atmosfair fairfuel- Catalogue of criteria

Label for green synthetic fuels in maritime and aviation sector

Version 1.2, 12/2023

Contents

Preface

This is the second version of the atmosfair fairfuel label for green, synthetic fuels in the aviation and maritime shipping sectors, which was developed by atmosfair on the basis of a commissioned study by the ifeu Institute and coordinated with experts at the German Environment Agency (UBA). The label governs environmental and social criteria for the production and crediting of synthetic aviation fuel and synthetic methanol for aircraft turbines and marine engines. It is set up in such a way that producers of e-kerosene and e-methanol can voluntarily be certified under an additional scheme according to the fairfuel criteria.

Compared to the first version from March 2021, references to RED II and the associated delegated acts have been added in this version furthermore the maritime shipping sector and e-methanol have been included. In addition, the certification processes were specified based on consultations with recognised certification bodies in order to increase compliance and the corresponding robustness of the standard.

atmosfair reserves the right to make changes to the criteria since the production of synthetic hydrocarbons is only in the development phase.

atmosfair gGmbH

Berlin, December 2023

SUMMARY

atmosfair fairfuel is a label for power-to-liquid (PtL) - e-kerosene and e-methanol for aviation and the maritime transport sector. e-kerosene is refined from synthetic crude oil to commercially applicable Jet A1, whereby the crude oil was produced by synthesis processes from the feedstocks CO_2 and water using electricity. e-kerosene can be used in the existing aviation infrastructure without having to modify either the infrastructure or the aircraft. This means that e-kerosene has the potential to solve the CO_2 problem of aviation permanently and and in enough time to meet the Paris climate targets. e-methanol is also produced in a synthesis process from the feedstock CO_2 and water using electricity and can be used directly as a fuel in the maritime sector. e-methanol has similar properties to marine diesel and can be used in the existing infrastructure of the maritime transport sector with only minor adjustments. In the future, once the corresponding ASTM certification has been awarded, e-methanol can also be further processed into e-kerosene. Both this variant and the use of by-products in the refinery processes of e-kerosene are covered by this standard. In order to exploit all these potentials, an integrated use of PtL technology is required from a climate perspective - this is ensured by the atmosfair fairfuel standard.

What then remains are the non-CO2 emissions from aviation, which contribute significantly to global warming and which are initially only reduced by e-kerosene, but not eliminated. Optimised flight routes[1] can help reduce these emissions in the long run but this is not covered by the fairfuel.

Target audience

The atmosfair fairfuel standard is a voluntary additional standard for all e-kerosene and e-methanol producers. The label shows the customer and consumer that extensive environmental and social criteria have been met during production.

Relationship to standards such as EU-ETS and RED II

The fairfuel standard independently complements the existing legislative framework, such as the EU-ETS and RED II, as well as their national implementations. The fairfuel standard adopts essential requirements of the legislation, such as the specifications for electricity procurement or the calculation methodology for greenhouse gas emissions. In addition, the fairfuel standard formulates criteria that go far beyond the legal requirements, for example in the selection of approved CO_2 sources. The fairfuel standard thus remains a voluntary additional standard that builds

atmosfair fairfuel - label for e-kerosene and e-methanol

Criteria/ Issuance:	atmosfair
Type:	Voluntary additional standard
For:	Producers of e-kerosene/e-methanol
Inspection:	TÜV or other technical auditor
Criteria:	additional green electricity, non-fossil CO_2 sources, water, ESG for Global South
Scope:	Validation of the plant, certification of the quantity and quality of the crude oil and e-kerosene/e-methanol.

[1]To learn more about the impact of e-kerosene on the non-CO2 effects of aviation and the importance for climate change mitigation, see the separate atmosfair paper “Sorgenfrei fliegen mit e-Kerosin?” (in German).

on European legislation. The atmosfair fairfuel standard can be used independently, but certification according to legal requirements should always be aimed for as a basis.

Overview of criteria for RFNBOs: EU requirements vs. fairfuel standard: (Detailed version under I.2)

<table>
<tr><th colspan="2"></th><th>EU requirements[2]</th><th>fairfuel</th></tr>
<tr><td rowspan="2">CO_2</td><td>Fossil CO_2 sources</td><td>▪ Permitted until 2035 (respectively 2040)</td><td>▪ Prohibited</td></tr>
<tr><td>Biogenic CO_2 sources</td><td>▪ No restriction</td><td>▪ Exclusion of non-sustainable biogenic CO_2 sources</td></tr>
<tr><td rowspan="7">Electricity</td><td rowspan="2">Additionality principle</td><td colspan="2">▪ Power generation facilities may not come into operation earlier than 36 months before the production facility</td></tr>
<tr><td>▪ Transition phase until 2038 (no additionality)</td><td>▪ No transition phase</td></tr>
<tr><td rowspan="2">Geographical correlation</td><td colspan="2">▪ Power generation facilities are located in the same bidding zone as the production facility</td></tr>
<tr><td>▪ No additional requirements</td><td>▪ Maximum radius of 500km</td></tr>
<tr><td>Temporal correlation</td><td colspan="2">▪ Renewable electricity was generated in the same calendar month in which it was consumed (From 2030 period = 1 h)</td></tr>
<tr><td>System serviceability</td><td>▪ No requirements</td><td>▪ The system must be controllable in a way that serves the grid</td></tr>
<tr><td colspan="0" style="display:none"></td></tr>
<tr><td rowspan="2"></td><td>Minimum THG savings</td><td colspan="2">▪ 70% GHG savings compared to conventional fuels</td></tr>
<tr><td>Social criteria</td><td>▪ No requirements</td><td>▪ Social criteria formulated</td></tr>
</table>

Restriction to air traffic and maritime transport sector

Due to the large amount of energy required to produce PtL products and the initially low production volumes, the atmosfair fairfuel standard limits e-fuels to use in aviation (medium and long distance) and ocean shipping, as there are no alternative types of propulsion for these sectors. atmosfair fairfuel may not be used on for cars and trucks.

Procedure for awarding the label

An audit of a fairfuel e-kerosene or e-methanol plant consists of a validation of the plant and the subsequent regular certification of the produced quantities by an independent auditor.

The e-kerosene/e-methanol producer is responsible for keeping the register while atmosfair checks the issue of certificates on an annual basis. The manufacturer can then sell these certificates to

[2] According to Directive (EU) 2018/2001; Delegated Regulations (EU) 2023/1184 and (EU) 2023/1185

customers from the aviation industry or the maritime transport sector. If the producer of e-kerosene or e-methanol markets his product via an alternative book and claim system, the issuing of fairfuel certificates in accordance with the requirements of the standard is not necessary. Instead, only the produced quantity is labelled with the fairfuel label.

Main objective: Decarbonisation of aviation and ocean shipping

The atmosfair fairfuel criteria ensure that the potential greenhouse gas reductions of e-kerosene/e-methanol are maximised - through the use of non-fossil, mainly biological CO_2 sources with residual character. PtL plants according to the fairfuel standard must also increasingly use *direct air capture (DAC)* plants for the provision of CO_2 in order to become completely independent of all biogenic and waste sources in the long term. There are also requirements related to additionality and regionality for the renewable electricity sources used, which support the energy transition and do not compete with it.

CO_2

Reliable CO_2 sources are non-fossil and have residual character. The sources are broken down into four classes (*direct air capture*, sustainable, conditionally sustainable, non-sustainable). The filtering of CO_2 from the air (*direct air capture, DAC*) is the best source. How the sources are assessed also depends on the environmental impact of the upstream chain and excludes, for example, certain substrates in biogas plants, such as cultivated biomass with maize. If climate-friendly alternatives are available, such as steel production with green hydrogen, the source steel coking is not permitted.

If CO_2 from fossil sources is used, greenhouse gas emissions can be reduced by a maximum of 50% because the CO_2 is now used at least 'twice' compared to the purely fossil status quo (see Figure 1). However, fossil CO_2 continues to be emitted from the earth into the atmosphere (see Figure 2), which therefore misses the climate targets. With DAC or biogenic CO_2, on the other hand, a short-term CO_2 cycle can be achieved, (Figure 3), as here atmospheric CO_2 is extracted from the atmosphere using plants or technology and then processed into e-kerosene or e-methanol. This is the only scenario in which no fossil CO_2 is used for the production of e-kerosene or e-methanol and is released into the atmosphere. Therefore, the atmosfair fairfuel standard derives its criteria for fairfuel from this scenario.

