

ALIGHT

SUSTAINABLE AVIATION

D8.2 Table of Metrics

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Table of Metrics

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1 Background

The overall mission of the ALIGHT project is to enhance sustainable aviation. With Copenhagen Airport (CPH) as lighthouse the project will bring forward the necessary solutions, knowledge, guidelines and best practice handbooks supporting an efficient airport paradigm shift towards zero emission aviation and airport operation. Fellow airports will replicate the example set by Copenhagen Airport. Through effective communication, the mission is to ensure maximum impact throughout the European and international aviation industry both during and beyond the duration of the project.

2 Definitions

Measure: a fundamental or unit-specific term

Metric: a quantifiable measure used to track progress and evaluate success

KPI: a key performance indicator is a quantifiable value used to track progress against set goals. KPIs provide direction towards achieving desired results and can help make better-informed decisions

KPA: a key performance area. It has to be underlined that these key performance areas (KPA) – focus areas - are consistent with the ones used by ICAO and Eurocontrol in its performance driven approach in SESAR (Single European Sky ATM Research Programme)

It's important not to confuse a metric with a measure. While a measure is a fundamental or unit-specific term, a metric can be derived from one or more measures.

Metrics are different “data points” that, when combined, make up a KPI.

3 Objective

The purpose of Deliverable D8.2 “Table of Metrics” is to define a set of metrics to be used in support of following progress in the implementation of ALIGHT and its two fields of development through dedicated KPIs:

1. Sustainable Aviation Fuel strategies (SAF) – Workstream A
2. Smart Energy Airport – Workstream B

In addition, metrics specific to sustainability (WP6) will be added, as a main contribution to Key performance indicators (KPIs) towards reporting about sustainability, such as in the framework of the commitment to the Paris Agreement and UN SDGs (United Nation Sustainable Development Goals).

These metrics shall contribute to and represent/compose Key Performance Indicators (KPIs) relevant for airports and representing their parameters of concern in both sustainable aviation fuel and smart energy airport’ strategies. These metrics are the basis for field performance monitoring, including economic, technical, operational, social and environmental indicators. These Metrics intend to support the decision-making process and definition of long-term strategies with related roadmaps & targets.

The values of these metrics will be the basis towards quantifying impacts from ALIGHT related activities, as well as for collecting reference data to quantify best practices. This deliverable will, thus, support replication and scaling-up of all ALIGHT outcomes.

It has to be noted that the majority of KPIs set in ALIGHT won’t move to significant improvement during the implementation of the project. Indeed, the aim of these KPIs is to follow the long-term progress of SAF and Smart Energy Airport related roadmaps implemented in airports, while ALIGHT’s aim is to define and set these roadmaps and KPIs towards easing the set of targets, actions plans and ways to follow progress of their implementation in replication and scaling-up phases.

This table of metrics deliverable will, thus, be considered in the replication toolboxes developed in ALIGHT for both topics, SAF and Smart Energy Airport, as well as for setting a Bold vision for future airports in 2050.

However, not all metrics will fit and be relevant for all airports, as local context differs. Thus, the replication toolboxes will propose this long list of metrics as a reference one where airports could select the appropriate and relevant metrics for their specific needs and usages. The objective of this list is for all airports to

refer to similar metrics - rather to create new ones with similar aim -, which will generate data that are comparable and feed later benchmarks of best practices, success stories, etc.... as well as “standardized” performances’ reporting.

4 Collection of metrics

The Metrics are defined as values used in a combined manner to “compose” Key Performance Indicators (KPIs) with quantifiable values, as from Alight project, in a way to support actions and targets towards decarbonizing the airports.

4.1 Collaborative Approach

These metrics are developed with all ALIGHT partners in a collaborative approach, and especially using inputs from vertical WPs, about Sustainable Aviation Fuels (SAF) - WPs 2 and 3 -, respectively Smart Energy Airport - WPs 4 and 5 -, as well as horizontal WP 6 about sustainability, WP 7 Cooperation Activities and WP 9 about Airport Development, transfer and tailoring of solutions (Figure 1).

