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

Inside this Issue

From the Task

By Mahmood Ebadian, Jim McMillan and Jack Saddler

Since publishing our last Newsletter in June 2020, IEA Bioenergy Task 39 has continued its work to advance the commercialization of sustainable, lower-carbon intensive biofuels to decarbonize the multi-faceted transport sector, particularly long-distance transport segments (i.e., marine, aviation, rail and trucking) where electrification is more challenging.

Task 39 Business Virtual Meeting in June 2020

The second Task 39 business meeting of 2020 was held on June 23, virtually using Zoom. The meeting's main purpose was to review and discuss active projects; to provide a forum for Task 39 members to share questions, thoughts and ideas regarding the scope, objectives and methodology of each project as well as its budget allocation. Project leaders presented progress updates and described next steps to seed these discussions; a listing of Task 39's projects for the 2019-2021 triennium is provided in the previous issue of this newsletter (link).

The group was excited to have India's newly appointed country representative, Mr. Ravi P. Gupta, General Manager of Bioenergy Research Centre at the Indian Oil Corporation joining the meeting despite the difficult time zone challenges.

Despite the COVID-19 pandemic disrupting global supply chains and economies, the long-distance transport sector continues to play a vital role in maintaining the delivery of essential goods and services (e.g., medical supplies, food, energy, etc.). However, economic challenges created by the pandemic are compounded by the mounting urgency to mitigate increasing climate disruption. Many national governments that have proposed and developed economic recovery packages are pursuing strategies that include reducing the energy demand and carbon intensity of their future economies.

Task 39 also continues to actively organize and participate in virtual webinars and conferences to share their insights on how decarbonization of the transport sector can contribute to a "green economic recovery".

Crystal Ball Gazing Panel Webinar with Canada's BC SMART Biofuels Consortium

The BC-SMART Biofuels Consortium and IEA Bioenergy Task 39 are fortunate to be involved in a "coalition-of-the-willing" of industry, government and academic stakeholders who are committed to decarbonizing transport, especially long-distance transport. Leveraging this network, on 30 June, 2020, jointly with the BC-SMART Biofuels Consortium, Task 39 hosted a panel webinar entitled, **"Crystal ball gazing: How do we decarbonise long distance transport during/after COVID-19?"**.

Image Source: esf.edu.com

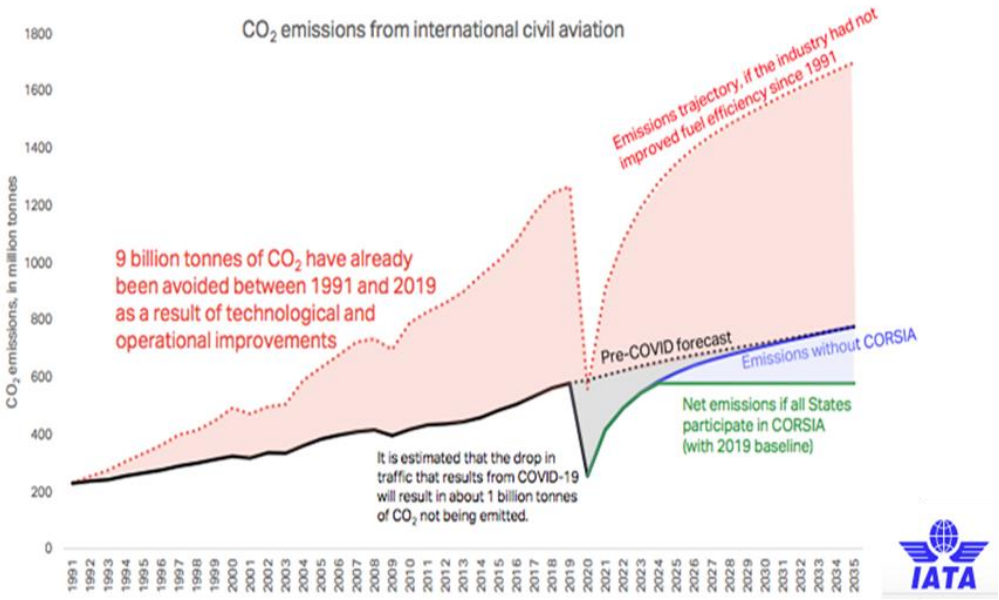
Image Source: Canola Council of Canada

We welcome your feedback. Please direct your comments to Mahmood Ebadian

Invited panel members included representatives of the oil refining, aviation, marine, rail/trucking and feedstock sectors. The purpose of this panel discussion webinar was to provide an update on the status of the long-distance transport sector during the COVID-19 pandemic and to prognosticate what things will look like on the other side of the pandemic. Panel members were asked to gaze into their figurative crystal balls and speculate what the future might hold for their sectors. Using Canada as an example, panel members discussed how the long-distance transport sector could be decarbonized while simultaneously driving national and international economic recovery and growth. Panel members collectively agreed that the greening of the long distance transport sector needs to be an integral part of the low-carbon economic recovery.

About 180 participants attended the webinar, mainly from North America, South America and Europe. A recording of the webinar and the presentation slides are posted on Task 39's website (link).

A summary of the webinar's takeaways is available on BC SMART's website (link).



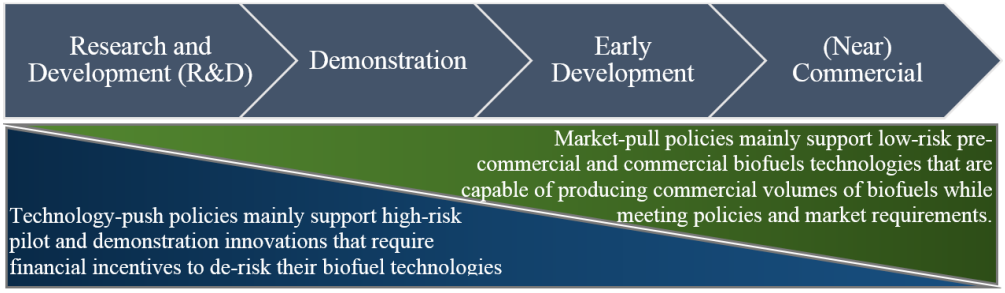
CO_2 emissions from international civil aviation, before and after COVID-19 pandemic, as presented at the virtual panel webinar: "Crystal ball gazing: How do we decarbonise long distance transport during/after COVID-19" held on 30 June, 2020.

e-EUBCE 2020

In July 2020, Dina Bacovsky, Austria's representative to Task 39, presented on "The contribution of advanced renewable transport fuels to transport decarbonization in 2030 and beyond" in the virtual EUBCE 2020 session "IBO.8 - Strategies and Initiatives". The main message was that assessments clearly show that all available options – including biofuels, electric vehicles, and efficiency gains in internal combustion engines – will have to be applied in order to reach future decarbonisation targets. Measures to decarbonize the transport sector have to include a transport efficient society, efficient vehicles, and renewable energy carriers. It takes around 20 years to completely renew the passenger car fleet, and thus the uptake of new vehicles alone will not be sufficient to reach ambitious future decarbonization targets. Further policy measures are needed, and it is important that they are widely accepted. This contribution will also be published as paper in the Elsevier journal, "Biomass and Bioenergy".

Recent publications, progress and information dissemination activities (June-September 2020)

In September 2020, Task 39's peer-review manuscript entitled, "Biofuels policies that have encouraged their production and use: An international perspective", was published in the *Energy Policy* Journal. This manuscript summarizes the policies currently used to promote the greater production and use of biofuels in Task 39 member countries as well as India (which has since become a member of Task 39) and China. This manuscript is published open access and can be viewed or downloaded here (link):



Technology-push and market-pull biofuel policies assessed in Task 39's implementation agendas report and discussed in the recently published Energy Policy journal article. Countries that use a mixture of market-pull and technology-push policy instruments have been most successful at increasing biofuels production and use and also at developing and deploying less mature advanced biofuels production technologies.

Updating Task 39's demonstration plants database

Task 39's global pilot and demonstration biofuels production plants database is maintained by Austria's BEST – Bioenergy and Sustainable Technologies GmbH organization. Technologies covered include gasification, fermentation, hydrotreatment, fast pyrolysis, hydrothermal liquefaction and lignin depolymerisation. This database was recently updated, with information on all European facilities (121) verified and updated. There are now 226 currently active entries. This database can be accessed via Task 39's website or here (link).

Snaphot of Task 39's online demonstration plants database

In closing, we are grateful to Tomas Ekbom, Sweden's representative to Task 39, and his colleague, Cecilia Higa, for co-authoring this newsletter's feature article on biofuels-related developments in Sweden.

As always, we appreciate your readership and value your input and feedback. Please email us any ideas or suggestions for increasing this newsletter's value.

Thanks for reading and participating in the IEA Bioenergy Task 39 network.

Mahmood, Jim, and Jack

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Sweden targets world's highest biofuel blending

Tomas Ekbom and Cecilia Higa (Swedish Bioenergy Association)

1 Driving a low-carbon society

1.1 In the beginning there was ethanol

In 1907, there were only 662 vehicles registered in Sweden. The fuel, "Benzin" (the word initially taken from the German language, i.e. petrol) was purchased then at the pharmacy, paint store or chemical store. With the improvement of roads in the 1920s and engines becoming more reliable, special stores – fuelling stations – started selling petrol. A mixture of 25% petrol and 75% ethanol, what would today be called "E75", was sold from the 1920s onwards under the product name Bentyl. The rationale was foremost to reduce dependence on imported petroleum.

