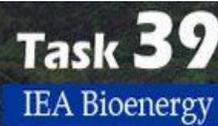




Biofuels to Decarbonize Transport



From the Task

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By Mahmood Ebadian, Tomas Ekbohm, Glaucia Mendes Souza, and Jack Saddler

Since publishing our last newsletter in December 2021, IEA Bioenergy Task 39 has continued its work to facilitate and advance development and deployment of sustainable, lower carbon intensity biofuels used to decarbonise the transport sector (particularly long-distance transport segments where electrification is more challenging, i.e., aviation, marine, trucking and rail). This issue of the newsletter provides a summary of Task 39’s accomplishments in the last triennium (2019-2021), recent business meetings on the programme of work for the current triennium (2022-2024), and publications and information dissemination activities. It also highlights recent reports and news articles of interest to biofuels stakeholders. **We are grateful to our Belgian colleagues, the new Task member for authoring this newsletter’s feature article on biofuels-related developments in Belgium.**

Summary of Task 39’s accomplishments in the last triennium (2019-2021)

During the last triennium (2019-2021), Task 39 assisted member countries and other transport biofuels stakeholders in their efforts to develop and deploy sustainable, lower carbon intensive biofuels through a coordinated focus on technology, commercialization, sustainability, policy, markets and implementation. These included conventional biofuels (i.e. ethanol and fatty acid methyl esters (FAME) biodiesel), drop-in biofuels produced by treating lipid feedstocks with hydrogen (known as hydrotreated vegetable oil (HVO)/hydrotreated esters and fatty acids (HEFA)) biofuels/renewable diesel/green diesel, biojet/sustainable aviation fuel (SAF), cellulosic ethanol, etc., through various technology routes such as oleochemical, biochemical, thermochemical and hybrid conversion technologies. The Task also continued to identify and facilitate opportunities for comparative technical, economic and life cycle assessment and to monitor the various policies that have been successfully used to increase the production and use of transport biofuels.

Sixteen countries participated in Task 39 during the last triennium including Australia, Austria, Brazil, Canada, Denmark, European Commission, Germany, Ireland, India, Japan, The Netherlands, New Zealand, Norway, South Korea, Sweden and the US. With the collaboration among these countries, Task 39 delivered several cooperative research projects which assessed policy, markets and sustainable biofuel implementation issues.

Task 39 covered several topics related to decarbonization of long-distance transport sectors including aviation, marine, trucking and rail. The aviation and marine sectors, in particular, have fewer alternatives to achieving carbon emission reductions compared to light duty/short distance “urban” transport sectors. Task 39 helped develop short-term and long-term opportunities that influenced the production and use of sustainable, low carbon intensive biofuels.





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Examples of Task 39 reports completed during the triennium include 1) “Biofuels in marine shipping: Issues affecting utilization of advanced biofuels in the marine sector” (download [here](#)); 2) “Progress in commercialisation of biojet fuels/SAF (download [here](#)); 3) Technologies, potential and challenges”, “Recent progress in the production of low carbon intensive drop-in fuels- Stand-alone production and coprocessing” and, 4) “Feedstock-to-biofuel(s) supply chain analysis; a focus on CAPEX and OPEX cost reduction opportunities for advanced biofuels”.

In terms of policy and sustainability assessments, Task 39 continued to facilitate LCA studies by focusing on the development of regional life cycle inventory data such as the data available from sugar cane production and processing Brazilian RenovaBio program. Task39’s periodically issued “Implementation Agendas” report that compares-and-contrasts biofuels policies across its member countries was updated (download [here](#)). Task 39 led a study on “biofuels production and use status in emerging economies (including Brazil, Argentina, Columbia and Guatemala). Another project reviewed existing/proposed certification processes for oleochemical and lignocellulosic-based biofuels supply chains which highlighted certification scheme improvement opportunities. As both policy and sustainability issues will continue to play crucial roles in biofuel development, this will continue to be a key activity for the Task in the current triennium.

Task 39 coordinated an InterTask project between Task 39, Task 40 and Task 45, that evaluated the reasons why there have been boom-and-bust cycles of biofuel technologies development, demonstration and deployment, and how we can learn from them. The Task also contributed to two IEA Bioenergy InterTask projects including Advanced Biofuels - Potential for Cost Reduction (IEA Bioenergy InterTask project) (download [here](#)) and The Role of Renewable Transport Fuels in Decarbonizing Road Transport (download [here](#)).

Task 39’s online Biofuels Demonstration Plants Database with information on all European facilities was verified and updated. There are currently about 290 active entries in the database, of which 220 are at technology readiness level 6-9 (View the online database [here](#)).

Other commissioned reports that were completed during the 2019-2021 triennium include:

- Compare and Contrast Transport Biofuels Policies- Implementation Agenda, 2018-2019 Update (2020)
- Comparison of biofuel life cycle analysis (LCA) tools, Phase 2, Part 2: biochemical second generation (2G or cellulosic) ethanol production and distribution (2020)
- Assessment of likely Technology Maturation pathways for biojet production from forest residues. The ATM Project, jointly sponsored by Boeing (2019)
- Drop-in Biofuels- The key role that co-processing will play in its production (2019)
- Comparison of Biofuel Life Cycle Analysis (LCA) Tools Phase 2, Part 1: FAME and HVO/HEFA (2019)

The reports from these research projects are/will be available on the Task’s website: (<http://task39.ieabioenergy.com/publications/>).

Publication via the peer reviewed literature has also been encouraged, to reach the broader transport biofuels community that are listed below:

We welcome feedback.
Please direct
comments to
[Glauca Mendes Souza](#)

- Challenges in determining the renewable content of the final fuels after co-processing biogenic feedstocks in the fluid catalytic cracker (FCC) of a commercial oil refinery (Su et al., 2021; Journal of Fuel) ([link](#))
- Determining the amount of “green” coke generated when co-processing lipids commercially by fluid catalytic cracking (FCC) (Su et al., 2021; Journal of Biofuels, Bioproducts and Biorefining) ([link](#))
- Biofuels in Latin America: Sustainability Assessment of Argentinian, Brazilian, Colombian, and Guatemalan cases (Canabarro et al., 2021, submitted to the journal of Renewable and Sustainable Energy Reviews)
- Biofuels policies that have encouraged their production and use: An international perspective (Ebadian et al., 2020, Energy Policy Journal) ([link](#))
- Potential synergies of drop-in biofuel production with further co-processing at oil refineries (van Dyk et al., 2019; Journal of Biofuels, Bioproducts & Biorefining) ([link](#))
- Comparison of biofuel life-cycle GHG emissions assessment tools: The case studies of ethanol produced from sugarcane, corn, and wheat (Pereira, L.G. et al., 2019; Renewable and Sustainable Energy Reviews) ([link](#))

As part its communication strategy, Task 39 also organized ten business meetings in the 2019-2021 triennium. The minutes of the business meetings are documented and posted on the Task 39’s website (access to minutes is limited to Task 39 membership and business meeting participants). Task 39 continued to actively organize and participate in other virtual webinars and conferences with the goal of sharing the networks insights on how decarbonization of the transport sector can contribute to a “green economic recovery”. These activities included three webinars concerning, “IEA Bioenergy Webinars”, the Task 39 sessions on Transport Biofuels in “the Biofuture Summit II / BBEST2021 Virtual Conference”, the “End of Triennium Conference 2021” and three joint webinars with groups such as the [BC SMART Low Carbon Fuels Consortium](#) on the decarbonization of long distance transport sectors. The flyer, recoding and presentation slides of some of the joint webinars are posted on Task 39 website ([Events and Conferences](#)).

In addition to the Task 39 commissioned reports, conference and workshop proceedings, the Task disseminated information through its periodic newsletters. In addition to providing updates on Task projects and meetings, every issue included a feature story highlighting biofuel development in a member country or region of interest including Brazil, The Netherlands, Denmark, Germany, Sweden, India, Ireland, and Norway. The Task’s newsletters are available for download at Task 39’s website:

<http://task39.ieabioenergy.com/newsletters/>.

