TEMPLATE FOR BUSINESS IMPLEMENTATION REPORTS ON SUSTAINABLE AVIATION FUELS

Version 1.0 (July 2024)

FOREWORD

The ICAO Assistance, Capacity-building and Training for Sustainable Aviation Fuels (ACT-SAF) Programme was launched in June 2022. Its objective is to enable States to develop their full potential in SAF development and deployment, in line with the ICAO's *No Country Left Behind initiative*, the 2050 ICAO Vision for SAF, and the three main pillars of sustainable development – economic, social, and environmental, recognized by the United Nations. With the adoption in November 2023 of the ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies, ICAO and its Member States have agreed to strive to achieve a collective global aspirational Vision to reduce CO_2 emissions in international aviation by 5 per cent by 2030, compared to zero cleaner energy use.

National feasibility studies and business implementation studies will help States develop SAF supply chains and contribute to this achievement. In supporting States' preparation of SAF feasibility studies, ICAO developed a template and an accompanying guide to facilitate the preparation of standardized state-level feasibility studies on SAF. This was published in July 2023. Examples of feasibility studies, applying the template, and developed under the ACT-SAF programme can be found here.

As a next step, ICAO has developed a template to support SAF business implementation studies and reports. This provides follow up support for States where a SAF feasibility study has already identified prospects for the establishment of a domestic SAF supply chain, notably with indications of feedstock availability, viability of production pathway supplemented with sustainability and life-cycle assessments, as well as preliminary assessments of SAF production costs and market supply/demand.

This template can be used to support a "ready-to-invest" report at a project level, with the participation of all SAF value chain actors, facilitating final investment decisions to drive the start of a concrete SAF project, culminating in the certification of CORSIA Eligible Fuels. In doing so, the template supports the ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies, in particular in *Building Block 3 – Implementation Support*, in supporting a 'project's readiness to attract investment, including training on financial aspects of project development, financial planning and investment promotion' (Paragraph 18g), and *Building Block 4 – Financing*, to 'initiate specific measures or mechanisms so as to facilitate, in particular for developing countries and States having particular needs, better access to private investment capacities, as well as funding from financial institutions' (Paragraph 26a, ICAO Assembly Resolution A41-21 Paragraph 18a).

The use of this template is not mandatory, but offers useful reference for States.

The structure of the template is summarized as follows, and the overall flow of the development of the project is detailed in the Annex:

- Executive Summary
- Section 1: Market Analysis (Scenario and Assumptions)
- Section 2: Techno-economic assessment and results
- Section 3: Financial and Operational Assessment of the project
- Section 4: Risk assessment
- Section 5: Business Implementation recommendations

For any questions, assistance, or suggestions, please contact the ICAO Secretariat by email (officeenv@icao.int) indicating "**ACT-SAF BIR template**" in the subject of the email message.

ICAO extends its appreciation to Kenya, Spain, Air Company, Airbus, IATA, Oneiros Aerospace Limited, SAF Investor, SFS Ireland, and all our other ACT-SAF Partners who have contributed to the preparation of this Template.

EXECUTIVE SUMMARY

The Executive Summary provides a concise, high-level overview of the entire business implementation study and report, highlighting the most important and relevant findings, and recommendations for stakeholders. It provides an overview of the scenario and assumptions, development of the techno-economic assessment, business case development and assessment, the proposed project implementation, and policy and financing opportunities mapped. The Executive Summary should also highlight the main partners engaged, such as collaboration from public entities, industry, etc.

Starting with the results of a preceding SAF feasibility study, a description on the approach towards the selection of one or more shortlisted feedstock / fuel conversion pathways for a techno-economic assessment should be elaborated. Suitability of a location for a SAF project, and key financial details of interest, e.g. financial projections, KPIs including Internal Rate of Return (IRR), Return on Equity (ROE), etc. should be provided.

With the results from a techno-economic assessment, it should highlight other key issues associated with the development, deployment and commercialization of a SAF project in the State, assessing project risks, operational/commercial considerations and mitigation means. This should incorporate multiple perspectives, such as from the government, fuel producers, feedstock producers, airlines, and other key stakeholders.

The following tables below provide additional guidance of how the Executive Summary may be framed.