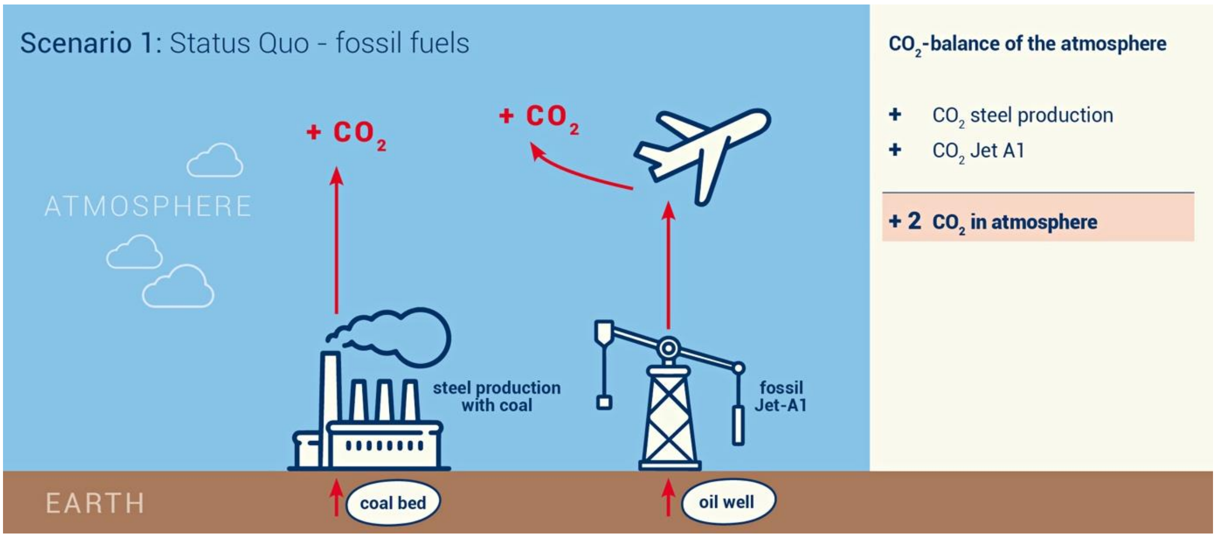

Figure 1: CO_2 emissions in the status quo.

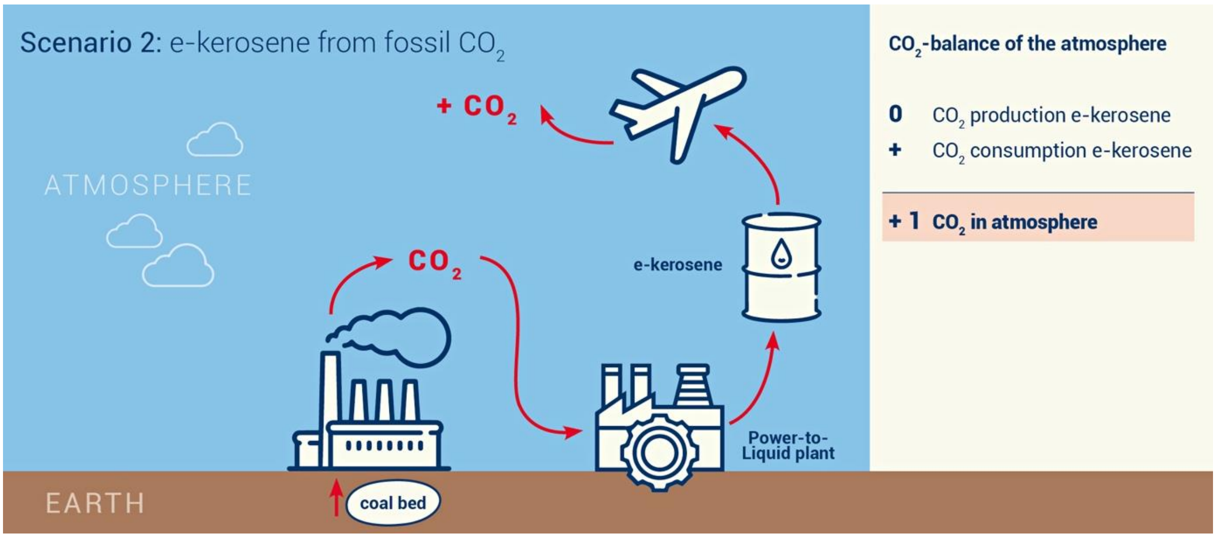

Figure 2: fossil CO_2 - emissions for e-kerosene from fossil sources - status quo reduced by a maximum of half.

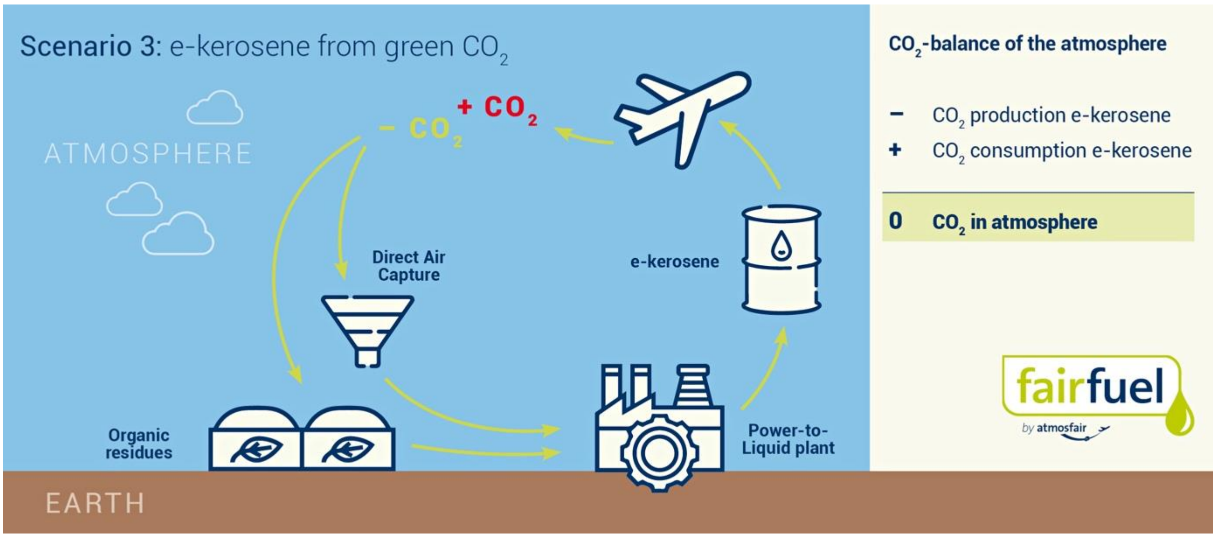

Figure 3: E-kerosene from non-fossil CO_2 . Greenhouse gas neutrality possible.

Over time, the criteria will become stricter to ensure that the targeted decarbonisation of the Paris Agreement will be achieved in 2040 and plants will only be allowed to operate with CO_2 from DAC from 2050 onwards.

Table 1: Permissible CO sources$_2$

	In the first year of operation	2023 - 2024	2025 – 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050	From 2051
AAA DAC, min.	In planning	DAC-capable	0-1%	1-5%	10%*	25%*	50%*	100%*
A sustainable, min.	In planning	25%	35%	45%	65%	75%	50%	
B conditionally sustainable, max.	100%	75%	65%	50%	25%	0%	0%	0%
C non-sustainable, max.	50% fossil**: 0%	25% fossil**: 0%	15% fossil**: 0%	0%	0%	0%	0%	0%
*DAC shares post 2035 subject to their technical development and the development of the other CO sources$_2$ **fossil sources are category **C** (3) ff.								

Electricity

The purchase of electricity for the synthesis plant must not be at the expense of the energy transition and the climate goals of Paris and must not delay the targeted decarbonisation of the electricity sector. Therefore, for atmosfair fairfuel, the electricity must not only be 100% renewable, but also additional and correlate geographically and temporally with the generation. To ensure this, the fairfuel standard is subject to the European renewable electricity sourcing requirements for the production of RFNBOs. The "Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001" sets out these requirements. This ensures that the conditions of additionality as well as a temporal and geographical correlation are guaranteed in the case of a grid reference. The specific requirements can be found in the above-mentioned legal acts.

The fairfuel standard supplements these criteria with additional requirements to ensure the production of e-kerosene / e-methanol in line with the Paris climate targets.

- Deletion of the transitional phase in the area of additionality
- Extension of the geographical correlation (500 km radius)
- System serviceability of the PtL plant

For locations in non-EU countries, the PtL plant operator must additionally provide electricity to the local population, if required, at socially compatible prices.

Other criteria: Water and ESG

The fairfuel standard also includes criteria on water consumption and social aspects of PtL plant construction. The production of synthetic fuels requires a considerable amount of water. The fairfuel standard therefore requires an evaluation of water resource management at sites with critical water consumption and, if necessary, the implementation of targeted measures to ensure the responsible use of water as a resource.

The evaluation of environmental, social and governance (ESG) criteria is becoming particularly important for investments that are built and operated outside Europe.

Water: In regions with water scarcity, the PtL plant operator is obliged to have an expert opinion on water utilisation and the associated environmental impact drawn up by an independent body. Depending on the result of this report, the plant operator is obliged to take measures to ensure the sustainable use of water as a resource. For example, the plant's water requirements can be met from its own desalination plants and not from groundwater.

Social standard and governance criteria: atmosfair uses the ESG criteria of the European Investment Bank, as well as the equator principles for the implementation of social standards, labour protection, preservation of cultural assets, and respect for the interests of disadvantaged groups. The ESG criteria are only checked when setting up PtL plants in other EU countries.

Economic efficiency and feasibility, market ramp-up

Although these criteria require increased effort from plant operators when it comes to planning, they do not automatically result in higher costs. On the contrary, in the long term the costs can be lower relative to other scenarios if the availability of CO_2 and electricity as the main resources in the fairfuel option also means becoming less dependent on external risk factors and being able to guarantee continuous plant operation.

The bottom line is that the fairfuel criteria can often be worthwhile financially speaking. Overall, these criteria do not jeopardise the market ramp-up of PtL fuels in the foreseeable future.

