



ICAO

ENVIRONMENT

PROJECT
FINAL
REPORT

**CAPACITY BUILDING
FOR CO₂ MITIGATION
FROM INTERNATIONAL AVIATION**

PROJECT FUNDED BY



European Union



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ENVIRONMENT



CAPACITY BUILDING FOR CO₂ MITIGATION FROM INTERNATIONAL AVIATION

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ACRONYMS

AES	Aviation Environmental System
AfDB	African Development Bank
AFPP	African Flight Procedure Programme
ANSP	Air Navigation Service Provider
APU	Auxiliary Power Unit
ASECNA	Agency for Aerial Navigation Safety in Africa and Madagascar
ATC	Air Traffic Controller
CASSOS	Caribbean Aviation Safety and Security Oversight System
CCO	Continuous Climb Operation
CDM	Clean Development Mechanism
CDO	Continuous Descent Operation
CO₂	Carbon dioxide
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
EBT	Environmental Benefits Tool
ECCAS	Economic Community of Central African States
EC	European Commission
EU	European Union
GHG	Green House Gases
GPU	Ground Power Unit
ICAO	International Civil Aviation Organization
IT	Information Technology
LACAC	Latin American Civil Aviation Commission
MAC	Marginal Abatement Cost
MOU	Memorandum of Understanding
MRV	Monitoring, Reporting and Verification
MSW	Municipal Solid Waste
NAPT	National Action Plan Team
PBN	Performance-Based Navigation
PCA	Pre-Conditioned Air
ROM	Results Oriented Monitoring
RTK	Revenue Tonne-Kilometre
SAT	Site Acceptance Test
SDD	System Design Document
SIDS	Small Island Developing States
UCO	Used Cooking Oil
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
UPS	Uninterruptible Power Supply

1. EXECUTIVE SUMMARY

In 2010, Member States of the International Civil Aviation Organization (ICAO) - United Nations Specialized Agency, established the global aspirational goal of carbon-neutral growth from 2020 for the international aviation sector. The ICAO Assembly also agreed on a basket of measures to achieve this goal and requested States to develop and submit State Action Plans on emissions reduction on a voluntary basis. While several Member States submitted action plans to ICAO, many others require technical assistance to develop their action plans.

The ICAO and European Union (EU) Assistance Project on *Capacity building for CO₂ mitigation from international aviation* is a response to the need for assistance in the development of action plans to ensure that all Member States can participate in the collective efforts to achieve the aspirational goal on environment agreed by the ICAO Assembly. The ICAO-EU project aimed at assisting 14 selected States from Africa and the Caribbean to develop and implement their action plans, and to establish aviation environmental systems for CO₂ emissions monitoring and reporting. Funded by the European Union, this 6.5 Million Euros initiative was successfully implemented by ICAO from 2014 to 2019, achieving all the expected results and exceeding the initial targets.

The first objective of the ICAO-EU project was to create national capacities for the development of action plans. ICAO organized specific training-seminars, directed the establishment of National Action Plan Teams in the selected States, and assisted each Civil Aviation Authority directly in the preparation of their action plans. By June 2016, the 14 selected States had developed action plans fully compliant with ICAO's guidelines, including robust historical data and a reliable baseline scenario. A total of 218 measures to reduce fuel consumption and CO₂ emissions were proposed in the action plans, including those related to aircraft technology, operational measures, and sustainable aviation fuels.

Lack of reliable aviation environmental data in developing States, such as the amount of CO₂ emissions produced by the aviation sector, is one of the challenges for assessing the impact of aviation on the global climate change and developing national strategies for environmental sustainability. The ICAO-EU project developed a tool – the Aviation Environmental System (AES), to establish data collection processes for environmental information in the beneficiary States, including CO₂ emissions from international aviation, and also to automate the organization and reporting by the Civil Aviation Authorities. To-date, all the beneficiary States have the capacity to use the AES to collect the relevant data from their aviation stakeholders and can generate monthly and yearly CO₂ emissions reports for their aviation sector.

In agreement with the European Union, and based on their carbon reduction potential and replicability, ICAO selected four pilot mitigation measures and five feasibility studies to be executed with project funding in the beneficiary States.

- Two “solar-at-gate” projects, which consist of a solar farm and airport gate electric equipment, to power aircraft with solar energy during ground operations at the international airports of Douala, Cameroon, and Mombasa, Kenya. The combination of electricity generated by the solar facility and the use of gate electrification equipment eliminates the CO₂ emissions while the aircraft is parked at the gate going through the pre-departure procedures before departing for the next flight. The installed capacity of these projects is 1,25MWp and 500kWp respectively, and they will eliminate over 4,000 tonnes of CO₂ per year and serve more than 7,500 flights per year.

- Design and implementation of Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) at the international airports of Ouagadougou, Burkina Faso and Libreville, Gabon. With these new procedures, aircraft can operate without altitude restrictions during departure or arrival phase, and thus optimize their flight profile. As a result, there is less noise exposure and reductions in fuel burn and greenhouse gas emissions.
- Five feasibility studies on the use of renewable energy at airports and sustainable aviation fuels in Burkina Faso, Dominican Republic, Kenya and Trinidad and Tobago, which provide these governments with policy advice to unveil new opportunities through innovation for a sustainable aviation sector.

In addition to these four pilot mitigation measures and five feasibility studies executed directly with project funding, the beneficiary States implemented 90 mitigation measures within the project timeframe, which had been included in their action plans developed under the project. A specific country fiche with a summary of the mitigation measures implemented in each beneficiary State is presented in Annex 1 of this report.

The implementation of the ICAO-EU project was assessed twice - in 2016 and 2017, by a consortium of experts contracted by the European Union, through independent Results Oriented Monitoring (ROM) reviews. Four criteria were examined during the ROM reviews (Relevance, Efficiency, Effectiveness, and Sustainability) and these independent reviews confirmed that the project design was logical and well sequenced, that the activities had been carried out as planned and that the project implementation was contributing to the achievement of the specific objectives and expected results, in some cases exceeding the targets. The project was assessed as “Good/Very good” in the four considered criteria.

With the support provided by the ICAO-EU project, ICAO has succeeded in assisting the beneficiary States transform the organizational culture towards environmental protection in aviation. An issue that was not regarded as a priority before has now become relevant for these States. The establishment of Environmental Units with dedicated staff in the Civil Aviation Authorities along with the voluntary decision of seven selected States of the project to join the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) from its outset are a testimony of the increased awareness and political will for climate action as a result of the ICAO-EU project. This gives confidence to ICAO that the results achieved will be sustainable in the future.

Capacity building and assistance on Environment will continue to be required for the transformation of policy into concrete actions at the national level. Many States have officially communicated to ICAO their interest to participate in similar assistance initiatives and replicate the positive results of the ICAO-EU project. The availability of further funding will allow ICAO to extend the benefits of this successful project to other Member States so that “No Country is Left Behind”¹.

¹ At the initiative of the ICAO Council, ICAO launched the No Country Left Behind (NCLB) campaign to assist States to effectively implement ICAO Standards and Recommended Practices (SARPs) and policies.

2. INTRODUCTION

The International Civil Aviation Organization (ICAO) and European Union (EU) Assistance Project on *Capacity building for CO₂ mitigation from international aviation* aims at providing technical assistance to a selected group of 14 States from Africa and the Caribbean regions to support their efforts in developing and implementing their States' Action Plans on CO₂ emissions reduction from international aviation, to establish aviation environmental systems for emissions monitoring and to identify and implement mitigation measures in selected States.

The selection of the beneficiary States was agreed between ICAO and the European Commission following a pre-determined set of criteria defined in the Contribution Agreement.



2.1 PROJECT FICHE

Project Title	Capacity building for CO₂ mitigation from international aviation
Project Ref. Number	EuropeAid/DCI-ENV/2013/322-049/TPS
Countries	<p>Africa: Burkina Faso, Kenya and ECCAS Member States (Angola, Burundi, Cameroon, Central African Republic, Chad, Republic of Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sao Tome and Principe).</p> <p>Caribbean: Dominican Republic and Trinidad and Tobago.</p>
Overall objective	To contribute to the mitigation of CO ₂ emissions from international aviation in the selected States, by implementing capacity building activities that will support the development of low-carbon air transport and environmental sustainability.

Specific objectives	<ul style="list-style-type: none"> • Improved capacity of the national Civil Aviation Authorities to develop action plans on CO₂ emissions reduction from international aviation in accordance with ICAO recommendations. • Efficient CO₂ emission monitoring system for international aviation developed in each selected Member State. • Priority mitigation measures identified and evaluated, and selected measures implemented.
Expected results	<ol style="list-style-type: none"> 1. National Action Plan teams built in at least 10 selected Member States. 2. At least 2 members of staff in the aviation sector or related authority trained to develop Action Plans in each selected State. 3. State specific ICAO Action Plans developed in at least 5 selected Member States and submitted to ICAO. 4. Aviation Environmental Systems (AES) developed in the selected Member States. 5. At least 2 members from national authorities/relevant stakeholder organizations per selected Member State trained to work with the AES and to have the capacity to report on aviation emissions for States inventories. 6. Feasibility studies developed for priority emissions mitigation measures identified in the Action Plans in at least 5 States/Group of States. 7. Measures to improve environmental benefits and reduce aviation fuel consumption selected and implemented in at least 5 selected Member States/Group of States.
Project start date	1 January 2014
Project duration	66 months – until 30 June 2019
Budget	€ 6.5 M funded by European Union
Implementation Organization	ICAO

2.2 MANAGEMENT AND PROJECT COORDINATION

The implementation and execution of the ICAO-EU Assistance Project were carried out by ICAO. A Project Coordination Unit was established in Environment, Air Transport Bureau for project management and coordination with other ICAO Bureaus and Regional Offices, in particular, the ICAO Technical Cooperation Bureau for the procurement of equipment related with the implementation of the mitigation measures.

On the other hand, the selected States designated at least two focal points at their Civil Aviation Authorities for the implementation of the project activities, to liaise with ICAO and to coordinate the National Action Plan Teams established in each beneficiary State.



STEERING COMMITTEE

A Steering Committee has been established for the strategic and political direction of the project. This Committee meets annually and includes representatives from ICAO, the European Commission and the selected States.

STRATEGIC DIRECTION



2.2.1 STEERING COMMITTEE

The **Steering Committee** is the project's inter-institutional strategic decision-making body. It provided the overall political and technical guidance on the implementation of the project and met at least once a year during the project timeframe to review the progress of the project and to provide guidance and assistance for the resolution of any difficulties encountered during the implementation. The Steering Committee included representatives from ICAO, the European Commission, and the selected States.

Representatives from ICAO

- Director, Air Transport Bureau
- Director, Technical Cooperation Bureau
- Deputy Director, Environment, Air Transport Bureau
- Chief, Finance

Representatives from the European Commission

- DG DEVCO
- DG CLIMA

Representatives from States and Group of States²

- Burkina Faso
- Kenya
- Trinidad and Tobago
- Dominican Republic
- Cameroon and ECCAS member States

2.2.2 PROJECT COORDINATION UNIT

ICAO Deputy Director, Environment – Strategic Direction

The ICAO Deputy Director, Environment, was in charge of overseeing the project implementation and provided strategic and managerial direction to the project ensuring that all the activities were in accordance with ICAO's Strategic Objective on Environment, in particular, with regards to the environmental protection policies and practices of the Organization. The Deputy Director, Environment also liaised with the Steering Committee, met regularly with the Permanent Representatives of the selected States to ICAO and conducted advocacy and outreach to secure the political buy-in from the relevant government authorities of the selected States.

ICAO Environment Officers – Technical Expertise and coordination with current ICAO programme

The ICAO Environment Officers provided continuous guidance to ensure the technical quality of the project deliverables and its coherence with the regular environmental protection programme. The ICAO Environment Officers also conducted the training and capacity building seminars for the focal points of the beneficiary States and reviewed and validated the feasibility studies funded by the project for the implementation of mitigation measures.

Programme Coordinator Consultant – Project Management

A Programme Coordinator was recruited to ensure that the project activities were implemented in accordance with the project document and in compliance with the EU/ICAO administrative regulations. The Programme Coordinator acted under the overall guidance of the ICAO Deputy Director, Environment, and in close consultation with ICAO/ENV Officers. The Programme Coordinator was also responsible for the planning, procurement, contracting, financial and reporting activities.

Technical Consultant – Development of the Aviation Environmental System and preparation of technical documentation

A Technical Consultant was recruited for the design, development and implementation of the aviation environmental systems in the selected States; and was also responsible for conducting the pre-feasibility studies for the implementation of mitigation measures and calculation of environmental benefits.

Local Technical Consultants – Support to the States' focal points and local coordination

A total of three Local Technical Consultants were recruited to work in the field and to coordinate the project implementation, per groups of States as follows:

- Local Consultant 1 (African Region): 10 ECCAS Member States and Burkina Faso
- Local Consultant 2 (Caribbean): Dominican Republic and Trinidad and Tobago
- Local Consultant 3 (Kenya): Kenya (part-time)

The Local Consultants worked closely with the focal points of the beneficiary States and conducted on-site visits -twice per year- to each State to ensure progress and the smooth implementation of the project activities. They met regularly with government counterparts and provided close support to the focal points across all the project phases.

Technical Consultants – Feasibility Studies

Five experts were recruited to conduct feasibility studies as part of the mitigation measures included in the State Action Plans submitted under the project. All these experts were recruited on a part-time basis for the project, based on deliverables, and conducted the work remotely with on-site missions to the States involved.

2.2.3 PROJECT OFFICES

In addition to the project management office at ICAO Headquarters in Montreal, Canada, project offices were established in Cameroon, the Dominican Republic, and Kenya, which were all hosted by the Civil Aviation Authorities of those selected States as an in-kind contribution to the project.

For the implementation of the 'solar-at-gate' projects at Mombasa International Airport and Douala International Airport, the Governments of Cameroon and Kenya granted two additional project offices at the airport premises to provide the necessary infrastructure for the project team and the contractor to work on site when required. This allowed for closer follow-up on the implementation activities.



ICAO Headquarters. Montreal, Canada

²Permanent Representatives of the selected States / Group of States to ICAO

2.3 RESULTS ORIENTED MONITORING (ROM) REVIEWS

The European Commission contracted a consortium of experts to implement a Results Oriented Monitoring (ROM) review of the project in 2016 and 2017. The objective of the ROM reviews is to provide an external opinion on project implementation in order to support project management by the EC Headquarters services and the implementing organisations through advice and recommendations. In this context, ROM reviews assess the status of a project through an analysis of project documentation and meaningful consultation with all parties involved, including beneficiaries.

ROM reviews are looking at progress in terms of input provision, activities undertaken and results delivered (outputs, direct outcomes). They are to highlight the strengths and weaknesses of the project implementation with a view to assisting the EC Operational Managers and key stakeholders in dealing with questions and problems that have emerged, to find solutions and revise approaches, and where relevant, to adapt to changing circumstances.

Four criteria are examined during the ROM review missions (Relevance, Efficiency, Effectiveness, and Sustainability). These ROM reviews took place during March-April in 2016 and 2017. The reviewers visited the project coordination unit at ICAO Headquarters, as well as the project offices and national stakeholders in Burkina Faso, Cameroon, Dominican Republic, Kenya and Trinidad and Tobago. During these country missions, the reviewers met with members of the project Steering Committee, ICAO Officers and project staff, the Directors General of the Civil Aviation Authorities, as well as the members of their National Action Plan Teams collectively and individually.

The ROM reviews confirmed that the project design was logical and well sequenced, that the activities had been carried out as planned and that the project implementation was contributing to the achievement of the specific objectives and expected results, in some cases exceeding the targets. The project was assessed as “Good/Very good” in the four criteria that were considered. The main conclusions stated in the last report of the ROM review conducted in 2017 are summarized below:

- The project relevance has increased during implementation, given a more decisive commitment of most of the targeted countries and the agreement of the ICAO Assembly on CORSIA. In this case, the AES, developed under the project, could serve as a solid basis to support States in their reporting requirements under CORSIA.
- Most of the recommendations made by the previous ROM review in 2016 have been addressed, and the project design and relevance have been improved through Addendum No.2 to the Contribution Agreement. The capacity development strategy and the exit strategy have been reinforced with the on-line training course developed by the project. The no-cost project time extension, recommended by DG DEVCO, allows the

implementation of the Action Plans’ mitigation measures, and the amended budget increases the resources for the mitigation measures.

- The selection of mitigation measures to be funded by the project is balanced and well distributed geographically. In particular, the solar-at-gate projects are the measures with the most interest from the selected States and they also have a high degree of replicability.
- Good progress observed in the implementation of activities and some targets have been exceeded. There is a solid understanding and commitment from the government authorities with regard to the project which has translated into progress in the regular submission of data through the AES and the implementation of mitigation measures within the Action Plans.
- The project results seem to be sustainable in the long-term due to the consolidation of the National Action Plan Teams in the selected States and stakeholders’ involvement, which could supersede any changes at the management level.

2.4 COMMUNICATIONS AND OUTREACH

ICAO implemented a communications strategy for the project aiming at showcasing the project objectives, progress and achievements amongst the beneficiary States, other ICAO Member States and also international organizations. This strategy had the objective of securing additional support for the implementation of the mitigation measures by the selected States and also inspiring other Member States to replicate the pilot mitigation measures.

The following outreach materials and events were conducted during the project implementation:

Project Promotional Video



A seven-minute video to inform about the project’s scope and objectives, to engage external stakeholders and the general public on the initiative and showcase the pilot mitigation measures to be implemented for CO₂ emissions reduction in the selected States. It was distributed to all the selected States and also presented to the general public through ICAO’s social media channels, ICAO’s environment events, and project events.

Project Brochure and Leaflets

A project brochure to provide an overview of the project and details on each area of activity, the analysis of mitigation measures selected by the States in their action plans and the selection of pilot mitigation measures funded by the project.

Three additional four-page leaflets provide further details on each of the project's objectives. One describes the Aviation Environmental System, including the main features, design, and data collection process. A second one provides an analysis of the mitigation measures included in the action plans submitted by the States and the selection process of the pilot mitigation measures implemented with project funding. A third one describes the online course on the preparation of action plans and instructions for registration.



All of these communications materials are publicly available at the project page within ICAO website³ and have been distributed at all ICAO's Environment events.

ICAO 39th Session of the Assembly



ICAO Assembly. Montreal, Canada

The ICAO Assembly is the Organization's sovereign body comprised of all Member States and regularly meets every three years. The 39th Session of the ICAO Assembly took place in Montreal from 27 September to 7 October 2016. During this important meeting, attended by representatives of all Member States, five working papers recognizing the project were presented by the selected States, in addition to one working paper from ICAO Secretariat, as follows:

- Burkina Faso
- Caribbean Aviation Safety and Security Oversight System (CASSOS) at the initiative of Trinidad and Tobago
- The Dominican Republic, on behalf of the 22 Member States of the Latin American Civil Aviation Commission (LACAC)
- Gabon, on behalf of nine States of the Central Africa beneficiaries of the ICAO-European Union project
- Kenya

All these working papers recognized the positive results achieved in the beneficiary States of the project and acknowledged the commitment of the European Union by providing financial resources to put in place such an initiative. All Member States agreed that further funding would be required to extend the benefits of the project to a larger number of States.

The fact that these working papers were presented at the initiative of the beneficiary States proves the relevance of the project at the institutional level in the States and, at the same time, provided a major endorsement at such an important venue.

International events



Side event at COP21. Paris, France

Presentations about the project and distribution of outreach materials took place at all ICAO's events regarding environmental protection, in particular the following international events:

- ICAO Alternative Fuels Seminar 2017
- ICAO Regional Seminars on States' Action Plans and CORSIA
- ICAO World Aviation Forum
- ICAO Seminars on Green Airports
- ICAO Sustainable Aviation Fuels Stocktaking Seminar 2019
- ICAO Environmental Symposium 2019
- Side-events at COP21 (Paris), COP22 (Marrakesh), COP23 (Bonn) and COP24 (Katowice)

³ http://www.icao.int/environmental-protection/Pages/ICAO_EU.aspx

3. ACHIEVEMENTS OF PROJECT OUTCOMES

As described in the figures below, all the expected results included in the project log-frame were successfully achieved even beyond the initial target indicators. The first objective of the project was to create national capacities for the development of action plans. By June 2016, the 14 selected States had developed action plans fully compliant with ICAO's guidelines, including robust historical data and a reliable baseline scenario. The quality of the action plans was assessed and the results are presented in section 4.2 below.

The AES – a tool developed under the project to collect and monitor environmental data and described in section 5 below, is being used consistently by all the 14 selected States to report on their CO₂ emissions from international aviation. From January 2016 to December 2018, a total of 446 monthly CO₂ reports were automatically generated by the States using the AES and submitted to ICAO, which represents 88% of the total possible submissions. The national regulations issued by the Civil Aviation Authorities of the selected States for the submission of environmental data by the national airlines have been critical for this success and will also continue to facilitate the systematic reporting through the AES in the future.



The Aviation Environmental System

As described in section 6 below, ICAO selected four pilot projects to be executed with project funding in the beneficiary States to assist in the implementation of mitigation measures. These pilot projects were selected in agreement with the European Union

based on their carbon reduction potential and replicability. In addition, five feasibility studies on the use of renewable energy at airports and on the use and development of sustainable aviation fuels were also conducted with project funding.

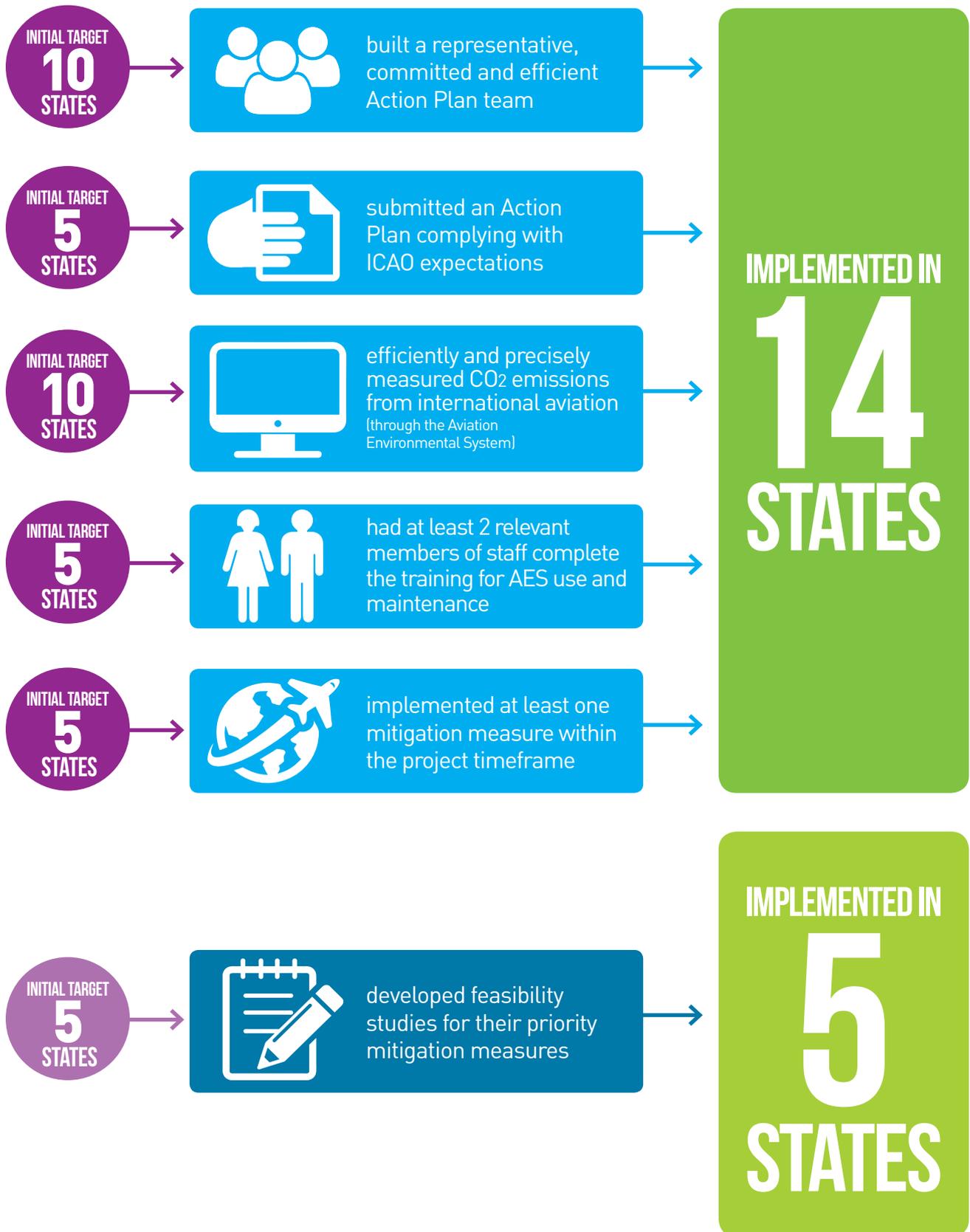
The pilot mitigation measures funded by the project included two “solar-at-gate” projects to power aircraft with solar energy while parked at the gate at Moi International Airport in Mombasa, Kenya and Douala International Airport in Douala, Cameroon. These “solar-at-gate” projects were inaugurated on 12 December 2018 by the President of the ICAO Council along with 32 Council Members and Representatives to ICAO in Mombasa, and on 10 January 2019 by the Minister of Transport of Cameroon in Douala. Their positive results and environmental benefits have triggered the interest of many other Member States to start their replication at a larger scale.



Inauguration of solar-at-gate project at Moi International Airport by the President of ICAO Council. Mombasa, Kenya

In addition to the mitigation measures funded directly by the project, the selected States implemented other 90 mitigation measures within the project timeframe, which had been included in their action plans. These mitigation measures implemented by the selected States represent an annual reduction of 102,606 tCO₂ emissions from international aviation, which in addition to the 5,243 tCO₂ reduced by the pilot mitigation measures funded by the project, result in a total of **107,849 tCO₂** emissions reduction per year within the project timeframe.

