ICAO Policy Guidance on SAF

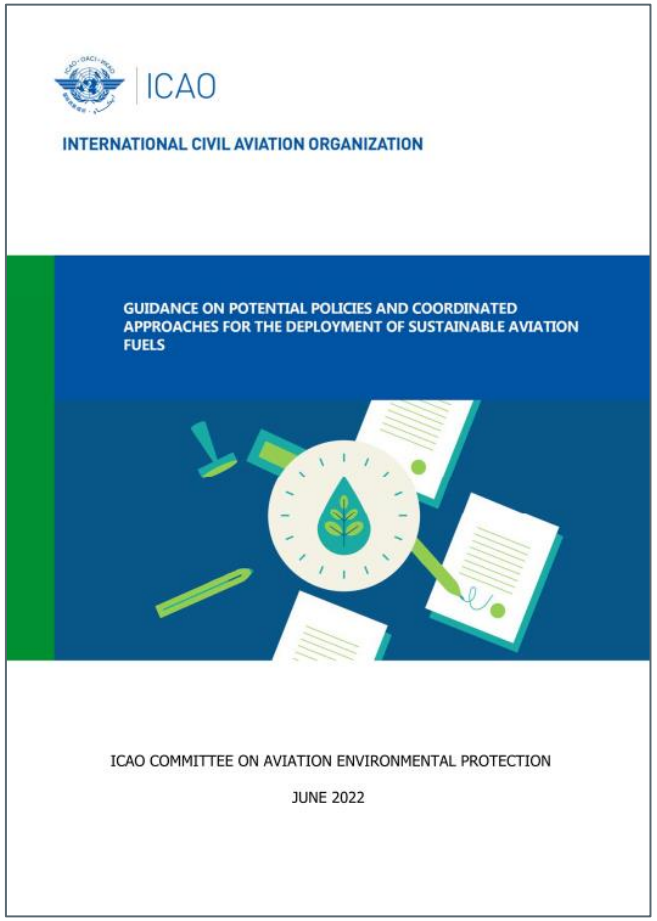
Presentation of the ICAO “Guidance on Potential Policies and Coordinated Approaches for the deployment of Sustainable Aviation Fuels”

Introduction

- SAF production capacity is limited by a number of barriers
  - Higher costs
  - Limited feedstock and fuel production infrastructure
  - Perceived financial risks
- In the presence of such barriers, policy intervention is required to develop SAF production.
  - In general, a supporting policy framework is in place in those states where SAF production has initiated
- Constraints and opportunities are specific to each State
  - Specific climates, agricultural systems, available resources, economic factors, political contexts, regulatory structures, etc.

→ Successful SAF policy making may require a customized strategy specific to each State's own circumstances.

ICAO Guidance on Potential Policies and Coordinated Approaches for the deployment of SAF



- Developed by CAEP based on studies performed since 2016
- A support reference for ICAO States to develop SAF production
  - Insight on types of policy measures and their impacts
  - Examples of policies used or under preparation
  - Links to additional helpful resources
- Completes a toolbox of guidance material for ICAO States
- Can be used in combination with the ICAO SAF Rules of Thumb

Publically available on the ICAO website

Guidance document

https://www.icao.int/environmental-protection/Pages/saf_guidance_potential_policies.aspx

SAF rules of thumb

https://www.icao.int/environmental-protection/Pages/SAF_RULESOFTHUMB.aspx

What defines an effective SAF policy? (1/2)

- Three key themes influence policy effectiveness:
  1. **Feasibility**: practicable and easy to implement
  2. **Effectiveness**: successful in producing a desired result
  3. **Practicality**: the policy targets the outcome rather than a theory or set of ideas

What defines an effective SAF policy? (2/2)

- To be effective, SAF policies/programmes should be:
  - **Stable**, predictable and consistent in implementation
  - Be of a **sufficient duration** to reflect project development timelines
  - Be "**stackable**" with other incentives – i.e., allowing credit to be received from multiple reinforcing incentives at the same time is helpful
  - Be **technology-neutral**
  - Link **incentives** to **performance**
  - Allow access to a **compliance credit market** to mediate prices between renewable fuels and fossil fuels by ascribing a compliance value
  - Recognize **needs of pre-revenue companies** through clear access to non-dilutive capital via grants and loans.
  - **Ambitious** to support aviation decarbonisation and **drive further innovation**
  - Ideally, be national in **scope** to allow innovation and project development where it can be accomplished most effectively
  - Designed with **broad political support** to avoid sudden policy reversals.
  - **Customized** to the specific circumstances of the State