Sufficient CO_2 sources available for air traffic

In addition to environmental standards, the sustainability of PtL also requires attention to the economic side. In addition to the costs already mentioned, it must be ensured that the CO_2 sources permitted under this standard are available in sufficient quantities.

As a result, atmosfair has calculated the CO_2 demand for PtL production for global air transport and compared this with the available quantities from Category **A** and **B** sources (sustainable and partially sustainable) of this standard. It shows that today there are sufficient global sources of residual CO_2 with a focus on waste biomass to fully supply global aviation with sustainable PtL. The faster air traffic grows in the future, the faster the switch to direct air capture must take place. The atmosfair criteria combine the need to switch to DAC quickly from an environmental point of view with the economic need to use sufficiently secure CO_2 sources for the necessary market ramp-up of e-kerosene or e-methanol.

I. INTRODUCTION AND BACKGROUND

e-kerosene and e-methanol, produced from biogenic CO_2 and renewables, have the potential to solve the climate problem of the aviation sector and the maritime transport sector, respectively. e-kerosene can be used directly in today's commercial aircraft fleet, as it is suitable as a substitute for fossil jet fuel and is approved for blending. e-methanol can also be blended in today's ships or replace fossil fuels with minor technical modifications. However, both fuels are not automatically green. ". From a climate perspective, it is crucial that the energy used for production is renewable and the underlying CO_2 sources are biogenic.

Atmospheric CO_2, captured via biogenic or technical processes, is the ideal feedstock for the production of synthetic fuels. The use of what are known as unavoidable fossil sources always results in the emission of fossil, terrestrial CO_2 into the atmosphere.

As renewable energy continues to be a highly contested commodity and an essential component in the energy transition, the electricity for e-kerosene and e-methanol will to come from additional generation capacity, i.e. from new plants built for production or by promoting old plants that would otherwise be taken off the grid.

The standard aims to firmly establish the use of CO_2 from the atmospheric cycle and additional, renewable electricity in the e-kerosene market and in the production of e-methanol.

1. *Target group and application of the fairfuel standard*

atmosfair fairfuel is a voluntary additional standard for all producers of synthetic jet fuel and methanol. It is a label of quality that essentially confirms the environmental quality of the product. The focus is on the requirements for the underlying raw materials CO_2 and renewable energy, but also on extended environmental and social aspects.

2. *Relationship to EU requirements*

An atmosfair fairfuel certification is to be understood as complementary to a certification according to EU requirements[3] (RED II) for the production of RFNBOs. Figuratively speaking, atmosfair fairfuel is the 'organic label' for synthetic fuels. As the fairfuel standard is based on European requirements, there are overlaps between the EU framework and the atmosfair fairfuel criteria. For example, the fairfuel standard adopts the legal requirements for renewable electricity procurement as well as the calculation method for greenhouse gas savings and the threshold value of 70% greenhouse gas savings compared to fossil fuels.

In some places, the fairfuel standard exceeds the legal requirements in order to guarantee the holistic sustainable production of synthetic fuels. Especially in the selection of permissible CO_2 sources, the fairfuel criteria clearly differ from the EU criteria. Fossil CO_2 sources are completely excluded and biogenic CO_2 from non-sustainable sources, such as energy crops and

[3] According to Directive (EU) 2018/2001; Delegated Regulations (EU) 2023/1184 and (EU) 2023/1185

animal waste, are also not permitted. In addition, the prescribed share of CO_2 sources of substrate classes AAA and A increases continuously until 2050.

The fairfuel standard takes the criteria for electricity procurement and the logic for certifying renewable electricity from the EU requirements laid down in Delegated Regulation (EU) 2023/1184. In the fairfuel Standard, however, these requirements are extended by some tightening. The fairfuel standard waives the 10-year transition period for plants built by 2028 and implements the additionality requirement immediately. In addition, the geographical correlation is tightened and the requirement for system efficiency is imposed.

<table>
<tr><th colspan="2"></th><th>EU requirements[4]</th><th>fairfuel</th></tr>
<tr><td rowspan="2">CO_2</td><td>Fossil CO sources$_2$</td><td>▪ CO_2 from power plants for electricity generation permitted until 2035
▪ CO_2 from other uses permitted until 2040</td><td>▪ Fossil CO_2 sources not permitted</td></tr>
<tr><td>Biogenic CO sources$_2$</td><td>▪ No restriction of biogenic CO_2-sources</td><td>▪ Exclusion of non-sustainable biomasses of substrate class C (energy crops and animal waste)</td></tr>
<tr><td rowspan="6">Electricity</td><td rowspan="2">Additionality principle</td><td colspan="2">▪ Power generation facilities may not be commissioned earlier than 36 months before the production facility</td></tr>
<tr><td>▪ Transition phase: Additionality does not apply until 01.01.2038.</td><td>▪ Extended additionality: no transitional phase</td></tr>
<tr><td rowspan="2">Geographical correlation</td><td colspan="2">▪ Power generation facilities are located in the same bidding zone as the production facility (Germany)</td></tr>
<tr><td>▪ No additional requirements</td><td>▪ Extended Geographical Correlation: 500km radius</td></tr>
<tr><td>Temporal correlation</td><td colspan="2">▪ Renewable electricity was generated in the same calendar month in which it was consumed. (From 2030 period = 1 h)</td></tr>
<tr><td>System serviceability</td><td>▪ No requirements for system serviceability</td><td>▪ The system must be controllable in a way that serves the system</td></tr>
<tr><td rowspan="2">Other</td><td>Minimum greenhouse gas savings</td><td colspan="2">▪ 70% GHG savings compared to conventional fuels (comparative value: 94 g CO2-eq./MJ)</td></tr>
<tr><td>Social criteria</td><td>▪ No social criteria formulated</td><td>▪ ESG criteria of the European Investment Bank and equator principles</td></tr>
</table>

[4] According to Directive (EU) 2018/2001; Delegated Regulations (EU) 2023/1184 and (EU) 2023/1185

3. *Compatibility with other standards*

The atmosfair fairfuel standard promotes the use of power-to-liquid e-kerosene to achieve climate targets in the aviation sector and e-methanol in ocean shipping. It does not compete with other voluntary standards that set comparable sustainability criteria and pursue the same goal. Therefore, it is possible to use the atmosfair fairfuel label in combination with other standards. The combination with other standards has no influence on the basic certification process.

However, if an alternative book and claim system is used to market the e-kerosene or e-methanol in the balance sheet, the issuing of fairfuel certificates is not required. In this case, only the produced quantities are labelled with the fairfuel label. In order to prevent double marketing, it is necessary for the plant operator to transparently present his distribution channels (see 1.4 Prohibition of double marketing).

atmosfair allows the use of the following book and claim systems for the balance sheet marketing of e-kerosene. This acceptance is provisional, as both systems are still being set up or are in the pilot phase.

RSB Book and Claim System

European Union database

4. *Restriction to air traffic and maritime transport sector*

Fischer-Tropsch synthesis, electrolysis for hydrogen production, but also other power-to-liquid processes such as methanol synthesis are energy-intensive processes in which a liquid fuel is produced as an energy carrier at high energy cost instead of using the electricity directly for propulsion. This is why this form of synthetic hydrocarbons should in principle be reserved for sectors where there is no better technological solution. These include, in particular, all flights from medium-haul upwards and the maritime transport sector, especially deep-sea shipping.

5. *Compatibility with the 1.5° C climate target set in Paris*

The IPCC's 6th Assessment Report of 2021 says that in order to prevent global warming of more than 1.5°C, there is a 66% probability that a total CO_2 budget of only 400 Gt CO_2 will remain from 2020 onwards. Annual global emissions of CO_2 are currently around 40 Gt (energy-related and direct industrial emissions from the production of cement and steel, for example).

This means that the CO_2 budget for the 1.5°C targets in a conservative scenario with unchanged emissions will be used up by around 2030, and the global economy would have to be fully decarbonised from that year onwards. This budget will be used up at a later point in time if the countries of the world lower their emissions sooner and it will be used up faster if it takes longer for them to lower their emissions.

In the status quo, both fossil point sources such as steel mills and fossil fuels emit CO_2 (Figure 1). The use of fossil CO_2 sources such as cement plants or the steel industry as raw materials for synthetic products achieves CO_2 reductions of no more than 50%. This is because if the CO_2 is extracted from a fossil source, it is only used "twice", but ultimately fossil CO_2 harmful to the climate ends up in the atmosphere (see figure 4). While the question arises to what extent this is attributed to the synthetic product or the source, from a climate perspective a solution of this kind can never be carbon neutral. The situation is different when CO_2 is extracted directly from the air or biogenic CO_2 sources. These filter CO_2 from the atmosphere and absorb it in the short term. Synthetic products from these sources are therefore ideally placed to bring about the complete decarbonisation necessary to meet the climate targets.