3.1 MAIN PROJECT ACHIEVEMENTS



3.2 PROJECT PROGRESS DASHBOARD

Indicators	Data to be collected - source of verification	Method of data collection	Deadline	Baseline	Target	Progress at project completion (white=not initiated, shaded=in progress, green=completed)
S0-1.	Improved capacity of the national civil aviation authorities to develop their Action Plan on CO2 emissions reduction from international aviation in accordance with ICAO recommendations.					
Number of States having built a representative, committed and efficient Action Plan team.	<ul style="list-style-type: none"> Communication logs with the respective Action Plan teams Project progress reports 	<ul style="list-style-type: none"> Emails and letters exchanged with the Action Plan teams. 	Y1 Q3	The composition of the Action Plan teams has not been clearly defined yet.	10 selected States have built an Action Plan team following ICAO's guidance.	Completed 14 selected States have officially established a National Action Plan Team following ICAO's guidance.
Number of States having submitted an Action Plan complying with ICAO expectations.	<ul style="list-style-type: none"> Submitted Action Plans. 	<ul style="list-style-type: none"> Online submission on the APER website. 	Y2 Q4	Only 3 States have submitted an Action Plan, but these are considered incomplete.	At least 5 selected States have submitted an Action Plan complying with ICAO's guidance.	Completed 14 selected States submitted their Action Plans in accordance with ICAO Doc 9988
R-1.1	National Action Plan teams built in the selected Member States.					
Number of States having defined a national Action Plan focal point complying with ICAO requirements.	<ul style="list-style-type: none"> National Action Plan focal point (i.e., State Focal Point) contact information submitted to ICAO by the relevant authority. 	Formal letter/email from the relevant authority.	Y1 Q3	9 selected States	14 selected States	Completed 14 selected States have officially registered in ICAO APER website their Action Plan Focal Point.
Number of States having defined an assistant focal point for this project.	<ul style="list-style-type: none"> Assistant focal point (i.e., Project Focal Point) contact information submitted to ICAO by the relevant authority. 	Formal letter/email from the relevant authority.	Y1 Q3	0 selected States	14 selected States	Completed 14 selected States have designated their Project Focal Point for the Assistance project
Number of States having defined an Action Plan team complying with ICAO requirements.	<ul style="list-style-type: none"> Detailed Action Plan team composition submitted to ICAO. 	Formal letter/email from the relevant authority.	Y1 Q3	0 selected States	10 selected States	Completed 14 selected States have officially established a National Action Plan Team following ICAO's guidance
R-1.2	At least 2 relevant members of staff in the aviation sector trained to develop Action Plans in each selected State.					
Number of States where at least 2 members of staff in the aviation or related authority have completed ICAO training for AP development.	<ul style="list-style-type: none"> Minutes of training sessions. Certification of completion of the State's Action Plan Seminar 	ICAO internal communication.	Y2 Q2	0 selected States	10 selected States	Completed 12 selected States have participated in the project "Kick-off" Seminar focused on the development of Action Plans In addition, the 2 States that did not attend the seminar, received 2 on-site missions each where the project team was able to brief and train them on-site
R-1.3	Country specific ICAO Action Plans developed in at least 5 selected Member States and submitted to ICAO					
Number of States having completed and submitted an Action Plan.	<ul style="list-style-type: none"> Action Plans submitted to ICAO. 	Online submission on the APER website.	Y2 Q4	3 selected States	At least 5 selected States	Completed 14 selected States submitted their Action Plans in accordance with ICAO Doc 9988
Quality of the submitted Action Plans.	<ul style="list-style-type: none"> Results of the review of the submitted Action Plans performed by ICAO. 	ICAO internal communication.	Y2 Q4	The 3 submitted Action Plans do not contain the minimal data requested by ICAO.	The Action Plans submitted by at least 5 selected States comply with ICAO's minimal expectations.	Completed The Project Team has reviewed the submitted Action Plans based on a set of criteria and reported in the Annual Report 2015. This assessment shows that the submitted Action Plans fully comply with ICAO's recommendations

Indicators	Data to be collected - source of verification	Method of data collection	Deadline	Baseline	Target	Progress at project completion (white=not initiated, shaded=in progress, green=completed)
S0-2. Efficient CO₂ emission monitoring system for international aviation developed in each selected Member State.						
Number of selected States able to measure efficiently and precisely CO ₂ emissions from international aviation.	<ul style="list-style-type: none"> Project evaluation reports. 	ICAO internal communication and submissions to APER website.	Y2 Q4	No selected State is able to measure efficiently and precisely CO ₂ emission from international aviation.	At least 5 selected States are able to measure efficiently and precisely CO ₂ emission from international aviation.	Completed Through the implementation of the AES, 14 selected States are already able to measure efficiently and precisely CO ₂ emissions from international aviation.
R-2.1 Aviation environmental system (AES) developed in the selected Member State.						
Number of States having an AES for CO ₂ monitoring.	<ul style="list-style-type: none"> Minutes of Steering Committee meetings. Interim or annual project reports. Audit reports issued by the verification team. 	ICAO internal communication.	Y2 Q4	0 selected States	At least 5 selected States	Completed 14 selected States have the AES installed at the CAA for their CO ₂ emissions monitoring
R-2.2 At least 2 relevant members of staff in the aviation sector per selected Member State trained to work with the AES and to have the capacity to report on aviation emissions for States inventories.						
Number of States where at least 2 relevant members of staff have completed the training for AES use and maintenance.	<ul style="list-style-type: none"> Minutes of training sessions. Certification of completion of the AES training. 	ICAO internal communication.	Y2 Q4	0 selected States	10 selected States	Completed 13 selected States participated in the second Capacity Building Seminar focused on the AES. Only Angola did not attend the Seminar. However, Angola attended the third Capacity Building Seminar in 2016 (which had a training session on the AES) and the focal points were individually trained to use the tool already operational in their State.
S0-3. Priority mitigation measures identified and evaluated, and selected measures implemented.						
Number of States having started to efficiently reduce CO ₂ emissions from international aviation.	<ul style="list-style-type: none"> Project evaluation reports. Action Plans, CO₂ reports submitted by the States. 	ICAO internal communication and online submissions to the APER website.	Y4 Q4	No selected State has taken measures to mitigate CO ₂ emission from international aviation so far.	At least 5 selected States have implemented at least one mitigation measure within the project timeframe.	Completed 14 selected States implemented 94 mitigation measures within the project timeframe, which had been selected and included in their action plans. 6 selected States received direct financial and technical assistance from the project for the implementation of 4 pilot mitigation measures and 5 feasibility studies.

<p>CO₂ emission reduction obtained or planned through the mitigation measures implemented within the project.</p>	<ul style="list-style-type: none"> • Project evaluation reports. • Action Plans, CO₂ reports submitted by the States. 	<p>ICAO internal communication and submissions to APER website.</p>	<p>Y4 Q4</p>	<p>No voluntary reduction of CO₂ emissions from international aviation has been obtained so far in the selected States.</p>	<p>A positive and quantified reduction of CO₂ emissions from international aviation is obtained or planned in at least 5 selected States within the project timeframe.</p>	<p>Completed The 94 measures implemented within the project timeframe represent an annual reduction of 102,606 tCO₂ emissions from international aviation. The 4 measures financially supported by the project represent an annual reduction of 5,243 tCO₂ emissions from international aviation.</p>
<p>R-3.1 Feasibility studies developed for priority emissions mitigation measures identified in the Action Plans in at least 5 States/Group of States.</p>						
<p>Number of States having feasibility studies developed for their priority mitigation measures.</p>	<ul style="list-style-type: none"> • Results of the costs/benefits analysis on mitigation measures performed for the State (giving its priority measures). • Feasibility reports. 	<p>ICAO internal communication.</p>	<p>Y4 Q4</p>	<p>No feasibility study developed yet.</p>	<p>At least 5 selected States</p>	<p>Completed Five feasibility studies completed and published by ICAO on the use of renewable energy at airports in Trinidad and Tobago and on the use and production of sustainable aviation fuels in Burkina Faso, Dominican Republic, Kenya and Trinidad and Tobago</p>
<p>R-3.2 Measures to improve environmental benefits and reduce aviation fuel consumption selected and implemented by participating Member States.</p>						
<p>Overall number of mitigation measures implemented within the project timeframe.</p>	<ul style="list-style-type: none"> • Final evaluation reports. 	<p>ICAO internal communication.</p>	<p>Y5 Q2</p>	<p>No mitigation measure implemented so far in the selected States.</p>	<p>The number of mitigation measures allowed by the remaining project budget and impacting the most States (to be determined by the costs/benefits analysis).</p>	<p>Completed 94 mitigation measures were implemented in the selected States within the project timeframe, including 4 pilot mitigation measures funded by the project.</p>
<p>Number of States having implemented at least one mitigation measure within the project timeframe.</p>	<ul style="list-style-type: none"> • Final evaluation reports. 	<p>ICAO internal communication.</p>	<p>Y5 Q2</p>	<p>No mitigation measure implemented so far in the selected States.</p>	<p>At least 5 selected States</p>	<p>Completed 14 selected States implemented 94 mitigation measures within the project timeframe. 90 mitigation measures were implemented directly by the States, while 4 mitigation measures were funded and implemented by the project in 4 States as follows: In 2 States (Cameroon and Kenya), the execution of two "solar-at-gate" projects to power aircraft with solar energy during ground operations at the international airports of Douala, Cameroon, and Mombasa, Kenya In 2 States (Burkina Faso and Gabon), design and implementation of Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) at the international airports of Ouagadougou, Burkina Faso and Libreville, Gabon.</p>

3.3 ENVIRONMENTAL BENEFITS OF THE PROJECT

DIRECT ENVIRONMENTAL BENEFITS: CO ₂ emissions reduction achieved with the implementation of mitigation measures funded by the project (tCO ₂ per year)	
Solar-at-gate Cameroon	2,575
Solar-at-gate Kenya	1,300
CCO/CDO Burkina Faso	354
CCO/CDO Gabon	1,014
TOTAL	5,243

INDIRECT ENVIRONMENTAL BENEFITS: CO ₂ emissions reduction achieved with the implementation of mitigation measures funded by the selected States (tCO ₂ per year)	
Africa	78,549
Caribbean	24,057
TOTAL	102,606

TOTAL OF CO₂ EMISSIONS REDUCTION PER YEAR WITHIN THE PROJECT TIMEFRAME (DIRECT AND INDIRECT): 107,849 tCO₂

4. OBJECTIVE 1: CAPACITY BUILDING FOR THE DEVELOPMENT OF STATE ACTION PLANS ON EMISSIONS REDUCTION

4.1 STATE ACTION PLANS ON EMISSIONS REDUCTION

In 2016, the 39th Session of the ICAO Assembly adopted Resolution A39-2: *Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate Change*. Resolution A39-2 reflects the determination of ICAO's Member States to provide continuous leadership to international civil aviation in limiting or reducing its emissions that contribute to global climate change.

The ICAO Assembly recognized ICAO's tremendous progress during the 2010 to 2013 triennium and reaffirmed the collective aspirational goals on environment that were established by the 37th Session of the ICAO Assembly.

A central element of Resolution A39-2 is for States to prepare and submit action plans to ICAO. It also laid out an ambitious work programme for capacity building and assistance to States in the development and implementation of their action plans to reduce emissions, which States were initially invited to submit by the 37th Session of the ICAO Assembly in October 2010.

The State Action Plans on Emissions Reduction are a strategic tool for States to plan their activities to address CO₂ emissions from international aviation. States submit their action plans to ICAO on a voluntary basis. The level of detail of the information contained in an action plan will ultimately enable ICAO to compile global progress towards meeting the aspirational goals on environment set by ICAO Member States.

States are encouraged to submit a State Action Plan that complies with the provisions established in ICAO Document 9988 *Guidance on the Development of States' Action Plans on CO₂ Emissions Reduction Activities*. States are also encouraged to submit their action plan using the APER website - an online platform dedicated to action plans on the ICAO secure portal.

In accordance with Resolution A38-18, action plans should incorporate information on activities that aim to address CO₂ emissions from international aviation, including national initiatives, as well as activities implemented regionally or on a global scale as the result of bilateral and regional/multilateral agreements.

Every action plan submitted to ICAO should contain, at a minimum, the following information:

1. **Contact information.** Identification of the focal point and any other person(s) responsible for the compilation and submission of the action plan.
2. **Baseline (without action) fuel consumption CO₂ emissions**

- and traffic (2010 or earlier to 2050) from international aviation
3. **Measures to mitigate CO₂ emissions.** The measures being proposed to address CO₂ emissions from international aviation, distinguishing between those that are already in place and those that are being considered for future implementation.
4. **Expected results** (fuel consumption, CO₂ emissions and traffic) with the aforementioned measures being taken.
5. **Assistance needs.** Description of any specific needs (for example, financial, technological or capacity building) for the implementation of future actions.

In order to facilitate the development of their action plan and ensure its inclusiveness, States are encouraged to establish a National Action Plan Team (NAPT) gathering representatives from the main stakeholders of the national aviation sector, such as relevant governmental institutions, airlines, airport operators, Air Navigation Service Providers, fuel suppliers, etc.

By 2016, the 14 beneficiary States of the ICAO-EU project developed and submitted their State Action Plans to ICAO. As described below, the project supported the States by assisting the Civil Aviation Authorities on the establishment of their NAPT, organizing capacity building seminars with all the focal points of the beneficiary States, and providing tailored support to each State through periodic on-site missions conducted by the project staff. All the action plans submitted by the selected States under the project are publicly available at ICAO's website⁴.

By including the State Action Plans developed through the ICAO-EU project on the ICAO public website, ICAO can encourage other States to use these State Action Plans as examples. Due to the fully quantified and detailed nature of the State Action Plans produced through the ICAO-EU Project, these State Action Plans have encouraged additional States to develop robust State Action Plans.

Furthermore, at least three ICAO-EU project beneficiary States have provided assistance to other States through the State Action Plan Buddy Programme. Through the State Action Plan Buddy Programme, States that have already submitted a State Action Plan provide guidance and support to States that have not yet developed a State Action Plan.

4.1.1 NATIONAL ACTION PLAN TEAMS

All of the 14 selected States created a National Action Plan Team dedicated to the development of the action plan. These teams were established by the Civil Aviation Authorities through official directive and were recognized as an important coordination mechanism that enabled an inclusive stakeholders' consultation

⁴ https://www.icao.int/environmental-protection/Pages/ClimateChange_ActionPlan.aspx



National Action Plan Team of the Dominican Republic. Santo Domingo, Dominican Republic

and the creation of important partnerships for the implementation and sustainability of the action plans in the long term.

In most States, the NAPT contributed in the creation of new synergies between the aviation sector and the existing national institutions for climate change mitigation in the State. For instance, since the creation of the NAPT, the Civil Aviation Authorities of the beneficiary States started to be recognized as an important player in the national climate change strategy and, since then, have been invited to join the national delegation to the Conference of the Parties (COP) of the UNFCCC. Also, several States began to include, for the first time, the data on CO₂ emissions from the aviation sector in their national inventories.

Furthermore, the involvement of representatives from other areas of the government in the NAPT has resulted in the identification of funding opportunities from the national government for the implementation of environmental initiatives such as the mitigation measures included in the action plans.

The table below describes the regulations that officially created the NAPTs in the selected States.

	State	Regulation	Date of issuance
1	Angola	Created without a regulation	N/A
2	Burkina Faso	Décision 14.425/ANAC/DG	31-Dec-14
3	Burundi	Décision 729/DG/3393/2014	11-Dec-14
4	Cameroon	Décision 1125/D/CCAA/DG/DTAS/SAE	24-Oct-14
5	Central African Republic	Decision 025/15/MTAC/DIR-CAB	24-Apr-15
6	Chad	Décision 002/ADAC/DG/2015	05-Jan-15
7	Republic of the Congo	Décision 184/ANAC/DG/DSA	04-Dec-14
8	Democratic Republic of the Congo	Décision AAC/DG/1083/2014	30-Dec-14
9	Dominican Republic	Decision 5828	03-Dec-14
10	Equatorial Guinea	Orden Ministerial N_/2015	09-Jan-15
11	Gabon	Décision 0003/2015/ANAC/DG-QM	09-Jan-15
12	Kenya	Decision KCAA/2/06B-78	26-Feb-15
13	Sao Tome and Principe	Decision 30/2015	19-Jun-15
14	Trinidad and Tobago	Decision CAA/283/14/DGCA	05-Dec-14

4.1.2 CAPACITY BUILDING REGIONAL SEMINARS

A total of eight Capacity Building Seminars were organized by the project to train the focal points and stakeholders on environmental protection and aviation. For the preparation of the action plans, a project kick-off Seminar was held on 11-12 December 2014 in Santo Domingo, Dominican Republic, for the selected States of the Caribbean region and on 3 - 6 February 2015 in Yaoundé, Cameroon for the selected States of the African region.

These kick-off seminars aimed at strengthening the capacities of the national focal points for the preparation of States' Action Plans and also at providing an overview of the activities included in the project to ensure the ownership by the Civil Aviation Authorities. A four-day programme was developed with training sessions that focussed on the five steps for development of an action plan based on ICAO Doc 9988 as well as the ICAO Environment tools available for the calculation of the



Capacity Building Seminars in Africa. Nairobi, Kenya and Libreville, Gabon

baseline scenario, expected results and environmental benefits of each mitigation measure. The focal points also prepared country-specific presentations with the information collected through an assessment questionnaire provided by the project team. A summary of the programme is presented below:

DAY 1	DAY 2	DAY 3	DAY 4
<ul style="list-style-type: none"> • Welcome • Project presentation • ASECNA – Regional initiatives on CO₂ mitigation • Training 1: Preparing and submitting your State Action Plan • Country assessments (by the States focal points) 	<ul style="list-style-type: none"> • Training 2: ICAO tools and exercises • Training 3: Establishing an Aviation Environmental System • Training 4: Calculating a baseline • Training 5: State baseline exercise 	<ul style="list-style-type: none"> • Training 6: Reviewing the mitigation measures • Training 7: Implementing ATM measures • Training 8: Quantifying the effects of mitigation measures + Exercise 	<ul style="list-style-type: none"> • Open consultation and review of draft action plans

The second capacity building seminars took place in Port-of-Spain, Trinidad and Tobago, on 13- 15 October 2015 and in Nairobi, Kenya, on 24-27 November 2015, and were dedicated to training the focal points on the use of the AES.

The third capacity building seminars addressed the selection and implementation of mitigation measures and took place in Libreville, Gabon, on 31 October - 4 November 2016 and in Punta Cana, Dominican Republic, on 13-16 December 2016.

The fourth and last capacity building seminars were organized in Punta Cana, Dominican Republic, on 12-13 July 2018 and in Mombasa, Kenya, on 12-14 December 2018. They aimed at giving the participants details on the project results, and sharing lessons learned regarding the development of the action plans, the use of the AES, and the implementation of mitigation measures.

Six of the eight capacity building Seminars were sponsored by the Civil Aviation Authorities of the Dominican Republic, Trinidad and Tobago, Kenya and Gabon as an in-kind contribution to the project.

The participation of ASECNA and ICAO Regional Officers for Western and Eastern Africa in these seminars provided the participants with an understanding of the regional strategy on CO₂ emissions reduction, especially in terms of operational measures. Their involvement was important to establish synergies between the regional initiatives and the project activities.

4.1.3 ON-SITE CAPACITY BUILDING

In addition to the capacity building seminars, the selected States received on-site support through regular on-site missions by the project team. These missions provided added value in addition to the regional seminars, as they allowed for training a wider audience of national stakeholders and to address local challenges more efficiently. These missions also supported the focal points in raising awareness on the project with members of their National Action Plan Teams as well as to leverage political support from senior management.

The on-site missions also allowed ICAO to overcome challenges related to poor internet connectivity in some of the selected States, where remote support had significant technical hurdles. Through these regular on-site missions, the project team was able to ensure progress on the project activities in the selected States and to address any challenges at an early stage.

The following table indicates the number of missions that took place in the 2014-2019 timeframe in each selected State (excluding the second, third and fourth capacity building seminars).

	State	2014	2015	2016	2017	2018	2019
1	Angola		2	2	1		
2	Burkina Faso		3	1	4	2	
3	Burundi		1	1	1		
4	Cameroon		2	2	1		2
5	Central African Republic		2	1	1		
6	Chad		2	1	1		
7	Republic of the Congo		2	1		1	
8	Democratic Republic of the Congo		2	1			
9	Dominican Republic	1	1	3			
10	Equatorial Guinea		1	2	1		
11	Gabon		1	3	2	3	
12	Kenya		2	2	5	2	
13	Sao Tome and Principe		2	1			
14	Trinidad and Tobago		2	3	3	1	

4.1.4 E-LEARNING COURSE ON STATES' ACTION PLANS TO REDUCE CO₂ EMISSIONS



To provide further support and training to the focal points and stakeholders of the beneficiary States, the project developed an online/e-learning course on States' Action Plans to reduce CO₂ emissions from aviation. This e-learning course is a self-paced tutorial for training on the preparation and implementation of State Action Plans on Emissions Reduction in accordance with ICAO's guidance

documents and best practices. It was launched on 30 November 2017 in a ceremony attended by ICAO and the European Union.

The course was developed in cooperation with the United Nations Institute for Training and Research (UNITAR), as a state-of-the-art learning experience divided into five modules which provide step-by-step direction for the development, update, and implementation of an action plan. Each module contains an interactive presentation, an e-book that can be downloaded and studied offline, and also animated videos as one of the techniques that have been used to increase the audience's engagement and retention during an e-learning course. Upon completion of the five modules and satisfactory approval of an assessment, the enrolled



participant is granted a Certificate of Completion.

The introductory module, which provides a general overview of the action plan's development process, is publicly available at no cost. The introductory module also serves as an advocacy and outreach tool to mobilize the support of key decision-makers at the national level by raising awareness of the importance of environmental protection in aviation.

The remaining four modules of the course are available free-of-charge to all the focal points appointed by the States and registered at the Action Plans for Emissions Reduction (APER) portal, which includes the focal points of the selected States of the project.

The second module that is solely available to the focal points nominated by ICAO Member States for the action plans relates to the development of the baseline scenario of CO₂ emissions that is to be included in the preparation of the action plan. The module explains in details how to define a baseline scenario; estimate



international aviation fuel burn, CO₂ emissions, and International Revenue Tonne-Kilometers (RTK); and how to calculate the baseline using the Environments Benefits Tool (EBT).

The third module provides an overview of the mitigation measures that a State can select to reduce its CO₂ emissions from international aviation. The module provides detailed information on the different categories of measures based on the ICAO Basket of Measures allowing States to assess the different measures that are of most relevance to them.

The fourth module provides information to States on how to select, prioritize and implement the mitigation measures described in the previous module. It also provides guidance on how to analyze the benefits and effectiveness of the selected measures in relation to the cost involved, as well as guidance on how to carry out a risk analysis ,while planning the implementation of the selected mitigation measures.

The fifth and last module available to the focal points relates to the ICAO environment tools and the calculation of the expected results from the implementation of the selected CO₂ emissions mitigation measures. This module provides step-by-step guidance on how to use each of the ICAO environment tools for the calculation of the CO₂ emissions and fuel savings from the implementation of the selected mitigation measures. All of the ICAO environment tools are available to support States in the development of their State Action Plan on CO₂ emissions reduction.

In addition, the course includes the success stories, best practices, and lessons learned drawn from the project implementation in the selected States. This facilitates the knowledge sharing not only amongst the States under the project but also with all ICAO Member States that can access this course and may also benefit from these experiences.

In the scope of the project, the course served to reinforce the expertise acquired by the focal points through the capacity building activities, and also ensured the transfer of knowledge to

any newly recruited staff at the Civil Aviation Authorities.

The e-learning course is hosted at the United Nations Climate Change Learning Platform (UN CC: Learn), which is the most recognized UN platform for knowledge sharing in the climate change field. This has been only possible as the project established a partnership for the development of the course with UNITAR, which acts as the Secretariat of the UN CC: Learn.

By the end of the project, the focal points of the beneficiary States completed the course and received their Certificate of Completion.

4.1.5 ONLINE PROJECT PLATFORM

An online project platform was created within the ICAO secure portal in December 2014. This platform has restricted access for the official focal points appointed by the beneficiary States and also the project team. This Sharepoint website was used as a document repository and knowledge management platform throughout the implementation of the project. It included in particular:

- [Summary of the main objectives of the project;](#)
- [All training materials and presentations used during the regional capacity building seminars;](#)
- [Specific Country Fiches with detailed information on each beneficiary State and progress on the implementation of the project outcomes;](#)
- [List of focal points and their contact information;](#)
- [Communication material produced for outreach on the project \(e.g., project brochures\);](#)
- [Instructions to register for the e-learning course on States' Action Plans and mitigation measures - developed under the project;](#)
- [Access to the online version of the AES user manual.](#)

4.2 ASSESSMENT OF THE QUALITY OF ACTION PLANS

The following table presents an overview of the action plans submitted by the selected States and their expected results.

	State	Submission Date	Version	Definition for International Flight	Expected results (tCO ₂ emissions reduction from international aviation)between 2016-2035
1	Angola	Jan-16	V1	ICAO	433,369
2	Burkina Faso	Jan-16	V1	ICAO	131,816
3	Burundi	Jan-16	V1	IPCC	87,160
4	Cameroon	Mar-15	V1	ICAO	29,084
5	Central African Republic	Apr-16	V1	ICAO	6,178
6	Chad	Dec-15	V1	IPCC	359,453
7	Republic of the Congo	May-16	V1	ICAO	22,635
8	Democratic Republic of the Congo	Mar-16	V1	ICAO	10,945
9	Dominican Republic	Jul-15	V2 (V1 in Dec-13)	ICAO	3,689
10	Equatorial Guinea	Mar-16	V1	ICAO	181,463
11	Gabon	Apr-16	V1	ICAO	141,426
12	Kenya	Dec-15	V2 (V1 in Jun-12)	ICAO	6,396,661
13	Sao Tome and Principe	Mar-16	V1	ICAO	192
14	Trinidad and Tobago	Aug-15	V2 (V1 in Jan-13)	ICAO	437,325
TOTAL					8,241,396

A set of criteria, detailed in the following table, was developed to assess the compliance of the submitted action plan with the recommendations detailed in ICAO Doc 9988.

ID	CRITERIA	DESCRIPTION
OVERALL ASSESSMENT		
C1	• Structure of the AP	- The structure of the AP is clear and includes all 5 steps recommended by ICAO in their logical order.
C2	• Submission on the APER website	- The 5 steps are completed on the APER website, and the results match with the paper version of the AP (if any).
STEP 1: CONTACTS - NATIONAL ACTION PLAN TEAM		
C3	• Focal points contact information	- The contact information of the focal points has been provided on the APER website.
C4	• Creation of the NAPT	- The NAPT has been created.
STEP 2: BASELINE		
C5	• Definition for international flights	- The choice of definition (ICAO or IPCC) for international flights is clearly stated and the choice justified.
C6	• Horizon chosen	- The horizon for the baseline encompasses at least 20 years (i.e. 2035 or beyond)
C7	• Metrics used	- The baseline is calculated in terms of net CO ₂ emissions and/or fuel efficiency, and the metrics chosen clearly stated.
C8	• Completeness of the collected data	- The data collected for the selected years is complete (international flights according to the chosen definition).
C9	• Accuracy of the collected data	- Estimates and assumptions (if any) are clearly stated, justified and appear appropriate.
C10	• Tabular and graphical representation	- The results of the baseline are provided both in tabular and graphical formats. Any anomaly is commented in the Action Plan.
STEP 3: SELECTED MITIGATION MEASURES		
C11	• Complete documentation	- Each measure is clearly documented, and the different required fields documented whenever relevant (description, start & end dates, objectives, expected results, costs, assistance needs, stakeholders)
C12	• Assistance needs	- Assistance needs are well characterized and detailed, and potential providers of this assistance identified. Efforts to capitalize on existing resources (if any) and reduce external dependence are evident.
STEP 4: EXPECTED RESULTS		
C13	• Identification	- A clear distinction is made between international CO ₂ emissions (expected results) and domestic emissions (co-benefits)
C14	• Quantification methodology	- The quantification methodology (EBT, IFSET, other) is detailed and applied correctly. Both expected results and co-benefits are quantified.
C15	• Horizon chosen	- The horizon for expected results and co-benefits correspond to the horizon chosen for the baseline.
C16	• Metrics used	- The metrics for expected results and co-benefits correspond to the metrics chosen for the baseline.
C17	• Tabular and graphical representation	- The expected results and co-benefits are provided both in tabular and graphical formats. In addition a graph illustrates the results compared to the baseline scenario. Any anomaly is commented in the Action Plan.

