Advanced Sustainable BIOfuels for Aviation

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RED II status report 1st

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Responsible Person:	Oskar Meijerink
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1 Summary

Over the past decades sustainable aviation fuels (SAF) have been used by over 30 airlines on all continents in the world. At the same time, structural production capacity and uptake of SAF is still limited compared to the uptake of sustainable fuels in road transport. This is mostly caused by the price premium compared to fossil jet fuel. Road transport fuels could the past decade rely on consistent policy, in form of the Renewable Energy Directive, stimulating the uptake of sustainable alternatives. The aviation industry has, for several reasons, not been included in these policies from the start. Only with the ILUC amendment in 2015, aviation was allowed on a voluntary basis to count towards the targets set out in the RED.

The RED II, provides a better opening for aviation inclusion, through the so-called opt-in for aviation, including a 1.2 multiplier for the use of sustainable fuels in aviation. However, although RED II specifies the implementation of aviation more clearly than the RED, it remains a Directive. This means that each EU Member State may decide upon itself how to include the aviation opt-in within its national legislation. There is a high possibility that we will see 27 different ways in which the use of SAF by an EU Member State will, or will not, be included. The expectation is that this will not be beneficial for the SAF industry in the EU, which prospers on an EU wide policy framework which provides the industry stability and trust. Another potential risk to the RED II policy is the use of a pre-defined list to safeguard the sustainability of feedstocks used for alternative fuels. Whether a feedstock is or isn't sustainable depends on many factors. Feedstocks included in the Annex IX, Part A and B can become unsustainable if the demand for these feedstocks rises out of proportion or are collected and utilised without considering its current usage and importance for the ecosystem. On the other hand, there are countless feedstocks which could be produced and collected in a sustainable way, supporting the environment and human wellbeing. Currently, you risk the possibility that these feedstocks are not used, due to list approach. This is a missed opportunity. This goes hand in hand with the fact that there is a clear mismatch between currently pushed feedstocks on Annex IX, part A, and the absence of technologies to convert these feedstocks into sustainable (aviation) fuels. There should be stronger financial policy to support the development of advanced feedstock-technology combinations beyond the current state of technology.

Even though, the EU Member States are still very much in the process of translating the RED II directive into national legislation to come into force early 2021. At the same time, a number of Member States are already looking at the next step of implementing mandates for aviation beyond the currently directed opt-in approach. There are key elements to consider when implementing mandates, most important is to make sure these mandates are proposed well in advance (at least 3-5 years) enabling production capacity to come online. Second, consistency of policy of at least 10 – 15 years is necessary to create investor confidence. Finally, the EU should provide financial support to develop future feedstock and technology projects. The goal of this is two-fold. First, it will enable sustainable feedstock projects, where for example the use of cover-crops and biochar can take away the pressure on the waste oil markets. And second this effort should support the development of technologies able to convert advanced feedstocks.

In the remainder of the Bio4A project, lasting the next 2 years, the consortium will review the actual implementation of the RED II (expected late 2020, early 2021) by the Member States. Additionally, the Bio4A team will be reviewing the development of mandates for the aviation industry.

2 Introduction

At present aviation is responsible for a considerable amount of the anthropogenic CO_2 emissions, >2% per year. Although current worldwide market dynamics are under severe pressure caused by the outbreak of COVID-19 which has led to an incredible demand reduction in aviation. We expect aviation to recover and enable the world to physically connect again in the future. While the aviation industry is currently coping with short-term focussed goals of survival and getting back into stable operation, this moment also provides an opportunity to take a step back and start building towards longer term targets of rebuilding the industry in a resilient and sustainable way.

The aviation industries' options to become more sustainable are limited. The options to become more efficient, like phasing out older aircraft, are rapidly introduced as this will, besides the sustainability impact, also improve the short-term cash position of an airline. On the longer term, we will need alternatives for the fuel to truly become sustainable, as over 99% of an airline's emissions is caused by fuel combustion. The only option, besides radically new aircraft design and propulsion technologies, which will still take decades to develop, is the use of sustainable hydrocarbons which can be a drop-in solution for the existing fuel supply. These fuels are known as Sustainable Aviation Fuel (SAF).

Even though SAF has been tested and used in various settings over the past decade by approximately 50 airlines, it's not yet a commodity product. With only one continuous producer of SAF in the world, supplying a mere 0.02% of the European jet volume, the uptake and production is thus still very much limited. The most important reason for this limited uptake can be found in the significantly higher price for SAF than conventional jet fuel. With the price competitiveness airlines are facing this premium creates difficulties for voluntary uptake of SAF.

The price premium can partly be covered through private initiatives, where e.g. corporates pay a premium on their business travel and therewith pay the premium and obtain the CO_2 benefits of using SAF. However, this will not be enough and will not result in wider demand of SAF and consequently not increase the total installed SAF production capacity. To meet the goals of reducing 50% of the GHG emissions in the aviation sector in 2050 compared to 2005, we estimate an uptake of >85% SAF is necessary. With the lead time in building facilities we need to start developing technology and build production capacity dedicated for SAF production fast.