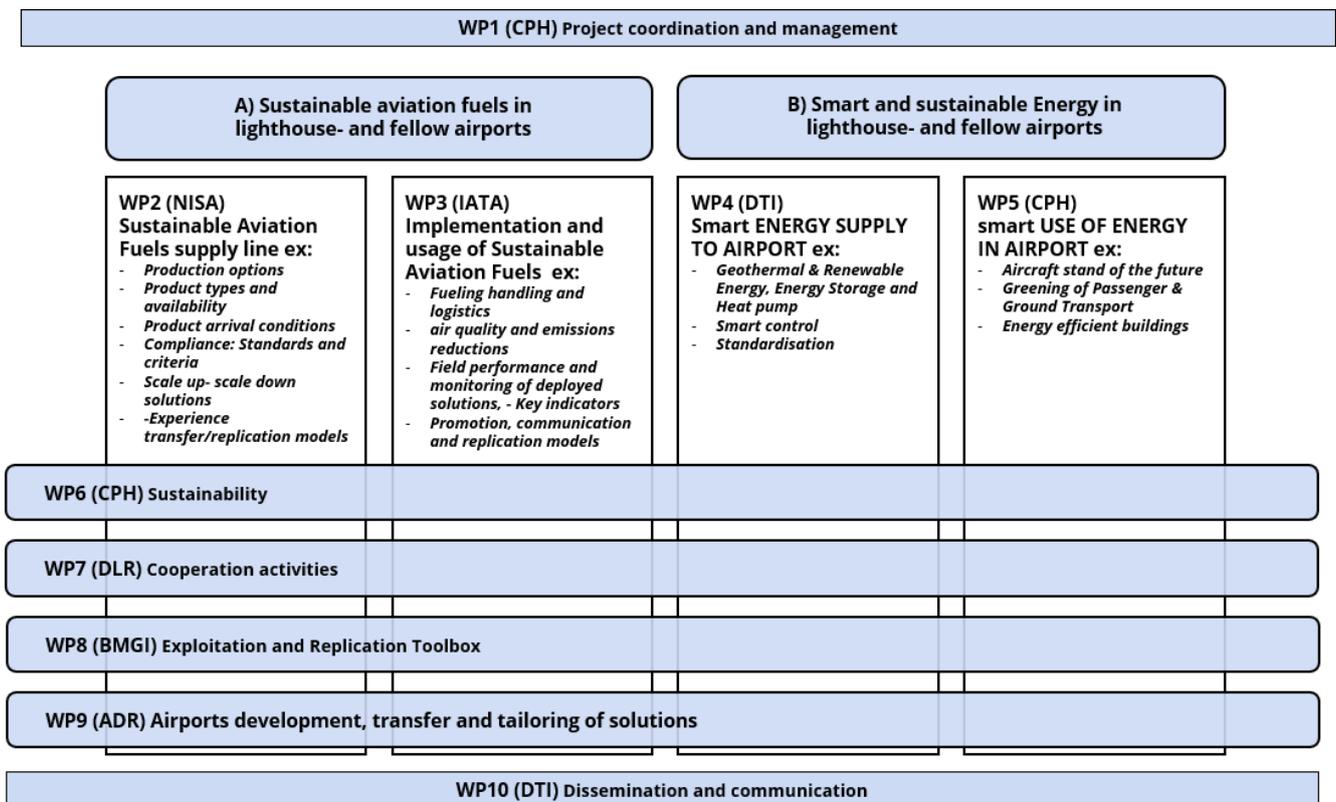


Figure 1: ALIGHT Work Package structure

The present Deliverable D8.2 contents the full table of metrics that will reflect the outcomes and needs for SAF, Smart Energy Airport and Sustainability related indexes towards drafting replication toolboxes (Deliverables D8.4 and D8.5) and towards preparing a Bold vision for future airports in 2050 (Deliverable D8.6).

The team worked through a couple of creativity sessions to finally identify, discuss and adopt the relevant organization of the tables, from focus areas of concern (KPA) and topics for which KPIs will be needed. Each Workstream and WP6 has considered this description and organization of KPIs' categories in their respective WP(s) development, for identifying and defining the relevant sets of metrics needed for composing the respective KPIs.