Every action plan was reviewed according to these criteria by ICAO. Both assessments revealed that all the 14 action plans met the minimum requirements, and included the different sections recommended in ICAO Doc 9988. They were showing a balanced selection of mitigation measures and had their baseline, mitigation measures and expected results fully quantified, including co-benefits. The quantification of environmental benefits is typically very challenging for States preparing their action plan, and the achievements of the selected States in this regard is particularly remarkable. States who had already submitted an action plan before the start of the project had not included a robust quantification and, therefore, were able to significantly improve their action plans in the scope of the project and submit an updated version to ICAO. The action plans of the selected States have now become examples for other States, in particular, States with limited capacity who aim at developing a complete and robust action plan.

4.3 OVERVIEW OF SELECTED MEASURES

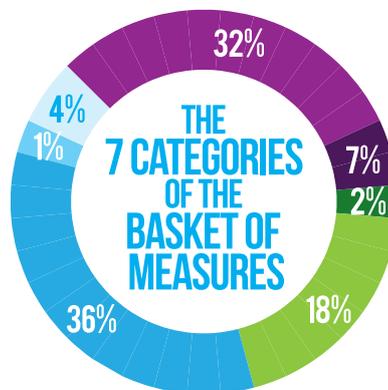
In their action plans, the 14 States of the project selected a total of 218 mitigation measures within the 7 categories of ICAO's basket of measures:

1. Aircraft-related technology: 9 measures
2. Alternative fuels: 3 measures
3. Improved Air Traffic Management and infrastructure use: 79 measures
4. More efficient operations: 39 measures
5. Economic measures: 4 measures
6. Regulatory measures: 15 measures
7. Airport improvements: 69 measures

The highest number of measures were selected in Category 3 (Improved ATM), followed by Category 7 (Airport improvements) and Category 4 (More efficient operations). The figure below illustrates the distribution of mitigation measures per category.

THE 218 MITIGATION MEASURES ARE DISTRIBUTED IN:

CAT 1	Aircraft related technology
CAT 2	Alternative fuels
CAT 3	Improved Air Traffic Management
CAT 4	More efficient operations
CAT 5	Economic/market based measures
CAT 6	Regulatory measures
CAT 7	Airports improvements



Of these 218 mitigation measures, 130 (60 %) could be quantified in terms of reduced CO₂ emissions (international emissions and/or co-benefits), and 60 (28%) were quantified in terms of cost.

While most measures listed in the action plans had only reached the planning phase and required resources and assistance for implementation, the implementation of 49 measures had already been started, and 25 measures had been completed prior to the submission of the action plan.

4.4 REGIONAL ACTION PLAN

Since the beginning of the project, it was agreed that a regional approach would set the strategy to work with the ten selected States which are also part of the Economic Community of Central African States (ECCAS). Following the submission of the individual action plans, the project facilitated the preparation of a regional action plan for these ten States, in coordination with the Secretariat of ECCAS.

Initially, the Secretariat of ECCAS expressed its limitation in adopting the regional action plan as it did not include Rwanda, which joined as a Member State of ECCAS after the inception of the project but was not a beneficiary State and did not have an action plan. In order to address this limitation, it was agreed that Gabon, a selected State under the project, would provide support to Rwanda in the development of its action plan under the ICAO “Buddy” Programme. Relevant information of the action plan of Rwanda would then be included in the regional action plan for its adoption by the ECCAS Head of States.

On 31 October 2016, in a one-day meeting co-organized with the Secretariat of ECCAS within the framework of the third capacity building seminar of the project in Africa, the regional action plan on CO₂ emissions reduction was discussed in plenary, finalized and validated at the technical level by the national focal points of the 10 ECCAS States beneficiaries of the project.

In addition, ICAO was invited to the ECCAS ministerial meeting in charge of civil aviation, jointly organized by the Government of Congo, the Secretariat of ECCAS and the African Development Bank (AfDB) in Brazzaville, Congo, from 3 to 6 April 2018. During this meeting, the ICAO-EU Project Consultant presented the regional action plan and the experts recommended its adoption. The Ministers took note of the recommendations of the experts and endorsed the regional action plan on CO₂ emissions reduction from international civil aviation in Central Africa.

5. OBJECTIVE 2: ESTABLISHMENT OF AVIATION ENVIRONMENTAL SYSTEMS

5.1 THE AVIATION ENVIRONMENTAL SYSTEM (AES)

The second objective of the ICAO-EU project was to establish, in the Civil Aviation Authority of each selected State, an efficient CO₂ emissions monitoring system to facilitate the preparation of robust emissions inventories and the periodic reporting to ICAO of CO₂ emissions from international aviation.

This objective was achieved through the development of a dedicated software, the Aviation Environmental System, which was installed in the 14 States of the project since 2015 through on-site missions and complemented by several capacity building activities. The tool was further improved in 2017 and 2018, and a final version was installed in the selected States in early 2019.

The AES is a Windows .NET application which embeds a SQL database. Considering the limited internet connectivity in many States of the project, it was decided at an early stage to develop the AES in such a way that all its functionalities (apart from the reporting to ICAO) could be used offline, without any dependency on an internet connection.

As illustrated on its main menu (see the figure below), the AES has six main functionalities:



Import data

The State can first import into the AES the baseline and expected results that were calculated in the scope of the preparation of the action plan, for instance using the ICAO Environmental Benefits Tool (EBT). This is typically done once, after the first submission of the action plan, and every time the action plan is updated.

Then the State can import on a monthly basis flight-by-flight data submitted by the airlines and other stakeholders through a dedicated Excel format called Form ENV1 or through XML.

Export data

The exporting functionalities of the AES allow the State to export data from the database to tabular and Excel formats (such as the baseline and expected results, monitored data and graphical trends on the main indicators for international aviation) and also to export monthly and annual CO₂ reports that can then be submitted to ICAO, to stakeholders or used internally at the Civil Aviation Authority.

Monthly reports are useful to monitor data collection and emission levels throughout the years, and to detect problems such as data gaps at an early stage. Annual reports, on the other hand, constitute the traditional level of aggregation for emission levels and are useful, for instance, to compare emission levels to what was expected in the action plan for a given year.

Following a request from the States, a functionality to generate airline-specific monthly and annual CO₂ reports was added, so they can give some customized feedback to the airlines who submit data through Form ENV1. These reports include airline-level indicators (such as least and most fuel-efficient routes) that can help the airline define mitigation measures to reduce CO₂ emissions from international aviation.

Finally, the AES also supports exporting ICAO Form M⁵, automatically filled with data from the database.

Manage data providers

Importing and exporting processes constitute the core functionalities of the AES. In addition, the AES allows the user to manage the data providers (meaning the stakeholders who submit flight data), for instance, by defining their data scope. The data scope corresponds to the fields filled by this data provider in Form ENV1, and is especially important if the data provider only submits partially filled forms. For instance, a data provider submitting information on passengers and freight for each flight (without information on fuel consumption) can still be useful for the AES to cross-check the information on passengers and freight submitted by the airline on these flights, provided that both sources of information are independent.

Manage database

The AES also has a functionality to manage the database, in particular, to review invalid and inconsistent flights that are detected by the tool during the importing process. An invalid flight is a flight with incorrect information (for instance a negative number of passengers or a flight with a different departure and destination but zero fuel consumption). An inconsistent flight has some information that is different from the same flights already registered in the database, typically submitted by a different source (for instance different number of passengers for the same flight).

A new functionality was added recently in the AES, to allow States to synchronize the data included in the monthly reports directly with the ICAO server, which is then showcased in a data visualization platform described in section 5.4 below.

Browse database

The user can browse the tables of the database and edit them manually if necessary.

Help

The user can get assistance by contacting ICAO through email or checking the user manual, which has been fully updated to reflect the final version of the AES. An online version of the manual is available on the ICAO-EU project online platform, accessible to all focal points.

5.2 TRAINING ON THE AES

Focal points were trained during regional capacity building seminars on the use of the AES, and through on-site missions by the project team. Remote assistance was also available throughout the project for those focal points that needed specific support in the use of the AES.

5.3 DATA COLLECTION FOR THE AES

The main challenge faced by the focal points in the use of the AES was to receive adequate data from the airlines that could be imported in the database of the AES. Many national airlines in the selected States did not have a systematic flight data recording and storage system, which made it very challenging for them to report the data through Form ENV1 to the State.

Several measures were adopted to address this challenge:

- States were encouraged to raise awareness among their national airlines, especially at the top management level where decisions could be taken to strengthen technical resources assigned to the collection and reporting of flights data;
- 10 States adopted a regulation (e.g. Aeronautical Information Circular) to request periodic reporting of the data included in Form ENV1 from the airlines (see the table below);
- Three software interfaces were developed by the project team for airlines with significant traffic who already had a data management system, in order to facilitate the conversion of their internal format into Form ENV1. The figure below illustrates the Graphical User Interface of the interface for Caribbean Airlines.

⁵ <https://www.icao.int/sustainability/pages/eap-sta-excel.aspx>

	State	Regulation	Date of issuance
1	Angola	AIC No. CIT-C02-01	08-Jul-16
2	Burkina Faso	None issued	N/A
3	Burundi	AIC No. 729/DG/1318/2016	26-May-16
4	Cameroon	AIC No. 000005/NC/CCAA/DG/DTA/CEAE	23-May-16
5	Central African Republic	AIC No. 605/2016/ANAC-C.DG	22-Apr-16
6	Chad	AIC N°0043/ADAC/DG/DSA/2015	28-Oct-15
7	Republic of the Congo	None issued	N/A
8	Democratic Republic of the Congo	Decision n°DO-AAC100/DG/TMJ/ALG/788/16	13-Jul-16
9	Dominican Republic	RAD 121 / RAD 135	17-May-16
10	Equatorial Guinea	AIC No. 1/016	01-Sep-16
11	Gabon	AIC No. 006/16	18-Oct-16
12	Kenya	AIC No. 8/15	21-Jul-15
13	Sao Tome and Principe	None issued	N/A
14	Trinidad and Tobago	None issued	N/A



Screenshot of the interface developed for Caribbean Airlines to simplify reporting to the AES

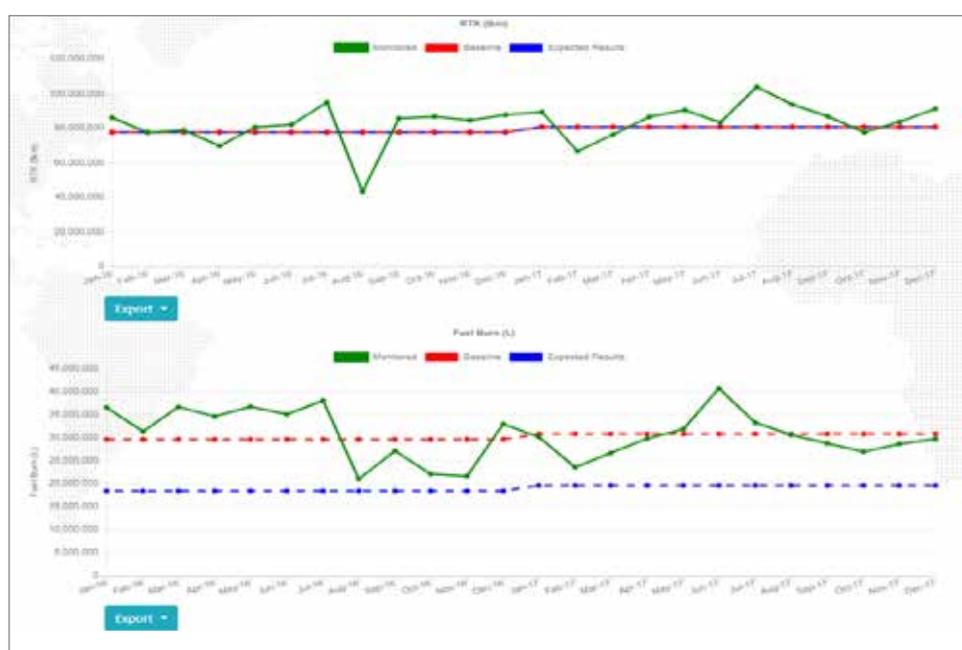
5.4 DATA VISUALIZATION PLATFORM

In 2018, the project developed a data visualization platform at ICAO to centralize data submitted from the States through the AES. Reserved to ICAO, this platform is useful for the monitoring of the data submission process, for reporting of consolidated data to monitor the global emissions reduction from aviation through the action plans, and for reporting to the ICAO Council on progress towards the aspirational goals.

This platform is linked to the new “Synchronize” button in the AES, that can be used by the States to upload data directly to the ICAO server. The screenshots below illustrate some of the functionalities of the AES data visualization platform.



Data visualization platform



Data analysis of monitored data within the Data visualization platform

5.5 STATUS OF THE REPORTING TO ICAO

5.5.1 SUBMISSION OF MONTHLY CO₂ REPORTS

In order to report the main indicators for CO₂ emissions from international aviation to ICAO on a regular basis, the selected States were requested to generate a monthly CO₂ report with the AES and submit it every month to ICAO.

The figure below describes the monthly CO₂ reports received by ICAO by the selected States during the period January 2016 to December 2018. Over this period, a total of 446 monthly CO₂ reports were received, which represents 88% of possible submissions.

As can be seen in the figure, four States (Angola, Equatorial Guinea, Sao Tome and Principe and Trinidad and Tobago) did not submit all their reports in 2018, with all the missing reports occurring at the end of the year. These data gaps can be attributed to delays in data submission from the airlines and should be filled in the course of 2019. Only Congo met significant challenges in the data collection process from 2017 onwards, that could not be overcome in the timeframe of the project, despite significant efforts from the project team (on-site missions, official communications from ICAO, etc.).

It should also be noted that in the case of the Central African Republic and Democratic Republic of the Congo, the national airline did not serve any international flights for several months over the period, as highlighted in red in the figure. Therefore, the State had no international traffic to report.

	2016												2017												2018												Total reports per State	Percentage data gap over 3 years
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
1 Angola	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												32	11%
2 Burkina Faso	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
3 Burundi	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												24	33%
4 Cameroon	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
5 Central African Republic	Report submitted with at least one flight												Report submitted without any flight												Report submitted without any flight												36	0%
6 Chad	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												25	31%
7 Republic of the Congo	Report submitted with at least one flight												Report submitted without any flight												Report submitted without any flight												12	67%
8 Democratic Republic of the Congo	Report submitted without any flight												Report submitted without any flight												Report submitted without any flight												36	0%
9 Dominican Republic	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												34	6%
10 Equatorial Guinea	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
11 Gabon	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
12 Kenya	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
13 Sao Tome and Principe	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												36	0%
14 Trinidad and Tobago	Report submitted with at least one flight												Report submitted with at least one flight												Report submitted with at least one flight												31	14%
TOTAL																																					446	

Report submitted with at least one flight Report submitted without any flight

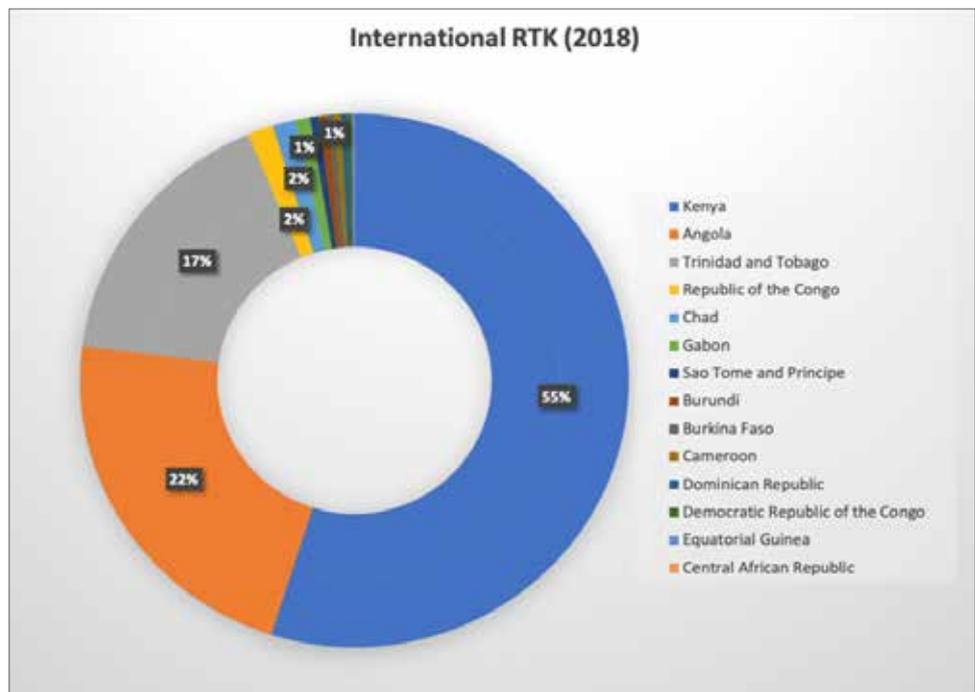
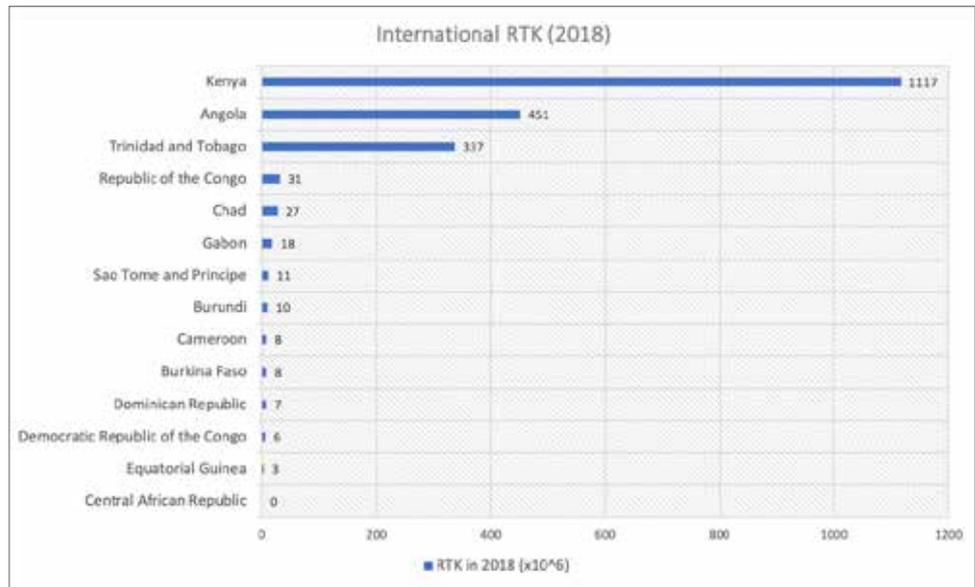
5.5.2 ANALYSIS OF THE DATA SUBMITTED THROUGH THE AES

This analysis is the result of the data submitted by the beneficiary States using the AES, which can be subject to errors. The analysis serves for general information purposes only. ICAO and the European Union do not endorse the accuracy or reliability of the data, and will not be liable for it.

In order to perform a data analysis over the three years 2016-2018, data gaps were filled using estimates, by performing a linear regression over the RTK and fuel efficiency over the period. This simple approach was selected because of the relatively important variability over the data in several States, and the absence of clear seasonality.

The analysis of the monitored data using the AES, especially the monthly RTK over the 36 months under consideration, confirms that the selected States have very different levels of international traffic, ranging from about 3,000 flights a month (e.g., Kenya) to zero, when no national airline serves international flights (e.g., Chad).

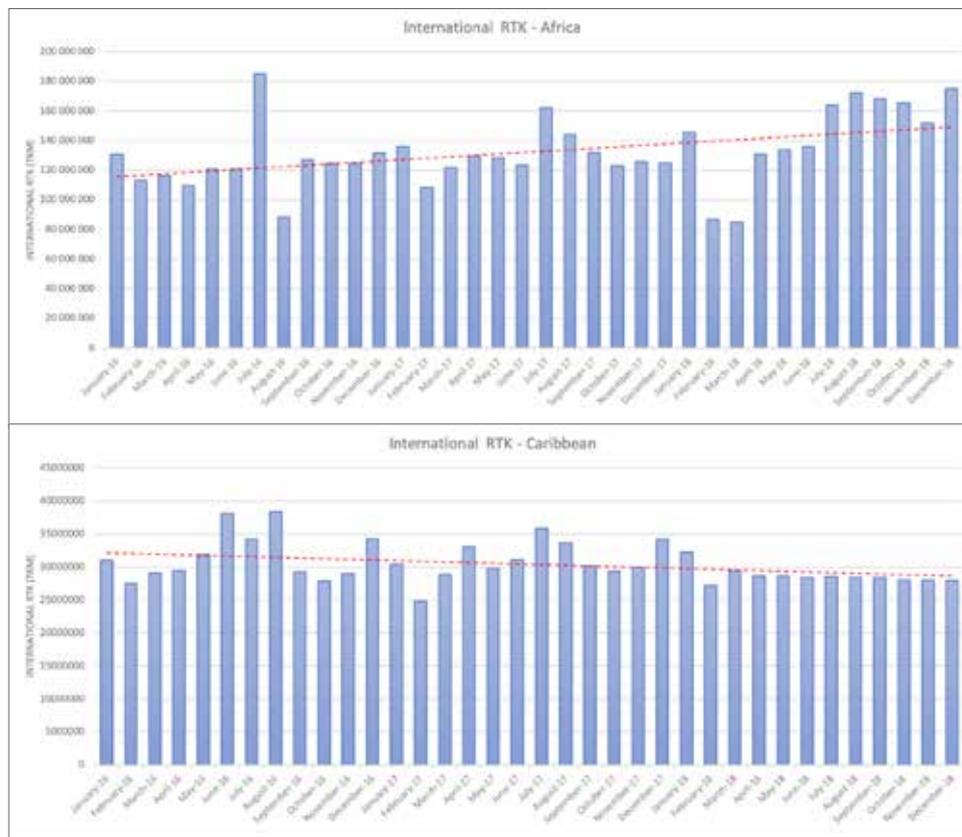
The two figures below show the amount of international RTK for each State in 2018 (according to the data submitted through the AES), and the share of RTK it represents among the selected States. Three States represent 94% of the international RTK covered by the beneficiary States of the project: Kenya (55%), Angola (22%) and Trinidad and Tobago (17%).



Visual inspection of the RTK trends of the selected States (provided in the Country Fiches in Annex 1) shows that individually, the international RTK of the selected States is mostly characterized by a significant variability without clear seasonality. The variability can be explained by different reasons, such as fleet restructuring (e.g. Angola, Kenya) or technical disruptions. In the Central African Republic for instance, the traffic dropped to zero in 2018 due to maintenance of the unique aircraft of the national airline serving international flights. In Cameroon, the traffic dropped significantly in 2017 when the Douala International Airport closed for several months of renovation. Since most of the selected States have only one national airline serving international flights with a small fleet of less than 10 aircraft, such disruptions impact significantly the aggregated international traffic reported by the State to ICAO.

The figures below show the overall variation of international RTK aggregated regionally for the selected States over 2016 to 2018 (according to the data submitted through the AES), as well as the corresponding trendline. The international RTK grew in average by 7.2% annually in the beneficiary States in Africa, and decreased by 4.8% annually in the beneficiary States in the Caribbean. While the increase in the beneficiary States of the African region is consistent with the regional forecast

on traffic growth in the region, the decrease of the RTK in the beneficiary States of the Caribbean region does not follow regional trends. This analysis is, however, mostly based on one major airline that dominates the traffic of the two Caribbean selected States, and can therefore not be used to draw conclusions at the regional level.

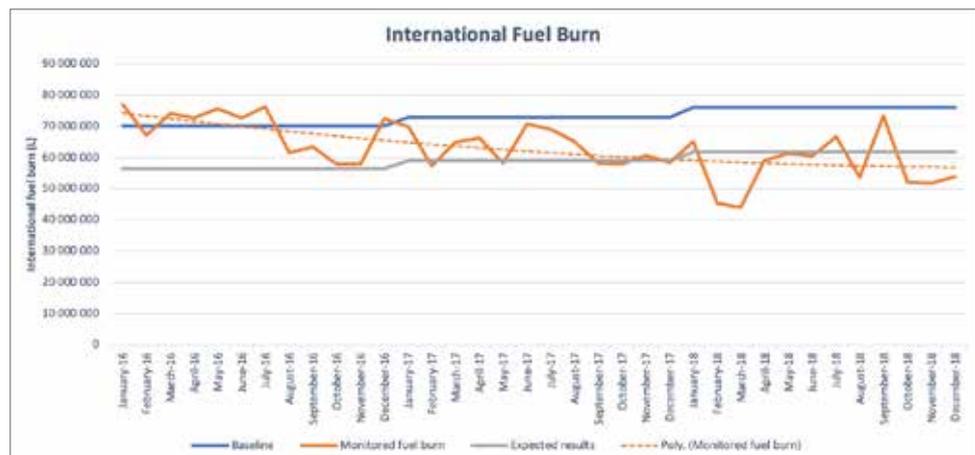


Fuel efficiency is the indicator of choice to evaluate environmental performance in terms of CO₂ emissions reduction from international aviation. The figure below illustrates the annual variation in fuel efficiency for each State from 2016 to 2017 and from 2017 to 2018, as well as the average annual fuel efficiency variation over the period. It is to note that the Democratic Republic of the Congo did not have international flights before August 2018 and the Republic of Congo did not report any flights in 2017 and 2018. The Central African Republic did not have any international flights in 2018. Therefore, these three States were not taken into account in this analysis.

