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## POLICY NOTE

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## **Glossary of terms**

CMU – Cabinet of Ministers of Ukraine

CORSIA – Carbon Offsetting and Reduction Scheme for International Aviation

EU – European Union

EU ETS – EU Emissions Trading System

ETS – Emissions Trading System

FAME – fatty acid methyl ester

GHG – greenhouse gases

HVO – hydrotreated vegetable oil

IMO – International maritime organization

LPG – liquefied petroleum gas

LNG – liquefied natural gas

MRV – monitoring, reporting and verification system of GHG emissions

NREAP – National Renewable Energy Action Plan

OPS – onshore power supply

RES – renewable energy sources

SAF – sustainable aviation fuel

TCU – Tax Code of Ukraine

toe – tons of oil equivalent

ktoe – 1000 tons of oil equivalent

## **Introduction**

The Policy note is devoted to the elaboration of basic recommendations for the development of the use of alternative fuels in the aviation and waterborne transport of Ukraine. In particular, the report includes consideration of the following issues:

- Analysis of European and Ukrainian legislation, including plans for the post-war recovery of Ukraine, to determine the main policies and measures necessary to increase the use of alternative fuels in aviation and waterborne transport;
- For most promising alternative fuels, development of initial recommendations on how to mainstream, relevant programs and strategic plans, with presentation of expected socio-economic benefits and trade-offs.

## **Executive summary**

### ***Aviation***

In July 2021, the European Commission presented a package of proposals aimed at achieving the goals of the European Climate Law, the so-called "fit for 55 package". The package of proposals also includes the RefuelEU Aviation initiative, which aims to stimulate the transition to sustainable aviation fuels in the aviation sector as they are considered to have the biggest potential to reduce emissions in the short term.

The presented initiative underwent a number of discussions with interested stakeholders and authorized bodies, after which the European Commission and the European Parliament presented their positions on the following issues that the initiative touches on:

- Definition of the "sustainable aviation fuel" (SAF) term;
- The minimum share of SAF in aviation fuel;
- Provision of infrastructure for the use of alternative fuels;
- Reporting obligation for aircraft operators;
- Reporting obligation for aviation fuel suppliers;
- Financial sanctions for failure to comply with the obligations.

The experts of the European Aviation Safety Agency determine the following main barriers to increasing use of SAF in aviation:

1. *Technical barriers.* Any new jet fuel must meet technical composition and performance requirements similar to conventional jet fuels in order to be approved and considered suitable for use. The approval process is quite strict and can therefore be an expensive and time-consuming process. In this regard, potential SAF manufacturers may prefer to use their products in other, less complex markets.

2. *Environmental barriers.* If a SAF supplier declares its fuel as "sustainable", it must guarantee the sustainability of the entire fuel life cycle, from the production of raw materials to the final fuel blends, by applying recognized certification schemes, which requires some effort and cost.

3. *Commercial barriers.* SAFs must be produced in sufficient quantities and at a price that would guarantee consumption. SAFs must also meet other key legal requirements, including safety in use, etc.

We consider the mentioned barriers to be relevant for Ukraine and, in addition, the following ones can be identified:

4. *Raw material associated barriers.* In order to ensure the possibility of increasing production capacity, raw materials must be available in sufficient quantities.

5. *Production associated barriers.* Capacities for the production of SAF are now available in limited quantities, and their expansion currently appears to be limited in time and speed.

6. *Financial barriers.* Technical modernization, re-equipment of production from traditional aviation fuels to SAF requires significant financial costs.

Experts determine the following ways to overcome the existing barriers and, therefore, to increase the use of alternative fuels in aviation transport:

*Price competitiveness.* The price of SAF should be a real alternative to the traditional fuel.

*Ensuring sustainability.* Using only those fuels and raw materials that do not adversely affect the food supply and the ecosystem, with a reliable sustainability certification system.

*Equal conditions.* Ensuring the same regulation for all the manufacturers.

*Compliance with technical requirements.* The standards on SAFs must meet the safety and usability requirements for use in existing aircraft, as well as in future generation aircraft.

*Availability of raw materials.* It is necessary to take into account the potential of raw materials for the production of SAFs and avoid any potential changes in land use.

National strategic documents of Ukraine envisage the use of renewable energy sources as one of the most important areas of Ukraine's energy policy aimed at saving traditional fuel and energy resources, improving the state of the surrounding natural environment, and preventing the climate change.

Such strategic documents that directly or indirectly affect the air transport include the draft Action Plan for post-war recovery and development of Ukraine, the National Economy Strategy of Ukraine until 2030, the Energy Strategy of Ukraine until 2035, the National Transport Strategy of Ukraine until 2030, the Energy Security Strategy of Ukraine, the draft National Renewable Energy Action Plan until 2030. However, no strategic document sets specific goals for the use of SAFs in the air transport, which implies the need to define them in the updated Energy Strategy of Ukraine for the period until 2050, the updated National Transport Strategy and other strategic documents, taking into account the post-war recovery plans of Ukraine.

The only strategic document that now mentions SAFs is the draft Action Plan for Post-War Recovery and Development of Ukraine. The third stage of the recovery called "Structural modernization and full integration into the EU" in 2026-2032 envisages the creation of the Airport Development Fund as a special fund of the State Budget, as well as the development of new

technologies aimed at the transition to sustainable aviation fuels (SAFs), implementing global market-based measures to reduce carbon (CO<sub>2</sub>) emissions within the framework of Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Achieving the objectives for the use of SAFs in aviation can be achieved by imposing an obligation on aviation fuel suppliers to ensure that the aviation fuel supplied to aircraft operators contains a minimum proportion of SAF, according to specified percentages and years, such as that envisaged in the EU. To do this, it is necessary to develop a methodology for determining the appropriate fractions of SAFs and to resolve the issue of including the synthetic fuel in them.

Setting the minimum percentages of SAFs may involve the introduction of reporting obligations for both aviation fuel suppliers and aircraft operators, with the imposition of financial sanctions in case of non-compliance with specified percentages of SAP. Obtained fines can be directed to a special fund intended for financing projects on the production, use and storage of sustainable aviation fuels.

In our opinion, in the current version of the Law of Ukraine "On Alternative Fuels", it is appropriate to legally define the term "sustainable aviation fuel", similarly to how it will be done in the EU legislation. That means to define fuel from which raw materials will be considered sustainable aviation fuel, the need for it compliance with sustainability criteria, as well as the certification procedure (confirmation of compliance with the sustainability criteria). This can become the basis for the adoption of other measures necessary to increase the use of alternative fuels in aviation transport.

In Ukraine, draft law "On Amendments to the Tax Code of Ukraine and other legislative acts of Ukraine regarding the payment of a single contribution and accounting for denatured ethyl alcohol and chemical and technical products" No. 7233 dated 30.03.2022 was registered. The draft Law proposes to introduce sustainability criteria for liquid biofuels (biocomponents) and biogas intended for use in transport. According to the draft Law, sustainability criteria are the requirements that liquid biofuels (biocomponents) and biogas, intended for use in transport, should meet, in particular, indicators of GHG emissions reduction from the use of the specified types of biofuels and the prohibition of using certain land plots for obtaining raw materials necessary for for the production of such biofuel types.

In case of the adoption of this draft Law, the sustainability criteria will also apply to aviation biofuels. However, in our opinion, it should be clarified that Directive (EU) 2018/2001 provides that aviation fuels may contribute to the achievement of renewable energy targets in the transport sector, but their contribution is not mandatory. Similarly, it should be the case in Ukraine that only aviation biofuels that meet the sustainability criteria are taken into account for the fulfillment of RES goals in the transport sector.

Sustainable aviation fuel should not be subject to excise tax in Ukraine since the classification of SAFs as excisable goods will increase their price (excise tax is included in the price of goods). For example, aviation fuel is exempt from excise tax in the EU.

The use of SAFs does not usually require changes to the aircraft fuel system and airport infrastructure, but may require additional infrastructure for blending with traditional aviation fuel.

At that, the use of electricity requires changing the infrastructure of airports through the introduction of fast charging systems or battery replacement systems. Similarly, the use of hydrogen implies the need to change the fuel system of the aircraft and the infrastructure of the airport. In this regard, SAF suppliers, aircraft operators and airports will have to attract additional investments in updating the specified infrastructure. Attracting such additional investments can take place through a special fund, which is replenished through imposing fines for non-compliance with the mandatory share of SAFs to finance the creation of the necessary infrastructure. In addition, in our opinion, state planning and substantiation of the priority and expediency of creating infrastructure necessary for SAFs at the designated airports are necessary. In particular, the State target program for the development of airports until 2023 will need to be revised and updated.

To increase the use of alternative aviation fuels, the possibility of introducing tax incentives should also be considered. In particular, temporary tax deductions may be applied regarding the import of special machinery, equipment and facilities by business entities into the customs territory of Ukraine without payment of import duty and value added tax, namely:

- 1) Machinery, equipment and facilities used for the reconstruction of existing and construction of new enterprises for the production of alternative types of aviation fuel;
- 2) Machinery, equipment and facilities used for mixing alternative types of aviation fuel with traditional aviation fuel. In general, mixing with traditional jet fuel can be done at the biofuel production site or in a specially designated place before entering the airport territory. *The mixing cannot be performed in the tank farm of the airport itself;*
- 3) Machinery, equipment and facilities used for the manufacture and reconstruction (refitting) of aircraft equipped with electric engines and charging infrastructure for them.

We believe that other tax incentives can also be applied, for example, exemption from paying income tax for companies that produce alternative aviation fuels, with the mandatory allocation of the released funds to research and development work to increase the production of such fuels and the introduction of the latest technologies, etc. The use of such funds must be related to the activity of the taxpayer, the profit from which is exempt from taxation.

The current Instruction on ensuring refueling of aircraft with fuel, lubricants and technical fluids in civil aviation transport enterprises of Ukraine, approved by Order of the State Aviation Service dated 14.06.2006 No. 416, does not take into account the possibility of mixing biofuels with traditional aviation fuel, and is outdated. In case of setting goals for the use of SAFs in Ukraine, we consider it necessary to review this Instruction. In addition, other by-laws regulating the use of aviation fuel are also subject to revision, in particular, the Aviation Rules of Ukraine "Technical requirements and administrative procedures for the certification of airfields", approved by the Order of the State Aviation Service of November 6, 2017 No. 849 and some others.

Main drivers for stimulating the reduction of GHG emissions in the world are fiscal (fuel or emission taxation) and market (emissions trading systems) incentives. Despite the formal availability of the tax on carbon dioxide emissions in Ukraine's legislation, in practice, the effect of its application is quite low due to several objective reasons. Because of these problems, the current mechanism of CO<sub>2</sub> taxation in Ukraine cannot be considered effective; its architecture



needs a full-scale reform in the direction of the transition to a classic carbon tax/energy tax by analogy with that in the EU member states. Funds raised in the special fund from the implementation of the new carbon tax can, among other directions, be used to encourage the application of alternative fuels in aviation.

After signing the Association Agreement with the EU in 2014, Ukraine undertook the implementation of Directive 2003/87/EU on the establishment of a GHG emissions trading scheme. The implementation of the Directive in Ukraine involves 2 stages: the launch of a monitoring, reporting and verification system of GHG emissions and the direct launch of the emissions trading system. After establishing the operation ETS in Ukraine, the issue of including GHG emissions from aviation transport in this system should also be considered, as well as the coordination of this system with CORSIA scheme in Ukraine.

Thus, **recommendations** for increasing the use of alternative fuels in aviation of Ukraine can be generalized as follows:

- **Setting national targets for using SAFs.**
- **Defining «sustainable aviation fuel» term.**
- **Introducing sustainability criteria.**
- **No excise tax for SAFs.**
- **Providing infrastructure for the use of alternative aviation fuels.**
- **Additional incentives for the use of alternative aviation fuels (exemption from taxation).**
- **Review and adoption of regulatory acts regulating or affecting the use of alternative aviation fuels.**
- **Reforming the tax on carbon dioxide emissions.**
- **Introduction and integration of the trading system for GHG emission quotas in Ukraine with the EU ETS.**

### *Waterborne transport*

The "Target 55 compliance" package presented by the European Commission also includes the FuelEU Maritime initiative, the main objective of which is to decarbonize the EU's maritime sector. FuelEU Maritime sets uniform rules on the limit on the intensity of GHG emissions from the energy used on-board of the ships that arriving at, stopping at or departing from EU ports, as well as the commitment to use shore power or zero-emission technologies in EU ports. The proposal introduces mandatory percentages of reduction of the average annual intensity of GHG emissions, as well as the methodology of fuel life cycle analysis and general principles of monitoring, reporting and verifying GHG emissions. Fines are also provided for non-compliance with fuel requirements and requirements for ensuring the coastal power supply network. Funds from penalties are allocated to a special fund and used to finance the production of alternative marine fuels and water transport decarbonization measures.

The draft Plan of measures for the post-war reconstruction and development of Ukraine pays considerable attention to the development of the waterborne sector. Among the main tasks of the above-mentioned Recovery Plan in the field of marine and inland water transport is the transition to alternative sources of energy supply, taking into account economic feasibility and efficiency, as well as encouraging private investors to build terminals for the reception of liquefied natural gas and other bases of fuel and lubricants.

Waterborne transport decarbonization targets can be set in two ways. The first option is to establish mandatory consumption shares of certain types of alternative fuels in waterborne transport. These objectives can be achieved, for example, by requiring marine fuel suppliers to ensure that marine fuel contains a certain minimum proportion of alternative fuels. The second option involves setting limits on the intensity of GHG emissions from the energy used on board the ship, similar to what is proposed to be introduced in the EU.

Since biomethane, which can be used in compressed or liquefied form, has been identified as one of the most promising types of alternative fuel for water transport in Ukraine, the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Development of Biomethane Production" adopted in 2021 opens opportunities for its production and use in Ukraine, including by water transport.

The use of biodiesel (FAME) and hydrotreated vegetable oil (HVO) are also promising types of alternative fuel for water transport in Ukraine, however, for their wider use, the adoption of draft law No. 7233 dated 30.03.2022 should be supported, as well as the abolition or reduction of excise tax rates on biodiesel.

Draft Law No. 7233 dated March 30, 2022 "On Amendments to the Tax Code of Ukraine and other legislative acts of Ukraine regarding the payment of a single contribution and accounting for denatured ethyl alcohol and products for chemical and technical purposes" proposes to regulate some important aspects of the liquid biofuel market in Ukraine. This draft Law provides for amendments to the Law of Ukraine "On Alternative Fuels". In particular, it is proposed to make changes to the definition of the term "biodiesel" (these are monoalkyl esters of higher organic acids obtained from vegetable oils or animal fats used as biofuel or biocomponent), to define the term "hydrorefined vegetable oil" (this is vegetable oil after thermochemical treatment with hydrogen), to establish a mandatory content share of liquid biofuels (biocomponents) in gasolines for automobiles and others. Although the provisions of the draft Law are mostly aimed at regulating the biofuel market for road transport, its adoption can become the basis for the development of marine biofuel production. In the future, in our opinion, the Law of Ukraine "On Alternative Fuels" should regulate the use of alternative marine fuels as well.

In Ukraine, the production of biodiesel, which can be used as marine fuel, is significantly hampered by high rates of excise tax on it. In case of cancellation or reduction of the excise tax rates on biodiesel, its price will decrease, which will encourage its production and consumption.

In recent years, liquefied natural gas has also become popular among alternative fuels for water transport. This is especially evident in the EU regulation, which foresees the need to ensure an adequate number of LNG filling stations in seaports by the end of 2025 and in inland ports by the end of 2030. However, for the use of LNG, it is necessary to build the appropriate infrastructure -

specialized terminals that provide reception, storage and bunkering, which requires significant investments. Ukraine has the prerequisites for launching a modern Black Sea hub for bunkering ships with alternative fuels: ammonia, methanol and LNG. The creation of such a hub will be regulated by a significant body of legislation, which may require revision in order to take into account the modern requirements of technology development and simplify the established legal procedures for the urgent restoration of seaport infrastructure.

While the use of biodiesel (FAME) and hydrotreated vegetable oil (HVO) as marine fuel is possible in the existing fuel systems using existing tanks and bunkering infrastructure, the use of LNG will be hampered by the lack of suitable LNG infrastructure in Ukraine, and the use of electricity will require the installation of onshore infrastructure. The use of other alternative fuels also requires special infrastructure, in particular, tanks for methanol and special bunkering infrastructure for methanol, ammonia, hydrogen. In this regard, Ukrainian ports will require additional investments in updating the mentioned infrastructure. Attracting such additional investments can take place through a special fund, which is replenished through the imposition of fines, in order to finance the production of alternative marine fuels and measures to decarbonize waterborne transport in Ukraine. The source of funds can also be a fund that will attract funds from the payment of the carbon tax (in case of implementing the reform of the carbon tax in Ukraine).

The Technical Regulation of requirements for automobile gasoline, diesel, marine and boiler fuels defines that marine fuel is liquid distillate petroleum fuel used in marine high- and medium-speed diesel engines, as well as gas turbine installations. In our opinion, the Technical Regulation does not take into account the possibility of using biofuel as marine fuel. Accordingly, it should be revised.

The introduction of an export duty on some types of oilseeds, in particular, on rapeseed, will contribute to the development of its domestic processing into a product with a high added value – liquid biofuels. In particular, it is possible to set the rate of export duty for rapeseeds as 10% of the customs value of the goods as it is now for sunflower seeds, Camelina seeds and flax seeds.

In addition, it is necessary to introduce a system of collecting used cooking oil in catering establishments, food industry enterprises and households. Such raw material is considered sustainable; biofuels and biogases produced from it provide a significant reduction of GHG emission; for such biofuels and biogases, double counting (by energy content) is applied to fulfill the goals for the share of biofuels in transport in accordance with EU RED II Directive.

In Ukraine, a temporary exemption from taxation of operations involving the import of the following equipment by business entities into the customs territory of Ukraine may be introduced, in particular without payment of import duty and value added tax:

- 1) Machinery, equipment, and facilities used for supply/acceptance, storage of alternative fuels and for bunkering;
- 2) Machinery, equipment and facilities used for the manufacture and modernization (refitting) of ships in order to ensure the consumption of alternative types of fuel and/or electric energy;
- 3) Machinery, equipment and facilities used for the manufacture and reconstruction (refitting) of vessels equipped with electric motors and the charging infrastructure for them;

4) Machinery, equipment and facilities used for the reconstruction of existing and construction of new enterprises for the production of alternative fuels for waterborne transport.

We think that other tax incentives can also be applied, for example, exemption from paying income tax for companies producing alternative marine fuels, with the mandatory allocation of funds for scientific and research work on increasing production volumes and introducing the latest technologies, etc. The use of such funds must be related to the activity of the taxpayer, the profit from which is exempt from taxation. In addition, there may be other (non-tax) incentives for the transition and use of alternative marine fuels, in particular, the admission to the territory of certain ports (for example, in nature reserves or near large cities) only vessels using alternative fuels.

From 2025, in case of successful launching ETS in Ukraine, the issue of including GHG emissions from maritime transport in this system should also be considered.

Thus, **recommendations** for increasing the use of alternative fuels in waterborne transport of Ukraine can be generalized as follows:

- **Setting goals for the decarbonization of waterborne transport.**
- **Use of biomethane for waterborne transport. Using the opportunities provided by the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Development of Biomethane Production".**
- **Use of biodiesel (FAME) and hydrotreated vegetable oil (HVO). Adoption of draft Law No. 7233 of March 30, 2022.**
- **Cancellation or reduction of excise tax rates on biodiesel.**
- **Review of regulatory documents and standardization.**
- **Provision of infrastructure and other necessary conditions for the use of liquefied natural gas (LNG) and other alternative marine fuels.**
- **Measures to stimulate domestic processing of raw materials into biofuel.**
- **Additional incentives for the use of alternative marine fuels (exemption from taxation).**
- **Involvement of waterborne transport in the system of trading quotas for GHG emissions.**

## **1. Determination of main policies and incentives required to increase the use of alternative fuels in aviation and waterborne transport**

### **1.1. Aviation**

#### ***Regulation in the EU***

On June 23, 2022, the European Council granted Ukraine the status of a candidate for the EU joining. For Ukraine, this implies the need to carry out a number of reforms affecting various spheres, starting from the continuation of judicial reform and ending with changes in the legislation on national minorities. At the same time, convergence of Ukrainian legislation with the EU legislation in the energy sector, including the use of alternative fuels, is becoming even more urgent.

In June 2021, the EU adopted the European Climate Law, which sets the EU's goal to reduce greenhouse gas emissions by 2030 by at least 55% compared to 1990 [1]. On July 14, 2021, the European Commission presented a package of proposals aimed at achieving the goals of the European Climate Law, the so-called "fit for 55 package". The package of proposals also includes the **RefuelEU Aviation** initiative [2] (**Annex 1**), which aims to stimulate the transition to sustainable aviation fuels in the aviation sector as they are considered to have the biggest potential to reduce emissions in the short term. The proposal also aims to combat the over-fuelling (that is fuelling more than it is required for safe flights) of aircraft at airports where it is cheaper leading to higher emissions due to increased aircraft weight.

Prior to the introduction of the RefuelEU Aviation initiative, there were already some measures in place in the EU to encourage and increase the use of SAF. In particular, within the framework of the EU Emissions Trading System, in the event that aircraft operators use SAF from sustainable biomass (according to Directive (EU) 2018/2001), they received "zero emissions". According to Directive (EU) 2018/2001 (hereinafter also RED II Directive or RED II) [3], Member States can count SAF towards the goal of achieving 14% of renewable energy in the transport sector by 2030, provided that SAF meets the sustainability criteria listed in the Directive. A specific factor of 1.2 is applied to SAF from non-food and non-feed raw materials, which means that in terms of energy content, they contribute 20% more to the achievement of the RES target in the transport sector. However, according to the estimates of the European Commission, the requirements of RED II Directive and EU ETS have not led to an adequate increase in the use of SAFs. In this connection, the RefuelEU Aviation initiative was presented, as well as changes to EU ETS in terms of its application in the aviation sector, and to RED II Directive.

As part of the consultation process, the European Commission published an initial impact assessment (Inception impact assessment) [4], in which it outlined the need for further actions to reduce emissions from aviation transport. The assessment envisages the following *possible measures* to increase the use of SAFs:

- the requirement for the content of SAF in fuel supplied to and used by airlines;
- revision of the factor of 1.2 according to RED II Directive;
- auctions for the supply of SAF;
- financing mechanism to encourage the increase of SAF production facilities.

After numerous consultations with interested stakeholders and authorized bodies, the European Commission presented its proposal, which envisages the following.

***RefuelEU Aviation. Proposal of the European Commission***

**Definition of SAF.** SAF means drop-in aviation fuel, which is either 1) synthetic fuel, or 2) advanced biofuel according to Article 2, Clause 34, Part 2 of the Directive (EU ) 2018/2001 or 3) biofuel produced from raw materials listed in Part B of Annex IX to this Directive, which meet the criteria of sustainability and reduction of GHG emissions provided for in Article 29(2) - (7) of this Directive and are certified in accordance with Article 30 of the Directive (EU) 2018/2001.

*Synthetic aviation fuel* is proposed to mean fuel that is a renewable fuel of non-biological origin used in aviation. As defined in Clause 36 Part 2 of Article 2 of Directive (EU) 2018/2001, renewable fuel of non-biological origin means liquid or gaseous fuel used in the transport sector (except for biofuel or biogas), the energy content of which is obtained from renewable sources, other than biomass.

*Advanced biofuel*, according to Clause 34 Part 2 of Article 2 of the Directive (EU) 2018/2001, is biofuel that is produced from raw materials specified in Part A of Annex IX to the Directive (EU) 2018/2001, such as straw, husks and other raw materials. Part B of Annex IX of the Directive (EU) 2018/2001 includes used cooking oil and animal fats.

**The minimum share of SAF.** Aviation fuel suppliers must ensure that all aviation fuel supplied to aircraft operators at each EU airport contains a minimum proportion of SAF, including a minimum proportion of synthetic aviation fuel according to the specified percentages and years (**Table 1.1**).

