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GREENER SKIES?

SUPPLY AND SUSTAINABILITY OF CARBON CREDITS AND ALTERNATIVE FUELS FOR INTERNATIONAL AVIATION

In February 2016 WWF-UK commissioned a study from the Stockholm Environment Institute (SEI) into the supply and sustainability of carbon credits and alternative fuels for international aviation. The temporal scope of the study is 2020-2035, which is the expected first term of the global market-based measure (MBM) to address carbon emissions from international aviation under development in the International Civil Aviation Organization (ICAO). In this booklet, WWF-UK summarises the key conclusions of the SEI research, and presents additional context and recommendations for policymakers and airlines.

The full report is available for download on the WWF website at:
www.wwf.org.uk/aviation2016

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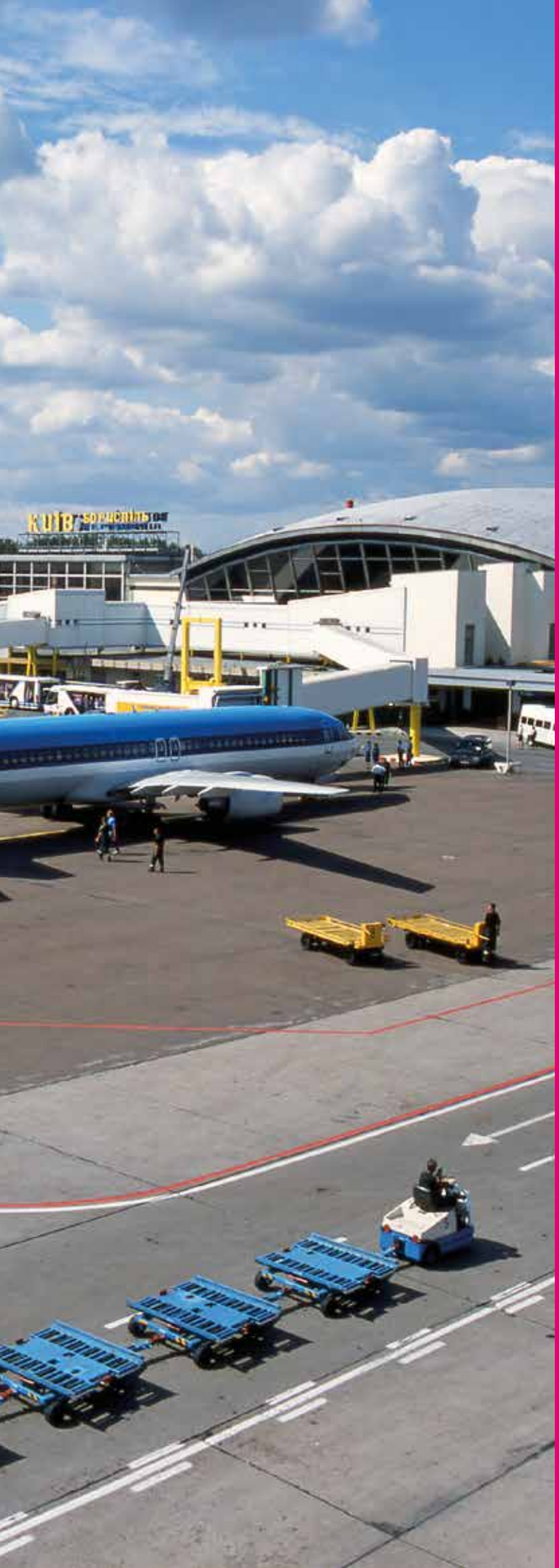

FOREWORD

The global transition to a low-carbon economy is gathering unstoppable momentum. More than 20 countries have managed simultaneously to grow their economies and reduce their carbon emissions since the turn of the century. But aviation has been left behind on this journey. As passenger numbers keep growing, so are the sector's emissions. Building better planes and flying them more efficiently is critical, but will only slow, not reverse, growing aviation emissions.

The most effective way to reduce aviation emissions is to realise the productivity benefits of ever-improving communications technology and high speed rail. At WWF we only fly when we have to, and we offset all our emissions. Offsetting is controversial, however, for two main reasons.

Firstly, offsetting should only be a last resort after making all efforts to avoid emissions, as a tonne of CO2 avoided is always better than a ton offset. Secondly, as this research shows, some offsets don't actually deliver emissions reductions, while others can be detrimental to people and nature.

The same is true for alternative fuels. Taking land use change fully into account means that some crop-based biofuels can actually increase emissions, while also posing risks to habitats and food security.

This autumn's Assembly of the UN International Civil Aviation Organization (ICAO) will decide key features of a global offset scheme for international flights, to flatline the sector's CO2 at 2020 levels. The main conclusion of this research is that there are plenty of good carbon credits and alternative fuels available to achieve, and exceed, ICAO's 2020 target, and no need at all to use poor quality credits or fuels.