72% of the data from the 11 States taken into account in this analysis show a decreasing trend (i.e. improvement) in fuel efficiency from 2016 to 2018, with an average decrease of 14.8% for the beneficiary States in Africa and 0.2% for the beneficiary States in the Caribbean, according to the data submitted through the AES. This significant improvement in the beneficiary States in the African region can be explained by the implementation of measures with high impact on fuel efficiency (such as fleet renewal) in States with important traffic, such as Kenya and Angola.

Finally, the monitored fuel consumption (which is directly proportional to CO₂ emissions) was compared to the baseline and expected results in the selected States. The chart below illustrates the aggregated result for all selected States, and the trendline of the monitored fuel burn data (dashed orange line). The trend shows a consistent decrease in fuel burn from a higher value than the baseline in early 2016 to a lower value than the expected results in 2018. This result illustrates that the quantification in the action plans did not fully capture the reduction in fuel burn that was experienced in the selected States within the timeframe of the project. This also highlights the importance of updating the action plan on a regular basis in order to realign the trends with the current situation, especially in a highly dynamic environment such as the regions selected for the project. In this regard, the AES will facilitate the update of the quantification of the action plan in the selected States by providing more reliable historical data than the one that was initially used for the calculation of the baseline and expected results.

State	Variation fuel efficiency 2016-2017	Variation fuel efficiency 2017-2018	Average annual fuel efficiency variable
Angola	-0.174	-0.153	-0.164
Burkina Faso	0.032	0.001	0.016
Burundi	0.011	0.198	0.105
Cameroon	0.063	-0.175	-0.056
Central African Republic	-0.319		
Chad	-0.103	0.005	-0.049
Republic of the Congo			
Democratic Republic of the Congo			
Dominican Republic	-0.379	1.001	-0.311
Equatorial Guinea	-0.255	0.138	-0.059
Gabon	-0.819	-0.290	-0.555
Kenya	-0.102	-0.119	-0.111
Sao Tome and Principe	-0.244	-0.257	-0.250
Trinidad and Tobago	0.005	-0.007	-0.001
TOTAL	-0.115	-0.130	-0.122
Africa	-0.145	-0.152	-0.148
Caribbean	0.018	-0.021	-0.002



5.6 TRANSITION PLAN

By the end of the project, a transition plan was developed to document the requirements for the continuous operation of the AES by the States and the role of ICAO Headquarters after the project's completion.

It was agreed that ICAO ICT will continue operating the AES data visualization database, website, and the server, ensuring its operational availability and security. ICAO ICT will also safe keep the AES source code.

On the other hand, the AES workstations in the States will be under the responsibility of their corresponding States. Maintenance, back-ups (system and data), security, and training will be managed by the IT services of the Civil Aviation Authorities. The only support available from ICAO after the projects' completion will be the provision of the AES application package if a State requires it (e.g., for a replacement installation). States were notified by the end of the project of their responsibilities in this transition plan.

An ICAO Environment focal point was also nominated amongst ICAO ENV staff in order to receive emails sent to the project team after the project ended (icao-eu-project@icao.int) and to respond to States' requests on the use of the AES.

5.7 AES AND CORSIA

The adoption of the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) at the 39th Session of the ICAO Assembly, and the subsequent development of Standards and Recommended Practices by the ICAO Council (Annex 16, Volume IV) have established new Monitoring, Reporting and Verification (MRV) requirements for ICAO States starting from 1 January 2019.

While the AES already includes the “embryo” of a MRV system, it was not designed for CORSIA. Many States asked about the possibility of using the AES for their CORSIA reporting requirements. However, this is not possible with the AES as it was developed before the agreement on the CORSIA SARPs and related guidance. Nevertheless, the environmental data collected through the AES can be used to complement and cross-check the information required for CORSIA monitoring and reporting.

In the annual Steering Committee of the ICAO-EU Project in 2018, it was agreed that the ICAO-EU project team would explore in 2018 and 2019 the possibility to enhance the AES to make it CORSIA-compatible, leading to a so-called “AES+”.

Discussions with the ICAO CORSIA team helped define the expected functionalities for the AES+ and its technical specifications. The project developed a “prototype AES+” with three additional functionalities for testing purposes only:

- Form ENV1 was expanded into Form ENV1+ with two new fields: fuel type and fuel use monitoring method;
- A new page called “CORSIA States” was added in the AES, whereby States can import, view and export the list of States who have joined CORSIA;
- The AES automatically labels flights imported in the database as either following a CORSIA route or not.

The prototype AES+ was installed in Kenya in May 2019 and successfully tested by the focal points at Kenya Civil Aviation Authority. A full version of the AES+ could be developed in the future subject to the availability of funding.

6. OBJECTIVE 3: IMPLEMENTATION OF MITIGATION MEASURES

6.1 SELECTION OF MITIGATION MEASURES

6.1.1 ICAO'S BASKET OF MEASURES

ICAO Assembly Resolution A38-18: Consolidated statement of continuing ICAO policies and practices related to environmental protection — Climate change indicates that “action plans should include information on the basket of measures considered by States, reflecting their respective national capacities and circumstances, and information on any specific assistance needs”. In ICAO Doc 9988 version 2, *Guidance on the Development of States' Action Plans on CO₂ Emissions Reduction Activities*, a “basket of measures” is presented where mitigation measures are classified in the following seven categories:

1. Aircraft-related technology development;
2. Alternative fuels;
3. Improved air traffic management and infrastructure use;
4. More efficient operations;
5. Economic/market-based measures;
6. Regulatory measures/other; and
7. Airport improvements.

It is recommended that the States make a “balanced” selection of mitigation measures in their action plan, with measures taken from different categories of ICAO's basket of measures. Accordingly, this basket of measures was used as a reference by the selected States.

6.1.2 SELECTION OF MEASURES FUNDED BY THE PROJECT

According to the project log-frame, the project aimed to support, with project funding, the development of feasibility studies in at least five selected States, and to facilitate (with or without the project funding) the implementation of mitigation measures in at least five States in the timeframe of the project.

All 218 mitigation measures selected in the States' action plans were initially considered, except for those where it was explicitly stated that assistance was not needed (46 measures).

An initial selection was made to exclude the measures to be implemented by airlines only, such as most of those included in Category 1 (Aircraft-related technology) and Category 4 (More efficient operations) of ICAO's basket of measures. Supporting these measures at the individual State level may have contributed to creating competitive distortion for one air carrier to the detriment of another carrier operating in the same area. Similarly, only international airports owned by governmental entities were considered for the implementation of mitigation measures at airports.

From the remaining measures, further selection criterion were applied to discard those measures that were not considered to be additional, such as those ones already supported in the short-term in the scope of other programmes (e.g. ICAO Performance-Based Navigation Programme, African Flight Procedure Programme, etc.).

Finally, the measures were further assessed to favor those achieving the highest reduction of CO₂ emissions from international aviation for a cost in the range of the allocated project budget. To a lesser extent, measures bringing significant co-benefits (mostly measures from Category 7 – Airport improvements) were also ranked higher than measures without associated domestic emission reduction.

The commitment of the States to the project (reflected in particular by the time spent to develop

their action plans and its timely submission) as well as the security situation and political stability of the States were also taken into consideration. The primary States considered for the implementation were those in which the involvement in the project had been stronger and where risks for implementation were lower.

The table below summarizes the selection criteria and number of States and measures meeting them.

Criteria	Number of States	Number of measures meeting this and previous criteria
Request assistance to implement the measures	14 States	172 measures
Measures do not create a competitive distortion	14 States	143 measures
State has political stability and security	12 States	114 measures
Additionality (i.e., measures are not covered by existing programmes)	12 States	72 measures
Airport owned by States and maintained in the short/middle-term	8 States	55 measures
Measures with the highest reduction of CO ₂ emissions	8 States	16 measures (5x electrical GPU/PCA and 11x CDO/CCO)

This analysis led to the selection of the implementation of the two following measures:

1. Implementation of Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) in selected States where these procedures have not yet been designed or planned to be implemented in the short-term;
2. Installation of “solar-at-gate” at international airports, consisting of a solar facility installed at the airport premises and electric airport gate equipment (Ground power unit and pre-conditioned air unit). The combination of the electricity provided by the solar facility with the use of electric airport gate equipment connected to aircraft at the gates provides both international and domestic CO₂ emissions reduction.

The ROM review concluded that the selection of mitigation measures to be funded by the project was balanced and well distributed geographically. In particular, the “solar-at-gate” projects are the measures with the most interest from the selected States and they also have a high degree of replicability.

6.1.3 SELECTION OF BENEFICIARY STATES FOR THE IMPLEMENTATION OF CCO/CDO

In order to be considered as additional, this measure needed to be implemented in States that were not currently benefitting (and were not expected to in the near future) from the support of other programmes targeting the improvement of ATM in the region, such as ASECNA's initiatives, the ICAO Performance-Based Navigation Programme or the African Flight Procedure Programme, and that had requested assistance for this measure in their action plan.

After discussions with relevant representatives of these programmes it was decided to focus the project support on Burkina Faso and Gabon, both ready to implement CCO and CDO but in need of support and out of the scope of the other programmes.

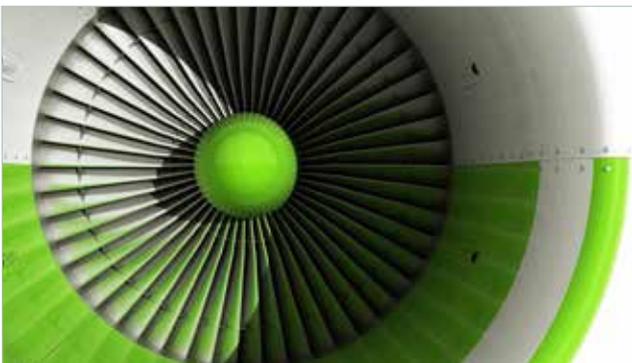
6.1.4 SELECTION OF BENEFICIARY STATES FOR THE IMPLEMENTATION OF “SOLAR-AT-GATE” PROJECTS AT AIRPORTS

From the 14 States that had planned the implementation of solar energy at airports in their action plans, the following States were not considered:

- States that did not request assistance for solar power systems;
- Airports that were operated by private entities;
- States where the main international airport was soon to be replaced by a new airport;
- States with significant political instability.

Based on the carbon reduction potential and replicability, two States were selected for the implementation of “solar-at-gate” projects at airports: Cameroon and Kenya.

6.1.5 FEASIBILITY STUDIES FOR THE DEVELOPMENT OF SUSTAINABLE AVIATION FUELS



For aviation, sustainable fuels are defined as those fuels that have the potential to be sustainably produced and to generate lower carbon emissions than conventional kerosene on a life-cycle basis. Sustainable aviation fuels can be produced from a variety of feedstocks, including renewable biomass (from algae, forest residues, etc.) or waste. The aviation industry focuses on “drop-in” sustainable aviation fuels that have the potential to reduce lifecycle CO₂ emissions. Drop-in sustainable aviation fuels are proven to be a technically sound solution that will not require changes to aircraft or fuel delivery and holding infrastructure.

Drop-in fuels are particularly important in aviation, because unlike other industries, such as road-transportation for example, aviation has no alternatives to liquid fuels for the foreseeable future. In addition, the concentration of aviation fuel distribution to a limited set of locations can facilitate initial deployment. The major potential benefit of introducing sustainable aviation fuels is to reduce aviation’s contribution to climate change by limiting carbon emissions.

The use of sustainable aviation fuels is a promising technological solution to contribute to the reduction of aviation emissions and could be beneficial for developing countries. Several States of the project had selected feasibility studies for the implementation of sustainable aviation fuels as a mitigation measure in their action plans.

To demonstrate that the aviation fuel is sustainable, the full life cycle of the fuel needs to be considered, including the production of the fuel itself, as that process is likely to produce greenhouse gas emissions. Thus, to assess the emissions reductions from using sustainable aviation fuels, comprehensive accounting must be done of all emissions across all steps of the fuel’s life cycle. If there are fewer emissions from the full life cycle of the sustainable aviation fuel, in comparison to the full life cycle of fossil fuels, then there is an environmental benefit for climate change.

Therefore, it is of high importance to carefully study the potential and constraints for the development of sustainable aviation fuels in each State before engaging in this path.

The project funded the conduct of feasibility studies on the use and development of sustainable aviation fuels in four States which had requested such assistance in their action plans: Burkina Faso, Dominican Republic, Kenya and Trinidad and Tobago.

6.1.6 FEASIBILITY STUDIES FOR THE USE OF SOLAR ENERGY AT AIRPORTS



Another significant source for emissions reduction is the use of electrical Ground Power Units (GPUs) and pre-conditioned air (PCA) instead of the aircraft Auxiliary Power Units (APUs). The use of renewable energy (such as solar energy) to power electric GPUs can lead to a carbon neutral solution that has a strong future potential for “greening” airports all over the world. This measure, called “solar-at-gate” (see section 6.2.2.1 below), brings reductions in CO₂ emissions from international aviation (through the reduced use of APUs) as well as reductions in domestic CO₂ emissions (through the use of renewable energy instead of fossil fuel to power ground equipment).

In the scope of the project, Trinidad and Tobago was selected for a feasibility study on the use of solar energy to power airport operations, including electric airport gate equipment.

6.1.7 SUMMARY OF MITIGATION MEASURES AND FEASIBILITY STUDIES FUNDED BY THE PROJECT

The analysis of the mitigation measures included in the Action Plans of the beneficiary States with the proposal of mitigation measures and feasibility studies to be funded by the project was submitted to the European Commission in the project Interim Report, June 2016.

The tables below give a summary of the selected mitigation measures funded by the project, which are described in more details in the following sections.

“SOLAR-AT-GATE” PROJECTS

“SOLAR-AT-GATE” PROJECTS		
	CAMEROON	KENYA
Location		
Airport	Douala International Airport	Moi International Airport
City	Douala	Mombasa
Stakeholders		
Airport Operator	Aéroports du Cameroun (ADC)	Kenya Airports Authority (KAA)
Civil Aviation Authority	Cameroon Civil Aviation Authority (CCAA)	Kenya Civil Aviation Authority (KCAA)
Contractor	Sagemcom Energy & Telecom SAS	Solar Century Holdings Ltd.
Timeframe		
Date of signature of the contract	16-Jan-18	27-Mar-18
Date of inauguration	10-Jan-18	12-Dec-18
Solar Photovoltaic System		
System siting	Airside	Landside
Nameplate capacity (MWp)	1.25	0.5
Energy produced per year (MWh)	1850	819.4
Number of panels	3840	1,560
Total project ground (m2)	27600	7500
Panels model	Twinkle TD672D from Talesun	Canadian Solar (CS6U 325P)
Gate equipment		
Electrical GPU	Purchased by the State	ITW GSE - 2400 Series, 180kVA Mobile
Electrical PCA	Purchased by the State	ITW GSE - 3400 Series, 210 Type – mounted on a locally fabricated trailer
Battery system	Purchased by the State	400 kVA Galaxy UPS by Schneider Electric with lithium Ion batteries manufactured by Samsung
Cost		
	US \$1,478,642.12	US \$1,501,132.32
Expected environmental benefits		
Annual CO ₂ emissions reduction (tCO ₂)	2,575	1,300

CCO/CDO PROJECTS

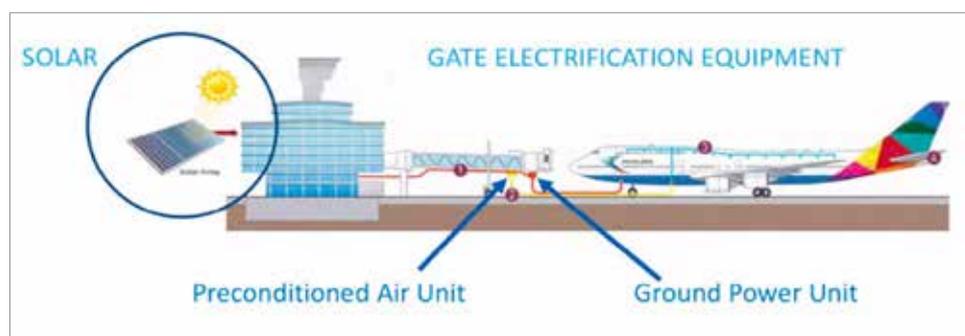
CCO/CDO PROJECTS		
	BURKINA FASO	GABON
Location		
Airport	Thomas Sankara International Airport	Léon-Mba International Airport
City	Ouagadougou	Libreville
Stakeholders		
Regional stakeholders	ASECNA, AFPP	ASECNA, AFPP
National stakeholders	Civil Aviation Authorities, the Ministry of Transports, the Ministry of Environment, Ministry of Defense airport operators, air traffic controllers, and airlines	Civil Aviation Authorities, the Ministry of Transports, the Ministry of Environment, Ministry of Defense airport operators, air traffic controllers, and airlines
Timeframe		
Date of kick-off meeting	Nov-17	Oct-17
Inception Phase	Sep-18	Sep-18
Design Phase	Nov-18	Nov-18
Expected environmental benefits		
Annual CO ₂ emissions reduction (tCO ₂)	354	1,014

6.2 IMPLEMENTATION OF THE “SOLAR-AT-GATE” PROJECTS

6.2.1 “SOLAR-AT-GATE” CONCEPT

Aircraft conventionally use on-board auxiliary power units (APU) or diesel-powered GPUs to provide electricity and cabin climate control while an aircraft is parked at the gate before departing for its next flight. The concept of a “solar-at-gate” project (illustrated on the figure below) aims at demonstrating how a solar photovoltaic facility installed at the airport premises can power airport gate equipment, consisting of an electric GPU and a PCA. The combination of electricity generated by the solar facility and the use of gate electrification equipment eliminate the use of fossil fuel to power aircraft at the gate and thus CO₂ emissions.

This innovative solution was designed by ICAO in cooperation with the United Nations Framework Convention on Climate Change (UNFCCC), to reduce greenhouse gases emissions by providing solar energy directly to aircraft during ground operation. This concept has become an approved methodology under the Clean Development Mechanism (CDM).



Solar-at-gate methodology

6.2.2 PROJECTS’ SCOPE OF WORK AND RATIONALE

Cameroon and Kenya were selected for the implementation of “solar-at-gate” projects in the international airports of Douala and Mombasa respectively. The specific design of each project was prepared based on the individual needs of the host organization, with the involvement of the airport authorities and relevant government staff.

6.2.2.1 “Solar-at-Gate” project at Douala International Airport, Douala, Cameroon

For the Cameroon project at Douala International Airport, the project funded a 1.25 MW solar photovoltaic facility while the airport authority purchased the airport gate equipment directly, including PCA and GPU frequency converters as a State contribution to the project.

The contribution of the State, allowed ICAO to double the size of the solar photovoltaic facility to power the airport electric equipment and also the airport energy demand, contributing to the reduction of airport emissions as a co-benefit.



Solar facility installed at Douala International Airport. Douala, Cameroon

6.2.2.2 “Solar-at-Gate” project at Moi International Airport, Mombasa, Kenya

For the Kenya project at Moi International Airport in Mombasa, the project design required all of the components of the “solar at-gate” concept including a 507 kW solar photovoltaic facility, both a PCA and a GPU mounted on trailers to enable service at all six airport gates, and an uninterruptible power supply (UPS) and battery system to ensure constant electricity flow to the aircraft. As both projects were afforded equal budgets, the Cameroon project was able to allocate more funding to solar, resulting in a larger solar facility. Both projects also included the same contractual requirements associated with equipment warranties, operations and maintenance support, staff training, and educational components.



Solar facility installed at Moi International Airport. Mombasa, Kenya

6.2.2.3 Procurement and project implementation process

ICAO followed the same process of project implementation for both projects. A procurement process was initiated in accordance with ICAO’s Procurement Code. An international tender was prepared and advertised for 10 weeks (8 March 2017 to 17 May 2017). During the bidding process, ICAO convened a technical bidders’ on-site meeting to discuss the technical specifications of the equipment to be supplied, provide further information of the project’s design and details, conduct a visit to the proposed sites for the project and respond to any inquiries before the submission of proposals. Participation in the technical bidders’ meeting was a condition for submitting a proposal. A total of 18 suppliers attended the technical meetings in Mombasa, Kenya, and 17 suppliers in Douala, Cameroon.

Upon the closing date of the tender, ICAO received 16 bids from 14 bidders. Subsequently, all bids were assessed, based on the evaluation criteria defined at the time of the tender and included as part of the tender package, and the principles and procedures established in the ICAO Procurement Code. The basis for the evaluation of the equipment and services are:

- Compliance with the technical requirements submitted by the end-user and with the ICAO instruction to tenderers and Terms and Conditions.
- Best value for money.

Only companies with a technically acceptable proposal were commercially reviewed. The best value technically-compliant bid was recommended. Best value is based on a comprehensive review of the proposal with a preference for projects that produce greater amounts of electricity as demonstrated through submission of a credible electricity yield report.

Following the evaluation and the approval of the ICAO Contracts Board, two suppliers were selected for contract award:

- **Sagemcom** was recommended for contract award for the Cameroon Project. Sagemcom is an international company based in France involved in engineering, procurement, and construction of communications and energy infrastructure. It is the sole bidder with local

presence from its subsidiary Sagemcom Cameroun Sarl. Its bid was only for the Douala Cameroon Project.

- **Solar Century** was recommended for contract award for the Kenya Project. Solar Century is a full-service solar company based in the United Kingdom with offices in Kenya. It is the prime bidder for this project. Its bid was only for the Mombasa Kenya Project.

Upon completion of the contracting process and execution of the final contract, ICAO project staff coordinated regular progress meetings to track project progress. Formal milestones associated with the project design and development included the preparation of two contractual deliverables: a system design document (SDD) to finalize and approve the project design, and a Site Acceptance Test (SAT) procedure for verification of the civil works and all the equipment performance and technical functional characteristics prior to the project's acceptance.

6.2.3 SUMMARY OF THE SDD FOR BOTH "SOLAR-AT-GATE" PROJECTS

The contractors for each project prepared system design documents, which were a specific requirement of the contract. The SDD included design drawings of project components, civil works procedures, geotechnical studies to support the designs, documentation to ensure that the projects comply with environmental laws and regulations, a transition plan for the period of project approval and transfer of facilities to the State, an operations and maintenance plan, and a training plan.

For the facility at Douala International Airport, flooding adjacent to and partially within the project site necessitated shifting part of the solar array. A revised project footprint was proposed by the contractor relocating solar panels and support structures from the east side of the project site to the west, which was approved by ICAO.

For the facility at Moi International Airport, the contractor had been unable to identify a battery storage system that met the requirements for uninterrupted power. It was determined that the SDD should be approved with the absence of a selected battery storage system. Approximately one month after the approval of the SDD, the contractor proposed an uninterrupted power supply (UPS) and battery that could meet the project technical specifications, and it was approved by ICAO.

6.2.4 STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Throughout the project design and implementation, ICAO worked with the relevant national stakeholders. For both projects, the primary stakeholders were the Civil Aviation Authority and the airport of each State. The Civil Aviation Authority in each State is ICAO's counterpart in coordinating international aviation Standards and guidance including the preparation of the action plans and the implementation of the mitigation measures in selected States. The airport authority is also a critical stakeholder as it is the organization involved in daily aviation activities and operation of the airport. In Cameroon, Aéroports du Cameroun (ADC) is the State-owned company that owns and operates Douala International Airport. In Kenya, Kenya Airports Authority (KAA) is the



Gate equipment (GPU and PCA) funded by the project is connected for the first time to an international flight at Moi International Airport, Mombasa, Kenya

parastatal institution in charge of all international airports of the country including Moi International Airport in Mombasa.

Other stakeholders consulted during the project included the airlines serving those airports and the ground handler companies, though this coordination was conducted by the national authorities.

To enhance coordination and involvement of ICAO and the relevant entities in Cameroon and Kenya for the implementation of the "solar-at-gate" projects, a Memorandum of Understanding (MOU) was agreed to provide a framework for collaboration between the Civil Aviation Authorities and the airport authorities of both States and ICAO.

The MOUs established the roles and responsibilities to be assumed by each party in the process of procurement, installation and further use of the solar photovoltaic system and ground support equipment implemented at both airports. They also established the coordination mechanism and the correct use and long-term maintenance of the equipment expected by the beneficiary States after the commissioning of the equipment.

The primary challenge associated with implementation was related to physical distance between technical managers and in-country activities. These challenges were mitigated by an active and interested State partner, having ICAO in-country project staff available, and conducting regular team progress calls. However, the contractors faced challenges for project implementation that are unique to developing countries, including procurement of materials, access to qualified labor, and importation of equipment and customs clearance, which required hands-on support from ICAO. This was also partially mitigated through targeted visits by the ICAO Programme Coordinator.

6.2.5 EXPECTED BENEFITS

For the solar project in Mombasa, the expected results are calculated assuming that the gate equipment will be used to service seven flights a day, with a "turn" time of 1.5 hours per flight, so 10.5 hours of operations per day, 365 days per year. The use of APU during this time would represent 1,300 tCO₂ emissions, which would then be avoided every year by the use of the gate equipment provided by the project.

A similar calculation for the project in Douala leads to an expected 2,575 tCO₂ emissions reduction per year.



Educational kiosk with live data on environmental benefits from the solar-at-gate project installed at Moi International Airport

6.2.6 SUSTAINABILITY OF THE PROJECTS AND NEXT STEPS

The nature of the projects and specific assurances built into the contract ensure the long-term sustainability of the facilities.

Solar facilities are relatively simple structures with few moving parts that could fail. They also can be constantly monitored in real-time from remote locations, which allows for quick identification of problems and appropriate correction. The contract requires that contractors have technical staff in-country allowing for a quick response time for any technical problems identified.

Each contract also includes a five-year operations and maintenance agreement from the date of the SAT to be implemented by the contractor, ensuring close oversight during the first five years of the project and after the commissioning process. Equipment and installation warranties were also required in the contract, including an extended warranty on the inverters. Staff training was also required prior to site acceptance to ensure that local staff had an initial understanding of the operations and functioning of the facilities.

The MOUs established between ICAO and the Civil Aviation Authorities, and airports authorities of the States included guidelines for project implementation during the operations and maintenance period. Among the requirements, the MOU required the airports to develop agreements with the airlines on the use of the gate electrification equipment and to give priority use for international flights.

As the ownership of the solar systems and associated equipment has been transferred to the beneficiary States for operations and maintenance, ICAO's role will be to monitor system performance through review of written progress reports and periodic online system access, to check in regularly with local partners to



Gate equipment (GPU) is being connected to power aircraft during ground operations which avoids the use of jet-fuel powered APUs

assess management experience with the systems, and to follow-up directly with the contractor if any problems are identified particularly where there may be a breach of the contract.

6.2.7 LESSONS LEARNED

The following is a list of lessons learned from the implementation of the two "solar at-gate" projects.