**Table 1.1.** The minimum share of SAF in aviation fuel. Proposal of the European Commission [2].

| <b>Index</b>                                | <b>2025</b> | <b>2030</b> | <b>2035</b> | <b>2040</b> | <b>2045</b> | <b>2050</b> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|
| Share of SAF,                               | 2%          | 5%          | 20%         | 32%         | 38%         | 63%         |
| <i>of which the share of synthetic fuel</i> | -           | 0,7%        | 5%          | 8%          | 11%         | 28%         |

**Refueling Obligations.** The annual amount of aviation fuel refuelled by an aircraft operator at a certain EU airport must be at least 90% of the required annual amount of aviation fuel. This provision aims to ensure that the amount of fuel refuelled before departure from the EU airport corresponds to the amount of fuel required to complete the flight, subject to safety regulations.

**Reporting obligation for aircraft operators.** By March 31 of the year following the reporting year, aircraft operators must notify the EU Aviation Safety Agency of information on:

- 1) The total amount of SAF purchased from aviation fuel suppliers for the purpose of flights departing from EU airports, in tons.
- 2) The name of the supplier of aviation fuel, the quantity purchased, in tons, the conversion technology, the characteristics and origin of the raw materials used for the production of the fuel,

as well as the emissions during the life cycle are indicated for each purchase of fuel. If a single purchase includes SAF with different characteristics, the report should include information for each type of SAF.

3) Declaration from the GHG emission reduction schemes in which they participate and in which the use of SAF may be reported.

**Reporting obligation for fuel suppliers.** By March 31 of the year following the reporting year, aviation fuel suppliers must report on:

- 1) Volume of aviation fuel delivered to each EU airport.
- 2) Volume of SAF delivered to each EU airport.
- 3) For each type of SAF – emissions during the life cycle, origin of raw materials and type of conversion.

**Financial sanctions.** In case of non-compliance with the mandatory share of SAF, an administrative fine is imposed on the supplier.

The new regulation is planned to enter into force from 1 January 2023, except for the obligations of suppliers on the mandatory share of SAF and refuelling at the EU airports, which will enter into force from 1 January 2025, but mandatory reporting is foreseen from 2024 for the previous year 2023.

After presenting the proposal to the European Commission, it was discussed in the European Economic and Social Committee [5], national parliaments and with stakeholders, after which the proposal was submitted to the European Parliament. The first response of the Parliamentary Committee on Transport and Tourism was published and discussed in March 2022 [6]. On July 7, 2022, the European Parliament considered the proposal in the first reading and proposed some changes [7].

#### ***RefuelEU Aviation. Proposal of the European Parliament***

It is proposed to expand the **definition of SAF**. SAF shall mean aviation fuel that is:

- 1) synthetic aviation fuel;
- 2) liquid and gaseous fuel produced from waste processing gas and exhaust gas of non-renewable origin, which are formed as a result of the production process at industrial facilities (recycled carbon fuels), which meet the threshold for reducing GHG emissions specified in Article 25 (2) of the EU Directives 2018/2001 (at least 70% starting from January 1, 2021);
- 3) advanced biofuel in accordance with Clause 34 Part 2 of Article 2 of the Directive (EU) 2018/2001, or
- 4) biofuels produced from raw materials listed in Part B of Annex IX to this Directive, which meet the criteria of sustainability and reduction of GHG emissions provided for in Article 29(2) - (7) of this Directive and are certified in accordance with Article 30 of the Directive (EU) 2018/2001. Until 31 December 2034, SAF may also include biofuels that meet the criteria of sustainability

and reduction of GHG emissions set out in Article 29 of the Directive (EU) 2018/2001 and are certified in accordance with Article 30 of this Directive, with the exception of biofuels produced from "food and fodder crops" as defined in Clause 40 Part 2 of Article 2 of this Directive.

*Synthetic aviation fuel* is proposed to mean renewable hydrogen or renewable electricity or fuel that is a renewable fuel of non-biological origin, as defined in Clause 36 part 2 of Article 2 of RED II, used in aviation.

**The minimum share of SAF.** Aviation fuel suppliers must ensure that all aviation fuel supplied to aircraft operators at each EU airport contains a minimum proportion of SAF, including a minimum share of synthetic aviation fuel according to the specified percentages and years (**Table 1.2**).

**Table 1.2.** The minimum share of SAF in aviation fuel. Proposal of the European Parliament [7].

| <b>Index</b>                                | <b>2025</b>  | <b>2030</b>            | <b>2035</b> | <b>2040</b> | <b>2045</b> | <b>2050</b> |
|---|--------------|------------------------|-------------|-------------|-------------|-------------|
| Share of SAF,                               | 2%           | <b>6%<sup>1)</sup></b> | 20%         | <b>37%</b>  | <b>54%</b>  | <b>85%</b>  |
| <i>of which the share of synthetic fuel</i> | <b>0,04%</b> | <b>2%</b>              | 5%          | <b>13%</b>  | <b>27%</b>  | <b>50%</b>  |

1. Changes compared to the European Commission's proposal are highlighted in bold.

At that, the European Parliament proposes to exclude from the calculation SAFs produced from food and fodder crops, intermediate crops, distillate of palm fatty acids and all raw materials obtained from palm trees and soybeans, as well as soap stock and its derivatives. Aviation fuel suppliers can demonstrate compliance using the mass balance system provided for in Article 30 of RED II.

**Provision of infrastructure.** The EU airports must take all necessary measures to accelerate the access of aircraft operators to aviation fuel containing an appropriate proportion of CAF and provide the infrastructure necessary for the delivery, storage and refuelling of such fuel, including infrastructure for hydrogen refuelling and electrical charging of aircraft, in accordance with the corresponding plan and regulation. The EU airports must identify and resolve the lack of adequate infrastructure within 3 years after the entry into force of the RefueEU Aviation Regulation.

**Reporting obligation for aircraft operators.** The reporting obligation is proposed to be left almost unchanged, except for the need to report in tons of kerosene equivalent. The report is submitted according to the template set out in the Regulations (**Annex 2**). The report must be also verified by an independent verifier in accordance with the requirements of the Directive on the establishment of a scheme to reduce emissions of greenhouse gases into the atmosphere [8].

**Reporting obligation for fuel suppliers.** By January 31 of the year following the reporting year, aviation fuel suppliers must additionally report on:

- 1) The amount of aviation fuel supplied to each EU airport, in tons of kerosene equivalent.
- 2) The amount of SAF supplied to each EU airport, in tons of kerosene equivalent.
- 3) For each type of SAF – emissions during the life cycle, characteristics and origin of raw materials, as well as the conversion process.



- 4) The amount of hydrogen and/or electricity supplied to each EU airport, indicated in tons of kerosene equivalent.
- 5) Average content of aromatics, naphthalene and sulphur in jet fuel per batch delivered at each EU airport.

***Financial sanctions.*** In case of non-compliance with the mandatory share of SAA, administrative fines may be imposed on the supplier, as well as on the *EU airports*.

Member States must have the necessary legal and administrative framework at the national level to ensure the fulfilment of obligations and the collection of administrative fines. Member States shall transfer funds from the administrative fines as a contribution to the Aviation Sustainable Development Fund established in accordance with Article 11a of the Regulation. The *Aviation Sustainable Development Fund* will be established for the period from 2023 to 2050 to accelerate the decarbonization of the aviation sector, in particular to support investments in innovative technologies and infrastructure for the production, use and storage of SAFs, other innovative technologies including hydrogen and electricity, research into new engines and direct air capture technologies (a process by which CO<sub>2</sub> is captured directly from the air) and to reduce aviation's non-CO<sub>2</sub> impact. All investments supported by the Fund must be disclosed and comply with the objectives of the Regulation.

The European Parliament also proposed to introduce the *SAF Flexibility Mechanism*, which will be established from 2025 for a period of 10 years. The mechanism will include elements of the book&claim system and may allow aircraft operators to purchase SAF under agreements with aviation fuel suppliers and declare its use at various EU airports. By January 1, 2025, the European Commission must adopt delegated acts having set out the detailed conditions for the SAF flexibility mechanism, including detailed rules on the registration, allocation, accounting and reporting of the supply and consumption of SAF.

### ***Barriers to increasing use of SAF in aviation***

The experts of the European Aviation Safety Agency determine the following **main barriers** to increasing use of SAF in aviation [9]:

1. *Technical barriers.* Any new jet fuel must meet technical composition and performance requirements similar to conventional jet fuels in order to be approved and considered suitable for use. The approval process is quite strict and can therefore be an expensive and time-consuming process. In this regard, potential SAF manufacturers may prefer to use their products in other, less complex markets.
2. *Environmental barriers.* If a SAF supplier declares its fuel as "sustainable", it must guarantee the sustainability of the entire fuel life cycle, from the production of raw materials to the final fuel blends, by applying recognized certification schemes, which requires some effort and cost.
3. *Commercial barriers.* SAFs must be produced in sufficient quantities and at a price that would guarantee consumption. SAFs must also meet other key legal requirements, including safety in use, etc.

In our opinion, the mentioned barriers are **relevant for Ukraine** and, in addition, the following ones can be identified:

4. *Raw material associated barriers.* In order to ensure the possibility of increasing production capacity, raw materials must be available in sufficient quantities.

5. *Production associated barriers.* Capacities for the production of SAF are now available in limited quantities, and their expansion currently appears to be limited in time and speed.

6. *Financial barriers.* Technical modernization, re-equipment of production from traditional aviation fuels to SAF requires significant financial costs.

As a result, experts determine the following ways to increase the use of alternative fuels in aviation transport [10]:

*Price competitiveness.* The price of SAF should be a real alternative to the traditional fuel.

*Ensuring sustainability.* Using only those fuels and raw materials that do not adversely affect the food supply and the ecosystem, with a reliable sustainability certification system.

*Equal conditions.* Ensuring the same regulation for all the manufacturers.

*Compliance with technical requirements.* The standards on SAFs must meet the safety and usability requirements for use in existing aircraft, as well as in future generation aircraft.

*Availability of raw materials.* It is necessary to take into account the potential of raw materials for the production of SAFs and avoid any potential changes in land use.

### ***Post-war restoration of Ukraine's aviation sector***

In accordance with the Presidential Decree of April 21, 2022 No. 266/2022 "Issues of the National Council for the Recovery of Ukraine from the Consequences of the War" [11], work has begun on the draft *Action Plan for Post-War Recovery and Development of Ukraine* [12]. The plan will include a list of measures for the post-war recovery and development of Ukraine, proposals for priority reforms and strategic initiatives, a list of legal acts, the adoption and implementation of which are necessary for the effective work and recovery of Ukraine in the war and post-war periods.

Regarding the field of air transport, the mentioned draft Action Plan notes that out of 19 operating civil airports, airfield complexes (runways, buildings, and structures) were destroyed in 12 airports. Estimated damages to the airports and aeronautical equipment amount to about 200 billion UAH. At that, the Action Plan provides that the *main tasks* of the development of the air transport sector in the post-war period are the reconstruction and further development of the airport infrastructure of Ukraine, liberalization and non-discriminatory regulation of air transport markets, implementation of the Agreement on a common aviation space with the EU, adaptation of national legislation to EU legislation, support for the air transport industry, including the reduction of excise duty on fuel and others.

The third stage of the recovery "Structural modernization and full integration into the EU" in 2026-2032 envisages the creation of the *Airport Development Fund* as a special fund of the State Budget,

as well as the development of new technologies aimed at **the transition to sustainable aviation fuels (SAFs)**, implementing global market-based measures to reduce carbon (CO<sub>2</sub>) emissions within the framework of Carbon Offsetting and Reduction Scheme for International Aviation (**CORSIA**).

The list of projects for the implementation of the Recovery Plan in the field of aviation transport also includes the reconstruction of the fuel and lubricants warehouse of State Enterprise MA Boryspil in the city of Boryspil on Zaporizhia Street, 16-a (implementation in 2023-2025) with renewal of its capacities and technical-technological re-equipment. The estimated need for financing is 446 million UAH. We believe that such reconstruction should be carried out *taking into account the goals of the transition to the use of SAFs*.

## 1.2. Waterborne transport

### *International level*

The International Maritime Organization is developing policies to reduce greenhouse gas emissions for international shipping. The first regulations, in particular, the energy efficiency index of the existing ship and the carbon intensity indicator, will enter into force on January 1, 2023. One of the goals of this activity is to achieve a 40% reduction in carbon emissions by 2030 compared to the 2008 level. The goal is to reduce GHG emissions by increasing the energy efficiency of ships, as well as introducing new technologies and fuels with low or zero carbon content [13]. The new requirements will apply to each vessel, which will mean that many will not be able to operate on international routes from the beginning of 2023 legally. However, the proposed regulations allow the ban to be postponed for 1-3 years if the ship owner agrees to carry out modernization to bring the ships into compliance with the established standards. Ukraine is a member of the IMO by the resolution of the Verkhovna Rada of Ukraine dated 04.02.1994 No. 3938-XI "On the adoption of the Convention on the International Maritime Organization of 1948 in the version of 1982" [14]. Acts of the IMO may have a mandatory or advisory nature and are subject to implementation in the legislation of Ukraine.

### *Regulation in the EU*

The "fit for 55 package" presented by the European Commission also includes the FuelEU Maritime initiative [15], the main goal of which is to decarbonize the EU maritime sector.

In general, the use of marine fuel in the EU is regulated by the following legislation:

- 1) **Alternative Fuel Infrastructure Directive** (AFID, 2014/94/EU [16]), according to which the Member States must create infrastructure for alternative fuels on their territory following national conditions, in particular:
  - LNG for ships – ensure adequate LNG refuelling in seaports by the end of 2025 and in inland ports by the end of 2030 to enable inland waterway vessels and marine vessels using LNG to operate on the TEN-T Core Network (Trans-European main transport network);
  - ensure the installation of shore-side electricity supply for inland waterway vessels and marine vessels in the sea and inland ports of the TEN-T Core Network by the end of 2025, except in cases of lack of demand and disproportionate costs.
- 2) **Regulation on monitoring, reporting and verification of CO<sub>2</sub> emissions from maritime transport** (EU MRV, Regulation 2015/757/EU [17]). From 2018, ships of more than 5,000 gross tonnage calling at EEA (European Economic Area) ports must monitor fuel consumption, and CO<sub>2</sub> emissions per voyage and on an annual basis.
- 3) **Directive on reducing the sulfur content in certain types of liquid fuel** (2016/802/ EU [18]). To reduce emissions of sulfur oxides (SO<sub>x</sub>), which are harmful to human health, the EU has implemented the already existing IMO limits on the maximum sulfur content of marine fuel in "emission control areas", giving them mandatory status in the EU. From 2020, all vessels operating on high-sulphur fuels must use scrubbers, and switch to low-sulphur fuels or LNG. The choice of approach and the responsibility to follow it rest with the transport companies.

These measures aim to reduce SO<sub>x</sub> emissions, but do not address the reduction of GHG emissions from shipping.

The "Target 55 compliance" package will have an impact on the following EU regulations governing water transport activities:

- 1) **EU directive on the emissions trading system** (EU-ETS, COM(2021) 551 [19]) aimed at attracting water transport to the EU emissions trading system. It will apply to ships of at least 5,000 gross tonnage, regardless of flag, calling at EU ports, and will cover emissions in EU ports, all intra-EU flights and 50% of emissions from flights to and from EU ports. Only tank-to-wake emissions are taken into account.
- 2) **FuelEU Maritime** – an initiative to transition to low-carbon marine fuel. The geographical distribution is similar to the EU-ETS, but the Regulation will consider GHG emissions from the entire supply chain ("well-to-wake").
- 3) Recast of the **Alternative Fuels Infrastructure Directive** (AFID, COM(2021)559 [20]) (to be adopted as Regulation) aims to improve the availability of LNG by 2025 and shore-based electric fueling stations in major EU ports by 2030.
- 4) Recast of the **Directive on taxation of energy products and electricity** (COM(2021)563 [21]) aims to abolish tax exemptions for traditional marine fuels and encourage the use of alternative fuels. Marine fuels sold in the EU for intra-EU voyages will no longer be tax-free.

During the preparation of the **FuelEU Maritime** initiative, an impact assessment (IA - Impact assessment) was prepared. The impact assessment takes as its starting point the need to provide legal certainty and focus on the demand side to stimulate the production and use of low-carbon alternative fuels while addressing carbon leakage. The impact assessment considers three regulatory options, each of which takes a different approach to technology selection and how to achieve the goals. A *first option* is a prescriptive approach, which provides for establishing the shares for certain types of fuel; that is, the technology is chosen centrally. In comparison, the *second and third options* are target-based, leaving the choice of technology to vessel operators but setting maximum GHG intensity limits for the energy used on the vessel board. In addition, the *third option* includes a flexibility mechanism that allows combining technologies with zero emissions. All options require cargo and passenger ships to use shore-based electric refuelling stations or equivalent zero-emission technologies. The third option was rated as the best, as it has the best balance between objectives and costs, and provides a flexibility mechanism.

The **FuelEU Maritime** initiative itself has the official name of the Regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport and amending Directive 2009/16/EC [15] (**Annex 3**). As stipulated in the Regulation, it establishes uniform rules regarding: 1) the limit on the intensity of GHG emissions from the energy used on ships board arriving at, stopping at, or departing from EU ports; 2) the obligation to use shore power supply or technologies with zero emissions in EU ports.

The reduction of the average annual intensity of GHG emissions from the energy used on ships board, compared to the base level of 2020, assumes the following indicators (**Table 1.3**).

**Table 1.3.** The yearly average greenhouse gas intensity reduction. Proposal of the European Commission [15].

| Indicator   | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|------|------|------|------|------|------|
| The yearly average greenhouse gas intensity reduction | -2%  | -6%  | -13% | -26% | -59% | -75% |

These requirements will apply to all energy used on-board by a ship in or between EU ports, but only up to 50% of energy used by ships arriving at or departing from EU ports from third countries. In addition, the requirements will apply to commercial vessels of more than 5,000 gross tonnage, regardless of flag. The regulation provides for applying a whole life cycle approach to determining CO<sub>2</sub> emission equivalents (including methane and nitrogen oxides) from the energy used.

Transport companies will be responsible for compliance. The new fuel standards will apply to vessels using fuel purchased in the EU and fuel purchased outside the EU.

The proposal introduces a fuel life cycle analysis methodology and general monitoring, reporting, verification and accreditation principles. The proposed system will be separate and complementary to the existing EU MRV system. Vessels will be required to have a valid *FuelEU compliance certificate*. FuelEU compliance Certificate means a certificate for an individual vessel issued to a transport company by a verifier confirming that the ship complies with this Regulation during a specified reporting period.

The provided *flexibility mechanism* provides an opportunity to credit the surplus of the fulfillment of obligations by an individual vessel for the reporting period to other periods, as well as to combine vessels into pools for the purpose of calculating compliance for the entire transport company.

From January 2030, cargo and passenger ships docked in EU ports for more than two hours will also have to connect to the onshore power supply (OPS) network and use this electricity for all energy needs while at berth, except when, if they are already using zero-emission technologies or are in an emergency. Until the end of 2034, exceptions will be allowed for cases where vessels cannot connect to OPS due to the unavailability of port connection points or because the port installation is incompatible with onboard OPS equipment.

Fines are also provided for non-compliance with fuel and OPS requirements. Funds from fines will be attracted to the *Innovation Fund* and will be used to finance the production of alternative marine fuels and water transport decarbonization measures.

The presented initiative was discussed among national parliaments and interested stakeholders, and was also submitted to the European Parliament. On 28 June 2022, the Committee on Industry, Research and Energy published its position on FuelEU Maritime [22], proposing some changes to it. In particular, regarding the average annual intensity of GHG emissions from energy, the following changes are proposed (**Table 1.4.**).

**Table 1.4.** The yearly average greenhouse gas intensity reduction. Proposal of the Committee on Industry, Research and Energy of the European Parliament [22].

| Indicator   | 2025 | 2030 | 2035                     | 2040        | 2045        | 2050         |
|---|------|------|--------------------------|-------------|-------------|--------------|
| The yearly average greenhouse gas intensity reduction | -2%  | -6%  | <b>-25%<sup>1)</sup></b> | <b>-50%</b> | <b>-75%</b> | <b>-100%</b> |

1. Changes compared to the European Commission's proposal are highlighted in bold.

In addition, it is proposed to establish the annual share of renewable fuels of non-biological origin in the energy used on-board by the ship during the reporting period: **2% from January 1, 2030 and 6% from January 1, 2035**. As defined in Clause 36 Part 2 of Article 2 of Directive (EC) 2018/2001, renewable fuel of non-biological origin means liquid or gaseous fuel used in the transport sector (except biofuel or biogas), the energy content of which is obtained from renewable sources, other than biomass.

FuelEU Maritime is expected to be applied from 1 January 2025 and will be fully binding in all the EU Member States.

#### ***Post-war restoration of Ukraine's waterborne transport***

As stated in the draft Plan of measures for the post-war recovery and development of Ukraine [12], the implementation of key program documents in the field of waterborne transport (Maritime Doctrine and the Strategy for the Development of Seaports of Ukraine) has actually been stopped. The tasks of the Plan of measures for the implementation of the National Transport Strategy of Ukraine and the National Economic Strategy of Ukraine cannot be fulfilled. Among other things, the transition to alternative sources of energy supply taking into account economic expediency and efficiency, as well as the introduction of changes in legislation for the purpose of implementing infrastructure projects, are among *the challenges* in the field of maritime and inland water transport. Among the *possibilities* of the field, maximum integration of the Ukrainian water transport system into the EU transport system is envisaged. *Key limitations* include the need for rapid adaptation of national legislation to EU legislation.

Among the *main tasks* of the Recovery Plan in the field of sea and inland water transport are defined:

- construction of new terminals and storage places for the import of critical products for defense and economy of Ukraine (oil refining products, mineral fertilizers);
- stimulation of private investors regarding the construction of terminals for the reception of liquefied natural gas and other bases of fuel and lubricants;
- construction of LNG (liquefied natural gas) terminals in seaports;
- simplification of established legislative procedures for urgent restoration of seaport infrastructure;
- *transition to alternative sources of energy supply*, taking into account economic feasibility and efficiency, as well as the needs for the implementation of environmental safety programs;

- improvement of legislation for the purpose of development of sea ports, transition to the European "port-landlord" management model, as well as consideration of the possibility of introducing other management models.

At the second stage of recovery (medium-term) in 2023-2025 (in case of protracted military operations, it will be postponed to 2024-2026) it is planned to involve the fleet of Ukrainian carriers in cargo transportation between EU ports and in the middle of the country (including state-owned: PJSC "Ukrainian Danube Shipping" (on the Danube), SE "Administration of River Ports" (on the Dnieper) through its modernization (refitting)), as well as the construction of a new fleet at Ukrainian shipyards for these enterprises, *including using alternative sources energy* (electricity, hydrogen), construction of the corresponding gas stations.



## 2. Development of preliminary recommendations

### 2.1. Aviation

#### *Setting national targets for using SAFs*

National strategic documents envisage the use of renewable energy sources as one of the most important areas of Ukraine's energy policy aimed at saving traditional fuel and energy resources, improving the state of the surrounding natural environment, and preventing the climate change.

The *National Economy Strategy of Ukraine until 2030*, approved by CMU's Resolution No. 179 dated March 3, 2021 [23], defines one of the key guidelines of the economic policy of Ukraine to be the decarbonization of the economy and development of **renewable energy sources**.

The *Energy Security Strategy of Ukraine*, approved by CMU's Decree dated 04.08.2021 No. 907-r [24], defines the strategic goals of ensuring the energy security of the country and the tasks to achieve them, in particular by promoting the replacement of traditional fuels in transport with the use of electricity and **biofuels**.

The *Energy Strategy of Ukraine until 2035* "Security, Energy Efficiency, Competitiveness", approved by CMU's Decree dated August 18, 2017 No. 605-p [25], at its second stage "Optimization and innovative development of energy infrastructure (until 2025)" envisages increasing the share of **RES in transport up to 20%** and stimulating the production of fuels that are safer for the consumers and the environment, in particular LPG and LNG, second-generation biofuels, as well as the use of electric energy in transport.