We urge ICAO, at its 2016 Assembly, to make it clear that offsets and biofuels must **generate real emissions reductions and support sustainable development.**

ICAO's rules on offsets and biofuels will test its commitment to climate action and sustainable development. ICAO must also set in train a process to strengthen its emissions target over time.

To help ICAO make these decisions, we encourage airlines to make their own commitments to high quality carbon credits and sustainable biofuels, and to going beyond the minimum level of ambition of the 2020 goal.

It's time for ICAO to set aviation onto a sustainable flightpath, one that is aligned to the two historic global agreements of 2015: the Paris Agreement on climate change and the 2030 Agenda for Sustainable Development.

David Nussbaum, Chief Executive, WWF-UK

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INTRODUCTION

THE EYES OF THE WORLD ARE ON AIRLINES, AND ON THE ICAO, TO DRIVE SUBSTANTIAL CONCRETE PROGRESS ON REDUCING EMISSIONS. WE NEED MORE SUSTAINABLE ENERGY ALTERNATIVES FOR FOSSIL FUELS. AIRLINES MUST INCREASE THEIR USE OF ENERGY-EFFICIENT TECHNOLOGY.

UN Secretary-General
Ban Ki-moon
February 2016

Aviation and climate change

Aviation is a fast-growing contributor to climate change. CO_2 emissions from international flights account for with approximately 1.5% of global CO_2 emissions today, and with aviation traffic expected to increase 300% out to 2050 as other sectors decarbonise, could account for over a fifth of the world's total carbon budget in 2050. This is before considering the global warming impact of non-CO_2 factors, such as NOx and SO_2, which are estimated to be at least equal in impact to CO_2 emissions.

Urgent action is therefore required to reduce aviation emissions if the sector is to make a contribution to the key goal of the 2015 Paris Agreement on climate change: "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C".

Since 1997, efforts to address emissions from international aviation have been primarily pursued through the International Civil Aviation Organization (ICAO), a specialised agency of the United Nations (UN). This briefing is a summary of new research into the potential for carbon credits and alternative fuels to contribute to ICAO's climate change objectives and sustainable development.

Aviation and sustainable development

Both the aviation industry and ICAO have made stated commitments to sustainable development, which is typically defined as comprising three "pillars": economic, social and environmental.

Business Action for Sustainable Development, the official business group at the 2012 UN Conference on Sustainable Development, stated that its members "incorporate sustainable development objectives into their core business strategies". One of its members was the Air Transport Action Group, which has also committed to "advancing and strengthening the interdependent pillars of sustainable development".

The UN system is expected to support implementation of the "integrated and indivisible" Sustainable Development Goals (SDGs), which were agreed by world leaders last September. ICAO believes its work is "strongly linked" to 13 of the 17 SDGs, and is "fully committed to work in close cooperation with States and other UN Bodies to support related targets".

ICAO's commitment to the SDGs must inform its policy decisions. For example, its climate measures must deliver on climate action (Goal 13), while supporting, and in no way undermining, related SDGs such as zero hunger (Goal 2) and life on land (Goal 15).

[WE] REITERATE OUR ENGAGEMENT TO WORK IN UNISON WITH OUR COLLEAGUES THROUGHOUT THE UN SYSTEM, TOWARDS AGENDA 2030 AND ITS HISTORIC SUSTAINABLE DEVELOPMENT GOALS.

ICAO Secretary General
Dr. Fang Liu
February 2016

The ICAO Market-Based Measure

At its 2010 Assembly, ICAO agreed a target "of keeping the global net carbon emissions from international aviation from 2020 at the same level". This is commonly referred to as "carbon neutral growth from 2020" (CNG2020). At its 2013 Assembly, ICAO agreed to "develop a global MBM (market-based measure) scheme for international aviation" in order to ensure the delivery of the CNG2020 goal.

The MBM is one measure in ICAO's "basket of measures" for addressing international aviation emissions, which also includes "technologies, operational improvements and sustainable alternative fuels". Decision on key elements of the MBM is expected at the next ICAO Assembly this autumn.

Several groups within ICAO have been working to develop the MBM proposals. Its Environmental Advisory Group (EAG) and High Level Group (HLG) are working to find agreement on how to equitably distribute emissions reductions between countries according to their special circumstance and respective capabilities. Meanwhile its Committee on Aviation Environment Protection (CAEP) is developing provisions for registries and monitoring, reporting and verification (MRV), as well as detailed rules for carbon credits and alternative fuels to count towards the CNG2020 goal.

The purpose of this research

ICAO has opted for an offsetting MBM requiring airlines to purchase "emissions units" (carbon credits or allowances) for each tonne of CO_2 emitted above 2020 levels. The use of sustainable alternative fuel with lower lifecycle emissions than conventional jet fuel will also enable airlines to reduce the number of emissions units they have to buy.

In February 2016, WWF-UK commissioned the Stockholm Environment Institute (SEI) to assess the potential supply and sustainability characteristics of carbon credits and alternative fuels during the expected first term of the MBM: 2020-2035. In the following pages, WWF-UK summarises the key conclusions of the research and presents recommendations for policymakers and airlines.