Market analysis (Scenario and assumptions)

Provide a brief overview of the background of the business implementation study, its main objectives including references to previous feasibility studies.

Describe the scenarios, assumptions, and methodology following the shortlisting of feedstock/conversion pathway(s). This should include details on i) Location, supply chain, and scale; ii) General facility inputs; iii) Process and energy/utility inputs; iv) Financial inputs; and v) Other inputs, as described in Section 1

Techno-economic assessment

Summarise the techno-economic assessment undertaken (Section 2) of shortlisted feedstock/conversion pathway option(s) informed by the scenario and assumptions defined in Section 1.

Include key findings, highlighting the most important and relevant information for the State and its stakeholders, such as minimum fuel selling prices, CO_2 abatement costs, and NPVs.

Sensitivity analysis may be applied to account for bull/bear cases for input parameters.

If viability of the business case will be conditioned by the presence of supporting policy and financing mechanisms, it should also be reflected here.

Financial and operational assessment of the project

Summarize the main characteristics of the business case developed, and proposed project implementation. This should include the project objectives (e.g. setting out the implementing parameters for a pilot/demonstration facility, and/or business case supporting the production of a full size SAF production facility, its scale) and relevant information for the State and its stakeholders such as the chosen feedstock and production technology pathway, the identified treatment/refining site and facility's production capacity (total and SAF), taking into account feedstock and production yields, utility and supply chain requirements, as well as the supply infrastructure.

Highlight the project's social and environmental benefits such as potential of jobs created locally, carbon abated, energy dependency reduction, etc.

Regulatory issues, such as permits required, environmental assessments at a state/federal level, and its expected timelines for approval should also be factored. Sustainability assessments that need to be adopted, aligned with CORSIA sustainability criteria, sustainability certification, and the methodology for the assessment of life cycle emissions used for CORSIA Eligible Fuels.

Summarize the projections for resource utilization and SAF production. Also, this section should highlight the type of stakeholders that have been consulted for the purpose of the project.

Risk assessment

Summarize the challenges and barriers that need to be addressed in order to realize the SAF opportunities, together with means of mitigation. Include, as possible, Environmental and Social (E&S) impact assessments.

Business implementation recommendations

Explores final recommendations, identify and describe next steps. It should also aim to identify interested project partners, including investors. If applicable, it may also highlight strategies for industry stakeholders for securing project finance.

List of Definitions, Abbreviations and Acronyms

SECTION 1. MARKET ANALYSIS (SCENARIO AND ASSUMPTIONS)

This section commences the deep-dive into at least one shortlisted feedstock / pathway that has been identified in a preceding SAF feasibility study, and thereafter sets out the methodology, scenario, and assumptions that will be used in a techno-economic assessment.

A recap on the shortlisted feedstock/pathway may be provided, summarizing its comparative sustainability and life-cycle assessments, with other feedstock/pathway options.

Effort should be made to ensure that methodology-wise, the type of valuation model (e.g. discounted cashflow, etc.) for the business case are to be explained, highlighting key outputs determining economic viability (e.g. Minimum Fuel Selling Price, Net Present Value).

Sources of technical information regarding SAF production facilities could be obtained from technical modelling, academic literature, industry norms, as well as engagements with technology providers. Interactions with stakeholders (States' economic development agency, technology provider, facility developer) supporting the assumptions may also be mentioned in this section.

On scenario and input assumptions, information on key parameters (general, utility, financials), may be provided and explained. Details are set out in the boxes below.

1.1 Location, supply chain, and scale

Background information on energy infrastructure, existing refinery capacities, use of aviation fuel (conventional/SAF), State's energy transition plan(s)/roadmaps/policies, fuel demand, stakeholder interests, etc. that can allow the State to gain a better understanding on the basis of the scenario, may be mentioned here.

The volume of national or regional feedstock supply and logistic options, coupled with existing demand for its other uses, will set out the basis for the scale of the SAF facility. Suitability analysis for the location for a SAF project should also be detailed

This will typically involve discussions with fuel suppliers and airport operators within a State.