Goals of the *National Transport Strategy of Ukraine* until 2030, which was approved by CMU's dated May 30, 2018 No. 430-p [26], provide for an increase in the level of **alternative fuels** (biofuels or their mixture with traditional fuels) and electricity (produced from both, traditional and renewable sources) usage up to **50%** by 2030.

On January 20, 2022, the draft CMU's Decree "*On the National Renewable Energy Action Plan until 2030*" [27] was published. According to the draft NREAP, the share of **RES** in the gross final energy consumption in the transport sector will be at least **14%** by 2030. That corresponds to 961 ktoe. At that, the structure of renewable energy consumption in the sector by types of sources is expected to be as shown in **Annex 4**.

However, **no strategic document sets any concrete goals for the use of alternative fuels in aviation transport.**

We believe that in general, it is necessary to accelerate the adoption and coordination of goals for the use of RES in the transport sector. In particular, we consider it necessary **to adopt the updated Energy Strategy of Ukraine until 2050** and **the updated National Transport Strategy** with the agreed goals regarding the use of RES in the transport sector, including the aviation. At the same time, it is necessary **to accelerate the adoption** of the available draft NREAP until 2030, which provides for the achievement of 14% of RES in the transport sector.

Achieving the objectives for the use of SAFs in aviation can be achieved by imposing an obligation on aviation fuel suppliers to ensure that the aviation fuel supplied to aircraft operators contains a

minimum proportion of SAF, according to specified percentages and years, such as that envisaged in the EU (**Table 2.1**). To do this, it is necessary to develop a methodology for determining the appropriate fractions of SAFs and to resolve the issue of including the synthetic fuel in them.

**Table 2.1.** The minimum share of SAFs in aviation fuel. Suggestion for Ukraine<sup>1)</sup>.

| Index                                       | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|------|------|------|------|------|------|
| Share of SAFs                               | 2%   | 5%   | 20%  | 32%  | 38%  | 63%  |
| <i>of which the share of synthetic fuel</i> | -    | 0.7% | 5%   | 8%   | 11%  | 28%  |

1) Based on the European Commission's view on the minimum share of SAF within ReFuelEU Aviation.

Setting the minimum percentages of SAFs may involve the introduction of reporting obligations for both aviation fuel suppliers and aircraft operators, with the imposition of financial sanctions in case of non-compliance with specified percentages of SAP. Obtained fines can be directed to a *special fund* intended for financing projects on the production, use and storage of sustainable aviation fuels.

#### ***Definition of “sustainable aviation fuel”***

The Law of Ukraine "On Alternative Fuels" [28] defines that *alternative fuels* are solid, liquid and gaseous fuels that are an alternative to the corresponding traditional fuels and are produced (extracted) from non-traditional sources and types of energy raw materials. At that, *biological types of fuel* (biofuels) are solid, liquid and gaseous fuels made from biologically renewable raw materials (biomass), which can be used as fuel or a component of other types of fuel. In addition, fuel is defined as alternative if it is completely produced (extracted) from non-traditional and renewable sources and types of energy raw materials (including biomass) or is a mixture of traditional fuel with alternative one, the content of which must meet the technical standards of motor fuel.

The Law of Ukraine "On Alternative Fuels" does not use the term "aviation fuel". At that time, the Technical Regulation on Requirements for Aviation Gasoline and Fuels for Jet Engines [29] defines that *aviation fuel* is fuel for aviation engines made from petroleum or other raw materials – aviation gasoline and fuel for jet engines. Thus, aviation fuel from other feedstocks (in particular, biomass) may fall under this definition.

In our opinion, in the current version of the Law of Ukraine "On Alternative Fuels", it is appropriate to legally define the term "**sustainable aviation fuel**", similarly to how it will be done in the EU legislation. That means to define fuel from which raw materials will be considered sustainable aviation fuel, the need for it compliance with sustainability criteria, as well as the certification procedure (confirmation of compliance with the sustainability criteria). This can become the basis for the adoption of other measures necessary to increase the use of alternative fuels in aviation transport.

It should be noted that the Aviation Rules of Ukraine "Technical requirements and administrative procedures for monitoring emissions by civil aircraft operators" are in force in Ukraine [30]. These Aviation Rules contain a definition of the term "CORSA Eligible Fuel – CEF": aviation fuel of

sustainable production or low-carbon aviation fuel that meets the conditions of CORSIA, which the aircraft operator can use to reduce emissions. Therefore, when defining the term "sustainable aviation fuel", it is desirable *to harmonize all existing regulations in Ukraine's legislation related to aviation fuel and take into account relevant regulation in the EU*.

The *advantage* of such a measure is the introduction of a unified terminology in Ukraine's legislation regarding sustainable aviation fuel, on the basis of which other measures can be taken to increase the use of alternative fuels in aviation transport. A *disadvantage* may be the difficulty of determining the types of fuel covered by the term "sustainable aviation fuel" for Ukraine's conditions.

### ***Introduction of sustainability criteria***

In the EU legislation, the definition of the term SAF will include its mandatory compliance with the criteria of sustainability and reduction of GHG emissions provided for in Article 29(2) - (7) of Directive (EU) 2018/2001. Such criteria include the impossibility of using raw materials for the production of biofuel grown on lands with high biodiversity, high carbon reserves, peatlands; forest biomass must be obtained as a result of sustainable production and meet the criteria of land use change. The criterion for reducing GHG emissions provides for a reduction of at least 50% , 60% and 65% for biofuels produced at installations that started operation, respectively, before 05.10.2015 inclusive, in the period from 06.10.2015 to 31.12.2020 and from 01.01. 2021.

In Ukraine, draft law *"On Amendments to the Tax Code of Ukraine and other legislative acts of Ukraine regarding the payment of a single contribution and accounting for denatured ethyl alcohol and chemical and technical products"* No. 7233 dated 30.03.2022 [31] was registered. The draft Law proposes to introduce sustainability criteria for liquid biofuels (biocomponents) and biogas intended for use in transport. According to the draft Law, *sustainability criteria* are the requirements that liquid biofuels (biocomponents) and biogas, intended for use in transport, should meet, in particular, indicators of GHG emissions reduction from the use of the specified types of biofuels and the prohibition of using certain land plots for obtaining raw materials necessary for for the production of such biofuel types.

In case of the adoption of this draft Law, the sustainability criteria will also apply to aviation biofuels. However, in our opinion, it should be clarified that Directive (EU) 2018/2001 provides that aviation fuels *may* contribute to the achievement of renewable energy targets in the transport sector, but their contribution *is not mandatory*. Similarly, it should be the case in Ukraine that *only aviation biofuels that meet the sustainability criteria are taken into account for the fulfillment of RES goals in the transport sector*.

An *advantage* of such a measure is the harmonization of Ukrainian legislation with EU legislation regarding the sustainability criteria for biofuels. A *disadvantage* may be the ambition of some criteria for Ukraine, in particular regarding compliance with the GHG reduction criterion, because they were implemented gradually in the EU, while Ukraine will have at once to ensure a 65% reduction in GHG emissions for new installations.

### ***No excise tax for SAFs***

Sustainable aviation fuel should not be subject to excise tax in Ukraine. Excise tax is an indirect tax on the consumption of certain types of goods, which is included in the price of such goods (products). According to clause 215.3.4 of the Tax Code of Ukraine, excisable fuel is fuel that belongs (among other things) to the following groups according to the Ukrainian classification of foreign trade goods [32]:

1. Group 27. Mineral fuels; oil and products of its distillation; bituminous substances; mineral waxes. In particular, 2710 (Oil or petroleum products obtained from bituminous rocks (minerals), except crude), 2711 (Petroleum gases and other hydrocarbons in a gaseous state).
2. Group 38. Various chemical products. In particular, 3824 (includes alternative motor fuel), 3826 (includes biodiesel and its mixtures) and others.

Sustainable aviation fuel does not fall under group 27 as it is not a mineral fuel, but if it is used in Ukraine, it can be classified under group 38 (chemical products). However, in our opinion, such a situation should be avoided, since the classification of sustainable aviation fuels as excisable goods will increase their price (excise tax is included in the price of goods). In addition, aviation fuel is exempt from excise tax in the EU [33].

The *advantage* of exempting SAFs from the excise tax is a reduction in their price, increased competitiveness of fuel manufacturers, and potential interest of manufacturers of traditional aviation fuels in the production of SAFs. A *disadvantage* may be the non-receipt of funds from the excise tax payments by the state budget.

### ***Providing infrastructure for the use of alternative aviation fuels***

The use of SAFs does not usually require changes to the aircraft fuel system and airport infrastructure, but may require additional infrastructure for blending with traditional aviation fuel. At that, the use of electricity requires changing the infrastructure of airports through the introduction of fast charging systems or battery replacement systems. Similarly, the use of hydrogen implies the need to change the fuel system of the aircraft and the infrastructure of the airport. In this regard, SAF suppliers, aircraft operators and airports will have to attract additional investments in updating the specified infrastructure. Attracting such additional investments can take place through a *special fund*, which is replenished through imposing fines for non-compliance with the mandatory share of SAFs to finance the creation of the necessary infrastructure. In addition, in our opinion, state planning and substantiation of the priority and expediency of creating infrastructure necessary for SAFs at the designated airports are necessary. In particular, the *State target program for the development of airports until 2023* will need to be revised and updated [34].

The *advantage* of these measures is compliance with EU legislation, because airports in the EU are obliged to take the necessary measures to accelerate the access of aircraft operators to aviation fuel containing the appropriate share of SAFs, and to provide the infrastructure necessary for the delivery, storage and refueling of such fuel, including the infrastructure for refueling with hydrogen fuel and electric charging of aircraft, according to the corresponding plan within 3 years after the entry into force of the RefuelEU Aviation Regulation. A *disadvantage* may be insufficient

financing from the special fund, which will require the involvement of funds provided for in the state and local budgets, as well as credits (loans) raised under state guarantees and other sources.

***Additional incentives for the use of alternative aviation fuels (exemption from taxation)***

To increase the use of alternative aviation fuels, the possibility of introducing tax incentives should also be considered. In particular, temporary tax deductions may be applied regarding the import of special machinery, equipment and facilities by business entities into the customs territory of Ukraine without payment of import duty and value added tax, namely:

- 1) Machinery, equipment and facilities used for the reconstruction of existing and construction of new enterprises for the production of alternative types of aviation fuel;
- 2) Machinery, equipment and facilities used for mixing alternative types of aviation fuel with traditional aviation fuel. In general, mixing with traditional jet fuel can be done at the biofuel production site or in a specially designated place before entering the airport territory. *The mixing cannot be performed in the tank farm of the airport itself;*
- 3) Machinery, equipment and facilities used for the manufacture and reconstruction (refitting) of aircraft equipped with electric engines and charging infrastructure for them.

We believe that other tax incentives can also be applied, for example, exemption from paying income tax for companies that produce alternative aviation fuels, with the mandatory allocation of the released funds to research and development work to increase the production of such fuels and the introduction of the latest technologies, etc. The use of such funds must be related to the activity of the taxpayer, the profit from which is exempt from taxation.

The *advantage* of such measures is an increase in the use of alternative types of aviation fuel. A *disadvantage* may be the non-receipt of funds from the tax collection by the state budget.

***Review and adoption of regulatory acts regulating or affecting the use of alternative aviation fuels***

The current Instruction on ensuring refueling of aircraft with fuel, lubricants and technical fluids in civil aviation transport enterprises of Ukraine, approved by Order of the State Aviation Service dated 14.06.2006 No. 416 [35], does not take into account the possibility of mixing biofuels with traditional aviation fuel, and is outdated. In case of setting goals for the use of SAFs in Ukraine, we consider it necessary *to review this Instruction*. In addition, other by-laws regulating the use of aviation fuel are also subject to revision, in particular, the Aviation Rules of Ukraine "Technical requirements and administrative procedures for the certification of airfields", approved by the Order of the State Aviation Service of November 6, 2017 No. 849 [36] and some others.

In order to expand the raw material base from which SAFs can be produced, we consider it expedient *to adopt* the draft Law "On Amendments to Certain Legislative Acts of Ukraine Regarding Promotion of the Development of Growing Energy Crops" [37]. The draft Law provides for the legislative basis for promoting the cultivation of energy crops. In particular, the draft law envisages defining the term "energy crops", as well as the extending the term of land lease agreement for the cultivation of energy crops up to 20 years, which is necessary to ensure the life cycle of plantations. In addition, it is proposed to simplify the lease of unproductive land for the cultivation of energy crops – without holding land auctions, which is aimed at facilitating the

process of land lease. The draft Law also lays the legislative foundations for the adoption of a mechanism for stimulating the cultivation of energy crops, which can be implemented through state support in the way determined by CMU.

A related draft Law is the one "On Amendments to Article 288 of the Tax Code of Ukraine regarding rent for land plots on which energy crops are grown" [38]. This draft Law proposes to limit the maximum amount of rent for unproductive and degraded land on which energy crops are grown to 5% of the normative monetary value. The specified restriction will prevent an unpredictable change in the rent during the lease term and will have a positive effect on the economic indicators of energy crops cultivation projects [39].

Since the use of **other types of alternative aviation fuel** (electricity, hydrogen) in aviation transport is the latest technology, there is no special regulation of their use in aviation transport of Ukraine. *With their development of use of these alternative fuels, legislative acts regulating relevant areas will also require changes.* For example, the general law regulating the use of renewable electricity in Ukraine is the Law of Ukraine "On Alternative Energy Sources" [40]. The law considers RES to be renewable non-fossil energy sources, namely solar, wind, aerothermal, geothermal, hydrothermal, wave and tidal energy, hydropower, biomass energy, gas from organic waste, gas from sewage treatment plants, and biogas. The law establishes the procedure for obtaining a feed-in tariff ("green" tariff) in case of supply of renewable electricity to the integrated energy system of Ukraine and does not envisage restrictions for the use of renewable electricity for other needs.

As the state of national regulatory and technical acts regarding the use of hydrogen does not correspond to EU legislation, the Technical Committee for Standardization TC 197 "Hydrogen Technologies" was established in Ukraine in 2020 (Order of the State Enterprise "UkrNDNC" No. 130 dated 22.06.2020 [41]). The Technical Committee works on hydrogen technologies according to the accepted international standardization classification. The activities of the committee can *contribute to the standardization and use of alternative fuels in aviation transport.*

A number of acts (technical regulations and rules) are already in force in Ukraine, which extend their effect to activities related to the production and use of hydrogen. These acts must be taken into account in case of the production of alternative fuels for aviation transport [42]:

- **Technical regulations:**

- 1) Equipment and protective systems intended for use in a potentially explosive environment (aligned with Directive 2014/34/EU dated 26.02.2014);
- 2) Equipment operating under pressure (aligned with Directive 2014/68/EU dated 15.05.2014);
- 3) Simple high-pressure vessels (aligned with Directive 2014/29/EU dated 26.02.2014);
- 4) Mobile equipment under pressure (aligned with Directive 1999/36/EC dated 29.04.1999);

- **Safety rules, labor protection rules, safety rules during operation:**

- 1) Rules of fire safety in Ukraine (NAPB A.01.001-2014);
- 2) Safety rules for the production of hydrogen by electrolysis of water (NPAOP 24.11-1.03-78);

- 3) Safe operation of piston compressors operating on explosive and toxic gases (NPAOP 0,00-1,14-76);
- 4) Labor protection during the operation of equipment under pressure (NPAOP 0,00-1,81-18) and others.

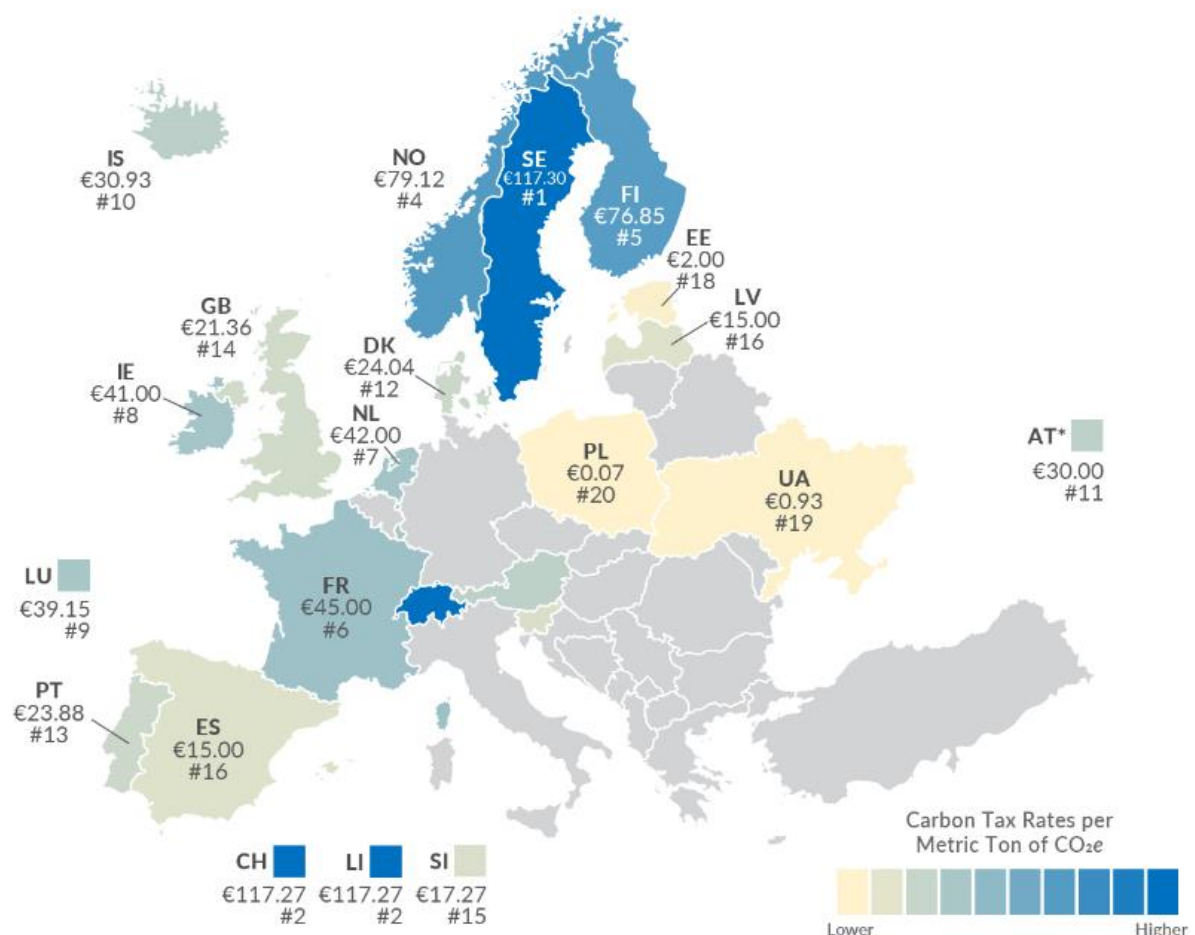
The *advantage* of the measure is the alignment and actualization of legal acts regulating the use of alternative aviation fuels. The *disadvantage* may be the considerable amount of time and efforts of the responsible central executive authorities in revising the legal acts regulating the use of alternative aviation fuels.

### ***Reforming the tax on carbon dioxide emissions***

Main drivers for stimulating the reduction of GHG emissions in the world are *fiscal* (fuel or emission taxation) and *market* (emissions trading systems) incentives. In 1990, Finland was the first in the world to introduce the carbon tax. Since then, 19 European countries have also introduced the carbon tax, which ranges from less than 1 euro per ton of emissions in Poland and Ukraine to more than 100 euros in Sweden, Liechtenstein, and Switzerland (**Fig. 1**) [43].

## **Carbon Taxes in Europe**

*Carbon Tax Rates per Metric Ton of CO<sub>2</sub>e, as of April 1, 2022*



Note: \* Austria's carbon tax is due to start July 2022.  
 The carbon tax rates were converted using the EUR-USD currency conversion rate as of April 1, 2022.  
 Source: World Bank, "Carbon Pricing Dashboard."

**Fig. 1.** Carbon taxes in Europe [43].

Sweden charges the highest carbon tax at €117.30 (\$129.89) per ton of emissions, followed by Switzerland and Liechtenstein (€117.27, \$129.86) and Norway (€79.12, \$87.61). The lowest carbon tax rates are in Poland (€0.07, \$0.08), Ukraine (€0.93, \$1.03) and Estonia (€2, \$2.21).

The carbon tax can be levied on different types of greenhouse gases, such as carbon dioxide, methane, nitrous oxide and fluorinated gases. The scope of the carbon tax varies from country to country resulting in a different share of GHG emissions covered by the tax. For example, Spain's carbon tax only applies to fluorinated gases, taxing only 2% of the country's total GHG emissions. Liechtenstein, by contrast, covers more than 81% of its GHG emissions (see **Annex 5** for details on carbon tax rates, the proportion of GHG emissions covered and the year of implementation in European countries).

In Ukraine, the tax rate for carbon dioxide emissions is 30 UAH per 1 ton. In accordance with clause 240.1 of Art. 240 of the Tax Code of Ukraine [44], taxpayers are business entities, legal entities that do not conduct economic (entrepreneurial) activities, budgetary institutions, public and other enterprises, institutions and organizations, permanent representations of non-residents, including those that perform agency (representative) functions in relation to such non-residents or their founders, during performing activities of which on the territory of Ukraine and within its continental shelf and exclusive (marine) economic zone, emissions of pollutants into the atmosphere by *stationary sources of pollution* are carried out, in particular. At that, clause 240.7 of Art. 240 of TCU establishes that entities specified in Clause 240.1 of Art. 240 are not tax payers for carbon dioxide emissions if the amount of the emissions is no more than 500 tons per year. If the annual volume of carbon dioxide emissions exceeds 500 tons per year, entities are required to register as taxpayers in the tax (reporting) period in which such excess occurred. Such taxpayers are required to prepare and submit tax returns, calculate and pay tax for the tax (reporting) period in which such an excess occurred, in accordance with the procedure provided by TCU. In addition, the tax base for carbon dioxide emissions tax based on the results of the tax (reporting) year is reduced by the volume of such emissions in the amount of 500 tons per year.

Despite the formal availability of the tax on carbon dioxide emissions in Ukraine's legislation, in practice, the effect of its application is quite low due to several reasons:

- 1) Funds collected from taxation go to the state budget and do not receive targeted use for projects aimed to reduce GHG emissions;
- 2) There is no special Fund as a point of collection/distribution of the tax on carbon emissions; no relevant national body has been appointed to manage such a fund; there is no procedure for the operation of the fund and no principles for the allocation of funds for projects aimed to reduce GHG emissions;
- 3) The tax level is low and is not an incentive to reduce GHG emissions;
- 4) The methodological approach to the accounting of GHG emissions is based on the amount of CO<sub>2</sub> emissions, and not on the carbon content of energy/fuel used/traded/purchased/entered the tax territory; some of the values used in the calculations are not in line with IPCC good practice.



Due to the mentioned problems, the current mechanism of CO<sub>2</sub> taxation in Ukraine cannot be considered effective; its architecture needs a **full-scale reform in the direction of the transition to a classic carbon tax/energy tax** by analogy with that in the EU member states. At the first stage of the reform, it is necessary to develop a *Concept for the introduction of a carbon tax in Ukraine*. The second stage could include the calculation and modeling (using energy sector modeling tools) of the carbon tax level for Ukraine, with the possible determination of the initial optimal level and a growth schedule for subsequent periods (at least until 2050) to provide a strong incentive for projects aimed to reduce GHG emissions. The third stage (in parallel with the second stage) may involve the development of amendments to the Tax Code of Ukraine and secondary legislation, which include at least the following:

- General basics of establishing a new carbon tax;
- Accounting principles (per ton of carbon/ton of fuel or other);
- Types of fuel covered, indicating the carbon content of the covered fuel types;
- The level of application (incoming fuel to Ukraine's tax territory, the first event of trade/purchase of fuel in the tax territory, the event of burning at the installation, etc.);
- Basic principles of carbon tax collection, including the principle of creating a special fund;
- Procedure for collection and distribution of funds from the taxation.