Figure 2 below represents the general organization

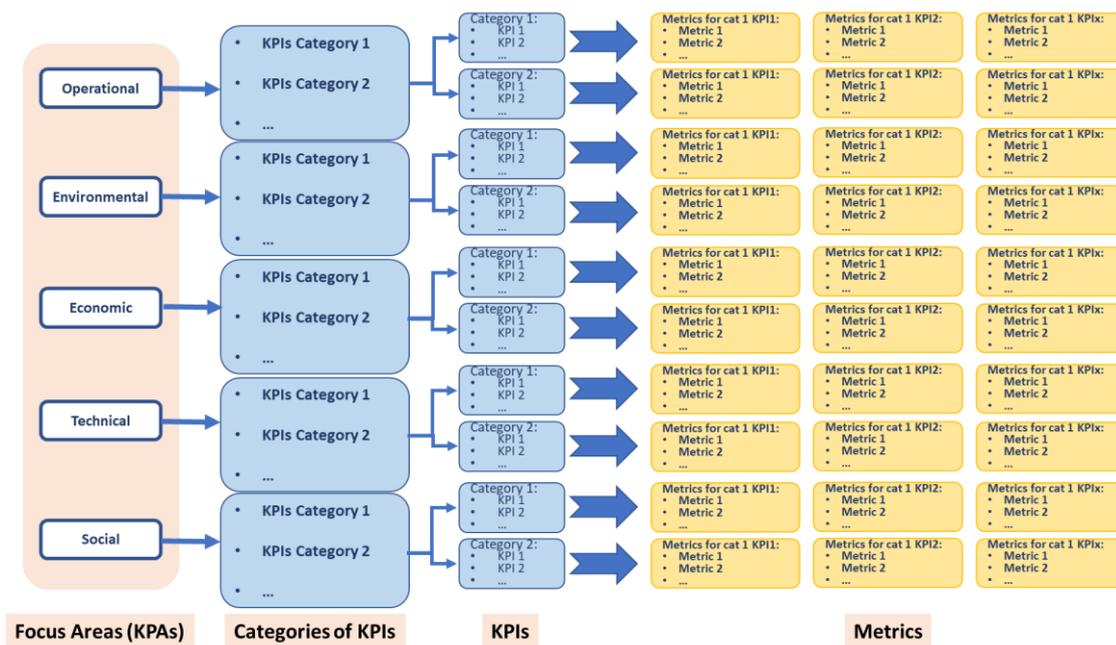


Figure 2: organization of the table of metrics

4.2 Categories of tables of metrics

Three categories of table of metrics are defined in coherence with the respective domains of ALIGHT activities and their needs towards setting KPIs:

- a) Sustainable Aviation Fuels (to facilitate the deployment of sustainable aviation fuels)
- b) Smart Energy Airport (to facilitate the achievement of a zero-carbon emission airport)
- c) Sustainability (gathering sustainable related metrics from Workstreams A and B, and adding specific ones towards reporting about sustainable development and improvement)

4.2.1 Workstream A: Sustainable Aviation Fuels (SAF)

Five focus areas (KPAs) are considered:

- Operational
- Environmental
- Economic
- Technical
- Social

The definition of appropriate categories of key performance indicators refers to each of these KPAs:

- Operational (such as deployment and logistics)
- Environmental (e.g. GHG emission reduction and local air quality)
- Economic (e.g. price, market availability, supply security),
- Technical (e.g. impact on fuelling process, on aircraft maintenance– considering that effects may be difficult to observe at low SAF blend rates),
- Social (e.g. communication, awareness raising, public acceptance)



The Key performance indicators (KPIs) will be defined to support the performance monitoring as part of the development, implementation and usage of SAF.

Thus, and based on the project plan, Metrics in the field of Sustainable Aviation Fuels shall consider the establishment of relevant Key performance Indicators (KPIs) in support of meeting reliable sustainable solutions in support of decarbonization, that is developed in WP3.

A two layers description is proposed, with a top layer consisting of focus areas – KPIs - (Figure 3).