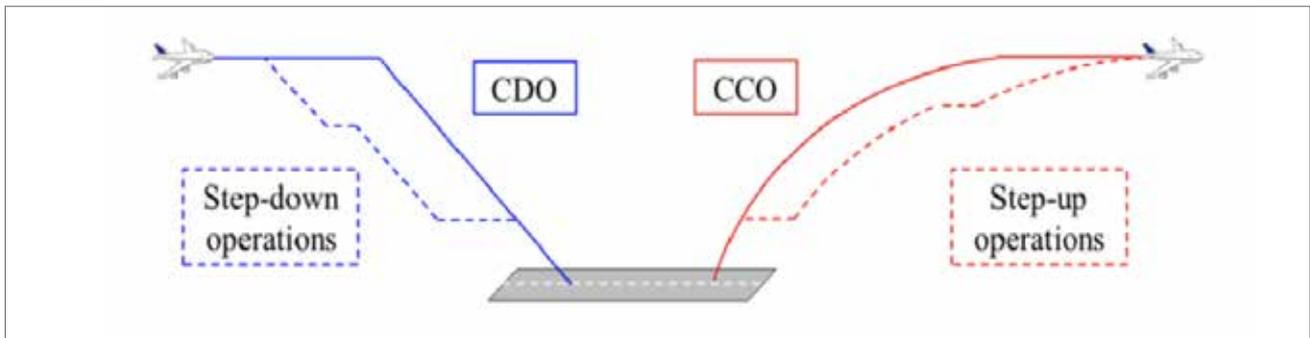
- Both projects benefitted from having an ICAO representative locally to communicate with the local partners and track progress.
- The design and schedule should consider seasonal weather events such as work during the rainy season, if feasible.
- The schedule should include a pre-Site Acceptance Test visit occurring at a time when project facilities have been substantially installed and reviewed to develop a final punch list for completing the project prior to scheduling the final SAT.
- Capacity building should be conducted with the beneficiaries to review basic concepts of solar power generation such as the difference between the nameplate (or peak) capacity of the solar facility and actual amount of electricity to be generated.
- Increased emphasis in the SDD should be applied to a clear operations and maintenance schedule for each of the facility components. For solar, this would be a single annual inspection though supported by monthly reports on performance and technical support. For gate equipment, inspections should occur quarterly and require direct participation by gate equipment manufacturers' technicians.
- There should be a requirement that the panels be cleaned, and vegetation managed prior to completion of the SAT. To achieve this, coordination is necessary between the contractor and the airport to identify required facilities/equipment and for the airport to install necessary plumbing and procure recommended vegetation management equipment.
- A plan for site security also needs to be addressed and codified in any transfer documents.
- Agreement with airlines for the use of the gate equipment should be programmed into the project documents to ensure that the gate equipment commences use as soon as is technically possible.

6.3 IMPLEMENTATION OF CCO/CDO

6.3.1 OVERVIEW OF THE MEASURES

Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) allow departing or arriving aircraft to climb or descend continuously, to the greatest extent possible (see figure below). This saves fuel burn for the whole flight compared to a step-wise climb or descent operations and consequently contributes to the reduction of CO₂ emissions.

Burkina Faso and Gabon were selected to receive support for the implementation of CCO and CDO procedures at the international airports of Ouagadougou and Libreville, respectively. These measures had been selected by both States in their action plans and were planned in compliance with ICAO Doc 9906, *Quality Assurance Manual for Flight Procedure Design*.



Continuous Climb Operations and Continuous Descent Operations

For the implementation, it seemed logical to join efforts with ASECNA for those pilot mitigation measures related to the improvement of air traffic management. ASECNA is the Air Navigation Services Provider (ANSP) for 17 States in Africa, including seven beneficiary States of the project. Since the beginning of the ICAO-EU project, ASECNA had been involved in the provision of relevant data on traffic and fuel consumption for the selected States in the African region, which had been critical for the preparation of the emissions baseline included in the States' Action Plans. Furthermore, ASECNA local officers are full members of the National Action Plan Teams in the seven selected States of the project, which are also members of ASECNA, where it provides air traffic management services and contributed to the selection of mitigation measures.

An informal assessment conducted in preparation of the implementation of CCO and CDO procedures revealed the need to create synergies both with ASECNA – the Air Navigation Service Provider in both selected States- and with the existing ICAO Programme “African Flight Procedure Programme” (AFPP), currently providing support to these States for the implementation of operational measures. In the second semester of 2016, ICAO initiated discussions with these entities to better define the scope of cooperation and the work plan and timeline that could be followed to successfully implement these selected measures.

6.3.2 IMPLEMENTATION STEPS

The process was based on several implementation phases that were completed in both States with the participation of ASECNA technical staff, ICAO and national stakeholders, which included the Civil Aviation Authorities, the Ministry of Transport, the Ministry of Environment, Ministry of Defense, airport operators, air traffic controllers and airlines.

Initial phase

In light of the initial informal review, a series of working meetings with the relevant departments of ASECNA were held in Dakar, Senegal, where ASECNA Headquarters is located, and it was identified that the main challenge for the implementation of these procedures, which had been tried first in Senegal and Côte d'Ivoire (pilot projects of ASECNA) was the coordination at the national level and the training of the controllers.

Considering the successful experience obtained with the establishment of NAPT, it was agreed that the ICAO-EU

project could play a vital role in supporting this coordination at the national level through the expertise obtained in its implementation in Burkina Faso and Gabon. Also, the project would organize and fund related training activities. On the other hand, ASECNA would be responsible for the technical activities, including the design, test, and calibration of the new procedures. In order to set out the role and responsibilities to be assumed by each party in this initiative, a MOU was put in place between ICAO and ASECNA, along with an implementation plan and budget.

The first activities performed in this phase were to set up the project team, and define in detail a work plan, budget, and timeline. This initial phase ended with exploratory missions conducted in both States to provide to the relevant high-level authorities and stakeholders a brief description of the project and details of the activities to implement in order to clarify their understanding and reinforce their commitment. It was also an opportunity to support national focal points of each State to establish a National Team that would follow up and support the project implementation at the national level and to start preparatory activities for the organization of the Kick-off event. Finally, a robust joint preliminary assessment ensured that subsequent CCO-CDO implementation steps were based on robust foundations. The overall aim was jointly determined that CCO-CDO operations were likely to be viable to secure interest from operational stakeholders.

Design phase I

During the design phase, the main activities performed were data collection for the design of procedures and to agree on the Conceptual Design for the implementation of these procedures during the kick-off seminar with the relevant stakeholders.

The CCO-CDO Project “Kick-off Seminar” was held in 2017 (October in Libreville, Gabon and November in Ouagadougou, Burkina Faso) with over 50 participants for each State from civil aviation and relevant stakeholders. It was important to engage all key operational stakeholders at an early stage. Collaboration with all stakeholders as early as possible allowed for the rapid development of a successful design. The procedures were presented unambiguously, ensuring the Air Traffic Controllers (ATC) and flight crews have a common understanding of requirements and the resulting flight profiles. In both Burkina Faso and Gabon, conceptual design for the implementation of

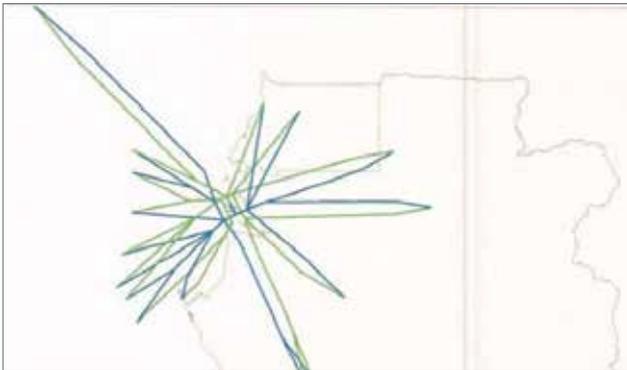
these new operational procedures was completed and validated with the national stakeholders.

The seminar also focused on strengthening the national capacities to:

- reach a common understanding on the present operational situation at the airport and potential operational improvements;
- reach a common understanding on CCO-CDO related opportunities, benefits, gaps, issues and risks from different operational perspectives;
- decide jointly whether or not CCO-CDO is considered sufficiently viable to continue with the implementation process;
- agree on an “in principle” way forward based on guidance;
- nominate focal points, define actions, and associated timelines arising from the workshop.

Design phase II

At this stage, the emphasis was to finalize the design of CCO-CDO procedures based on a validated conceptual design in both countries. SID/STAR procedures have been designed in concert with one another and balance flight path profiles to ensure that they meet the needs of both the ATC and operators to the greatest extent possible.



Approved trajectory for Leon Mba International Airport in Libreville

Following the completed conceptual design, the on-site performance evaluation meeting was a key activity to (i) identify and define the perimeter of the performance evaluation; (ii) complete performance evaluation; and (iii) develop an environmental impact assessment. During this four-and-a-half day workshop, brainstorming sessions were conducted to review the three phases of performance evaluation (FHA-PSSA-SSA) of the methodology used by ASECNA to result in a preliminary performance report. Over 30 participants from the Civil Aviation Authority and relevant stakeholders attended the workshops in Libreville, Gabon and Ouagadougou, Burkina Faso.

It was essential to consider all of the options for facilitating CCO-CDO implementation as well as the scope of any CCO-CDO procedures. This was especially important because the assessment method was governed by safety and environmental impact assessment legislation that requiring that alternatives be considered. In the end, many CCO-CDO implementation

solutions were described, with adequate reasoning to explain how and why this was selected.

Validation phase

Following the brainstorming sessions for the safety file completed in both States, one of the performance evaluation requirements identified and in accordance with ICAO provisions for the implementation of PBN was to train ATC on the operations of the procedures related to CCO-CDO flights. This training took place in both States: in June 2018 in Libreville, Gabon and in December 2018 in Ouagadougou, Burkina Faso.

The training of ATC started on knowledge with capacity building activities where controllers gained a thorough understanding of the operational benefits and consequences with regard to the conduct of CCO-CDO procedures and the profiles associated with these procedures. During the operational training, realistic simulation exercises were an essential part of the training process to ensure controller proficiency. In the end, controllers understood the basis of the aircraft energy management, the trade-offs inherent in the specific CCO-CDO-based procedure design and were aware of the need for unambiguous controller-pilot communications.

Furthermore, this phase also focussed on validation of the CCO-CDO procedures. At this stage of the process, detailed flight and ATC simulation were necessary. This activity included participation by those individuals who would be involved in implementing and taking part in any trial. This helped to double-check the viability of the selected solution and to foster acceptance and understanding. Issues encountered in the simulation were reported to the procedure designer to correct any observed discrepancies.

Flight simulation was accomplished in cooperation with Air France to confirm predicted aircraft performance and to highlight areas that may need to be modified in CCO-CDO design. In this regard, a successful flight simulation was performed on February 2019, and ATC simulation allowed for the finalization of the CCO-CDO design. Based on the results of simulations, the initial safety assessment was rechecked and updated to allow an operational flight trial.

Approval phase

To support CCO-CDO procedures implementation, a safety file containing awareness material and specific information related to the CCO-CDO has to be submitted to the States for approval. Based on the outcome of the simulation and validation activities, and the results of the safety assessment showing that all identified hazards have been managed to an acceptable level of risk, the plan to proceed is endorsed by the Civil Aviation Authority of each State, which is coordinated by ASECNA. Following the approval, these procedures are published through established channels to ensure stakeholders awareness. As part of the approval phase, a transparent assessment of the impact of CCO-CDO procedures on other traffic operations and the environment is developed and made available to all interested parties.

Implementation phase

It was agreed that a trial would be implemented initially on a limited basis for a single runway, in low traffic density levels and with Air France and Afrijet in Libreville, Gabon and Air France and Air Burkina in Ouagadougou, Burkina Faso for 3 to 6 months. During this trial, defined ATC procedures for the integration of aircraft not participating in the CCO-CDO trial will be established. All parties involved in the CCO- CDO trial in both States will be informed of the decision to proceed and given access to the trial plan. This plan will include delegated accountability for assuring the readiness of controllers and pilots, including training activities, in order to proceed to the operational trial.

For the trial period, ASECNA will define the parameters by which to assess CCO-CDO participation and performance. Performance assessment will be based on the progress and results of the trial. It will cover the key performance areas of most relevance for local circumstances.

Following a successful trial outcome, full implementation of the CCO-CDO procedures will be performed and coordinated by ASECNA according to a plan developed by the relevant national stakeholders and approved by the Civil Aviation Authorities. It is expected that the CCO-CDO project will be fully completed in Libreville, Gabon and Ouagadougou, Burkina Faso by September 2019.

6.3.3 EXPECTED BENEFITS

Expected benefits were calculated using ICAO's Rules of Thumb from ICAO Doc 9988 on CCO/CDO:

- One CCO provides 100kg fuel savings on average;
- One CDO provides 60kg fuel savings on average.

The following table details the fuel savings and equivalent CO₂ emissions reduction expected annually from the implementation of CCO and CDO in Ouagadougou and Libreville. In total, a CO₂ emissions reduction of 1,368 tonnes is expected every year from these measures.

	Number of operations considered per year	Fuel savings (t/year)	CO ₂ emissions reduction (tCO ₂ /year)
Burkina Faso			
CCO	700	70	221
CDO	700	42	133
Subtotal			354
Gabon			
CCO	2,005	201	634
CDO	2,005	120	380
Subtotal			1,014
Total			1,368

The implementation of CCO/CDO is expected to bring the following additional benefits beyond the reduction of CO₂ emissions, such as:

- Reducing the noise on the ground;
- Improving the safety and regularity of flights, and the airspace capacity;
- Strengthening collaboration between all involved stakeholders.

6.4 FEASIBILITY STUDIES ON SUSTAINABLE AVIATION FUELS

The project funded four feasibility studies on sustainable aviation fuels in the Dominican Republic, Trinidad and Tobago, Burkina Faso, and Kenya. These studies aimed at conducting a comprehensive feasibility study in each State on the use of drop-in sustainable aviation fuels associated with the reduction of CO₂ emissions. Their objective was to support the current progress on the technical, regulatory, and economic measures in place or planned for the development and deployment of sustainable aviation fuels in these countries.

Four international consultants were recruited to conduct these studies following vacancy notices published on the ICAO public website and climate-change related portals. Their tasks included the following:

- Assist the identification of national conditions, legislation, existing structures, and related stakeholders, roles of government and industry, research and investment and best practices on-going and implemented actions in the field of alternative fuels development and deployment of sustainable aviation fuels.
- Evaluate the different potential feedstocks, production potential, supply chain, storage, logistics, certification, and economics for the development and deployment of sustainable aviation fuels.
- Analyze the available transformation and refining technologies, as well as their technical and regulatory constraints and certification for the production of (i) alternative jet fuel and (ii) alternative fuel for Ground Support Equipment.
- Determine the existing demand for biojet fuel and alternative fuel for Ground Support Equipment, and the perspectives for market development in the State and in the region, including a cost/capacity, cost/benefit analysis, and price determination.
- Estimate the reduction potential of GHG emissions on a life-cycle basis and the contribution and impacts on the local social and economic development, in particular with regard to the competitive use of food and water, for alternative fuel production.
- Assess enabling policy and sustainability of a high-efficiency value chain focussed on sustainable alternative fuel for the aviation sector.
- Identify obstacles and alternatives to overcome the challenges on the technical, financial, and training/capacity building needs with regard to production and consumption of sustainable aviation fuels.

Following two on-site missions to each State and an extensive stakeholders' consultation, each consultant prepared a guidance document containing an executive summary, the findings on the above items, recommendations and a proposed roadmap with milestones and efficient monitoring strategy for the development of a sustainable production chain of alternative fuel in the country. These documents were officially handed over to the States following a one-day workshop gathering the main relevant stakeholders in each country.

The missions of the consultants were also successful at mobilizing the political support from the authorities. In Burkina Faso in particular, the President of the Republic expressed full support to the initiative and the willingness to pursue the recommendations and roadmap to be developed by the feasibility studies.

The next paragraphs describe the main findings of the feasibility study in each State.

6.4.1 FINDINGS OF THE FEASIBILITY STUDY IN THE DOMINICAN REPUBLIC

The first feasibility study was conducted in the Dominican Republic. Several potential feedstock types were analyzed, but sugarcane was identified as the feedstock with the most significant potential for the State. Importantly, the use of sugarcane as a sustainable aviation fuel feedstock would not displace other crops or interfere with the need for sugarcane as a food crop.

As an outcome of the study, the Dominican Republic has created a national committee for environment and aviation to facilitate information sharing related to sustainable aviation fuel at the national level. This cooperation has led the major Ministries and government institutions of the State to sign a declaration, known as the "Punta Cana Declaration", which included a commitment to pursue the main actions outlined in the feasibility study roadmap.

In the medium-term, the feasibility study recommended that the Dominican Republic prepare a framework for potential investments in the production and use of sustainable aviation fuel. This can be accomplished through adapting existing regulations and standards to include sustainable aviation fuel, disseminating information to national stakeholders about the relevance of sustainable aviation fuel for the State, and also by increasing research and development on feedstock capacity in order to guarantee a sustainable and affordable supply for a production facility.

Once the regulatory market is favourable for the use of sustainable aviation fuel, and there is reliable information on the availability of feedstock, the Dominican Republic would be prepared to define the actual implementation of sustainable aviation fuel production from 2020, including the establishment of stable demand through the definitions of technology and incentive measures. The support defined within the Punta Cana Declaration will be instrumental in achieving these implementation goals.

6.4.2 FINDINGS OF THE FEASIBILITY STUDY IN TRINIDAD AND TOBAGO

The feasibility study developed in Trinidad and Tobago was particularly unique, as the study found that the current volumes of feedstock available within the State are insufficient for commercial scale production with current technologies. Contrary to the roadmaps developed within the other feasibility studies, the strategy developed for Trinidad and Tobago included a recommendation that the State focuses on the development of gas-to-liquid fuels from natural gas. While this feedstock is not considered sustainable, it can help the State reduce GHG emissions in the short-term, while work continues to assess the further possibility of using of municipal solid waste as a feedstock in the medium-term. This would include improving waste management techniques and related policies, which could support the development of a waste-to-jet supply chain in the long-term.

Trinidad and Tobago also has a significant level of experience in fuel management and processing, so in the short- to medium-term, the State could develop strategic partnerships for the production and deployment of sustainable aviation fuel. By developing sustainable aviation fuel from feedstock available in nearby States, Trinidad and Tobago could play a primary role in the production and distribution of sustainable aviation fuel throughout the Caribbean region. This possibility highlights the important role of international and regional cooperation in order to scale-up sustainable aviation fuel deployment.

6.4.3 FINDINGS OF THE FEASIBILITY STUDY IN BURKINA FASO

In Burkina Faso, several feedstock types are already available for the development of sustainable aviation fuel. The feasibility study in Burkina Faso emphasized the important role that sustainable aviation fuel could play in the State's strategies, such as the achievement of energy security; however, considering the experiences of previous projects in the region, the study suggests that the State takes a cautious approach when scaling up the production of any sustainable aviation fuel feedstock.

In the short-term, the study recommended that the State focuses on the production of feedstock and the conversion of biomass for ground transportation fuels. The development of such infrastructural facilities will be less capital-intensive for the State than it would be to develop sustainable aviation fuel production facilities, while these actions could raise awareness of alternative fuels and potentially attract future investors. The ground transportation fuels could specifically be used for airport ground support equipment at Ouagadougou Airport, the State's main airport. Such actions could support the gradual adoption of sustainable aviation fuel in the long-term.

Additionally, several of the specific actions recommended for Burkina Faso were highlighted as potentially relevant throughout sub-Saharan Africa. The replication of such actions would further multiply the related positive environmental, social, and economic impacts of moving towards the adoption of sustainable aviation fuel.

6.4.4 FINDINGS OF THE FEASIBILITY STUDY IN KENYA

While further research is required on potential feedstock yields, sustainability, and techno-economic potential, Kenya has favorable conditions for the development of a sustainable aviation fuel supply chain. The feasibility study suggests that specific attention be given to used cooking oil (UCO) as a feedstock in the short- and medium-term, while other feedstocks, such as municipal solid waste, agricultural waste from sugarcane harvesting, and water hyacinth could be considered in the long-term. Initial analyses suggest that up to 200 million liters of sustainable aviation fuel could be derived from UCO by 2030.

In order to attract project developers, the study highlights the importance of developing strong governance and policy. Specifically, the study recommended that the Biofuel Department of the Ministry of Energy and Petroleum take the lead on advancing the study's recommendations. Such definitions of stakeholder roles are a fundamental aspect of feasibility studies, in order to ensure that the recommendations of the study are carried out.

Additionally, the feasibility study provided a list of potential funding sources that may be able to support further research that is required. This list of resources could also benefit other States within the region that may be interested in assessing the potential for developing a sustainable aviation fuel supply chain in their own State.

6.4.5 SUMMARY OF FINDINGS

The table below highlights the main findings of the feasibility studies in terms of feedstocks with the highest potential and recommended roadmap strategy.

	Feedstocks with highest potential	Recommended roadmap strategy
Dominican Republic	<ul style="list-style-type: none"> Vegetable oils & fats have low potential Production of municipal or industrial wastes is limited and disperse Major agricultural residues are being currently used However, the country has a significant potential for sugarcane, which could be renewed to produce sustainable aviation fuel. 	<p>Short Term (2017 – 2018):</p> <ul style="list-style-type: none"> Establish information sharing mechanisms for SAFs <p>Medium term (2018 – 2020):</p> <ul style="list-style-type: none"> Adapt regulations & standards Disseminate the relevance of the use SAFs Increase R&D on feedstock capacity <p>Long term (from 2020):</p> <ul style="list-style-type: none"> Promote the sustainable implementation of a value chain Establish incentive measures for stable demand
Trinidad and Tobago	<ul style="list-style-type: none"> Feedstocks considered: agricultural products (sugarcane), algae, waste gases from the petrochemical industry, and municipal solid wastes. Low volumes of feedstock availability - insufficient for scale production with current production technologies. Due to existing expertise in fuel management and processing, Trinidad and Tobago could play a primary role in the supply of SAF in the Caribbean region, using imports from neighboring nations 	<p>Short-Term (2018-2023):</p> <ul style="list-style-type: none"> Develop a national strategy for carbon pricing and GHG emissions. Support Gas To liquid industry from Natural Gas <p>Medium-Term (2023-2028):</p> <ul style="list-style-type: none"> Adapt waste disposal policies to increase availability for SAF production <p>Long Term (from 2028):</p> <ul style="list-style-type: none"> Conduct a feasibility study for SAFs produced from imported and local renewable biomass.
Burkina Faso	<ul style="list-style-type: none"> Positive outlook for the use of cashew and shea nutshells Significant potential for increased use of sorghum residues and jatropha Expansion of sugarcane seems limited Animal waste fats and municipal solid waste- potentially attractive for sustainable aviation fuel production 	<p>Short-Term (2018-2023):</p> <ul style="list-style-type: none"> Secure buy-in from national stakeholders Set up a central coordinating platform <p>Medium-Term (2023-2028):</p> <ul style="list-style-type: none"> Provide small holders with financing Promote central purchasing Explore the potential for carbon financing <p>Long Term (from 2028):</p> <ul style="list-style-type: none"> Investigate concept for a multi-feedstock processing plant.
Kenya	<ul style="list-style-type: none"> Seventeen feedstock types evaluated Significant potential for waste-based feedstocks (sugarcane by-products, water hyacinth, used cooking oil, municipal solid waste) available in significant quantities and already aggregated or localised in specific regions 	<p>Short-Term (2018-2023):</p> <ul style="list-style-type: none"> Develop cooperation and capacity building initiatives <p>Medium-Term (2023-2028):</p> <ul style="list-style-type: none"> Demonstrate the potential and prove the viability of projects <p>Long Term (from 2028):</p> <ul style="list-style-type: none"> Determine the implementation plan of a waste-based SAF supply chain

As an additional outcome of these feasibility studies being made publically available, ICAO has been contacted by other Member States that are interested in replicating this work. These feasibility studies have captured the attention of Member States by highlighting the economic, social, and environmental benefits that are possible from the development of a national sustainable aviation fuels industry.

ICAO provided an opportunity for States to express interest in benefiting from future sustainable aviation fuel feasibility studies during the First ICAO Stocktaking Seminar toward the 2050 Vision for Sustainable Aviation Fuels. States and organizations were also invited to express interest in supporting the development of future feasibility studies. Through these expressions of interest, ICAO hopes to be able to facilitate partnerships that will lead to the development of future SAF feasibility studies in more ICAO Member States.

6.5 FEASIBILITY STUDY ON RENEWABLE ENERGY IN TRINIDAD AND TOBAGO

In addition to the four feasibility studies on sustainable aviation fuel, the project funded a feasibility study on the use of solar energy at Piarco International Airport in Trinidad and Tobago. This followed a request from the Government of Trinidad and Tobago, who had included in their action plan a mitigation measure on the use of electric gate equipment powered by renewable energy to replace aviation fuel-powered Auxiliary Power Units and some diesel-powered Ground Power Units. The feasibility study was to be used to leverage funding for the construction of a solar facility and the purchase of electric gate equipment.

The benefits of developing solar projects at airports in Small Island Developing States (SIDS) are enormous. In particular, solar projects can help to limit or reduce the impact of aviation CO₂ emissions on the global climate while providing, at the same time, economic benefits. For some SIDS airports, energy can constitute a major operational cost. Therefore, the use of renewable energy sources can help them to take a significant and very positive step toward greater economic and environmental sustainability.

The feasibility study, published in July 2018, assessed opportunities to develop solar projects on airport property and use the power to supply electricity to the airport terminal, including existing gate electrification equipment. The study identified six potential solar project sites at Piarco International Airport, including three solar canopy sites over carparks and three ground-mounted sites to the north of the terminal. The project sites were identified based on their compatibility with aviation activities, proximity to existing electricity infrastructure, and avoidance of environmental resources. The feasibility study provided initial design concepts for each project site and an estimated nameplate capacity based on the project area and design type. Project designs include canopy structures over surface parking to generate power and provide shaded parking and ground-mounted facilities in underutilized airport land. Project sizes range from 1 to 6 MW peak power with installed costs of USD 1.7 million to USD 9 million.

Shortly after technical meetings were held in Trinidad and Tobago in April 2018 to discuss the outcomes of the feasibility study with the relevant stakeholders, staff from the European Union in Trinidad and Tobago contacted ICAO requesting information produced by the feasibility study. Initially, general information contained in the draft document was supplied to the EU staff. The complete feasibility study was then supplied upon its release in July of 2018. ICAO learned in February 2019 that the EU had selected one of the sites proposed in the study at Piarco International Airport, a ground-mounted project near

the carpark entrance, for funding and that it was entering into a contract with the airport authority to provide funding for it to implement the project. The project is being coordinated by the EU Delegation to Trinidad and Tobago.

The five feasibility studies developed with project funding are publicly available at ICAO's website⁵.