Funds raised in the special fund from the implementation of the new carbon tax can also be *used to encourage the application of alternative fuels in aviation*.

All member states of the European Union (as well as Iceland, Liechtenstein and Norway) are part of the *EU Emissions Trading System* (EU ETS), a market created to trade a limited number of quotas for GHG emissions. With the exception of Switzerland, Ukraine and Great Britain, all European countries that levy a carbon tax are also part of the EU ETS. Switzerland has its own emissions trading system, which has been linked to the EU ETS since January 2020. After Brexit, Great Britain introduced its own UK ETS from January 2021 [33].

As the aviation transport sector is one of the fastest growing sources of GHG emissions, the EU is taking measures to reduce them. CO<sub>2</sub> emissions from aviation have been included in the EU emissions trading system since 2012. The main goals of such inclusion are to reduce GHG emissions based on the cap-and-trade principle. Under the EU ETS, all airlines operating in Europe, both European and non-European, are required to monitor, report and verify their emissions, and to receive quotas for these emissions covering a certain level of emissions from their flights per year. The European Commission is now proposing to revise the aviation rules of ETS as part of the 'Target 55 compliance' legislative package to ensure that the more ambitious target of reducing emissions by at least 55% by 2030 compared to 1990 is met [45]. The purposes of such a revision include:

- the need to contribute to the achievement of the goal of the European Green Deal to reduce transport emissions by 90% by 2050 compared to the level of 1990;

- to implement CORSIA scheme under the leadership of the International Civil Aviation Organization;
- to ensure the same conditions for airlines operating flights on the same routes, regardless of their nationality.

The European Commission proposes that flights within the European Economic Area should continue to be covered by the EU ETS, including flights to Switzerland and the UK. With certain exceptions, flights between the outermost regions of the EU, international flights between the outermost regions of the EU and countries of the European Economic Area will also be included in the EU ETS. The total number of aviation quotas in the ETS will be limited to the current level and will decrease annually. The number of free quotas provided to aircraft operators will also be gradually reduced to achieve full auctioning by 2027.

In parallel, the European Commission proposes to introduce CORSIA Scheme of the International Civil Aviation Organization for non-European flights. Under the proposal, CORSIA will be applied to flights that are outside the EU ETS and depart from or arrive in countries that apply CORSIA. In order to avoid market distortions, the Commission will support the approach of ensuring a level playing field for airlines operating on the same routes, regardless of their nationality.

#### ***Introduction and integration of the trading system for GHG emission quotas in Ukraine with the EU ETS***

After signing the Association Agreement with the EU in 2014, Ukraine undertook the implementation of Directive 2003/87/EU [71] on the establishment of a GHG emissions trading scheme. The implementation of the Directive in Ukraine involves 2 stages: the launch of a monitoring, reporting and verification system of GHG emissions (MRV) and the direct launch of the emissions trading system. The first stage began on January 1, 2021, after the entry into force of the Law of Ukraine "On Principles of Monitoring, Reporting and Verification of Greenhouse Gas Emissions" [46]. At the first stage of MRV system operation, it covers only the types of activities included in the List of activities, the emissions of GHG of which are subject to monitoring, reporting and verification [47]. In particular, it includes such activities as fuel combustion in installations with a total nominal thermal capacity > 20 MW, oil refining, iron or steel production, ammonia production, and others.

The implementation of the second stage is expected from 2025 [48], since the process of creating ETS is quite complicated; even in the EU, the introduction of ETS started in 2005 as a pilot phase, and the system became fully operational only from 2008. Ukraine should take into account the experience of European countries and, if possible, harmonize the architecture of its ETS with the rules and procedures of the EU ETS operation as much as possible, as well as take into account the experience of the first phases of its implementation, in particular, in terms of setting GHG emission targets and free distribution of emission quotas [49]. The implementation of ETS should also include:

- Development (and annual revision) of the National Plan for the allocation of emission quotas;

- Definition of the term "emission quota" and the corresponding unit of measurement (similar to quotas in the European Union - EU Allowance);
- Methodological support, including the development of benchmarking rules, rules for the exclusion of individual installations, regulations for the development of a simplified monitoring plan, exclusions for small installations, borrowing procedures, etc.;
- Appointment of a national body that will be responsible for the functioning of the system;
- Integration with the EU ETS.

After establishing the operation ETS in Ukraine, the issue of including GHG emissions from aviation transport in this system should also be considered, as well as the coordination of this system with CORSIA scheme in Ukraine.

*The advantages and disadvantages of the carbon tax and ETS are detailed in Annex 6 [50].*

*Thus, recommendations for increasing the use of alternative fuels in aviation can be generalized as follows: see Table 2.2.*

**Table 2.2.** Recommendations regarding measures of state regulation in aviation. Their advantages and disadvantages.

| <b>State regulation measure in aviation</b>          | <b>Advantages</b>   | <b>Disadvantages</b>   |
|--|---|--|
| <b>1. Setting national targets for using SAFs.</b>   | <ul style="list-style-type: none"> <li>• No financial expenditures for the state to increase the use of SAFs.</li> <li>• Relative simplicity of monitoring compliance through the introduction of reporting obligations.</li> </ul>                                 | <ul style="list-style-type: none"> <li>• The reluctance of aviation fuel suppliers to fulfill such obligations due to the need for additional investments and changes to the established practices in the market.</li> </ul> |
| <b>2. Defining «sustainable aviation fuel» term.</b> | <ul style="list-style-type: none"> <li>• the introduction of a unified terminology in Ukraine's legislation regarding sustainable aviation fuel, on the basis of which other measures can be taken to increase the use of alternative fuels in aviation.</li> </ul> | <ul style="list-style-type: none"> <li>• Difficulty of determining the types of fuel covered by the term "sustainable aviation fuel" for Ukraine's conditions.</li> </ul>  |
| <b>3. Introducing sustainability criteria.</b>       | <ul style="list-style-type: none"> <li>• The harmonization of Ukrainian legislation with EU legislation regarding the sustainability criteria for biofuels.</li> </ul>  | <ul style="list-style-type: none"> <li>• The ambition of some criteria for Ukraine, in particular regarding compliance with GHG reduction criterion, because they were implemented gradually in the EU, while</li> </ul>     |

|   |  |   |
|---|--|---|
|   |  | Ukraine will have at once to ensure a 65% reduction in GHG emissions for new installations  |
| <b>4. No excise tax for SAFs.</b>   | <ul style="list-style-type: none"> <li>• A reduction in SAFs price;</li> <li>• Increased competitiveness of SAF producers;</li> <li>• Potential interest of manufacturers of traditional aviation fuels in the production of SAFs.</li> </ul>  | <ul style="list-style-type: none"> <li>• Non-receipt of funds from the excise tax payments by the state budget.</li> </ul>  |
| <b>5. Providing infrastructure for the use of alternative aviation fuels.</b>                                   | <ul style="list-style-type: none"> <li>• Compliance with EU legislation, because airports in the EU are obliged to take the necessary measures to provide the required infrastructure, including the infrastructure for refueling with hydrogen fuel and electric charging of aircraft.</li> </ul> | <ul style="list-style-type: none"> <li>• Possible insufficient financing from the special fund, which will require the involvement of funds provided for in the state and local budgets, as well as other sources.</li> </ul>   |
| <b>6. Additional incentives for the use of alternative aviation fuels exemption from taxation.</b>              | <ul style="list-style-type: none"> <li>• Increasing the use of alternative types of aviation fuel.</li> </ul>  | <ul style="list-style-type: none"> <li>• Non-receipt of funds from the tax collection by the state budget.</li> </ul>   |
| <b>7. Review and adoption of regulatory acts regulating or affecting the use of alternative aviation fuels.</b> | <ul style="list-style-type: none"> <li>• The alignment and actualization of legal acts regulating the use of alternative aviation fuels.</li> </ul>  | <ul style="list-style-type: none"> <li>• Considerable amount of time and efforts of the responsible central executive authorities in revising the legal acts regulating the use of alternative aviation fuels.</li> </ul>   |
| <b>8. Reforming the tax on carbon dioxide emissions.</b>  | <ul style="list-style-type: none"> <li>• A high tax rate can contribute to significant emission reductions.</li> <li>• Minor administrative costs.</li> <li>• Requires minimal implementation legislative changes.</li> <li>• Easy to implement and administrate.</li> </ul>                       | <ul style="list-style-type: none"> <li>• A low tax rate will not lead to emission reductions.</li> <li>• Has a regressive effect on society; lacks flexibility.</li> <li>• Requires frequent revision and correction to achieve the goal.</li> <li>• May face a strong political opposition.</li> </ul> |

|   |  |   |
|---|--|---|
| <p><b>9. Introduction and integration of the trading system for GHG emission quotas in Ukraine with the EU ETS.</b></p> | <ul style="list-style-type: none"> <li>• Evenly distributes the marginal costs of reducing emissions across the entire economy.</li> <li>• More politically acceptable than the tax.</li> <li>• The regressive effect for society is smaller than in case of introducing the tax.</li> <li>• Can stimulate the introduction of energy-efficient technologies.</li> </ul> | <ul style="list-style-type: none"> <li>• Fluctuating prices for CO<sub>2</sub> emissions complicate investment decisions.</li> <li>• Very high administrative costs.</li> <li>• Requires significant institutional changes.</li> <li>• Requires significant legislative changes.</li> <li>• Requires a well-developed carbon market;</li> <li>• Very complex implementation and administration mechanism;</li> <li>• There is a risk of providing an excessive amount of emission permits, which undermines the general system efficiency.</li> </ul> |
|---|--|---|

## 2.2. Waterborne transport

### *Setting-up goals for waterborne transport decarbonization*

Similarly, to aviation transport, the use of alternative fuels and renewable energy sources in water transport for the purpose of its decarbonization should become a strategic goal of Ukraine, because they have the greatest potential for GHG emissions reduction (up to 100%). Accordingly, in our opinion, it is necessary to adopt the updated *Energy Strategy of Ukraine for the period up to 2050 and the updated National Transport Strategy* with agreed goals for the use of alternative fuels and renewable energy sources in the transport sector, including water transport, taking into account the acts of the IMO and EU legislation.

Water transport decarbonization targets can be set in two ways. *The first option* is to establish mandatory consumption shares of certain types of alternative fuels in water transport. These objectives can be achieved, for example, by requiring marine fuel suppliers to ensure that marine fuel contains a certain minimum proportion of alternative fuels. *The second option* involves setting limits on the intensity of GHG emissions from the energy used on board the ship, similar to what is proposed to be introduced in the EU. In particular, the reduction of the average annual intensity of GHG emissions from the energy used on board ships, compared to the base level of 2020, can predict the following indicators (**Table 2.3**).

**Table 2.3** Reduction of the average annual intensity of GHG emissions. A proposal for Ukraine<sup>1)</sup>

| Indicator  | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|--|------|------|------|------|------|------|
| Reduction of the average annual intensity of GHG emissions | -2%  | -6%  | -13% | -26% | -59% | -75% |

1) *The proposal is based on the European Commission's view on reducing emissions within FuelEU Maritime.*

The specified requirements should apply to the energy used on-board of commercial vessels with a gross tonnage of more than 5,000 tons in Ukrainian ports. It is also necessary to approve the methodology for calculating the specified reduction in the intensity of GHG emissions. Failure to comply with these obligations may result in the imposition of fines and the transfer of funds received from them to a special fund for the purpose of financing the production of alternative marine fuels and measures to decarbonize water transport in Ukraine.

*The advantage* of the mandatory reduction of the average annual intensity of GHG emissions from the energy used on-board of ships is the absence of direct financial costs of the state for the decarbonization of the sector. *The disadvantage* may be the reluctance of ship operators to fulfil such obligations due to the need for additional investments and changes in established practices in the market, as well as the difficulty of calculating the reduction in the average annual intensity of GHG emissions.

According to the results of the comparative analysis and technical assessment (Report 2), the following fuels for waterborne transport are considered the most promising for Ukraine:

1. Biomethane, which can be used in compressed or liquefied form.
2. Biodiesel (FAME) and hydrotreated vegetable oil (HVO).
3. Electric power plants with accumulator batteries.
4. Liquefied natural gas (LNG).

### ***The use of biomethane for waterborne transport***

The development of biomethane production in Ukraine and its liquefaction and compression technologies in the medium term will create prerequisites for the use of bio-LNG and compressed biomethane in water transport, which will contribute to its decarbonization. The Law of Ukraine “On Amendments to Certain Laws of Ukraine Regarding the Development of Biomethane Production” [51] defines the legal basis for biomethane production in Ukraine. According to the mentioned law, biomethane is biogas, which, according to its physical and chemical characteristics, meets the requirements of legal acts for natural gas for supply to the gas transportation or gas distribution system or for use as motor fuel. The law also provides for the possibility of obtaining guarantees of biomethane origin, which confirm that biomethane is produced from biomass, and contain information on the amount of biomethane supplied to the gas transportation or gas distribution system, as well as other information. The guarantee of the origin of biomethane is formed with the help of the biomethane register by the central executive body, which implements state policy in the field of efficient use of fuel and energy resources, energy conservation, renewable energy sources and alternative fuels.

Currently, the Resolution of the CMU “On Approval of the Procedure for the Operation of the Biomethane Register” [52] has already been adopted, which determines the detailed terms and procedure for submitting information to it, creating a biomethane producer account, the procedure for obtaining and cancelling guarantees of origin of biomethane, as well as other issues of the functioning of the biomethane register. The functioning of the biomethane registry will enable biomethane producers to obtain guarantees of the origin of biomethane, and will also open opportunities for biomethane trade through the use of gas transportation and gas distribution networks of Ukraine, including for the export of biomethane. The mentioned Law currently does not define the specifics of the use of biomethane in waterborne transport, but it opens up opportunities for its production and use in Ukraine.

*The advantage* of the event is the presence of a valid special law and by-laws establishing the basis of the functioning of the biomethane market, a proven production technology and the possibility of its transportation in existing gas networks, due to the use of biomass, a significant reduction in greenhouse gas emissions is achieved. *The disadvantage* may be that the volumes of biomethane production are limited by available local reserves of raw materials, significant capital costs in biogas plants and equipment for cleaning biogas to biomethane. In addition, for use as a fuel for transport, biomethane must be liquefied at a cryogenic temperature of -162°C into bio-LNG (LBG) or compress to a pressure of 200-250 bar.

### ***Use of biodiesel (FAME) and hydrotreated vegetable oil (HVO). Adoption of draft law No. 7233 of March 30, 2022.***

Despite the fact that the said draft law is entitled “On Amendments to the Tax Code of Ukraine and other legislative acts of Ukraine regarding the payment of a single contribution and accounting for denatured ethyl alcohol and chemical and technical products” [53], it proposes to regulate important aspects of the liquid biofuel market in Ukraine. The specified draft law provides for amendments to the Law of Ukraine “On Alternative Fuels”. In particular, it is proposed to make changes to the definition of the term "biodiesel" (these are monoalkyl esters of higher organic acids

obtained from vegetable oils or animal fats, used as biofuel or biocomponent), to define the term “hydrotreated vegetable oil” (this is vegetable oil after thermochemical treatment with hydrogen), to establish a mandatory share of the content of liquid biofuel (biocomponents) in volumes of gasoline for automobiles and others. Although the provisions of the draft law are mostly aimed at regulating the biofuel market for road transport, its adoption can become the basis for the development of marine biofuel production. In the future, in our opinion, the Law of Ukraine “On Alternative Fuels” should regulate the use of alternative marine fuels as well.

*The advantage* of the measure is the updated legal definition of the term "biodiesel" and the definition of the term “hydrotreated vegetable oil”. *The disadvantage* is the focus on regulating the biofuel market for road transport.

#### ***Cancellation or reduction of excise tax rates on biodiesel***

The production of biodiesel in Ukraine, which can be used as marine fuel, is significantly hampered by the presence of high rates of excise tax on biodiesel. According to Article 215 of the Tax Code of Ukraine [44], biodiesel and its mixtures belong to excise goods. Excise tax is an indirect tax on the consumption of certain types of goods, which is included in the price of such goods (products). Accordingly, the excise tax increases the price of biodiesel on the market, because it is paid by both manufacturers and business entities that import excise goods (products) into the customs territory of Ukraine. According to clause 215.3.4 of the Tax Code of Ukraine, the rate of excise tax on biodiesel and its mixtures (which do not contain or contain less than 70 wt.% of oil or petroleum products obtained from bituminous rocks) based on monoalkyl esters of fatty acids is **106 EUR per 1000 liters**. Until 2012, the excise tax on biodiesel was not collected. At the same time, in 2013, biodiesel became an excise product [54]. If the excise tax on biodiesel is abolished or reduced, its price will decrease.

*The advantage* of cancelling or reducing the rates of excise tax on biodiesel is the reduction of its price, the strengthening of the competitiveness of biodiesel producers, and the potential interest of producers of traditional aviation fuels in the production of biodiesel. *A disadvantage* may be the non-receipt of funds from the payment of excise tax to the budget.

#### ***Review of regulatory documents and standardization***

The procedure for the use of marine fuels in Ukraine is determined by the Technical Regulation on requirements for motor gasoline, diesel, marine and boiler fuels, approved by Resolution No. 927 of the Cabinet of Ministers of Ukraine dated August 1, 2013 [55], which establishes requirements for marine fuels introduced into circulation and implemented on the territory of Ukraine, with the aim of protecting life and health of humans, animals, plants, national security, environmental protection and natural resources, and developed on the basis of EU legislation. In addition, the Order of the Ministry of Economic Development and Trade of Ukraine “On approval of the list of national standards, the voluntary application of which can be perceived as proof of the compliance of fuels with the requirements of the Technical Regulation on requirements for automobile gasoline, diesel, marine and boiler fuels” dated October 1, 2014 No. 1179 [56] is in force.



The Technical Regulation on requirements for automobile gasoline, diesel, marine and boiler fuels defines that marine fuel is liquid distillate petroleum fuel used in marine high- and medium-speed diesel engines, as well as gas turbine installations. In our opinion, the Technical Regulation does not take into account the possibility of using biofuel as marine fuel. Accordingly, it should be revised.

An important aspect is the standardization of alternative fuels for water transport. In the EU, the standard for fatty acid methyl esters (FAME) EN 14214 [57] applies to biofuels for diesel engines. The specified standard is valid in Ukraine as national DSTU EN 14214:2012 Fatty acid methyl esters (FAME) for diesel engines. Requirements and test methods [58], which allows the production of standardized biodiesel in Ukraine. In our opinion, it is also necessary to adopt the EN 15940 standard for paraffinic synthesis or hydrotreated diesel fuels, which includes hydrotreated vegetable oil (HVO) and biomass to liquid (BtL). Biofuels can be used both in their pure form and in mixtures with traditional petroleum fuels. Currently, only biodiesel (FAME) (in concentrations up to 7% by volume) is approved for use with marine gas oil as a marine fuel under the distillate fuel classes DFA, DFZ and DFB of the international standard ISO 8217:2017. The specified ISO 8217:2017 standard should also be implemented in Ukraine.

*The advantage* of the event is the alignment and updating of legal acts regulating the use of alternative marine fuels, while the *disadvantage* may be the significant expenditure of time and effort of the responsible central executive authorities in revising the legal acts regulating the use of alternative marine fuels.

#### ***Use of liquefied natural gas (LNG) and other alternative fuels***

In recent years, liquefied natural gas has become the most widely used alternative fuel for waterborne transport. This is especially evident in the EU regulation, which foresees the need to ensure an adequate number of LNG filling stations in seaports by the end of 2025 and in inland ports by the end of 2030. However, for the use of LNG, it is necessary to build the appropriate infrastructure - specialized terminals that provide reception, storage and bunkering, which requires significant investments. In Ukraine, a national project on the construction of an LNG terminal was launched back in 2010 [59]. This project involved the construction of a terminal for regasification of liquefied natural gas on the Black Sea coast of Ukraine next to the "Southern" sea trade port near the city of Yuzhne. The project was not implemented, however, in 2017, the Ministry of Infrastructure of Ukraine reported on agreements with Qatar regarding cooperation in the construction of a stationary LNG terminal on the Black Sea coast of Ukraine, which would be connected to the gas transportation system [60]. Currently, the investment project LNG TERMINAL SOUTH FCZO for the construction of a liquefied natural gas trans-shipment terminal with an annual throughput capacity of 200 million m<sup>3</sup> of natural gas is being implemented in the "Pivdennyi" port [61]. The volume of investments will amount to 122 million USD. In the future, the infrastructure for LNG bunkering can be created on the basis of this terminal, and if biomethane liquefaction equipment is installed, bio-LNG bunkering will be possible.

In addition, in the Odesa port plant near the "Pivdennyi" port, there are facilities for the production of ammonia and other chemical products, as well as complexes for trans-shipment of ammonia, urea, methanol and liquid complex nitrogen fertilizers to sea vessels for export. In particular, the

plant includes two ammonia production units, each with a capacity of 450,000 tons/year; ammonia overloading complex with a capacity of 4.3 million tons/year, with a warehouse for 120,000 tons; a methanol trans-shipment complex with a capacity of 1 million tons/year, with a warehouse for 48,000 tons. In the future, on the basis of these capacities, it is possible to establish bunkering of ships with ammonia and methanol. Ammonia is produced from natural gas, and the specific energy consumption is 8.8 Gcal/t of ammonia. It is necessary to assess the possibility of production of ammonia from biomethane on existing equipment. If such production is established, the Odesa port plant will be able to supply ammonia as a fuel for water transport both on the domestic market and abroad. Thus, in Ukraine, the prerequisites are being created for the launch of a modern Black Sea hub for bunkering ships with alternative fuels: ammonia, methanol, and LNG in the "Pivdennyi" port. *The creation of such a hub will be regulated by a significant body of legislation, which may require revision in order to take into account the modern requirements of technology development and simplify the established legal procedures for the urgent restoration of seaport infrastructure.* In particular, the Law of Ukraine "On the Natural Gas Market" [62] defines the legal basis for the functioning of the natural gas market of Ukraine, provides that LNG installation services are an economic activity that is subject to licensing and consists in the transformation of natural gas from gaseous to liquid state (liquefaction) or conversion of liquefied natural gas from a liquid to a gaseous state (regasification) using an LNG plant. In order to implement this law, a number of by-laws have been adopted, which should also be taken into account when using LNG for water transport.

The use of methanol for the production of fuels requires compliance with current legislation, as methanol is a dangerous substance. Methanol is a highly flammable liquid, highly poisonous of a nervous and vascular nature with a pronounced cumulative effect, similar in colour, smell and taste to ethyl (wine) alcohol. In this regard, a number of normative legal acts defining the procedure for handling methanol are in force in Ukraine. In particular:

1. Rules of labor protection at facilities for the production of basic organic products and polymers [63].
2. Exemplary instructions on labour protection when working with methanol [64].
3. DSTU 3057-95 Technical Methanol. Technical conditions (GOST 2222-95) [65].
4. Decree of the Cabinet of Ministers of Ukraine dated July 11, 2002 No. 956 "On identification and declaration of safety of objects of increased danger" [66]. The said Resolution provides that methanol belongs to individual hazardous substances. The threshold mass for methanol is 1 class – 5000 t, 2 class – 500 t. If the economic entity owns or uses facilities where dangerous substances (including methanol) are manufactured, processed, stored or transported, such objects are subject to identification and assignment to the appropriate hazard class.

Similarly, the use of ammonia requires compliance with current legislation, because Ukraine has a number of legal acts that determine the procedure for handling it. In particular:

1. Rules for the safe operation of ground warehouses of synthetic liquid ammonia [67].
2. Rules of labor protection during the operation of main pipelines for transporting liquid ammonia (ammonia pipelines) [68].

*The advantage* of the event is the need to review the legislation in order to take into account the modern requirements of technology development. For LNG, this is also the maturity of the technology, many ships have already been converted to LNG, and a significant number of LNG ships are on order, for methanol - prospects for reducing emissions and improving the environmental performance of shipping, ammonia is a carbon-free fuel. *The disadvantage* may be the need for significant investments in the development of infrastructure and time spent, since there is no infrastructure for the use of alternative marine fuels in Ukraine. For methanol and ammonia - toxicity and corrosiveness to some metals.

