CBSCI
Canada's Biojet
Supply Chain Initiative

Considerations for the Application of a Biojet Sustainability Standard in the Aviation Sector

Stand-alone paper
developed as part of CBSCI

2019

CBSCI.CA

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1. Background & Objective

The approach to sustainability in the aviation sector has mostly been based on voluntary commitments from aviation stakeholders. This has driven a greater consensus at the level of ICAO and agreement on a carbon offset scheme, CORSIA, as well as long-term goals to 2050 for emission reductions. As a stakeholder organisation in the sector IATA has worked with the Ecofys Consulting group to develop a framework for sustainability known as the IATA Meta Standard. Sustainability criteria for biojet are, within CORSIA, currently under development by the Alternative Fuels Task Force (AFTF) and should be completed in 2019. It is anticipated that this will form the basis of the approach adopted within ICAO for regulation of sustainability under CORSIA.

KEY OBSERVATIONS

As sustainability is still a work in progress under ICAO, the approach taken towards sustainability in the CBSCI project is guided by the following observations:

1.Sustainability assessment and certification is a developing methodology. The transition to more sustainable fuels (as well as food, feed, and other bio-products) will be incremental, with the foundation for future advancements provided with each successive step.

2.The numerous initiatives to define sustainability in the agriculture, forestry, transportation fuel, and biojet sectors make clear that environmental, societal and economic criteria, and their relative weighting, can be subjective and qualitative. Pursuit of a single 'universal' screen for sustainability will fail to adequately address critical regional or specific value chain issue. Rather than championing a single sustainability certification scheme for biojet, it is pragmatic to support approaches that will enable participation of multiple schemes via a meta standard (as proposed by IATA).

3.The sustainability performance of biojet can improve over time. To enable continuous improvement within sustainability metrics, it is necessary to establish commercially viable production capacity. A virtuous cycle can be initiated by creating proven demand for biojet, which can remove the barriers already experienced in Canada to the forward supply of feedstocks that can meet the biojet sustainability criteria. (In Canada, agricultural producers and forest fibre owners see reliable market access as a pre-condition to investment in novel production systems).

4.Renewable fuels and their feedstocks can be procured under sustainability certification to assure their environmental, social, and economic performance against a defined set of principles, criteria, and indicators. This has been shown to be important in the aviation sector as most fuels are now procured under an established certification scheme. This project does not review specific, singular certification regimes or make recommendations for introduction of a specific scheme in the Canadian marketplace for biojet specific purposes. The approach to certification used in CBSCI is to utilize the IATA Sustainability Meta Standard that is currently under development.

5.This section of the CBSCI project report aims to provide:

A. a summary of the IATA Meta Standard and the criteria and principles identified as important for the aviation industry and biojet sustainability;

B. a brief explanation of the criteria under the IATA Meta Standard and how they are applicable to the sector and to biojet fuel production and consumption;

C. a brief summary of key voluntary sustainability certification schemes, and;

D. a specific focus on CO2 emissions, life cycle analysis in relation to biojet production.

2. Introduction to Biojet Sustainability

Climate change mitigation has become a primary concern of our society. The UNFCCC COP21 Paris agreement was a global commitment to reduce greenhouse gas emissions. However, aviation and shipping fell outside the scope of this agreement and those industries were tasked to develop their own policies for reducing emissions at ICAO and IMO.

In many respects, the aviation sector had already adopted proactive measures, including measures to improve fuel efficiency, air traffic management, operations and aeronautics. Organisations like IATA developed voluntary, ambitious, aspirational goals for reducing emissions in 2009 setting the following targets for the sector (IATA, 2009):

- An average improvement in fuel efficiency of 1.5% per year from 2009 to 2020;
- A cap on net aviation CO2 emissions from 2020 (carbon-neutral growth);
- A reduction in net aviation CO2 emissions of 50% by 2050, relative to 2005 levels.

In addition, IATA has established several programs to assist airlines in improving their environmental performance, including alternative fuels, the carbon offset program, environmental assessment (IEnvA), fuel and emissions database (FRED) and cargo sustainability (IATA, 2017).

It was recognized by the aviation industry that biojet fuels were a key component of the strategy for reducing greenhouse gas (GHG) emissions in the aviation sector and ICAO Member States were unlikely to achieve aspirational goals for reducing emission emissions from international aviation without such fuels. Biojet fuels are recognized as so essential to sustainability measures, the aviation sector itself refers to biojet as "Sustainable Aviation Fuels" (SAF) as well as "Sustainable Alternative Jet Fuel" (SAJF).