The primary success of Task 39 during the 2019-2021 triennium was to encourage the decarbonization of the transportation sector, particularly the long-distance transport sector (Aviation, Marine, Rail, Trucking) via a combination of commissioned reports, seminars, webinars and newsletters. Due to many “issues’ such as complex supply chains, fuel specifications, price sensitivity, etc., Task 39 covered many aspects of the biofuel production and use including technology, commercialisation, sustainability, policy, markets and implementation. Task members have been invited and engaged in many workshops, seminars and studies such as the preparation of “biofuels for aviation-technology brief”. The two sessions organized by Task 39 in the IEA Bioenergy End of Triennium Conference in December 2021 on "[Emerging biofuels markets and the importance of LCA and certification](#)" and "[The potential of drop-in biofuels to decarbonise aviation](#)" were among the most registered and attended sessions in the conference. This indicated the importance of these topics to the biofuel stakeholders. Active industry involvement, particularly the long-distance transport sector such as aviation/Boeing, helped facilitate the development and deployment of sustainable and low-carbon intensity lower carbon intensity biofuels used to decarbonize the transport sector.

During the 2019-2021 triennium, Task 39 tried to expand Task membership. The addition of India, Norway and Ireland showed the multiple benefits of gaining enthusiastic new members. India is one of the fastest growing economies and the third largest consumer of primary energy in the world (after the US and China). In collaboration with Brazil, the US

and Germany, the Task 39 Indian representatives identified potential opportunities across the feedstock-to-biofuel supply chain to reduce capital and operating costs for advanced biofuels production. These four-member countries are at the forefront of the commercialization of advanced biofuels. The membership of Norway in the 2019-2021 triennium provided the opportunity to highlight the use of biomethane for the transportation sector. Norway has 40 operating biogas plants that process municipal, food and industrial organic wastes (and the number is growing). Of these, 10 plants produce biogas for transportation, mainly for buses and trucks. The world's largest liquefied biogas plant, Biokraft, is located in Norway and is processing fish farming and paper mill waste. The details of the biogas and biomethane production and use in Norway are provided in the Task 39 [Newsletter#58](#).

Another success of Task 39 was to strengthen collaborations with other IEA Bioenergy Tasks (e.g., InterTask project with Task 40 and Task 45 and joint workshop with Task 44). The Task also continued its excellent rapport with other groups such as IEA HQ, IRENA, FAO, GBEP, other IEA TCP's (e.g., AMF) and various national and international organizations and programs such as the US DOE, Brazil FAPESP, EC, etc. In addition, Task 39 continued to benefit from extensive industry involvement of companies and institutions at the forefront of biofuels development. These include Boeing, Borregaard, DSM, ENI, GoodFuels, International Air Transport Association (IATA), IFPEN, ISCC, Haldor Topsoe, LanzaTech, LBST, Licella, Neste, Novozymes, Renewable Energy Group (REG), Roundtable on Sustainable Biomaterials (RSB), (S&T)² Consultants, skyNRG, Steeper, UPM, World Wildlife Federation, etc.

Task 39 Leadership Update

Jim (James) McMillan (NREL) and Jack Saddler (UBC) stepped down as Task leaders at the end of the previous triennium (2019-2021). Task 39 wants to thank Jim and Jack for their leadership of Task 39 over the last few years. We want to acknowledge the "blood-sweat-and-tears" they put into these positions. Jim and Jack helped the group recognize the increasing importance of various issues such as the carbon-intensity of biofuels, the growth in drop-in biofuels and the importance of LCA/certification in helping biofuels compete with established fossil fuels. They were also big supporters of the need to involve industry groups such as oil-and-gas, biotechnology, airlines, shipping, etc. We are very pleased that they will continue to be involved in the Task, representing the US and Canada. Their colleague, Mahmood Ebadian, will continue to help the Task with various "deliverables", such as this newsletter and reports such as the compare-and-contrast of national policies used to facilitate biofuels production and use (the Implementation Agenda's report)

A polling was performed in May 2021 among Task member countries to understand Task 39 members' preferences for future the Task leadership. Polling results demonstrated a strong preference for future leadership of the Task to be led by Sweden (Tomas Ekblom) supported by Brazil (Glaucia Mendes Souza) for the 2022-2024 triennium. Task 39 is looking forward to continuing its success on the decarbonisation of the transport sector using low carbon intensity biofuels under their leadership.

Task 39's business meetings in 2022 on the programme of work for the current triennium (2022-2024)

Task 39 held three virtual business meetings via Zoom in February April and June 2022 to finalize the programme of work for the current triennium. The proposed Task 39 program of work builds on Task 39's already established strong and active participating network of experts from industry, academia and government research institution. This has been developed and expanded over the last decade. The proposed program of work will continue to span technology, commercialization, sustainability and policy aspects of producing and using low carbon intensity transport biofuels. The active, strong participation of industry will continue to be emphasized.

The Task will continue to lead and coordinate activities in the three main program areas of:

1) **Technology and Commercialization** (T-projects): To address technical/commercial aspects of producing and using low carbon intensity (CI) liquid and gaseous biofuels for transport, including both “conventional” and “advanced” biofuels

2) **Sustainability** (P-projects): Sustainability and carbon intensity metrics are playing an ever-increasing role in the policies used to develop and use biofuels. Biofuels sustainability/LCA assessment will stay a priority for the Task

3) **Policy** (P-projects): The “right” policies (such as LCFs) significantly influence the rate and extent of development, deployment and use of biofuels (e.g., bioethanol, biodiesel, renewable diesel, drop-in biofuels, etc.).

The list of discussed projects in the proposed Task 39 programme of work is provided below. Task 39 leadership is currently requesting the member countries who expressed interest to lead/co-lead these projects to submit the project proposal. More information about these projects will be provided in the next issue of the newsletter.

- T39-T1: Continuation/further work on **Drop in biofuels/Co-Processing**
- T39-T2: Continuation/further work on **Decarbonisation Strategies for the Aviation Sector**
- T39-T3: Continuation/further work on **Decarbonizing the Marine Sector**
- T39-T4: Assessment of Large-scale **Demonstration Plants**
- T39-T5: Phase 2- Successes and Lessons Learned for **Advanced Biofuel Technologies** Commercialization (possibly InterTask with Tasks 40 and 45)
- T39-T6: Synergies of **green hydrogen and bioenergy** (InterTask with Task 44)
- T39-P1: Update Biofuels Implementation Agendas: Compare and Contrast **Transport Biofuels Policies**
- T39-P2: Extend assessment of the **Sustainability of Biofuels Pathways** (LCA)
- T39-P3: Review existing and proposed **Certifications for oleochemical and lignocellulosic-based biofuels** and other potential renewable fuel supply chains; identify certification scheme improvement opportunities
- T39-P4: Extend assessment on the status of **Biofuels in Emerging Markets**-potential for sustainable production and consumption

Task 39 is pleased and welcome new members including Belgium, Estonia and the US Grains Council as limited sponsor. The Task leadership is continuing its efforts to expand Task membership and currently trying to re-recruit other countries including China and Türkiye.

As always, we appreciate your readership and value your input and feedback. Please email us your ideas or suggestions on how we can increase the newsletter’s value. Thank you for reading and participating in the IEA Bioenergy Task 39 network!

Mahmood, Tomas, Glauca and Jack

IEA Bioenergy Task 39 Member Countries, Representatives and ExCo Members

Member Country	Task Representative (s)	ExCo Member
Australia (in discussion with IEA Bioenergy ExCo to rejoin Task 39)	Steve Rogers	Mark Brown
Austria	Dina Bacovsky, Andrea Sonnleitner	Hannes Bauer
Belgium	Robert Malina	Thibaut Masy
Brazil	Glaucia Mendes Souza, Rubens Maciel Filho, Luiz A Horta Nogueira	Pietro Adamo Sampaio Mendes
Canada	Jack Saddler, Mahmood Ebadian	Oshada Mendis
Denmark	Sune Tjalfe Thomsen, Michael Persson	Mikael Pedersen
Estonia	Ain Ladoja	Kristo Kaasik
European Commission	Nicolae Scarlat, Marco Buffi	Maria Georgiadou
Germany	Franziska Mueller-Langer, Nicolaus Dahmen, Gabriel Costa De Paiva	Birger Kerckow
Ireland	Stephen Dooley	TBD
Japan	Yuta Shibahara	Shinji Furukawa
New Zealand	Paul Bennett	Paul Bennett
South Korea	Jin Suk Lee	In-Gu Lee
Sweden	Tomas Ekbohm, Hannah Edgren	Jonas Lindmark
The Netherlands	Paul Sinnige, José Muisers, Stephan Janbroers	Ir Kees Kwant
United States	Jim McMillan	Jim Spaeth
US Grains Council	Isabelle Ausdal	

Biofuels production and consumption in Belgium

Robert Malina and Freddy Navarro, Hasselt University

Overview on current energy status

Belgium, a country with a population of approx. 11.5 million people and an area of 30,690 km², was the 8th largest energy consumer in the European Union in 2020, consuming 1,597 PJ. The country consumed about 76% of its gross available energy, similar to the European Union average (74%). In terms of energy productivity, Belgium was in the 15th position, lying, inter alia, behind Germany, France, and the whole European Union, and the Netherlands. Figure 1 illustrates these and other key energy indicators in Belgium, in comparison to other European countries.