To solve the above sketched market circumstances, there is a strong call for clear policy. At the start of the Renewable Energy Directive, back in 2010, aviation was not included as an option to meet the transport targets for Member State's share of renewable energy. During the ILUC amendment, in 2015, we have identified and seen changes where aviation was allowed in the policy schemes to be included on a voluntary basis. Now, in 2020, wider integration of SAF under RED II is proposed while some European Member States are taking a next step in considering mandating SAF in a similar way as the road transport markets are regulated.

In this update report, which is part of the Bio4A project, we provide a recap of the development in SAF policy over the past decade in Europe. This includes the original RED implementation and the opportunity of the RED aviation opt-in. This is followed by a review of RED, the RED II, and the initial understanding of opportunities and challenges for SAF within the RED II policy framework. An additional review is done on specific Member States who consider obligating SAF use, in a way like the road transport market. We will finalize this report with a forecast on the tasks left in the tasks during the next 2 years of Bio4A.

3 SAF policy framework

In this section we will review the policy that shapes the market for SAF in Europe. When writing the proposal for the Bio4A project back in 2017, we were in the middle of the RED I and started to understand the dynamics and potential of the RED opt-in for aviation. Three years later we are facing changed policy dynamics with the RED II finalized and currently being transposed into national legislation, different for each EU Member State. Furthermore, SAF blending mandates are being discussed by various Member States individually. In this section we will recap the RED I implementations including its pros and cons and we will focus on RED II transposition challenges and status on SAF mandates in Europe.

3.1 RED I – Implementation

The use of biofuels in Europe was initially managed and stimulated through the Renewable Energy Directive, or RED, and the Fuel Quality Directive, or FQD. The FQD (officially known as 2009/30/EC) requires a reduction of the greenhouse gas intensity of transport fuels by a minimum of 6% by 2020. The RED (officially known as 2009/28/EC) requires EU Member States to have “at least 10% of their transport fuels come from renewable sources by 2020.” These renewable sources consider both biofuels and electricity. The 10% obligation applies to road and rail transportation, but not to aviation and other transport modes. During the creation of RED I, aviation was not even mentioned nor included in any of the policy language.

The majority of the obligation is currently being fulfilled with sustainable road transport fuels (biodiesel, bioethanol, renewable diesel). This fuel is blended with fossil fuels and used as blended fuel by consumers throughout Europe. The sustainability of SAF is mainly a result of the feedstock used to produce the fuel. Since the start of the RED, in 2010, the RED caused an increase in production of various vegetable oils (“vegoils”) for biofuel production, such as palm oil, soybean oil and rapeseed oil. The RED also already promoted the use of fuels produced from wastes and residues, the energy value of which “shall be considered to be twice that made by other biofuels”. As such, the RED first introduced the notion of ‘double-counting’ for biofuels.

In 2015, the RED was amended by Directive 2015/1513, also known as the ILUC directive. The original RED lead to a big increase in fuels produced from vegetable oils, such as soybean oil, rapeseed oil and palm oil. As these feedstock grew in importance, more and more agricultural land was used to produce these feedstock. The first fear was that these crops would replace other crops, such as grains or corn and as such, would reduce the world’s food supply and increase global food prices. This was also known as the ‘food vs fuel’ debate or Direct Land Use Change.

Perhaps even more worrying however was the spill over effect from the crops that were replaced at the original agricultural land, which lead to rapid deforestation in countries such as Indonesia and Malaysia. Here, rainforests were burned to make room for palm oil plantations, or similarly in Argentina for large scale soybean plantations. This phenomenon is referred to as Indirect Land Use Change, or ILUC.

The ILUC directive was aimed at reducing these ILUC effects by setting a cap of 7% on fuels produced from “cereal and other starch-rich crops, sugars and oil crops and from crops grown as main crops primarily for energy purposes on agricultural land”. The ILUC directive also introduced a list of specific feedstock that could be used for double-counting fuels, the so called Annex IX. In specifying which feedstock are eligible for double-counting, the ILUC directive moves away from the broader definition of wastes and residues as used in the original RED. Part A of Annex IX includes a number of feedstock, including for instance algae, municipal waste, animal manure and straw. Part B consists of used cooking oil (UCO) and animal fats with no other purposes in for instance pharmaceuticals. Both the feedstock in Annex IX part A and part B are eligible for double-counting under the ILUC directive.

While the original RED didn't include any language around aviation, the Netherlands created the possibility of using SAF to fulfil the mandate as part of the RED legislation already in 2013. This was the start of the so-called voluntary aviation opt-in. From 2016 onwards it was also possible for other Member States to facilitate this, due to a change in the RED and FQD under the ILUC amendment, which stated:
"*In the case of suppliers of biofuels in aviation, Member States may permit such suppliers to choose to become contributors to the reduction obligation provided that those biofuels comply with the sustainability criteria*" – Directive 2015/153 amending FQD (98/70/EC) and the RED (2009/28/EC). In the next section we will review this Dutch system in more detail.