### ***Provision of infrastructure for the use of alternative marine fuels***

While the use of biodiesel (FAME) and hydrotreated vegetable oil (HVO) as a marine fuel is possible in existing fuel systems using existing tanks and bunkering infrastructure, the use of LNG will be hampered by the lack of suitable LNG infrastructure in Ukraine, the use of electricity will require the installation of onshore infrastructure. The use of other alternative fuels also requires special infrastructure, in particular, tanks for methanol and special bunkering infrastructure for methanol, ammonia, hydrogen. In this regard, Ukrainian ports will require additional investments in upgrading the specified infrastructure. Attracting such additional investments can take place through a *special fund*, which is replenished through the imposition of fines, to finance the production of alternative marine fuels and measures to decarbonize water transport in Ukraine. The source of funds can also be a fund that will attract funds from the payment of the carbon tax (in the case of the introduction of the reform of the tax on carbon emissions in Ukraine).

The current *Strategy for the Development of Seaports of Ukraine for the period until 2038* [69] does not properly take into account the need to provide infrastructure for the use of alternative marine fuels. It only envisages the task of creating infrastructure for the possibility of receiving and servicing ships that use liquefied gas as a marine fuel, as well as the introduction of environmentally safe technologies aimed at reducing harmful emissions from production processes in ports and obtaining energy from alternative sources without specifying such priority measures for individual ports of Ukraine. In this regard, in our opinion, the specified Strategy for the Development of Seaports of Ukraine for the period until 2038 needs to be revised and take into account the need to provide infrastructure for the use of alternative marine fuels, in particular, with the introduction of the approaches of the updated EU Directive on the infrastructure of alternative fuels (AFID, COM (2021)559 [20]).

*The advantage* of these measures is the integration with the relevant EU legislation because in the EU there is an obligation to ensure an adequate number of LNG filling stations in seaports by the end of 2025 and in inland ports by the end of 2030 and to ensure the installation of shore-based electric refuelling stations for inland navigation vessels and sea vessels in sea and inland ports of the TEN-T Core Network until the end of 2025. Of course, there is no question of establishing such duties in Ukraine yet, but for planning, the relevant measures should be defined in strategic documents. *The disadvantage* may be insufficient financing from a special fund, which will require the involvement of funds provided for in the state and local budgets, credits (loans) raised under state guarantees, as well as from other sources.

### ***Measures to stimulate domestic processing of raw materials into biofuel***

The introduction of an export duty on some types of oilseeds, in particular, on rapeseed, will contribute to the development of its domestic processing into a product with a high added value - liquid biofuels. In particular, it is possible to set the rate of export (export) duty as a percentage of the customs value of the goods for seeds of 10%, as for sunflower seeds, rye seeds and flax seeds.

In addition, it is necessary to introduce a system for collecting used cooking oil in catering establishments, food industry enterprises and households. Such raw materials are considered sustainable, biofuels and biogases from them provide a significant reduction of greenhouse gases, and for them double crediting (by energy content) is used to fulfil the goals for the share of biofuels in transport in accordance with the EU RED II Directive.

*The advantage* of such measures will be the formation of significant volumes of raw materials to meet the needs of the domestic transport sector in biofuel and biogas. *A disadvantage* may be a decrease in the competitiveness of oilseeds on the international market, for which an export duty will be imposed, and possible difficulties in implementing a system for collecting used edible oil.

### ***Additional incentives for the use of alternative fuels for waterborne transport (tax exemption)***

Other measures may also be considered to encourage the use of alternative fuels for water transport. In particular, the introduction of alternative fuels for water transport: LNG, ammonia, methanol and hydrogen and batteries requires significant investments in:

- 1) supply/reception, fuel storage and bunkering infrastructure;
- 2) new vessels or modernization (refitting, equipping) of existing vessels for the use of alternative types of fuel and/or electric energy;
- 3) charging stations (use of electric vessels with batteries in ports requires a special powerful charging infrastructure);
- 4) equipment for the production of alternative fuel for waterborne transport.

In this regard, temporary tax breaks may be introduced when business entities import such equipment into the customs territory of Ukraine without paying import duty and value added tax. In particular, this may concern:

- 1) machinery, equipment, and facilities used for supply/acceptance, storage of alternative types of fuel and bunkering;
- 2) machinery, equipment and devices used for the manufacture and modernization (refitting) of ships in order to ensure the consumption of alternative types of fuel and/or electric energy;
- 3) machinery, equipment and devices used for the manufacture and reconstruction (refitting) of vessels equipped with electric motors and the charging infrastructure for them;
- 4) machinery, equipment and facilities used for the reconstruction of existing and construction of new enterprises for the production of alternative fuel for water transport.

We believe that other tax incentives can also be applied, for example, exemption from paying income tax for companies producing alternative marine fuels, with the mandatory allocation of funds for scientific and research work on increasing production volumes and introducing the latest

technologies, etc. The use of such funds must be related to the activity of the taxpayer, the profit from which is exempt from taxation.

In addition, other (non-tax) incentives for the transition and use of alternative marine fuels are possible, in particular, the admission to the territory of certain ports (for example, in nature reserves or near large cities) only vessels using alternative fuels.

*The advantage* of such measures is an increase in the use of alternative marine fuels. A *disadvantage* may be the non-receipt of funds from tax collection to the budget.

#### ***Involvement of the waterborne transport sector in the system of trading quotas for GHG emissions***

From 2025, in the case of establishing the work of ETS in Ukraine, the issue of including GHG emissions from maritime transport in this system should also be considered. As noted above, the “Fit for 55” package proposes amendments to the EU Emissions Trading System Directive (EU ETS, COM (2021) 551 [19]) aimed at bringing water transport into EU emissions trading. The European Commission proposes to extend the scope of the EU ETS to cover CO<sub>2</sub> emissions from large ships (over 5000 gross tonnage), regardless of their flag. The extension will include all emissions from ships calling at EU ports for intra-EU (intra-EU) voyages, plus 50% of emissions from voyages starting or ending outside the EU and all emissions emitted when ships are at berth in EU ports. This will create a price signal that should encourage more energy efficiency and low-carbon solutions, and reduce the price gap between alternative fuels and traditional marine fuels. In practice, if the proposal is adopted, shipping companies will have to buy and surrender ETS emission allowances for each tonne of CO<sub>2</sub> emitted. Shipping companies will be assigned to a Member State's administrative authority, which will enforce compliance using the same rules as for other sectors.

To ensure a smooth transition, according to the proposal, shipping companies would have to quota only a part of their emissions during the initial period, reaching 100% after 3 years [70].

*The advantage* of the measure is to stimulate the improvement of energy efficiency and low-carbon solutions, as well as to reduce the difference in price between alternative fuels and traditional marine fuels. *The disadvantage* is a very complex implementation and administration mechanism.

Thus, *recommendations for increasing the use of alternative fuels in waterborne transport can be generalized as follows*: see **Table 2.4**.

**Table 2.4.** Recommendations regarding measures of state regulation in the waterborne transport sector. Advantages and disadvantages

| <b>Measures of state regulation in the waterborne transport sector</b>  | <b>Advantages</b>   | <b>Disadvantages</b>   |
|---|---|--|
| <b>1. Setting goals for the decarbonization of waterborne transport</b>   | <ul style="list-style-type: none"> <li>• absence of the state's direct financial costs.</li> </ul>  | <ul style="list-style-type: none"> <li>• the reluctance of ship operators to fulfil such obligations due to the need for additional investments and changes to established practices in the market.</li> <li>• the difficulty of calculating the reduction in the average annual intensity of GHG emissions.</li> </ul>  |
| <b>2. Use of biomethane for waterborne transport</b>  | <ul style="list-style-type: none"> <li>• the presence of a valid special law and by-laws establishing the basis for the functioning of the biomethane market.</li> <li>• proven production technology and the ability to transport in existing gas networks.</li> <li>• due to the use of biomass, a significant reduction in greenhouse gas emissions is achieved</li> </ul> | <ul style="list-style-type: none"> <li>• volumes of biomethane production are limited by available local reserves of feedstocks.</li> <li>• significant capital expenditures in biogas plants and equipment for cleaning biogas into biomethane.</li> <li>• for use as fuel for transport, biomethane must be liquefied at a cryogenic temperature of -162°C into bio-LNG (LBG) or compressed to a pressure of 200-250 bar.</li> </ul> |
| <b>3. Use of biodiesel (FAME) and hydrotreated vegetable oil (HVO). Adoption of Draft Law No. 7233 of March 30, 2022.</b> | <ul style="list-style-type: none"> <li>• the updated legal definition of the term "biodiesel" and the definition of the term "hydrotreated vegetable oil".</li> </ul>   | <ul style="list-style-type: none"> <li>• focus on the regulation of the biofuel market for motor transport.</li> <li>• focus on the regulation of the biofuel market for automobile transport.</li> </ul>  |

|  |  |   |
|--|--|---|
| <p><b>4. Cancellation or reduction of excise tax rates on biodiesel</b></p>          | <ul style="list-style-type: none"> <li>• reduction of biodiesel price.</li> <li>• increasing the competitiveness of biodiesel producers.</li> <li>• potential interest of traditional aviation fuels producers in the production of biodiesel.</li> </ul>  | <ul style="list-style-type: none"> <li>• non-receipt of funds from the payment of excise tax to the budget.</li> </ul>  |
| <p><b>5. Review of regulatory documents and standardization</b></p>                  | <ul style="list-style-type: none"> <li>• alignment and updating of legal acts regulating the use of alternative marine fuels.</li> </ul>   | <ul style="list-style-type: none"> <li>• considerable expenditure of time and effort by the responsible central bodies of the executive power on revising the legal acts governing the use of alternative marine fuels.</li> </ul>  |
| <p><b>6. Use of liquefied natural gas (LNG) and other alternative fuels.</b></p>     | <ul style="list-style-type: none"> <li>• the need to review the legislation to take into account the modern requirements of technological development.</li> <li>• for LNG, this is also the maturity of the technology, many vessels have already been converted to LNG, and a significant number of LNG vessels are on order.</li> <li>• for methanol - prospects for reducing emissions and improving environmental indicators of shipping.</li> <li>• ammonia is a carbon-free fuel.</li> </ul> | <ul style="list-style-type: none"> <li>• the need for significant investments in the development of infrastructure and time spent, since there is no infrastructure for the use of alternative marine fuels in Ukraine.</li> <li>• for methanol and ammonia - toxicity and corrosiveness to some metals.</li> </ul> |
| <p><b>7. Provision of infrastructure for the use of alternative marine fuels</b></p> | <ul style="list-style-type: none"> <li>• integration with the relevant EU legislation, because in the EU there is an obligation to ensure an adequate number of LNG refuelling stations in seaports by the end of</li> </ul>   | <ul style="list-style-type: none"> <li>• insufficient financing from the special fund, which will require the involvement of finances provided from the state and local budgets, credits (loans) raised under state</li> </ul>  |

|  |  |   |
|--|--|---|
|  | <p>2025 and in inland ports by the end of 2030 and to ensure the installation of shore-based electric refuelling stations for inland waterway vessels and marine vessels in seaports and internal ports of the TEN-T Core Network until the end of 2025.</p> | <p>guarantees, as well as from other sources.</p>   |
| <p><b>8. Measures to stimulate domestic processing of raw materials into biofuel</b></p>                           | <ul style="list-style-type: none"> <li>• formation of significant volumes of raw materials to meet the needs of the domestic transport sector in biofuel and biogas.</li> </ul>  | <ul style="list-style-type: none"> <li>• oilseeds, for which an export duty will be established, and possible difficulties in the implementation of the used edible oil collection system.</li> </ul> |
| <p><b>9. Additional incentives for the use of alternative marine fuels (tax exemption)</b></p>                     | <ul style="list-style-type: none"> <li>• increase the use of alternative marine fuels.</li> </ul>  | <ul style="list-style-type: none"> <li>• non-receipt of funds from tax collection by the state budget.</li> </ul>   |
| <p><b>10. Involvement of the waterborne transport sector in the system of trading quotas for GHG emissions</b></p> | <ul style="list-style-type: none"> <li>• promotes energy efficiency and low-carbon solutions, as well as reducing the price difference between alternative fuels and traditional marine fuels.</li> </ul>  | <ul style="list-style-type: none"> <li>• a very complex mechanism of implementation and administration.</li> </ul>  |



## Conclusions

Starting the production and consumption of alternative fuels in the aviation and water transport sectors of Ukraine requires the implementation of a number of important measures. They include setting appropriate national goals, making changes to certain legislative and strategic documents, developing the necessary infrastructure, and introducing some incentives.

**Recommendations** for increasing the use of alternative fuels in aviation of Ukraine can be generalized as follows:

- Setting national targets for using SAFs.
- Defining «sustainable aviation fuel» term.
- Introducing sustainability criteria.
- No excise tax for SAFs.
- Providing infrastructure for the use of alternative aviation fuels.
- Additional incentives for the use of alternative aviation fuels (exemption from taxation).
- Review and adoption of regulatory acts regulating or affecting the use of alternative aviation fuels.
- Reforming the tax on carbon dioxide emissions.
- Introduction and integration of the trading system for GHG emission quotas in Ukraine with the EU ETS.

**Recommendations** for increasing the use of alternative fuels in waterborne transport of Ukraine can be generalized as follows:

- Setting goals for the decarbonization of waterborne transport.
- Use of biomethane for waterborne transport. Using the opportunities provided by the Law of Ukraine "On Amendments to Certain Laws of Ukraine Regarding the Development of Biomethane Production".
- Use of biodiesel (FAME) and hydrotreated vegetable oil (HVO). Adoption of draft Law No. 7233 of March 30, 2022.
- Cancellation or reduction of excise tax rates on biodiesel.
- Review of regulatory documents and standardization.
- Provision of infrastructure and other necessary conditions for the use of liquefied natural gas (LNG) and other alternative marine fuels.
- Measures to stimulate domestic processing of raw materials into biofuel.
- Additional incentives for the use of alternative marine fuels (exemption from taxation).
- Involvement of waterborne transport in the system of trading quotas for GHG emissions.

# **Annex 1. Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on ensuring a level playing field for sustainable air transport**

## *Article 1*

### **Subject matter**

This Regulation lays down harmonised rules on the uptake and supply of sustainable aviation fuels.

## *Article 2*

### **Scope**

This Regulation shall apply to aircraft operators, Union airports, and to aviation fuel suppliers.

## *Article 3*

### **Definitions**

For the purposes of this Regulation, the following definitions apply:

- ‘Union airport’ means an airport as defined in Article 2(2) of Directive 2009/12/EC of the European Parliament and of the Council<sup>1</sup>, where passenger traffic was higher than 1 million passengers or where the freight traffic was higher than 100000 tons in the reporting period, and is not situated in an outermost region, as listed in Article 349 of the Treaty on the Functioning of the European Union;
- ‘aircraft operator’ means a person that operated at least 729 commercial air transport flights departing from Union airports in the reporting period or, where that person may not be identified, the owner of the aircraft;
- ‘commercial air transport flight’ means a flight operated for the purposes of transport of passengers, cargo or mail for remuneration or hire, or business aviation flights;
- ‘aviation fuel’ means the fuel manufactured for direct use by aircraft;
- ‘sustainable aviation fuels’ (‘SAF’) means drop-in aviation fuels that are either synthetic aviation fuels, advanced biofuels as defined in Article 2, second paragraph, point 34 of Directive (EU) 2018/2001, or biofuels produced from the feedstock listed in Part B of Annex IX to that Directive, which comply with the sustainability and greenhouse gas emissions criteria laid down in Article 29(2) to (7) of that Directive and are certified in accordance with Article 30 of this Directive;
- ‘batch’ means a quantity of sustainable aviation fuels that can be identified with a number and can be traced;
- ‘lifecycle emissions’ means carbon dioxide equivalent emissions of sustainable aviation fuels that take into account carbon dioxide equivalent emissions of energy production, transport, distribution and use on-board, including during combustion, calculated in accordance with Article 31 of Directive (EU) 2018/2001;

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<sup>1</sup> Directive 2009/12/EC of the European Parliament and of the Council of 11 March 2009 on airport charges.

- ‘synthetic aviation fuels’ means fuels that are renewable fuels of non-biological origin, as defined in Article 2, second paragraph, point 36 of Directive (EU) 2018/2001, used in aviation;
- ‘conventional aviation fuels’ means fuels produced from fossil non-renewable sources of hydrocarbon fuels, used in aviation;
- ‘aviation fuel supplier’ means a fuel supplier as defined in Article 2, second paragraph, point 38 of Directive (EU) 2018/2001, supplying aviation fuel at a Union airport;
- ‘reporting year’ means a period of one year in which the reports referred to in Articles 7 and 9 are to be submitted starting 1 January and ending 31 December;
- ‘reporting period’ means a period from 1 January until 31 December of the year preceding the reporting year;
- ‘yearly aviation fuel required’ means the amount of aviation fuel necessary to operate the totality of commercial air transport flights operated by an aircraft operator, departing from a given Union airport, over the course of a reporting period;
- ‘yearly non-tanked quantity’ means the difference between the yearly aviation fuel required and the actual fuel uplifted by an aircraft operator prior to flights departing from a given Union airport, over the course of a reporting period;
- ‘total yearly non-tanked quantity’ means the sum of the yearly non-tanked quantities by an aircraft operator at all Union airports over the course of a reporting period;
- ‘greenhouse gas scheme’ means a scheme granting benefits to aircraft operators for the use of sustainable aviation fuels.

#### *Article 4*

##### **Share of sustainable aviation fuel available at Union airports**

Aviation fuel suppliers shall ensure that all aviation fuel made available to aircraft operators at each Union airport contains a minimum share of sustainable aviation fuel, including a minimum share of synthetic aviation fuel in accordance with the values and dates of application set out in Annex I.

Without prejudice to the application of Article 11(3) and (4), where an aviation fuel supplier fails to supply the minimum shares set out in Annex I for a given reporting period, it shall at least complement that shortfall in the subsequent reporting period.

#### *Article 5*

##### **Refuelling obligation for aircraft operators**

The yearly quantity of aviation fuel uplifted by a given aircraft operator at a given Union airport shall be at least 90% of the yearly aviation fuel required.

#### *Article 6*

##### **Obligations of Union airports to provide the infrastructure**

Union airports shall take necessary measures to facilitate the access of aircraft operators to aviation fuels containing shares of sustainable aviation fuels in accordance with Annex I and, shall provide the infrastructure necessary for the delivery, storage and uplifting of such fuels.

Where aircraft operators report difficulties to the European Union Aviation Safety Agency ('the Agency') in accessing aviation fuels containing sustainable aviation fuels at a given Union airport for lack of adequate airport infrastructure, the Agency may request the Union airport to provide the information necessary to prove compliance with paragraph 1. The Union airport concerned shall provide the information without undue delay.

The Agency shall assess the information received and inform the Commission if such information allows to conclude that the Union airport does not fulfil its obligations. Union airports shall take the necessary measures to identify and address the lack of adequate airport infrastructure in 5 years after the entry into force of the Regulation or after the year when they exceed one of the thresholds in Article 3(a).

## *Article 7*

### **Reporting Obligations for Aircraft Operators**

By 31 March of each reporting year, aircraft operators shall report the following information to the Agency:

- (a) The total amount of aviation fuel uplifted at each Union airport, expressed in tonnes;
- (b) The yearly aviation fuel required, per Union airport, expressed in tonnes;
- (c) The yearly non-tanked quantity, per Union airport. If the yearly non-tanked quantity is negative or if it is lower than 10% of the yearly aviation fuel required, the reported yearly non-tanked quantity shall be reported as 0;
- (d) The total amount of sustainable aviation fuel purchased from aviation fuel suppliers, for the purpose of operating their flights departing from Union airports, expressed in tonnes.
- (e) For each purchase of sustainable aviation fuel, the name of the aviation fuel supplier, the amount purchased expressed in tonnes, the conversion technology, the characteristics and origin of the feedstock used for production, and the lifecycle emissions of the sustainable aviation fuel. Where one purchase includes sustainable aviation fuels with differing characteristics, the report shall provide this information for each type of sustainable aviation fuel.

The report shall be presented in accordance with the template laid down in Annex II.

The report shall be verified by an independent verifier in compliance with the requirements set out in Articles 14 and 15 of Directive 2003/87/EC of the European Parliament and of the Council<sup>2</sup>, and in Commission Implementing Regulation (EU) 2018/2067<sup>3</sup>

## *Article 8*

### **Aircraft operator claiming of use of sustainable aviation fuels**

Aircraft operators shall not claim benefits for the use of an identical batch of sustainable aviation fuels under more than one greenhouse gas scheme. Together with the report referred to in Article 7, aircraft operators shall provide the Agency with:

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<sup>2</sup> Directive 2003/87/CE du Parlement européen et du Conseil du 13 octobre 2003 établissant un système d'échange de quotas d'émission de gaz à effet de serre dans la Communauté

<sup>3</sup> Commission Implementing Regulation (EU) 2018/2067 of 19 December 2018 on the verification of data and on the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council (OJ L 334, 31.12.2018, p. 94).

- (a) A declaration of greenhouse gas schemes they participate in and in which the use of sustainable aviation fuels may be reported;
- (b) A declaration that they have not reported identical batches of sustainable aviation fuels under more than one scheme.

For the purpose of reporting sustainable aviation fuels use under the provisions of Article 7 of this Regulation, or under a greenhouse gas scheme, aviation fuel suppliers shall provide aircraft operators with the relevant information free of charge.

#### *Article 9*

##### **Reporting obligations for fuel suppliers**

By 31 March of each reporting year, aviation fuel suppliers shall report in the Union Database referred to in Article 28 of Directive (EU) 2018/2001, the following information relative to the reporting period:

- (a) The volume of aviation fuel supplied at each Union airport;
- (b) The volume of sustainable aviation fuel supplied at each Union airport, and for each type of sustainable aviation fuel, as detailed in point c);
- (c) The lifecycle emissions, origin of feedstock and conversion process of each sustainable aviation fuel type supplied at Union airports.

The Agency shall have access to the Union database and shall use the information contained in the Union database, once the information has been verified at Member State level pursuant to Article 28 of Directive (EU) 2018/2001.

#### *Article 10*

##### **Competent authority**

- (1) Member States shall designate the competent authority or authorities responsible for enforcing the application of this Regulation and for imposing the fines for aircraft operators, Union airports and fuel suppliers. Member States shall inform the Commission thereof.
- (2) The Agency shall send the data received pursuant to Articles 7 and 9 to the competent authorities of the Member States. The Agency shall also send to the competent authorities data aggregated for the aircraft operators and aviation fuels suppliers for which the authorities are competent pursuant to paragraphs 3, 4 and 5.
- (3) The competent authorities in respect of an aircraft operator shall be determined pursuant to Commission Regulation (EC) No 748/2009<sup>4</sup>.
- (4) The competent authorities in respect of Union airports shall be determined on the basis of the respective territorial jurisdiction.
- (5) The competent authorities in respect of aviation fuel suppliers shall be determined pursuant to their Member State of establishment.