Research questions

- What is the potential supply of carbon credits and alternative fuels for international aviation over the period 2020-2035?
- Which credits and fuels could deliver genuine emissions reductions and/or support sustainable development and the SDGs?
- If potential supply of credits and fuels was screened for confidence in emissions reductions and impacts on sustainable development, would the available supply meet ICAO's demand?

Key conclusions

- The potential contribution of carbon credits for which there is both relatively high confidence in environmental integrity and strong sustainable development potential is 3.0 Gt CO_2e, 67-91% of the CNG2020 goal.
- The potential contribution from sustainable alternative fuels with appropriate restrictions on direct and indirect land use change and certification to promote sustainable development is 0.1-0.3 Gt CO_2e, 2-9% of the CNG2020 goal.
- There is no need for airlines to use carbon credits or alternative fuels for which there is relatively low confidence in emissions reductions or risks to sustainable development in order to meet the CNG2020 target.

CARBON CREDITS

Environmental integrity

SEI's analysis evaluated the environmental integrity of offset project types based on how easily a typical project can meet criteria for additionality, quantification certainty and verifiability. The distinctions reflect inherent differences between project types, irrespective of standards used; strong standards are required to ensure integrity in all cases.

Higher confidence: Project types in this category generally have no other revenue streams, have costs that can be covered by carbon revenues, have high quantification certainty (e.g. gas quantities can be accurately monitored), have no leakage effects and can be easily verified.

Medium confidence: This category includes several energy sector project types, which typically have other revenue streams (e.g. energy savings for efficiency projects or energy sales for supply-side projects), making additionality determinations more challenging. Emission reductions may also be more uncertain for these project types, especially when emissions are indirectly displaced or avoided.

Lower confidence: Project types in this category include supply-side energy efficiency projects (where additionality is a major concern), and several land use project types (where carbon measurement is often challenging).

Sustainable development

SEI's analysis evaluated the sustainable development characteristics of offset project types based on their likely contributions, or risks, to the achievement of the UN SDGs. Robust certification is necessary to ensure both the avoidance of potential harm, and the achievement of potential sustainable development benefits.

Potential benefits: This category includes demand-side energy efficiency, small-scale renewables, public transport, certain types of methane avoidance, and forestry. These project types can reduce pollution (SDGs 3, 6, 11), provide access to clean energy (SDG 7), promote economic growth (SDG 8), help build sustainable communities (SDG 11), and enhance biodiversity (SDGs 6.6, 15).

Although these project types are likely to support sustainable development, they can also potentially undermine the SDGs. Certain energy or forestry projects, for example, can cause disruption to local communities (counter to SDGs 1.4, 11). Ensuring that such projects are beneficial requires oversight and stakeholder consultation, which can be assured through sustainability certification standards.

Neutral: These project types have little potential to contribute to SDGs, but likewise have low risk of causing significant social, environmental or economic harm. This category includes industrial gas destruction and avoidance, and reduction of process emissions (e.g. calcination emissions in cement production).

Potential risks: These project types are frequently associated with negative impacts. This includes projects that encourage continued reliance on fossil fuels (counter to SDGs 7, 12). Examples include fossil fuel switching, supply-side energy efficiency involving fossil fuels, and methane avoidance in the fossil fuel industry.

This category also includes large hydropower projects, which have the potential to cause displacement of local communities (counter to SDG 1.4) and environmental degradation (counter to SDG 6.6), impacts which have proved difficult to mitigate.

Figure 1: The UN Sustainable Development Goals (SDGs)

Table 1: Classification of offset project types by relative confidence in their environmental integrity (SEI analysis)

CATEGORY	DEFINITION	PROJECT TYPES
Higher confidence	Based on information available, there is relatively high confidence in the additionality and limited concerns related to the quantification certainty of carbon creditsfrom this project type	CO_2 usage • Coal mine methane – ventilation air methane • HFC-23 (revised methodology) • Landfill gas • Methane avoidance • N_2O nitric acid
Medium confidence	Available information raises some possible additionality and/or quantification concerns, but reasonable confidence in carbon credits from these project types is possible with sound (e.g. UN-backed) methodologies	Coal mine methane / Coal bed methane • Energy distribution • Energy efficiency – households (inc. cookstoves) • Energy efficiency – service • Geothermal • Hydropower – small • Mixed renewable – small • PFCs & SF6 • Municipal solid waste gasification / combustion
Lower confidence	Available information suggests that carbon credits from this project type are more likely to be non-additional or are subject to significant quantification and verification challenges	Agriculture • Biomass energy • Cement • Energy efficiency – industry • Forestry (afforestation / reforestation, avoided deforestation, improved forest management, agroforestry) • Fossil fuel switch • Fugitive gas • Fugitive gas – charcoal production • Geothermal • HFC-23 (old methodology) • Hydropower - large • Mixed renewable – large • Transport • Wind – large • Wind – small