While the motivation to reduce GHG emissions in the aviation sector is paramount, the aviation industry has emphasized a commitment to sustainability beyond emission reductions. Sustainability is a dynamic and evolving concept. It is most often defined via its predecessor term 'sustainable development' which the Brundtland Commission report defines as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland Commission, 1987). Sustainability is recognized to have ecological, social, and economic aspects. These aspects are generally represented as being three interdependent pillars of sustainability, or 'legs of a stool'.

Rather than trying to define sustainability, sustainability is assessed against principles, criteria and indicators. There are presently no globally recognized sets of principles or criteria for sustainability. The aviation industry, as an international sector, has been seeking to define such principles or criteria for the use of biojet fuels as they try to establish common methods for calculating carbon emissions and offsets under the CORSIA scheme. Global agreements under ICAO require standardized methods for assessing compliance.

According to ICAO, "addressing the sustainability of the production of alternative fuels requires the definition of:

- the impacts and consequences of alternative fuel production that need to be considered for the assessment of sustainability (for example the consequences on the use of water);
- a reference for what is or is not acceptable for these impacts through a set of principles (e.g., "preservation of water availability and quality") which are further detailed in a set of acceptance criteria (for example "biofuel production should not contribute to the depletion of water resources");
- the indicators and associated thresholds to measure whether a principle or criteria is met (in the example of

water depletion, an indicator can be the volume of water drawn from a specific watershed), or other proofs of compliance or implementation of mitigation measures, when no quantitative indicator may be associated with the requirements.

Taken together, the above elements form a "sustainability standard"." (ICAO, 2017)

Historically, sustainability criteria have been user defined, established by voluntary certification schemes such as the Roundtable on Sustainable Biomaterials (RSB). Companies or organisations can become members of such schemes and obtain a sustainability certification based on an independent audit carried out by the certification scheme. In this manner, many certification bodies have been established in different industries and sector for reasons such as access to markets requiring certification, etc.

Against this background, IATA developed its Meta Standard, defining the principles and criteria for sustainability that are directly applicable to the aviation sector and biojet fuels. This forms an umbrella under which existing voluntary certification schemes can become recognised. All the relevant parties in the biojet supply-chain (e.g. the biojet fuel producer and user) therefore have the option to choose use of a voluntary scheme, provided that the scheme meets the criteria of the IATA Meta Standard. Depending on the historical development of the voluntary scheme, a greater focus may be placed on the environmental, social or economic leg of the sustainability stool and strictness of compliance may vary. Schemes developed by Environmental NGOs may place a greater focus on the environmental criteria while industry-established schemes may place greater emphasis on economic criteria.

The IATA Meta Standard specifies requirements that biojet producers would need to be recognised by the aviation industry or governments internationally under CORSIA. While the IATA Meta Standard aims to encompass a globally harmonised approach to implementing sustainability requirements, it will also allow for differentiated levels of sustainability. Within this framework, the IATA Meta Standard proposes different levels of sustainability, including Basic (mandatory compliance with a set of core criteria) to Premium (incorporating additional voluntary requirements). Biojet that meets more stringent sustainability criteria could potentially be incentivised through the offset rules set out under CORSIA.

Taking a broad view of the complete biojet supply chain, the chief concerns and opportunities for biojet production are primarily situated in the feedstock production systems. Although there is general agreement that sustainability of feedstock production systems is important, a high degree of variability is observed both in how sustainability in agriculture is defined and how it is practically pursued and applied in the policy-making and regulatory process (Binder, 2010). Because agriculture is practiced across a diverse range of environmental, social, and economic contexts, creating a single globally accepted sustainability definition and criteria to measure it is elusive.

3. The IATA Meta Standard and application

3.1 Introduction

The International Air Transport Association (IATA) recognizes the need for a standard that defines key sustainability requirements for biojet fuel producers and specifies internationally recognized biojet fuel accounting methodologies (Alberici et al., 2014).