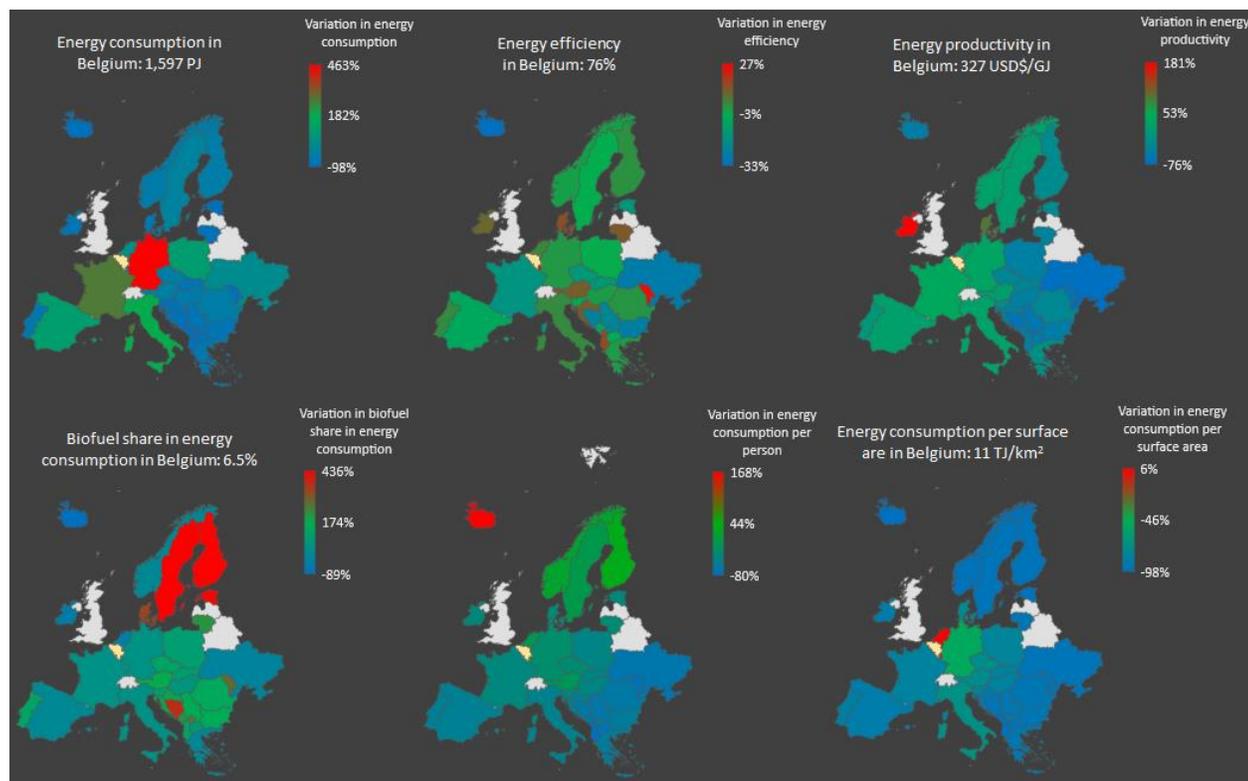


Figure 1. Variation in energy indicators in Europe compared to Belgium. White areas denote regions without available data. Data taken from [1, 2].

The role of biofuels in Belgium

Figure 2 shows the breakdown of energy consumption in Belgium in the year 2020 excluding bunker fuels (any fuel used on board an ocean ship or planes on international routes). With 104 PJ, biofuels covered about 6.5% of the final energy consumed in Belgium, while other renewable sources, excluding nuclear, covered 7.2 PJ, which highlights the great dependency of the country on fossil sources. The transport sector represented about 20% of total energy consumption in Belgium in 2020, dominated by the road transport sector. Biofuels' energy contribution to this sector is lower than 10%, with biodiesel the highest contributor (83% of road transport bioenergy consumption). The energy consumption of other non-road transport sectors (aviation, in-land navigation, and rail) represents less than 5% of the total energy consumed by the transport sector and is currently covered almost entirely with fossil resources. For

instance, the rail sector covered about 86% of its energy requirements (6 PJ) using electricity generated from nuclear sources (39%), natural gas (34%), biofuels (6%), and other renewable sources (21%, mostly wind and solar) [2]. Thus, biofuels contributed less than 0.4 PJ to the energy requirements of this sector.

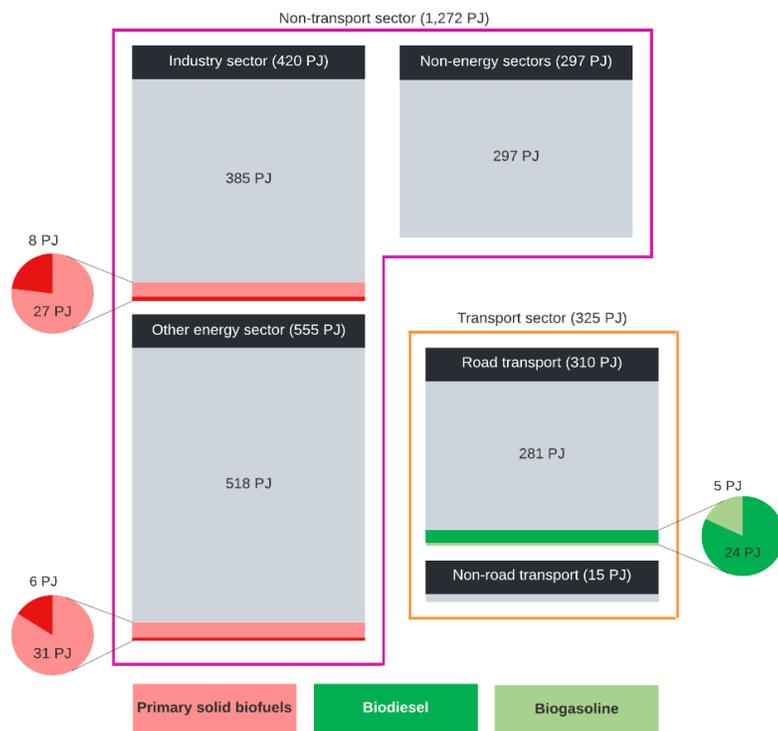


Figure 2. Disaggregated energy consumption in Belgium excluding bunker fuels [2].

Biofuels contribution to the industry sector and other energy sectors is also relatively low (8.3%, and 6.7%, respectively), with primary solid biofuels (PSBs) being the dominant biofuel. No biofuels were used in other non-energy sectors. The contribution of PSB and other biofuels to the transport sector is negligible ($\approx 0.1\%$).

If bunker fuels are included, the total energy consumption in Belgium in 2020 would increase by 294 PJ, which is almost the energy consumed by non-energy sectors in the country by the same year [3]. This is due to the outsized importance of the Port of Antwerp.

Putting Belgian biofuels consumption in perspective

In 2019, the household energy consumption in Belgium reached about 331 PJ, that is, about 21% of the total energy consumption of the country [2]. Furthermore, Belgium had about 5 million houses by that year [5]. Thus, the average energy consumption of households reached about 67 GJ/year, used mostly (73%) for space heating. The energy contribution of biofuels equals then the annual energy consumption of about 1.6 million households, almost the whole of all households in the Walloon region.

Where do biofuels in Belgium come from?