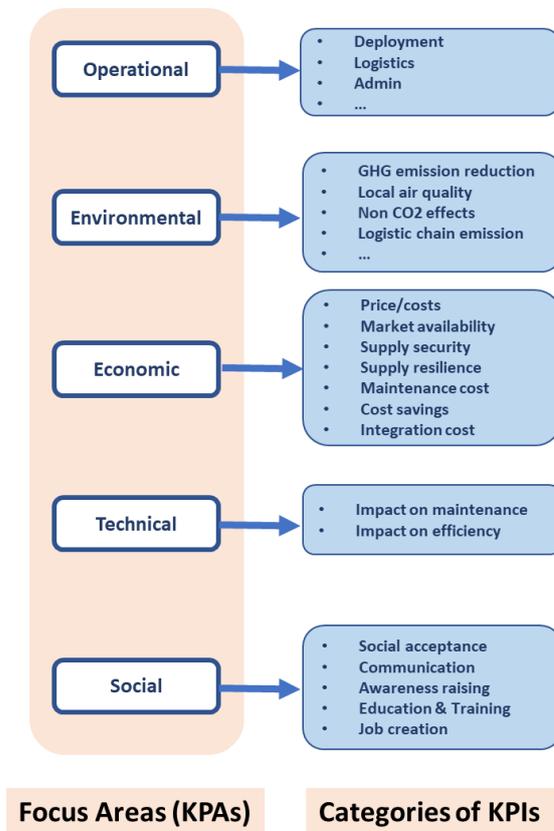


Figure 3 : ALIGHT Workstream A KPAs and categories of KPIs framework

It has to be underlined that these focus areas are consistent with the principle of key performance areas (KPA) used by ICAO and Eurocontrol in its performance driven approach in SESAR (Single European Sky ATM Research Programme). In this two layers description, the focus areas serve to categorize main aspects of SAF implementation in one thematic category of KPIs. This helps in an easy-to-consider-and-to-represent multidimensional approach of implementation of SAF.

KPIs will be determined in order to represent these categories. There will be composed a list of KPIs for each category. These KPIs shall support the evaluation of progress from the actions implemented within Alight, and especially beyond the project in support of replication and scaling-up, towards meeting key targets set in each focus areas (KPA), such as described in Figure 3.

Metrics will then be defined in order to compose each KPI, as described in Figure 2.

4.2.2 Workstream B: Smart Energy Airport

In the same spirit as for Workstream A, Metrics in the field of Smart Energy Airport shall consider the establishment of relevant Key performance Indicators (KPIs) in support of meeting reliable sustainable solutions towards a fossil free airport roadmap.

The same five focus areas (KPAs) are considered:

- Operational
- Environmental
- Economic
- Technical
- Social/Communication

The definition of appropriate categories of key performance indicators refers to each of these KPAs:

- Operational (energy consumption)
- Environmental (e.g. GHG emission reduction, energy supply from renewables)
- Economic (e.g. costs),
- Technical (),
- Social (e.g. enhancing local work force)

A table of metrics will be elaborated, with the same approach as for SAF (4.2.1 above)

All metrics to be collected in order to meet the targets set for each field and each of the KPI categories will composed a list of KPIs. These KPIs shall support the evaluation of progress from the actions implemented within Alight, towards meeting key targets.

Figure 4 describes this organization for field "Smart Energy in Airports":