Table 2: Classification of offset project types by expected sustainable development impacts (SEI analysis)

CATEGORY	DEFINITION	PROJECT TYPES
Potential benefits	These project types can typically make positive contributions to one or more of the following SDGs: 2, 3, 6, 7, 8, 9, 10, 11, 12 and 15.	Agriculture • Biomass energy - Industrial waste • Biomass energy – Other • Energy efficiency - households (inc. cookstoves) • Energy efficiency - industry • Energy efficiency - service • Energy distribution • Forestry • Geothermal • Landfill gas • Methane avoidance • Municipal solid waste • Renewable energy mixed – large • Small renewable (Wind, Solar, Hydro) • Transport • Wind – large
Neutral effects	These projects tpyically would not make significant positive contributions, nor pose significant risks, to any SDGs.	Cement • CO_2 usage • HFC destruction • N_2O Adipic Acid • N_2O Nitric Acid • PFCs & SF_6
Potential risks	These project types can typically pose risks to one or more of the following SDGs: 1, 6, 7, 8 and 12.	Coal mine methane • Energy efficiency - own generation • Energy efficiency - supply side • Fossil fuel switch • Fugitive gases • Hydro – large

Supply

SEI's analysis projects a total cumulative global supply of carbon offsets of up to 26.4 Gt CO_2e over the period 2020-2035, compared to ICAO's expected demand of 3.3-4.5 Gt CO_2e under CNG2020. This includes currently registered projects from 2017 and new projects from 2020. Jurisdictional REDD+ could provide an additional 2.4 Gt CO_2e, should ICAO choose to recognise REDD+.

ICAO could screen project types by confidence in their environmental integrity, expected sustainable development impacts, or both. Restricting eligibility to project types with higher confidence in environmental integrity and expected sustainable development benefits (with certification) would limit supply to 3.0 Gt CO_2e (Group 1), approximately 70-90% of ICAO's expected demand.

Expanding eligibility to project types with medium confidence in environmental integrity or neutral sustainable development outcomes, but excluding project types with lower confidence in environmental integrity or potential sustainable development risks, would expand supply to 5.1 Gt CO_2e (Group 1 + Group 2), easily covering ICAO's expected demand.

Therefore, project types with lower confidence in environmental integrity or potential sustainable development risks (Group 3) are not needed to meet CNG2020 target and could be excluded by ICAO."

Figure 2: Total cumulative supply of offset credits 2020 – 2035 by potential environmental integrity and sustainable development screens (Gt CO_2e) (SEI analysis)

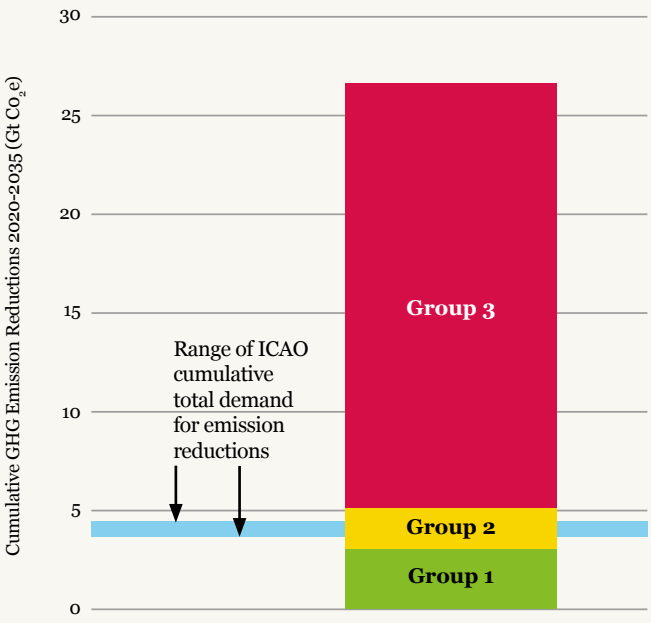


Table 3: Total cumulative supply of offset credits 2020 – 2035 by potential environmental integrity and sustainable development screens (Gt CO_2e) (SEI analysis)