Figure 3 shows the energy balance of biofuels in Belgium in 2020. In this year, biofuels production in the country was about 1.7 times as high as biofuels imports. On the other hand, exports amounted to about 18% of domestic biofuels production. PSBs are the most important biofuel, contributing more than half of the total biofuel energy input in the country. Biodiesel is the second most important biofuel with 22% of contribution. The total biofuel energy inputs in Belgium reached 151.87 PJ. About 12% of biofuels inputs in Belgium were exported, leaving 134.29 PJ available.

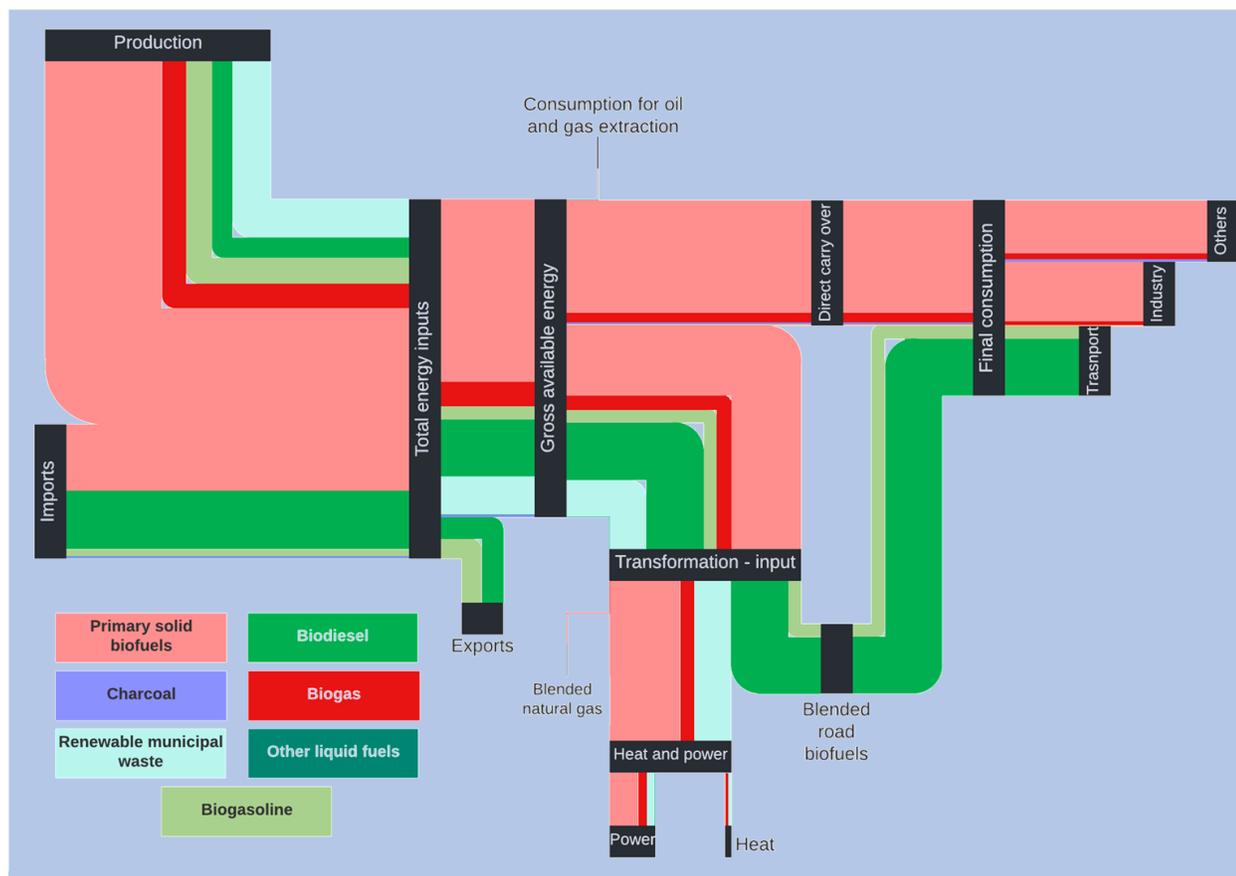


Figure 3. Energy balance of biofuels production in Belgium [1, 2].

About 60% of the gross available biofuels (81 PJ) were transformed prior final consumption. Thus, biogasoline (liquid biofuels suitable to replace gasoline or be blended with it) and biodiesel were blended with conventional fossil fuels almost entirely (>99%) and used for the road transportation sector. Biodiesel and biogasoline contributed 24 PJ and 5 PJ to the road transportation sector, respectively. On the other hand, almost 30 PJ, 15.5 PJ, 6 PJ, and 0.25 PJ of PSB, renewable municipal waste (RMW), biogases, and OLF were used to generate heat and power. Moreover, only a small portion of biogas for transformation (<1 %, 49 TJ) is blended with natural gas. The biofuel-based generated heat and power (21.7 PJ) covers about 6.4% of the total heat and power generation in the country. In Belgium, about half of the entire generated heat and power is used by the industry sector, about half is used by other energy sectors, and <2% for the transport sector.

About 47.6 PJ of PSB (62%) was directly used and divided almost equally to be used by the industry and other sectors. On the other hand, about 40% of the gross available biogas (4 PJ) was also directly used by the industry (1.6 PJ) and other (2.4 PJ) sectors.

Figure 4 shows the evolution of liquid biofuels production capacity in Belgium. From 2011 to 2020, production capacity has decreased from 48 PJ to 33 PJ. Biodiesel contributes the most to total production capacity (54%), followed by biogasoline (38%). Comparing liquid biofuels production capacities with primary production in 2020, biodiesel and biogasoline, facilities were operating at 48%, and 88% of production capacity, respectively.

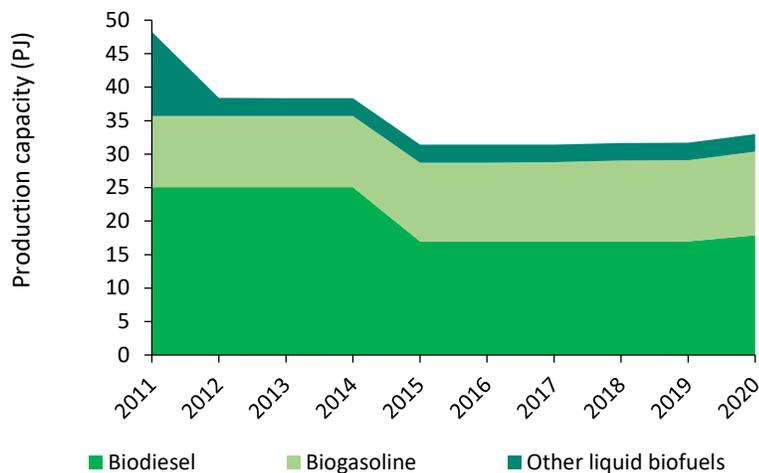


Figure 4. Liquid biofuels production capacity in Belgium [2].

Figure 5 shows a breakdown of biodiesel and bioethanol in Belgium by feedstock in 2014 and 2018. Most of the biodiesel in Belgium is derived from rapeseed. However, its contribution has decreased from 2014 to 2018. For bioethanol, wheat is the highest-used feedstock, followed by corn [6].

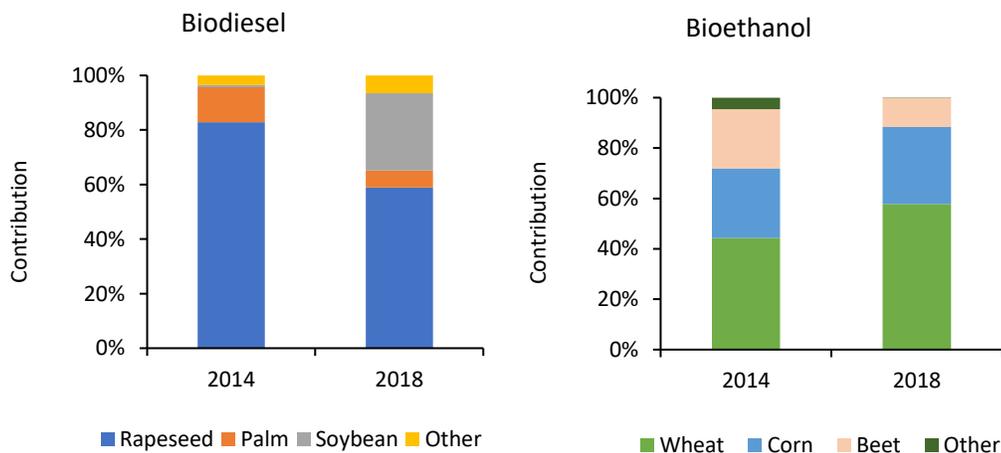
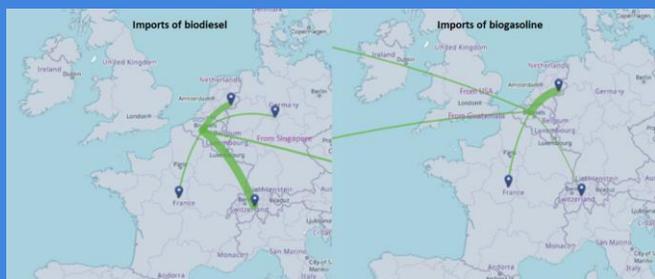


Figure 5. Breakdown of liquid biofuels in Belgium [6].