3.1.1 The Netherlands EU RED sustainable aviation fuel opt-in

In the Netherlands, the original RED was implemented in January 2011 and updated in 2015 and 2017. The legislation is set through the 'Renewable Energy for Transport Act', the 'Renewable Energy for Transport Decree' and the 'Renewable Energy for Transport Regulations'. The Dutch policy relies on the tradable HBE (translated from Dutch: Renewable Energy Units – formerly known as bio-tickets), the function of which is twofold:

1. it gives the national government a tool with which to measure and manage biofuel usage
2. it provides biofuel producers additional income to bridge the price gap between fossil and biofuels

The Dutch legislation mandates an increasing renewables percentage per year and enforces this obligation at the fuel suppliers supplying fuels to road and rail. In order to show compliance with the renewable targets, these suppliers have to register their supplied biofuels at the national authorities; they are 'mandatory participants'. Each fuel supplier on the Dutch market is required to have a specified number of HBEs available at the end of each compliance year, which is then collected by the NEa (Nederlandse Emissie Autoriteit or Dutch emissions authority). The volume of HBEs is determined by the total energy value of fuels supplied to the market multiplied by the renewables percentage for that year, with each HBE representing one giga-joule (GJ) of renewable energy. An obligated party can either obtain the necessary HBEs by supplying biofuels to the Dutch market or by buying HBEs from other parties in the market.

Fuel suppliers supplying only biofuels have no annual HBE target. These suppliers can however voluntarily participate in the system by registering their supplied biofuels, thereby receiving HBEs. These they can sell to the mandatory participants in the road transport market, giving them a means to bridge the price gap between the costs of producing biofuels and the market price for (fossil) fuels.

With the implementation of the ILUC directive in Dutch legislation in late 2017, some changes were necessary. Most notably, the system of HBEs was changed to now include three different HBEs:

- the HBE-G, the advanced HBE
- the HBE-C, the conventional or 'crop-based' HBE
- the HBE-O, the other HBE

These three HBEs are used to regulate three different targets:

- An overall obligated renewables percentage (all three summed)
- A maximum usage of crop-based feedstock
- A minimum usage of advanced feedstock

As with the general HBE, the three specific HBEs as listed above can be obtained by supplying biofuels to the market. The difference between the three HBEs lies in the feedstock that was used to produce the biofuels:

- an HBE-G requires feedstock listed in Annex IX, part A of the ILUC directive
- an HBE-C comes from crop-based feedstock, such as palm, soybean or rapeseed oil
- an HBE-O is generated through feedstock from Annex IX, part B (UCO and cat 1 and 2 animal fat), electricity and non-crop-based fuels that are not listed in Annex IX.

The three blend rates as set for the years 2015 – 2020 are depicted in the below Figure 1.

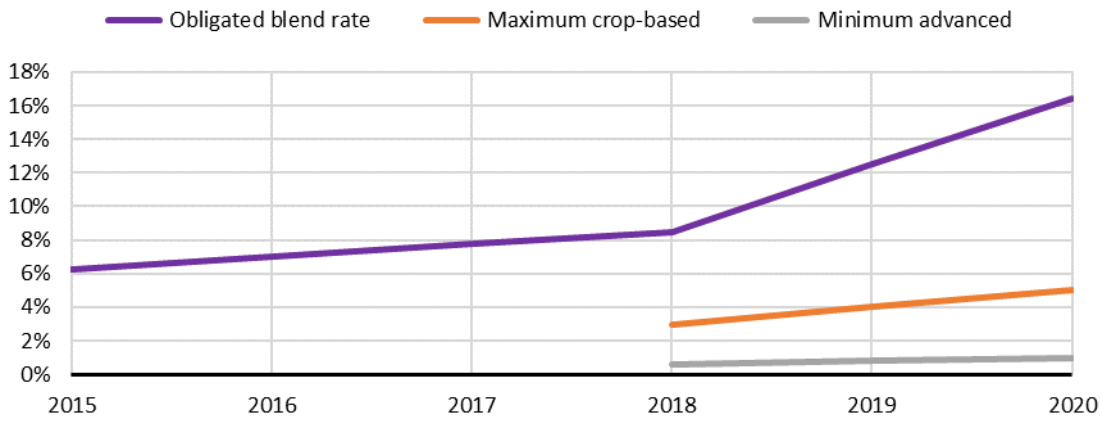

Figure 1 - Biofuel blend rate in the Netherlands (Source: NEA)

Through these changes, the Dutch policy reflects the changes in the ILUC directive and also prepares for the implementation of the RED2, which also works with various minimum and maximum obligations. The different HBEs will be used to comply with the three targets set in the legislation.