		ENVIRONMENTAL INTEGRITY			
		HIGHER CONFIDENCE (A)	MEDIUM CONFIDENCE (B)	LOWER CONFIDENCE (C)	TOTALS
SUSTAINABLE DEVELOPMENT	POTENTIAL BENEFITS (1)	**A1: 3.0 Gt CO_2e**	**B1: 1.6 Gt CO_2e**	**C1: 8.9 Gt CO_2e**	**13.5 Gt CO_2e**
		Landfill gas • Methane avoidance	Energy distribution • Energy efficiency – households (inc. cookstoves) • Energy efficiency – service • Geothermal • Hydropower – small • Mixed renewable – small • Municipal solid waste gasification/ combustion	Agriculture • Biomass energy • Energy efficiency – industry • Forestry (afforestation/ reforestation, avoided deforestation, improved forest management, agroforestry) • Mixed renewable – large • Transport • Wind - large Wind – small	
	NEUTRAL EFFECTS (2)	**A2: 0.3 Gt CO_2e**	**B2: 0.2 Gt CO_2e**	**C2: 1.4 Gt CO_2e**	**1.9 Gt CO_2e**
		CO_2 usage • HFC-23 (revised methodology) • N_2O nitric acid	PFCs & SF_6	Cement • Fugitive gas – charcoal production • HFC-23 (old methodology) • N_2O adipic acid	
	POTENTIAL RISKS (3)	**A3: 0.3 Gt CO_2e**	**B3: 1.5 Gt CO_2e**	**C3: 9.2 Gt CO_2e**	**11.0 Gt CO_2e**
		Coal mine methane – ventilation air methane	Coal mine methane / Coal bed methane	Fossil fuel switch • Fugitive gas • Hydropower - large	
TOTALS		**3.6 Gt CO_2e**	**3.3 Gt CO_2e**	**19.5 Gt CO_2e**	**26.4 Gt CO_2e**

Methane avoidance projects score highly for both confidence in environmental integrity and sustainable development benefits.

CASE STUDY

SICHUAN RURAL POOR-HOUSEHOLD BIOGAS POA

Where: Rural regions of Sichuan Province in China.

Who: UPM, Chengdu Oasis Science & Technology Co., Ltd. and the Sichuan Rural Energy Office (SREO).

What: One million biogas digesters and cookstoves are being installed in low-income communities.

Certification: Gold Standard CDM Programme of Activity (PoA).

Climate benefit: To date, the PoA has avoided more than 1.9 Mt CO_2e, and is expected to save up to 20 Mt CO_2e over its 28-year lifetime.

Sustainable development benefits:

- **SDG 1: No poverty** The PoA shares a proportion of CER sales revenue with the participating poor rural households. Available annual household incomes have increased up to 25% from avoided fossil fuel costs, higher crop yields and improved sanitation and health conditions.
- **SDG 2: Zero hunger** Superior quality organic fertilizer produced in the biogas digester tanks increases both crop yields and the quality of agricultural products.
- **SDG 3: Good health and well-being** The smoke-free biogas cookstoves reduce indoor air pollution of CO, SO_2, PM10 and NH_3 and prevent respiratory diseases and eye ailments.
- **SDG 5: Gender equality** The biogas digesters and cookstoves reduce the time spent mostly by rural women collecting firewood or purchasing fossil fuel and firing up traditional stoves.
- **SDG 6: Clean water and sanitation / SDG 11: Sustainable cities and communities** The storage and recycling of animal manure and organic waste in closed tanks instead of open pits avoids odours, flies, infectious diseases, water pollution and degradation of arable land.
- **SDG 7: Affordable and clean energy** Fuel switching to renewable biogas puts an end to the farmer's dependency on expensive and dirty fossil fuels, leading to substantial cost savings.
- **SDG 8: Decent work and economic growth** According to SREO figures, the PoA supports thousands of jobs in the distribution, installation and maintenance of biogas plants.

ALTERNATIVE FUELS

Emissions reductions

SEI's analysis grouped common aviation biofuel feedstock pathways according to their expected emissions reductions versus conventional jet fuel. Emissions reductions are calculated on a life-cycle basis, including both direct and indirect land use change (DLUC and ILUC).

Technology pathways considered include Hydro-processed Esters and Fatty Acids (HEFA), Fischer Tropsch (FT) and Direct Sugars to Hydrocarbons (DSHC). Feedstocks considered include algae, various waste materials and various agricultural crops. The analysis examines the use of different feedstocks under each pathway.

Life-cycle estimates of emissions for each feedstock pathway vary because of systemic uncertainties and different methodological approaches. In addition, emissions caused by DLUC or ILUC can be as large as emissions from the rest of the life cycle, and must be minimized or avoided to ensure emissions reductions are achieved.

Feedstock pathways were split into two groupings:

- **Lower range emission reductions:** This includes the upper end of emission estimates for oilseed crops such as rapeseed, soybean and jatropha (assuming no land use change);
- **Upper range emission reductions:** This includes fuels from waste, most cellulosic feedstocks (assuming no land use change), and sugarcane in the DSHC pathway.

The HEFA-oilseed pathways have broad ranges of emission estimates, with HEFA-algae presenting an extreme case, ranging from zero net emissions, to more than twice the emissions of conventional jet fuel. FT pathways with cellulosic feedstocks typically achieve greater emissions reductions than most HEFA feedstock pathways, with the exception of HEFA produced from waste fats and oils.