Ethanol was a readily available domestic raw material then, a so-called sulphite spirit by-product from the Swedish pulp industry. The wood pulp plant Domsjö Fabriker in Örnsköldsvik still produces fuel ethanol and has over a century of experience with biofuel. Motor gas as it was then called, i.e., petrol with a high content of ethanol, was sold for many decades, even into the 1950s. Oil then became much cheaper and the use of fuel ethanol diminished until the oil crises in the 1970s, when interest in alternative fuels was rekindled and became widespread.

Fuel ethanol for transport however returned in 1984 when the oil company OK introduced E4 as a new petrol and marketed it with commercials focusing on the environment. The ethanol was purchased from a plant in Lidköping, and this E4 fuel became the world's first blended petrol fuel partly based on grain. Other petrol companies followed suit and ethanol blended petrol became widely available. Then, in 1997, also as the first petrol company to do so, OK introduced E10 and like before the other companies followed suit. However, because of EU regulations and taxes, in 2000 the ethanol blending was lowered to E5. From 2004, almost all petrol 95 sold in Sweden has been E5. Blending of biodiesel (rapeseed methyl ester, RME) in diesel as B2 was introduced in 2005, and raised to B5 in 2006, and then in 2011 increased to B7 in accordance with changed fuel standards.

1.2 Pure biofuels changing the market

The first commercial introduction of a pure biofuel in Sweden was in 1986, with ED95 (also called Etamax Diesel) containing 95% ethanol and an ignition improver introduced as a new fuel for heavy-duty diesel engines, mainly for use in the municipal bus transport sector. This was followed by introducing E85 fuel for passenger fuel-flexible vehicles (FFV) in 1994, with widespread sales of FFV cars and E85 fuel in a nation-wide distribution network available at a large share of fuelling stations. The use of E85 in FFVs became a huge success and a breakthrough for both sales of environmental-friendly cars (which initiated a new classification of vehicles) and of alternative, renewable fuels for the private consumer at a large-scale.

During the 1990s, there was also market introduction of biogas for transport with a mix of biomethane and compressed natural gas (CNG), bio-CNG, together with RME as B100 for both passenger cars and heavy transport. Thus, the journey for biofuels in Sweden started over 100 years ago and has become increasingly important since 1995 when the government began giving biofuels tax exemptions. After the mid-2000s, consumption of biofuels in Sweden started increasing significantly, as shown in Figure 1. This strong development and deployment was enabled by the full tax exemption of biofuels as well as economic incentives and other benefits for owners and drivers of environmental-friendly cars.

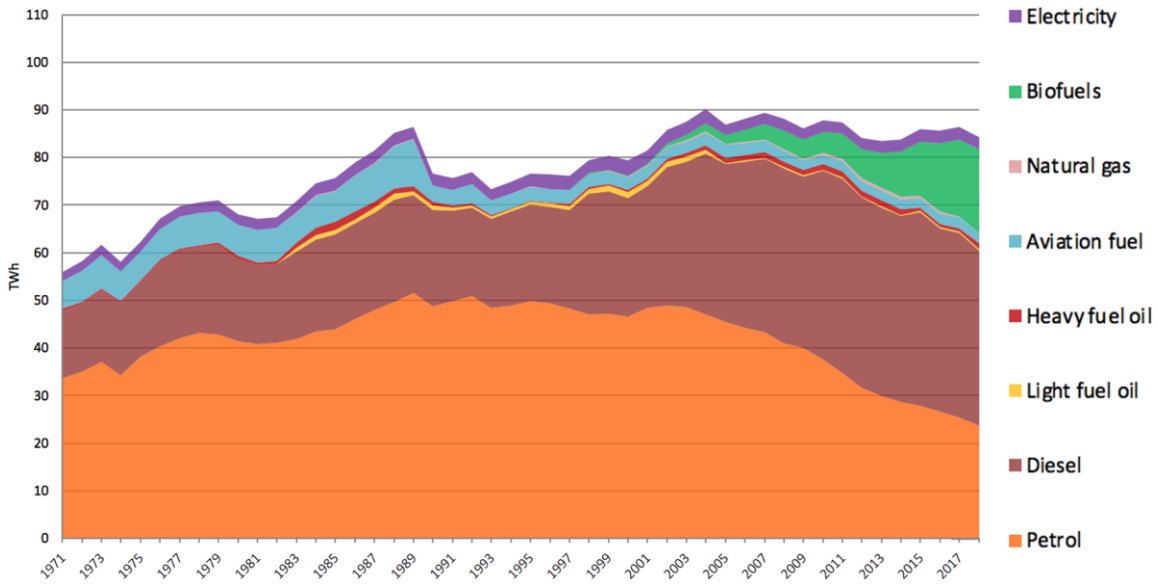

Figure 1. Final energy use in Sweden's transport sector, from 1971 to 2018 (TWh). References: Swedish Energy Agency and SCB, 2020.

Although petroleum products (e.g., petrol and diesel) accounted for 75% of Sweden's energy use in the transport sector in 2017, the proportion of biofuels in the transport fuels mix has also increased substantially during the last few years. According to the Swedish Energy Agency, in 2017 road transport represented 94% of Sweden's final domestic transport sector energy use, followed by rail transport (3%), aviation (2.5%) and shipping (0.4%). Additionally, there is a clear trend in increasing utilization of biofuels in transport, particularly of biodiesel, as Figure 2 shows.

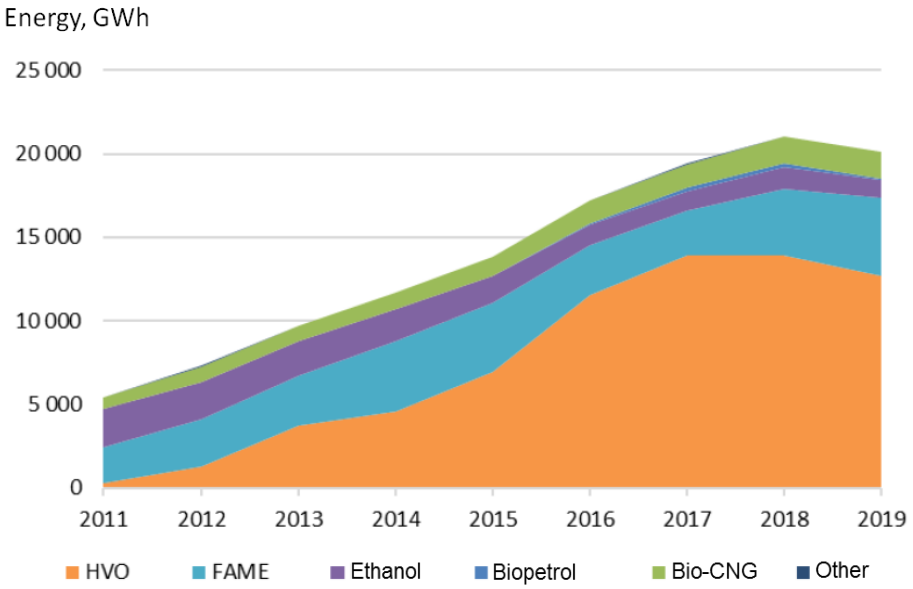

Figure 2. The use of biofuels within Sweden's transport sector, from 2011 to 2019 (GWh). Reference: Swedish Energy Agency, 2020.

Biodiesel is sold in the market as low-blend RME and pure RME (termed RME100 or B100) and as low-blend hydrotreated vegetable oil (HVO) [also known as renewable diesel] and pure HVO (termed HVO100). In 2018, the RME share was 24% of total biodiesel use. By energy, biofuels use totalled almost 20 TWh in 2019, representing 21.8% of

the road transport sector's total energy use.

The European Union (EU) adopted the Renewable Energy Directive in 2009 (2009/28/EC), which had a goal to reach a 20% share of gross final energy consumption from renewables by 2020. Each Member State designed its own national action plans to reach this goal. All EU countries must also ensure that at least 10% of their transport fuels come from renewables by 2020.

In December 2018, the EU's recast Renewable Energy Directive (2018/2001/EU) entered into force, as part of the Clean Energy for All Europeans package, helping the EU to meet its emissions reduction commitments under the Paris Agreement. The recast directive, RED II, extends the legal framework to 2030 and sets a new binding renewable energy target for the EU for 2030 of at least 32%. This includes an increased 14% target for the share of renewable fuels in transport by 2030, including multipliers, and also an advanced biofuels quota.

Biofuels markets are largely affected by political decisions within the power spheres at the national (Sweden) and international levels (EU). Since the 1970s, diverse political driving forces have been affecting this market, including:

- The lowering of dependence on oil exports, mainly after the 1970s oil price shocks,
- The promotion of the bioenergy sector and the consequent generation of employment and better economic well-being within this sector,
- The decreasing of greenhouse gas (GHG) emissions from the transport sector.

Additionally, as biofuels markets are international, changes in individual neighbouring countries or other world regions also affect Sweden's biofuels markets. Within the EU, Sweden has the largest share of biofuels in the transport segment, according to RED calculation rules (based on energy content). This high share derives from the growing utilization of both low and high-blend (neat) biofuels in Sweden. In addition, the utilization of biogas-derived biomethane in the automotive segment is also growing more rapidly in Sweden than in other EU countries.

1.3 CO_2 emissions from the transport sector

One third of Sweden's national GHG emissions originate from domestic transport. Additionally, 95% of the emissions from this segment come from domestic transport. When excluding domestic flights, road transport represents 98% of the emissions. Specifically, passenger cars represent two-thirds of road traffic emissions, light trucks comprise just under 10%, heavy trucks approximately 20%, and other vehicles about 5%.

2 Production of biofuels

The use of bioenergy in the Swedish energy system has increased steadily over the years. In 1983, bioenergy accounted for 15% or 52 TWh of total energy use. In 2018, the use of bioenergy had increased to 141 TWh, which corresponded to 38% of the total energy use. Bioenergy is now the largest energy source. Total growth of biomass (round wood) is 436 TWh per year. In addition, forest growth increases 1% annually, or 4 TWh. In addition to the forest sector, the agriculture sector produces 74 TWh (harvested products and wastes).