The IATA approach offers the ability to utilize multiple sustainability schemes under a single system. This is valuable as there are multiple approaches to sustainability evaluation and certification within the aviation sector. Selected groups within the sector have endorsed specific sustainability standards (e.g., ISCC, RSB) and approaches to biojet sustainability (e.g., ATAG). The global nature of the aviation sector also gives relevance to emerging standards and approaches that can be applied internationally and across multiple operating contexts. In light of this, the global aviation industry and commercial airline participants, as represented by IATA, have moved forward to create a globally-oriented approach to sustainability certification.

IATA and Ecofys proposed the potential use of an approach to sustainability certification that would leverage existing sustainability certification schemes by including them in a global approach. This approach to biojet sustainability is presented in Figure 1.

3.2 The principles of the IATA Meta Standard

The IATA Meta Standard seeks to define the criteria for biojet that will be recognized within the CORSIA framework. The IATA Meta Standard seeks to leverage the work of other, voluntary certification schemes for biofuels. For example, the IATA's approach could adopt some or all of the sustainability principles of the Roundtable on Sustainable Biomaterials (RSB) and other standards such as the International Sustainability & Carbon Certification (ISCC). The RSB standard has found support from airlines as it is understood to have broad coverage and an inclusive governance structure. This is apparent as the IATA META STANDARD reflects the RSB 12 principles that cover environmental, social, and economic sustainability criteria. These 12 principles are included in the IATA Meta Standard, as summarized in Table 1 on the following page.

Figure 1: IATA Meta Standard approach to biojet sustainability (Alberici et al., 2014)

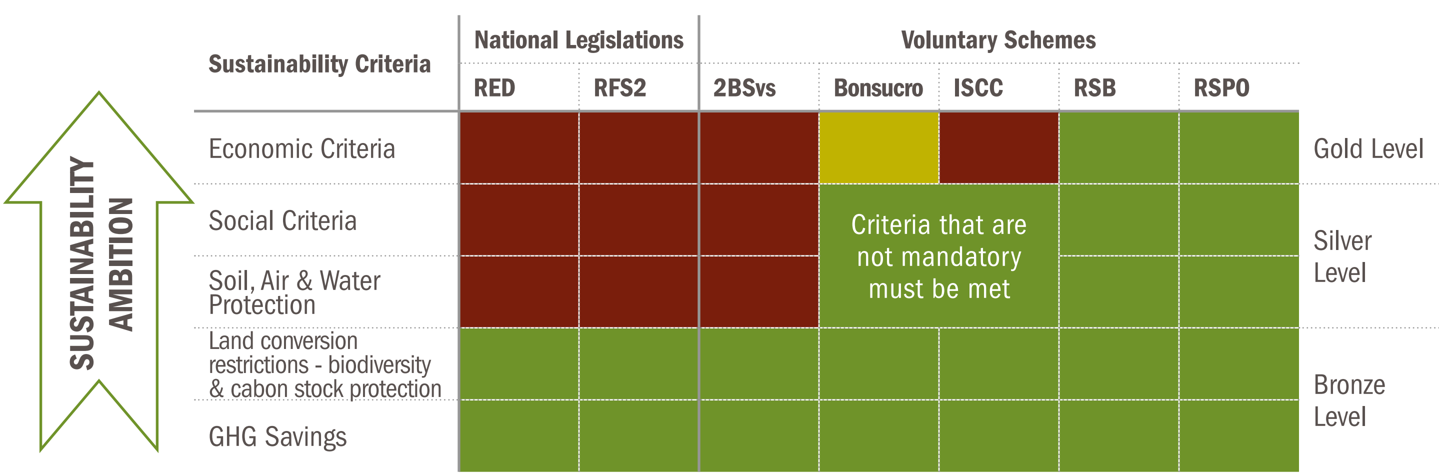

Table 1: IATA Meta Standard principles and criteria for sustainable alternative jet fuel (Alberici and Spoettle, 2016)