3.1.1.1 Regulatory framework

The requirements the biofuel and the HBE registrant need to meet are stated in the national law; in The Netherlands this is recorded in the Environmental Management Act (Title 9.7 Renewable Energy for Transport). The regulatory framework can be summarized as follows:

1. The registrant:
    a. is a Dutch enterprise;
    b. holds title of the biofuel at a location certified for that type of biofuel;
    c. is certified by an EU RED approved sustainability scheme (i.e. ISCC, RSB, etc.);
    d. holds a permit for an Excise Goods Place for mineral oils, is a Registered Consignee, or an Importer.

2. The registered biofuel:
    a. is certified by an EU RED approved sustainability scheme;
    b. is supplied to the next consignee without Proof of Sustainability (PoS). The PoS is addressed to the Dutch Emission Authority instead, and as a result the biofuel loses its sustainability status and is further supplied as regular fuel;
    c. has to be supplied from a location in The Netherlands to the Dutch transport market (supply to end-user by fulfilling excise duty, or supply to another Dutch Excise Goods Place permit holder including title transfer);
    d. should be supplied from a location that is certified by an EU RED approved sustainability scheme and of which the registrant manages the mass balance.

Biofuels can either be registered for HBE generation or for tax reduction under EU ETS, not for both. Requirement 2.b prevents this from happening as on paper the biofuels lose their sustainability status upon registration for HBE generation. The end-user can therefore not claim the use of certified sustainable biofuels, hence under EU ETS the consumed biofuels are considered regular fossil fuel.

The NEa is responsible for checking compliance to this regulatory framework; its inspectors perform audits at each mandatory and voluntary party.

3.1.1.2 Blueprint for HBE generation for SAF in The Netherlands

Within the FP7 funded project ITAKA (Initiative Towards sustAinable Kerosene for Aviation), a blueprint for HBE generation for SAF supply in The Netherlands was created (ITAKA deliverable D3.12). It summarizes the translation of the regulatory framework into practice and serves as guidance for SAF suppliers to make use of this financial incentive through the so-called aviation opt-in. The blueprint is depicted in the below Figure 2.