Qualitative metrics for assessing policy effectiveness (1/2)

The following metrics can be used as a “check-list” to assess policy effectiveness:

1. Flexibility
   - Can the policy be easily adjusted given evolving circumstances?
2. Certainty
   - Relates to the time frame, legal conditions and/or political decisions.
   - Medium to long-term policy certainty tend to increase investor interest.
3. Financial cost and benefits
   - Policy effectiveness should consider costs and benefits, including social costs.
4. Price sensitivity to externalities
   - The higher the sensitivity to externalities, the more potential unintended consequences.
   - Price-based policies can be less volatile if a floor and ceiling price is established.

Qualitative metrics for assessing policy effectiveness (2/2)

The following metrics can be used as a “check-list” to assess policy effectiveness:

5. Ease of implementation
   - Administrative, governance and/or procedural complexity can hinder implementation.
6. Contribution to SAF deployment and GHG reduction
   - clear criteria on target quantity, sustainability, commercial parameters and timeframe improve results
7. Unintended consequences
   - mechanisms to identify and mitigate the impact of unintended consequences (economic, environmental or social).
8. Robustness of policy
   - regulating systems to ensure that policy objectives are achieved and procedures have been followed.

I. Stimulating growth of SAF supply

Policy category 1: **Government funding** for SAF research, development, demonstration and deployment (RDD&D)

Policy option	Description
1.1 - **Government funding R&D**	Government research and funding (to public programs or private research activities) can help early stage SAF production innovations, accelerate the learning curve and help optimize production.
1.2 - **Government funding demonstration and deployment**	Government research and funding to demonstrate and de-risk new feedstock and conversion technologies can provide support to both feedstock and fuel technology providers to scale up and integrate their production. This support accelerates the learning process around technology and supply chain scale up. Support can occur from establishing specific programs that support existing private sector producers.

I. Stimulating growth of SAF supply

Policy category 2: Targeted **incentives** and **tax relief** to support SAF supply infrastructure

Policy option	Description
2.1 - **Capital grants**	A government grant given to an entity to build or buy SAF-specific infrastructure. This can support a range of production facilities, transportation, re-fuelling or blending infrastructure. Capital grants reduce the financial needs and financial risks of the targeted investment.
2.2 - **Loan guarantee programs**	A loan backed by a government institution helps the project financial case, and also reduces overall project risk, making acquiring additional equity of debt easier and lowers cost of capital.
2.3 – **Tax advantaged business status**	To give SAF projects a specific tax status that relieves them from certain fiscal obligations. E.g. MLPs in the US.

I. Stimulating growth of SAF supply

Policy category 2: Targeted **incentives** and **tax relief** to support SAF supply infrastructure

Policy option	Description
2.4 - **Accelerated depreciation/'bonus' depreciation**	Accelerated or bonus depreciation allows the accounting write-off of capital investment or the potential to write off more than the actual capital investment. This will result in less expected tax to be paid over the life of the project and improve overall project economics.
2.5 - **Business Investment Tax Credit (ITC) for SAF investments**	An ITC tax credit allows deduction of construction and/or commissioning costs of a qualifying asset which can reduce income tax payable and flow through to investors. This will result in less expected tax to be paid over the life of the project and improve overall project economics.
2.6 - **Performance-based tax credit**	The concept offers a tax credit for a project meeting certain conditions. The credit could be a sliding scale performance credit (higher credit for better GHG performing projects) and should have a defined policy life (i.e. 10-15 years).

I. Stimulating growth of SAF supply

Policy category 2: Targeted **incentives** and **tax relief** to support SAF supply infrastructure

Policy option	Description
2.7 – **Bonds / Green Bonds**	Bonds can be issued by private companies, supranational institutions, and public entities including sub-national and local governments to provide low-interest rate and tax exempt financing used to support fuel production infrastructure build out. Green Bonds are designed specifically to support specific climate-related or environmental projects.