PRINCIPLES	CRITERIA
1. Legality	1.1 Sustainable alternative jet fuel shall comply with all applicable national and local laws and regulation.
2. Greenhouse gas emissions	2.1 Sustainable alternative jet fuel shall achieve net greenhouse gas emissions reductions on a life-cycle basis.
3. Carbon stock conservation	3.1 Sustainable alternative jet fuel shall not be made from biomass obtained from land with high carbon stock.
4. Biodiversity conservation	4.1 Sustainable alternative jet fuel shall not be made from biomass obtained from land with high biodiversity value. 4.2 Basic ecosystem services in critical situations shall be maintained or enhanced. 4.3 Biodiversity within the area of operation shall be maintained or enhanced. 4.4 Biodiversity within the area of operation shall not be compromised by the use of genetically modified plants, microorganisms or algae.
5. Soil conservation	5.1 Good agricultural practices shall be implemented to maintain or enhance soil physical, chemical, and biological conditions.
6. Sustainable water use	6.1: Good agricultural practices shall be implemented to maintain or enhance water quality. 6.2 Good agricultural practices shall be implemented to use water efficiently and to avoid the depletion of surface or groundwater resources beyond replenishment capacities.
7. Air quality	7.1 Open-air burning as part of land clearance or the burning of agricultural residues and wastes shall not be practiced unless there are no viable alternatives. 7.2 Air pollution emissions shall be minimized.
8. Use of chemicals, wastes and byproducts	8.1 Chemicals, wastes or by-products arising from fuel production shall be stored, handled and disposed of responsibly to safeguard the environment and to minimise the risk to people.
9. Land and water rights and community engagement	9.1 Sustainable alternative jet fuel operations shall respect existing land rights and land use rights. 9.2 Sustainable alternative jet fuel operations shall respect the existing water rights of local and indigenous communities. 9.3 Sustainable alternative jet fuel operations shall only be established with the free, prior and informed consent of land and water users or owners.
10. Human rights and labour rights	10.1 Human rights and labour rights governing child labour, forced labour, discrimination, freedom of association and the right to organise and bargain collectively shall not be violated.
11. Local food security	11.1 Sustainable alternative jet fuel operations shall not adversely impact the human right to adequate food and shall not adversely impact food security in food insecure regions.
12. Rural, social and economic development	12.1 In regions of poverty, alternative jet fuel operations shall contribute to the social and economic development of local, rural and indigenous people and communities.

Alberici and Spoettle (2016) proposes that a phased approach to sustainability be utilized to meet the sustainability ambitions of ICAO. Among these, a baseline level of sustainability could be established and additional levels of performance determined to recognize differing levels of performance. For instance, a mandatory minimum level of sustainability could be developed based on the principles related to maintaining carbon stocks, biodiversity conservation, lowering GHG emissions, soil conservation, sustainable water use and air quality. This fuel could be termed Sustainable Jet Fuel (a baseline for sustainability). Once the fuel can be certified to additionally comply with principles related to fundamental rights and local food security, it could be classified as Sustainable Jet Fuel Plus, meeting a higher, voluntary standard.

Additional standards, designated as Sustainable Jet Fuel Premium, could be incorporated on a voluntary basis. These relate to rural, social and economic development (Alberici and Spoettle, 2016). In this way all ICAO signatories would be required to use Sustainable Jet Fuel, with the other classes of jet fuel used on a voluntary basis and achieving additional incentives based on meeting a higher standard for sustainability (See Table 2).

Table 2: Sustainability and compliance levels of sustainable jet fuels, relative to the IATA Meta Standard principles and criteria for sustainable alternative jet fuel proposed by Alberici and Spoettle (2016).

SUSTAINABILITY LEVEL	COMPLIANCE LEVEL	CRITERIA COVERED
Sustainable Jet Fuel	Mandatory	**Legality (1.1)** GHG emissions – no GHG saving threshold (2.1) Carbon stock conservation (3.1) Biodiversity conservation (4.1) Soil conservation (5.1) Sustainable water use (6.1, 6.2) Air quality (7.1, 7.2) **To be met in future CAEP[1] cycles:** Biodiversity conservation (4.2, 4.3, 4.4) Responsible use of chemicals and management of waste (8.1)
Sustainable Jet Fuel Plus	Voluntary	**All above, and:** GHG emissions – min. 35% GHG emission savings (2.1) Land & Water rights, and Community engagement (9.1, 9.2, 9.3) Human rights and Labor rights (10.1) Local food security (11.1)
Sustainable Jet Fuel Premium	Voluntary	**All above, and:** GHG emissions – min. 60% GHG emission savings (2.1) Rural, Social and Economic development (12.1) Human rights and Labor rights (10.1) Indirect land use change mitigation or Restoration of degraded or heavily contaminated land