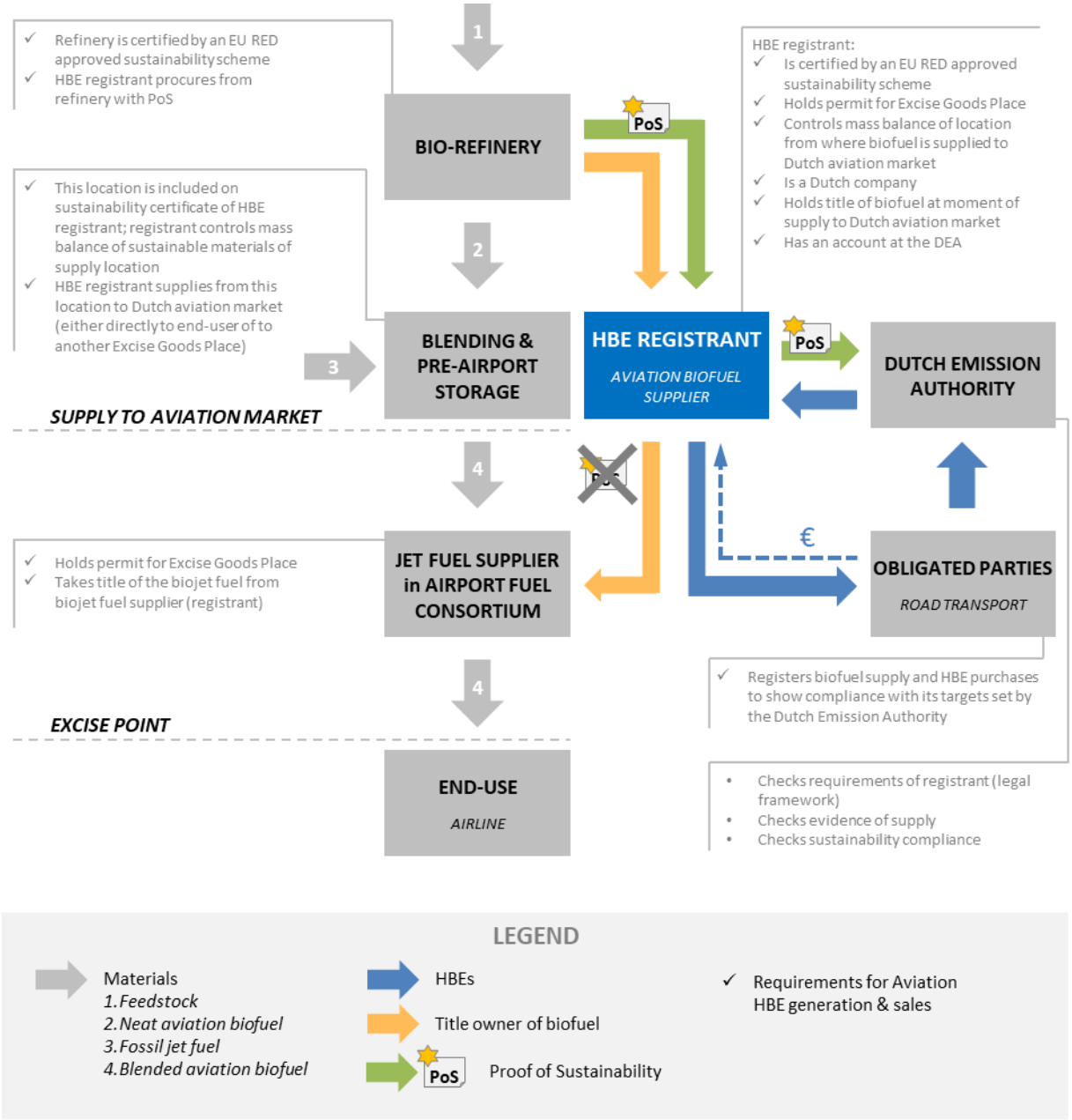

Figure 2 - Blueprint HBE generation and sales in The Netherlands

3.1.2 Other countries implementation

Besides the Dutch system, when assessing the Dutch aviation opt-in we also assessed the opportunity for other Member States to take such an approach. As each of the 28 EU Member States have a different approach to the directive, we have categorised them, based on their potential to implement the voluntary aviation opt-in into their RED legislation. Although the RED II now provides the opportunity to create a new system, it is to be expected that most Member States will keep their approach as they took under the original RED.

3.1.2.1 Criteria

Based on the workings of the Dutch system, we reviewed which countries have the highest opportunity or likelihood of implementing a similar system in their respective countries. We focused this analysis based on two main criteria, discussed below.

1. Certificate system

As the Dutch blueprint shows, an existing certificate system, like the Dutch bioticket system, is ideal for a quick and easy implementation of the voluntary aviation opt-in.

2. Other innovative policy incentives

Other incentives are also considered, as for example an existing tax exempt on road biofuels could be used to cover part of the SAF premium. Although this is more difficult than including SAF directly in an existing certificate system specifically designed for biofuels.

3.1.2.2 Opportunities in other Member States

Based on the above-mentioned criteria we have discovered that in 2017 EU Member States had four ways of dealing with the inclusion of SAF. At the time of writing in 2020, this still holds for most of the Member States, although some are looking into diverting into other systems.

1. The first category consists of the Member States in which the aviation opt-in is already included in the legislation. This only holds for the Netherlands.
2. The second category entails Member States that have a tradable certificate system in place for road biofuels. These countries are: Ireland, United Kingdom, Spain, Portugal, Italy and Germany.
3. The third category, includes Member States with a mix of policies. Certificate systems for power generation or tax cuts on biofuels as a means of mandating the obligation are included. This holds for the Nordic countries, Belgium, France and Croatia.
4. The fourth and final category includes all Member States without any specific biofuel policy besides the road transport obligation. This is the category of Member States in which SAF opt-in systems will be furthest away.

3.1.2.3 Conclusion

The six Member States in category two, have the biggest opportunity to implement the aviation opt-in into their existing RED legislation. It is important to note, that this does not mean that the Member States in category three and four will have no opportunity to implement SAF. We will also see in the remainder of this policy update that the Member States in categories 1, 2 and 3 are still leading in developing ambitious regulations under RED II and more specifically their national SAF mandates.

3.2 RED II – Implementation

As the RED and ILUC directive only cover the period up to 2020, the revised version of the RED, the RED II, speaks about the 10-year period starting in 2021. Late 2016, the European Commission has sent out its first draft for the RED II, which shows a number of interesting developments compared to the RED and ILUC directive. First of all, Member States have to ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 32 %, increasing the previous target. Secondly, there is a sub-target for renewable energy in the transport sector, which once more exceeds the previous transport target. The share of renewable energy in the transport sector has to be 14% by 2030. Within this transport target, there are two important policy mechanisms included to stimulate renewable fuel production and consumption in the aviation sector. The first mechanism allows aviation to count their renewable fuels provided to an EU Member States towards the 14% target, this is basically a more formal inclusion than the 'aviation opt-in' as we have known it under RED I. The second mechanism proposes a stimulus for the uptake of sustainable aviation fuels (SAF) via the use of a so-called multiplier for aviation. This aviation multiplier will be discussed in more detail below.

Within the 14% target for transport, there are certain limitations and drivers included to fulfill the target. As an important part of the sustainability of SAF is determined by the feedstocks, these measures often refer to the maximum and minimum, the use or non-use of a certain type of feedstock. One of these measures include the 7% cap on fuels produced from food- or feed crops (already introduced in the ILUC Directive), which will decrease to 3.8% by 2030, with the possibility for Member States to set lower targets. With this reducing cap on feedstock usage and an increasing renewable energy target, the European Commission wants to encourage the use of more sustainable feedstocks and the stimulate the development of new technologies.