The road of biofuels into Belgium



About 59% of the liquids biofuels inputs in Belgium are imported (see Figure). Most of biodiesel and biogasoline imports come from Switzerland and the Netherlands, respectively [1].

The GHG emissions impact of biofuels in Belgium

Biofuels are used in order to reduce carbon dioxide emissions of human activity by replacing conventional fossil-based fuels. Therefore, biofuels must have lower lifecycle carbon emissions than their conventional, fossil-derived counterparts. An existing assessment of the carbon dioxide emissions of the road transport sector and the biofuel consumption in Belgium indicates that GHG emissions decreased by 6% from 2008 to 2019. In the same period, the share of biofuel consumption in this sector increased from 0 to 5.5% (see Figure 6).

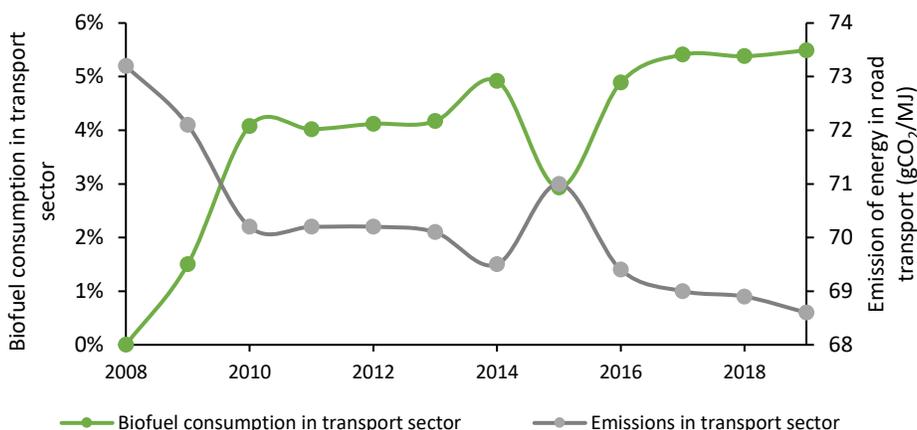


Figure 6. Carbon dioxide emissions of the transport sector and the contribution of biofuels in it [2].

Policies towards biofuels in Belgium

Belgium has developed 98 energy-related policies, out of which 49 are oriented for renewable energies. Nine of these laws are ended, 39 are in force, and 1 is being planned. **Error! Reference source not found.** summarizes the policies focusing on the use of liquid biofuels for the transport sector in Belgium. The “*law of obligation for the incorporation of biofuels in fossil fuels*” and the “*blending mandate 2017 and 2020*” are important laws as they set targets for the incorporation of biofuels in line with the 10% minimum target to be achieved by all EU member States for the share of biofuels in transport petrol and diesel consumption. The available biogasoline and biodiesel in Belgium in 2020 was enough to cover 8% and 10% of the energy needs of motor gasoline and gas/diesel in the road-transport sector, respectively. Overall, both biofuels covered 9.3% of the total gasoline and diesel energy requirements, which means that the country requires a small effort to fulfill with the European Union target.

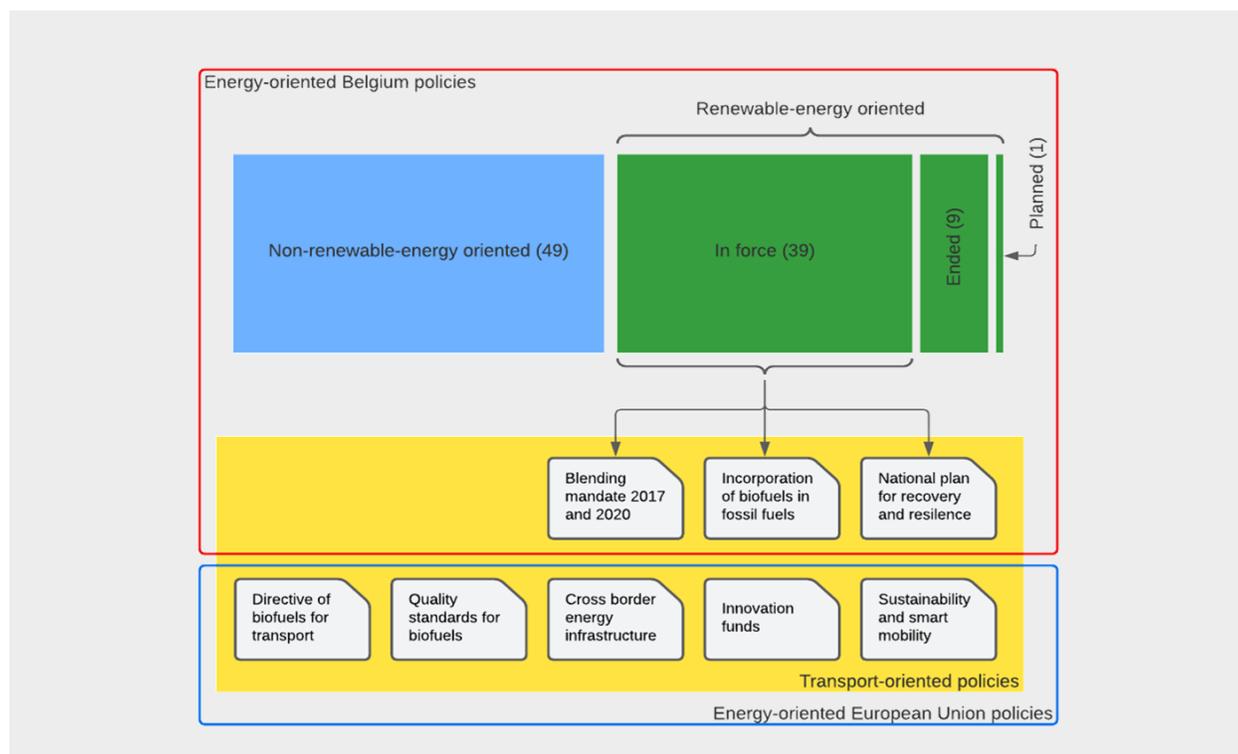


Figure 7. Policies regarding the use of renewable energy in the transport sector in Belgium [7].

Recently, Belgium joined Denmark, France, and the Netherlands to ban biofuels derived from palm oil or soy from 2022 onwards due to issues related to deforestation, loss of biodiversity, and human rights violations [8]. Unlike palm oil, the soybean restriction could compromise the biodiesel availability in the country (see Figure 5) and hinder the fulfilment of targets stated by the European Union. Regarding advanced biofuels, legislation in Belgium allows for double counting of those fuels when using them in the transport sector and established a target for covering 0.1% of its total transport energy with them from 2020 onwards [9].

Table 1. Summary of policies focusing on the use of liquid biofuels for the transport sector in Belgium [7].

Law	Year	Status	Description
Excise Tax Reduction for Biofuels	2006	Ended	Tax reduction for diesel oil containing at least 3.37 % biodiesel and on gasoline containing at least 7 % ethanol of non-chemical nature
Law of obligation for the incorporation of biofuels in fossil fuels	2009	In force	Fossil fuel companies in Belgium must incorporate at least 8.5% bioethanol and 6% biodiesel
Blending mandate 2017 and 2020	2017	In force	Set the binding target for blending biofuels in petrol to 8.5% vol/vol. The update in 2020 set the target to 8.5% MJ/MJ.