1. CAEP: Committee on Aviation Environmental Protection

3.3 Current regulatory and voluntary certification standards

Sustainability certification of biojet fuel is a means of demonstrating that the certified fuel meets the compliance levels required by national laws, regulatory standards, or voluntary schemes. Any proposed scheme should at least demonstrate compliance with the sustainability requirements of CORSIA (as they are defined and updated). Proposed regulatory or certifying schemas should be informed by benchmarking their reporting matrices against the specific requirements of the IATA Meta Standard. An objective benchmark process can be defined by ICAO, based on a fair and transparent evaluation for all member states that meets all internationally accepted norms and standards. For instance, biojet that meets the regulatory requirements of standards such as the EU Renewable Energy Directive (RED, including its revisions) and the Renewable Fuel Standard (RFS) will likely comply with the IATA Meta Standard as well.

Voluntarily met standards like aireg (The Aviation Initiative for Renewable Energy in Germany e.V.) and the UK Renewable Transport Fuel Obligation (RTFO) provide guidance for the development of the IATA Meta Standard. These standards were developed in collaboration with stakeholders to encourage the selection of sustainable feedstocks for biofuel production and to provide a clear and credible benchmark for sustainability reporting. In their evaluation of 10 voluntary certification standards for their compliance with the sustainability criteria of aireg, Alberici and Spoettle (2016) found that none of those standards conformed to 100% of the aireg criteria, which is viewed by these authors as the most rigorous sustainability standard for aviation biofuels.

Voluntary certification standards and frameworks, and their potential to meet the requirements of the IATA Meta Standard were reviewed by Alberici and Spoettle (2016) as follows:

1. Roundtable on Sustainable Biomaterials (RSB) standard, launched in 2011 and discussed in the previous section. The RSB is considered suitable to evaluate the sustainability of aviation biofuels.

2. International Sustainability and Carbon Certification (ISCC) is a multi-stakeholder initiative launched in 2010 and has issued ISCC certificates to over 2,500 operators. About 58 per cent are traders, warehouses and collecting-point entities (for waste/residue material not grown/harvested on farms/plantations), indicating that most operators certifying under the ISCC are not feedstock producers and operate further along the biofuel supply chain. The ISCC is considered suitable to evaluate the sustainability of aviation biofuels.

3. Global Bioenergy Partnership (GBEP) framework. Since its inception in 2007, this framework was designed for governments to develop social and environmental policy applicable to the sustainable production of bioenergy. Pilot testing of this scheme was done in several South American countries, and it remains to be calibrated with local data (Chidiak et al., 2015).

4. ISO 13065:2015 framework. Work on this framework began in 2009, the result of four subcommittees/working groups under the program ISO/PC 248. "The new ISO 13065:2015, Sustainability criteria for bioenergy, gives a practical framework for considering environmental, social and economic aspects to facilitate the evaluation and comparability of bioenergy production and products, supply chains and applications" (Denis, 2015).

5. Round Table on Responsible Soy (RTRS) is a sustainability certification scheme for soybean producers. The standard was developed in 2010 and is designed to certify the sustainability of soybean oil destined for the EU biodiesel market. By 2016, 75 RTRS certificates were issued, covering a total of 595,127 hectares (ha) and 1,867,365 metric tonnes of soybean products. Many of the certificate holders have certification for their chain of custody. Certification is a requirement for operators who intend to sell soybean oil to the EU; European biofuel producers must comply with EU-RED rules on sustainability and net GHG savings (i.e., the EU-RED (2009/28/EG) which require a 35% or greater reduction in GHG emissions as compared to fossil fuels. The certification scheme is driven primarily by demands from the food and animal feed industries, since soybean oil makes up approximately 18% of the seed content by weight.

6. Roundtable on Sustainable Palm Oil (RSPO) is a certification scheme launched in 2012 that includes 356 operators who hold valid certificates on a land area of 3,386,525 ha, about 20% of global palm oil production. The demand for RSPO palm oil comes primarily from food producers, since palm oil is the most consumed vegetable oil and the food industry is under pressure to ensure that it is sourced from sustainable sources.

7. BONSUCRO EU is a certification scheme applicable to sugar cane and co-products, including ethanol, for use as transport fuel and in the chemical industry. Of the 47 operators that hold valid production certificates and 25 valid Chain of Custody certificates, the majority produce sugar cane or sugar cane and ethanol. Ethanol producers are motivated to obtain sustainability certificates to meet the demand for certified ethanol in the EU biofuels' market which must comply with the EU RED regulations (Potts et al., 2014).