3.2.1 Advanced feedstocks – Annex IX

In order to stimulate that sustainability feedstocks are being used to produce for example SAF, the Annex IX list, including the Part A and B, was taken from the ILUC directive and used in the RED II directive. A summarized version of Annex IX is listed in TABLE 1 below.

Table 1 - Summarized Annex IX, Part A & B (source: European Commission Proposal for RED II)

PART A	PART B
Algae if cultivated on land in ponds or photobioreactors	Used cooking oil
Biomass fraction of mixed municipal waste	Animal fats classified as category 1 and 2
Bio-waste	
Biomass fraction of industrial waste not fit for use in the food or feed chain	
Straw	
Animal manure and sewage sludge	
Palm oil mill effluent and empty palm fruit bunches	
Bagasse	
Grape marcs and wine lees	
Nut shells	
Husks	
Cobs cleaned of kernels of corn	
Biomass fraction of wastes and residues from forestry and forest-based industries	
Other non-food cellulosic material	
Other ligno-cellulosic material	

Additional to the ILUC directive, in which Annex IX part A and B were mostly guiding discussions and taking away unclarity. Under RED II, feedstock from Annex IX, Part A are now mandated in use, from 0.2% in 2022, growing to at least 3.5% in 2030. These fuels are referred to as advanced biofuels and shown in Figure 3 below in orange. The use of part B feedstock (shown in grey), is caped to 1.7% (there are a few exceptions to this rule).

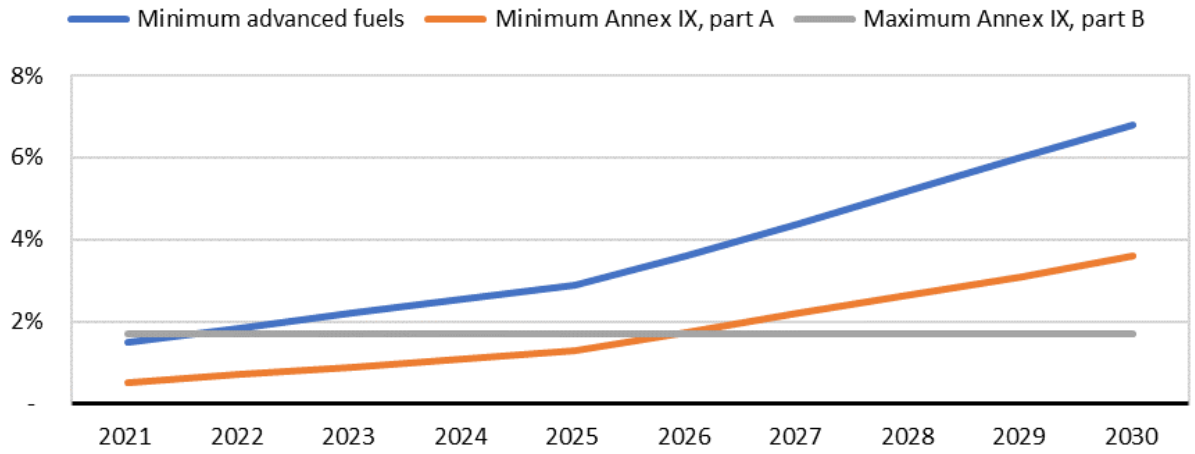

Figure 3 - Minimum and maximum requirements (source: European Commission Proposal for RED II)

Furthermore, the energy content of the feedstocks listed in the Annex IX may be counted twice for the transport target. Thus, in certain policy frameworks (such as the Dutch HBE (or: bio ticket) system) feedstocks included in Annex IX have a financial advantage compared to feedstocks which are not included in this list.

The reason why the European Commission (EC) has taken a list approach to stimulate feedstocks which they consider sustainable, has to do with the unsustainable practices which has been a result of a strong blend-mandate in the biodiesel sector. Via the Fuel Quality Directive the road fuel producers where obligated in the EU to blend a certain percentage of renewable fuels with their fossil fuels. Fuel producers therefore looked for alternatives and soon found that feedstocks such as palm or soy could create a cost competitive alternative to fossil sources. However, due to (indirect) land use change and other damaging social- and environmental impacts, these feedstocks often cannot be classified as (more) sustainable (than fossil). To prevent these practices from happening again, the EC drafted a list on which feedstock they see as sustainable and the feedstock they want to see used in the renewable energy sector.

Unfortunately, this list-approach also has its downsides, as whether a feedstock is sustainable or not, is highly situational. Not only can the feedstocks, which are listed in Annex IX, can become unsustainable (for example, using all forest residues in a forest is bad for biodiversity and the health of the soil), other sustainable feedstocks are not likely to be used when they are not on the list. Often the financial incentive, that can be achieved through these frameworks, is necessary for a solid business case.