Four Swedish governmental authorities published in 2017 a report called "Bioenergi på rätt sätt" (Bioenergy in the right way), which projected a national bioenergy potential of 170-180 TWh in the short-term and 220-240 TWh per year for the longer-term[1]. The estimated potential of wood-based biofuels (calculating with conversion factors) is 20-30 TWh in the short-term and about 50 TWh in the longer term (depending on many factors, like demand in other sectors).

In order to make use of this vast potential to produce more Swedish biofuels, market demand and long-term steering

[1] https://www.skogsstyrelsen.se/globalassets/om-oss/publikationer/2017/rapport-201710-bioenergi-pa-ratt-satt.pdf

instruments (policy) are necessary. A bio-based circular economy (or bio-economy) will develop with bioenergy. While there is substantial research in Sweden on wood-based biofuels, the main production is grain-based ethanol and conventional RME biodiesel and more lately renewable diesel (HVO).

Future plans for new production plants in Sweden are focussed on achieving very large capacities for HVO production and virtually no expansion of ethanol or RME. The most ambitious targets are for Preem to be producing 5 million tonnes of HVO products by 2030. This is increased from an original 3 million tonnes because of a transition and capacity expansion to use renewable hydrogen for its increased biofuel production.

Examples of selected, current biofuel plants in operation and under construction or in development are shown in Figure 3. Of these, the plants black text are plants with firm investment decisions whereas the others are in the planning stage. The latest plant coming on-line is Södra's biomethanol plant in Mönsterås with start up in October.

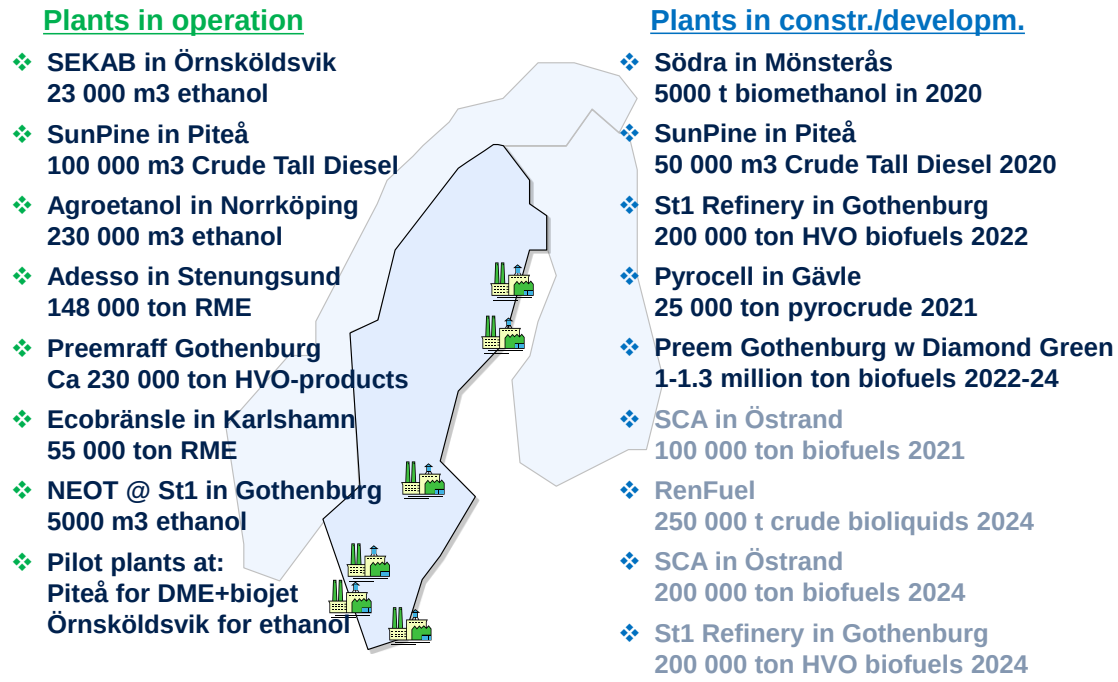

Figure 3. Selected biofuel plants in Sweden.

3 The Biodiesel Market

There are two types of biodiesel in the Swedish market – HVO (Hydrogenated Vegetable Oil, also called renewable diesel) and FAME (Fatty Acid Methyl Ester).

HVO biodiesel is produced in an integrated process in petroleum refineries and is a biofuel that is fully fungible with traditional fossil fuel-based diesel. Although HVO generally is produced from various types of oilseeds and fats, tall oil – a by-product from the forest industry – is mostly used as the feedstock for HVO production in Sweden.

FAME biodiesel is produced from diverse types of oilseed feedstocks (e.g., rapeseed, sunflower,

soybean and palm oils). It can be also produced from animal fats, vegetable and animal waste oils.

Since HVO is structured similarly to fossil diesel, it behaves the same way in an engine. Additionally, some of HVO's advantages are related to its distribution and refuelling infrastructure not requiring additional investments. HVO can be produced in oil refineries thanks to the refining processes present, like hydrogenation. However, a refinery may require additional investments to develop HVO production capacity. The main feedstock sources used in the HVO consumed in Sweden in 2017 are shown in Figure 4. Since 2017, rapeseed and CTO have diminished as materials used for HVO.

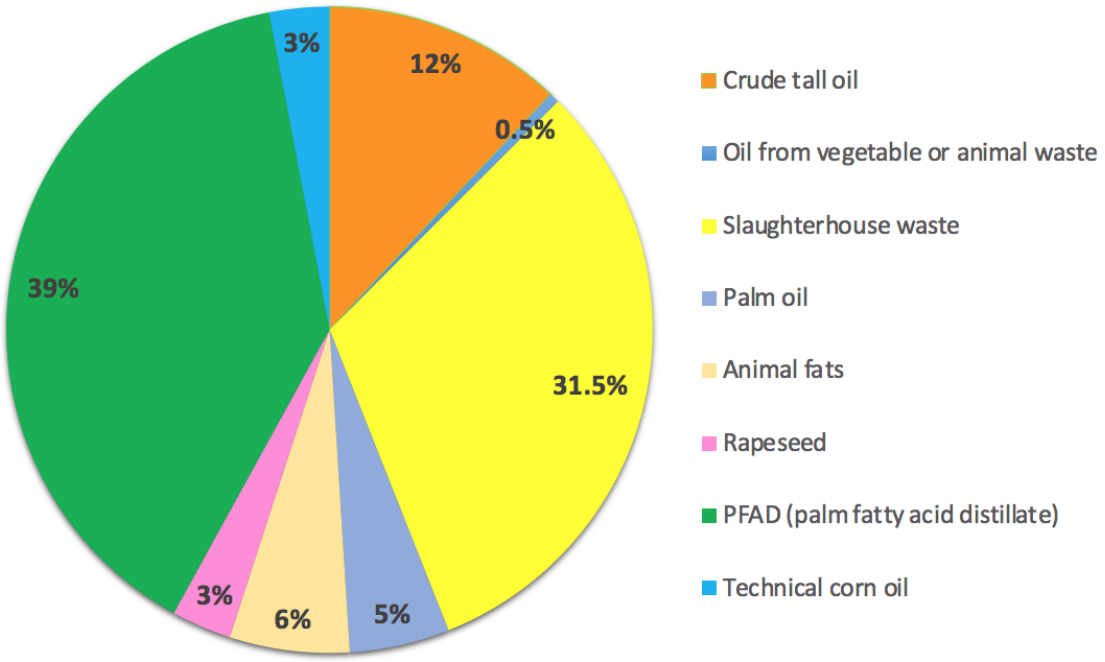

Figure 4. Raw material used in HVO consumed in Sweden in 2017, by volume.
Reference: Swedish Energy Agency, 2019.

For FAME biodiesel production in Sweden, rapeseed oil is the most common feedstock. Rapeseed-based Methyl Ester (RME) biodiesel is produced through a chemical process in which rapeseed oil is reacted with methanol to form RME, with glycerol also produced as a by-product. Methanol either can be fossil origin or produced from biomass. In cases where the methanol is fossil, the RME product is not 100% renewable-based and the climate reduction thus lower.

3.1 Important HVO market actors

There are two major HVO producers supplying the Swedish market today – Preem and Neste. HVO from Preem has been on the Swedish market since 2011 and for Neste since 2012 (although Neste has no production plants in Sweden, only storage facilities). A third company, Colabitoil, develops HVO and has built a small pilot plant for its proprietary hydrogenation technology. A fourth company, the large energy company St1, is building a large HVO production plant in Gothenburg intended to produce 200,000 tonnes of products per year, starting in 2022.

Preem is the largest fuel company in Sweden, with fuel production accounting for 80% of its refining capacity. Preem has two modern refineries, one in Gothenburg and another in Lysekil. Its combined refining capacity annually generates more than 18 million m^3 of crude oil products. The share for export is very high (65-75%), with the important domestic market comprised mainly of petrol, diesel, heating oil and renewable fuels to industries and consumers.

Preem produces HVO from crude tall diesel supplied by SunPine which in turn processes and refines crude tall oil (CTO, a residual product from the chemical pulp industry). Crude tall oil is processed to crude tall diesel in two steps in the SunPine plant in Piteå, and then transported to Gothenburg, where it is further processed in the Preem oil refinery. SunPine is jointly owned by Preem, Södra forest owners, Sveaskog, Lawter and Kiram and has a production capacity of about 100,000 m^3 of crude tall diesel per year.
Neste produces HVO from many raw materials, e.g. ranging palm oil to waste oils and animal fats. In Finland, Neste operates at the Porvoo refinery and has other production plants mainly in Singapore and the Netherlands.