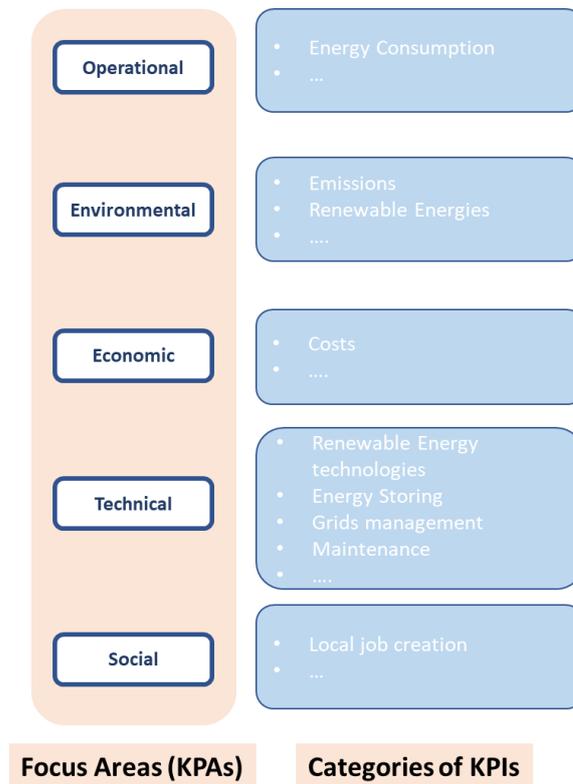


Figure 4: ALIGHT Workstream B KPAs and categories of KPIs framework

4.3 Metrics for Sustainability

In the same spirit as for Workstreams A and B, Metrics in the field of Sustainability (WP6) shall be considered as a main contribution to Key performance indicators (KPIs) towards reporting about sustainability, such as in the framework of the commitment to the Paris Agreement and UN SDGs (United Nation Sustainable Development Goals).

Thus, a list of metrics about sustainability, with the aim to support airports' reporting, would help in harmonizing the reports and benchmarking best practices and their impacts.

The organization of this table of metrics dedicated to sustainability will also include the metrics related to sustainability from Workstream A and Workstream B, in a way to consider what will be useful for reporting about sustainability. Furthermore, metrics considered within workstream A and B will most likely also be

relevant in the context of sustainability considering the scope of the project of Alight.

This set of metrics towards sustainability will then allow the quantification of key sustainable targets defined in WP6 in support of replication, scaling -up and bold vision, and thus feed the respective KPIs.

These KPIs will support the follow-up of progress against sustainable targets, such as set towards meeting our EU Paris agreement commitment, UN SDGs and local/national sustainability strategic objectives.

5 Table of Metrics

This chapter describes all categories of KPIs and a list of related KPIs, for which metrics are needed, in each Workstream and WP6 (sustainability).

Each KPI will be represented by one or several metrics. A point of attention is about the “name” of each metric, that need a clear definition. Metrics’ Terms and definition, as well as units (when applicable) are a full part of this final list of metrics.

This Deliverable D8.2 contains the long list of metrics airports would be recommended to collect towards composing the main KPIs for each category of KPIs, towards progress and reporting of each focus area (KPA).

5.1 Lists of Metrics

Three lists of Metrics are elaborated from WPs inputs, one for Smart Aviation Fuels (SAF), another for Smart Energy Airport, and the third one for sustainability. All ALIGHT partners contributed in a collaborative manner to feeding these lists, as part of each Workstream’s work. These lists are organized through the above categories’ description (Chapter 4.2).

5.1.1 List of Metrics for Sustainable Aviation Fuels (SAF)

The metrics to be defined are listed in table 1 below, in different subtables that reflect the different SAF related “scopes” and “issues” an airport is concerned with.



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KPA's	Category of KPI's	KPI's	Metrics
<p>Economic</p> <p>Operational</p> <p>Technical</p>	<p>eSAF development:</p> <p>Arcadia eFuels,</p> <p>Fjord eFuels,</p> <p>PtX plant-project</p>	<p>National prioritization</p> <p>Progress and main steps:</p> <p>Capacity potential</p> <p>Construction start-up</p> <p>Grid integration</p> <p>Sector couplings [costs]</p> <p>Deployment plan</p> <p>Challenges/barriers</p>	<p>Approvals</p> <p>Feedstocks</p> <p>Technology decisions,</p> <p>Financial Investment De-</p> <p>isions (FID),</p> <p>Product sales options</p> <p>Political support</p> <p>Value chain obligations</p>
<p>Environmental</p> <p>Communication</p>	<p>Fossil fuel reduction</p> <p>Renewable energy supply</p>	<p>CO2/GHG reductions</p> <p>Air quality (local)</p> <p>Publications etc.</p>	<p>Calculated usage</p> <p>SAF contribution</p>
<p>Social</p>	<p>New jobs, investments and</p> <p>new technology-knowledge</p>	<p>Contributions local: Actions,</p> <p>jobs, financials</p>	<p>Number of jobs/busi-</p> <p>nesses</p>
KPA's	Category of KPI's	KPI's	Metrics
<p>Economic</p> <p>Operational</p> <p>Technical</p>	<p>SAF accessibility: SAF pool</p>	<p>Program developed</p> <p>Meetings and dialogues</p> <p>SAF pool discussed</p> <p>Involvements</p> <p>Postpone/put on hold</p>	<p>Organizations</p> <p>Description</p>
<p>Environmental</p>	<p>Fossil fuel reduction-potential</p>	<p>Delivery options</p> <p>Amount of SAF</p> <p>Local air quality</p>	<p>Potential amount of:</p> <p>Tonnes</p> <p>GHG reductions</p> <p>Airlines</p> <p>Others</p>