3.2.2 Multiplier for aviation

Another important change in the RED II is the proposed multiplier for aviation. To promote the use of sustainable fuels in aviation and the maritime sector, these fuels will count as “1.2 times their energy content”. To compensate for stricter product specifications in aviation compared to road transport, the production of fuels delivered to aviation will be eligible for additional support. Under the Dutch system, for instance, all biofuels are eligible for 1 HBE (the Dutch bioticket) per energy unit, a biofuel for aviation would be eligible for 1.2 HBE per energy unit. If this multiplier would be combined with a SAF which is produced from feedstocks listed in Annex IX, Part A or B, the financial benefit of an energy unit becomes even higher (x2.4 times the energy content of the feedstock).

It is important to note that only because of a policy framework such as a bioticket system, the multiplier get its value. In the situation where the policy is created such that only a mandate is enforced on road transport fuels without a controlling system like tradable certificates, it can be harder to generate the monetary incentive to stimulate the use of SAF as well. Also, in future

situations of a possible blend-mandate for SAF, discussed in the next section, a multiplier is not needed.

3.2.3 Hurdles under RED II for SAF uptake

Even though the RED II imposes the possibility for EU Member States to count the renewable energy volumes produced in aviation towards their RED II renewable energy transport targets, we see some challenges in this system which needs to be overcome in order to effectively stimulate the production and consumption of SAF throughout the EU.

1. As the RED II is a Directive and does not provide clear legislative guidelines for implementation, each EU Member State may decide upon itself how to include the aviation opt-in within its national legislation. This means that there is a high possibility that there will be 27 different ways that the use of SAF by an EU Member State will, or will not, be included in their RED II translation into national legislation. This will not be beneficial for the SAF industry in the EU, which prospers on an EU wide policy framework which provides the industry stability and trust.
2. Due to the complexity of the regulations in the RED II referring to the aviation opt-in, every EU Member State interpretation on these rules differ. Some consider the aviation opt-in as something mandatory, the other as something voluntary. The one country thinks that, if the aviation opt-in is included in their national legislation, that they can decide upon whether they want to include the multiplier for aviation as well, whereas the other then sees the multiplier as an obligation. All in all, it is advised to the Commission to provide their Member States with clear guidance on how to interpret these sections of the RED II.
3. The aviation industry would not prefer the multiplier for aviation as mere policy instrument in promoting the uptake and use of SAF, as this only stimulates fictive growth. Also, this multiplier will likely not be successful in establishing the growth of the EU SAF sector as long as the multiplier for shipping is as high as aviation.
4. Currently, the RED II tries to safeguard the sustainability of the feedstocks for alternative fuels by using a list-approach. The aviation sector wants to highlight the situational nature of sustainability. Whether a feedstock is or isn't sustainable depends on many factors. Using a feedstock list to tell the industry what is sustainable is in that sense impossible. Feedstocks included in the Annex IX, Part A and B can become unsustainable if the demand for these feedstocks rises out of proportion or are collected and utilised without considering its current usage and importance for the ecosystem. On the other hand, there are countless of feedstocks which could be produced and collected in a sustainable way, supporting the environment and human wellbeing. Currently, you risk the possibility that these feedstocks are not used, due to this list approach. This could create a missed opportunity.

3.3 SAF mandates

Were the offtake of SAF by airlines is a voluntary market under previous and existing Directives, the landscape is changing. An increasing amount of countries is considering the implementation of a mandate in their national legislation, demanding airlines to replace a certain percentage of their fossil kerosene with SAF. Some EU countries have already announced or implemented a SAF blend-mandate. Norway has officially passed their mandate structure into national legislation. They demand airlines to substitute fossil kerosene with at least 0,5% SAF from 2020 onwards.[1]

Norway is not the only country which has strong ambitions when it comes to a sustainable aviation industry. Sweden suggested to integrate a 1% SAF blend-mandate in 2021, which rapidly increases to 30% in 2030[2]. Spain is looking into a mandatory SAF blend- percentage of 2% from 2025 onwards[3], and the Netherlands wants to commit itself to 14% SAF in 2030.