3.2 Important FAME market actors

There are two major companies producing FAME biodiesel for the Swedish market at a large scale – Adesso BioProducts AB located in Stenungsund and Energifabriken (formerly Ecobränsle) in Karlshamn. Additionally, there are a number of smaller companies in the agricultural sector producing small amounts of FAME biodiesel in Sweden.

In Adesso's plant in Stenungsund, the annual production capacity is about 148,000 m^3. Adesso produces a 100% renewable FAME product called Verdi Polaris Aura using a bio-based methanol. The methanol is purchased from BioMCN in the Netherlands and is in reality based on natural gas, however BioMCN purchases equivalent amounts of biogas to substitute for the energy used for methanol production which makes it virtually renewable based. From 2010 to 2014 BioMCN produced methanol from the glycerol by-product from FAME production, but subsequently halted this production due to alkali-salt problems.

The Energifabriken production plant in Karlshamn has an annual production capacity of about 55,000 m^3. Plans were discussed to double this plant's capacity, however put on hold because of weakening market conditions (increased taxes on FAME, on-going lower fossil fuel prices and growing competition from HVO).

In addition to domestic production, an important amount of FAME used in Sweden is imported from Germany and Lithuania, among other countries. Figure 5 summarizes Sweden's main imports of FAME biodiesel fuel in 2018.

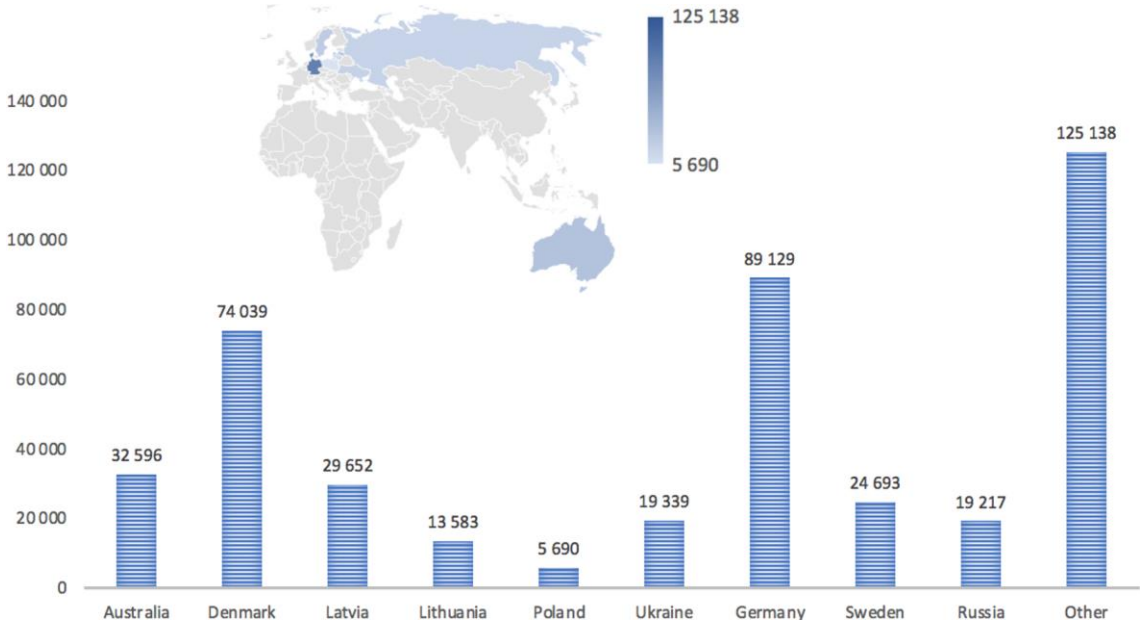

Figure 5. FAME biodiesel used in Sweden in 2018, by country of origin and volume (m^3). Reference: Swedish Energy Agency, 2020.

4 The Ethanol and Biogas Markets

Ethanol in Sweden is blended in all 95 and 98 octane petrol and sold as high-blend E85 (85% ethanol in petrol) and ED95 (95% ethanol with 5% ignition improvers).

Biogas produced and sold for the transport sector in Sweden is called *Fordonsgas*. Mainly the anaerobic digestion process is used and the raw biogas contains methane and CO_2 and a smaller share of sulphur compounds. Upgrading and compressing produces a gaseous vehicle fuel, Bio-CNG, that contains at least 98% methane by volume.

4.1 Important ethanol market actors

There are three main producers of fuel ethanol in Sweden – Lantmännen Agroetanol, Domsjö Fabriker and St1. Lantmännen Agroetanol is located in Norrköping and has a capacity of 230,000 m^3 per year. Domsjö Fabriker is in Örnsköldsvik and has an annual capacity of 23,000 m^3. St1 is a large Nordic energy group headquartered in Finland, which in Sweden owns an oil refinery and operates large chain of fuel stations, with E85 forming an important part of the fuel products.

Since 2007, St1 has operated a food-waste-based ethanol plant and demonstrated cellulosic-based ethanol production in Finland. In 2015, a bakery-waste ethanol plant of 5,000 m^3 annual capacity was started at the refinery in Gothenburg. However, the general plan for the future is to increase HVO production, with a current 200,000 ton HVO plant investment underway and project development started for a second plant of equal size.
In addition to these ethanol production facilities, SEKAB's E-Technology has a small pilot plant for ethanol from wood technology in Örnsköldsvik; the process technology is called CelluTech™ and fractionates biomass into bioethanol, biogas and solid fuel products. The plant operates in campaigns and has from time to time been idle. However, with new projects to develop new products underway, this plant's activity is now high.

Lantmännen Agroetanol produces ethanol by fermenting grain, which largely comes from Swedish farmers. This company is also working to expand its raw material base further to include straw and sawdust. To improve the climate performance (lower the carbon intensity) of its ethanol, a cooperation has been initiated with Linde Gas, in which CO_2 from ethanol production is converted into carbonic acid within Linde's facility adjacent to Lantmännen Agroetanol. Most of Lantmännen's ethanol is exported to Germany for blending at low levels in petrol. Some is also sold for producing E85 and ED95 used in Sweden.

The ethanol from Domsjö Fabriker is sold to SEKAB, which distributes it as both technical grade ethanol and fuel ethanol. The raw material used is sugar-rich black liquor from the sulphite pulp mill. This ethanol is mostly sold to Finland, where it can be double-counted in the country's obligation schemes. Some is also sold in Sweden as ED95.
In addition to its own production, Sweden also imports a large amount of ethanol. Figure 6 summarizes the ethanol used in Sweden in 2018 by country of origin.

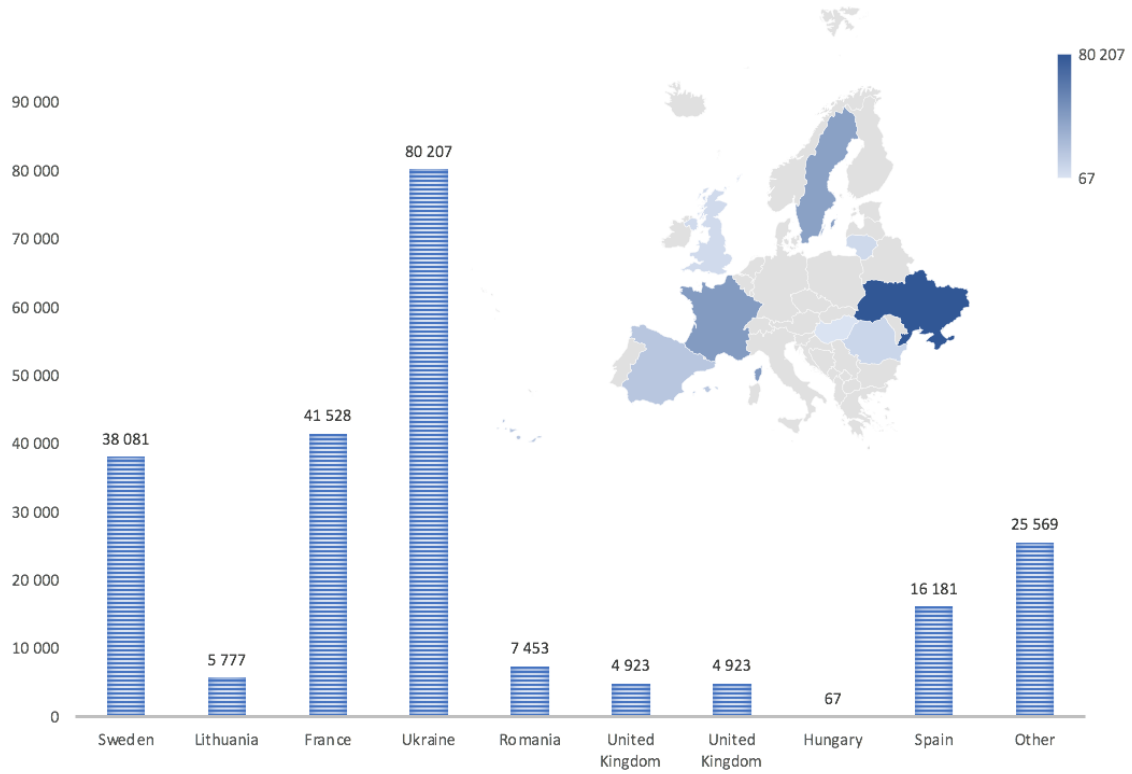

Figure 6. Ethanol used in Sweden in 2018, by country of origin and volume (m^3). Reference: Swedish Energy Agency, 2020.