1.2 General facility inputs

Provide information such as:

- *Construction timeframes (start, duration)*
- *Expected capacities (SAF, other products with economic value) over time*
- *Expected timeline for ramping up of operations towards full capacity*
- *Planned /Estimated uptime / downtime*
- *Operational lifespan*
- *Capex*
- *Other off-site costs*

Much of these information feeds into subsequent analysis on the economic viability of the feedstock/production pathway, thereby setting up the business case.

Information may be obtained from local industry stakeholders, technology providers, analysis of SAF facilities with comparable capacities, etc. If there are industry norms (e.g. timeline for ramp up of capacity), they may also be explained here.

1.3 Process and energy/utility inputs

Defining the parameters and provide information such as:

- *Availability and cost of energy/utility inputs (electricity, water, hydrogen, natural gas, etc.)*
- *Availability (national/regional supply) and cost of feedstock*
- *Opex*

Information over energy/utility inputs are typically obtained from State's energy market authorities – in which details over transition from grey – clean electricity may also be provided. This could have implications on the overall sustainability assessments of SAF production.

Feedstock supply and prices are typically obtained from local stakeholders, showcasing a range of prices for depending on pathway (e.g. HEFA – used cooking oil, tallow), with details on where they are sourced from, and the upstream supply chain, and assumptions of the feedstock mix. Some feedstock (e.g. municipal solid waste) may have negative prices. Expected price variability for the considered inputs, including feedstock and its logistics/supply, along the expected life of a facility is recommended to be shown here, as well as possibility of establishing long term supply contracts.

1.4 Financial inputs

Provide information such as:

- *Cost of capital*
- *Tax rates*
- *Expected return on equity*
- *Internal rate of return*
- *Depreciation*
- *Payback period*
- *Buildup towards discounted cashflow*
- *Sensitivity Analysis*

Some of the information would be obtained from the State (e.g. corporate tax rates), whilst others will require discussions with potential project partners (e.g. existing fuel (non-SAF) producers/suppliers) in the State.

1.5 Other inputs

Provide information such as:

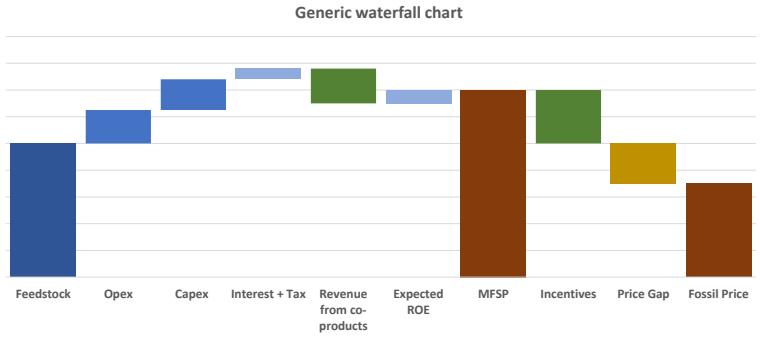
- *Presence of policies and incentives that may impact the business case*
- *Reference jet fuel price*
- *Prices of co-products*

The type of policy/incentives on SAF, or co-products may have implications on the overall business case (e.g. resulting in a positive/negative NPV) – it should be highlighted, where applicable.

SECTION 2. TECHNO-ECONOMIC ASSESSMENT AND RESULTS

This section applies the input parameters (scenario and assumptions from the preceding section) into a techno-economic assessment, providing the results assessing the viability of a SAF project in question.

Applying the input parameters, key findings and outputs such as capital and operating expenses (CapEx, OpEx), Total Capital Investment (TCI), Net Present Values (NPV), Minimal Fuel Selling Price (MFSP), price gap vis-à-vis fossil jet prices, CO_2 abatement cost, demand/supply forecasts and any indicators highlighting the viability of the investment such as Internal Rate of Return, are to be expected. Many similar studies apply a waterfall chart outlining the cost/revenue breakdowns and the outputs as a visualization tool. These outputs may be compared against ICAO's set of heuristics or 'Rules of Thumb' for SAF.



Depending on the scope of the study, sensitivity analysis may be applied, taking into account bull/bear cases in each input parameter – in such cases, the deviations from the base scenario have to be explained clearly (e.g. how one input is expected to deviate more/less than the other). At times, the analysis will show which inputs (and its interrelated parameters) are more critical to impacting the NPV (e.g. cost of energy/utility inputs in PtL pathways)

At times, different technology providers for the same production pathway may reflect different costs, hence, its key outputs could be varied.