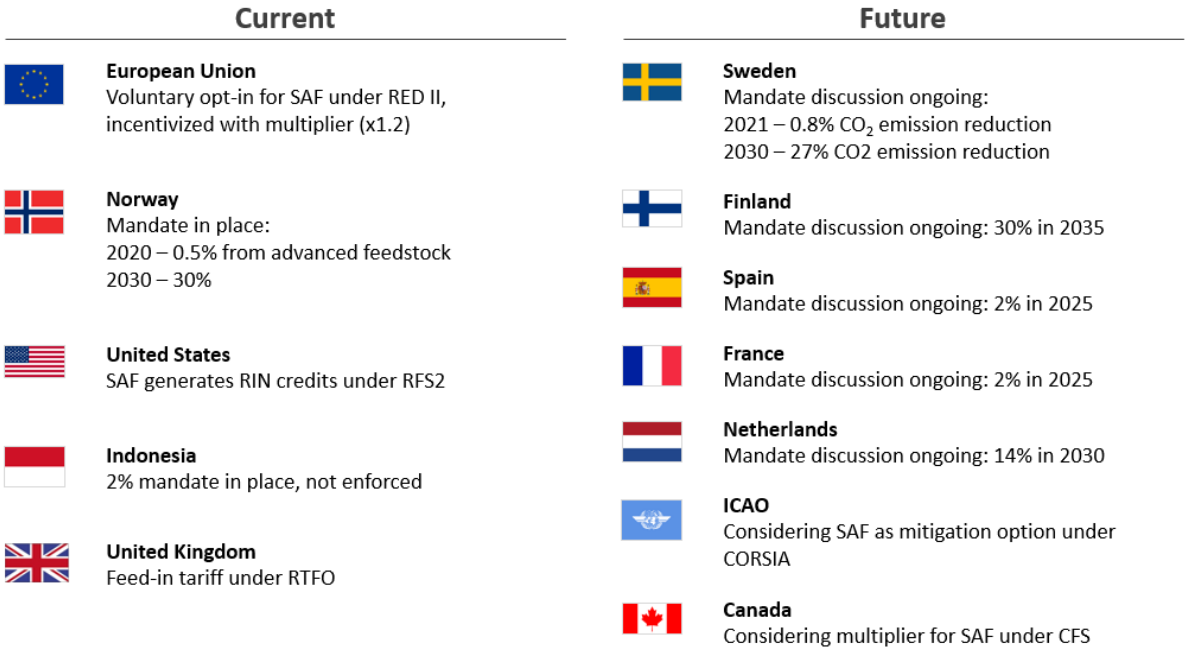

Figure 4 - Mandate overview

These policy incentives create urgency within the aviation sector to act, with guaranteed volumes to supply the aviation market with. For a long time, investments in different technology and feedstock pathways for SAF were lacking due to future uncertainty off a guaranteed market. With the implementation of mandates into national legislation, the demand for SAF becomes a certainty, giving investors reason to invest in this sector.

3.3.1 Mandate implementation suggestions

Although a(n) (EU wide) SAF blend-mandate can accelerate the energy transition within the aviation sector, when implementing such an obligation, one should be mindful about the following aspects:

- It is favoured that the mandate is announced some years (3-5) before it will be installed. This gives companies time to develop new production capacity and secure investments.

[1] http://biomassmagazine.com/articles/15657/norway-to-implement-biofuel-mandate-for-aviation-fuel-in-2020

[2] https://ilbioeconomista.com/2019/03/14/sweden-will-introduce-a-greenhouse-gas-reduction-mandate-for-aviation-fuel/

[3] https://www.biofuelsdigest.com/bdigest/2019/01/02/spain-looking-at-2-aviation-biofuel-mandate-by-2025/

- Once this mandate is installed, investors need a policy framework of at least 10-15 years before they will have the confidence to step in
- Governments and the EU should provide (financial) support to develop the technology and feedstock portfolio to produce SAF. Currently, only one SAF technology pathway can be used on a commercial scale (this pathway is based on the Hydroprocessed Esters and Fatty Acids (HEFA) technology). As this technology cannot process feedstocks on the Annex IX – A list, there is a mismatch between push for advanced fuels and technology readiness of the feedstock technology combinations to produce the fuels. The technologies used to produce SAF need to be diversified in order to broaden the feedstock base. It should be prevented that more pressure on the waste oil market is created through the deployment of only HEFA facilities. It can also be seen as an opportunity to initiate sustainable waste, residue and cover cropping projects, which could improve environmental and social conditions.
- Last but not least, in order to ensure the functioning of an EU wide blend mandate, it is important to impose a cost of non-compliance which is higher than the cost of compliance. Otherwise the obligated party of the blend-mandate will simply refuse to produce or buy renewable fuels for the aviation sector.

4 Conclusions and forecasts for task 3.3.

The results of this deliverable have shown the state of the RED II aviation opt-in implementation and provided guidelines on elements Member States should consider when implementing the RED II directive into national legislation. The next 2 years of the project towards the final deliverable in M48, will show whether and how Member States will translate the aviation opt-in into national legislation. This will also lead to potential best practices created by leading Member States. Besides this, and additional to the envisioned work plan, the project team will review and discuss the currently proposed mandates for the aviation industry with relevant stakeholders.

5 Bibliography/References

Interaction with various working groups in the European context: ART Fuels Forum, Set Plan 8 implementation working group, EU Advanced Biofuel Flightpath.

ITAKA Project – Deliverable 3.12 and Deliverable 3.14 regarding implementation of the RED directive in EU Member states.

Nederlandse Emissie Autoriteit – Information retrieved from the website: https://www.emissieautoriteit.nl/ and from various meetings with representatives in 2018 and 2019.

RED - Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources.

RED II - Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.