4.2 Important biogas market actors

In the early 1990s, *Fordonsgas* (methane-rich gas for transport) was introduced on to the Swedish market. As a substantial number of biogas production plants were being built in Sweden in the mid-1990s, the market possibility became evident to upgrade raw biogas for use as fuel in the transport sector (generic name: bio-CNG). By 2014, Sweden was producing about 1.8 TWh of biogas from a total of 277 production plants, with 57% of this biogas upgraded to Fordonsgas in comparison to 24% used for heating, 4% for industrial purposes, 3% for power production and 11% flared.

From 1996, fuel statistics have included biogas used as transport fuel, i.e. Fordonsgas. However, as production and distribution was not steady and could not meet the full demand, fossil-CNG was mixed with bio-CNG. Consumption of Fordonsgas has since gradually increased but remained at low levels. On the other hand, the renewable proportion to fossil has increased dramatically last years. The share of bio-CNG exceeded that of fossil-CNG in 2008 and constitutes now more than 90%.

Pure bio-CNG which is 100% renewable based is available and also with contracts. Since 2014, the company E.ON has had a clearing system in place to ensure that purchases comply with contracted volumes over time. E.ON offers two biogas transport fuel products with corresponding renewable percentages – Biogas 50 and Biogas 100. At the end of 2014, there were 155 public filling stations around Sweden as well as 63 non-public stations, such as bus depots and the like, distributing bio-CNG-containing fuels. Figure 7 summarizes biogas production in Sweden from 2005 to 2017 by category of facility.

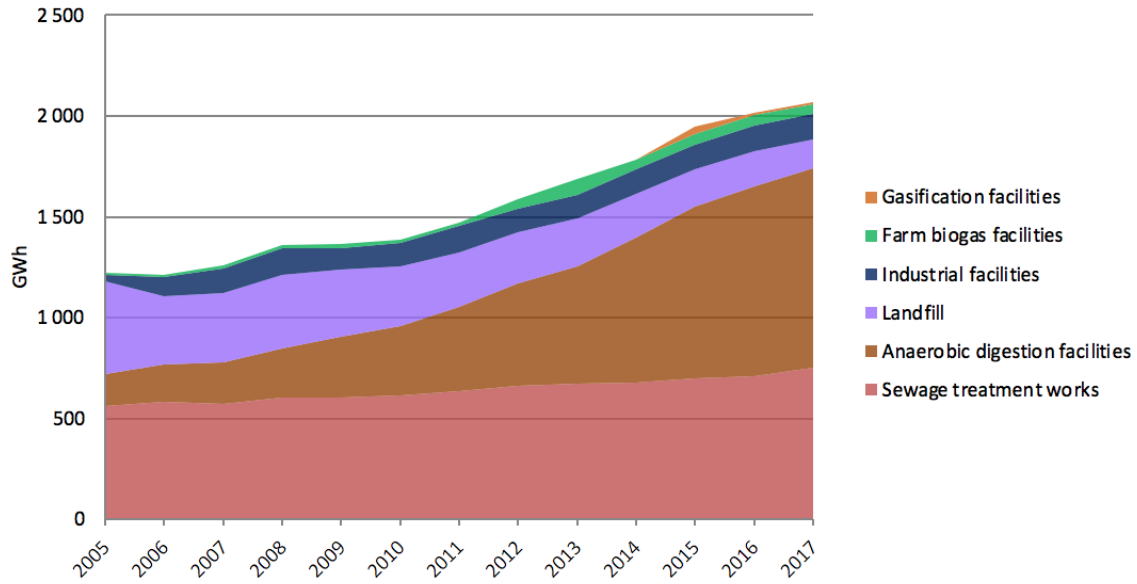

Figure 7. Biogas production in Sweden from 2005 to 2017, by category of facility (GWh). Reference: Swedish Energy Agency, 2019.

5 Towards a transport-efficient society

Over the past 10 years, emissions from domestic transport and road traffic in Sweden have decreased significantly and, as shown in Figure 8, they are projected to decrease by almost 40% from 2019 to 2030. This figure shows that some measures and policy instruments have already been adopted to reduce future emissions. However, additional policies will be required to meet future emissions reductions targets. In the EU policy context, requirements for light and heavy duty vehicles and bonus malus (reward-penalty) provisions are especially important to Sweden, however probably insufficient to accomplish the Swedish targets.

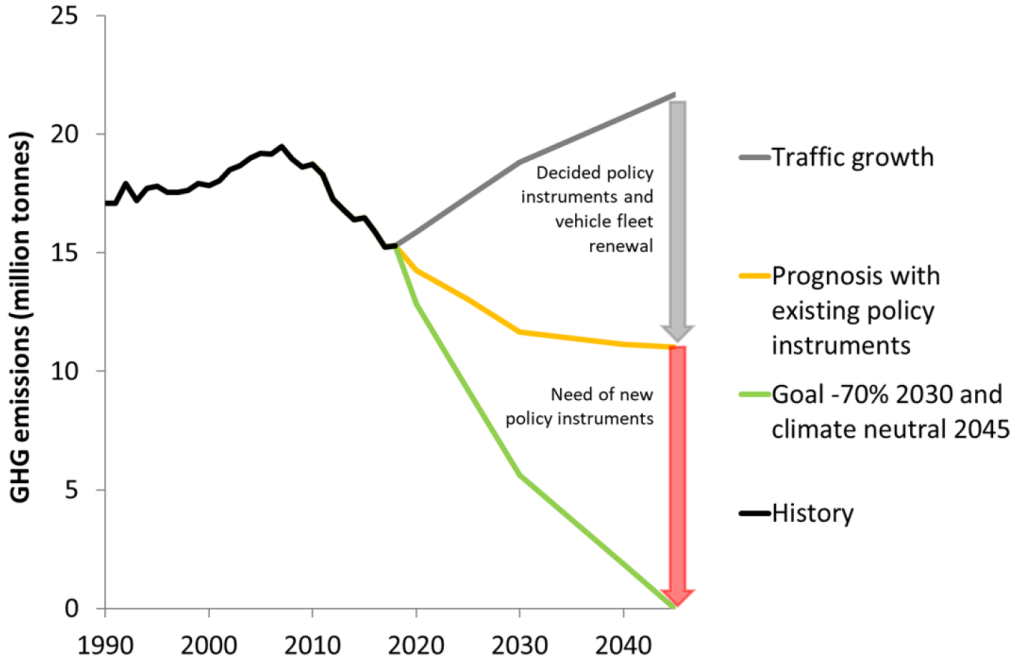

Figure 8. Forecast of possible future transport sector emissions in Sweden.
Reference: Swedish Transport Administration Agency, 2019.

In Figure 8, the historical development of road traffic CO_2 emissions is represented by the black line, from 1990 to current levels. The grey line represents how CO_2 emissions would increase if current vehicles and fuels continue to be used in the future, according to a traffic prediction assessment by the Swedish Transport Administration. The yellow line shows the projected outcome of the decisions made today on policy instruments and measures (e.g., bonus-malus, reduction quota mandate up to 2020). The green line shows the target in accordance with the new national GHG emissions reductions objectives decided by the Swedish Parliament.

In this context, emissions can be decreased through a more transport-efficient society, in which travel and transport are not major contributors to GHG emissions like they are now. In addition, in a transport-efficient society, a higher efficiency in transports is demanded, in order to decrease the volume of traffic. Energy-efficient vehicles and energy-efficient use of vehicles are key elements to improve transport energy efficiency, considering traffic and transport from a holistic perspective. Thus, a transport-efficient society alongside increasing energy efficiency of transport decreases the quantity of energy required within the transport system.

Additionally, the fossil energy being used in transport today needs to be replaced by cleaner options (e.g., biofuels, electricity, hydrogen). Advanced motor fuels will also play an important role, since the rate of turnover of the vehicle fleet is relatively slow. Related to this, many ideas are being considered for how to most cost effectively increase the share of renewable energy within the transport sector.

Some of the leading options include:
- Using more renewable fuels in conventional engines,
- Using renewable fuels in adapted engines, and
- Producing electricity, hydrogen and electro fuels (power-to-X fuels) from renewable energy.

The utilization of drop-in biofuels in conventional petrol and diesel engines does not demand any new infrastructure. Also, the availability of vehicles will not impact the transition to biofuels. In fact, access to biofuels and their market prices are the main issues limiting the transition. HVO can be utilized in admixtures up to 70-100% in fossil diesel. It is also possible to run HVO in conventional diesel motors.

6 Biofuels policy for 2020-2030

6.1 Reduction quota mandate

Biofuel markets are largely affected by political decisions. There have been several political driving forces for expanding the use of biofuels, such as reducing dependence on petroleum and other fossil fuels, creating new jobs and reducing carbon dioxide emissions from the transport sector. As biofuels markets are international, changes in individual countries or regions also affect the Swedish biofuel market.

The Swedish government decided to implement a petroleum reduction quota mandate system on carbon emissions starting from 1 July 2018 with initial targeted reduction levels specified until 2020. This came after having tried to introduce a biofuels quota mandate in 2014, which the European Commission ultimately revoked. The Swedish Energy Agency has investigated a continuation of the petroleum reduction quota mandate to 2030 with targeted annual reduction levels shown in Table 1.

Table 1. Petroleum reduction quota levels proposed by the Swedish Energy Agency from 2021 to 2030.
Reference: Swedish Energy Agency, 2019.

Reduction	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Petrol	5.6%	7.8%	10.1%	12.5%	12.9%	17.4%	19.9%	22.6%	25.3%	28.0%
Diesel	25.3%	29.5%	33.8%	38.2%	42.6%	47.1%	51.6%	56.2%	60.9%	65.7%

The focus of Swedish biofuel policy has for many years been to promote high biofuel use in the Swedish market. This consumer-driven policy has made Sweden the leader in renewable energy-based transport within the EU. This is shown in Figure 9, where Sweden has 24% renewables in transport (2018) without multipliers, and 30% with multipliers.