#### *Article 11*

##### **Enforcement**

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<sup>4</sup> Commission Regulation (EC) No 748/2009 of 5 August 2009 on the list of aircraft operators which performed an aviation activity listed in Annex I to Directive 2003/87/EC

- (1) Member States shall lay down the rules on penalties applicable to infringements of the provisions adopted pursuant to this Regulation and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. Member States shall notify these provisions to the Commission by 31 December 2023 at the latest and shall notify it without delay of any subsequent amendment affecting them.
- (2) Member States shall ensure that any aircraft operator failing to comply with the obligations laid down in Article 5 is liable to an administrative fine. That fine shall be at least twice as high as the multiplication of the yearly average price of aviation fuel per tonne and of the total yearly non-tanked quantity;
- (3) Member States shall ensure that any aviation fuel supplier failing to comply with the obligations laid down in Article 4 relative to the minimum share of sustainable aviation fuels is liable to an administrative fine. That fine shall be at least twice as high as the multiplication of the difference between the yearly average price of conventional aviation fuel and sustainable aviation fuel per tonne and of the quantity of aviation fuels not complying with the minimum share referred to in Article 4 and Annex I;
- (4) Member States shall ensure that any aviation fuel supplier failing to comply with the obligations laid down in Article 4 relative to the minimum share of synthetic aviation fuels is liable to an administrative fine. That fine shall be at least twice as high as the multiplication of the difference between the yearly average price of synthetic aviation fuel and conventional aviation fuel per tonne and of the quantity of the aviation fuel not complying with the minimum share referred to in Article 4 and Annex I;
- (5) In the decision imposing the administrative fines referred to in paragraphs 3 and 4, the competent authority shall explain the methodology applied for the determination of the price of aviation fuel, sustainable aviation fuel and synthetic aviation fuel on the Union market, based on verifiable and objective criteria;
- (6) Member States shall ensure that any aviation fuel supplier which has accumulated a shortfall from the obligation laid down in Article 4 relative to the minimum share of sustainable aviation fuels or of synthetic fuels in a given reporting period, shall supply the market in the subsequent reporting period with a quantity of that respective fuel equal to that shortfall, additional to their reporting period obligation. Fulfilling this obligation shall not exonerate the fuel supplier from the obligation to pay the penalties laid out in paragraphs 3 and 4 of this Article;
- (7) Member States shall have the necessary legal and administrative framework in place at national level to ensure the fulfilment of the obligations and the collection of the administrative fines. Member States shall transfer the amount collected through those administrative fines as contribution to the InvestEU Green Transition Investment Facility, as a top-up to the EU guarantee.

## *Article 12*

### **Data collection and publication**

The Agency shall publish every year a technical report on the basis of the yearly reports referred to in Articles 7 and 9. That report shall contain at least the following information:

- (a) The amount of sustainable aviation fuel purchased by aircraft operators at Union level in aggregate, for use on flights departing from a Union airport, and by Union airport;
- (b) The amount of sustainable aviation fuel and of synthetic aviation fuel supplied at Union level in aggregate and by Union airport;
- (c) The state of the market, including price information, and trends in sustainable aviation fuel production and use in the Union;
- (d) The status of compliance of airports regarding obligations set out in Article 6;
- (e) The compliance status of each aircraft operator and aviation fuel supplier having an obligation under this Regulation in the reporting period;
- (f) The origin and the characteristics of all sustainable aviation fuels purchased by aircraft operators for use on flights departing from Union airports.

### *Article 13*

#### **Transitional period**

By way of derogation from Article 4, from 1 January 2025 until 31 December 2029, for each reporting period, an aviation fuel supplier may supply the minimum share of sustainable aviation fuel defined in Annex I as a weighted average over all the aviation fuel it supplied across Union airports for that reporting period.

### *Article 14*

#### **Reports and Review**

By 1 January 2028 and every five years thereafter, the Commission services shall present a report to the European Parliament and the Council, on the evolution of the aviation fuels market and its impact on the aviation internal market of the Union, including regarding the possible extension of the scope of this Regulation to other energy sources, and other types of synthetic fuels defined under the Renewable Energy Directive, the possible revision of the minimum shares in Article 4 and Annex I, and the level of administrative fines. The report shall include information, where available, on development of a potential policy framework for uptake of sustainable aviation fuels at ICAO level. The report shall also inform on technological advancements in the area of research and innovation in the aviation industry which are relevant to sustainable aviation fuels, including with regards to the reduction of non-CO<sub>2</sub> emissions. The report may consider if this Regulation should be amended and, options for amendments, where appropriate, in line with a potential policy framework on sustainable aviation fuels uptake at ICAO level.

### *Article 15*

#### **Entry into force**

This Regulation shall enter into force on the day twentieth following that of its publication in the *Official Journal of the European Union*.

It shall apply from 1<sup>st</sup> January 2023.

However, Article 4 and 5 shall apply from 1 January 2025 and Articles 7 and Article 9 shall apply from 1<sup>st</sup> April 2024 for the reporting period of the year 2023.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

## Annex 2. Report template for aircraft operators

According to Annex II of the proposal for a regulation of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport (COM(2021)0561 – C9-0332/2021 – 2021/0205(COD)).

|   |  |   |   |   |   |
|---|--|---|---|---|---|
| <b>Template for aircraft operator reporting</b> |  |   |   |   |   |
| Union airport                                   | ICAO code of Union airport                       | Yearly aviation fuel required (tonnes of kerosene equivalent) | Actual aviation fuel uplifted (tonnes of kerosene equivalent) | Yearly non-tanked quantity <sup>5</sup> (tonnes of kerosene equivalent) | Total yearly non-tanked quantity <sup>6</sup> (tonnes of kerosene equivalent) |
| <b>Template 2</b>                               |  |   |   |   |   |
| Fuel Supplier                                   | Amount purchased (tonnes of kerosene equivalent) | Conversion technology   | Characteristics   | Origin of feedstock   | Lifecycle emissions   |

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<sup>5</sup> Means the difference between the yearly aviation fuel required and the actual fuel uplifted by an aircraft operator prior to flights departing from a given Union airport, over the course of a reporting period.

<sup>6</sup> Means the sum of the yearly non-tanked quantities by an aircraft operator at all Union airports over the course of a reporting period.



**Annex 3. Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT  
AND OF THE COUNCIL on the use of renewable and low-carbon fuels in maritime  
transport and amending Directive 2009/16/EC**

Brussels, 14.7.2021  
COM(2021) 562 final  
2021/0210 (COD)

**CHAPTER I  
GENERAL PROVISIONS**

*Article 1*

**Objective and purpose**

This Regulation lays down uniform rules imposing:

(a) the limit on the greenhouse gas ('GHG') intensity of energy used on-board by a ship arriving at, staying within or departing from ports under the jurisdiction of a Member State

and

(b) the obligation to use on-shore power supply or zero-emission technology in ports under the jurisdiction of a Member State,

in order to increase consistent use of renewable and low-carbon fuels and substitute sources of energy across the Union, while ensuring the smooth operation of maritime traffic and avoiding distortions in the internal market.

*Article 2*

**Scope**

This Regulation applies to all ships above a gross tonnage of 5000, regardless of their flag in respect to:

(a) the energy used during their stay within a port of call under the jurisdiction of a Member State,

(b) the entirety of the energy used on voyages from a port of call under the jurisdiction of a Member State to a port of call under the jurisdiction of a Member State, and

(c) a half of the energy used on voyages departing from or arriving to a port of call under the jurisdiction of a Member State, where the last or the next port of call is under the jurisdiction of a third country.

This Regulation does not apply to warships, naval auxiliaries, fish-catching or fish-processing ships, wooden ships of a primitive build, ships not propelled by mechanical means, or government ships used for non-commercial purposes.

*Article 3*

**Definitions**

For the purposes of this Regulation, the following definitions apply:

(a) 'greenhouse gas emissions' means the release of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxides (N<sub>2</sub>O) into the atmosphere;

- (b) ‘biofuels’ means biofuels as defined in Article 2, point (33), of Directive (EU) 2018/2001;
- (c) ‘biogas’ means biogas as defined in Article 2, point (28), of Directive (EU) 2018/2001;
- (d) ‘recycled carbon fuels’ means recycled carbon fuels as defined in Article 2, point (35), of Directive (EU) 2018/2001;
- (e) ‘renewable fuels of non-biological origin’ means renewable fuels of non-biological origin as defined in Article 2, point (36), of Directive (EU) 2018/2001;
- (f) ‘food and feed crops’ means food and feed crops as defined in Article 2, point (40), of Directive (EU) 2018/2001;
- (g) ‘zero-emission technology’ means a technology fulfilling the requirements of Annex III that does not imply the release of the following greenhouse gases and air pollutants into the atmosphere by ships: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxides (N<sub>2</sub>O), sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM);
- (h) ‘substitute sources of energy’ means renewable wind or solar energy generated onboard or electricity supplied from on-shore power supply;
- (i) ‘port of call’ means a port of call as defined in Article 3, point (b) of Regulation (EU) 2015/757;
- (j) ‘voyage’ means voyage as defined in Article 3, point (c) of Regulation (EU) 2015/757;
- (k) ‘company’ means company as defined in Article 3, point (d) of Regulation (EU) 2015/757;
- (l) ‘gross tonnage’ (GT) means GT as defined in Article 3, point (e) of Regulation (EU) 2015/757;
- (m) ‘ship at berth’ means ship at berth as defined in Article 3, point (n) of Regulation (EU) 2015/757;
- (n) ‘energy use on-board’ means the amount of energy, expressed in mega joules (MJ), used by a ship for propulsion and for the operation of any on-board equipment, at sea or at berth;
- (o) ‘greenhouse gas intensity of the energy used on-board’ means the amount of greenhouse gas emissions, expressed in grams of CO<sub>2</sub> equivalent established on a well-to-wake basis, per MJ of energy used on-board;
- (p) ‘well-to-wake’ means a method for calculating emissions that takes into account the greenhouse gas impact of energy production, transport, distribution and use onboard, including during combustion;
- (q) ‘emission factor’ means the average emission rate of a greenhouse gas relative to the activity data of a source stream, assuming complete oxidation for combustion and complete conversion for all other chemical reactions;
- (r) ‘on-shore power supply’ means the system to supply electricity to ships at berth, at low or high voltage, alternate or direct current, including ship side and shore side installations, when feeding directly the ship main distribution switchboard for powering hotel, service workloads or charging secondary batteries;
- (s) ‘verifier’ means a legal entity carrying out verification activities, which is accredited by a national accreditation body pursuant to Regulation (EC) No 765/2008 and this Regulation;
- (t) ‘reporting period’ means reporting period as defined in Article 3, point (m) of Regulation (EU) 2015/757;

(u) ‘FuelEU certificate of compliance’ means a certificate specific to a ship, issued to a company by a verifier, which confirms that that ship has complied with this Regulation for a specific reporting period;

(v) ‘passenger ship’ means a ship that carries more than 12 passengers, including cruise ships, high speed passenger crafts, and ships with facilities to enable road or rail vehicles to roll on and roll off the vessel;

(w) ‘containership’ means a ship designed exclusively for the carriage of containers in holds and on deck;

(x) ‘non-compliant port call’ means a port call of during which the ship does not comply with the requirement of Article 5(1), and none of the exceptions provided for in Article 5(3) apply;

(y) ‘least favourable pathway’ means the most carbon-intensive production pathway used for any given fuel;

(z) ‘CO<sub>2</sub> equivalent’ means the metric measure used to compute the emissions from CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O on the basis of their global-warming potential, by converting amounts of CH<sub>4</sub> and N<sub>2</sub>O to the equivalent amount of carbon dioxide with the same global warming potential;

(aa) ‘compliance balance’ means the measure of a ship’s over- or under-compliance with regards to the limits to the yearly average greenhouse gas intensity of the energy used on-board by a ship, which is calculated in accordance with Annex V.

(bb) ‘compliance surplus’ means a compliance balance with a positive value.

(cc) ‘compliance deficit’ means a compliance balance with a negative value;

(dd) ‘total pool compliance balance’ means the sum of the compliance balances of all ships included in the pool.

(ee) ‘managing body of the port’ means any public or private body as defined in Article 2(5) of Regulation (EU) 2017/352 of the European Parliament and of the Council<sup>7</sup>.

## CHAPTER II

### REQUIREMENTS ON ENERGY USED ON-BOARD BY SHIPS

#### *Article 4*

#### **Greenhouse gas intensity limit of energy used on-board by a ship**

1. The yearly average greenhouse gas intensity of the energy used on-board by a ship during a reporting period shall not exceed the limit set out in paragraph 2.

2. The limit referred to in paragraph 1 shall be calculated by reducing the reference value of [X grams of CO<sub>2</sub> equivalent per MJ]\* by the following percentage:

- -2% from 1 January 2025;
- -6% from 1 January 2030;
- -13% from 1 January 2035;
- -26% from 1 January 2040;
- -59% from 1 January 2045;
- -75% from 1 January 2050.

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<sup>7</sup> Regulation (EU) 2017/352 of the European Parliament and of the Council of 15 February 2017 establishing a framework for the provision of port services and common rules on the financial transparency of ports (OJ L 57, 3.3.2017, p. 1).

[Asterix: The reference value, which calculation will be carried out at a later stage of the legislative procedure, corresponds to the fleet average greenhouse gas intensity of the energy used on-board by ships in 2020 determined on the basis data monitored and reported in the framework of Regulation (EU) 2015/757 and using the methodology and default values laid down in Annex I to that Regulation.]

3. The greenhouse gas intensity of the energy used on-board by a ship shall be calculated as the amount of greenhouse gas emissions per unit of energy according to the methodology specified in Annex I.

4. The Commission is empowered to adopt delegated acts in accordance with Article 26 to amend Annex II in order to include the well-to-wake emission factors related to any new sources of energy or to adapt the existing emission factors to ensure consistency with future international standards or the legislation of the Union in the field of energy.

#### *Article 5*

#### **Additional zero-emission requirements of energy used at berth**

1. From 1 January 2030, a ship at berth in a port of call under the jurisdiction of a Member State shall connect to on-shore power supply and use it for all energy needs while at berth.

2. Paragraph 1 shall apply to: (a) containerships; (b) passenger ships.

3. Paragraph 1 shall not apply to ships:

(a) that are at berth for less than two hours, calculated on the basis of hour of departure and arrival monitored in accordance with Article 14;

(b) that use zero-emission technologies, as specified in Annex III;

(c) that have to make an unscheduled port call for reasons of safety or saving life at sea;

(d) that are unable to connect to on-shore power supply due to unavailable connection points in a port;

(e) that are unable to connect to on-shore power supply because the shore installation at the port is not compatible with the on-board on-shore power equipment;

(f) which, for a limited period of time, require the use of on-board energy generation, under emergency situations representing immediate risk to life, the ship, the environment or for other reasons of force majeure.

4. The Commission is empowered to adopt delegated acts in accordance with Article 26 to amend Annex III in order to insert references to new technologies in the list of applicable zero-emission technologies or criteria for their use, where these new technologies are found equivalent to the technologies listed in that Annex in the light of scientific and technical progress.

5. The managing body of the port of call shall determine whether the exceptions set in paragraph 3 apply and issue or refuse to issue the certificate in accordance with the requirements set out in Annex IV.

6. From 1 January 2035, the exceptions listed in paragraph 3, points (d) and (e), may not be applied to a given ship, in total, more than five times during one reporting year. A port call shall not be counted for the purpose of compliance with this provision where the company demonstrates that it could not have reasonably known that the ship will be unable to connect for reasons referred to in paragraph 3, points (d) and (e).

7. Emergency situations resulting in the need to use on-board generators, referred to in paragraph 3, point (f), shall be documented and reported by the ship to the managing body of the port.

CHAPTER III  
COMMON PRINCIPLES AND CERTIFICATION

*Article 6*

**Common principles for monitoring and reporting**

1. In accordance with Articles 7 to 9, companies shall, for each of their ships, monitor and report on the relevant data during a reporting period. They shall carry out that monitoring and reporting within all ports under the jurisdiction of a Member State and for any voyages to or from a port under the jurisdiction of a Member State.

2. Monitoring and reporting shall be complete and cover the energy used on-board by ships, while the ships are at sea as well as at berth. Companies shall apply appropriate measures to prevent any data gaps within the reporting period.

3. Monitoring and reporting shall be consistent and comparable over time. To that end, companies shall use the same monitoring methodologies and data sets subject to modifications assessed by the verifier. Companies shall enable reasonable assurance of the integrity of the data to be monitored and reported.

4. Companies shall obtain, record, compile, analyse and document monitoring data, including assumptions, references, emission factors and activity data, in a transparent and accurate manner, so that the verifier can determine the greenhouse gas intensity of the energy used on-board by ships.

5. In undertaking the monitoring and reporting activities set out in Articles 7 to 9 and 14 of this Regulation, information and data collected for the purpose of Regulation (EU) 2015/757 shall be used where appropriate.

*Article 7*

**Monitoring plan**

1. By 31 August 2024, companies shall submit to the verifiers a monitoring plan for each of their ships indicating the method chosen from among those set out in Annex I to monitor and report the amount, type and emission factor of energy used on-board by ships and other relevant information.

2. For ships falling under the scope of this Regulation for the first time after 31 August 2024, companies shall submit a monitoring plan to the verifier without undue delay and no later than two months after each ship's first call in a port under the jurisdiction of a Member State.

3. The monitoring plan shall consist of a complete and transparent documentation and shall contain at least the following elements:

(a) the identification and type of the ship, including its name, its IMO identification number, its port of registry or home port, and the name of the ship-owner;

(b) the name of the company and the address, telephone and e-mail details of a contact person;

(c) a description of the energy conversion systems installed on-board, and the related power capacity expressed in megawatt (MW);

(d) a description that the ship has installed and certified equipment to allow connection to onshore power supply, at a specified voltage and frequency, including the gear specified in IEC/IEEE 80005-1 (High Voltage) and IEC/IEEE 80005-3 (Low Voltage) or is equipped with substitute sources of energy or a zero-emission technology as specified in Annex III;

(e) a description of the intended source(s) of energy to be used on-board while in navigation and at berth to comply with the requirements set out in Articles 4 and 5;

(f) a description of the procedures for monitoring the fuel consumption of the ship as well as the energy provided by substitute sources of energy or a zeroemission technology as specified in Annex III;

(g) well-to-wake emission factors referred to in Annex II;

(h) a description of the procedures used to monitor the completeness of the list of voyages;

(i) a description of the procedures used for determining activity data per voyage, including the procedures, responsibilities, formulae and data sources for determining and recording the time spent at sea between the port of departure and the port of arrival and the time spent at berth;

(j) a description of the procedures, systems and responsibilities used to update any of the data contained in the monitoring plan over the reporting period;

(k) a description of the method to be used to determine surrogate data for closing data gaps;

(l) a revision record sheet to record all the details of the revision history.

4. Companies shall use standardised monitoring plans based on templates. The Commission shall, by means of implementing acts, determine those templates, including the technical rules for their uniform application. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 27(3).

#### *Article 8*

##### **Modifications to the monitoring plan**

1. Companies shall check regularly, and at least annually, whether a ship's monitoring plan reflects the nature and functioning of the ship and whether any of the data it contains can be improved.

2. Companies shall modify the monitoring plan in any of the following situations:

(a) where a change of company occurs;

(b) where new energy conversion systems, new types of energy, including substitute sources of energy or a zero-emission technology as specified in Annex III are in use;

(c) where a change in availability of data, due to the use of new types of measuring equipment, new sampling methods or analysis methods, or for other reasons, may affect the accuracy of the data collected;

(d) data resulting from the monitoring method applied has been found to be incorrect;

(e) where any part of the monitoring plan is identified as not being in conformity with the requirements of this Regulation and the company is required by the verifier to revise it.

3. Companies shall notify to the verifiers without undue delay any proposals for modification of the monitoring plan.

4. Modifications of the monitoring plan referred to in paragraph 2, points (b), (c) and (d) of this Article shall be subject to assessment by the verifier. Following the assessment, the verifier shall notify the company concerned whether those modifications are in conformity with Article 6.

## *Article 9*

### **Certification of biofuels, biogas, renewable liquid and gaseous transport fuels of nonbiological origin and recycled carbon fuels**

1. Where biofuels, biogas, renewable fuels of non-biological origin and recycled carbon fuels, as defined in Directive (EU) 2018/2001, are to be taken into account for the purposes referred to in Articles 4(1) of this Regulation, the following rules apply:

(a) greenhouse gas emission factors of biofuels and biogas that comply with the sustainability and greenhouse gas saving criteria set out in Article 29 of Directive (EU) 2018/2001 shall be determined according to the methodologies set out in that Directive;

(b) greenhouse gas emissions factors of renewable fuels of non-biological origin and recycled carbon fuel that comply with the greenhouse gas emission savings thresholds set out in Article 27(3) of Directive (EU) 2018/2001 shall be determined according to the methodologies set out in that Directive;

(c) biofuels and biogas that do not comply with point (a) or that are produced from food and feed crops shall be considered to have the same emission factors as the least favourable fossil fuel pathway for this type of fuel;

(d) renewable fuels of non-biological origin and recycled carbon fuels that do not comply with point (b) shall be considered to have the same emission factors as the least favourable fossil fuel pathway for this type of fuels.

2. Companies shall provide accurate and reliable data on the GHG emission intensity and the sustainability characteristics of biofuels, biogas, renewable fuels of nonbiological origin and recycled carbon fuel, verified by a scheme that is recognised by the Commission in accordance with Article 30(5) and (6) of the Directive (EU) 2018/2001.

3. Companies shall be entitled to divert from the established default values for the tank-to-wake emission factors provided that actual values are certified by means of laboratory testing or direct emissions measurements. The Commission is empowered to adopt delegated acts in accordance with Article 26, in order to supplement this Regulation by establishing the rules on conducting the laboratory testing and direct emissions measurements.

## **CHAPTER IV**

### **VERIFICATION AND ACCREDITATION**

#### *Article 10*

##### **Verification activities**

1. The verifier shall assess the conformity of the monitoring plan with the requirements laid down in Articles 6 to 9. Where the verifier's assessment identifies nonconformities with those requirements, the company concerned shall revise its monitoring plan accordingly and submit the revised plan for a final assessment by the verifier before the reporting period starts. The company concerned shall agree with the verifier on the timeframe necessary to introduce those revisions. That timeframe shall in any event not extend beyond the beginning of the reporting period.

2. The verifier shall assess the conformity of the information reported with the requirements laid down in Articles 6 to 9 and Annexes I, II and III before performing the operations set out in Article 15(2).

3. Where the verification assessment identifies incorrect statements or non-conformities with this Regulation, the verifier shall inform the company concerned thereof in a timely manner.

That company shall then amend the incorrect statements or nonconformities so as to enable the verification process to be completed in time.

#### *Article 11*

##### **General obligations and principles for the verifiers**

1. The verifier shall be independent from the company or from the operator of a ship and shall carry out the activities required under this Regulation in the public interest. For that purpose, neither the verifier nor any part of the same legal entity shall be a company or ship operator, the owner of a company, or be owned by them, nor shall the verifier have relations with the company that could affect its independence and impartiality.

2. The verifier shall assess the reliability, credibility and accuracy of the data and information relating to the amount, type and emission factor of the energy used onboard by ships, in particular

(a) the attribution of fuel consumption and the use of substitute sources of energy to voyages;

(b) the reported fuel consumption data and related measurements and calculations;

(c) the choice and the employment of emission factors;

(d) the use of on-shore power supply or the presence of exceptions certified in accordance with Article 5(5).

3. The assessment referred to in paragraph 2 shall be based on the following considerations:

(a) the reported data are coherent in relation to estimated data that are based on ship tracking data and characteristics such as the installed engine power;

(b) the reported data are free of inconsistencies, in particular when comparing the total volume of fuel purchased annually by each ship and the aggregate fuel consumption during voyages;

(c) the collection of the data has been carried out in accordance with the applicable rules; and

(d) the relevant records of the ship are complete and consistent.

#### *Article 12*

##### **Verification procedures**

1. The verifier shall identify potential risks related to the monitoring and reporting process by comparing reported amount, type and emission factor of the energy used on-board by ships with estimated data based on ship tracking data and characteristics such as the installed engine power. Where significant deviations are found, the verifier shall carry out further analyses.

2. The verifier shall identify potential risks related to the different calculation steps by reviewing all data sources and methodologies used by the company.

3. The verifier shall take into consideration any effective risk control methods applied by the company concerned to reduce levels of uncertainty associated with the accuracy specific to the monitoring methods used.

4. The company concerned shall provide the verifier with any additional information that enables it to carry out the verification procedures. The verifier may conduct checks during the verification process to determine the reliability of reported data and information.



### *Article 13*

#### **Accreditation of verifiers**

1. Verifiers shall be accredited for activities under the scope of this Regulation by a national accreditation body pursuant to Regulation (EC) No 765/2008.
2. Where no specific provisions concerning the accreditation of verifiers are laid down in this Regulation, the relevant provisions of Regulation (EC) No 765/2008 shall apply.
3. The Commission is empowered to adopt delegated acts in accordance with Article 26, in order to supplement this Regulation by establishing further methods and criteria of accreditation of verifiers. The methods specified in those delegated acts shall be based on the principles for verification provided for in Articles 10 and 11 and on relevant internationally accepted standards.