Sustainable development

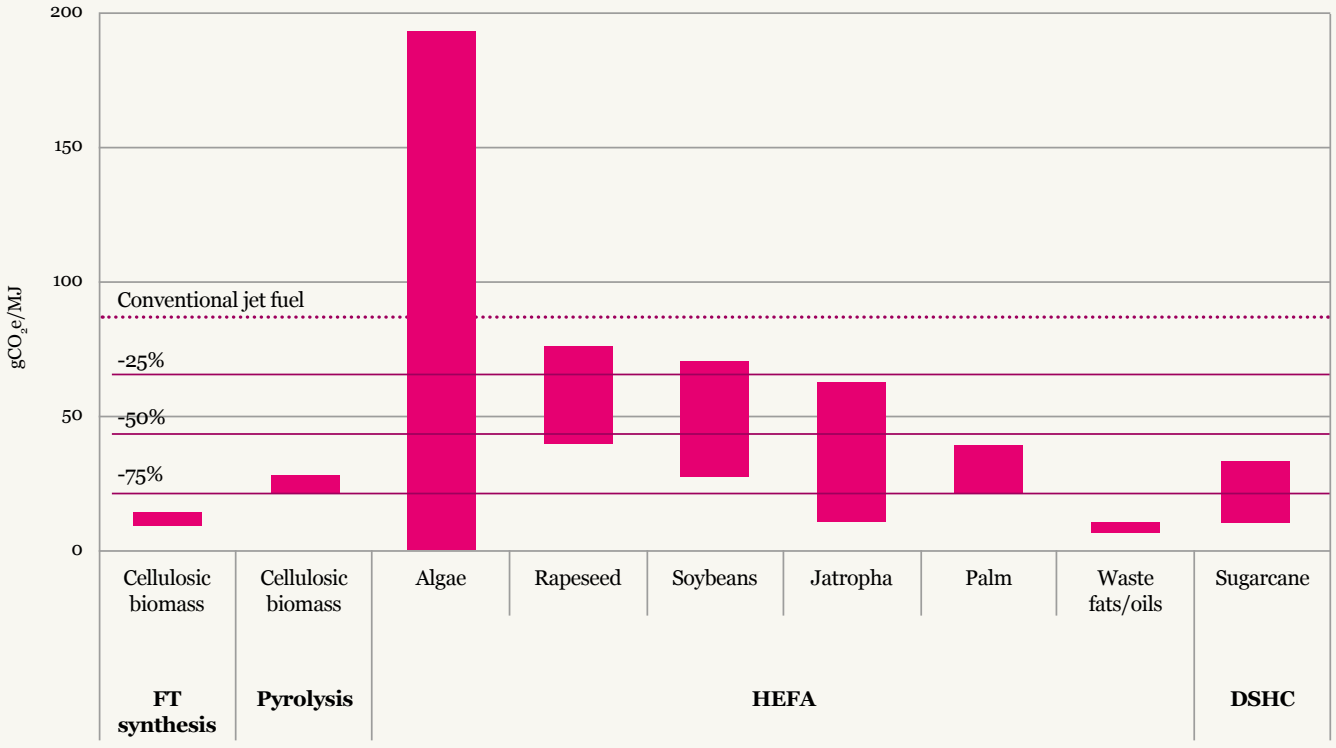
SEI's analysis evaluated the differences in sustainable development impacts across a range of potential aviation biofuel feedstocks. In contrast to the carbon credits analysis, where there was significant variation in sustainable development impacts by project type, in the case of alternative fuels the variation is mostly due to specific institutional arrangements and management practices, rather than the choice of feedstock per se.

Perennial oilseed crops, perennial cellulosic crops and waste materials were all found to have similar sustainable development characteristics. Waste products are unlikely to do harm, but are equally unlikely to result in positive benefits unless specific measures are taken (for example, encouraging socially inclusive supply chains to support SDGs 8 and 10). Similarly, perennial cellulosic crops have only been planted in small areas and neither positive or negative impacts have been well documented. Likewise, the potential impacts of algae-based biofuels are largely unknown, because production has not moved beyond the pilot phase.

In contrast oilseed crops such as soy, oil palm, and jatropha have been associated with many documented instances of negative social and environmental impacts, including conflict over land (SDG 1.4), risks to soil fertility and food security (SDG 2), and threats to water quality (SDG 6) and biodiversity (SDG 15). Sugarcane has also been implicated in some instances.

Regardless of feedstock choices, sustainability certification standards for alternative fuels can help strengthen institutions and promote management practices that work for, rather than against, sustainable outcomes. The SEI study reviewed common biofuel standards and found that the majority mention sustainable development themes and include "no harm" criteria, but do not require positive improvements. Two standards, the Roundtable for Sustainable Biomaterials (RSB) and the Roundtable for Sustainable Palm Oil (RSPO), do include some criteria and indicators that require positive impacts in some SDG thematic areas. RSB certification can ensure positive contributions to poverty alleviation (SDG 1) and food security (SDG 2).

Figure 3: Life cycle emissions reductions for various alternative fuel feedstock pathways, without land use change (SEI analysis)



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Supply

In the scenario that ICAO has deemed "most likely", about 3% of global jet fuel demand in 2020 would be met by alternative fuels (6.5–7.2Mt). However, production today is negligible. Using data from E4Tech, SEI estimates that the near-term supply (defined by production facilities that are either operating, under construction, or planned) totals just 1.8 Mt/yr.