The type of supporting policies / incentives, if present, will also impact the NPV, and should be included.

SECTION 3. FINANCIAL AND OPERATIONAL ASSESSMENT OF THE PROJECT

This section **develops the business case** and provides an assessment to define and understand the economic and operational potential of the project, based on the outcomes from the preceding section.

Information related on location of a facility, options for SAF integration to the aviation fuel supply chain, should be detailed here. It is also important to indicate the accuracy of Capex/Opex estimates that are being done (e.g. +/- 50%, 30%, 10%) – as the work progresses towards more detailed front end engineering and design studies, towards final investment decisions, a certainty level of +/- 10% would be expected

An operational assessment may provide information on facility general plot plans, development timelines, implementation schedules, taking into account availability of local resources (including impact on jobs), the fuel supply chain, as well as identifying gaps that need to be addressed (e.g. presence/efficiency of SAF quality certification, blending facilities).

Sensitivity analysis/impact from input parameters, especially key cost drivers where prices may evolve in the future, when it is likely to take place, thereby leading to a more viable business case, may also be analyzed in greater detail in this section.

While an outcome of a positive NPV represents the most ideal scenario, in cases where a negative NPV is generated, the assessment may focus on potential viable government interventions (e.g. supporting policy such as minimum guaranteed prices) and discussions from industry engagement. SAF offtake potential, incidence of a supporting policy landscape (e.g. environmental regulations) further supporting the economic assessment of the project, could be included.

Regulatory issues, such as permits required, environmental assessments at a state/federal level, and its expected timelines for approval should also be factored into the assessment. An approach could be to engage practitioners working on other renewable energy projects, as similar requirements are likely to apply for SAF facilities.

This section should also explain the sustainability assessments that needs to be adopted, aligned with CORSIA sustainability criteria, sustainability certification, and the methodology for the assessment of life cycle emissions used for CORSIA Eligible Fuels.

Feedback from additional domestic and regional industry stakeholders on the above, with potential capacity to participate in a business case implementation, may also be documented in this section. Examples may include airlines, that through agreements, alliances, or investments into SAF projects, can help lower the financing risks for projects, as well as bridge financial and operational gaps.

SECTION 4. RISK ASSESSMENT

This section highlights the challenges and barriers that need to be addressed in order to realize the SAF opportunities, focusing on risks (identifying, analyzing, prioritization)

Common challenges include scalability, impact on the aviation market's competitiveness, those related to feedstock supply (seasonal variations, regional availability constraints, transportation/logistics), technology risks (requiring the consideration of performance guarantee insurance for technologies), other financial risks. Competition with the proposed refinery's alternative products (e.g. renewable diesel), taking into account policy incentives favouring other transportation sectors may also be considered. They may be evaluated in terms of likelihood, as well as impact to project success.

An assessment of implications on air transport costs and aviation market competitiveness of any proposed SAF supply objectives and policy options may also be addressed.

The report should include mitigation means to address these risks and challenges. It would also be useful to include a risk monitoring and review plan, regularly reviewed and updated in light of developments. A scenario analysis to assess the robustness of the project under different conditions to analyse the impact of these scenarios on the viability of a potential SAF project could be included in this section.

Where additional analytical tools (SWOT, PESTEL) may prove useful in structuring the assessments in Sections 3 and 4, they may be used.

SECTION 5. BUSINESS IMPLEMENTATION RECOMMENDATIONS

This section explores final recommendations for the business case.

It should aim to identify interested project partners - if more than one has been identified, support towards setting out the structure of a possible Public-Private Partnership (PPP) or joint venture should be provided, outlining key areas such as division of expenditures, access to technology, procurement methods, etc.

It should also identify potential financial institutions (both public and private), that could provide the necessary funding (equity/debt) for the SAF project. Strategies for securing project finance may be incorporated. If possible, support in linking up project partners with these potential financial institutions can be done. Initial preparation for an application may be included.

An action plan, if developed as a recommendation, should be aligned with the State's existing and planned policies related to SAF development.

Linkage to the ICAO State Action Plan process the support LTAG monitoring may also be included.

Annex

Overall flow of the development of a business implementation project