It is notable that the RSB and ISCC directly address aviation biofuels whereas others were developed for liquid biofuels. IATA listed the following voluntary programs as compatible with EU RED regulations and the European Emissions Trading Scheme (EU ETS), namely:

1. RSB EU RED (Roundtable on Sustainable Biofuels EU RED)
2. ISCC (International Sustainability and Carbon Certification)
3. RTRS EU RED (Round Table on Responsible Soy EU RED)
4. Bonsucro EU
5. 2BSvs (Biomass Biofuels voluntary scheme)
6. RBSA (Abengoa RED Bioenergy Sustainability Assurance)
7. Greenergy (Greenergy Brazilian Bioethanol verification programme)
8. Ensus (Voluntary scheme under RED for Ensus bioethanol production)
9. Red Tractor (Red Tractor Farm Assurance Combinable Crops and Sugar Beet Scheme)
10. Scottish Quality Farm Assured Combinable Crops Scheme
11. Red Cert
12. NTA 8080

The following table, taken from the Ecofys Roadmap (Alberici & Spoettle, 2016), compares significant regulatory and voluntary standards and their compliance within the principles and criteria set out in the IATA Meta Standard.

Table 3: Regulatory and voluntary standards and their compliance with IATA Meta Standard criteria

PRINCIPLE	CRITERION	REGULATORY STANDARDS		VOLUNTARY STANDARDS		
		RED	RFS2	aireg Meta-standard	RSB	UK RTFO Meta-standard
Legality	Compliance with applicable laws and regulations			✓	✓	✓
GHG Emissions	Lifecycle GHG emission savings compared to fossil fuels	✓	✓	✓	✓	✓
Carbon Conservation	No conversion of high carbon stock areas	✓	✓	✓	✓	✓
Biodiversity	No conversion of highly biodiverse areas	✓	✓	✓	✓	✓
	Conservation values			✓	✓	✓
	Ecosystem functions and services		✓ (EPA Reporting)	✓	✓	
	Buffer zones			✓	✓	✓ (Recommendation)
	Ecological corridors			✓	✓	✓ (Recommendation)
	Invasive species		✓ (EPA Reporting)	✓	✓	
	GMO			✓	✓	
Soil Conservation	Implement good agricultural practices; maintain or enhance soil physical, chemical, and biological conditions	✓ (Commission Reporting)	✓ (EPA Reporting)	✓	✓	✓
	Integrated plant protection and crop management			✓		
	Use of agricultural residues			✓	✓	✓ (Recommendation)
Water Conservation	Efficient water use	✓ (Commission Reporting)	✓ (EPA Reporting)	✓	✓	✓
	Water quality			✓	✓	✓
Air Quality	Air pollution	✓ (Commission Reporting)	✓ (EPA Reporting)	✓	✓	
	No burning			✓	✓	✓
Land and Water Rights and Community Engagement	Land use rights	✓ (Commission Reporting)		✓	✓	✓
	Water rights			✓	✓	
	Stakeholder consultation			✓	✓	✓

PRINCIPLE	CRITERION	REGULATORY STANDARDS		VOLUNTARY STANDARDS		
		RED	RFS2	aireg Meta-standard	RSB	UK RTFO Meta-standard
Human and Labour Rights	Freedom of association and right to collective bargaining	✓ (Commission Reporting)		✓	✓	✓
	No forced and slave labour			✓	✓	✓
	No child labour			✓	✓	✓
	No discrimination			✓	✓	✓
	Fair wages and compensation			✓	✓	✓
	Health and safety			✓	✓	✓
	Subcontracting				✓	✓
	Contracts			✓		✓
	Provision of information to employees					✓
	Working hours				✓	✓ (Recommendation)
	Education and training			✓		
	Basic schooling for children			✓		
Local Food Security	Local food security	✓ (Commission Reporting)		✓	✓	
Rural, Social and Economic Development	Rural, social and economic development	✓ (Commission Reporting)		✓	✓	
Use of Technology, Inputs, and the Management of Waste	Info on technology use				✓	✓
	Minimising technology risk or damage to the environment and people (including GMO, microorganisms, algae)				✓	
	Containment of microorganisms to prevent release into the environment				✓	
	Storage, handling, use, and disposal of agrochemicals			✓	✓	✓
	Management of residues, wastes, and byproducts to safeguard soil, water & air			✓	✓	✓
	Safe use of field crop production equipment and machinery			✓		
	Emergency systems and procedures for accidents			✓		
Economic Performance	Economic Performance			✓	✓	
	Energy Efficiency			✓		

4. Discussion of key sustainability issues

Advancing the aviation industry's goal of reducing carbon intensity requires clear focus on sustainability throughout the entire life cycle of biomass production, fuel refining, and use. This section briefly highlights three key areas of sustainability: GHG performance, food security, and biodiversity.