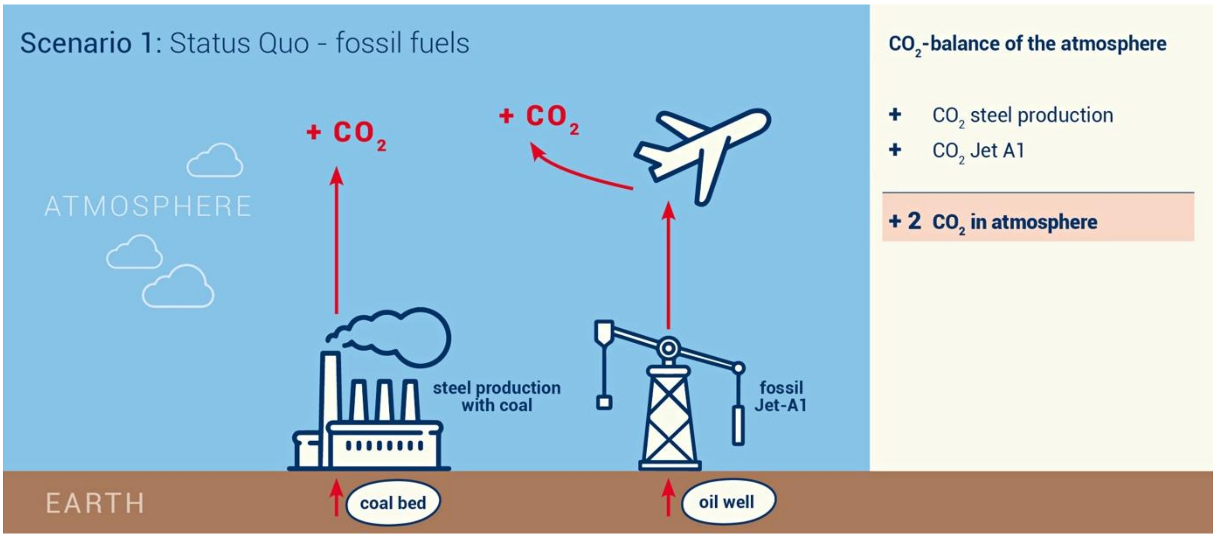

Figure 4: CO_2 emissions in the status quo.

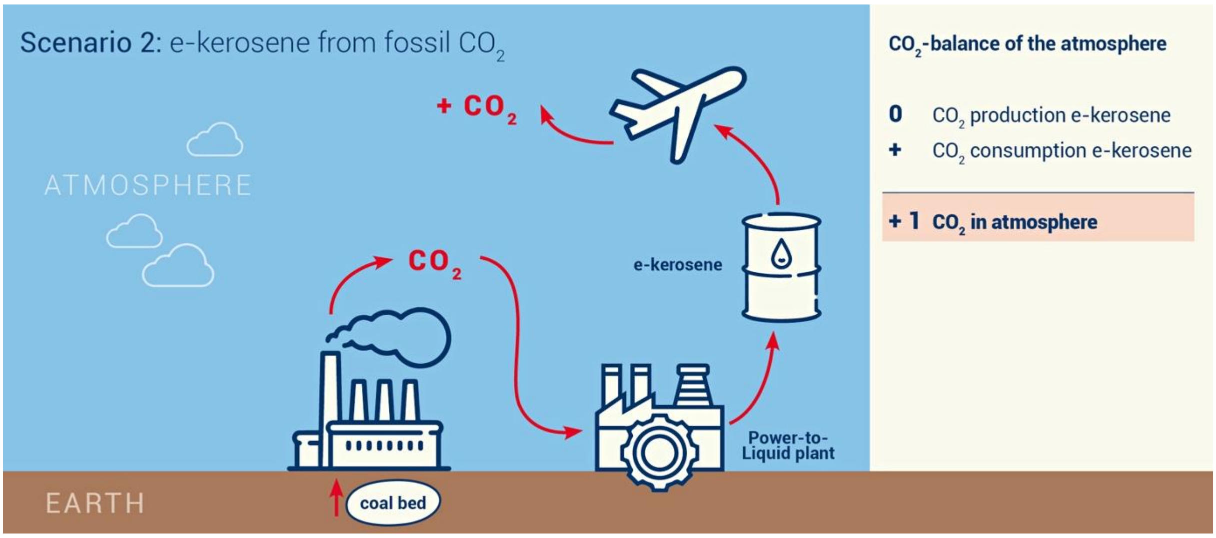

Figure 5: fossil CO_2 emissions for e-kerosene from fossil sources - maximum halving of the status quo.

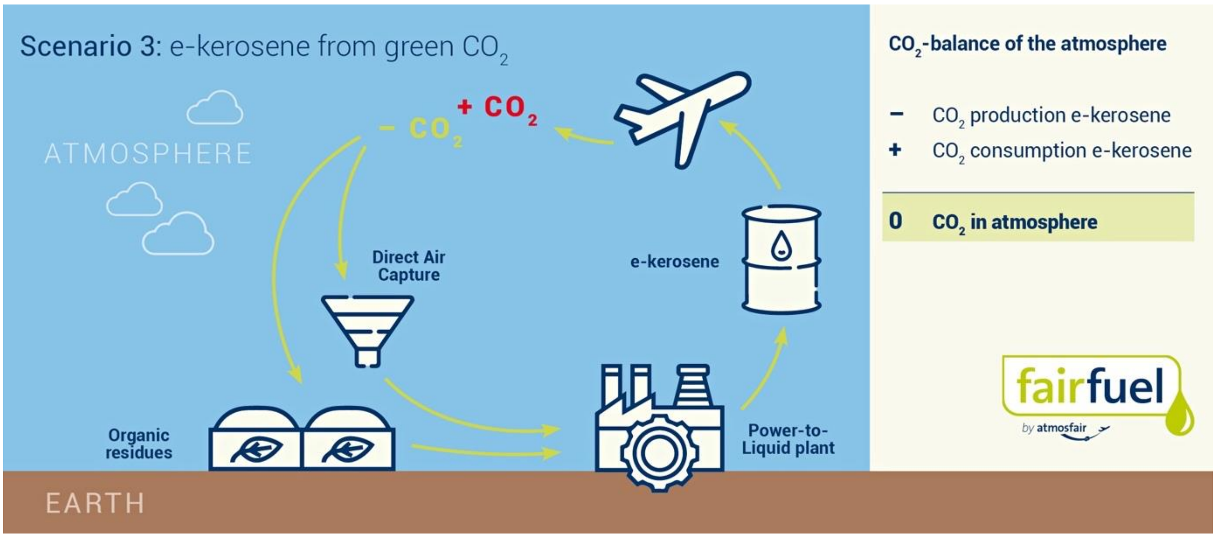

Figure 6: e-kerosene from non-fossil CO_2. CO_2 neutrality possible

The atmosfair fairfuel standard therefore prescribes a strictly non-fossil CO2 supply. Thus, the fairfuel standard is compatible with the conservative development scenario described above for meeting the 1.5° C target.

In addition to the CO_2 and climate problem, the atmosfair fairfuel standard means to solve potential resource challenges of CO_2 provision for PtL production (including sustainable biomass, sustainable substrates for biogas plants) permanently and sustainably through total DAC supply from 2050 onwards.

6. *Global sustainability systems*

To evaluate the wide range of possible raw material sources and to give substance to the concept of sustainability, atmosfair commissioned a study from the ifeu Institute in 2019 with the aim of deriving criteria from global sustainability systems, which we can use to evaluate the sustainability of a wide range of raw materials. To this end, atmosfair has specified the following global sustainability systems for the development of the criteria.

- UN-SDG
- WBGU planetary guard rails
- Planetary boundaries from Rockström et al. (2009) and Steffen et al. (2015)
- ISO standard on sustainability criteria and indicators for bioenergy
- Sustainability indicators of the *Global Bioenergy Partnership*

For the use of CO_2 from *direct air capture (DAC),* we have developed a ramp-up scenario that envisages complete supply by DAC by 2050.

7. *Overarching principles for CO_2 and electricity*

The criteria of the atmosfair label are derived at the highest level from approaches such as the WBGU guard rails, the global boundaries according to Rockström et al, the UN-SDG as well as the climate goals of Paris and environmental legislation. They are intended to ensure that atmosfair fairfuel is in line with the Paris climate goals and that at least no further direct or indirect environmental disadvantages arise from its use (such as competition for renewable electricity as a raw material), but rather additional environmental and social benefits, especially in production in the global South.

The certification of synthetic fuels is based on criteria for the resources used. In the following, we look at the main sources, CO_2 and electricity.

A. CO2

The principles derived here for CO_2 sources ensure both a closed carbon cycle and a compatible approach to the environment.

i. **Exclusion of fossil sources:** This includes not only sources such as coal gasification, but also carbon capture from the waste gas of coal-fired power plants and similar sources. In this case, the carbon cycle would not be closed; the CO_2 emissions would merely be reused. This also further increases the concentration of CO_2 in the atmosphere.
ii. **Residual character of CO_2**: The CO_2 source should be similar to waste, i.e. that of an involuntarily produced waste material. This excludes CO_2 produced in industrial processing.
iii. **Environmental impacts of CO_2 production:** The process from which the CO_2 originates may not cause any other adverse environmental effects.
iv. **Avoidance of lock-in effects:** We exclude sources that can be replaced by emission-free or lower-emission sources in order to prevent new economic and environmental opportunities from being created for them by including them as CO_2 sources in the PtL process.
v. **DAC to 100% from 2050:** This principle is necessary to ensure the global economy's is completely decarbonised in enough time. It is based on the assumption that by 2050 renewable energy will be available cost-effectively worldwide and will fully meet the energy needs of the global economy. This then justifies the energy-intensive DAC process from an energy standpoint, while it otherwise has no harmful environmental impacts or other negative effects that become almost unavoidable with other sources of CO_2 when large quantities are involved.