### CHAPTER V

#### **RECORDING, VERIFICATION, REPORTING AND ASSESMENT OF COMPLIANCE**

### *Article 14*

#### **Monitoring and recording**

1. Based on the monitoring plan referred to in Article 7, and following the assessment of that plan by the verifier, companies shall record, for each ship arriving in or departing from, and for each voyage to or from a port of call under the jurisdiction of a Member State, the following information:
  - (a) port of departure and port of arrival including the date and hour of departure and arrival and time spent at berth;
  - (b) for each ship that the requirement of Article 5(1) applies, the connection to and use of on-shore power or the existence of any of the exceptions listed in Article 5(3);
  - (c) the amount of each type of fuel consumed at berth and at sea;
  - (d) the well-to-wake emission factors for each type of fuel consumed at berth and at sea, broken down by well-to-tank, tank-to-wake and fugitive emissions, covering all relevant greenhouse gases;
  - (e) the amount of each type of substitute source of energy consumed at berth and at sea.
2. Companies shall record the information and data listed in paragraph 1 on annual basis in a transparent manner, that enables the verification of compliance with this Regulation by the verifier.
3. By 30 March of each year, companies shall provide to the verifier the information referred to in paragraph 1.

### *Article 15*

#### **Verification and calculation**

1. Following the verification laid down in Articles 10 to 12, the verifier shall assess the quality, completeness and accuracy of the information provided by the company in accordance with Article 14(3).
2. On the basis of the information verified according to paragraph 1, the verifier shall:
  - (a) calculate, using the method specified in Annex I, the yearly average greenhouse gas intensity of the energy used on-board by the ship concerned;

- (b) calculate, using the formula specified in Annex V, the ship's compliance balance;
  - (c) calculate the number of non-compliant port calls in the previous reporting period including the time spent at berth for each non-compliant port call.
  - (d) calculate the amount of the penalties referred to in Article 20(1) and (2).
3. The verifier shall notify to the company the information referred to in paragraph 2.

#### *Article 16*

### **Compliance database and reporting**

1. The Commission shall develop, ensure functioning and update an electronic compliance database for the monitoring of compliance with Articles 4 and 5. The compliance database shall be used to keep a record of the compliance balance of the ships and the use of the flexibility mechanisms set out in Articles 17 and 18. It shall be accessible to the companies, the verifiers, the competent authorities and the Commission.

2. The Commission shall, by means of implementing acts, lay down the rules for access rights and the functional and technical specifications of the compliance database. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 27(3).

3. By 30 April of each year, the company shall record in the compliance database for each of its ships the information referred to in Article 15(2), as ascertained by the verifier, together with information allowing to identify the ship, the company, as well as the identity of the verifier that carried out the assessment.

#### *Article 17*

### **Banking and borrowing of compliance surplus between reporting periods**

1. Where the ship has a compliance surplus for the reporting period, the company may bank it to the same ship's compliance balance for the following reporting period. The company shall record the banking of the compliance surplus to the following reporting period in the compliance database subject to approval by its verifier. The company may no longer bank the compliance surplus once the FuelEU certificate of compliance has been issued.

2. Where the ship has a compliance deficit for the reporting period, the company may borrow an advance compliance surplus of the corresponding amount from the following reporting period. The advance compliance surplus shall be added to the ship's balance in the reporting period and subtracted from the same ship's balance in the following reporting period. The amount to be subtracted in the following reporting period shall be equal to the advance compliance surplus multiplied by 1.1. The advance compliance surplus may not be borrowed:

(a) for the amount exceeding by more than 2% the limit set out in Article 4(2), multiplied by the energy consumption of the ship calculated in accordance with Annex I;

(b) for two consecutive reporting periods.

3. By 30 April of the year following the reporting period, the company shall record the advance compliance surplus, following approval by its verifier, in the compliance database.

#### *Article 18*

### **Pooling of compliance**

1. The compliance balances of two or more ships, which are verified by the same verifier, may be pooled for the purposes of fulfilling the requirements of Article 4. A ship's compliance balance may not be included in more than one pool in the same reporting period.

2. By 30 March of the year following the reporting period, the company shall notify to the verifier the intention of including the ship's compliance balance in a pool for the immediately preceding reporting period. In the case where the ships participating in the pool are controlled by two or more companies, the companies shall make a joint notification to the verifier.

3. By 30 April of the year following the reporting period, the pool shall be recorded in the compliance database by the verifier. The composition of the pool shall not change after that date.

4. In case of pooled compliance under paragraph 1 of this Article, and for the purposes of Article 15(2)(b), the company may decide how to allocate the total compliance balance of the pool to each individual ship, provided that the total pool compliance balance is respected. In case where the ships participating in the pool are controlled by two or more companies, the total compliance balance of the pool shall be allocated in accordance with the method specified in the joint notification.

5. If the pool average compliance balance results in the compliance surplus for an individual ship, Article 17(1) applies.

6. Article 17(2) does not apply to a ship participating in the pool.

7. The company may no longer include the ship's compliance balance in a pool once the FuelEU certificate of compliance has been issued.

#### *Article 19*

#### **FuelEU certificate of compliance**

1. By 30 June of the year following the reporting period, the verifier shall issue a FuelEU certificate of compliance for the ship concerned, provided that the ship does not have a compliance deficit, after possible application of Articles 17 and 18, and does not have non-compliant port calls.

2. The FuelEU certificate of compliance shall include the following information:

(a) identity of the ship (name, IMO identification number and port of registry or home port);

(b) name, address and principal place of business of the ship-owner;

(c) identity of the verifier;

(d) date of issue of this certificate, its period of validity and the reporting period it refers to.

3. The FuelEU certificate of compliance shall be valid for the period of 18 months after the end of the reporting period.

4. The verifier shall inform the Commission and the flag State, without delay, of the issuance of any FuelEU certificate of compliance.

5. The Commission shall adopt implementing acts establishing models for the FuelEU certificate of compliance, including electronic models. Those implementing acts shall be adopted in accordance with the advisory procedure referred to in Article 27(2).

#### *Article 20*

#### **Penalties**

1. Where on 1 May of the year following the reporting period the ship has a compliance deficit, the company shall pay a penalty. The verifier shall calculate the amount of the penalty on the basis of the formula specified Annex V.

2. The company shall pay a penalty for each non-compliant port call. The verifier shall calculate the amount of the penalty by multiplying the amount of EUR 250 by megawatts of power installed on-board and by the number of completed hours spent at berth.

3. Notwithstanding Article 19(1), the verifier shall issue a FuelEU certificate of compliance once the penalties referred to in paragraphs 1 and 2 of this Article have been paid. The actions referred to in this Article as well as the proof of the financial payments in accordance with Article 21 shall be recorded in the FuelEU certificate of compliance.

4. The Commission is empowered to adopt delegated acts in accordance with Article 26 to amend Annex V in order to adapt the formula referred to in paragraph 1 of this Article, and to amend the amount of the fixed penalty laid down in paragraph 2 of this Article, taking into account the developments in the cost of energy.

#### *Article 21*

### **Allocation of penalties to support renewable and low-carbon fuels in the maritime sector**

1. The penalties referred to in Article 20(1) and 20(2) shall be allocated to support common projects aimed at the rapid deployment of renewable and low carbon fuels in the maritime sector. Projects financed by the funds collected from the penalties shall stimulate the production of greater quantities of renewable and low carbon fuels for the maritime sector, facilitate the construction of appropriate bunkering facilities or electric connection ports in ports, and support the development, testing and deployment of the most innovative European technologies in the fleet to achieve significant emission reductions.

2. The revenues generated from penalties referred to in paragraph 1 shall be allocated to the the Innovation Fund referred to in Article 10a(8) of Directive 2003/87/EC. These revenues shall constitute external assigned revenue in accordance with Article 21(5) of the Financial Regulation, and shall be implemented in accordance with the rules applicable to the Innovation Fund.

3. The Commission is empowered to adopt delegated acts in accordance with Article 26 to supplement this Regulation concerning the modalities for the payment of the penalties referred to in Article 20(1) and 20(2).

#### *Article 22*

### **Obligation to carry a valid FuelEU certificate of compliance on-board**

1. The ships calling at a port under the jurisdiction of a Member State shall carry onboard a valid FuelEU certificate of compliance.

2. The Fuel EU certificate of compliance issued for the ship concerned in accordance with Article 19 shall constitute evidence of compliance with this Regulation.

#### *Article 23*

### **Enforcement**

1. Member States shall lay down the rules on sanctions applicable to infringements of this Regulation and shall take all measures necessary to ensure that they are implemented. The sanctions provided for must be effective, proportionate and dissuasive. Member States shall notify those provisions to the Commission by [dd/mm/20xx], and shall notify to the Commission without delay any subsequent amendments.

2. Each Member State shall ensure that any inspection of a ship in a port under its jurisdiction carried out in accordance with Directive 2009/16/EC includes checking that a valid FuelEU certificate of compliance is carried on board.

3. Where a ship has failed to present a valid FuelEU certificate of compliance for two or more consecutive reporting periods and where other enforcement measures have failed to ensure compliance, the competent authority of the Member State of the port of call may, after giving the opportunity to the company concerned to submit its observations, issue an expulsion order. The competent authority of the Member State shall notify the expulsion order to the Commission, the other Member States and the flag State concerned. Every Member State, with the exception of any Member State whose flag the ship is flying, shall refuse entry of the ship which is subject to the expulsion order into any of its ports until the company fulfils its obligations. Where the ship flies the flag of a Member State, the Member State concerned shall, after giving the opportunity to the company concerned to submit its observations, order a flag detention until the company fulfils its obligations.

4. The fulfilment of those obligations shall be confirmed by the notification of a valid FuelEU certificate of compliance to the competent national authority which issued the expulsion order. This paragraph shall be without prejudice to the provisions of international law applicable in the case of ships in distress. 5. Sanctions against a specified ship by any Member State shall be notified to the Commission, to the other Member States and to the flag State concerned.

#### *Article 24*

##### **Right to review**

1. The companies shall be entitled to apply for a review of the calculations and measures addressed to them by the verifier under this Regulation, including the refusal to issue a FuelEU certificate of compliance pursuant to Article 19(1).

2. The application for review shall be lodged, within one month of the notification of the result of calculation or of the measure by the verifier, with the competent authority of the Member State in which the verifier has been accredited. The decision of the competent authority shall be subject to judicial review

3. The decisions taken under this Regulation by the managing body of the port shall be subject to judicial review.

#### *Article 25*

##### **Competent authorities**

Member States shall designate one or more competent authorities as responsible for the application and enforcement of this Regulation ('competent authorities'). They shall communicate their names and contact information to the Commission. The Commission shall publish on its website the list of competent authorities.

## CHAPTER VI

### **DELEGATED AND IMPLEMENTING POWERS AND FINAL PROVISIONS**

#### *Article 26*

##### **Exercise of delegation**

1. The power to adopt delegated acts is conferred on the Commission subject to the conditions laid down in this Article.

2. The power to adopt delegated acts referred to in Articles 4(6), 5(4), 9(3), 13(3), 20(4), and 21(3) shall be conferred on the Commission for an indeterminate period of time from [date of entry into force of this Regulation].

3. The delegation of power referred to in Articles 4(7), 5(4), 9(3), 13(3), 20(4), and 21(3) may be revoked at any time by the European Parliament or by the Council. A decision to revoke shall put an end to the delegation of the power specified in that decision. It shall take effect the day following the publication of the decision in the Official Journal of the European Union or at a later date specified therein. It shall not affect the validity of any delegated acts already in force.

4. Before adopting a delegated act, the Commission shall consult experts designated by each Member State in accordance with the principles laid down in the Interinstitutional Agreement on Better Law-Making of 13 April 2016.

5. As soon as it adopts a delegated act, the Commission shall notify it simultaneously to the European Parliament and to the Council.

6. A delegated act adopted pursuant to Articles 4(7), 5(4), 9(3), 13(3), 20(4), and 21(3) shall enter into force only if no objection has been expressed either by the European Parliament or by the Council within a period of two months of notification of that act to the European Parliament and the Council or if, before the expiry of that period, the European Parliament and the Council have both informed the Commission that they will not object. That period shall be extended by two months at the initiative of the European Parliament or of the Council.

#### *Article 27*

##### **Committee procedure**

1. The Commission shall be assisted by the Committee on Safe Seas and the Prevention of Pollution from ships (COSS) established by Regulation (EC) 2099/2002 of the European Parliament and of the Council<sup>8</sup>. That committee shall be a committee within the meaning of Regulation (EU) No 182/2011.

2. Where reference is made to this paragraph, Article 4 of Regulation (EU) No 182/2011 shall apply. Where the opinion of the Committee is to be obtained by written procedure, that procedure shall be terminated without result when, within the time-limit for delivery of the opinion, the chair of the committee so decides

3. Where reference is made to this paragraph, Article 5 of Regulation (EU) No 182/2011 shall apply. Where the committee delivers no opinion, the Commission shall not adopt the draft implementing act and the third subparagraph of Article 5(4) of Regulation (EU) No 182/2011 shall apply.

#### *Article 28*

##### **Report and review**

1. The Commission shall report to the European Parliament and the Council, by 1 January 2030, the results of an evaluation on the functioning of this Regulation and the evolution of the technologies and market for renewable and low-carbon fuels in maritime transport and its impact on the maritime sector in the Union. The Commission shall consider possible amendments to:

- (a) the limit referred to in Article 4(2);
- (b) the ship types to which Article 5(1) applies;

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<sup>8</sup> Regulation (EC) No 2099/2002 of the European Parliament and of the Council of 5 November 2002 establishing a Committee on Safe Seas and the Prevention of Pollution from Ships (COSS) and amending the Regulations on maritime safety and the prevention of pollution from ships (OJ L 324, 29.11.2002, p. 1).

(c) the exceptions listed in Article 5(3).

*Article 29*

**Amendments to Directive 2009/16/EC**

The following point shall be added to the list set out in Annex IV to Directive 2009/16/EC:  
'51. The FuelEU certificate of compliance issued under Regulation (EU) xxxx on the use of renewable and low-carbon fuels in maritime transport'.

*Article 30*

**Entry into force**

This Regulation shall enter into force on the twentieth day following that of its publication in the Official Journal of the European Union. It shall apply from 1 January 2025.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

ANNEX I

**METHODOLOGY FOR ESTABLISHING THE GREENHOUSE GAS INTENSITY LIMIT ON THE ENERGY USED ON-BOARD BY A SHIP**

For the purpose of calculating the greenhouse gas intensity limit of the energy used on-board a ship, the following formula, referred to as Equation (1) shall apply:

| GHG intensity index                                     | WtT   | TtW   |
|---|---|---|
| GHG intensity index $\left[\frac{gCO_2eq}{MJ}\right] =$ | $\frac{\sum_i^n fuel_i M_i \times CO_{2eq\ WtT,i} \times LCV_i + \sum_k^c E_k \times CO_{2eq\ electricity,k}}{\sum_i^n fuel_i M_i \times LCV_i + \sum_k^c E_k}$ | $\frac{\sum_i^n fuel_i \sum_j^m engine M_{i,j} \times \left[ \left(1 - \frac{1}{100} C_{engine\ slip\ j}\right) \times (CO_{2eq\ TtW,i}) + \left(\frac{1}{100} C_{engine\ slip\ j} \times CO_{2eq\ TtW\ slippage,j}\right) \right]}{\sum_i^n fuel_i M_i \times LCV_i + \sum_k^c E_k}$ |

Equation (1)

where the following formula is referred to as Equation (2):

$$CO_{2eq,TtW,j} = \left( C_{f\ CO_2,j} \times GWP_{CO_2} + C_{f\ CH_4,j} \times GWP_{CH_4} + C_{f\ N_2O,j} \times GWP_{N_2O} \right)_i \quad \text{Equation (2)}$$

| Term   | Explanation  |
|--|--|
| <i>i</i>   | Index corresponding to the fuels delivered to the ship in the reference period   |
| <i>j</i>   | Index corresponding to the fuel combustion units on board the ship. For the purpose of this Regulation the units considered are the main engine(s), auxiliary engine(s) and fired oil boilers  |
| <i>k</i>   | Index corresponding to the connection points (c) where electricity is supplied per connection point  |
| <i>c</i>   | Index corresponding to the number of electrical charging points  |
| <i>m</i>   | Index corresponding to the number of energy consumers  |
| $M_{i,j}$  | Mass of the specific fuel <i>i</i> oxidised in consumer <i>j</i> [gFuel]   |
| $E_k$  | Electricity delivered to the ship per connection point <i>k</i> if more than one [MJ]  |
| $CO_{2eq\ WtT,i}$                                | WtT GHG emission factor of fuel <i>i</i> [gCO <sub>2eq</sub> /MJ]  |
| $CO_{2eq\ electricity,k}$                        | WtT GHG emission factor associated to the electricity delivered to the ship at berth per connection point <i>k</i> [gCO <sub>2eq</sub> /MJ]  |
| $LCV_i$  | Lower Calorific Value of fuel <i>i</i> [MJ/gFuel]  |
| $C_{engine\ slip\ j}$                            | Engine fuel slippage (non-combusted fuel) coefficient as a percentage of the mass of the fuel <i>i</i> used by combustion unit <i>j</i> [%]  |
| $C_{f\ CO_2,j}, C_{f\ CH_4,j}, C_{f\ N_2O,j}$    | TtW GHG emission factors by combusted fuel in combustion unit <i>j</i> [gGHG/gFuel]  |
| $CO_{2eq,TtW,j}$                                 | TtW CO <sub>2</sub> equivalent emissions of combusted fuel <i>i</i> in combustion unit <i>j</i> [gCO <sub>2eq</sub> /gFuel]<br>$CO_{2eq,TtW,j} = \left( C_{f\ CO_2,j} \times GWP_{CO_2} + C_{f\ CH_4,j} \times GWP_{CH_4} + C_{f\ N_2O,j} \times GWP_{N_2O} \right)_i$                 |
| $C_{sf\ CO_2,j}, C_{sf\ CH_4,j}, C_{sf\ N_2O,j}$ | TtW GHG emissions factors by slipped fuel towards combustion unit <i>j</i> [gGHG/gFuel]  |
| $CO_{2eq,TtW\ slippage\ j}$                      | TtW CO <sub>2</sub> equivalent emissions of slipped fuel <i>i</i> towards combustion unit <i>j</i> [gCO <sub>2eq</sub> /gFuel]<br>$CO_{2eq,TtW\ slippage,j} = \left( C_{sf\ CO_2,j} \times GWP_{CO_2} + C_{sf\ CH_4,j} \times GWP_{CH_4} + C_{sf\ N_2O,j} \times GWP_{N_2O} \right)_i$ |
| $GWP_{CO_2}, GWP_{CH_4}, GWP_{N_2O}$             | CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O Global Warming Potential over 100 years   |



In the case of fossil fuels, the default values in Annex II shall be used.

For the purpose of this regulation the term  $\sum_k^c E_k \times CO_{2eq\ electricity,k}$  in the numerator of Equation (1) shall be set to zero.

#### **Method for determining [M<sub>i</sub>]**

The [M<sub>i</sub>] mass of fuel shall be determined using the amount reported in accordance with the framework of the reporting under Regulation (EU) 2015/757 for voyages falling within the scope of this Regulation based on the chosen monitoring methodology by the company.

#### **Method for determining WtT GHG factors**

For non-fossil fuels, wherever values different from the default values in Annex II are used, these shall be based on relevant Bunker Delivery Notes (BDNs), for the fuels delivered to the ship in the reference period, for at least equal quantities of fuels as the one determined as being consumed in scope of the regulated journey in accordance with point A.

WtT GHG ( $CO_{2eq\ WtT}$ ) of the fuels (which are not fossil fuels) are established in Directive (EU) 2018/2001. The actual values, contained in the Directive that shall be used for the purpose of this Regulation, in accordance with the methodology, are those without combustion<sup>9</sup>. For those fuels for which pathways are not included in the Directive and for fossil fuels, the WtT GHG emission factors WtT ( $CO_{2eq\ WtT}$ ) default values are contained in Annex II.

#### **Fuel Bunker Delivery Note (BDN)**

For the purposes of this regulation, relevant BDNs of fuels used on board shall contain at least the following information:

- product identification
- fuel mass [t]
- fuel volume [m<sup>3</sup>]
- fuel density [kg/m<sup>3</sup>]
- WtT GHG emission factor for CO<sub>2</sub> (carbon factor) [gCO<sub>2</sub>/gFuel] and for CO<sub>2eq</sub> [gCO<sub>2eq</sub>/gFuel] and related certificate<sup>10</sup>
- Lower Calorific Value [MJ/g]

#### **BDN Electricity**

For the purposes of this regulation, relevant BDNs for electricity delivered to the ship shall contain at least the following information:

- supplier: name, address, telephone, email, representative
- receiving ship: IMO number (MMSI), ship name, ship type, flag, ship representative
- port: name, location (LOCODE), terminal/ berth
- connection point: OPS-SSE connection point, connection point details
- connection time: date/time of commencement/finalisation

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<sup>9</sup> Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term eu ‘emissions from the fuel in use’

<sup>10</sup> This value is not required in case of fossil fuels referred to in Annex II. For all other fuels, including blends of fossil fuels, this value should be made available together with a separate certificate identifying the fuel production pathway.

- energy supplied: power fraction allocated to supply point (if applicable) [kW], electricity consumption (kWh) for the billing period, peak power information (if available)
- metering

### Method for determining TtW GHG factors

The TtW emissions are determined on the basis of the methodology contained in this Annex as provided in Equation (1) and Equation (2)

For the purpose of this Regulation, the TtW GHG emission factors ( $CO_{2eq,tW,j}$ ) that shall be used to determine the GHG emissions are contained in Annex II. The  $CO_2$  Cf factors shall be the ones established in Regulation (EU) 2015/757 and are reported in the Table for easy reference. For fuels whose factors are not included in the said regulation, default factors as contained in Annex II shall be used.

In accordance with its compliance plan referred to in Article 6 and upon assessment by the verifier, other methods, such as direct  $CO_{2eq}$  measurement, laboratory testing, may be used if it enhances the overall accuracy of the calculation.

### Method for determining TtW fugitive emissions

Fugitive emissions are emissions caused by the amount of fuel that does not reach the combustion chamber of the combustion unit or that is not consumed by the energy converter because they are uncombusted, vented, or leaked from the system. For the purpose of this Regulation, fugitive emissions are taken into account as a percentage of the mass of the fuel used by the engine. The default values are contained in Annex II.

### Methods for determining the reward factors linked to substitute sources of energy

In case substitute sources of energy are installed on board, a reward factor for substitute sources of energy can be applied. In case of wind power such reward factor is determined as follow:

|  |                            |
|--|----------------------------|
| Reward factor for substitute sources of energy - WIND ( $f_{wind}$ ) | $\frac{P_{Wind}}{P_{Tot}}$ |
| 0.99   | 0.1                        |
| 0.97   | 0.2                        |
| 0.95   | $\geq 0.3$                 |

The ship GHG intensity index is then calculated by multiplying the result of Equation (1) by the reward factor.

### Verification and Certification

| Fuel Class | WtT  | TtW  |
|------------|--|--|
| Fossil     | Default values shall be used as provided in Table 1 of this Regulation | MRV Regulation $CO_2$ carbon factors shall be used for fuels for which such factor is provided<br>For all other emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively |

|   |   |   |
|---|---|---|
|   |   | Certified values by mean of laboratory testing or direct emissions measurements   |
| Sustainable Renewable Fuels (Bio Liquids, Bio Gases, e-Fuels) | CO <sub>2eq</sub> values as provided in RED II (without combustion) can be used for all fuels whose pathways are included in RED II, alternatively RED II approved certification scheme can be used | Emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively Certified values by mean of laboratory testing or direct emissions measurements. |
| Others (including electricity)                                | CO <sub>2eq</sub> values as provided in RED II (without combustion) can be used for all fuels whose pathways are included in RED II, alternatively RED II approved certification scheme can be used | Emissions factors, default values can be used as provided in Table 1 of this Regulation, alternatively Certified values by mean of laboratory testing or direct emissions measurements. |

## ANNEX II

The emissions factors for fossils fuels contained in this Annex shall be used for the determination of the greenhouse gas intensity index referred to in Annex I of this Regulation.