4.1 Greenhouse Gas (GHG) reduction potential of biojet fuels

While fuel quality technical specifications (i.e., ASTM D1655, Def Stan 91-91) address the physical properties of the fuel, they do not address the GHG or other environmental or sustainability attributes of the fuel. At present, the carbon and sustainability performance of biojet fuel are communicated by the documentation format in use by the party providing the fuel; reporting templates, for example, vary widely. While ICAO is finalising all aspects of the CORSIA offset scheme, fuel producers, airlines and other stakeholders have been using voluntary sustainability schemes such as RSB to demonstrate sustainability compliance. Airlines and other industry stakeholders may require a certificate of sustainability (among other indicators specifying GHG performance) so they can claim the CO2 emissions savings associated with the fuel consumption and demonstrate its environmental performance. Until the CORSIA scheme is in place, however, recognition of emission reductions proceeds on a voluntary basis.

ICAO has published a guidance document on Life Cycle Assessment (LCA) methodology which sets forth recommendations on LCA approach. Fuel producers, etc. can submit calculations of relevant fuel production pathways to the Alternative Fuels Task Force (AFTF). These calculations will ultimately be considered for defining default values under CORSIA. The LCA methodology is summarized in ICAO-CAEP information paper CAEP/11-AFTF/1-IP/9.

Different fuels using different technologies and feedstocks can result in different GHG emission profiles. It is critical that any potential biojet supply chain is compared against the fossil fuel baseline by looking at the full life cycle emissions, utilizing equivalent system boundaries. The potential GHG advantage for biofuels is based on a "closed carbon cycle" where carbon dioxide is absorbed from the air when feedstocks are grown and later released when fuel is combusted. Fossil fuels may be used in growing, harvesting and delivering feedstocks, as well as in producing and delivering biofuels. Besides emissions from fossil fuels used in cultivation and processing, additional emissions can arise from land use changes.

The LCA performance of a HEFA biojet production pathway are discussed below. It is important to emphasize that these numbers are based on GHGenius and Canadian feedstocks. Note that as the model uses the system expansion method for co-product allocation you can reach greater than 100% GHG reductions vs Jet A1 values. This is important, as this would not be the case in all jurisdictions and under all systems. The GHGenius model contains default pathways for HEFA biojet produced from the Canadian feedstocks included in this report. It is recognized that the GHGenius model is specific to Canadian regulations, and that there are different approaches used in LCA modelling. As GHGenius follows LCA guidelines established through ISO 13064, its approach and results are comparable with similarly designed models. Numerous models presently in use may produce valid results in so far as they make reference to or comply with existing sustainability schemas.

While ICAO is contemplating a minimum threshold for emission reductions from alternative fuels, an alternative system that rewards greater emission reductions could automatically promote fuels with the best sustainability.

Table 4: GHGenius LCA values for HEFA - biojet prodcution from default value Canadian feedstocks, based on the GHGenius model version 4.03a.

FUEL TYPE	CARBON INTENSITY (gC02e/MJ)	% REDUCTION VS JET A-1
Baseline Fuel:		
Fossil Jet A-1 (15ppm sulphur)	94.57	
Biojet Fuel:		
Tallow	-32.80	-138%
Yellow Grease	-12.05	-114%
Canola	-2.46	-103%
Camelina	1.64	-98%
Algae	28.87	-67%
Soy	44.48	-49%

4.2 Food security concerns

Many first-generation biofuel feedstocks, such as corn for ethanol and soybeans or canola for biodiesel, are derived from crops that have multiple uses in the food, feed, and/or fibre sectors. Feedstocks with multiple uses have been under scrutiny for potential impacts on food security. Concerns with food security are important to recognize as it is generally agreed that the development of a biojet supply chain should not exacerbate food insecurity. Major sustainability certification systems include indicators that seek to monitor impacts on local food security from biofuel development activities. Within these systems, each feedstock source and supply chain must be evaluated on its own merits. Annual crops with multiple uses (including fuels) can have better sustainability performance vs. purpose grown feedstocks for either food or fuel. At the same time, the potential indirect effects that may exist in all fuel supply chains should be examined, under equivalent system-boundaries of analysis, to continue progress towards understanding all potential impacts of our energy systems.