DAC and other sustainable CO_2 sources: no cost drivers

However, the CO2 criteria and in particular the requirement to ramp up DAC as the main source of CO2 for fairfuel is not only necessary from a climate perspective, but also feasible and sensible from an economic standpoint. With costs for DAC already forecast in the mid to low 3-digit euro range per tonne today, supplying all CO2 from DAC only accounts for about 10% of the total costs of a PtL plant. In the atmosfair fairfuel ramp-up scenario described here, the total costs for DAC during the first decades are even in the low single-digit percentage range of the total costs. In exchange, the operator avoids the costs for other CO2 sources, the long-term availability of which, however, poses a considerable risk to the economic viability of the PtL plant, especially at locations in areas with high political and economic instability. DAC, on the other hand, can be used virtually regardless of location and involves an independent source of CO2 that is reliable in the long term.

The considerations mentioned above apply to an even greater extent to other CO2 sources, which today cost even less than DAC. With this in mind, it becomes clear that fairfuel's criteria for CO2 described here do not make a trade-off necessary between the economic viability of PtL plants and their environmental integrity.

B. Electricity

The electricity purchased for the synthesis plant must not be at the expense of the energy transition and the climate goals of Paris and must not hinder the decarbonisation of the electricity sector. Therefore, for atmosfair fairfuel, the electricity must not only be 100% renewable, but also additional and correlate geographically and temporally with the generation. To ensure this, the fairfuel standard is subject to the European guidelines for renewable electricity procurement for the production of RFNBOs. These are set out in the Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001. This ensures that the conditions of additionality as well as a temporal and geographical correlation are guaranteed in the case of grid procurement.

The European Union sets three essential criteria for the purchase of renewable electricity from the grid. The specific requirements and exemptions can be found in Delegated Regulation (EU) 2023/1184.

i. **Additionality (Article 5):** The renewable electricity installations were commissioned no earlier than 36 months prior to the commissioning of the production facility and have not received public support.

ii. **Time correlation (Article 6):** The renewable electricity from Power Purchase Agreements was generated in the same calendar month in which it was consumed.

iii. **Geographical correlation (Article 7):** The power generation facility is located in the same bidding zone as the synthesis facility.

The fairfuel standard supplements these criteria with additional requirements to ensure that the synthesis plant is operated in line with the Paris climate targets.

- Extended additionality: The fairfuel standard waives the transitional period specified in Article 11 (Delegated Regulation (EU) 2023/1184), for installations commissioned before 1 January 2028.
- Extended Geographical Correlation: The power generation plants must be located within a radius of 500 km around the PtL plant.
- System serviceability: The PtL system must be able to throttle the output immediately upon request of the grid operator in order to relieve the grid if necessary.

8. Other principles: Water, ESG etc.

In addition to sourcing the two essential raw materials, CO_2 and electricity, there are other principles that ensure the sustainable use of local resources.

Water

A synthesis plant needs a significant amount of water, which can be critical in areas with high water scarcity. Consequently, it must also be ensured here that the plant does not harm or even decrease the water resources of the local residents, for example through the construction of desalination plants. When desalinated seawater is used, it must be ensured that the resulting waste product, the concentrated brine, has no negative impact on the environment.

Social and governance principles

Due to the more favourable electricity production conditions in the Global South, it is predestined as a plant location. With a project of this kind, it is imperative that project development protects the interests of the local community and also represents added value for the location.

9. Greenhouse gas calculation

The fairfuel standard follows the methodology for determining the greenhouse gas savings of synthetic fuels of the European Union and also adopts the threshold for greenhouse gas savings of 70% compared to fossil fuels. The methodology is set out in the "Commission Delegated Regulation (EU) 2023/1185 of 10 February 2023 supplementing Directive (EU) 2018/2001". The calculation is carried out by the synthesis plant operator and regularly verified by an approved certification body.

10. Environmental integrity vs. economic viability and scalability

Although the present criteria require increased effort from plant operators in planning, they do not automatically result in higher costs. On the contrary, in the long term the costs can be lower relative to other scenarios if the availability of CO2 and electricity as the main resources in the fairfuel option also means becoming less dependent on external risk factors and being able to guarantee continuous plant operation. For example, supplying CO2 with DAC plants on a large scale in the future will prevent potential conflicts of use with biomass. This idea is further developed in the following sections.

The bottom line is that the fairfuel criteria can often pay off. Overall, these criteria will not jeopardise the market ramp-up of PtL fuels in the foreseeable future.

Sufficient CO_2 sources available for air traffic

The sustainability of PtL requires paying attention to the economic side as well as the environmental standards. In addition to the costs already mentioned, it must be ensured that the CO_2 sources permitted under this standard are available in sufficient quantities.

atmosfair has therefore calculated the CO_2 demand for PtL production for global aviation and compared it with the available quantities from sources in categories **A** and **B** (sustainable and conditionally sustainable) of this standard. It shows that sufficient residual CO_2 sources are available globally today, with a focus on waste biomass, to fully supply global aviation with sustainable PtL. In order to supply the growing air traffic and other no-regret applications with sufficient synthetic fuels in the future, the switch to direct air capture must take place, as shown in Table 1.

II. Criteria

This part contains the atmosfair fairfuel criteria. These describe the requirements for the atmosfair fairfuel label.

The requirements for providing proof of compliance with the criteria can be found in section VERIFICATION, the audit process is described in the section PROCEDURE.

1. *Principles*

atmosfair fairfuel is a label for synthetically produced crude oil and synthetic methanol for use and crediting as fuel in aviation and shipping that comply with these criteria for the entire production chain.

1.1 Use only in aviation and maritime transport

The marketing of atmosfair fairfuel is exclusively permitted for civil, commercial aviation and the maritime transport sector. This also includes the corresponding areas of logistics companies. Marketing in the road transport sector is explicitly excluded.

1.2 Not limited to a single technology

The label is open to all technologies; the operator of the synthesis plant can produce the hydrocarbons via the currently available pathways, e.g. Fischer-Tropsch synthesis or the methanol route. Other routes are possible, provided that they are approved for the corresponding use (e.g. ASTM for aviation).

1.3 Book&claim crediting, fairfuel certificates

The current volumes of synthetic crude oils that can be produced do not usually justify separate processing in a refinery , but require the crude oil to be processed into fuel in what is known as co-processing, where the refinery processes synthetic and conventional fossil crude oils together. Co-processing makes it necessary to credit the climate-friendly attribute of the synthetic crude oil to the paying customer (e.g. airlines) in balance sheet form, since at the refinery exit the fuels can no longer be physically separated according to the different crude oils at the refinery entrance. The book&claim crediting is done analogously to the green electricity market with production certificates that certify quantity and quality. These proofs for customers (fairfuel certificates) can be certified by independent auditors at the end of the certification process for the respective quantity produced on the basis of these criteria. If the plant operator prepares and markets the balance sheet proofs via an alternative system, the fairfuel standard serves exclusively as a label of quality. In this case, the issuance of fairfuel certificates in accordance with the provisions of the standard is not required.

1.4 Prohibition of double counting

Double counting (crediting) is prohibited. The applicant must prove that intermediaries, e.g. service providers such as refineries or refueling companies, do not already credit themselves with the CO_2 emission savings of the fairfuel. In addition, the applicant must transparently demonstrate its distribution channels and the use of alternative marketing systems to ensure that there is no double issuance of accounting certificates for the e-kerosene or e-methanol produced.

1.5 Exemptions, case-by-case assessment, further development

The criteria outlined here are an initial start for the relatively new field of synthetic fuel production for aviation and shipping. atmosfair will continue to develop and adapt the criteria over time, incorporating developments from practical experience.

If plant operators cannot currently comply with individual criteria for certain reasons, they can still submit his plant to atmosfair for review. atmosfair can then decide in a case-by-case review whether the arguments presented justify a temporary or permanent exemption from an environmental point of view.

2. *CO_2 supply*

1.1 Categories of permissible and impermissible CO_2 sources

Category **AAA**: Direct Air Capture, permitted

The PtL plant has to cover part of the CO_2 demand by Direct Air Capture (DAC) units. The scope is defined in Table 1.

Category **A**: Unrestricted CO_2 sources

(2) Biogas (e.g. CO_2-biomethane upgrading by amine gas treating): Only residual substrates of class A may be used for the biogas plants, see *Substrate classes for biogas production*.
(3) Biomass: Permissible biomasses of class A see *Substrate classes for biomass* .
(4) Sewage sludge and biogas from municipal wastewater.
(5) Pulp&paper: only with expert opinion according to *Proof of CO2 sources* (no net forest loss, no biodiversity degradation, depending on recycling share).
(6) Waste incineration with CCU (Carbon Capture and Use), proportionate according to expert classification of fuels in class A as per *Substrate classes for biomass* .

Category **B**: CO_2 sources permitted to a limited extend

(1) Biogas (e.g. CO_2-biomethane upgrading by amine scrubbing): Only class B residual substrates may be used for the biogas plants, see *Substrate classes for biogas production*.
(2) Biomass: Permissible biomasses of class B see *Substrate classes for biomass* .
(3) Pulp&paper: only with expert opinion according to *Proof of CO2 sources* (no net forest loss and no biodiversity degradation).
(4) Waste incineration with CCU (Carbon Capture and Use), proportionate according to expert classification of fuels in class B as per *Substrate classes for biomass* .