Looking further ahead, E4tech estimates that 3–13 Mt could be produced annually by 2030. The International Energy Agency projects slower growth, with biofuels accounting for just 1% of aviation fuel demand in 2040. To estimate future emissions reductions from alternative jet fuels, SEI's analysis starts with the near-term supply estimate of 1.8 Mt/yr described above, and assumes that production capacity grows 14% annually between 2020 and 2035, the same rate that US bioethanol production capacity grew between 2001 and 2015.

Given the nascent state of the alternative aviation fuels market, it is challenging to predict with certainty the feedstock pathways that will be used 15-20 years from now. SEI's analysis provides an illustrative estimate of the range of potential emissions reductions that could be achieved over this period. If requirements are in place to ensure feedstocks are produced with little or no DLUC and/or ILUC, and strong sustainability certification schemes are followed, cumulative emission reductions could range from 0.1 to 0.3 Gt CO2e between 2020 and 2035, depending on whether feedstock pathways at the lower or higher range of emission reductions are used. This represents 2-9% of ICAO's CNG2020 target.

Table 4. Cumulative emissions reductions from alternative fuels 2020 – 2035 based on total capacity in 2020 (SEI analysis)

UPPER RANGE EMISSIONS REDUCTIONS		LOWER RANGE EMISSIONS REDUCTIONS	
Path	**Illustrative feedstocks**	**Path**	**Illustrative feedstocks**
HEFA	Waste fats and oils	HEFA	Low ILUC risk rapeseed, low-performing algae
FT	Low ILUC risk switchgrass, maize-stover, bagasse, forest wastes or municipal solid waste		
DSHC	Sugarcane with no D/ILUC	DSHC	Sugarcane with minimal D/ILUC
Other	Low ILUC risk switchgrass, maize-stover, bagasse, forest residues, municipal solid waste	Other	Switchgrass with ILUC
Total potential emissions reductions:	0.3 Gt CO_2e	Total potential emissions reductions:	0.1 Gt CO_2e

AIRLINES' ENGAGEMENTS IN SUSTAINABLE ALTERNATIVE FUELS

WWF supports the efficient use of sustainable bioenergy in sectors where other alternative energy sources are not available, including aviation, as part of the global transition to 100% renewable energy. The aviation industry has shown considerable interest in alternative fuels. Indeed, ATAG's "sustainable flightpath towards reducing emissions" relies heavily on biofuels to achieve their commitment to reduce international aviation emissions by 50% in 2050 compared to 2005.

Several airlines have run biofuel demonstration flights in previous years, but 2016 is being considered a breakthrough year by many in the industry. For instance, United this year became the first US airline to start using commercial-scale volumes of aviation biofuel for regularly scheduled flights, while SkyNRG started regularly supplying RSB-certified biofuel at Oslo Airport.

RSB certification is one way biofuel producers can demonstrate that their direct operations promote sustainable development. For example, RSB Principle 5 requires that "in regions of poverty, biofuel operations shall contribute to the social and economic development of local, rural and indigenous people and communities," directly supporting SDG 1: No Poverty. The International Air Transport Association (IATA) and Sustainable Aviation Fuel Users Group (SAFUG) have both expressed clear support for RSB.

However indirect sustainability impacts – most notably indirect land use change (ILUC) – must also be addressed. ILUC occurs when biofuel feedstock production displaces existing agricultural activity into pristine environments, potentially causing significant land use change emissions that can cancel out any direct emissions benefit from biofuel, as well as adverse impacts on food security (SDG 2: No Hunger) and habitats (SDG 15: Life on Land).

There are two main options for addressing ILUC: either by accounting for expected ILUC emissions in the GHG life cycle analysis, or by applying project-level measures to mitigate ILUC risk. SAFUG has expressed a preference for alternative fuels that are not associated with high ILUC risk.

In 2015, RSB introduced the first certification module to enable alternative fuel producers to demonstrate their fuels have a "low ILUC risk", building on the Low Indirect Impact Biofuel methodology developed by WWF, EPFL and Ecofys. Currently, no alternative fuel producers have yet achieved RSB "low ILUC risk" certification.

The first airline to source sustainable alternative fuel that is RSB-certified as "low ILUC risk" will take a big step forward towards proving that alternative aviation fuels can both directly reduce emissions and support sustainable development, whilst mitigating the risks of negative indirect impacts on emissions and sustainability.

CONCLUSIONS

ICAO is proposing that airlines achieve carbon-neutral growth after 2020. Beyond operational and technical efficiency, it is envisaged that airlines will rely on alternative fuels and offsetting their carbon emissions. Both these approaches, however, are subject to uncertainties about how well they reduce emissions and how much they contribute to broader sustainable development goals. Given how important the airline industry's efforts will be for mitigating climate change, it is important for ICAO to establish robust criteria for the tools airlines will use to reduce emissions.