I. Stimulating growth of SAF supply

Policy category 3: Targeted **incentives** and **tax relief** to assist SAF facility operation

Policy option	Description
3.1 **Blending incentives: Blender's Tax Credit**	An incentive targeted at the providers or blenders of fuel that provides a credit against taxes. This mitigates the blenders cost of production or purchase difference between SAF and fossil jet fuel.
3.2 – **Production incentives: Producer's Tax Credit**	An incentive targeted at the producers of fuels that provides a credit against taxes. This mitigates the cost of production difference between SAF and fossil jet

I. Stimulating growth of SAF supply

Policy category 3: Targeted **incentives** and **tax relief** to assist SAF facility operation

Policy option	Description
3.3 - **Excise tax credit for SAF**	For States that tax domestic jet fuel consumption, a reduction or elimination of the tax in proportion to quantity of SAF consumed serves to incentivize fuel consumers to purchase SAF by contributing to lower SAF cost.
3.4 - **Support for feedstock supply establishment and production**	Targeted support can address the risks and costs to farmers and feedstock suppliers of establishing a new crop and producing it under uncertain conditions. Crop insurance program support for SAF can also be considered in addition to subsidy payments made to farmers aimed at incentivizing production.

Examples of SAF Policy options (7/12)

I. Stimulating growth of SAF supply

Policy category 4: Recognition and **valorization of SAF environmental benefits**

Policy option	Description
4.1 – **Recognize SAF benefits under carbon taxation**	Where a jurisdiction has introduced a carbon tax, carbon price, or carbon levy (that is setting a tax rate on carbon emissions for each fuel type, thereby providing a signal to reduce emissions) SAF could be rated as either zero or in proportion to the life-cycle greenhouse gas emissions benefit of the particular fuel, thereby subject to reduced tax.
4.2 - **Recognize SAF benefits under cap-and-trade systems**	Cap-and-trade systems limit total GHG emissions by setting a maximum emissions level and allowing participants with lower emissions to sell surplus emission permits to larger emitters. This system creates supply and demand for emissions permits and establishes a market price for emissions and a value for avoided emissions. When SAF are used in such a system, it exempts the user of the SAF of obligations under the regulation, hence reducing the price of SAF versus fossil jet fuel.

I. Stimulating growth of SAF supply

Policy category 4: Recognition and **valorization of SAF environmental benefits**

Policy option	Description
4.3 - **Recognize non-carbon SAF benefits**: improvements to air quality	Some programs and incentives place a value on local air quality. SAF should be able to financially participate in these incentive schemes based on air quality benefits that certain SAFs may be able to provide.
4.3 - **Recognize non-carbon SAF benefits**: reduction in contrails	As the understanding of the science evolves, reductions in contrail formation resulting from use of SAF may be able to be recognized for their environmental benefits.

II. Creating demand for SAF

Policy category 5: Creation of **SAF mandates**

Policy option	Description
5.1 - **Mandate SAF energy volume requirements in the fuel supply**	An obligation on fuel suppliers to provide increasing SAF fuel volumes added to the existing fuel supply on a multi-year schedule creates an incentive for production of more SAF and other fuels which meet the renewable energy definitions of the program. These definitions can include life-cycle greenhouse gas emissions requirements.
5.2 - **Mandate reduction in carbon intensity of the fuel supply**	An obligation on fuel suppliers to reduce the carbon intensity (life-cycle greenhouse gas emissions intensity) of the transportation fuel supply on a multi-year schedule creates an incentive for production of more SAF and other fuels with greenhouse gas benefits.

II. Creating demand for SAF

Policy category 6: **Update existing policies** to incorporate SAF

Policy option	Description
6.1 - **Incorporating SAF into existing national policies**	Many national level policies may be adapted to incorporate SAF. Typically, legacy biofuel policies have focused on road-transport fuels and do not include SAF as an option. With the more recent advent of SAF production technologies, an opportunity exists to update existing policies to support SAF production.
6.2 - **Incorporating SAF into existing sub-national, regional or local policies**	Existing alternative fuel incentive policies at a sub-national, regional or local level may be able to incorporate SAF as qualified fuels. An update to these existing policies to support SAF production can provide additional support and may enable a beneficial "stacking" of incentives at multiple levels that contributes to SAF economic viability.

II. Creating demand for SAF

Policy category 7: Demonstrate **government leadership**

Policy option	Description
7.1 - Policy statement to establish direction	Setting aspirational goals or signaling future intent to develop comprehensive SAF policy measures. This can be linked to the implementation of future policies, sending a signal for project planning. Examples could including State level commitments for a quantitative SAF use goal or carbon reduction by a certain time, or signals from industry such as a commitment to achieve net zero by 2050.
7.2 - Government commitment to SAF use and carbon neutral air travel	A strong demand signal can be created by requiring national, state, local governments, and military to commit to renewable fuel/SAF procurement to reduce environmental impacts of air travel and operations. Governments often have the ability to commit to long term contracts backed by strong credit rating which lowers project risk.