Category **C**: non-sustainable CO_2 sources

(1) Biogas: Class C substrates, see *Substrate classes for biogas production*.
(2) Class C biomasses, *Substrate classes for biomass* .
(3) Waste incineration with CCU, fossil, state of the art recyclable fraction of waste according to expert classification.
(4) Cement plants
(5) All fossil sources (CCS at power plants, natural gas, etc.)
(6) Petroleum sector (refineries etc.)
(7) Bioethanol production
(8) Steel, aluminium, glass and ceramic production

Upon request, atmosfair will consider sources or substrates not listed on a case-by-case basis. This is based on the principles from the section *Overarching principles for CO2 and electricity*.

1.2 Permissible proportions of the different CO_2 sources

Table 1 shows the composition of the permissible CO_2 categories for a given operating period.

The specified values are to be achieved at the beginning of the period. An exception exists in the first ten years of operation. Here, the values must only be achieved by the end of the first ten years of operation. At least 1/10 of the final value must be increased (**AAA** and **A**) or decreased (**B** and **C**) annually.

	In the first year of operation	2023 - 2024	2025 – 2030	2031 - 2035	2036 - 2040	2041 - 2045	2046 - 2050	From 2051
AAA DAC, min.	In planning	DAC-capable	1%	5%	10%*	25%*	50%*	100%*
A sustainable, min.	In planning	25%	35%	45%	65%	75%	50%	
B conditionally sustainable, max.	100%	75%	65%	50%	25%	0%	0%	0%
C non-sustainable, max.	50% fossil**: 0%	25% fossil**: 0%	15% fossil**: 0%	0%	0%	0%	0%	0%
*DAC shares post 2035 subject to their technical development and the development of the other CO sources$_2$ **fossil sources are category **C** (3) ff.								

Table 1 Requirements for CO_2 supply.

Example: If a synthesis plant is commissioned in 2024, the restrictions in the first column apply in the first year. In 2034, the plant must be operated with at least 5% DAC CO_2, at least 45% CO_2 of category **A, a** maximum of 50% CO_2 **of category B** and without CO_2 of category **C.** This means that from the second year onwards, the plant must already use at least 0.5% of CO_2 from DAC and 4.5% (+45%/10) of CO_2 from category **A and a** maximum of 95% (-50%/10) from category **B, and a** maximum of 90% (-100%/10) from category **C.**

3. Electricity supply

3.1 Principles

(1) The amount of electricity required for the production of synthetic hydrocarbons must be provided 100% from renewable energy sources that are not remunerated under the EEG.
(2) The synthesis plant operator must give priority to wind and solar power (incl. *concentrated solar power,* CSP) over hydropower and biogas power generation.
(3) The synthesis plant operator receives electricity from a PPA and complies with the requirements for renewable electricity purchases set out in the "Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001". The European Union sets out three main criteria for the purchase of renewable electricity from the grid: additionality, temporal correlation and geographical correlation. Please refer to Delegated Regulation (EU) 2023/1184 for the specific requirements and exemptions.
(4) The fairfuel standard supplements these criteria with additional requirements (3.5) to ensure operation of the synthesis plant in line with the Paris climate targets.

3.2 Additionality (Article 5, EU 2023/1184):

(1) The renewable electricity generation facilities were commissioned no earlier than 36 months before the production facility went into operation.
(2) The renewable electricity generation plants have not received any public funding.
(3) Commissioning also applies after re-powering of the generation plant and promotion before re-powering is also not relevant.

3.3 Temporal correlation (Article 6, EU 2023/1184):

(1) The renewable electricity was generated in the same calendar month in which it was consumed.
(2) As of 01.01.2030, a time correlation of one hour applies.

3.4 Geographical correlation (Article 7, EU 2023/1184):

(1) The power generation plant is located in the same bidding zone as the synthesis plant.
(2) The power generation facility is located in an offshore bidding zone that is connected to the bidding zone of the production facility.

3.5 Extended fairfuel requirements

(1) Extended additionality: The fairfuel standard waives the transitional period specified in Article 11 (Delegated Regulation (EU) 2023/1184), for installations commissioned before 1 January 2028.
(2) Extended Geographical Correlation: The power generation plants must be located within a radius of 500 km around the PtL plant.

(3) System serviceability: The synthesis plant operator should strive to upgrade his plant to provide grid-serving services (e.g. through curtailment via external specialised load managers in a previously defined scope and time window).

3.6 Ramp-up phase

(1) The ramp-up phase is the time before commissioning. Commissioning is the time when the synthesis plant is handed over from the plant manufacturer to the operator.
(2) The power purchase requirements do not apply during the ramp-up phase. As there is no production at full load during this period and the electricity demand fluctuates strongly, no sustainable PPA can be concluded with generating plants.

3.7 EU and non-EU foreign countries

(1) The location of the power generation plants must be examined and assessed on a case-by-case basis. The basis for assessment is the infrastructure of the grid and the power generation plants in the country of the PtL plant. It should be ensured that the PtL plant does not further exacerbate bottlenecks in the grids.
(2) If an installation is erected in a non-EU country, the PtL plant operator is responsible for rural electrification, if applicable. If the last determined rural electrification rate (based on World Bank data) of the country where the plant is located is below 75% or if the Human Development Index (based on United Nations Development Programme data) of the country where the plant is located is below 55%, the PtL plant operator is required to construct additional power supply facilities. The electricity generated in these facilities must be made available to local residents at socially acceptable prices. The PtL plant operator must strive to ensure that the capacity of the power supply facilities corresponds to the total capacity of the PtL plant and to make an ambitious contribution to the development of renewable electricity supply in the country.

4. Water

(1) Water scarcity at the plant location is determined on the basis of the "Overall Water Risk" parameter in the [Aqueduct Water Risk Atlas] (World Resources Institute). The parameter combines various physical and regulatory indicators of regional water utilization.
(2) If the PtL plant site has an "Overall Water Risk" value of over 3 (medium-high), the operator is obliged to have an expert opinion on the impact of water utilisation at the site drawn up by an independent body. On the basis of this report, measures must then be taken to ensure sustainable water consumption.
(3) When using desalinated seawater, it is important to ensure that the resulting waste product, the concentrated brine, has no negative impact on the environment.

5. Social standards and governance

The ESG criteria of the European Investment Bank and the equator principles are applied to the implementation of minimum social standards, occupational safety, the preservation of cultural assets and the representation of interests in non-EU countries.

(1) If a PtL plant is constructed at locations outside the European Union, the plant operator undertakes to submit a report to atmosfair showing how compliance with and verification of the ESG criteria for the construction and operation of the plant can be guaranteed.
(2) atmosfair reviews this report and may request further evidence of compliance with the ESG criteria.
(3) In particular, the following areas of the European Investment Bank's ESG criteria must be demonstrated for the construction and operation of the facility:
    5. Cultural heritage,
    6. Involuntary resettlement,
    7. Rights and Interests of vulnerable groups,
    8. Labour standards,
    9. Occupational and public health, safety and security,
    10. Stakeholder engagement.

(4) Proof must be provided of compliance in the following areas for construction and operation of the plant in accordance with the Equator Principles:
    5. Grievance mechanism and
    10. Reporting & transparency.

6. Book&claim crediting, CO_2 emissions reduction, certification for customers

(1) The following applies to the quantity of fairfuel (synthetic crude oil) produced: one tonne of synthetic crude oil produced and placed on the market is equivalent to one tonne of fairfuel. This achieves climate relief compared to fossil fuels. This approach applies as long as no other approach, such as mass balancing under another standard, applies.
(2) In order to make a maximum contribution to the decarbonisation of air and sea transport, the plant operator undertakes to ensure that the highest possible proportion of all solid and liquid starting products from its plant flows into the corresponding end products, such as paraffin. To this end, the optimum feasible processing methods for waxes and oils must be selected in co-operation with the downstream stage (refineries).
(3) Avoidance of double counting: The operator of the PtL production plant must prove in the immediately upstream stage (CO_2 source) and downstream stage (refinery) of synthetic crude oil production that the associated suppliers or customers do not credit the climate relief of the CO_2 used or the synthetic crude oil produced to themselves in the same accounting area or market it to other third parties.
(4) The PtL plant operator can issue fairfuel certificates for book&claim marketing in accordance with these standards. The issuing of the certificates and the comparison with the quantities produced is checked by atmosfair on an annual basis. He can market this certificate to his customers as proof of the quantity of synthetic crude oil produced for the customer, the fuels placed on the market and the corresponding climate relief. The PtL plant operator is

responsible for the necessary register management (proof of inflow and outflow of all certificates to avoid double marketing in suitable registers) and its transparent documentation and verification by independent third parties vis-à-vis its customers.

(5) Point (4) does not apply if the plant operator does not sell the e-kerosene or e-methanol via fairfuel certificates, but via a recognised book and claim system (e.g. Union database or RSB book and claim).

III. Verification

In this section, we list the documents that the applicant for the fairfuel label should provide for the validation of the facility and verification of the production of synthetic e-kerosene and e-methanol.

1. *Proof of sales to air transport and ocean shipping*

During validation, the operator undertakes in an atmosfair fairfuel marketing commitment to sell the atmosfair fairfuel only to customers from the civil, commercial aviation or maritime transport sector. The marketing commitment contains specifications of the evidence such as reports of the applicant's auditor, marketing materials on websites etc. in the verifications as well as sanctions in case of non-compliance.