Within the EU, Sweden is the only country that has achieved the EU's target of 10% renewable energy within the transport sector (RES-T) without multipliers. Thanks to the use of multipliers, Finland can report it achieves 14.9% RES-T however this only represents 9.4% "real" (no multipliers) renewables in transport. Most member states are well below the 10% RES-T target and the overall value for the EU is 6%. Thus, most states still rely massively on non-renewable fossil resources to fuel their transport sector.

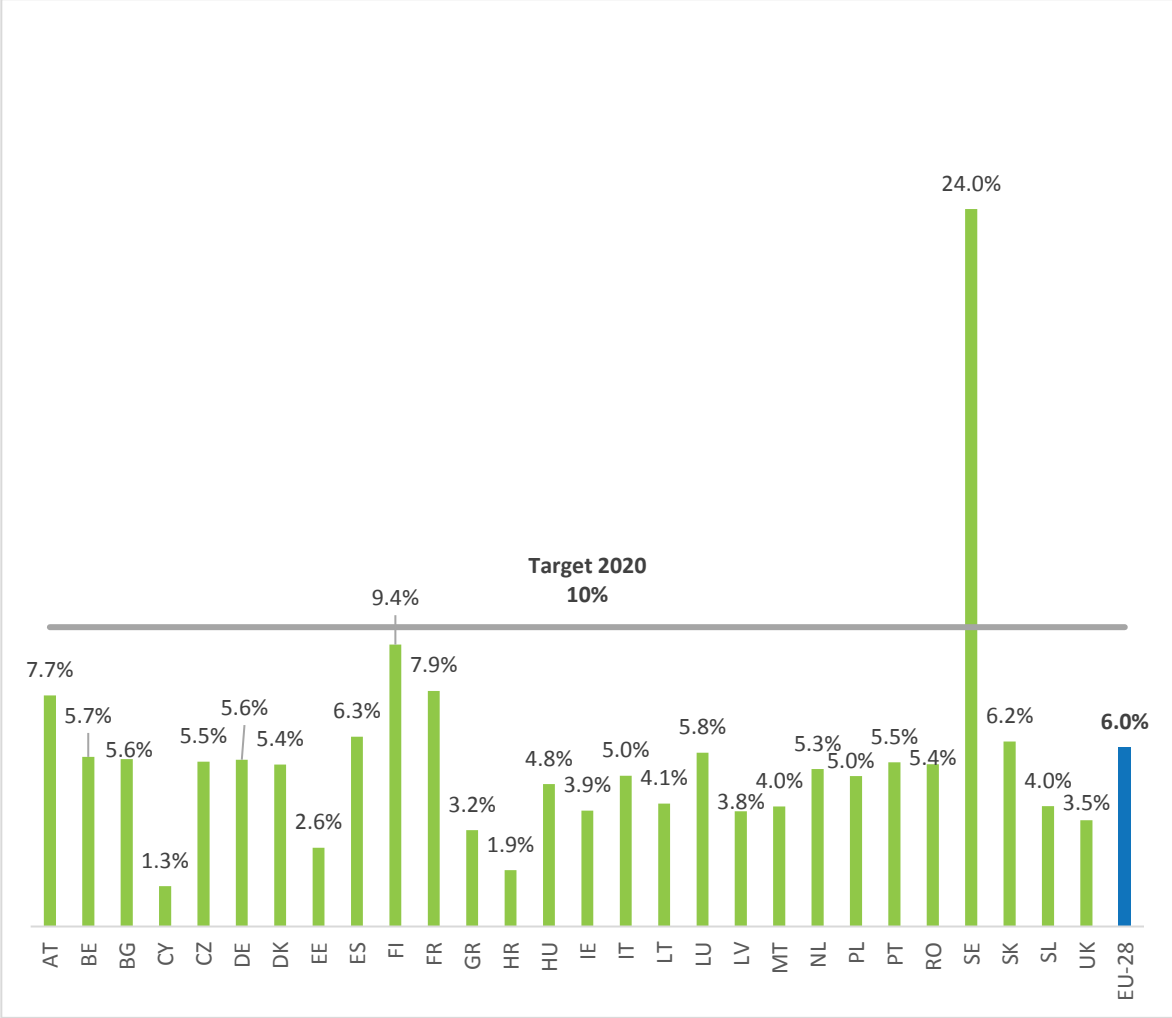

Figure 9. Renewables in transport (RES-T) per member state without multipliers – 2018. Sweden is indicated as SE. This can be compared with Finland as FI and Germany as DE.
Reference: EC SHARES, 2020 (https://ec.europa.eu/eurostat/web/energy/data/shares).

The biofuels industry has for a long time asked the Swedish government to establish stable, long-term policy steering instruments and a biofuels policy that promotes production, i.e. production-driven measures. The shift from policies based on tax exemption to reduction quota mandates has, however, not improved the situation. As a matter of fact, biofuels consumption decreased in 2018 when the system was introduced, albeit beginning at an impressively high level from start. The main decrease was seen for HVO, where two factors largely affected this.

Before the reduction quota mandate on diesel, all blended HVO was subject for tax exemption. After the mandate, all HVO was fully taxed. The other factor was a new regulation for HVO based on palm oil, where PFAD used as raw materials could be approved as sustainable only if its origin was able to be traced. Another effect was that the reduction

quota system was not based on volume quotas but rather on emission reduction quotas. That is, with higher emissions reduction per litre, the required volumes to meet the reduction quotas will be lower than were previously needed.

On the 11th of September, 2020, the Swedish government issued a press release, related to the proposed budget for the Parliament, on the continuation of the measure called "Fuel Change". After starting in July 2018 specifying reduction quotas until 2020, this policy has now been extended until 2030 with targeted reduction quota levels close to those proposed by the Swedish Energy Agency (Table 1). The government will enforce the new higher reduction quotas, and these reduction quotas also will be gradually increased.

The goal of the Fuel Change policy is to achieve a linear progression towards the targeted 2030 reduction quota levels of 28% for petrol and 66% for diesel (Table 1). The levels and steering policy will be reviewed in 2022. The Fuel Change policy is intended to provide a clear signal to industry that there will be an on-going increasing demand for sustainable renewable fuels to displace petroleum-derived fuels, thereby creating the necessary conditions for new investments to further increase production capacity. The extended policy will be effective beginning on the 30th of June 2021 (subject to approval by the Parliament), with minimum reduction quotas of 6% for petrol and 26% for diesel, compared with respectively 4.2% and 21.0% today. Preliminary calculations show that this policy will reduce annual carbon dioxide emissions by 6-7 million tonnes by 2030.

Biofuels are today more expensive than fossil fuels. In order to cope with increasing fuel prices for the consumer, it is proposed that fuel tax indexations based on GDP are paused until 2022. However, the energy taxes on fuels are still increased based on changes in the consumer price index (CPI). These changes will be in effect from 1 January 2021.

The aviation transport sector also will be changed. In 2019, a reduction quota mandate was proposed for aviation fuel, starting with 0.8% for 2021 and increasing to 27% in 2030. This would be equivalent to an aviation fuel blending on volume of 1% in 2021 and 30% in 2030. This will include all fuelling at Swedish airports, for both domestic and international flights. The target is 100% by 2045, meaning a total phase-out of fossil aviation fuels.

6.2 Tax exemption

The tax exemption for highly concentrated biofuels, i.e. fuels other than petrol (Environmental Class I) and diesel (Environmental Class I), requires approval by the European Commission, as this form of support is classified as state aid and governed by the EU's state aid rules. The decision for this tax exemption came into effect from the 1st of January 2018 and has not been changed however it will expire on the 31st of December 2020.

The Swedish government made a pre-notification to the European Commission in the spring of 2020, both for biogas (including Liquefied Biogas, LBG similar to LNG, for heating) and liquid biofuels. The European Commission approved the later full application for tax exemption of biogas for transport on 29th of June, which will be for 10 years starting on the 1st of January 2021. The European Commission just recently approved on the 8th of October a continued tax exemption for liquid biofuels from the 1st of January 2021.

However, the EU's state aid rules on energy support are due to expire on the 31st of December 2020 and there is a prolongation until 2022 when these rules will be revised. It is difficult to predict future tax exemption, however, the European Commission have made it clear that food and feed based biofuels should be limited and not likely to be approved for future tax exemption. The Swedish government's ambition is also focused on the reduction quota mandates system. Still, the tax exemption has been the measure that has most helped Sweden's development in high use of biofuels.

6.3 Climate investments subsidies

The Swedish government has proposed a SEK 9.7 billion (about EUR 1 billion) climate package for “green recovery” from the Coronavirus pandemic. The re-start of the economy will be “green”, meaning investments will be made in climate-neutral industrial production and sustainable transport. One such measure is credit guarantees issued by the state to facilitate large investments, lowering the risk of financing large projects.

The provision of credit guarantees will be assessed on the basis of technology-neutral criteria and these are proposed to be issued for several years starting during the first half of 2021. In 2021, credit guarantees are proposed to amount to a maximum of SEK 10 billion. For 2022, the guarantee framework is estimated to grow to SEK 15 billion and by 2023 to SEK 25 billion.

Under Swedish law, a fee must be charged for a credit guarantee that corresponds to the state's expected cost of the commitment, which means that the fee must reflect the risk of credit losses (expected loss) and also the state's administrative costs. The investments that may be considered are assumed to be of such a scope that they will be able to bear the cost of a risk-reflecting guarantee fee. The fee policy will be designed to be compatible with EU state aid rules.