4.3 Biodiversity concerns

Land-use impacts may result in the loss of valuable natural ecosystems and biodiversity. These impacts are not solely limited to biofuel feedstocks; they apply to the entire agricultural system. For example, significant tracts of Southeast Asian tropical forest—critical habitat for endangered species such as orangutans—have been degraded due to clearing for palm oil plantations.

Another habitat concern is the potential for emerging biofuels crops to become invasive species. For instance, perennial grasses, such as Miscanthus and Arundo donax, are considered biofuels feedstock candidates because of their rapid biomass accumulation, which can also pose a danger to ecosystems if these species spread beyond the growing environment.

Sustainability schemes, including those included in the IATA Meta Standard, seek to limit these concerns by creating prohibition on feedstock created from highly biodiverse areas, requiring buffer zones, establishing ecological corridors, and prohibit the introduction of invasive species among other approaches.

5. Accounting methods for biojet volumes

The accounting methods for tracking and allocating volumes of biojet, and their attendant environmental and sustainability attributes, are necessary when incorporating fuel into a multi-user fuel system (such as an airport's hydrant fuel system).

To help enable airlines, verifiers, regulators (and other stakeholders) in determining the physical quantity of biojet utilized over a reporting year, the IATA Monitoring and Reporting Regulation (MRR) was approved and adopted at the ICAO member state level from January 1, 2013 to estimate biofuel consumption by airlines. According to the MRR, the mass of biofuel purchased during the year is to be reported along with the Annual Emissions Report as a memo-item (IATA, 2012).

The MRR, Article 53 (specific provisions for biomass), states that "the biomass fraction, net calorific value and emission factor or carbon content of the fuel used in an EU ETS aviation activity... shall be determined using fuel purchase records." Only sustainable biofuels will be zero-rated, as Article 53 goes on to say that biofuels "for aviation shall be assessed in accordance with Article 18 of Directive 2009/28/EC," which describes the sustainable production of biomass and biofuels under the EU Renewable Energy Directive (RED). Therefore, for biofuels to qualify for EU ETS exemptions, the biofuel must be produced in accordance with the RED's sustainability requirements. Compliance with Article 18 of the Directive can be achieved via a sustainability scheme approved by the EU Commission.

The MRR is clear that two pieces of documentation will be sufficient to demonstrate compliance: (1) fuel purchase records that indicate the biomass fraction, net calorific value and emission factor/carbon content of the fuel, and (2) certificate of sustainability demonstrating compliance with the RED, RFS2 or other renewable fuels schemes.

Over the course of the reporting year, airlines are required to track the total mass of biojet fuel purchased and used, subsequently reporting this value as a memo item on the Annual Emissions Report. Any biojet fuel sold to a third party prior to use must be subtracted from this total.

In the event that the biomass fraction cannot be determined from fuel purchase records, the IATA (2012) guide contains a procedure for use by a competent authority for tracking quantities of biojet.

The hybrid chain of custody methodology states that GHG emissions should be accounted for using mass balance up to a specific stage in the supply chain (most likely to be the biojet production facility). Emissions associated with any activities beyond this point, e.g. transportation of the fuel to the airport, will be represented by a default value. The airline purchasing the biojet fuel batch can then claim the emission reductions using a book and claim system.

To demonstrate the environmental merits of the CBSCI project, the hybrid chain of custody has been used to account for GHG emission reductions throughout the supply chain. Regardless of the choice of the control point, feedstock acquisition is the first stage in the supply chain and therefore will require GHG emission accounting using mass balance.

6. Conclusion

Sustainability measurement and performance are inextricably linked to biojet development as a means for aviation decarbonization. Progress to codify an international approach at the ICAO level has been deliberate; the implementation of any system is likely to be expensive and onerous during its initial period of use. The use of the IATA Meta Standard has the benefit of allowing systems that have already been developed and used (and with which there is familiarity), to be incorporated into a larger international approach to biojet sustainability.

Image courtesy of Air Canada

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