The emissions factors of biofuels, biogas, renewable fuels of non-biological origin and recycled carbon fuels shall be determined according to the methodologies set out in Annex 5 part C of Directive (EU) 2018/2001.

In the table:

- TBM stands for To Be Measured
- N/A stands for Not Available
- The dash means not applicable

Table 1 – Default factors

| 1   | 2  | 3                         | 4  | 5  | 6  | 7  | 8  | 9   |
|---|--|---------------------------|--|--|--|--|--|---|
|   | WtT  |                           |  | TtW  |  |  |  |   |
| Class / Feedstock                                 | Pathway name                               | LCV<br>[ $\frac{MJ}{g}$ ] | $CO_{2ekg\ WtT}$<br>[ $\frac{gCO_2eq}{MJ}$ ] | Energy Converter Class                                     | $C_f\ CO_2$<br>[ $\frac{gCO_2}{gFuel}$ ]                   | $C_f\ CH_4$<br>[ $\frac{gCH_4}{gFuel}$ ] | $C_f\ N_2O$<br>[ $\frac{gN_2O}{gFuel}$ ] | $C_{slip}$<br>As % of the mass of the fuel used by the engine |
| Fossil  | HFO<br>ISO 8217<br>Grades<br>RME to<br>RMK | 0,0405                    | 13,5   | ALL ICES   | 3,114<br>MEPC245<br>(66)<br>Regulation<br>(EU)<br>2015/757 | 0,00005                                  | 0,00018                                  | -   |
|   |  |                           |  | Gas Turbine  |  |  |  |   |
|   |  |                           |  | Steam Turbines and Boilers                                 |  |  |  |   |
|   |  |                           |  | Aux Engines  |  |  |  |   |
|   | LSFO                                       | 0,0405                    | 13,2 crude<br>13,7 blend                     | ALL ICES   | 3,114  | 0,00005                                  | 0,00018                                  | -   |
|   |  |                           |  | Gas Turbine  |  |  |  |   |
|   |  |                           |  | Steam Turbines and Boilers                                 |  |  |  |   |
|   |  |                           |  | Aux Engines  |  |  |  |   |
|   | ULSFO                                      | 0,0405                    | 13,2   | ALL ICES   | 3,114  | 0,00005                                  | 0,00018                                  | -   |
|   | VLSFO                                      | 0,041                     | 13,2   | ALL ICES   | 3,206<br>MEPC245<br>(66)<br>Regulation<br>MRV              | 0,00005                                  | 0,00018                                  | -   |
| LFO<br>ISO 8217<br>Grades<br>RMA to<br>RMD        | 0,041                                      | 13,2                      | ALL ICES                                     | 3,151<br>MEPC245<br>(66)<br>Regulation<br>(EU)<br>2015/757 | 0,00005  | 0,00018                                  | -  |   |
| MDO<br>MGO<br>ISO 8217<br>Grades<br>DMX to<br>DMB | 0,0427                                     | 14,4                      | ALL ICES                                     | 3,206<br>MEPC245<br>(66)<br>Regulation<br>(EU)<br>2015/757 | 0,00005  | 0,00018                                  | -  |   |
| LNG   | 0,0491                                     | 18,5                      | LNG Otto<br>(dual fuel<br>medium<br>speed)   | 2,755<br>MEPC245<br>(66)<br>Regulation                     | 0  | 0,00011                                  | 3,1                                      |   |
|   |  |                           | LNG Otto                                     |  |  |  | 1,7                                      |   |

| 1                                | 2   | 3      | 4                                 | 5                                 | 6  | 7              | 8              | 9   |
|----------------------------------|---|--------|-----------------------------------|-----------------------------------|--|----------------|----------------|-----|
|                                  | WtT   |        |                                   | TtW                               |  |                |                |     |
|                                  |   |        |                                   | (dual fuel slow speed)            | (EU) 2015/757  |                |                |     |
|                                  |   |        |                                   | LNG Diesel (dual fuel slow speed) |  |                |                | 0,2 |
|                                  |   |        |                                   | LBSI                              |  |                |                | H/D |
|                                  | LPG   | 0,046  | 7,8                               | ALL ICES                          | 3,03<br>Buthane<br>3,00<br>Propane<br>MEPC245 (66)<br>Regulation (EU) 2015/757 | TBM            | TBM            |     |
|                                  | H2 (natural gas)                                  | 0,12   | 132                               | Fuel Cells                        | 0  | 0              | -              |     |
|                                  |   |        |                                   | ICE                               | 0  | 0              | TBM            | -   |
|                                  | NH3 (natural gas)                                 | 0,0186 | 121                               | No engine                         | 0  | 0              | TBM            | -   |
|                                  | Methanol (natural gas)                            | 0,0199 | 31,3                              | All ICES                          | 1375<br>MEPC245 (66)<br>Regulation (EU) 2015/757                               | TBM            | TBM            | -   |
| Liquid biofuels                  | Ethanol E100                                      | 0,0268 | Ref. to Directive (EU) 2018/2001  | All ICES                          | 1,913<br>MEPC245 (66)<br>Regulation (EU) 2015/757                              | TBM            | TBM            | -   |
|                                  | Bio-diesel Main products / wastes / Feedstock mix | 0,0372 | Ref. to Directive (EU) 2018/2001  | ALL ICES                          | 2,834  | 0,00005<br>TBM | 0,00018<br>TBM | -   |
|                                  | HVO Main products / wastes / Feedstock mix        | 0,044  | Ref. to Directive (EU) 2018/2001  | ALL ICES                          | 3,115  | 0,00005        | 0,00018        | -   |
|                                  | Bio-LNG Main products / wastes / Feedstock mix    | 0,05   | Ref. to Directive (EU) 2018/2001  | LNG Otto (dual fuel medium speed) | 2,755<br>MEPC245 (66),<br>Regulation (EU) 2015/757                             | 0,00005        | 0,00018        | 3,1 |
|                                  |   |        |                                   | LNG Otto (dual fuel slow speed)   |  |                |                | 1,7 |
|                                  |   |        |                                   | LNG Diesel (dual fuels)           |  |                |                | 0,2 |
|                                  |   |        |                                   | LBSI                              |  |                |                | N/A |
| Gas biofuels                     | Bio-H2 Main products / wastes / Feedstock mix     | 0,12   | N/A                               | Fuel Cells                        | 0  | 0              | 0              | -   |
|                                  |   |        |                                   | ICE                               | 0  | 0              | TBM            |     |
| Renewable Fuels of nonBiological | e-diesel  | 0,0427 | Ref. to Directive (EU) 2018/2001) | ALL ICES                          | 3,206<br>MEPC245 (66)<br>Regulation  | 0,00005        | 0,00018        | -   |

| 1              | 2           | 3      | 4                                   | 5                                 | 6   | 7       | 8       | 9   |
|----------------|-------------|--------|-------------------------------------|-----------------------------------|---|---------|---------|-----|
|                | WtT         |        |                                     | TtW                               |   |         |         |     |
| Origin (RFNBO) |             |        |                                     |                                   | (EU) 2015/757                               |         |         |     |
| - (e-fuels)    | emethano    | 0,0199 | Ref. to Directive (EU) 2018/2001)   | ALL ICES                          | 1,375 MEPC245 (66) Regulation (EU) 2015/757 | 0,00005 | 0,00018 | -   |
|                | e-LNG       | 0,0491 | Ref. to Directive (EU) 2018/2001)   | LNG Otto (dual fuel medium speed) | 2,755 MEPC245 (66) Regulation (EU) 2015/757 | 0       | 0,00011 | 3,1 |
|                |             |        |                                     | LNG Otto (dual fuel slow speed)   |   |         |         | 1,7 |
|                |             |        |                                     | LNG Diesel (dual fuels)           |   |         |         | 0,2 |
|                |             |        |                                     | LBSI                              |   |         |         | N/A |
|                | e-H2        | 0,12   | 3,6                                 | Fuel Cells                        | 0   | 0       | 0       | -   |
|                |             |        |                                     | ICE                               | 0   | 0       | TBM     |     |
|                | e-NH3       | 0,0186 | 0                                   | No engine                         | 0   | N/A     | TBM     | N/A |
| Others         | Electricity | -      | 106,3 EU MIX 2020<br>72 EU MIX 2030 | OPS                               | -   | -       | -       | -   |

Column 1 identifies the class of the fuels namely Fossils, Liquid Biofuels, Gaseous Biofuels, e-Fuels;

Column 2 identifies the name or the pathway of the relevant fuels within the class. For the Liquid Biofuels, Gaseous Biofuels, RFNBO (e-Fuels) the values for the WtT section shall be taken from Directive (EU) 2018/2001 (without combustion<sup>11</sup>); for fossils fuels only the default values in the table shall be used.

Column 3 contains the Lower Calorific Value of the fuels expressed in [MJ/g].

Column 4 contains the CO<sub>2eq</sub> emissions values in [gCO<sub>2eq</sub>/MJ]. For fossils fuels only the default values in the table shall be used. For all other fuels, (except were expressly indicated), values shall be calculated by using the methodology or the default values as per in Directive (EU) 2018/2001 deducted of the combustion emissions considering full oxidation of the fuel<sup>12</sup>.

Column 5 identifies the main types/classes of energy converters such as 2 and 4 strokes Internal Combustion Engines (ICE) Diesel or Otto cycle, gas turbines, fuels cells etc.

Column 6 contains the emission factor C<sub>f</sub> for CO<sub>2</sub> in [gCO<sub>2</sub>/gfuel]. Emissions factors values as specified in the Regulation (EU) 2015/757 (or IMO MEPC245 (66) as amended) shall be used. For all those fuels not contained in Regulation (EU) 2015/757, the default values contained in the table should be used. Values certified by a by a trusted certifier (under the relevant provisions made in Directive (EU) 2018/2001) can be used in place of the default values.

<sup>11</sup> Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term eu ‘emissions from the fuel in use’.

<sup>12</sup> Reference is made to Directive (EU) 2018/2001, Annex V.C.1.(a) to the term eu ‘emissions from the fuel in use’.

Column 7 contains the emission factor  $C_f$  for methane in  $[\text{gCH}_4/\text{gfuel}]$ . Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values. For LNG fuels  $C_f$  for methane are set to zero.

Column 8 contains the emission factor  $C_f$  for nitrous oxide in  $[\text{gN}_2\text{O}/\text{gfuel}]$ . Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values.

Column 9 identifies the part of fuel lost as fugitive emissions ( $C_{\text{slip}}$ ) measure as % of mass of fuel used by the specific energy converter. Default values as contained in the table shall be used. Values certified by mean of testing can be used in place of the default values. For fuels such as LNG for which the fugitive emissions (slip) exists, the amount of fugitive emissions as presented in Table 1 is expressed in % of the mass of fuel used (Column 9). The values contained in Column 9 shall be used, in accordance with equation (1). The values of  $C_{\text{slip}}$  in Table (1) are calculated at 50% of the engine load.

*ANNEX III*

**CRITERIA FOR THE USE OF ZERO-EMISSION TECHNOLOGY AS REFERRED  
TO IN ARTICLES 5(3)(b) and 7(3), points (d) and (f)**

The following table provides a list of zero-emission technologies as referred to in Article 5(3)(b), as well as, specific criteria for their use as applicable.

| <b>Zero-emission technology</b>                            | <b>Criteria for use</b>  |
|--|--|
| Fuel cells   | Fuel cells used on board for power generation while at berth should be fully powered by renewable and low carbon fuels.  |
| On-board Electricity Storage                               | The use of on-board electricity storage is allowed irrespective on the source of energy that produced the stored power (on-board generation or onshore in case of battery swapping). |
| On-board Electricity production from wind and solar energy | Any ship that is capable to sustain energy needs at berth through the use of wind and solar energy.  |

The use of these zero-emission technologies shall continuously achieve emissions that are equivalent to the emissions reductions that would be achieved by using on-shore power supply.



## ANNEX IV

### CERTIFICATE TO BE ISSUED BY THE MANAGING BODY OF THE PORT OF CALL IN CASES WHERE SHIPS CANNOT MAKE USE OF OPS FOR JUSTIFIED REASONS (ARTICLE 5(5)) - MINIMUM ELEMENTS TO BE INCLUDED IN THE CERTIFICATE

For the purposes of this Regulation, the certificate referred to in Article 5(5) shall contain at least the following information:

- (1) Ship identification
  - (a) IMO number
  - (b) Ship name
  - (c) Call sign
  - (d) Ship type
  - (e) Flag
- (2) Port of call
- (3) Location/terminal name
- (4) Arrival date and time (ATA)
- (5) Departure date and time (ATD)

The confirmation from the managing body of the port that the ship was found among any of the following cases:

- the ship made an unscheduled port call for reasons of safety or saving life at sea (Article 5(2), point (c))
- the ship was unable to connect to on-shore power supply due to unavailable connection points in the port (Article 5(2), point (d))
- the on-shore power supply equipment on board was found to be incompatible with the shore installation at the port (Article 5(2), point (e))
- that the ship used, for a limited period of time on-board energy generation, under emergency situations representing immediate risk to life, the ship, or the environment (Article 5(2), point (f)).

- (6) Details of the managing body of the port
  - (a) Name
  - (b) contact (phone, email)
- (7) Date of issue

ANNEX V

FORMULAS FOR CALCULATING THE COMPLIANCE BALANCE AND PENALTY LAID DOWN IN ARTICLE 20(1)

**Formula for calculating the ship's compliance balance**

For the purpose of calculating the compliance balance of a ship the following formula shall apply:

|   |  |
|---|--|
| Compliance balance [gCO <sub>2eq</sub> /MJ] = | $(GHGIE_{target} - GHGIE_{actual}) \times [\sum_i^n M_i^{fuel} \times LCV_i + \sum_i^l E_i]$ |
|---|--|

Where:

|                  |  |
|------------------|--|
| $gCO_{2eq}$      | Grams of CO <sub>2</sub> equivalent  |
| $GHGIE_{target}$ | Greenhouse gas intensity limit of the energy used on-board a ship according to Article 4(2) of this Regulation                 |
| $GHGIE_{actual}$ | Yearly average of the greenhouse gas intensity of the energy used on-board a ship calculated for the relevant reporting period |

**Formula for calculating the penalty laid down in Article 20(1).**

The amount of the penalty laid down in Article 20(1) shall be calculated as follows:

|           |   |
|-----------|---|
| Penalty = | $(\text{Compliance balance} / GHGIE_{actual}) \times \text{conversion factor from MJ to tonnes of VLSFO (41.0 MJ/kg)} \times \text{EUR 2400}$ |
|-----------|---|

Source:

[https://ec.europa.eu/info/sites/default/files/fueleu\\_maritime\\_-\\_green\\_european\\_maritime\\_space.pdf](https://ec.europa.eu/info/sites/default/files/fueleu_maritime_-_green_european_maritime_space.pdf)

**Annex 4. Estimated share of renewable energy in the transport sector (Annex 6 to NREAP 2030)**

|   | (ktoe)      |             |             |             |             |             |             |             |             |             |             |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>Direction of renewable energy application</b>  | <b>2020</b> | <b>2021</b> | <b>2022</b> | <b>2023</b> | <b>2024</b> | <b>2025</b> | <b>2026</b> | <b>2027</b> | <b>2028</b> | <b>2029</b> | <b>2030</b> |
| <b>Renewable electricity consumed in transport sector, including:</b>                                       | <b>44</b>   | <b>64</b>   | <b>86</b>   | <b>104</b>  | <b>133</b>  | <b>169</b>  | <b>199</b>  | <b>229</b>  | <b>260</b>  | <b>290</b>  | <b>320</b>  |
| electric cars   | 0           | 1           | 3           | 5           | 6           | 7           | 16          | 25          | 33          | 42          | 51          |
| railway transport   | 35          | 50          | 63          | 73          | 95          | 119         | 131         | 144         | 156         | 169         | 181         |
| other types of electric transport   | 8           | 13          | 20          | 26          | 32          | 43          | 52          | 61          | 70          | 79          | 88          |
| <b>Consumption of liquid biofuels (bioethanol, biodiesel), including:</b>                                   | <b>51</b>   | <b>110</b>  | <b>124</b>  | <b>168</b>  | <b>190</b>  | <b>210</b>  | <b>235</b>  | <b>257</b>  | <b>281</b>  | <b>302</b>  | <b>325</b>  |
| <i><b>Bioethanol:</b></i>   | <b>51</b>   | <b>110</b>  | <b>119</b>  | <b>158</b>  | <b>171</b>  | <b>184</b>  | <b>195</b>  | <b>206</b>  | <b>217</b>  | <b>226</b>  | <b>238</b>  |
| bioethanol from food and feed crops   | 51          | 110         | 119         | 128         | 137         | 147         | 156         | 164         | 173         | 181         | 190         |
| bioethanol from waste, residues, (II generation)  |             |             |             | 30          | 34          | 37          | 39          | 42          | 44          | 45          | 48          |
| <i><b>Biodiesel:</b></i>  |             | <b>0</b>    | <b>5</b>    | <b>10</b>   | <b>19</b>   | <b>26</b>   | <b>40</b>   | <b>51</b>   | <b>64</b>   | <b>75</b>   | <b>87</b>   |
| biodiesel from food and feed crops  |             |             | 5           | 10          | 16          | 21          | 32          | 41          | 52          | 61          | 70          |
| biodiesel from waste, residues, (II generation)   |             |             |             |             | 3           | 5           | 8           | 10          | 12          | 14          | 17          |
| <b>Consumption of biomethane, including</b>   |             |             |             |             |             | <b>1</b>    | <b>2</b>    | <b>3</b>    | <b>4</b>    | <b>5</b>    | <b>6</b>    |
| biomethane from food and feed crops   |             |             |             |             |             | 1           | 2           | 3           | 4           | 5           | 5           |
| biomethane from waste, residues, (II generation)  |             |             |             |             |             |             |             |             |             |             | 1           |
| <b>Total consumption of renewable energy in transport sector</b>  | <b>95</b>   | <b>174</b>  | <b>210</b>  | <b>272</b>  | <b>323</b>  | <b>380</b>  | <b>436</b>  | <b>489</b>  | <b>544</b>  | <b>597</b>  | <b>651</b>  |
| <b>Total contribution of renewable energy to achieving the indicative target on RES in transport sector</b> | <b>148</b>  | <b>202</b>  | <b>251</b>  | <b>353</b>  | <b>426</b>  | <b>504</b>  | <b>595</b>  | <b>686</b>  | <b>778</b>  | <b>869</b>  | <b>961</b>  |

**Annex 5. Carbon tax rates, share of covered GHG emissions and year of implementation of carbon tax in European countries (as of April 1, 2022)**

|   | Carbon tax rate (per t CO <sub>2</sub> eqv) |          | Share of covered GHG emissions | Implementation year |
|---|---|----------|--------------------------------|---------------------|
|   | EUR   | USD      |                                |                     |
| Austria (AT)  | €30.00                                      | \$33.15  | 40%                            | 2022                |
| Denmark (DK)  | €24.04                                      | \$26.62  | 35%                            | 1992                |
| Estonia (EE)  | €2.00                                       | \$2.21   | 6%                             | 2000                |
| Finland (FI)  | €76.00                                      | \$85.10  | 36%                            | 1990                |
| France (FR)   | €45.00                                      | \$49.29  | 35%                            | 2014                |
| Iceland (IS)  | €30.93                                      | \$34.25  | 55%                            | 2010                |
| Ireland (IE)  | €41.00                                      | \$45.31  | 40%                            | 2010                |
| Latvia (LV)   | €15.00                                      | \$16.58  | 3%                             | 2004                |
| Liechtenstein (LI)  | €117.27                                     | \$129.86 | 81%                            | 2008                |
| Luxembourg (LU)   | €39.15                                      | \$43.35  | 65%                            | 2021                |
| The Netherlands (NL)  | €42.00                                      | \$46.14  | 12%                            | 2021                |
| Norway (NO)   | €79.12                                      | \$87.61  | 63%                            | 1991                |
| Poland (PL)   | €0.07                                       | \$0.08   | 4%                             | 1990                |
| Portugal (PT)*  | €23.88                                      | \$26.44  | 36%                            | 2015                |
| Slovenia (SI)   | €17.27                                      | \$19.12  | 52%                            | 1996                |
| Spain (ES)  | €15.00                                      | \$16.58  | 2%                             | 2014                |
| Sweden (SE)   | €117.30                                     | \$129.89 | 40%                            | 1991                |
| Switzerland (CH)  | €117.27                                     | \$129.86 | 33%                            | 2008                |
| Ukraine (UA)  | €0.93                                       | \$1.03   | 71%                            | 2011                |
| The United Kingdom (GB)   | €21.36                                      | \$23.65  | 21%                            | 2013                |
| <p>* Portugal links the carbon tax rate to the price of EU ETS allowances for the previous year. Carbon tax rates were converted at the Euro-USD exchange rate as of April 1, 2022 (US\$1 = EUR 0.90307).</p> |   |          |                                |                     |
| <p>Source: World bank, «Carbon Pricing Dashboard», as of April 1, 2022</p>  |   |          |                                |                     |

## Annex 6. Advantages and disadvantages of Carbon Tax and ETS

### *Advantages and disadvantages of Carbon Tax*

| <i>Advantages of Carbon Tax</i>   | <i>Disadvantages of Carbon Tax</i>  |
|---|---|
| <ul style="list-style-type: none"> <li>• determines the price of CO<sub>2</sub> emissions;</li> <li>• a high tax rate can contribute to a significant reduction in emissions;</li> <li>• performs a fiscal function, i.e. brings profit to the state;</li> <li>• minor administrative costs;</li> <li>• implementation does not require the creation of new institutions;</li> <li>• requires minimal legislative changes for implementation;</li> <li>• easy to implement and administer;</li> <li>• can contribute to the introduction of energy-efficient technologies.</li> </ul> | <ul style="list-style-type: none"> <li>• does not guarantee the achievement of the environmental goal,</li> <li>• a low rate will not lead to emission reductions;</li> <li>• has a regressive effect on society;</li> <li>• lack of flexibility;</li> <li>• requires frequent review and correction to achieve the environmental goal;</li> <li>• may face strong political opposition if a high-rate tax is introduced, however, social and political acceptability may be improved if the tax is implemented as part of an eco-tax reform;</li> <li>• requires a strong analytical basis for determining the optimal tax rate and truthful information from the industry.</li> </ul> |

### *Advantages and disadvantages of ETS*

| <i>Advantages of ETS</i>  | <i>Disadvantages of ETS</i>   |
|---|---|
| <ul style="list-style-type: none"> <li>• inherent environmental efficiency (guarantees the achievement of the specified goal);</li> <li>• evenly distributes marginal costs for reducing emissions over the entire economy (it is cheaper for the economy as a whole to achieve the necessary emissions reduction);</li> <li>• more politically acceptable than a tax;</li> <li>• the regressive effect on society is smaller than in the case of the introduction of a tax;</li> <li>• can stimulate the introduction of energy-efficient technologies;</li> <li>• the sale of permits at an auction can bring profit to the state.</li> </ul> | <ul style="list-style-type: none"> <li>• fluctuating prices for CO<sub>2</sub> emissions complicate investment decisions;</li> <li>• cannot cover all sectors of the economy and all installations;</li> <li>• very high administrative costs;</li> <li>• requires significant institutional changes (perhaps the creation of new institutions);</li> <li>• requires significant legislative changes;</li> <li>• requires a well-developed carbon market;</li> <li>• very complex implementation and administration mechanism;</li> <li>• there is a risk of granting an excessive number of emission permits, which undermines the overall efficiency of the system;</li> <li>• there is a risk of uneven distribution of the number of permits between sectors of the economy and individual installations;</li> <li>• a significant limitation of emissions and/or the sale of permits at an auction may have a negative impact on the competitiveness of national enterprises in the international market.</li> </ul> |

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