Comparison of Biofuel Life Cycle Analysis Tools: Biochemical 2G Ethanol Production and Distribution

The present report is the continuation of the other technical reports on Comparison of Biofuel Life Cycle Analysis Tools, particularly for ethanol from sugarcane, corn and wheat (Phase 1); FAME and HVO/HEFA (phase 2, Part 1).

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Workshop Report: Waste-To-Energy Fly Ash Valorisation

Report of a digital workshop held on October 7, 2020. The workshop was organized by SINTEF and RISE, within the framework of IEA Bioenergy Task 36..

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Case Story: Deep Bedding: A Co-Digestion Substrate with Significant Potential (Denmark)

This case story, developed within the framework of IEA Bioenergy Task 37, describes the Danish experience with handling and feeding deep bedding to biogas plants.

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Workshop Report: Waste for Feedstock Recycling – Challenges and Opportunities

Report of a digital workshop held on June 15, 2020. The purpose of this workshop was to explore several facets of producing higher value biochemicals and bioproducts from waste streams.

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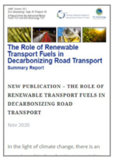
The Role of Renewable Transport Fuels in Decarbonizing Road Transport



A team of experts has assessed the transport sector and its projected development up to 2030 and 2050 for a number of countries, including Germany, Sweden, Finland, the USA, and Brazil.

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Case Story: Production of Food Grade Sustainable CO2 from a Large Biogas Facility (Denmark)

Biogas typically consists of 60% biomethane which is used as a renewable fuel, while the remaining 40% is a natural residual product in the form of CO2.

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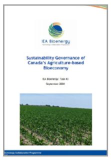
Sustainability Governance of Canada's Agriculture-Based Bioeconomy



This report, produced in the framework of IEA Bioenergy Task 43, provides a current Canadian perspective on how the sustainability of the agricultural bioeconomy is governed.

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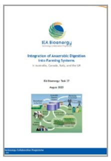
Integration of Anaerobic Digestion into Farming Systems (in Australia, Canada, Italy, and the UK)



This report of IEA Bioenergy Task 37 assesses the role of biogas integrated into the farming system through examination of policy, practices and strategies in four very distinct countries with very different climatic conditions: Australia, Canada, Italy and the UK.

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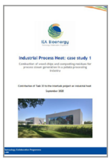
Case Studies Illustrating How Bioenergy Is Used in Industry to Provide High Temperature Heat



With the increasing motivation in industry to reduce their carbon footprint, several other industry sectors are also shifting towards biomass based heat generation in cases where there are suitable biomass resources and technologies available nearby.

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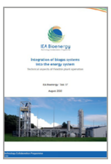
Integration of Biogas Systems into the Energy System – Technical Aspects of Flexible Plant Operation



This new report by IEA Bioenergy Task 37 addresses the flexibility of biogas systems.

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Trends and Drivers in Alternative Thermal Conversion of Waste

This report, by IEA Bioenergy Task 36, discusses trends impacting solid waste management systems and selected alternative thermal treatment technologies.

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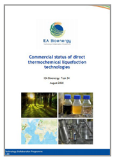
Commercial Status of Direct Thermochemical Liquefaction Technologies



This report, by IEA Bioenergy Task 34, covers current commercial activity, near-to market activities and market plants.

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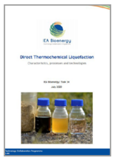
Direct Thermochemical Liquefaction of Biomass – Characteristics, Processes and Technologies



This brochure explains some of the characteristics of different DTL processes, and their perspectives as a key enabling technology to access biogenic resources for a future bioeconomy.

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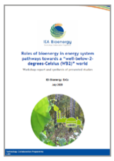
Roles of Bioenergy in Energy System Pathways Towards A "Well-Below-2-Degrees-Celsius (WB2)" World



The report assesses the role of bioenergy in WB2 strategies, identifies the current state of knowledge and gaps in knowledge that need to be addressed.

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Novel Regional and Landscape-Based Approaches to Govern Sustainability of Bioenergy and Biomaterials Supply Chains

The study is based on 9 case studies from Africa, Asia, South America and Europe, where landscape governance has been adopted to manage the resources and land uses.

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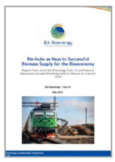
Bio-Hubs as Keys to Successful Biomass Supply for the Bioeconomy



Natural Resources Canada, with IEA Bioenergy Task 43 held a workshop in Ottawa on 6 March 2020 to inform the implementation of innovative biomass supply chains

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IEA Bioenergy Events

Executive Committee

ExCo87 will be held as a Virtual Meeting in Q2, 2021, dates to be confirmed

ExCo88 will be held in Q4, 2021, location and dates to be decided

Task Events

Due to COVID-19 travel restrictions Tasks currently hold online meetings on a regular basis. Physical meetings will be considered for the second half of 2021.

The 2nd International Conference on Negative CO2 Emissions at Chalmers University of Technology, Gothenburg, Sweden planned for 12th -15th May 2020 is postponed. The organizers will come back with a new date for the conference when the situation allows, with the hope of hosting the conference in the fall of 2021.
http://negativeco2emissions2020.com

Webinars

Integration of biogas systemsinto the energy-system
21st January 2021 at 4:00 p.m. CEST/ 3:00 p.m. BTS/ 10:00 a.m. EST

Other Events

Refer to https://www.ieabioenergy.com/iea-bioenergy-task-events/other/

Other Items

Biomass Workshop Series 2020-21: REDII Implementation and Beyond - Workshop 5: Social impacts of Woody Biomass
Date: 20th January 2021, 15.00 -18.00 CET
Location: Virtual Workshop

website

Lignofuels 2021
Date: 10th – 11th February 2021
Location: Helsinki, Finland

website

European Pellet Conference 2021
Date: 24th - 25th February 2021
Location: online conference

website

REGATEC 2020
Date: 14th – 15th April 2021
Location: Weimar, Germany

website

EUBCE 2021
Date: 26th – 29th April 2021
Location: Online & Marseille, France

website

Gasification Summit 2021
Date: 5th- 6th May 2021
Location: Lyon, France

website

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