Biofuels technology development and deployment

In 2020, Belgium committed to the objectives set out in Lisbon and the European 2020 strategy to invest 3% of its GDP on research and development. One-third of the R&D budget is supposed to be funded by public agencies while the remaining by private sectors [10]. About 5% - 10% of the total is aimed to be spent on climate and energy projects by means of the federal Energy Transition Fund.

Figure 8 maps some research projects on bioenergy in Belgium [11]. In the region of Flanders in the north of Belgium, there is a focus on bio-based value chains from available ligno-based raw materials with projects such as the Flanders Biobased Valley or the Lignin-based Biorefinery. Other projects, such as the BIG-Cluster, collaborate with institutions from other countries. Furthermore, research centers imec and VITO, together with industrial partners Bekaert, Colruyt Group, DEME and John Cockerill undertake research projects related to green hydrogen production [12].

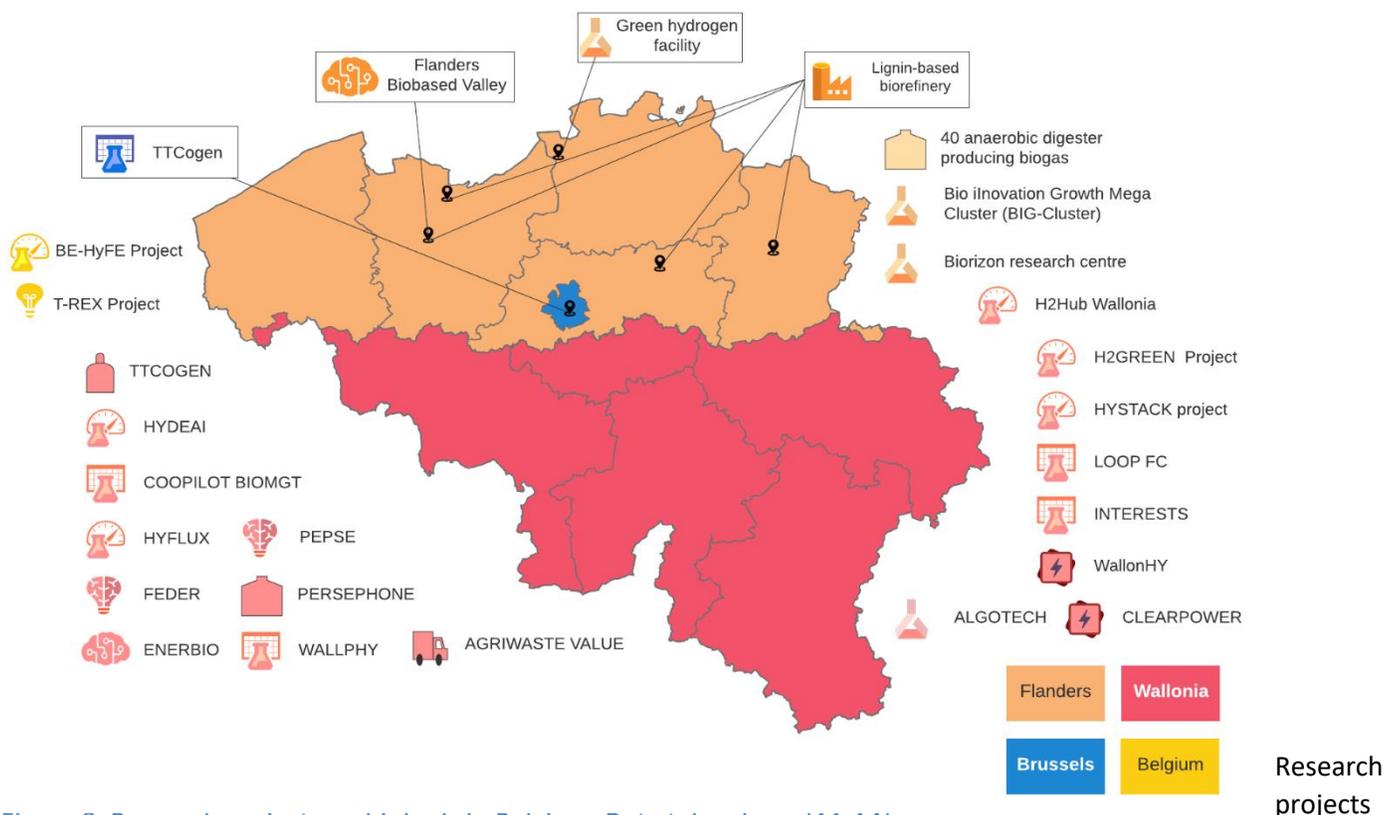


Figure 8. Research projects on biofuels in Belgium. Data taken from [11-14].

in the region of Wallonia include renewable hydrogen generation (H2GREEN, HYSTACK, HYDEAI, HYFLUX, WallonHY, H2Hub Wallonia), waste recovery (LOOP FC, AGRIWASTE VALUE), local renewable energy integration (INTERESTS, TTCOGEN, ENERBIO), microorganism-based biofuel generation (ALGOTECH, PERSEPHONE, COOPILOT BIOMGT), or energy-oriented technologies (OPTI-AGV, CLEARPOWER, PEPSE). In the region of Brussels, the TTCogen project aims to valorize biomass through gasification and cogeneration. As a Belgian-wide collaboration, BE-HyFE is aiming to enhance the expertise in Belgium with regard to addressing key hydrogen challenges, including the transition to green hydrogen [14].

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In the News

Reports and Research

- January- In Illinois, new research from scientists at Argonne National Laboratory suggests that swapping heavy fuel oil with fuels made from wood waste, waste fats, oils, and greases could drastically cut planet-warming emissions from the shipping industry by 40% to 93%. The team also found that cleaner biofuels could be cost-effective after considering credits, like those offered by California's Low Carbon Fuel Standard ([Read more](#)).
- April- In 2010-2019 average annual global greenhouse gas emissions were at their highest levels in human history, but the rate of growth has slowed. Without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5°C is beyond reach. However, there is increasing evidence of climate action, said scientists in the latest Intergovernmental Panel on Climate Change (IPCC) report ([Read more](#)).

Policy and Regulatory Developments

- January- The Food and Agriculture Organization of the United Nations (FAO) and the European Commission's Joint Research Centre (JRC) today launched an important new bioeconomy publication for policymakers in countries and macro-regions. The *Guidance note on monitoring the sustainability of bioeconomy at a country or macro-regional level*, which was commissioned by the International Bioeconomy Forum (IBF) and released to coincide with the IBF plenary meeting on 29-30 November 2021, for the first time describes in easy-to-follow steps how countries and macro-regions, such as the European Union (EU), can monitor sustainability along with their bioeconomy strategies and policies ([Read more](#)).
- February- In Washington, D.C., the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Bioenergy Technologies Office released two new Requests for Information (RFI) around biomass and energy issues, focusing on biomass conversion research, development and analysis and community-scale resource and energy recovery from waste solutions ([Read more](#)).
- February- In Brazil, the environmental minister announced the upcoming Metanol Zero program on national radio that aims to use national banks to transform methane emissions into biofuel. The program is set to launch in 30 days with a focus on MSW and agricultural waste, from livestock to sugarcane. The eventual biogas production is seen as a future fuel for heavy vehicles to offset the country's diesel dependence where domestic logistics is dominated by trucking ([Read more](#)).
- February- In Belgium, the European Commission is considering taxation of fossil fuels and crop-based biofuels at the same rate as part of the revision of the 2003 Energy Taxation Directive in an effort to transition the biofuel supply more quickly away from agricultural feedstocks. With patchwork fixes of the taxation policy since its implementation, anomalies have popped up around the EU, such as in the Visegrad countries where biofuels are currently taxed higher than fossil fuels ([Read more](#)).
- February- In New Zealand, the debate about indirect land use change and the use of food crops as biofuels feedstocks have reared their ugly heads ahead of the country's plan to implement biofuel blending from April 1, 2023. Spooked by pushback received by the European Commission regarding their handling of feedstock sustainability, New Zealand is looking to limit corn-based ethanol and palm oil-based biodiesel. The cap on crop-based biofuels could be 50% but is still under discussion ([Read more](#)).
- March- In Belgium, the Commission published its Communication "REPowerEU: Joint European action for more affordable, secure, and sustainable energy". The Communication aims to support the EU's energy independence by accelerating the deployment of renewables and ensuring the affordability and security of energy supply ([Read more](#)).
- March- In Illinois, Illinois Soybean Growers (ISG) are celebrating the passage of the organization's B20 Legislation, sponsored by State Senator Patrick Joyce (D-Essex). The legislation passed with strong bipartisan support from every

region of Illinois, and it will now move to the Illinois House of Representatives where State Representative Eva Dina Delgado (D–Chicago) will be the lead sponsor ([Read more](#)).