6.6 ICAO MAC CURVE TOOL

Numerous measures are available to States and their aviation stakeholders seeking to reduce CO₂ emissions from international aviation. Limited financial and technical resources represent a challenge for the implementation of these measures and make prioritizing a necessity. In this context, the ICAO-EU project, in conjunction with the ICAO-UNDP-GEF project, has enabled the development of a tool supporting States and their stakeholders in their discussions on the prioritization of the implementation of CO₂ mitigation measures for international aviation.

This tool is based on the Marginal Abatement Cost (MAC) curve concept. MAC curves illustrate the relative CO₂ emissions reductions from possible measures on a comparative cost basis. They provide a simple, quantitative way to directly compare the costs and amount of CO₂ emission reductions associated with numerous projects.

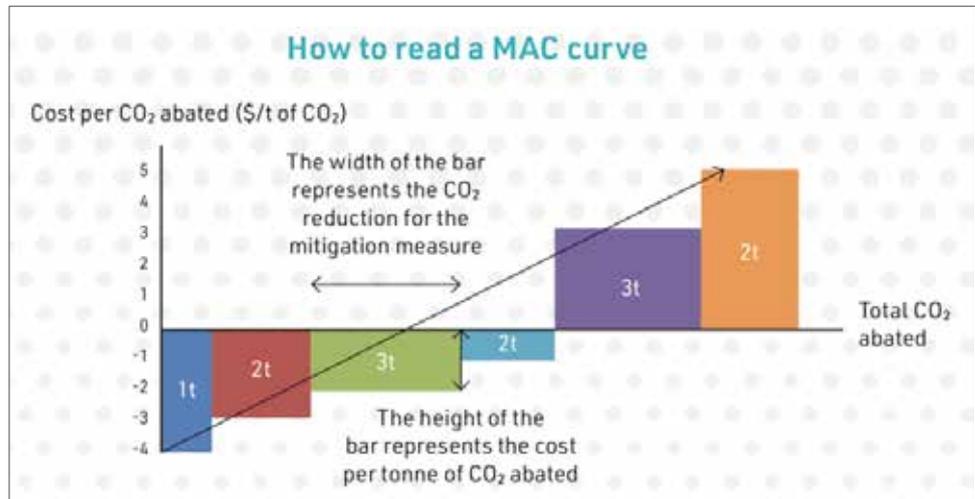
Marginal Abatement Costs

Any single emissions mitigation project has a limit on the maximum possible CO₂ emissions reductions, and similarly, each proposed measure requires a specific investment to achieve these reductions. MAC curves are a way to compare projects on a common basis. By evaluating projects in terms of the cost to reduce one ton of emissions, analysts can readily compare various projects. MAC curves plotted according to a \$/ton of CO₂ reduced compare multiple project costs while highlighting the total potential emissions reductions. Since some projects reduce energy use or other operating costs over current operations, they can actually have a negative \$/ton of CO₂ reduction, saving money for the project sponsors. By plotting multiple projects, sponsors can compare and prioritize them.

ICAO analyzed emissions mitigation measures, using expert knowledge and the information included in the State Action Plans submitted by its Member States. Using this data, ICAO developed global MAC curves, which can be used to simplify the process of calculating the emission reduction costs for specific projects and so putting the amount of emission reductions in priority order. The Global MAC curves for 2020, 2030, 2040 and 2050 can be found on the ICAO website⁶. Using the MAC Curve Tool as a focal point for their analysis, States can input local data to create MAC charts specific to their conditions to prioritize and estimate needed investment to achieve their CO₂ emission reduction goals.

⁵ https://www.icao.int/environmental-protection/Pages/ICAO_EU.aspx

⁶ https://www.icao.int/environmental-protection/Pages/ICAO_UNDP.aspx



MAC Curve Tool

The MAC Curve Tool allows States to conduct a dedicated and tailor-made cost-benefit analysis of the most popular mitigation measures included in the ICAO basket of measures to reduce CO₂ emissions from international aviation. It is simple to use and requires a limited amount of information from the user, adjusting to the specific circumstances of States.

The results of the analysis performed by the tool will guide civil aviation authorities and the national stakeholder teams who develop the State Action Plan, as they select and prioritize mitigation measures to be included in the plan. The tool provides a brief overview of potential emission reductions for a given scenario. The MAC Curve Tool allows the MAC curves to be tailored to the individual reality of States, allowing them to input their local data, create MAC charts specific to their conditions at various time horizons, and prioritize the measures to be implemented in light of their own circumstances.

The ICAO-EU project, in conjunction with the ICAO-UNDP-GEF project, enabled the development of a global MAC curve, showing the global abatement potential for 20 CO₂ mitigation measures identified by ICAO. It ranks these measures by cost-effectiveness, and the width of every bar is an approximate visualization of the measure's CO₂ emissions reduction potential.

Using the ICAO resources helps States obtain essential information on the financial costs and CO₂ emission reduction benefits associated with the various measures. The approach provides technical support and practical guidance enabling the user to identify feasible emissions reduction measures and allows them to make informed decisions about implementing CO₂ mitigation measures.

The tool has been deployed on the APER website and is accessible free of charge by the State Action Plan focal points. This online tool will facilitate the cost-benefit analysis of the mitigation measures included in the action plans of the selected States and will be particularly instrumental for the update of States action plans.

7. ADDITIONAL BENEFITS

7.1 ADDITIONAL MITIGATION MEASURES IMPLEMENTED BY THE SELECTED STATES

In parallel to the mitigation measures funded by the project, the selected States have implemented mitigation measures included in their States' Action Plans with nationally allocated resources, as detailed in the Country Fiches in Annex 1.

The table below describes the percentage of measures included in the action plans that have been fully implemented by 31 January 2019 in each State, as well as the percentage of CO₂ emissions reduction they represent.

As can be seen in the table, in the case of the Caribbean States, more than 80% of the mitigation measures included in the action plans have been implemented as of 31 January 2019. In particular, a solar farm of 1.0 MW has been installed and inaugurated in the Dominican Republic to power Las Americas International Airport in Santo Domingo, while a 1.5 MW solar farm is being installed at the Cibao International Airport in Santiago. There is an increased interest by the States - which could be attributed to the project and the positive results of the "solar-at-gate" projects, to adopt the use of solar energy at airports. It is expected that there will be more airports in the Dominican Republic powered by solar energy in the short-term.

In total, including the Caribbean and African States, 44% of the planned mitigation measures have been implemented by the end of the ICAO-EU Project.

	State	Total number of mitigation measures in the action plan	Number of measures completed by the end of the project	Percentage of measures completed by the end of the project	Total expected CO ₂ emissions reduction for international aviation	Tonnes of CO ₂ emissions from international aviation reduced by the end of the project	Percentage of CO ₂ emissions from international aviation reduced by the end of the project
1	Angola	11	4	36%	25,313	6,256	25%
2	Burkina Faso	12	9	75%	6,629	5,761	87%
3	Burundi	14	6	43%	4,408	846	19%
4	Cameroon	16	6	38%	11,490	1,429	12%
5	Central African Republic	16	2	13%	312	0	0%
6	Chad	11	4	36%	17,972	800	4%
7	Republic of the Congo	11	4	36%	1,296	369	28%
8	Democratic Republic of the Congo	4	1	25%	576	12	2%
9	Dominican Republic	17	13	76%	22,089	9,347	42%
10	Equatorial Guinea	20	4	20%	7,310	101	1%
11	Gabon	15	5	33%	7,563	1,247	16%
12	Kenya	36	11	31%	289,323	61,728	21%
13	Sao Tome and Principe	4	1	25%	9	0	0%
14	Trinidad and Tobago	28	24	86%	30,513	14,710	48%
	Subtotal Africa	170	57	34%	372,201	78,549	
	Subtotal Caribbean	45	37	82%	52,602	24,057	
	TOTAL	225	94	44%	424,803	102,606	

7.2 ESTABLISHMENT OF ENVIRONMENTAL UNITS AT THE CIVIL AVIATION AUTHORITIES

During the timeframe of the project, seven States created an Environmental Unit at their Civil Aviation Authority, with at least one full-time member of staff dedicated to environmental matters. In four States, the environmental unit is already operational as of May 2019, representing nine full-time positions dedicated to environment in the respective Civil Aviation Authorities, including five female staff. In three States, the creation of the environmental unit is awaiting high-level approval as of May 2019, which is expected to trigger the creation of an additional eleven full-time positions on environment. This result of the project contributes, therefore, to two Sustainable Development Goals (SDG): SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth).

The table below lists the States with an effective or planned environmental unit, its status, and the number of full-time staff members composing the unit. The last column gives the percentage of female members in the staff of the unit.

By addressing the issue of limited qualified human resources in charge of environment and formalizing environmental staff positions at the Civil Aviation Authorities, these States will have the capacity to continue the implementation of national strategies for addressing climate change in aviation and will improve the frequency and quality of their reporting to ICAO on CO₂ emissions reduction.

	State	Environmental Unit Creation Year	Status	Number of full-time member(s) of staff in the unit	% staff who are female
1	Angola		Not created	0	
2	Burkina Faso		Not created	0	
3	Burundi		Not created	0	
4	Cameroon	2016	Effective	1 (+ 1 intern)	100%
5	Central African Republic		Not created	0	
6	Chad		Not created	0	
7	Republic of the Congo		Not created	0	
8	Democratic Republic of the Congo	2018	Awaiting approval of board of directors	5	N/A
9	Dominican Republic	2017	Effective	6	33%
10	Equatorial Guinea	2018	Awaiting approval of board of directors	1	N/A
11	Gabon	2016	Effective	1	100%
12	Kenya	2017	Awaiting approval of board of directors	5	N/A
13	Sao Tome and Principe		Not created	0	0
14	Trinidad and Tobago	2017	Effective	1	100%

7.3 PARTICIPATION AT COPS

In several States (for instance Burkina Faso, Burundi, Cameroon, Chad), focal points or members of the National Action Plan Team accessed high-level positions within the Civil Aviation Authority in the timeframe of the project, which contributed, through their awareness and commitment, to leverage the environment activities in the aviation sector in these States.

The awareness of top management of the Civil Aviation Authority in the selected States also allowed many of the focal points to be included in the national delegations for the UNFCCC Conference Of the Parties (COP), which was not the case before the project. Several States (such as Kenya and Gabon) also testified of their experience with the project in the scope of side events held by ICAO at the COPS. The inclusion of the Civil Aviation Authorities in the national discussions regarding climate change will position the aviation sector in the national strategies for environment and may facilitate access to national and international funding for the implementation of mitigation measures.

7.4 PARTICIPATION IN CORSIA

The project has facilitated a greater understanding of environmental protection in the aviation sector in the selected States. Increased awareness of the role of aviation in taking actions to address climate change, has translated into States' support for the international initiatives on environment. Consequently, following the approval of CORSIA by the ICAO Assembly in 2016, seven States of the project decided to voluntarily join CORSIA from its onset: Burkina Faso, Cameroon, Democratic Republic of Congo, Dominican Republic, Equatorial Guinea, Gabon, and Kenya.

7.5 MULTIPLICATION OF BENEFITS

Throughout the course of this initiative, great efforts were made to highlight the successful outcomes of the project objectives. By publishing the completed State Action Plans on the ICAO public website, ICAO has been able to encourage other Member States to use these as examples of fully quantified, well-structured and robust State Action Plans. Having these examples publically available has encouraged other Member States to develop and submit fully quantified State Action Plans. Additionally, at least three of the States assisted through this project have provided support to other ICAO Member States through the State Action Plan Buddy Programme. These States have been able to pass along the expertise developed through their participation in the ICAO-EU Project to further support States that had no experience in developing a State Action Plan. ICAO will continue to encourage ICAO-EU Project beneficiary States to share their experience, in an effort to further multiply the benefits of this project.

Additionally, all of the feasibility studies conducted throughout this project have also been published on the ICAO public website, and have been presented in detail during several ICAO and other international events. As a result of this dissemination of information, several Member States have approached ICAO to express interest in developing feasibility studies within their State. In particular, many States have recognized the potential benefits available from the development of sustainable aviation fuels. ICAO has also encouraged States to express their interest in either supporting or benefiting from future sustainable aviation fuel feasibility studies and hopes to facilitate future partnerships on the development of sustainable aviation fuels.

8. ANNEX 1: COUNTRY FICHES



COUNTRY FICHE ANGOLA

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Costa Claudio

ICAO-EU Project Focal Points:

- Ms. Vicência Tania Fernandes
- Mr. Samuel Afonso Toto
- Mr. Osvaldo de Jesus Rosa

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

National Action Plan Team

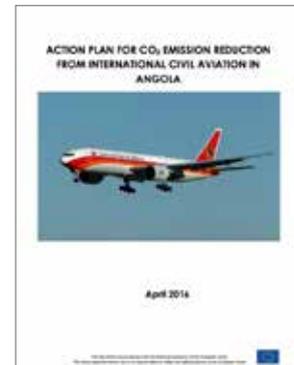
Date of creation of the NAPT: 2016

Frequency of meetings: Quarterly

Number of meeting held as of 31 Dec 2019: 4 meetings

Date of submission

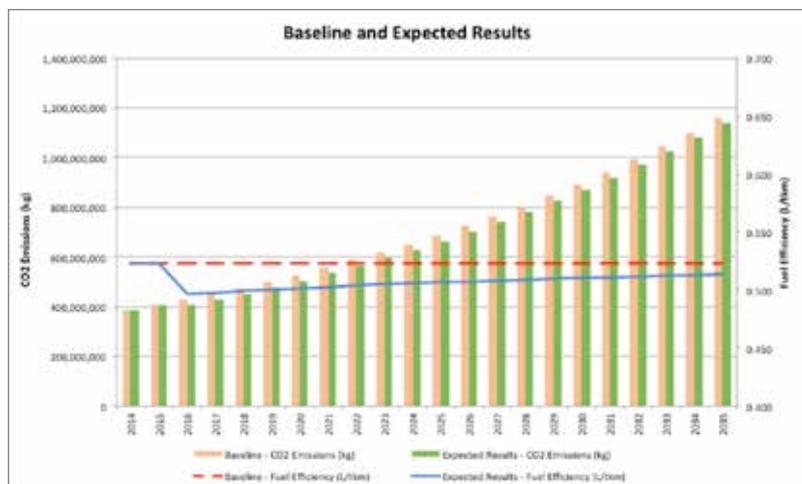
of the Action Plan:
June 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 03 Sep 2015
AES installation date: 03 Sep 2015

Data Providers:
 • TAAG

Current version: Last AES release from 22 Mar 2019

AES interfaces: None

Regulatory Measure

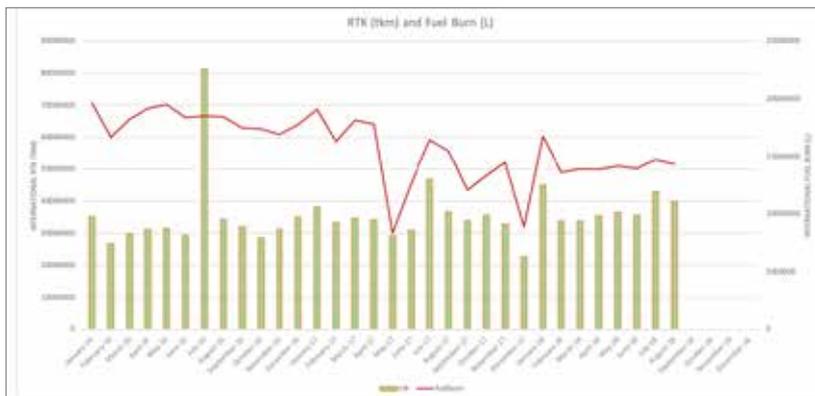
Regulatory measure to support the periodic data submission by airlines: None

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	8	Delay in data submission from the airline due to staff change.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

Overview of Selected Mitigation Measures

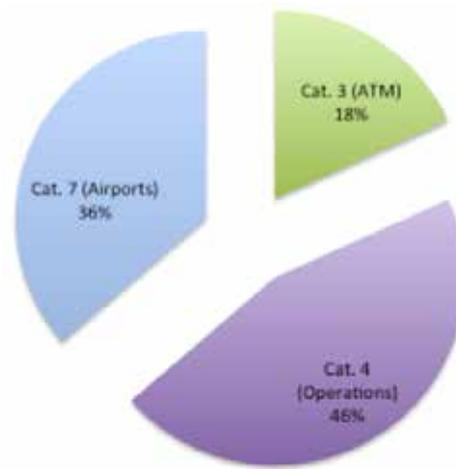
Number of mitigation measures in the latest Action Plan: 11

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	2
Cat. 4 (Operations)	5
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	4
TOTAL	11

Voluntary participation in CORSIA: No

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	1
Ongoing	6
Completed	4
TOTAL	11

Mitigation measures funded by the project: None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
4 (Operations)	Minimising/delaying flaps (take-off and landing)	2016	2016	2,268	Not quantified
4 (Operations)	Minimising reversers use	2016	2016	352	Not quantified
4 (Operations)	Training pilots	2016	2016	3,636	Not quantified
7 (Airports)	Reduce distance travelled by GSE, by defining parking areas close to the stands for aircraft parking	2015	2016	Not quantified	Not quantified
TOTAL				6,256	



COUNTRY FICHE BURKINA FASO

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Azakaria TRAORE

ICAO-EU Project Focal Points:

- Mr. Salifou ZANGA
- Mr. Azakaria TRAORE
- Mr. Nicolas Z. KOURA

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Equipe Nationale du Plan d'Action

Date of creation of the NAPT: 03 June 2015

Frequency of meetings: Bimonthly

Number of meeting held as of 31 Dec 2019: 19 meetings

Date of submission of the Action Plan:

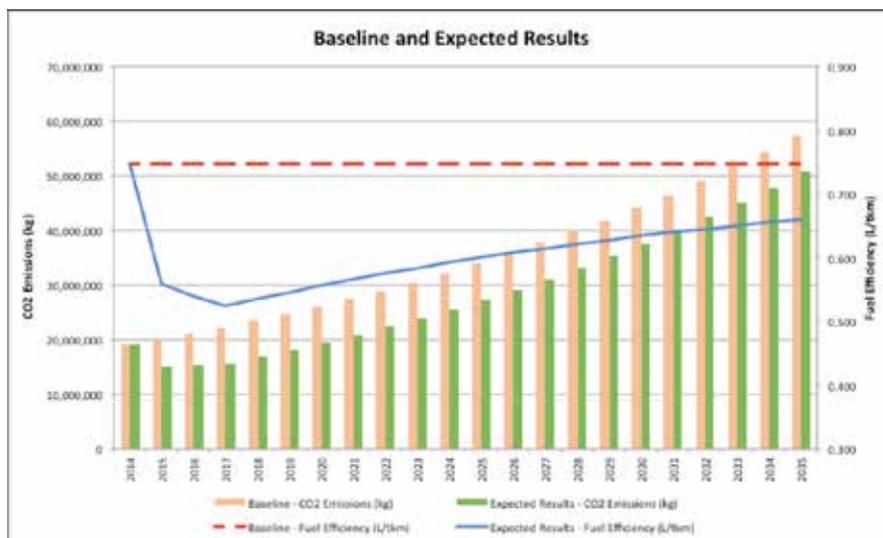
January 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 25 March 2015
AES installation date: 25 March 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Air Burkina

AES interfaces:

- Air Burkina (v5 delivered on 31 Mar 2016)

Regulatory Measure

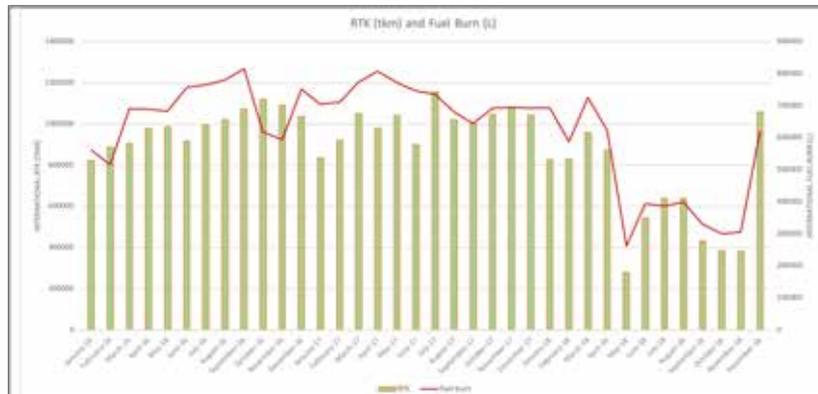
Regulatory measure to support the periodic data submission by airlines: None

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO₂ reports submitted:

Year	Number of monthly CO ₂ reports submitted	Comments
2016	12	
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored CO₂ emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

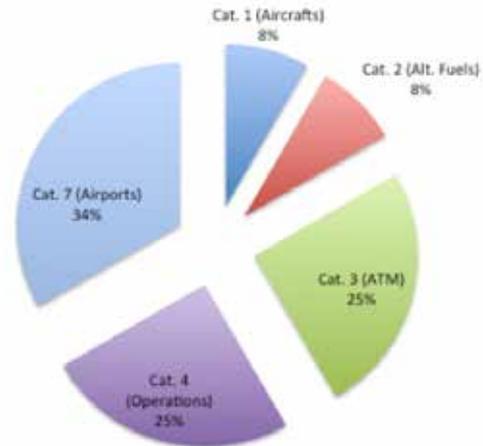
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 12

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	1
Cat. 2 (Alt. Fuels)	1
Cat. 3 (ATM)	3
Cat. 4 (Operations)	3
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	4
TOTAL	14

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	1
Ongoing	2
Completed	9
TOTAL	12

Mitigation measures funded by the project:

- Implementation of Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) in Ouagadougou.
- Feasibility study on sustainable aviation fuels

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
1 (Technology)	National airline purchased new aircraft (new generation)	2015	2015	4475.5	Not quantified
2 (Sust. Aviation Fuels)	Feasibility study on alternative fuels	2016	2017		Not quantified
3 (ATM)	Shortening the taxi time of aeroplanes by allowing them to park in nose-in position	2016	2016	143.0	Not quantified
3 (ATM)	Implementation of Continuous Climb Operations (CCO)	2015	2017	221.2	Not quantified
3 (ATM)	Implementation of Continuous Descent Operations (CDO)	2016	2017	132.7	Not quantified
4 (Operations)	Aircraft required to taxi using one motor	2017	2017	788.7	Not quantified
4 (Operations)	Aircraft body wash to improve fuel efficiency	2015	2015	Not quantified	Not quantified
7 (Airports)	Reduce APU usage on the ground	2016	2016	234	Not quantified
7 (Airports)	More parking bays allocated in conjunction with slot as a result of quick sequencing of traffic to reduce fuel consumption	2015	2015	Not quantified	Not quantified
TOTAL				5,761	



COUNTRY FICHE BURUNDI

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Jean-Pierre Niyukuri

ICAO-EU Project Focal Points:

- Mr. Jean-Pierre Niyukuri
- Mr. Gerard Havyarimana

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Comité National du Plan d'Action

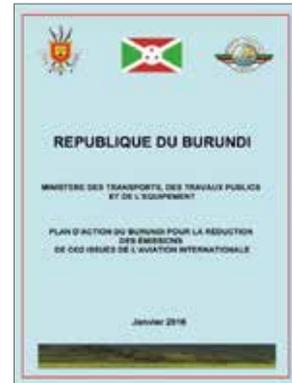
Date of creation of the NAPT: 30 April 2015

Frequency of meetings: Quarterly

Number of meeting held as of 31 Dec 2019: 9 meetings

Date of submission of the Action Plan:

January 2016



National Action Plan Team

Definition for international flights: IPCC

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 09 April 2015
AES installation date: 10 April 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Foreign airlines (no national airline serving international flights)

AES interfaces: None

Regulatory Measure

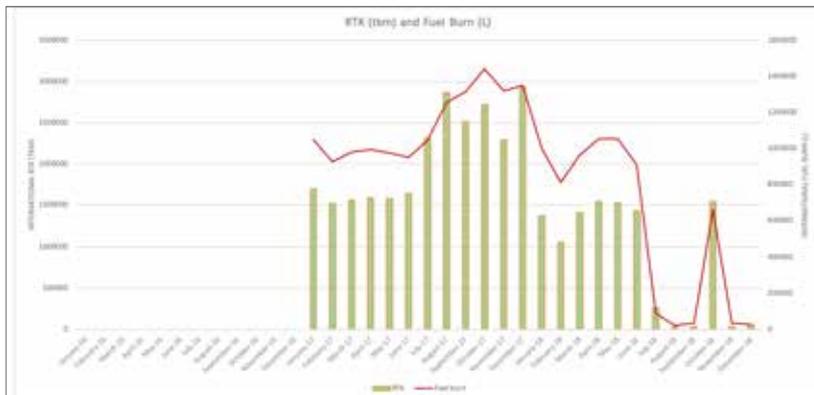
Regulatory measure to support the periodic data submission by airlines: On 26th May 2016, the CAA of Burundi issued an Aeronautical Information Circular (AIC No. 729/DG/1318/2016) to require periodic data submission from airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

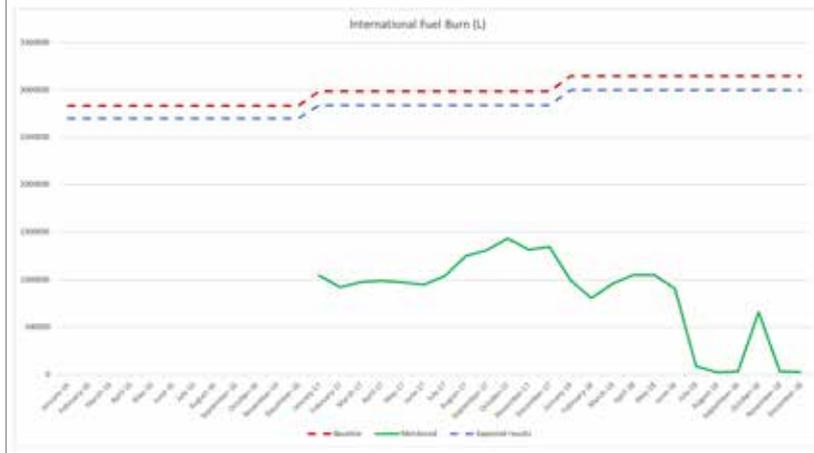
Monthly CO₂ reports submitted:

Year	Number of monthly CO ₂ reports submitted	Comments
2016	0	
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored CO₂ emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

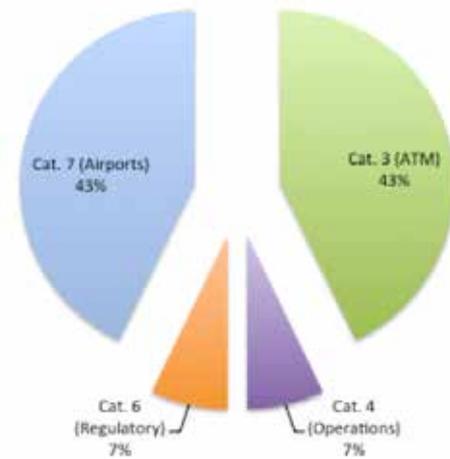
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 12

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	6
Cat. 4 (Operations)	1
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	1
Cat. 7 (Airports)	6
TOTAL	14

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	6
Completed	6
TOTAL	14

Mitigation measures funded by the project: None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Approach procedures simplified over restricted area to achieve shorter routes overflying military airspace	2016	2016	610.8	Not quantified
3 (ATM)	Acquisition of push back and towing truck equipment allowing aircraft to park in nose-in position	2016	2017	110.9	Not quantified
4 (Operations)	Implementation of single-engine taxi for all airlines	2016	2016	124.2	Not quantified
6 (Regulations)	Raising awareness of aviation stakeholders on the State action plan for CO ₂ emissions reduction	2016	2016	Not quantified	Not quantified
7 (Airports)	Installation of LED lighting in the airport	2015	2018	Not quantified	4.5
7 (Airports)	Implementation of energy efficiency measures in the airport to optimize the energy consumption and reduce the energy demand	2016	2016	Not quantified	167.0
TOTAL				846	172



COUNTRY FICHE CAMEROON

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Ms. Olive Ndungo

ICAO-EU Project Focal Points:

- Ms. Olive Ndungo
- Mr. Ritzentelar Akkum

Environmental Unit at the CAA: Created in March 2016 with 1 staff member and 1 intern.