2. *Proof of CO_2 sources*

2.1 DAC use

Validation

(1) The operator of the synthesis plant shall indicate planning and DAC capability by means of planning documents, in particular the installation plan, the overall flow diagram of the plant and contracts of interest or purchase agreements with DAC plant suppliers.

Certification

(2) The synthesis plant operator proves the produced quantities via the operating documentation (measurement data from a calibrated and protected flow sensor).

2.2 Categories **A** and **B**

Validation

(1) The synthesis plant operator shall submit the supply contracts with the CO_2 source operators as evidence of quantities and qualities.

Certification

(2) Qualities: Proof of the actual qualities is provided by a suitable certification of the CO_2, which shows the quality of the CO_2, e.g. DENA or NABISY certification of a biogas plant or expert opinion for wood. The wood expert opinion must confirm that the wood used is at the end of the utilisation cascade (material utilisation - chip-based utilisation - fibre-based utilisation). For paper sources, it must be confirmed that the fresh fibre content is minimised according to the state of the art. The fresh fibre sources must be fully verified and may only originate from sustainably managed, ecologically harmless biodiverse and site-appropriate mixed forests. In addition, the expert opinion must confirm that the criteria according to section

(3) *Social standards and governance* are also respected in timber procurement.
(4) Quantities: The use of CO_2 quantities is verified by the synthesis plant operator via the production documents (measurement data from a flow sensor).

3. *Proof of electricity supply*

3.1 Principles

Validation

(1) The synthesis plant operator shall submit the electricity supply contract as proof of the exclusive use of renewable energy.

3.2 Additionality

Validation

(1) The synthesis plant operator submits PPA contracts showing the date of commissioning of the power generation plants. In addition, it must be proven that the plants have not received public funding.

3.3 Temporal correlation

Certification

(1) The synthesis plant operator shall submit the electricity origin certificates, as well as the production profile of the electricity generation facilities and the load profile of the synthesis plant.

3.4 Geographical correlation

Validation

(1) The synthesis plant operator shall submit PPA contracts indicating the location of the generating facilities.

3.5 System serviceability

Validation

(1) The system operator must provide evidence of certification of the grid-friendly control system from the third year of operation. This can be ensured through processes as well as technical implementation.

3.6 EU-RED certification

Validation

(1) If official certification in accordance with EU requirements is available, the proofs for 3.2 and 3.3 are not required. Instead, the system operator must submit valid documentation for certification in accordance with RED II.

4. Proof of production quantity

4.1 Monitoring and mass balancing system

Validation

(1) The synthesis plant operator develops a monitoring and mass balancing system in which all relevant input and output quantities and processing steps along the supply chain are regularly documented.

Certification

(1) The synthesis plant operator submits the monitoring and mass balancing system and the quantities contained therein to atmosfair gGmbH for review at least once a year.

4.2 Refinery acceptance agreement

Validation

(1) The synthesis plant operator proves the agreement with the refinery by submitting the offtake agreement [one-off proof].

Certification

(1) The synthesis plant operator provides proof of the quantity of synthetic crude oil delivered in the form of a confirmation of receipt from the refinery. This also certifies the conversion of the synthetic crude oil into the refinery's final products.
(2) If the synthesis plant operator makes use of I 7.3 (separate utilisation of the wax phase), it shall provide suitable documentation to prove that the synthetic crude oil used was not produced with CO_2 of fossil origin, as well as the quantity produced by weight measurement (in kg). The installation operator shall provide evidence of the quantity of synthetic crude oil used as a substitute in the form of delivery documents containing the quantity of crude oil in kg.

4.3 Prohibition of double counting

Validation

(1) The synthesis plant operator shall provide written declarations from the CO_2 supplier and the purchaser of synthetic crude oil (refinery) to prove that they do not offset the CO_2 reductions achieved by the fairfuels themselves.

5. *Proof of GHG calculation*

5.1 Calculation matrix

Validation

(1) The operator of the synthesis plant shall submit a calculation matrix in accordance with the method set out in Delegated Regulation (EU) 2023/1185, which it will use in future to calculate the greenhouse gas savings of the synthetic fuels it produces.

Certification

(1) The synthesis plant operator calculates the greenhouse gas savings for the quantities of synthetic fuel it produces for each quarter.

6. *Proof of water*

6.1 Evaluation of water scarcity

Validation

(1) The plant operator submits an evaluation of water scarcity at the site based on the Aqueduct Water Risk Atlas.
(2) If the "Overall Water Risk" value is above 3 (medium-high), the synthesis plant operator submits an independent expert opinion on water utilisation at the site.
(3) If the limit value from (2) is exceeded, the synthesis plant operator submits a water management strategy based on the expert opinion drawn up, which shows which measures are used to ensure sustainable water utilization.

6.2 Measures for water resource management

Validation

(1) If necessary, the synthesis plant operator submits planning documents on technical measures for water resource management, such as seawater desalination plants or water treatment plants. In particular, the purchase contract and the technical specifications, as well as technical data on the water requirements of the synthesis plant.

(2) If desalinated seawater is used, the plant operator must submit an independent study that rules out any negative effects of the concentrated brine on the environment. If negative effects are to be expected, the plant operator must provide evidence of appropriate countermeasures.

Certification

(1) After commissioning, the synthesis plant operator verifies the desalinated or treated water quantities by means of operating documents (measured data from a flow sensor).

7. *Proof of compliance with social standards and governance*

7.1 Evaluation ESG criteria

Validation

(1) If the synthesis plant operator operates or is planning a plant in another EU country, the plant operator submits a report to atmosfair showing how compliance with and verification of the ESG criteria for the construction and operation of the plant is ensured.

Certification

(1) After reviewing the report, atmosfair is free to request further evidence of compliance with the ESG criteria at any time.

IV. Process for awarding the Label

The formal procedure for awarding the "atmosfair fairfuel" label is divided into two steps: validation and certification. Validation consists of a one-off assessment of the suitability of the synthesis plant. Certification consists of an ongoing ex-post review of the synthetic hydrocarbon produced.

1. *Responsibility*

atmosfair is responsible for the entire procedure for awarding the label. atmosfair is also authorised to involve third parties in the procedure in accordance with this section IV, in particular as certification bodies approved by atmosfair for the validation of the synthesis facilities.

In detail, atmosfair approves the certification bodies (see section IV, paragraph 2), carries out the application and registration process (see section IV, paragraph 3), has the certification bodies validate synthesis plants (see section IV, paragraph 4), certifies the synthetic hydrocarbon produced together with the certification bodies (see section IV, paragraph 5) and conducts the proceedings in the event of violations (see section IV, paragraph 6).

2. *Authorisation of certification bodies*

Certification bodies are directly authorised by atmosfair. Approval as a certification body requires valid recognition in a "voluntary scheme" recognised by the EU in accordance with Article 30, Paragraph 4, RED II. In this way, atmosfair ensures that the certification bodies comply with the EU requirements in accordance with Implementing Regulation (EU) 2022/996 and have the necessary accreditations.

If a natural or legal person fulfils the aforementioned requirements, they are entitled to submit an informal application for approval as a certification body by email to atmosfair (fairfuel@atmosfair.de). This standard is freely accessible on the atmosfair website and can also be made available by atmosfair if interested.

If atmosfair approves a person as a certification body, atmosfair publishes the newly approved certification body on its website www.atmosfair.de. From the time of the corresponding publication, certification bodies are authorised to validate and certify synthesis facilities in accordance with the fairfuel standard. atmosfair is entitled to refuse approval as a certification body at its own discretion; it is not necessary to give reasons for this.

3. Application for the award of the label; registration

Applications for the award of the label and all related communication (including questions about details of the fairfuel standard) are sent informally by email to atmosfair (fairfuel@atmosfair.de). By sending an e-mail, the applicant agrees to communication via e-mail and the corresponding storage and processing of data.

Operators of synthesis plants with the aim of producing e-kerosene are eligible to apply for certification. The application is followed by registration by atmosfair, during which all relevant data is recorded and the applicant is presented with a list of possible certification bodies.

4. Validation

Validation is the one-off determination of the suitability of a synthesis plant. It is carried out by a recognised certification body, unless otherwise specified below. The validation consists of a comprehensive review of all relevant documents based on the criteria specified in Section III. The audit includes an on-site inspection of the facility and serves to determine the basic suitability of the facility to produce synthetic hydrocarbons in accordance with the atmosfair fairfuel standard. The results are recorded in writing by the certification body in an audit report, which is immediately sent to atmosfair for information and archiving.

Test fields are those listed in Section III. Verification under the keyword validation.

Furthermore, the certification body checks compliance criteria with the points:

- Legitimate authorisation
- Operating licences
- Insurances

The verification of the evidence in accordance with Section III, Item 7 Social Standards and Governance is carried out by atmosfair and not by the responsible certification body.

Validated PtL plants and the corresponding synthesis plant operators are published on the atmosfair website and included in the management system of the fairfuel standard as a production site. This date marks the beginning of the possibility of marketing atmosfair fairfuel.

5. Certification

A successfully completed validation authorises the synthesis plant operator to have the synthetic hydrocarbons produced certified. The certification consists of calendar-yearly inspections and relates to a specific production volume in each case.