- March- In India, Bloomberg reports Civil Aviation Minister Jyotiraditya Scindia has called on all airlines to quickly adopt sustainable fuels to help transition the aviation industry towards net carbon zero. The minister wants 96 Indian airports to be carbon neutral and powered by renewable energy by 2024 compared to the two that are considered “green” today. IndiGo and SpiceJet are both making moves towards incorporating SAF including securing SAF. Delhi airport is already working to reduce its fuel demand by using semi-robotic vehicles to tow aircraft that save 214,000 liters of fuel annually ([Read more](#)).
- April- The Canadian government awarded funding to several biofuel and bioenergy projects, including those focused on liquid transportation fuels, biocarbon, renewable natural gas (RNG), and sustainable aviation fuel (SAF) ([Read more](#)).
- April- The U.S. EPA on April 12 published a proposed rule approve Renewable Fuel Standard pathways for renewable diesel, jet fuel, heating oil, naphtha, and liquefied petroleum gas (LPG) produced from canola/rapeseed oil via a hydrotreating process ([Read more](#)).
- April- Sens. John Barrasso, R-Wyo., and Dianne Feinstein, D-Calif., on April 7 introduced legislation that aims to improve data reporting for renewable diesel and sustainable aviation fuel (SAF), incentivize their production, and eliminate unnecessary labeling regulations ([Read more](#)).
- May- In Iowa, Gov. Kim Reynolds signed into law HF2128, the Biofuels Bill. This bill was a top priority of hers, which she introduced to the legislature earlier this year and received strong bipartisan support. This historic bill makes Iowa the first state in the nation to adopt an E15 standard and expands access to higher blends of ethanol and biodiesel across the state, lowering fuel prices for consumers ([Read more](#)).
- May- In India, the Union Cabinet, chaired by Prime Minister Shri Narendra Modi, has approved the Amendments to the National Policy on Biofuels -2018. The “National Policy on Biofuels – 2018” was notified by Ministry of Petroleum and Natural Gas on June 4, 2018 in supersession of National Policy on Biofuels, promulgated through the Ministry of New & Renewable Energy, in 2009 ([Read more](#)).
- May- the U.S. Department of Energy announced \$38 million to begin decarbonizing four of DOE’s 17 National Laboratories, including NREL and PNNL, in support of President Biden’s goal to reach net-zero greenhouse gas emissions no later than 2050, with a new Net Zero Labs Pilot initiative ([Read more](#)).

Industry Developments

- January- In Denmark, the Prime Minister announced that she wants all domestic flights to be fossil fuel free by 2030. Although she admitted that it would be a major challenge to achieve, she said Denmark needed to lead the way to push for the energy transition in aviation. Sweden last year announced it also wanted all domestic flights to be fossil fuel free by 2030. There has been “flight shaming” due to the carbon footprint of air travel that the Danish prime minister wants to end, saying that “To travel is to live and therefore we fly” ([Read more](#)).
- January- In Denmark, bp and Maersk Tankers, with support from the Danish Maritime Authority, have successfully completed trials using biofuel-blended marine fuel in product tankers, demonstrating that sustainable biofuels can be used as a marine ‘drop-in fuel’ to help reduce carbon emissions in shipping ([Read more](#)).
- January- the CBH Group partnered with leading dry bulk operator Oldendorff Carriers to conduct the first biofuel trial on a grain vessel exporting from Australia, using biofuel supplied by big name bp. The grain being shipped? ISCC-certified barley going to Intermalt whose largest brewing customer is Heineken. Sustainable grain on a sustainable ship for more sustainable beer ([Read more](#))

- January- In the Netherlands, Spliethoff Group's constant striving to reduce its CO2 emissions has led to two trials using biofuel on its vessels. The first trial took place between June and November last year on BigLift Shipping's HTV BigLift Baffin ([Read more](#)).
- January- In the Netherlands, KLM will start adding 0.5% Sustainable Aviation Fuel (SAF) for flights departing from Amsterdam. In addition, KLM will offer its customers the option of purchasing an extra amount of sustainable fuel. In this manner, KLM aims to stimulate the market for SAF ([Read more](#)).
- February- In California, Aemetis, Inc. has signed an offtake agreement with Japan Airlines for 90 million gallons of blended sustainable aviation fuel to be delivered over the 7-year term of the agreement. The blended sustainable aviation fuel to be supplied under this agreement is 40% SAF and 60% Petroleum Jet A to meet international blending standards ([Read more](#)).
- February- In Washington state, Boeing announced a supply agreement for two million gallons (7.5 million liters) of blended sustainable aviation fuel (SAF) with EPIC Fuels to power its Commercial Airplanes operations in Washington state and South Carolina through 2022. The agreement is the largest announced SAF procurement by an airframer and further demonstrates Boeing's commitment to decarbonizing aviation ([Read more](#)).
- February- In Illinois, LanzaJet has entered into a memorandum of understanding (MOU) with Marquis Sustainable Aviation Fuel to construct a 120 million gallons per year integrated sustainable fuels plant in the U.S. using low-carbon intensity feedstocks to produce SAF and renewable diesel via the LanzaJet™ Alcohol-to-Jet process. The plant will employ on-site carbon capture and sequestration and renewable energy to produce SAF, resulting in a lifecycle greenhouse gas reduction of more than 70% compared to conventional jet fuel ([Read more](#)).
- February- In Germany, it's full speed ahead for Kohler Engines and its commitment to lessen the environmental impact of its engines. The company recently approved use of EN15940- compliant Hydrotreated Vegetable Oils, or HVOs, for all its diesel engines – either pure or as a blend with conventional diesel ([Read more](#)).
- March- Neste has established a 50/50 joint venture with Marathon Petroleum to produce renewable diesel following a conversion project of Marathon's refinery in Martinez, California. Through the JV Neste obtains a 50% interest in the Martinez Renewable Fuels project. The production output will be split evenly between the joint venture partners, and each partner will be responsible to market the products under its own brand and responsibility. The facility will be operated by Marathon, which has long experience as a leading refinery operator and in executing major capex projects in the US. Both Neste and Marathon will be responsible for feedstock sourcing for the joint venture ([Read more](#)).
- March- In Nebraska, Union Pacific Railroad will begin using a higher biodiesel blend in locomotives it acquired from Wabtec. The new collaboration helps Union Pacific as it works to increase the percentage of low-carbon fuels consumed to 10% of its total diesel consumption by 2025 and 20% by 2030 ([Read more](#)).
- March- In France, TotalEnergies' Normandy platform has successfully started production of sustainable aviation fuel (SAF). This new site complements the biojet fuel production capacities of La Mède biorefinery (Bouches-du-Rhône) and the Oudalle plant (Seine-Maritime) ([Read more](#)).
- March- In the UK, DB Cargo UK has successfully trialed the use of 100% renewable Hydro-treated Vegetable Oil (HVO) as it continues to look for new and innovative ways to power its fleet and decarbonize its operations ([Read more](#)).
- March- In Singapore, Anglo American has successfully completed a sea trial using biofuel blended with very low sulfur fuel oil (VLSFO), reducing carbon emissions by approximately 10%. The trial further demonstrates the potential for sustainable biofuel to be used as a 'drop-in' fuel, improving its viability to help reduce emissions in the shipping sector. The fuel was blended and bunkered in Singapore, marking an important step in establishing a local supply chain and a cost-efficient, low-carbon biofuel offer for the region ([Read more](#)).