KPA's	Category of KPI's	KPI's	Metrics
Economic Operational Technical	SAF delivery and storage	Segregated delivery and storage Potential for optimize the use of SAF and use where it is most beneficial	Potential: - Optimize SAF quantity - Calculated usage (N/A) - SAF contribution (N/A)
Environmental	Fossil-fuel reduction	Potential: - Non-Co2 reduction - Improvement of air quality (at airport)	Transport - supplier Airport - storage Distribution Airlines
Social	Jobs / workplace / investment in import, export, storage at airport	Strategy / decision makers	
Communication	Knowledge sharing	Communication between Stakeholders, Airlines, Airports, SAF producers	
KPA's	Category of KPI's	KPI's	Metrics
Economic Operational Technical	SAF purchase Air Greenland a.o	SAF amount Share of CAF at CPH Share of Danish domestic Method + documentation	Tonnes or litres Supplier doc. -
Environmental	Fossil fuel reduction	CO2/GHG reductions Air quality (local)	Calculated share Share of local air quality- improvement
Communication		Publications, media, web etc.	
Social	Jobs, investments export	Contributions local: Actions, jobs, financials	Production and transport investments and jobs

KPA's	Category of KPI's	KPI's	Metrics
Economic Operational Technical	Electric aircraft Prepare future operations	Program/proposal Aircraft stand of the future Aircraft types/producers Conceptual design Recommendations Coordination/network	Publish Overview/amount Potential develop- ments Recommendations for: Airports Producers/developers Regulators Decisionmakers
Environmental	Emission reductions	Energy used compared with conventional jet	Simulated energy
Communication		Reports, web, SM, confer- ences, simulation program	Communication ef- forts Initiatives taken
Social	Jobs/workplaces, invest- ment, new green technol- ogy/companies/ subcontractors	Companies, jobs and in- vestments	Estimated expansion
KPA's	Category of KPI's	KPI's	Metrics
Economic Operational Technical	SAF purchase FGF (Fly Green Fund) Primarily Sweden experi- ences	SAF purchasing program Customers involved SAF amounts 2015-2025 Method + documentation	Number Tons of fossil fuel re- placed Supplier/FGF doc
Environmental	Fossil fuel reduction	CO2/GHG reductions	CO2 reduction
Communication		Publications, media, web, ..	
Social	Jobs, investments export	Contributions local: Ac- tions, jobs, financials	Investments and jobs

KPA's	Category of KPI's	KPI's	Metrics
Economic Operational Technical	SAF supply line	Conditions Local supply process Approvals Inspections Transport Handling modes Storage Logistics Quality	Documentation Certificates, regulations
Environmental	Best practices		Documentation and values referred
Communication	Documentation		Certificates,
Social			

Note: SAF regulations, mandates, conditions, production, delivery options, conditions for the supply of sustainable aviation fuels to Copenhagen Airports were identified and analysed - NISA -see Best practice handbook and tools for fuel logistics, fuel quality monitoring, handling and responsibilities.