The certification is divided into two test areas:

- on the one hand, the quality inspections of production, e.g. proof of origin of electricity, whereby this is carried out by the responsible certification body (see A. below) and

- secondly, the verification of the issuance of fairfuel certificates and the comparison with the quantities of synthetic hydrocarbons produced, which is carried out by atmosfair (see B. below).

The certifications cover the period of one calendar year and must be completed by the end of the first quarter of the following year at the latest.

1. Production quality checks

The responsible certification body checks all the required evidence of the production of synthetic hydrocarbons listed under Section III. Verification under the label "Certification" (except 7.1 Evaluation ESG criteria). The certification body prepares a written report on the results of its inspections. The certification body submits the report of the calendar year certification to atmosfair.

2. fairfuel certificates

atmosfair verifies the issuance of fairfuel certificates. The operator of a validated synthesis plant can issue and sell fairfuel certificates for the quantities of synthetic hydrocarbons produced in accordance with the atmosfair fairfuel criteria. The synthesis plant operator undertakes to set up a monitoring and mass balancing system, which is checked for the first time by the certification body in the course of validation. In this system, the synthesis plant operator continuously archives all relevant supply chain data, the quantities of synthetic fuels produced and the quantities of fairfuel certificates sold. In addition, the synthesis plant operator undertakes to archive the following documents: invoice receipts in connection with the sale of atmosfair fairfuel, confirmations of receipt from refineries.

As part of the annual certification process, the synthesis plant operator has the monitoring and mass balancing system, the certificates issued and all associated documents audited by an auditor for the previous calendar year and submits the report to atmosfair for review in the first quarter of the following year. The auditor's report must confirm that the quantities produced correspond to the quantities of atmosfair fairfuel sold. Unsold fairfuel certificates are carried forward to the following year. If more fairfuel certificates are sold in a calendar year than have been produced, atmosfair may, at its own discretion, carry over a negative amount into the new calendar year. This negative carryover may correspond to a maximum of 5% of the quantities produced in this calendar year. If the shortfall exceeds this limit, it is an offence and atmosfair can take appropriate measures.

In addition, atmosfair has the right to check the quantity and correctness of the issuance of fairfuel certificates itself or through an authorised third party, also in the course of a production year in the form of random samples or as a whole. For this purpose, the synthesis plant operator is obliged to provide atmosfair or the authorised third party with all necessary business documents within a period of 2 weeks.

6. Procedure in case of violations

A) Violations by system operators

If a synthesis plant operator violates the requirements of the fairfuel standard, atmosfair warns the plant operator. A third warning leads to a permanent withdrawal of the fairfuel certification. In the event of particularly serious or wilful violations in connection with the sale of fairfuel certificates, the fairfuel certification will be withdrawn without the need for a prior warning. A particularly serious offence is given, for example, if the number of fairfuel quantities sold exceeds the actual quantities of synthetic fuels produced in accordance with the fairfuel criteria by more than a negligible amount. If the fairfuel standard is withdrawn, sales of fairfuel certificates must be cancelled at the request of atmosfair.

B) Violations by certification body

In the event of more than minor violations of the requirements of the fairfuel standard by a certification body, atmosfair is authorised to revoke the approval of the certification body with immediate effect. This is particularly the case if a certification body validates a synthesis plant even though the requirements are not met.

7. *Relevant legislation*

The atmosfair fairfuel standard adopts the criteria for renewable electricity procurement and the calculation method for greenhouse gas savings from the legal requirements in Europe. The legal acts listed here are therefore a substantive basis for certification according to the fairfuel Standard. It should be noted that possible changes to the laws and regulations may affect the atmosfair fairfuel standard.

(1) 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.
URL: https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=celex%3A32018L2001

(2) Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology laying down detailed rules for the production of liquid or gaseous renewable fuels of non-biogenic origin for transport.
URL: https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX:32023R1184

(3) Commission Delegated Regulation (EU) 2023/1185 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a minimum threshold for greenhouse gas savings from recycled carbon fuels and a methodology for determining greenhouse gas savings from renewable liquid or gaseous transport fuels of non-biogenic origin and from recycled carbon fuels
URL: https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX:32023R1185

(4) Commission Implementing Regulation (EU) 2022/996 of 14 June 2022 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria
URL: https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX%3A32022R0996

V. Annex: Substrate classification for biogas and biomass use

This section contains the classification of substrates for biogas and biomass sources from which the CO_2 originates. It also provides a detailed breakdown of the individual substrates.

1. *Substrate classes for biogas production*

Biogas substrate list

Origin	Substrate	Category
Agriculture	Crop residues	A
	Fodder residues, mashed grain, spoiled silage	B
	Cereal straw	B
	Renewable raw materials (conventional)	C
	Renewable raw materials (organic farming)	B
	Liquid manure, dung	C
Landscape management	Green waste	A
Waste from food production, plant-based	(see below for exceptions)	A
	Rapeseed and sugar beet products	B
Waste from food production, animal-based	As a general rule	C
Food distribution	Food with expired best before date	A
	Defective batches (transport damage)	A
Municipal solid waste	Biowaste	A
	Sewage sludge	A
	Kitchen waste	A

Class A: sustainable, Class B: sustainable to a limited extent, Class C: non-sustainable

Upon request, atmosfair will consider substrates not listed on a case-by-case basis. This is based on the principles from the section *Overarching principles for CO2 and electricity*.

2. *Substrate classes for biomass use*

Substrate list biomass

Origin	Substrate	Category
Forestry	Wood residues only at the end of the use cascade (residues only after the upstream material, chip-based and fibre-based use) and only from forest use without biodiversity loss and without net forest loss, confirmed by expert report (see proof)	B
Agriculture	Cereal straw	B
Municipal waste	Sewage sludge	A
	Wood residues with expert report (see proof)	A-C
	Plastic (non-recyclable, end of life, e.g. from rivers) with expert report	A-C
Industrial waste	Wood residues only at the end of the use cascade (residues only after the upstream material, chip-based and fibre-based use) and only from forest use without biodiversity loss and without net forest loss, confirmed by expert report (see proof)	B
	Black liquor	A
	Animal meal	C
	Plastic (non-recyclable, end of life), depending on expert report	A-C
	Substitute fuels, according to expert report	A-C
	Sewage sludge	B

Class A: sustainable, Class B: sustainable to a limited extent, Class C: non-sustainable

Upon request, atmosfair will consider substrates not listed on a case-by-case basis. This is based on the principles from the section *Overarching principles for CO2 and electricity*.

3. Detailed list: Classes of biogenic waste and residues

Origin	**Species/substrate** [a)]	**A**	**B**	**C**
Agriculture	Crop residues	**X**		
	Fodder residues, mashed grain, spoiled silage		**X**	
	Cereal straw		**X**	
	Liquid manure, solid manure			**X**
	Energy crops, renewable raw materials			**X**
Landscape management	Wood waste, residual wood (end of use cascade) according to expert report		**X**	
	Roadside grass	**X**		
	Green cuttings from private and public garden and park maintenance	**X**		
Food, Plant-based	baking waste	**X**		
	spent grains (fresh/pressed)	**X**		
	Vegetables (rejected)	**X**		
	Vegetable trailings	**X**		
	Cereals (trailings)	**X**		
	Cereal vinasse	**X**		
	Cereal vinasse from alcohol production	**X**		
	Grain dust	**X**		
	Glycerine	**X**		
	Medicinal and spice plants (rejected)	**X**		
	Potato waste water from starch production	**X**		
	Potatoes (rejected)	**X**		
	Potatoes (mashed, medium starch content; not or no longer suitable for consumption)	**X**		
	Potato processing water from starch production	**X**		
	Potato pulp from starch production	**X**		
	Potato peels	**X**		
	Potato vinasse	**X**		
	Potato vinasse from alcohol production	**X**		
	Bran	**X**		
	Molasses from beet sugar production	**X**		
	Fruit and grape marc (fresh/untreated)	**X**		
	Small beet pieces from sugar processing	**X**		
	Rapeseed cake		**X**	
	Rapeseed meal		**X**	

Origin	Species/substrate [a)]	A	B	C
	Sugar beet press cake from sugar production		X	
	Sugar beet shavings		X	
Food, animal-based	Buttermilk fresh (not/no longer suitable for consumption)			X
	Casein			X
	Grease separator contents			X
	Flotation fats			X
	Flotation sludge			X
	Frying oil and fats			X
	Rennet whey			X
	Rennet whey fresh			X
	Guts (pork)			X
	Skimmed milk fresh			X
	Skimmed milk dry			X
	Milk (not or no longer suitable for consumption)			X
	Lactose			X
	Lactose molasses			X
	Lactose molasses low protein			X
	Ruminal contents			X
	Curd cheese (not or no longer suitable for consumption)			X
	Acid whey			X
	Acid whey fresh			X
	Animal blood			X
Other vegetable waste	Cut flowers (rejected)		X	
Other	Old bread	X		
Food	leftovers	X		
	Black liquor	X		
	Plastic (non-recyclable, end of life, e.g. from rivers), classified as A, B or C according to expert report	(X)	(X)	(X)
	Substitute fuels according to expert report			
	Sewage sludge, industrial		X	
	Sewage sludge, municipal	X		

Upon request, atmosfair will assess substrates that are not listed on a case-by-case basis. This is based on the principles from the section *Overarching principles for CO2 and electricity*.