- March- In California, through its Sustainability Fund, Shopify has committed buy \$2.5 million worth of Twelve's E-Jet fuel. Through this first-of-its-kind agreement, Shopify's purchase of E-Jet will support Twelve as it scales, accelerate future adoption by commercial airlines and freight carriers, and help bring more E-Jet to market. Shopify is supporting nine new entrepreneurial, tech-driven companies through our Sustainability Fund, bringing its total carbon removal purchase commitment to \$32 million ([Read more](#)).
- April- In Denmark, NORDEN has launched a 100% carbon-neutral biofuel sailing option for customers looking to decarbonize their supply chains. The biofuel sailing is the first in a range of green freight products to be rolled out to customers this year as part of NORDEN's transition to zero-carbon shipping by 2050. NORDEN has secured supply of biofuel made from waste cooking oil and is in discussion with several customers over the first carbon-neutral freight contract ([Read more](#)).
- April- In Japan, Mitsui O.S.K. Lines, Ltd., its wholly-owned company MOL Chemical Tankers Pte. Ltd., leading commodity trading company Trafigura Pte Ltd., and its vessel fuel supply joint-venture company TFG Marine Pte Ltd, have signed a Memorandum of Understanding this month. The MOU is for a joint study on the full-scale supply of biodiesel fuel (BDF) for MOLCT-operated vessels in bunkering ports around the world. Based on the MOU, the companies will move forward with the study, with the intention to establish a global supply of BDF for MOLCT's operated fleet ([Read more](#)).
- April- In Sweden, as part of the strategy to switch to large-scale renewable fuel production, Preem will sign a \$308.7 million loan agreement with Swedish Export Credit Corporation (SEK). The loan is covered by the Swedish National Debt Office's program for green credit guarantees ([Read more](#)).
- April- In the Netherlands, Ryanair announced a partnership with Neste to power approximately a third of its flights at Amsterdam Airport Schiphol (AMS) with a 40% SAF blend. This blend will reduce greenhouse gas emissions by over 60%, supporting Ryanair's Pathway to Net Zero by 2050 decarbonization goals. Ryanair has already significantly advanced this commitment by partnering with Trinity College Dublin to open the Ryanair Sustainable Aviation Research Centre and investing \$22 billion in its 'Gamechanger' fleet, which offers 4% more seats but are 16% more fuel & CO2 efficient and reduce noise emissions by 40% ([Read more](#)).
- April- Bunge and CoverCress Inc. announced a unique commercial partnership to bring a new renewable oilseed and animal feed crop to market. The agreement establishes a long-term commercial relationship between the two companies and supports the expansion of CCI's CoverCress technology, a new winter oilseed crop that is ideal as a lower carbon intensity feedstock to help meet the growing demand for renewable fuels ([Read more](#)).
- May- In California, Air Products is teaming up with World Energy to build a new \$2 billion major expansion project at World Energy's Sustainable Aviation Fuel (SAF) production and distribution hub in Paramount, California. The LA county facility is the world's first commercial scale and North America's only SAF production facility and its total fuel capacity will be expanded to 340 million gallons annually ([Read more](#)).
- May- In Iowa, on the occasion of the official opening ceremony on May 6th, VERBIO CEO Claus Sauter said in front of the attending state Governor Kim Reynolds and other representatives from politics and business: "The plant in Nevada (Iowa) is our first plant in the USA. Until summer 2022, we will achieve full-scale production. Then we will process up to 100,000 tons of corn stover into renewable natural gas (RNG) every year and make it available for the market as a climate-friendly, renewable biofuel ([Read more](#)).
- May- Together with its partner Nordic Marine Oil, Neste is piloting a new Neste Marine™ 0.1 co-processed marine fuel in Scandinavia – a solution helping the maritime sector to reduce greenhouse gas (GHG) emissions. The ISCC PLUS certified marine fuel enables up to 80% GHG emission reduction over the life cycle compared to fossil fuels without compromising the product quality and performance ([Read more](#)).

- May- In Singapore, GoodFuels and ITOCHU Corporation announced a new partnership agreement to scale sustainable marine biofuel in Singapore, Japan, and Asia-Pacific. The long-term partnership, which was signed on 12 May 2022, will combine GoodFuels' deep expertise in sustainable biofuels, extensive client and sourcing portfolio, and strong sustainable impact brand with ITOCHU's mature trading and supply operations and developed client base. Under the partnership, GoodFuels will be mainly responsible for sourcing, production, technical expertise, and brand marketing whilst ITOCHU will be responsible for logistics, blending, and distribution. Both parties will share responsibilities in sales and marketing and work jointly towards scaling capabilities in production and sourcing ([Read more](#)).
- May- A team of energy industry companies led by SGP BioEnergy is joining the Government of Panama to develop the world's largest biofuels production and distribution hub. Once complete in five years, Biorefineria Ciudad Dorada (Golden City Biorefinery), located in Colon and Balboa, Panama, will be the largest advanced biorefinery and Sustainable Aviation Fuel (SAF) production platform in the world producing 180,000 barrels per day (2.6 billion gallons per year) of biofuel ([Read more](#)).
- May- In the UK, Rolls-Royce has taken a significant step towards meeting its net zero goals, set out last year, with the approval by Power Systems of its Series 4000 and Series 1600 diesel engines for use with a range of EN15940-certified synthetic diesel fuels in power generation applications. Following successful testing, including in the field, both types of engines can use a range of sustainable fuels including Biomass to Liquid (BtL), Hydrotreated Vegetable Oil (HVO) and Power to Liquid (PtL) fuels such as e-diesel. They can all be used to replace conventional diesel fuel ([Read more](#)).
- May- In Germany, the Handelsblatt newspaper said that Verbio could be looking at refurbishing the PCK Schwedt refinery in eastern Germany into biofuel production, a facility that Alcmene Group is trying to take over, although neither company commented on the report. The facility, majority owned by Russian energy company Rosneft, is reliant on imports of Russian oil it receives via pipeline from Poland. Part of Verbio's plans could include expanding biogas activities in the area to help decarbonize the refinery in the long run ([Read more](#)).
- June- In Romania, Renewables Now reports that Clariant has opened its \$150 million cellulosic ethanol plant in Dolj. Feedstock contracts have been signed with more than 300 local farmers to secure the required 250,000 metric tons of straw required annually. The facility will produce 50,000 metric tons of cellulosic ethanol annually. Production was last expected to start in Q4 2021 following the start of construction in 2018. The project has received about \$43 million in funding from the European Union ([Read more](#)).

Upcoming Meetings, Conferences & Webinars

Advanced Biofuels Conference, 13-15 September 2022, Stockholm, Sweden

www.advancedbiofuelsconference.org

The ABC event is back on the road again. Energy security and security of supply are high on the international agenda. Biofuels have reemerged as one of the available now-alternatives to address both short-term fuel shortages, and medium-term greenhouse gas reduction. This conference gathers leading actors and stakeholders in the global biofuels industry. It will bring two conference days, six sessions and some 30 plus high-level speakers covering all modes of transport for drop-in and high-concentrated biofuels. Delegates includes policymakers, politicians, business executives, developers, researchers & engineers and stakeholders. There will be a pre-conference study visit to the novel PyroCell plant, a state-of-the-art facility that converts sawdust into a biocrude that is used as a refinery co-processing feedstock to produce renewable motor fuel, and potentially sustainable aviation fuel (SAF). In addition, there will be a roll-up tabletop mini-expo with technology providers for business networking rounded off by an exclusive conference dinner evening.

Task 39 is scheduled for several presentations of projects and reports at the international biofuels conference in Stockholm.

Argus Biofuels Europe Conference, 11 October - 13 October 2022, London, UK & Online Access

<https://www.argusmedia.com/en/conferences-events-listing/biofuels>

The Argus Biofuels Europe Conference returns to London in-person at the Hilton London Bankside and online on 11-13 October 2022. The event will bring together the biofuels industry to gain insight from industry leaders into the latest impacts of geopolitical tensions on biofuels markets. The event will also show the evolving landscape for policy in the EU, how biofuels will continue to play a role in the energy transition with feedstock availability. The event will start with a SAF Focus Day for developments on regulation, global SAF supply and demand and alternative technology pathways.

Upcoming IEA Bioenergy Task 39 Meeting, 13-15 September 2022, Stockholm, Sweden

Task 39 will likely hold its first face-face business meeting since the COVID-19 outbreak in 2020 in conjunction with Advanced Biofuels Conference, which is held on 13-15 September 2022, Stockholm, Sweden. The expected focus of the meeting will be on the approved Program of Work and Task projects for the 2022-2024 triennium as well as a study visit to PyroCell plant in Gävlebay area. Please [contact us](#) for more detailed information about the Task's evolving plans for its future business meetings.