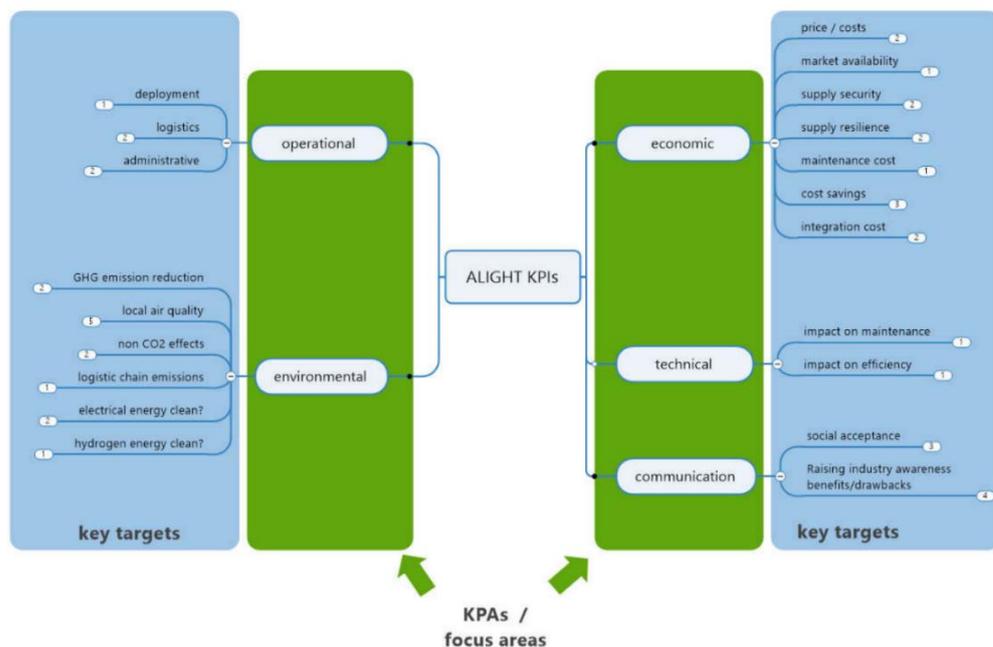
Table 1: List of Metrics for SAF

5.1.2 List of Metrics for Smart Energy Airport

The metrics to be defined are listed in table 2 below.

The KPIs related to Smart Energy Airports aim to:

- Increase use of smart energy management of various airport applications
- Support a potential increase in the airport’s own renewable energy production
- Improve climate effects of energy production and use at the airport
- Improve environmental effects of energy production and use at the airport
- Support local job creation for smart energy projects



Overall KPIs relevant to track progress within the field of smart energy are listed in the following table. In addition to these overall KPIs, two related tools have been developed within Alight:

- 1.22b KPIs for smart energy:** To help airports in defining more specific KPIs related to a selection of smart energy initiatives and technologies.
- 1.10.b Checklist for data collection for smart energy solutions:** To identify the needed measures and data sources to monitor and follow progress.

The tools can be found as part of D8.7¹ and will be placed in an online replication toolbox expected to be available in October 2025.

¹ D8.7 Replication toolbox for smart energy: <https://alight-aviation.eu/>



Focus Area (KPA)	Category of KPIs	KPIs	Metric
Operational	Energy consumption	Reduction of energy consumption	Annual electricity consumption [MWh/year]
			Annual heat consumption [MWh/year]
			Electricity consumption per building [MWh/m ²]
			Heat consumption per building [MWh/ m ²]
			Electricity consumption per pax [MWh/pax]
			Heat consumption per pax [MWh/pax]
			Electricity consumption per flights [MWh/flight]
Environmental	Emissions	Reduction of CO2 emissions for electricity	CO ₂ eq of electricity from grid [ton CO ₂ eq/MWh]
		Improvement of local air quality	CO ₂ eq in air
	Renewable energy technologies	Share of RES in energy mix	Local RE production [MWh/year], [MW installed]
			Self-consumption from RE [%] [Average $\left(\frac{MW\ RE\ production - MW\ export}{MW\ RE\ production}\right)$]
			Self-sufficiency from local RE [%] [Average $\left(\frac{MW\ consumption - MW\ import}{MW\ consumption}\right)$]