Another measure is the subsidy program called “Industriklivet” (Industry Leap) for climate investments in the industry that is run by the Swedish Energy Agency, which will be broadened to include biorefineries. However, in the sister program “Klimatklivet” (Climate Leap) there already have been subsidies for investments in biogas and pyrolysis plants, with a subsidy level of about 40% of the capital cost. There also have been numerous projects focused on improving the infrastructure and distribution for biofuels that have received subsidies.

The Klimatklivet program makes local investments for the greatest possible climate gain and it is managed by Sweden’s Environmental Protection Agency. The main aim of this program is to reduce emissions that affect the climate. The Environmental Protection Agency has been directed, along with other central government agencies and county administrative boards, to support local climate investments.

During the years 2015–2018, Klimatklivet granted SEK 4.7 billion to support 3,200 measures. In the budget for 2020 the funds were increased from SEK 1.5 to 1.9 billion. With grant saving from 2019 carried over into 2020, the Klimatklivet 2020 budget will be SEK 2.4 billion. In 2021, the budget will be SEK 1.9 billion and a maximum SEK 3.5 billion during 2022–2026 with SEK 500 million each year for 2024–2026.

The Industriklivet was launched in 2018 with an annual budget of SEK 300 million for projects focused on reducing industry process related emissions. This was later increased to SEK 500 million per year from 2020 to 2022. The 2020 budget is now SEK 600 million with 500 million for industry and 100 million for negative emissions. The new budget for 2021 is increased to SEK 750 million and a total of SEK 1800 million during 2022–2028.

The program is broadened to also include investments for biorefineries, recycled plastics refineries, hydrogen manufacturing, including research and development, and project development, although investments for biofuel plants have been granted earlier within the Klimatklivet program.

In aggregate, Sweden’s state support will total SEK 12.1 billion for Klimatklivet from 2015 until 2026 and for Industriklivet SEK 4.2 billion until 2028. Whether the budgets for these programmes will be used fully depends on the outcomes of projects receiving support. History has shown that calls for projects have been postponed and even cancelled numerous times, as well as projects.

6.4 Bonus-malus on vehicles and engine-conversion

On 1st of July 2018, a new system for vehicle taxation came into effect, referred to as the bonus-malus (reward-penalty) for sales of new light-duty vehicles. This replaced the five-year exemption from vehicle tax on "environmental vehicles" and the "super environmental premium" for certain types of vehicles. With the new system, vehicles with lower carbon emissions are given a bonus (lower sales price) whereas vehicles with higher carbon emissions have to pay higher vehicle taxes for the first three years after purchasing a vehicle.

For electric and hydrogen cars (zero emission vehicles) the bonus is maximum SEK 60,000 and not higher than 25% of the new sales price. The bonus decreases as vehicle carbon emissions in grams per kilometre increase. Electric-charged hybrid vehicles with emissions below 70 gram carbon dioxide per kilometre (based on the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) emission cycle) get bonus. For vehicles driven on E85 there is no bonus, but also no increased tax, or malus. However, vehicles driven with bio-CNG receive a bonus of SEK 10,000.

This bonus-malus vehicle taxation system is now proposed to be modified to increase the maximum bonus for zero emission vehicles to SEK 70,000 and to decrease the maximum emissions to qualify for taxation as an electric-charged hybrid vehicle to 60 gram CO_2 per kilometre. In addition, heavy-duty vehicles like trucks and buses are proposed to be included.

Another policy measure being introduced is a premium to support converting conventional diesel and petrol engines for running on liquid biofuels or biogas. The reason for this is the large number of passenger cars in Sweden that have a long remaining service life. In fact, Sweden has one of the oldest vehicle fleets in the EU, with an average service life of 17 years. The budget is estimated as SEK 10 million for 2022 and 2023. A maximum of half of the cost for engine conversion will be provided as support and it is estimated that around 2000 vehicles will be converted.

Further reading and references

Swedish Environmental Protection Agency, www.naturvardsverket.se
Swedish Energy Agency, www.energimyndigheten.se
Statistics Sweden, www.scb.se
Swedish Transport Agency, www.transportstyrelsen.se/sv/vagtrafik/

In the News

Reports and Research

- June - New U.S. DOE Co-Optima reports issued, including FY19 year in review report: https://www.energy.gov/eere/articles/wheels-keep-turning-innovations-more-efficient-and-clean-vehicles-0 and https://www.energy.gov/eere/bioenergy/co-optima-fy19-year-review-report and https://www.energy.gov/eere/bioenergy/downloads/co-optima-fy-2019-year-review
- July - In the UK, PA Consulting presented key findings from a white paper on sustainable aviation fuels (SAF) at the Farnborough International Air show (FIA Connect) (Read more).
- July - In the Netherlands, a new USDA GAIN report says the COVID-19 pandemic will slash European bioethanol and biodiesel use by approximately ten and six percent, respectively. EU biofuel demand is driven by the Renewable Energy Directives I and II (Read more).
- July - The report, "Integrated strategies to enable lower-cost biofuels," by the U.S. DOE's Office of Energy Efficiency and Renewable Energy summarizes the findings of a qualitative analysis to identify integrated strategies needed for more affordable biofuels. It outlines five key strategies to achieve lower fuel production costs in an integrated biorefinery and outlines high-level research needs across the biofuel supply chain (Read more).
- August - The U.S. Department of Energy awarded more than $97 million in funding for 33 projects that will support high-impact technology research and development to accelerate the bioeconomy. These projects will improve the performance and lower the cost and risk of technologies that can be used to produce biofuels, biopower, and bioproducts from biomass and waste resources (Read more).
- August - In Denmark, Alfa Laval, Hafnia, Haldor Topsoe, Vestas, and Siemens Gamesa issued the report, "Ammonfuel – an industrial view of ammonia as a marine fuel", providing a comprehensive and up-to-date overview of the applicability, scalability, cost, and sustainability of ammonia as a marine fuel (Read more).
- September - The Sustainable Aviation Fuel: Review of Technical Pathways report by the U.S. DOE's Office of Energy Efficiency and Renewable Energy provides an overview of commercial jet aviation fuel and summarizes learnings from three BETO-supported workshops. In addition, it provides insights for reducing costs and optimizing the value proposition of sustainable aviation fuel. Download the report to learn more (Read more).

Policy and Regulatory Developments

- May - The U.S. EPA approved a fuel pathway under the Renewable Fuel Standard for a biomass gasification plant under development in McFarland, California, that will produce renewable natural gas (RNG) for sale into the transportation fuel market (Read more).
- May - In Australia, Licella Holdings signed a Memorandum of Understanding to work with Indian based company Unnmukt Urja Private Limited to explore the opportunity for utilising Licella's innovative Cat-HTR ('Catalytic Hydrothermal Reactor') technology as a more sustainable and higher value solution for rice straw residues in India (Read more).
- August - In the UK, the government has opened a public consultation that seeks to ensure the continued decarbonization of road transport fuels through the supply of renewable fuels under the Renewable Transport Fuel Obligation (RTFO) (Read more).
- August - In Switzerland, as part of their global drive to support the aviation industry in achieving decarbonization through the use of alternative sustainable aviation fuels, RSB is turning its attention to China. In a project made possible by the ClimateWorks Foundation, RSB is working with MotionECO to develop a roadmap for SAF in China to help guide the trajectory of growth along a sustainable path (Read more).

- August - The European Commission launched a public consultation on the potential revision of the 2018 Renewable Energy Directive (REDII) to better align the policy with the European Union's new Green Deal and its goal of making the EU climate neutral by 2050. (Read more).

- August - In France, the Biofuture Platform, a twenty-country, multi-stakeholder initiative, announced the launch of a set of voluntary principles. These are intended to offer guidance to governments and policymakers around the world on the need to promote the sustainable bioeconomy in both short-term relief packages and broader post-COVID economic recovery programs (Read more).

- August - In Canada, the Minister of Economic Development and Official Languages for Ontario (FedDev Ontario), announced a total FedDev Ontario investment of C$10 million to support the scale-up and growth of two renewable fuel producers in the region: FORGE Hydrocarbons and IGPC Ethanol Inc. (Read more).

- September - In California, Governor Gavin Newsom issued an executive order requiring sales of all new passenger vehicles to be zero-emission by 2035 and additional measures to eliminate harmful emissions from the transportation sector (Read more).

Industry News

- June - LanzaJet was officially launched as a LanzaTech spin-off. Suncor Energy and Mitsui & Co. are investing $15 million and $10 million, respectively, to establish the new venture. All Nippon Airways is also contributing in exchange for accessing offtake. As a leading biotech company and carbon recycler, LanzaTech set out to produce SAF for a sector that requires climate-friendly fuel options as recovery from the impacts of COVID-19 begins. The company will construct a demonstration plant that is planned to produce renewable diesel from sustainable ethanol sources and 10 million gallons of SAF per year, and production is slated to begin in early 2022. (Read more).

- June - In Texas, HollyFrontier Corporation said that its Board of Directors has approved a plan to convert the Cheyenne Refinery to renewable diesel production and to construct a pre-treatment unit at the Artesia Refinery (Read more).

- June - Pyrocell AB will build the first plant in Sweden for processing sawdust into renewable bio-oil at Kastet's sawmill outside Gävle. Pyrocell AB is a company jointly owned by Setra and Preem (Read more).

- June - In the Netherlands, the Dutch statistics service CBS says that in 2019, renewable energy consumption in the Netherlands grew by 16 percent, to 181 petajoules (PJ), relative to 2018 (Read more).