II. Enabling SAF markets

Policy category 8: Market enabling activities

Policy option	Description
8.1 - Adopt clear and recognized sustainability standards	Use of clear standards and harmonized methods for life cycle GHG emissions calculation and sustainability certification will support broad SAF markets and ensure environmental integrity.
8.2 - Support systems for environmental attribute ownership and transfer	Systems for calculating, crediting and trading the environmental attributes of SAF may facilitate “book and claim” purchasing of SAF that decouples the physical fuel location and the environmental benefit in order to support more use of SAF.
8.3 - Support SAF stakeholder initiatives	Stakeholder consultation groups serve to align the diverse stakeholders that make up the SAF supply chain. They can directly coordinate actions and provide critical information and feedback to policymakers.

1. ICAO SAF Rules of Thumb

Provides order of magnitude estimations on SAF costs, investment needs and production potential. It can be used to inform policymakers and project developers.

- Provides the impact of feedstock cost, fuel yield, facility scale, total capital investment (TCI) and minimum selling price (MSP) for both the ***n*th plant** and a **pioneer plant**.
- Provides **big-picture trends** for costs and processing technology/feedstock comparisons. However, they do not provide precise cost or price information.

Processing Technology	Feedstock	Feedstock Cost ($/tonne)	Feedstock Cost ($/L)	TCI (million $)		MSP ($/L)	
				nth	pioneer	nth	pioneer
GFT	MSW	0	-	1170	724	0,7	1,8
GFT	Forest Residues	125	-	1636	1063	1,8	3,3
GFT	Agricultural Residues	110	-	1506	1238	2,1	3,8
ATJ	Ethanol	456	0.36	333	99	0,8	1,0
ATJ	Isobutanol - Low	1110	0.89	343	67	1,3	1,4
ATJ	Isobutanol - High	1496	1.20	424	75	1,8	1,9
HEFA*	FOGs	580	-	428	112	0,8	1,0
HEFA*	Vegetable Oil	809	-	431	108	1,1	1,2

2. Determining the marginal abatement cost of CO_2 mitigation using SAF

Evaluating the cost of abating 1 ton of CO2 with the use of SAF can be valuable for a policy maker to assess the effectiveness of a specific policy relative to other alternatives (fleet renewal, ATM operations improvement, etc.)

Cost of 1 tonne of conventional kerosene = $600

Cost of 1 tonne of SAF = $1100

Jet fuel combustion CO_2 emissions factor = 3.16

CO_2 emissions reduction factor of this SAF = 80%

Firstly, the amount of CO_2 reduced must be determined which is a function of the amount of SAF used, the jet fuel combustion factor and the SAF emissions reduction factor.

Net CO_2 emissions reduction = 2 tonnes * 3.16 * 80% = 5.06 tonnes CO_2

The cost per tonne of CO_2 reduced is found by calculating the cost difference between SAF and conventional kerosene divided by the amount of CO_2 reduced.

Cost per tonne of CO_2 reduced = 2 tonnes * (1100-600) / 5.06 = $197.78 / tonne

How do policies impact SAF project economics?

The report proposes 5 simplified examples to illustrate the effects of policies on the economic viability of a SAF project (no support, grant, interest-free loan, subsidy, and combination thereof).