Economic	Costs	Reduction of energy costs	LCOE electricity [EUR/MWh]
			LCOE heat [EUR/MWh]
			Costs saved [EUR/year]
Technical	Maintenance	Working hours to maintain local RE, own charging infrastructure, storage facilities etc.	Time to wash panels pr. year [h/year] = <i>(washing time pr. panel · number of panels · washing interval pr. year)</i>
			Yearly service time for chargers [h/year] = <i>Number of chargers · yearly service time pr. charger</i>
			Reduction in service time for eGSEs [h/year] = <i>yearly service time pr. eGSE – yearly service time pr. conventional GSEs</i>
			Yearly service time for batteries [h/year] = <i>Number of battery racks · yearly service time pr. rack</i>
Social	Local job creation	Prioritising local/EU workforce	Share of local workforce used for smart energy projects [%]
		Prioritising local/EU components	Share of local/EU manufactured components in smart energy project [%]

Table 2: List of Metrics for Smart Energy Airport

5.1.3 List of Metrics for Sustainability

The metrics defined are listed in table 3 below.

In comparison with Table 1 and Table 2, respectively lists of metrics for Sustainable Aviation Fuels (SAF) and for Smart Energy Airport. For sustainability of SAF it has been taken as a framework RSB Principles and Criteria since it is aligned with RSB ICAO CORSIA standard for SAF.

Focus Area (KPA)	Category of KPIs	KPIs	Metrics
Environmental	SAF feedstock	Preservation and improvement of soil quality.	Soil organic carbon levels, sustainable practices adopted.
Environmental	SAF feedstock	Conservation. Protection of ecosystems and biodiversity.	Fulfilment of the current national legislation for biodiversity conservation
Environmental	SAF feedstock	Water conservation	Ensure availability of clean water and mitigation plan to ensure water ways are not polluted
Environmental	Air quality	Reduce air pollution components.	NOx, SOx, PM and UFP
Environmental	Monitoring of GHG emissions stemming from airport operations	Areas of emissions <ul style="list-style-type: none"> • Transportation to and from the airport • Airport ground activities • Aircraft activities (LTO) • Aircraft activities full destination (out-bound) 	CO2e

Environmental	Carbon standard for Airports	Airport Carbon accreditation Commitments	Level of accreditation
Social	Communication on SAF to passengers	Communication toolkit	Use of toolkit
Social	Food security	No adverse effects on local food access.	Conduct Food security assessment like in accordance with the RSB Food Security Assessment Guidelines
Social	Rural and Social development	Improvement of jobs linked to SAF and sustainability at airports	Increase in the number of jobs related to SAF and airports

Table 3: List of Metrics for Sustainability

6. Conclusion

Metrics are essential elements towards defining/composing KPIs, as main indicators for setting strategic targets then following progress of actions against these targets.

Instead of facing multiple definitions of similar KPIs, that prevent comparisons and alignments, Alight aims at listing a series of metrics, that could be considered as a reference towards defining appropriate and relevant KPIs.

Such an approach has multiple benefits. First, it will contribute to harmonizing targets' setting and values. Second, it will support benchmarking of practices and use cases, and thus supports deciding making and setting targets' values. And third, it will contribute in a significant manner to unifying reporting from actions towards fulfilling regulation and policies, as well as commitment, such as UN SDGs.

In the present document, a list of metrics and related KPIs has been drafted from the experience and pilots actions of Alight as a lighthouse project, for both Sustainable Aviation Fuel and Smart Energy Airport, with the aim to support transition to carbon neutral airports.

However, airports are facing different contexts, geographical geopolitical, social, economic, and with different policies and regulatory frameworks, especially local ones. To ensure coherence with these local contexts, the list of Metrics, as developed in this document, is proposed as a reference list of metrics, where each airport could find the appropriate ones in line with its own context.

In consequence, this list has not to be understood as all described metrics to be systematically implemented by each airport, but rather as a list for each airport to get the ones that fit with their needs.

This is an initial step towards standardized metrics then KPIs, Standardization Development Organisations (SDOs) – ESOs in Europe – could consider as major inputs in future standardization development.