- June - Renewable diesel capacity expanding with petroleum-to-renewable refinery conversions (Read more)

- June - In Brazil, the Oil & Gas Journal reports that Petrobras will begin production tests at its Presidente Getúlio Vargas (REPAR) refinery in Araucária, Paraná where it has installed a 208,000-b/d renewable diesel unit. The unit uses Petrobras' proprietary H-Bio process to produce HVO (Read more).

- July - Neste, the world's largest producer of renewable diesel and sustainable aviation fuel (SAF) made from waste and residue raw materials, successfully delivered its first batch of SAF to San Francisco International Airport (SFO) via pipeline, where it will be used by major airlines committed to reducing carbon emissions (Read more).

- July - In Canada, the City of Calgary and Steeper Energy Canada Ltd. signed a new cooperation agreement, by way of an MoU, to use city sewage sludge and other urban generated bio-organic wastes to produce sustainable biofuels such as renewable diesel or jet fuel (Read more).

- August - GranBio and NextChem have inked a strategic alliance and will co-license GranBio's patented technology for the production of second-generation ethanol. NextChem is a subsidiary of Italian engineering giant Maire Tecnimont dedicated to the energy transition (Read more).

- August - In Spain, Repsol has successfully completed the production of the Spanish market's first batch of aviation biofuels. This milestone enables the company to advance its production of low-carbon fuels for industries such as aviation, where alternatives like electrification are not viable today (Read more).

- August - In Oklahoma, CVR Energy is looking to begin renewable diesel production at its Wynnewood refinery. The company is looking at the possibility, following in the footsteps of other refiners who have added renewable diesel production capacity (Read more).

- August - Clariant expects to commission its sunliquid plant in Podari by Q4 2021. The EUR140 million facility was expected to be online this year but even so, the company's CFO says construction is progressing well. When online, it will produce 50,000 metric tons of cellulosic ethanol annually (Read more).

- August - In China, Clariant's business line Biofuels and Derivatives announced during a joint presentation at the 7th Asia-Pacific Biomass Utilization Summit in Guangzhou that a strategic partnership has been formed with Chemtex Global Corporation for the realization of second-generation biofuel projects (Read more).

- August - In Colorado, Gevo entered into a long term, take or pay Renewable Hydrocarbons Purchase and Sale Agreement with Trafigura Group, the largest contract in Gevo's history. Trafigura is one of the world's leading independent commodity trading companies with over $171B and over $54B in revenue and assets, respectively (Read more).

- September - In Finland, in a move which anticipates increasing desire from airlines to reduce emissions, Neste and Shell Aviation have entered into a sustainable aviation fuel (SAF) supply agreement. This agreement significantly increases the supply and availability of SAF for the aviation industry effective from October 2020 (Read more).

- September - In Sweden, Air bp has delivered 210 tons of sustainable aviation fuel (SAF) to Swedish airport operator, Swedavia, at Stockholm Arlanda Airport (ARN/ESSA). Swedavia and its partners SOS Alarm, Systembolaget and the 2030 Secretariat procured the fuel through a joint tender, as part of an initiative to promote the large-scale production of SAF and its use as a way to reduce carbon emissions from air travel (Read more)

- September - In the UK, VistaJet has signed a new partnership with SkyNRG, offering all VistaJet customers around the world access to sustainable aviation fuel. This will promote substantial reductions in aviation carbon emissions and increase stable demand and availability of SAF around the world (Read more).

- September - In Denmark, Jan De Nul Group announced that its trailing suction hopper dredger, 'Alexander von Humboldt', had completed 2,000 hours operation on 100% renewable, second-generation Biofuel Oil (BFO). The vessel is powered by 2 ×MAN 12V32/40 and 1 × MAN 7L32/40 main engines (Read more).

- September - In Japan, Japanese companies are bucking the trend and investing in algae-based and palm oil waste-based biofuels even though COVID-19 has negatively impacted fuel demand and there is a limited market currently for aviation biofuels (Read more).

- September - In the UK, ExxonMobil has completed a successful sea trial of the company's first marine biofuel oil with shipping company Stena Bulk, bunkered in the port of Rotterdam. The marine biofuel oil is a 0.50% sulphur residual-based fuel (VLSFO) processed with a second-generation waste-based FAME component (ISCC certified) – and will be available later this year – initially in Rotterdam – before wider launch across the ExxonMobil port network (Read more).

- September - Novozymes announced the launch of Fiberex, a new platform based on novel enzymes and yeast strains to convert corn fiber into ethanol. The company also introduced two new Fiberex products: Fiberex R1 and Fiberex F1 (Read more)

- September - French firm Total is latest to convert a fossil fuel refinery to biofuels, but the trend has its limits (Read more).

- September - Sweden's largest oil refiner and transportation fuels producer Preem AB announced that in light of "new economic circumstances", it will cancel its proposed Residue Oil Conversion Complex (ROCC) project at its Lysekil refinery. As a result, the 2016 Environmental Permit Application at Lysekil Refinery will be withdrawn in favour of a re-prioritization centered around renewable product production (Read more).

- September - New IRENA report reveals 2.5m people working in global biofuels sector (Read more; read report).

- October - US refinery utilization improved from 71.5% in the second quarter to 77.8% in the third quarter, according to the Energy Information Administration, but as profit margins and demand for transportation fuels remain weak, US refiners are accelerating the transition to renewable fuels (Read more).

Past and Upcoming Meetings, Conferences & Webinars

Note: Due to the coronavirus pandemic, which has resulted in severe restrictions on travel and physical meetings, the dates of the following conferences and meetings may change. Please check their websites to learn about the latest status of these conferences and meetings.

2020

May

- IEA Bioenergy Webinar (May 2020) IEA Bioenergy, Global Collaboration on Sustainable Bioenergy, A Look Forward (watch recording; download presentation).

June

- DigestConnect #9 - a role for renewable fuels in Green Recovery (watch recording)
- Tammy Klein´s Advanced Biofuels Roundtable (for details on the content, click here)
- ETIP Bioenergy Pyrolysis oil webinar (for details on the content, click here)

July

- DigestConnect #11 - Biofuels + Agriculture, Hybrid Chemistry Clusters (watch recording)
- Biofuel Digest Webinar: Port of Rotterdam: Opportunities in renewable fuels and chemicals at the port (watch recording)
- Under Construction: Refocusing Our Renewable Fuels Research and Innovation Priorities (download presentation)

August

- DigestConnect #17 - Renewable diesel: Looking at 11 technologies, 21 projects and 13 emerging projects, plus market drivers and economics (watch recording)
- DigestConnect #18 - Cellulosic ethanol, algae (watch recording)
- DigestConnect #20 - California Here I Come (watch recording)
- Producing Renewable Biofuels through Co-processing/Co-refining – Bioenergy/Biofuels R&D at CanmetENERGY Devon (download presentation)

September

- DigestConnect #23 - Biofuels Mandates Around the World (watch recording)
- DigestConnect #25 - Hydrothermal Liquefaction for BioCrude (watch recording)
- ICBE 2020: 14. International Conference on Bioengineering

October

- ICEFE 2020: International Conference on Environment-Friendly Energies, 1-2 October, Dubrovnik, Croatia
- ICHEPS 2020: 14. International Conference on Hydrogen and Energy Production Systems, 1-2 October, Baku, Azerbaijan
- Towards sustainable and clean mobility in Europe, 28 October 2020 (For registration and details, click here)

November

- Upcoming IEA Bioenergy webinar on Transport Decarbonisation planned for 17 November 2020. The webinar will be announced by IEA Bioenergy. The findings of the joint AMF-IEA Bioenergy project on "The role of advanced renewable transport fuels in the decarbonisation of transport in 2030 and beyond" will be presented.
- All-Energy Exhibition & Conference, 4-5 November, Glasgow, Scotland
- International Conference on Biomass Pretreatment and Process Development, November 9-10, Dubai, United Arab Emirates
- Future of Biogas Europe 2020, 11-12 November, Berlin, Germany
- International Conference on Biofuels, Bioenergy and Biotechnology, November 17-18, Tokyo, Japan
- European Bioenergy Future 2020, 18-20 November
- International Conference on Biomass Pretreatment and Hydrolysis, November 19-20, London, United Kingdom
- 5th International Conference on Biofuels and Bioenergy, November 23-24, Edinburgh, Scotland

December

- ICHRES 2020: 14. International Conference on Hydrogen and Renewable Energy Sources, December 3-4, Tokyo, Japan
- 10th International Conference on Algal Biomass, Biofuels and Bioproducts, December 7–9, Pittsburgh, USA
- ICHEPRES 2020: 14. International Conference on Hydrogen and Energy Production from Renewable Energy Sources, December 10-11, Rome, Italy
- International Conference on Biofuels and Bioenergy Technologies, December 17-18, Kuala Lumpur, Malaysia
- International Conference on Industrial Biotechnology and Bioenergy, December 28-29, Paris, France

2021

January

- Fuels of The Future 2021, 18-19 January
- Nordic Pellets Conference 2021, 27-28 January, Varberg, Sweden

March

- International Conference Progress in Biogas, 10-12 March, Stuttgart, Germany
- Biofuels International Conference and Expo, 23-24 March, Brussels, Belgium

IEA Bioenergy Task 39 Meetings

IEA Bioenergy Task 39 is reviewing its plans for future meetings in light of the ongoing global COVID-19 pandemic and with travel and gatherings continuing to be highly curtailed. Task 39 has decided to hold its the next business meeting virtually on 23-24 November, 2020; this meeting was originally planned to be held in Germany. In addition, in 2021, Task 39 plans to have its first business meetings in Denmark on 21-23 April, 2021, and its second in Australia in late 2021 (dates still be to finalized) in conjunction with the end of triennium IEA Bioenergy meeting and conference.

Please contact us for more detailed information about the Task's future business meetings.