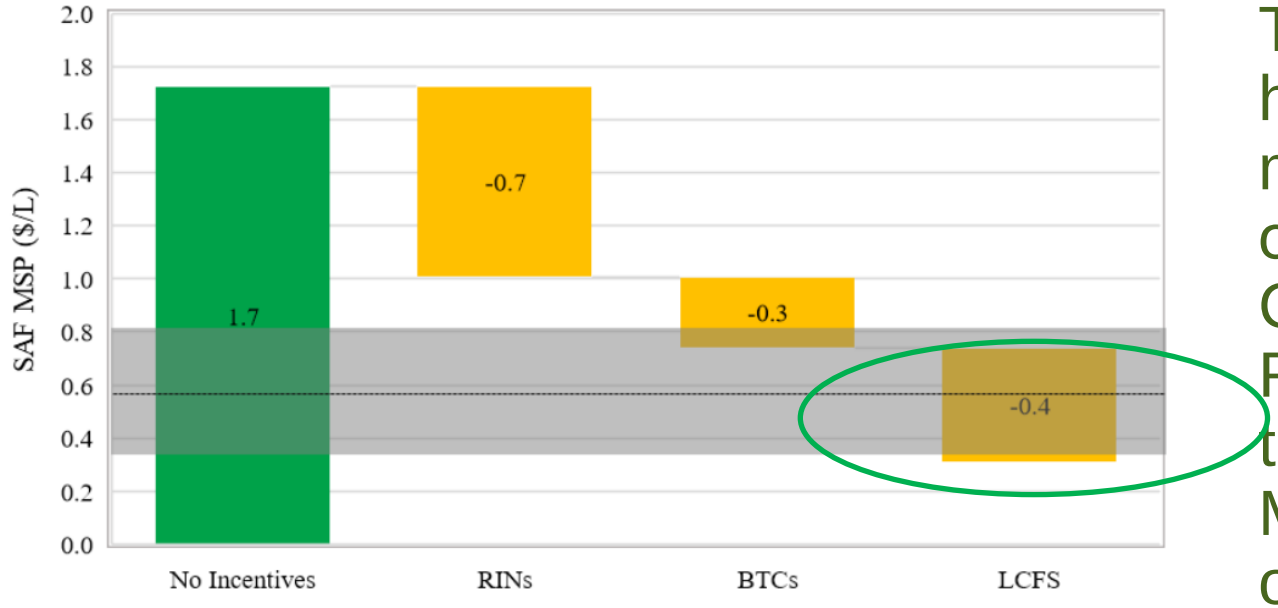
EXAMPLE: 5 Project analysis (Million USD)	*Simplified cost-benefit example - project grant*										
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Capital costs											
Project construction	-250										187.5
Project grant	50										0
Interest free loan	100										-100
Improvements						-25					17.5
Equiptment	-10					-10					5
Total	-110	0	0	0	0	-35	0	0	0	0	110
Operating costs											
Aggregate annual costs		-5	-15	-20	-20	-20	-20	-20	-20	-20	-20
Revenues											
Subsidy		1.5	2.5	4	4	4	4	4	4	4	4
Annual aggragate revenues		15	25	40	40	40	40	40	40	40	40
Net Cash Flow	-110	11.5	12.5	24	24	-11	24	24	24	24	134
Discount rate	9%										
NPV	**$46.59**										
IRR	**15%**										

Combining some policy mechanisms can make an otherwise unattractive project successful. This example generates a forecast Net Present Value (NPV) of $46.59 million at an internal rate of return (IRR) of 15.1%. Even at a discount rate of 9% this project is comfortably acceptable.

This interactive modelling tool will be made available on the ICAO website, for policy makers to explore the economic effects of various policies on a SAF project.

How do policies impact SAF Minimum Selling Price?

The report proposes 5 examples to illustrate the effects of policies on the minimum selling price (MSP) of SAF for a given plant.



This example shows the hypothetical effect of combining 3 measures from the US policy context (Blenders' Tax Credit, Low Carbon Fuels Standard and the Renewable Fuel Standard). Thanks to the combined measures, the MSP falls under the average price of fossil jet fuel.

This interactive modelling tool will be made available on the ICAO website, for policy makers to explore the economic effects of various policies on a SAF project.

Policy examples – EU, US, UK

Among others, the European Union, the United States and the United Kingdom have developed/are developing their own SAF strategies/policies*.

1. European Union
   - EU-wide SAF mandate with obligations on fuel suppliers to distribute increasing shares of SAF at EU airports from 2025 onwards.
2. United States
   - Multi-agency SAF Grand Challenge Roadmap
   - IRA legislation includes the Sustainable Aviation Fuel Credit (“SAF blenders tax credit”) of $1.25 per gallon of SAF achieving at least 50% GHG emissions savings vs fossil jet fuel (2023-2024)
   - Clean Fuel Production Credit, up to $1.75 per gallon of SAF (2025-2027)
3. United Kingdom
   - UK is preparing a SAF mandate from 2025 onwards. Obligation on fuel suppliers to reduce the GHG emission of aviation fuel by the equivalent of at least 10% SAF use by 2030.
   - Government support with Advanced Fuels Fund competitions (165 million) launched in July 2022, with the aim to have at least 5 commercial-scale SAF plants under construction by 2025.
   - Establishment of a “Jet Zero Council SAF Delivery Group”.

*Some of the policies listed above may still be in the process of preparation/validation. Policy elements may not be definitive and could still evolve.

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