SEI's analysis suggests that focusing on certain types of fuels and carbon offsets could bolster confidence in their GHG reductions and directly promote sustainable development. Furthermore, doing so would still enable airlines to meet ICAO's CNG2020 target.

Airlines could meet most of their carbon-neutral growth requirements even if they focus on carbon credits for which there is both relatively high confidence in GHG reductions and demonstrable potential for sustainable development benefits.

The potential supply of alternative jet fuels is subject to greater uncertainties. However, the use of alternative fuels with appropriate eligibility criteria to advance key sustainable development objectives could yield GHG reductions between 2020 and 2035 up to 9% of the reductions needed for ICAO's CNG2020 target.

RECOMMENDATIONS FOR AIRLINES

WWF urges airlines to first of all maximise the emissions reduction potential in operational and technical efficiency before then turning to sustainable alternative fuels and carbon credits. This will help reduce the pressures facing other sectors of the economy in reducing their emissions, and reduce the risk of reliance on unsustainable biofuels and poor quality credits.

Carbon credits

When sourcing carbon credits, WWF calls on airlines to commit to:

- sourcing carbon credits from activities for which there is both higher confidence in environmental integrity, and certification to promote sustainable development benefits;
- ruling out carbon credits from activities for which there is either lower confidence in environmental integrity, or that pose risks to sustainable development.

Alternative fuels

To prove the concept of sustainable low-ILUC biofuels, WWF encourages airlines as a priority to seek certification via the RSB "low ILUC risk" module. WWF also calls on airlines to commit to:

- sourcing alternative fuels from feedstock pathways that are both likely to reduce emissions by 50% or more compared to conventional jet fuel (including ILUC factors unless certified "low ILUC risk"), and are certified to promote sustainable development benefits;
- ruling out alternative fuels from feedstock pathways that are either unlikely to reduce emissions by 50% compared to conventional jet fuel (including ILUC factors unless certified "low ILUC risk"), or are not certified to avoid negative sustainable development impacts.

Reporting

WWF encourages airlines to report against these commitments by publishing details of the carbon credits and alternative fuels they have used towards the CNG2020 goal, in order to assure customers that they are supporting, and in no way hindering, climate action and sustainable development.

Ambition

WWF urges airlines to go beyond the CNG2020 target, to enable a greater contribution to the overall objectives of the 2015 Paris Agreement. Ideally airlines should offset all their emissions, not just growth above 2020 levels, and buy at least two credits for every tonne of CO_2 to account for non-CO_2 impacts and the increased global warming impact of emissions at altitude.

RECOMMENDATIONS FOR POLICYMAKERS

WWF calls on ICAO to level the playing field for all airlines and incentivise investment in sustainable solutions by:

In the 2016 Assembly Resolution

- Clearly stating the principle that carbon credits and alternative fuels will only be eligible for claiming emissions reductions under the MBM if they achieve real emissions reductions while promoting, and in no way hindering, sustainable development.
- Establishing a process to increase the ambition of its emissions goal over time beyond CNG2020.
- Introducing a mechanism to ensure that an airline's emissions reductions achieved through efficiency or sustainable alternative fuels can be subtracted from its offsetting obligation, to ensure effective incentive for in-sector climate action.

As soon as possible after the 2016 Assembly

- Finalising the eligibility criteria and implementation procedures for both carbon credits and alternative fuels, drawing on experience of existing sustainability standards.

- For carbon credits, this includes ensuring that emissions reductions claimed by airlines are compatible with UNFCCC COP decisions and are not also claimed towards countries' Paris Agreement pledges.

- For alternative fuels, this includes experiences of ILUC modelling and the RSB "Low ILUC Risk" module.

- Developing the criteria to promote best-in-class solutions and exclude options with low confidence in environmental integrity or risks to sustainable development.
- Introducing sustainability reporting requirements on airlines' use of carbon credits and alternative fuels towards the CNG2020 target, carefully balancing public and commercial interests.

WWF is a member of the International Coalition for Sustainable Aviation (ICSA). For further recommendations on the design of the MBM, please see "ICSA's checklist for an effective plan to cut aviation global warming pollution".

FURTHER ACTION

Beyond ICAO, WWF also urges stakeholders at all levels to continue to take action on other climate impacts of aviation (e.g. CO_2 emissions beyond CNG2020, non-CO_2 factors, the additional impacts of emissions at altitude) through the full suite of available policy options to encourage increased technical and operational efficiency, modal shift and, where necessary, demand moderation.

3.3-4.5 GT

The cumulative emissions reductions required from airlines to achieve carbon neutral growth from 2020-2035

0.3 GT

The potential contribution of sustainable alternative fuels to reducing aviation emissions from 2020-2035

3.0 GT

The potential contribution of higher-integrity carbon credits with potential sustainable development benefits from 2020-2035

1.5°C

The limit to global warming that all countries are pursuing through the 2015 Paris Agreement on climate change