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

National Environment Working Group

Date of creation of the NAPT: 23 Oct 2014

Frequency of meetings: Monthly in 2015 and quarterly in 2016

Number of meeting held as of 31 Dec 2019: 18 meetings

Date of submission of the Action Plan:

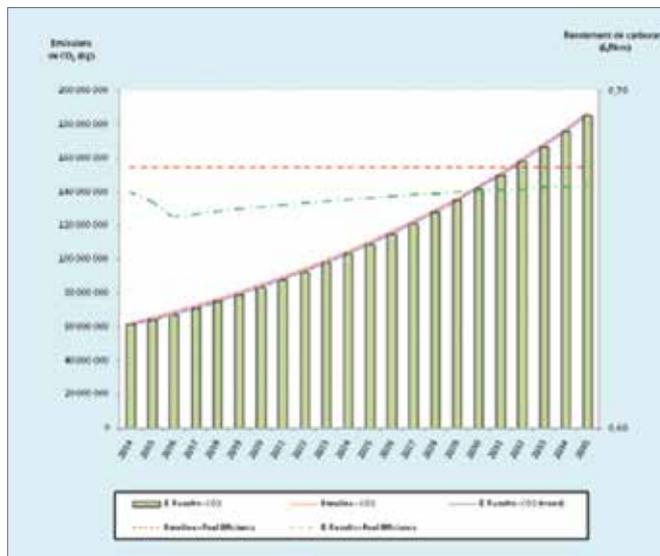
December 2015



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 29 March 2015
AES installation date: 29 March 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Camair-Co

AES interfaces: None

Regulatory Measure

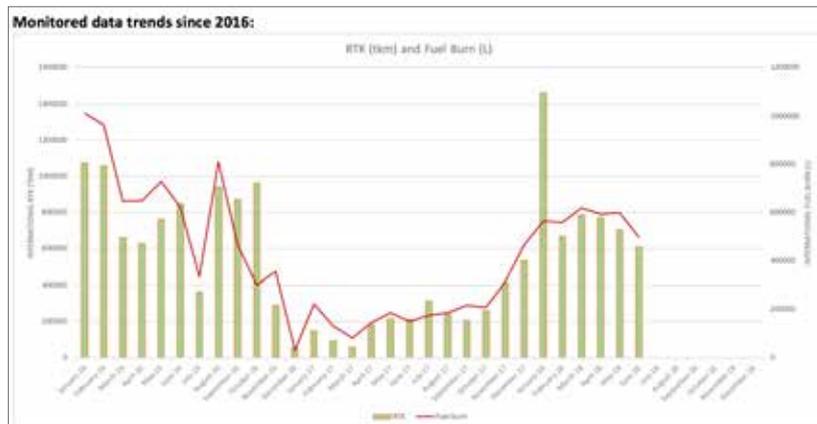
Regulatory measure to support the periodic data submission by airlines: On 23rd May 2016, the Cameroon Civil Aviation Authority issued an Aeronautical Information Circular (AIC No. 000005/NC/CCAA/DG/DTA/CEAE) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

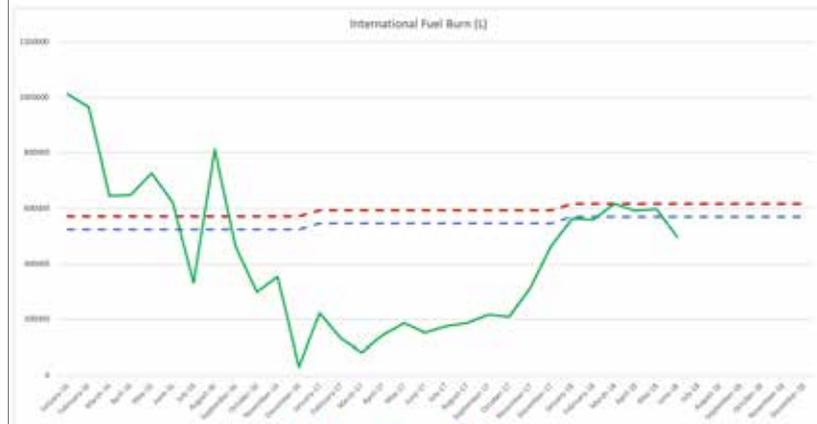
Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	6	Delay in data submission from the airline.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

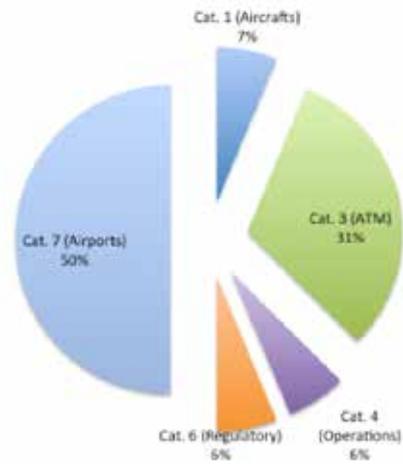
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 12

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	1
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	5
Cat. 4 (Operations)	1
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	1
Cat. 7 (Airports)	8
TOTAL	16

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	8
Completed	6
TOTAL	16

Mitigation measures funded by the project:

- Implementation of solar panels and a gate electrification system in Douala International Airport (1.3M EUR)

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
7 (Airports)	Installation of LED lighting in Douala and Yaounde international airports	2016	2018	Not quantified	210.0
7 (Airports)	Implementation of a solar-at-gate project in Douala airport	2016	2017	1204.0	177.0
7 (Airports)	Rehabilitation of power plants at airports	2016	2018	Not quantified	3.6
7 (Airports)	Construction of an airfield taxiway at Douala airport	2015	2016	225.0	Not quantified
7 (Airports)	Reduce electrical demand (switch off unnecessary lights, promote stairs instead of lifts, etc.)	2016	2017	Not quantified	Not quantified
7 (Airports)	Commissioning of dedicated ground handling equipment such as push-back tractors and towbars	2016	2017	Not quantified	364.0
TOTAL				1,429	755



OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Ms. Irma Murielle Singa Wazidet

ICAO-EU Project Focal Points:

- Ms. Irma Murielle Singa Wazidet
- Mr. Bertin Gbongo Bayanga
- Ms. Nicole Stelly Peya

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi;
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Equipe Nationale du Plan d'Action

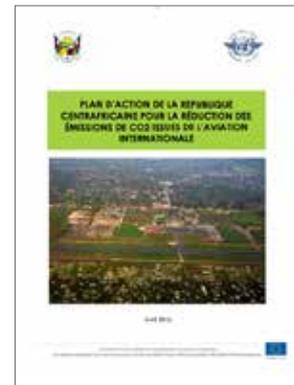
Date of creation of the NAPT: 24 April 2015

Frequency of meetings: Bimonthly

Number of meeting held as of 31 Dec 2019: 15 meetings

Date of submission of the Action Plan:

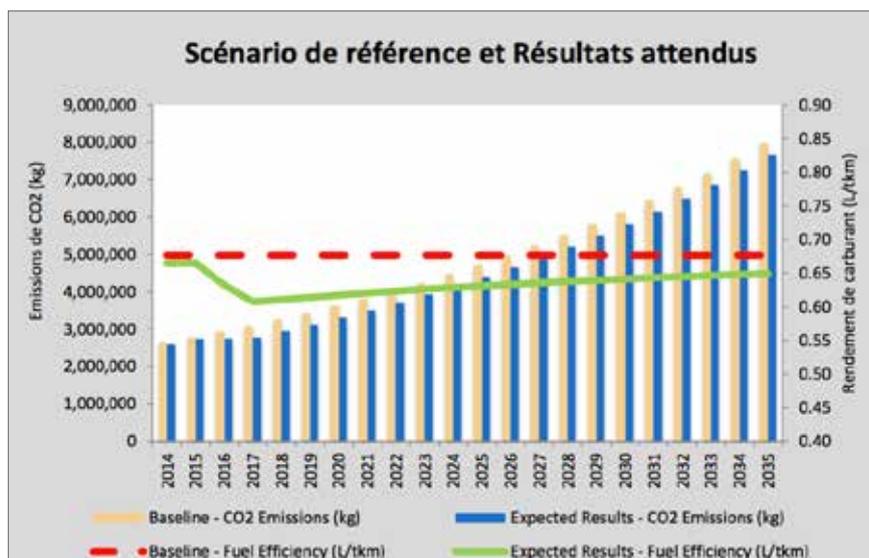
April 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 14 Oct 2015
AES installation date: 14 Oct 2015

Current version: Last AES release from 22 Mar 2019

Note: The project computer was stolen in 2017, preventing the National Focal Points to further use the AES. The project computer was replaced early 2019 by the Civil Aviation Authority. In the meantime, the collected data was sent by the National Focal Points to ICAO who generated the monthly reports on their behalf.

Data Providers:
 • Karinou Airlines

AES interfaces: None

Regulatory Measure

Regulatory measure to support the periodic data submission by airlines: On 22nd April 2016, the CAA of Central African Republic issued an Aeronautical Information Circular (AIC No. 605/2016/ANAC-C.DG) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	0	The national airline stopped international operations in 2018 due to aircraft maintenance.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

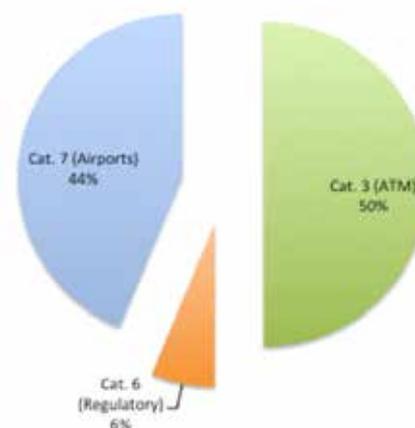
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
12

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	8
Cat. 4 (Operations)	0
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	1
Cat. 7 (Airports)	7
TOTAL	16

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	10
Ongoing	4
Completed	2
TOTAL	16

Mitigation measures funded by the project:
None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Runway occupation time reduced, and management of the traffic and parking optimized	2014	2015	Not quantified	Not quantified
3 (ATM)	Airlines encouraged to use gradually direct or short routes	2010	2017	Not quantified	Not quantified
TOTAL					



COUNTRY FICHE CHAD

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Hissein Chigattome Abdelkerim

ICAO-EU Project Focal Points:

- Mr. Hissein Chigattome Abdelkerim
- Mr. Brahim Adam Fadoul
- Mr. Sadick Mahamat Saleh Douga

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Equipe Nationale du Plan d'Action

Date of creation of the NAPT: 05 January 2015

Frequency of meetings: Every two months

Number of meeting held as of 31 Dec 2019: 6 meetings

Date of submission of the Action Plan:

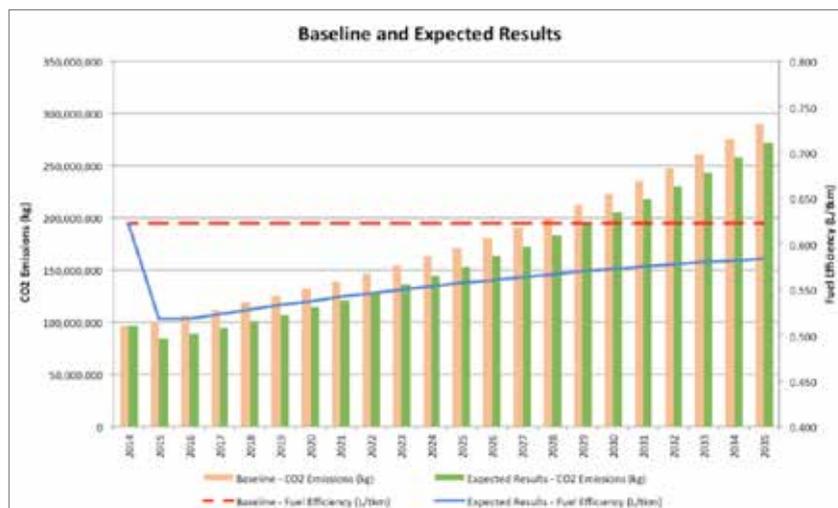
31 Dec 2015



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 14 Apr 2015
AES installation date: 14 Apr 2015
Current version: Last AES release from 22 Mar 2019

Data Providers:
 • Foreign airlines (no national airline serving international flights)
AES interfaces: None

Regulatory Measure

Regulatory measure to support the periodic data submission by airlines: On 28 October 2015, the CAA of Chad issued the Circular N°0043/ADAC/DG/DSA/2015 to require periodic data submission from airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO₂ reports submitted:

Year	Number of monthly CO ₂ reports submitted	Comments
2016	0	Since 2017, a ground handler is providing the necessary data on international flights served by foreign airlines, and the fuel burn is calculated using the ICAO Carbon Calculator. Prior to this, no data could be collected.
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored CO₂ emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

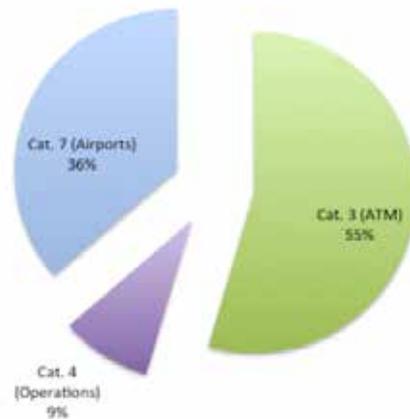
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 11

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	6
Cat. 4 (Operations)	1
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	4
TOTAL	11

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	5
Completed	4
TOTAL	11

Mitigation measures funded by the project:

None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Construction of a continuous taxiway and a rapid exit taxiway	2016	2017	279.0	Not quantified
7 (Airports)	Installation of LED lighting at Ndjamaena airport	2016	2017	Not quantified	128.0
7 (Airports)	Commissioning of new push-back trucks and GSE	2015	2016	Not quantified	Not quantified
7 (Airports)	Connecting GPU and ACU for reduction of APU use	2016	2017	520.7	Not quantified
TOTAL				800	128



COUNTRY FICHE REPUBLIC OF THE CONGO

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Alain M. Joseph Moboula

ICAO-EU Project Focal Points:

- Mr. Alain M. Joseph Moboula
- Mr. Moutoumoukata Moukoubia

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Comité chargé de l'Elaboration du Plan d'Action en République du Congo (CEPARCG)

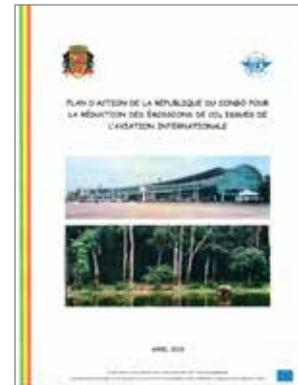
Date of creation of the NAPT: 04 Dec 2014

Frequency of meetings: Bimonthly

Number of meeting held as of 31 Dec 2019: 10 meetings

Date of submission of the Action Plan:

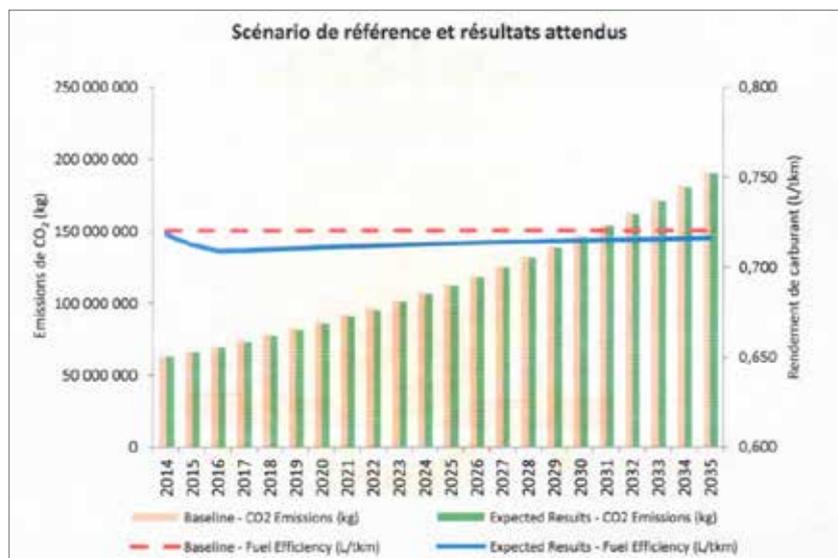
May 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 21 Oct 2015
AES installation date: 21 Oct 2015
Current version: Last AES release from 22 Mar 2019

Data Providers:
 • ECAir
 • Trans Air Congo (TAC)
AES interfaces: None

Regulatory Measure

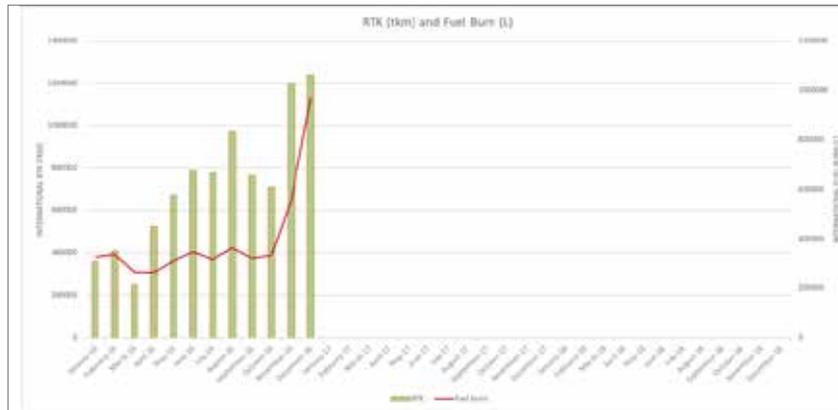
Regulatory measure to support the periodic data submission by airlines: None

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	0	Challenges at the CAA to collect the data
2018	0	Challenges at the CAA to collect the data

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

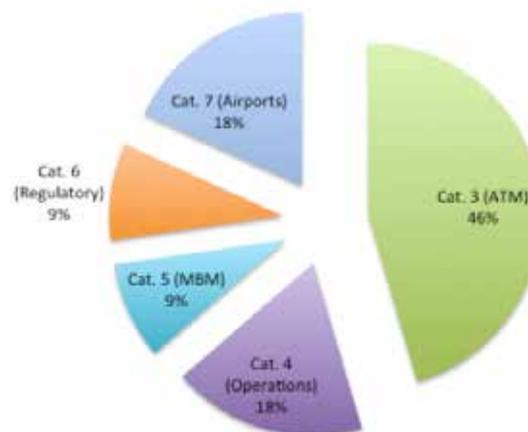
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 11

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	5
Cat. 4 (Operations)	2
Cat. 5 (MBM)	1
Cat. 6 (Regulatory)	1
Cat. 7 (Airports)	2
TOTAL	11

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	5
Completed	4
TOTAL	11

Mitigation measures funded by the project: None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
3 (ATM)	Shortening the taxi time of aircrafts by allowing them to park in nose-in position	2011	2016	Not quantified	Not quantified
7 (Airports)	Replacement of all GSE that are fully gas by electrical or hybrid systems	2011	2017	Not quantified	Not quantified
7 (Airports)	Reduction of electrical demand (promote stairs instead of lifts, switch off unnecessary lights, etc.) and installation of LED lighting	2011	2017	Not quantified	Not quantified
7 (Airports)	Implementation of energy efficiency programs in the airports	2011	2017	Not quantified	Not quantified
TOTAL					



OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Juan Veras

ICAO-EU Project Focal Points:

- Mr. Luis Bautista
- Mr. Juan Jose Veras

ICAO-EU Project seminars attended:

- 11-12 Dec 2014: Kick-off Seminar in Santo Domingo;
- 13-15 Oct 2015: Second Capacity Building Seminar in Port of Spain;
- 14-16 Dec 2016: Third Capacity Building Seminar in Punta Cana;
- 12-13 July 2018: Fourth Capacity Building Seminar in Punta Cana.

Environmental Unit at the CAA: Establishment of a Sustainable Development Unit (SDU) and an Environmental Committee within the CAA, including fulltime staff and funds allocation. The SDU has 6 full-time positions dedicated to environment.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Equipo Nacional de Plan de Accion (DRWG)

Date of creation of the NAPT: December 2014

Official decision from IDAC Director General 5828 and IDAC Resolution 002/2017 and 04/2018.

Date of submission of the Action Plan:

December 2013

Updated Action Plan submitted in July 2015 and August 2018.



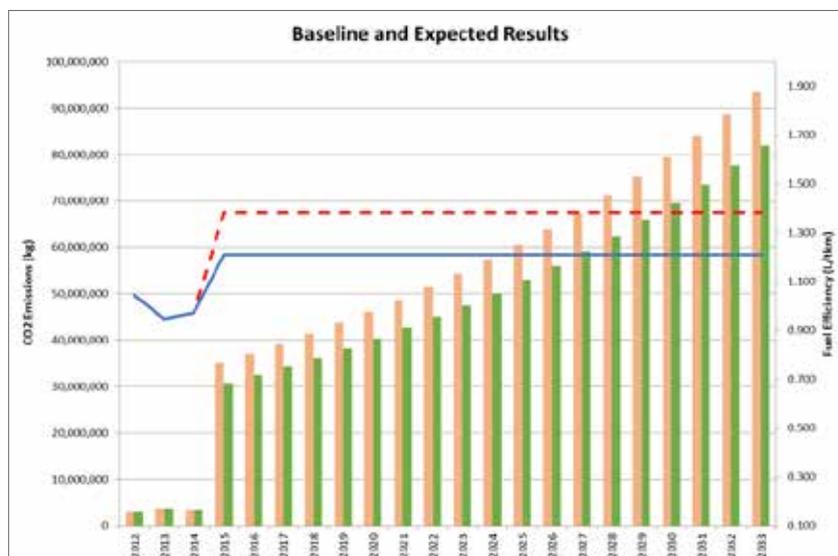
Frequency of meetings: Bimonthly

Number of meeting held as of 31 Dec 2019: 31 meetings

National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 02 Oct 2015
AES installation date: 02 Oct 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Aerolineas MAS
- AIR CENTURY, S.A.
- SERVICIOS AÉREOS PROFESIONALES, S.A. (SAP)
- PAN AMERICAN WORLD AIRWAYS DOMINICANA (PAWA)

- DOMINICAN WINGS, S.A.
- AEROLINEAS SANTO DOMINGO, S.A.
- HELICÓPTEROS DOMINICANOS, S.A. (HELIDOSA)
- SKYHIGH

AES interfaces: None

Regulatory Measure

Regulatory measure to support the periodic data submission by airlines:

- RAD 121 (Rev. 5, may 17, 2016)
 - <https://siagagestion.idac.gob.do/documentos/download?id=809145223&dir=docs>
 - Section 121.708 paragraph d) (page 283)
 - Appendix P, section A9-Aircraft Operation, paragraph A 9.1.8.1 (page 475)
- RAD 135 (Rev. 6, Feb 07, 2019)
 - <https://siagagestion.idac.gob.do/documentos/download?id=809284937&dir=docs>
 - Section 135.422a paragraph d) (page 171)
 - Section 135.427 paragraph g) (page 178)
 - Appendix H, Section A9-Aircraft Operations, paragraph A 9.1.81 (Page 135-AP-H-11)

Data Submission to ICAO (as of 31 Dec 2018)

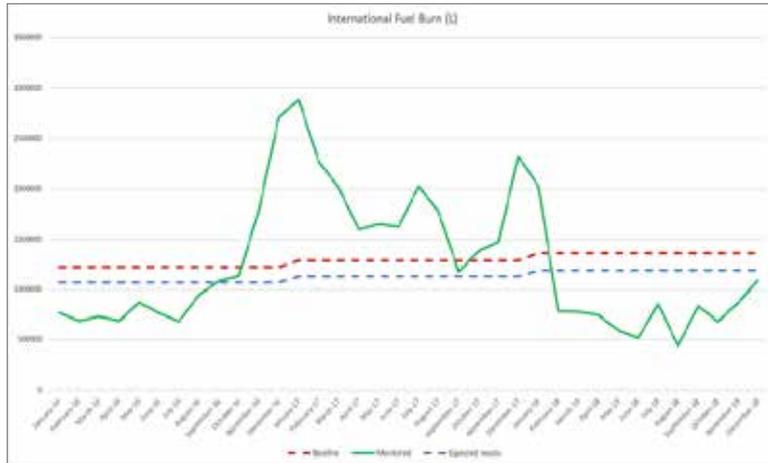
Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

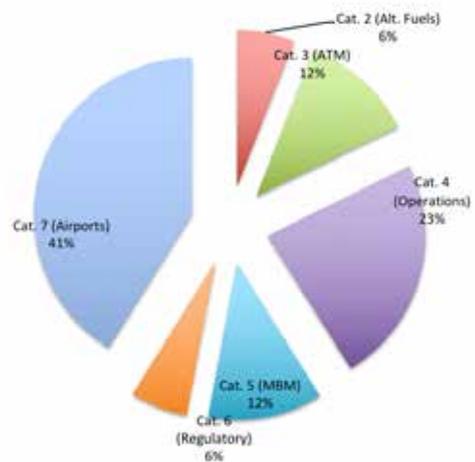
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan: 17

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	1
Cat. 3 (ATM)	2
Cat. 4 (Operations)	4
Cat. 5 (MBM)	2
Cat. 6 (Regulatory)	1
Cat. 7 (Airports)	7
TOTAL	17

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	0
Ongoing	4
Completed	13
TOTAL	17

Mitigation measures funded by the project:

- Feasibility study for the development of Sustainable Aviation Fuels in Dominican Republic (50,000 EUR)
- Assistance Mission on ATFM to design procedures and establish the ATFM Unit at IDAC (2,000 EUR)

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
2 (Sust. Aviation Fuels)	Research to explore the feasibility to include alternative fuels for the civil aviation to medium term.	2016	2017	0	0
3 (ATM)	Introduce the ATFM concept	2018	2019	9,281	0
4 (Operations)	Implement single engine taxi from June 2016.	2016	2017	39	0
6 (Regulations)	Upgrade with appropriate environmental actions on CO ₂ reduction for the air operator or air carriers currently certified under RAD 121, including enhanced monitoring processes, operational restrictions and carbon reporting	2016	2017	0	0
7 (Airports)	Commissioning of the Pre-Conditioned Air (PCA) and the energy power converters available on seven (7) electric jet-bridges in Punta Cana International Airport by 2016.	2016	2017	0	<i>Not quantified</i>
7 (Airports)	Commissioning of GPU and PCA available to allow aircraft APU switch-off	2017	2018	0	<i>Not quantified</i>
7 (Airports)	Acquire and install twenty one (21) electrical PCA and energy converters for the jet-bridges in three international airports that represent together 48.3% of the international operations in the State: SDQ, STI and POP	2018	2019	0	<i>Not quantified</i>
7 (Airports)	Implement a solar energy park to cover 1.5 MW in the CIBAO's International Airport	2017	2018	0	2463
7 (Airports)	Implement energy efficiency programs in the main international airports to optimize the energy consumption and reduce the energy demand.	2015	2016	0	<i>Not quantified</i>
4 (Operations)	Reduce at least 20 pounds of aircraft weight from the national air operators from 2016.	2016	2017	4.39	0
4 (Operations)	Review the program maintenance to assurance the inclusion and compliance assurance of the engine wash from 2016.	2016	2017	22.8	0
4 (Operations)	Design a training program for pilots on best practices in operations to reduce fuel consumption to start the next year (2016).	2017	2018	0	0
7 (Airports)	Implement a solar energy park to cover 1.0 MW in the IDAC Building (International Airport LAS AMERICAS)	2016	2017	0	1642
7 (Airports)	Use of electric Ground Support equipment (GSE) at Punta Cana Airport. Including Tractors, Conveyors belt, Pax Stairs and more power by either batteries or solar panels	2018	2019	0	0
TOTAL				9,347	4,105



OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Job Mukuna Ntumba

ICAO-EU Project Focal Points:

- Mr. Job Mukuna Ntumba
- Mr. Mafu Onsenge
- Mr. Alain Mulembwe
- Mr. Kazadi Ilunga
- Mr. Akalonbo Gabriel Kasongo

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

Environmental Unit at the CAA: Creation in process waiting for the approval of the board of directors

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Comité d'Elaboration du Plan d'Action pour la Réduction des émissions de CO₂ (CEPARG)

Date of submission of the Action Plan:

March 2016

Date of creation of the NAPT: 03 Jun 2015

Frequency of meetings: Every two months

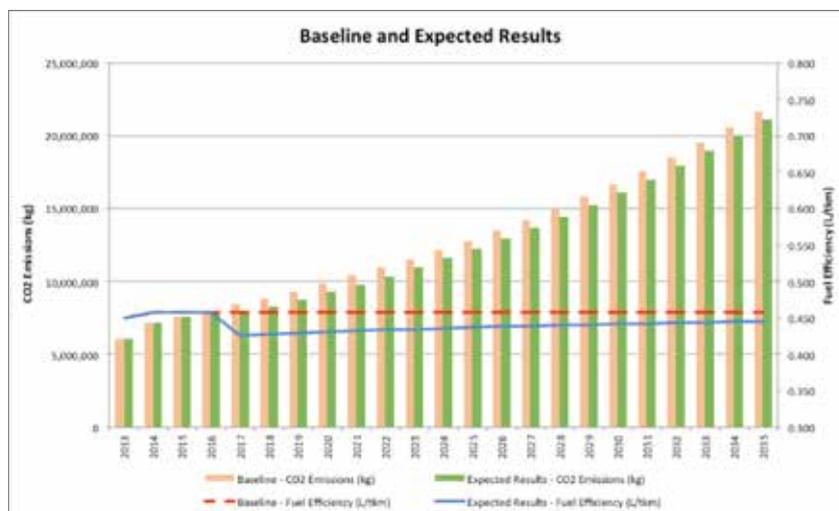
Number of meeting held as of 31 Dec 2019: 5 meetings



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 05 Nov 2015
AES installation date: 05 Nov 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- National airline Congo Airways since August 2018

AES interfaces: None

Regulatory Measure

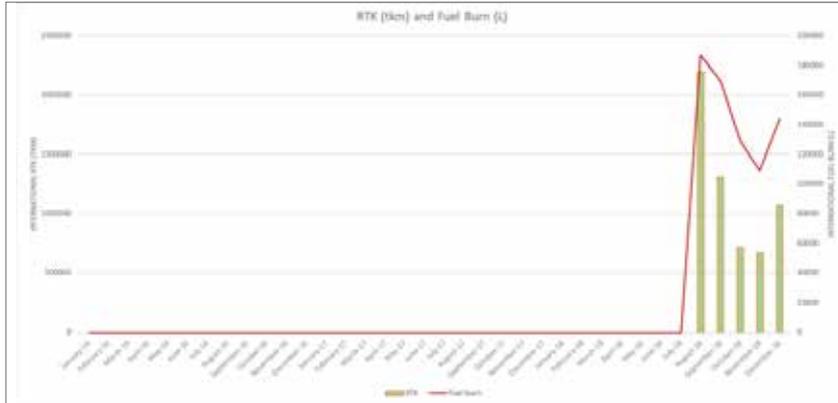
Regulatory measure to support the periodic data submission by airlines: On 13 July 2016, the CAA of DRC published Decision n°DO-AAC100/DG/TMJ/ALG/788/16 to require periodic data submission from airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

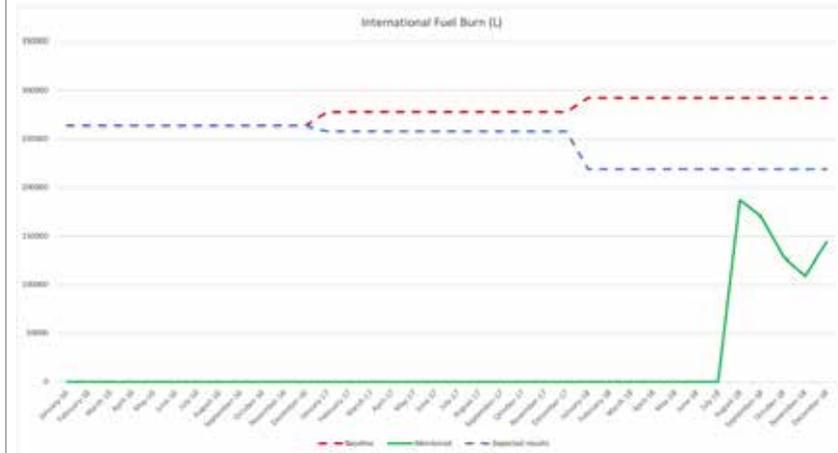
Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	0	No international flight served by national airlines
2017	0	No international flight served by national airlines
2018	5	Since August 2018, data submitted by Congo Airways.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

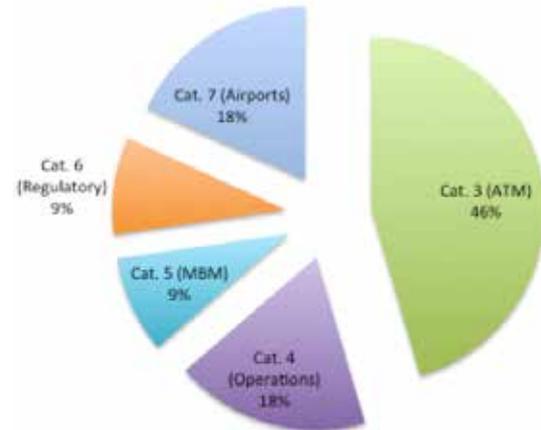
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
4

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	3
Cat. 4 (Operations)	0
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	1
TOTAL	4

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	1
Completed	1
TOTAL	4

Mitigation measures funded by the project:
None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Implementation of PBN Star operations in the 3 international airports of the State (Ndjili, Luano and Bangoka)	2017	2018	12.0	295.0
TOTAL				12	295



COUNTRY FICHE EQUATORIAL GUINEA

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Leandro Miko Angue

ICAO-EU Project Focal Points:

- Mr. Juvenal Owono Obama Avomo
- Ms. Justino Bayeme Ela Andeme

Environmental Unit at the CAA: Creation in process waiting for the approval of the board of directors

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Equipe Nationale du Plan d'Action

Date of creation of the NAPT: 09 Jan 2015

Frequency of meetings: Every three months

Number of meeting held as of 31 Dec 2019: 9 meetings

Date of submission of the Action Plan:

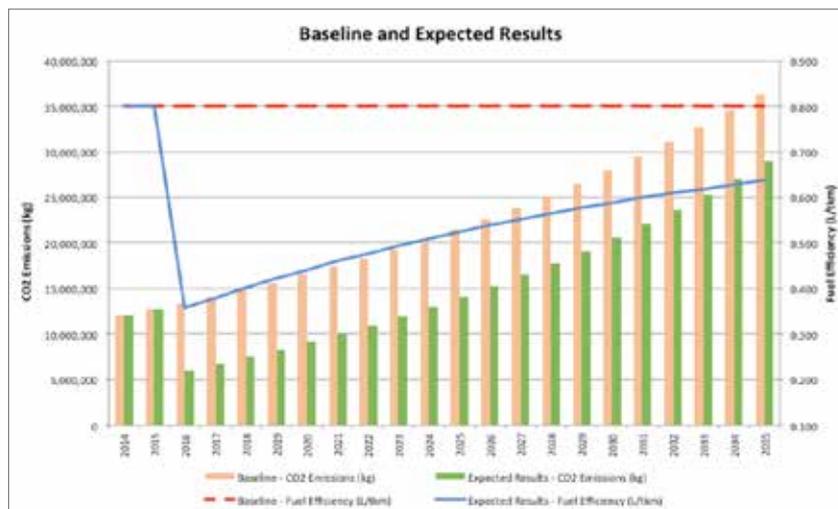
March 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 03 Feb 2016
AES installation date: 03 Feb 2016
Current version: Last AES release from 22 Mar 2019

Data Providers:
 • Ceiba Intercontinental
 • Chronos Airlines
AES interfaces: None

Regulatory Measure

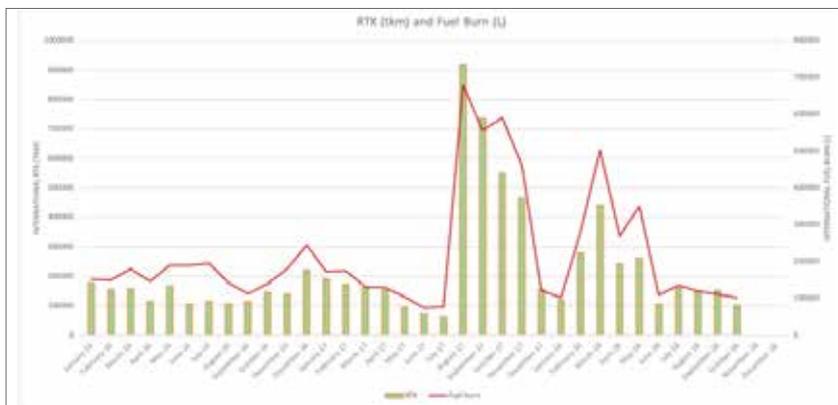
Regulatory measure to support the periodic data submission by airlines: On 1st September 2016, the CAA of Equatorial Guinea issued an Aeronautical Information Circular (AIC No. 1/016) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

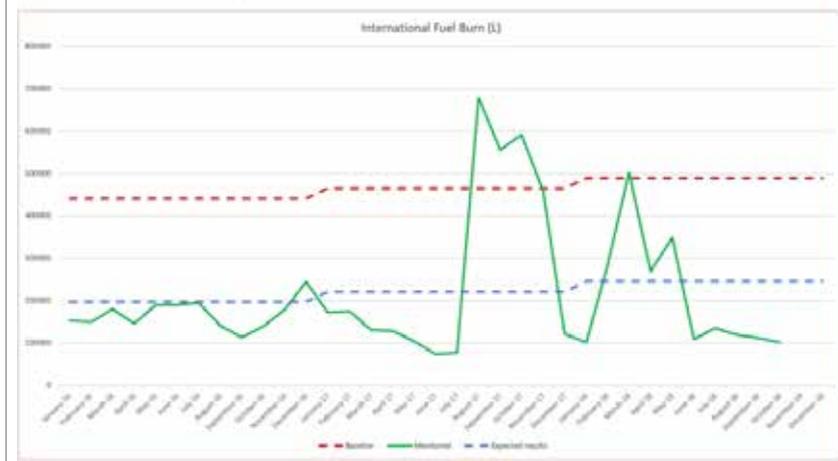
Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	10	Delay in data submission from the airline.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

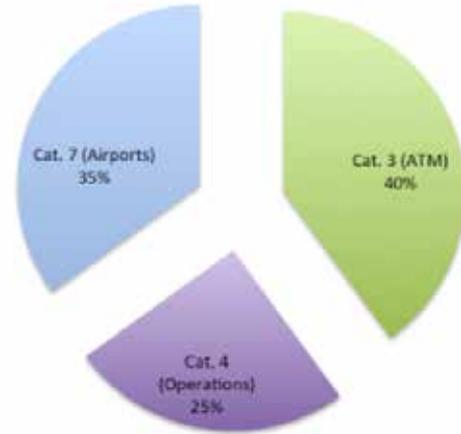
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
20

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	8
Cat. 4 (Operations)	5
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	7
TOTAL	20

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	14
Completed	4
TOTAL	20

Mitigation measures funded by the project:

None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
4 (Operations)	Implement single engine taxi in all airlines	2016	2017	101.1	Not quantified
7 (Airport)	Expansion and modernization of Malabo airport terminal	2016	2020	Not quantified	Not quantified
7 (Airport)	Install LED lighting in Malabo airport	2015	2018	Not quantified	21.6
7 (Airport)	Implementation of energy efficiency programs in the airports	2012	2018	Not quantified	Not quantified
TOTAL				101	22



COUNTRY FICHE GABON

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Edmond Hocke Nguema Biteghe

ICAO-EU Project Focal Points:

- Mr. Edmond Hocke Nguema Biteghe
- Ms. Larissa Pamela Dianga Nzengue

Environmental Unit at the CAA: Created in June 2016 with 1 staff member

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Comité du Plan d'Action

Date of creation of the NAPT: 09 Jan 2015

Frequency of meetings: Monthly in 2015 and quarterly in 2016

Number of meeting held as of 31 Dec 2019: 16 meetings

Date of submission of the Action Plan:

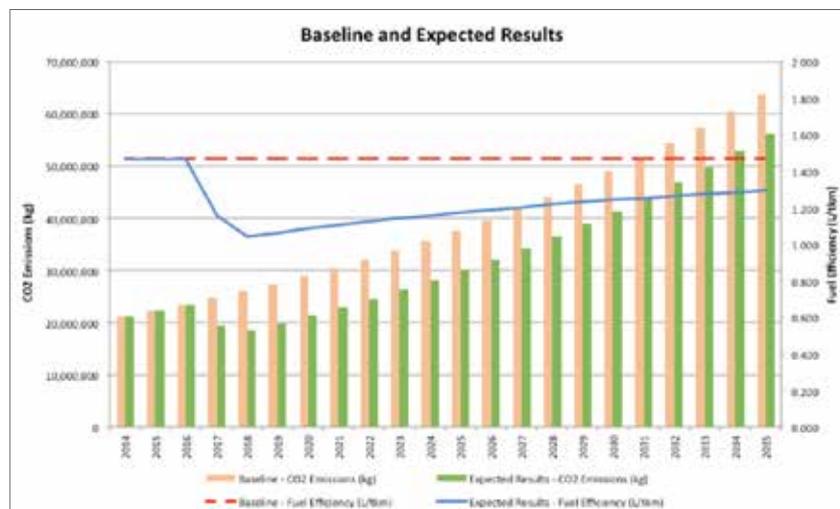
April 2016



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 08 Sep 2015
AES installation date: 08 Sep 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Afrijet
- Afric Aviation
- Solenta Gabon

AES interfaces:

- Afric Aviation, delivered in Sep 2015

Regulatory Measure

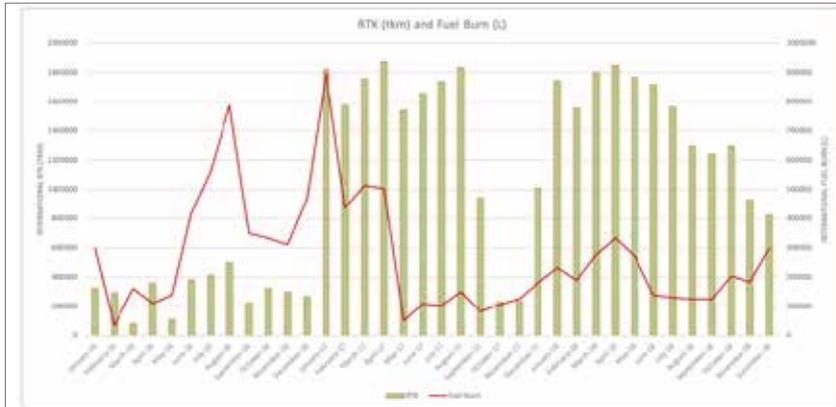
Regulatory measure to support the periodic data submission by airlines: On 18th October 2016, the CAA of Gabon issued a Circular (No. 006/2016) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO₂ reports submitted:

Year	Number of monthly CO ₂ reports submitted	Comments
2016	12	
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored CO₂ emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
15

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	10
Cat. 4 (Operations)	1
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	4
TOTAL	13

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	7
Completed	6
TOTAL	15

Mitigation measures funded by the project:

- Implementation of Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) in Libreville.

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Implementation of PBN SID procedure	2017	2017	95.05	Not quantified
3 (ATM)	Implementation of PBN STAR procedure	2017	2017	221.7	Not quantified
3 (ATM)	Improvement of execution approach phase based on fixed reference points	2017	2017	3860.44	Not quantified
3 (ATM)	Improvement of execution approach phase (RNP AR APCH)	2017	2017	26.98	Not quantified
3 (ATM)	Full use of airspace capabilities (PBN, RNAV/RNP, etc.)	2017	2017	40.4	Not quantified
3 (ATM)	Strengthening of Civil and military cooperation for the use of restricted airspace area FOP2 and FOP3	2017	2018	Not quantified	Not quantified
TOTAL				4244.57	



COUNTRY FICHE KENYA

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Winstone GICHERU
- Mr. Francis MWANGI

ICAO-EU Project Focal Points:

- Mr. Winston GICHERU
- Mr. Francis MWANGI

ICAO-EU Project seminars attended:

- 03-06 Feb 2015: Kick-off Seminar in Yaoundé;
- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Aviation Environmental Working Group (AEWG)

Date of creation of the NAPT: 2010, enhanced in 2015

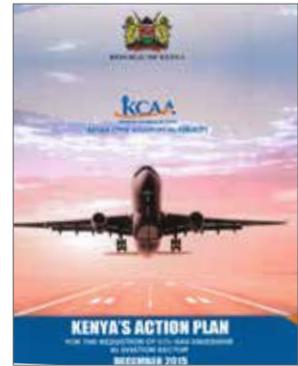
Frequency of meetings: Quarterly

Number of meeting held as of 31 Dec 2019: 10 meetings and 3 workshops

Date of submission of the Action Plan:

24 December 2015

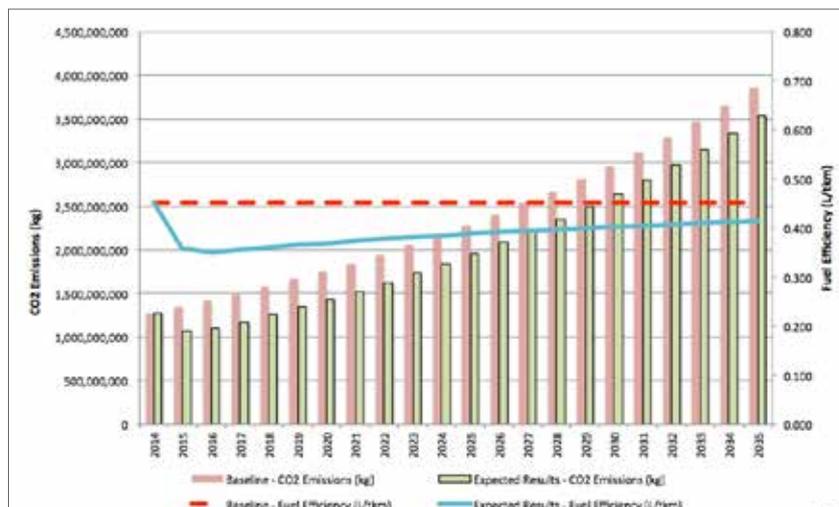
A first Action Plan was submitted in 2013 by Kenya.



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



Note: The State has already recalculated its baseline and expected results using data monitored through the AES.

OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 31 March 2015
AES installation date: 31 March 2015

Current version: Last AES release from 22 Mar 2019

Data Providers:

- Kenya Airways
- Astral Aviation

AES interfaces: • Kenya Airways

Regulatory Measure

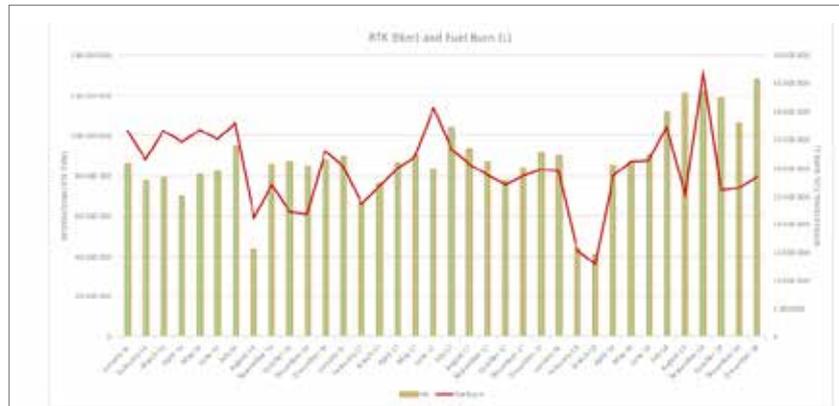
Regulatory measure to support the periodic data submission by airlines: On 21st July 2015, KCAA issued an Aeronautical Information Circular (AIC No. 8/15) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	12	

Monitored data trends since 2016:



Monitored fuel burn compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

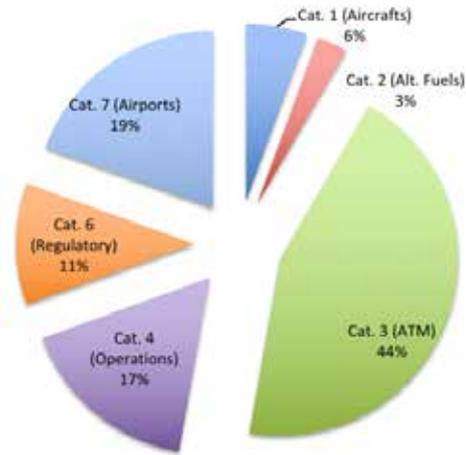
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
36

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	2
Cat. 2 (Alt. Fuels)	1
Cat. 3 (ATM)	16
Cat. 4 (Operations)	6
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	4
Cat. 7 (Airports)	7
TOTAL	36

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	3
Ongoing	7
Completed	26
TOTAL	36

Mitigation measures funded by the project:

- Implementation of solar panels and a gate electrification system in Mombasa International Airport (1.3M EUR)
- Feasibility study for the development of Sustainable Aviation Fuels in Kenya (50,000 EUR)

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
1 (Technology)	Replacement of four B737-700 by four B737-800	2011	2020	11692	Not quantified
1 (Technology)	Replacement of six B767 by six B787	2011	2020	66644	Not quantified
2 (Sust. Aviation fuels)	Conducting aviation research on environment - Feasibility study on alternative fuels	2016	Cont	Not quantified	Not quantified
3 (ATM)	To allocate parking bays in conjunction with slot as a result of quick sequencing of traffic' additional parking slots from 20 to 34.	2009	Cont	Not quantified	Not quantified
3 (ATM)	Achieve less turn around time, additional airbridges and airport transport buses.	2009	Cont	Not quantified	Not quantified

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
3 (ATM)	Alternate airport - Moi International airport	1978	Cont	<i>Not quantified</i>	<i>Not quantified</i>
3 (ATM)	Measures to improve pre-departure planning (DMAN) and arrival planning (AMAN)	2016	2017	240	<i>Not quantified</i>
3 (ATM)	To have reduced taxi times by having rapid exit taxiways and construction of a continuous taxiway linking end of RWY 06 and RWY 24	2015	2017	565	<i>Not quantified</i>
3 (ATM)	To achieve minimum internal times between flights	2010	Cont	613	<i>Not quantified</i>
3 (ATM)	To Lower flight level separations	2016	2017	3156	<i>Not quantified</i>
3 (ATM)	To continually improve the airport operational by involving all stakeholders - Airport CDM	2014	Cont	<i>Not quantified</i>	<i>Not quantified</i>
3 (ATM)	To benchmark the country CO ₂ emissions. Develop and Implement procedures To reduce emission for all phases of flight Gate to Gate- The perfect flight Facilitate world-wide interoperability of environmentally friendly	2012	Cont	<i>Not quantified</i>	<i>Not quantified</i>
3 (ATM)	To Achieve shorter routes by overflying military airspace	1977	Cont	252	<i>Not quantified</i>
3 (ATM)	Improve Flexibility & Efficiency in Descent Profiles.	2010	Cont	1839	<i>Not quantified</i>
3 (ATM)	Enabling the execution of a flight profile optimized to the performance of the aircraft.	2010	Cont	3068	<i>Not quantified</i>
3 (ATM)	To manage traffic allocation for different level To minimize time required before correct flight level allocation that saves fuel	2009	Cont	17520	<i>Not quantified</i>
3 (ATM)	To generate shorter routes or direct routes that saves fuel	2009	Cont	17520	<i>Not quantified</i>
3 (ATM)	To have flexible tracts for delay reduction	2009	Cont	17520	<i>Not quantified</i>
3 (ATM)	To Achieve delay reduction as results of maximization of flight level and routes	2009	Cont	64097	<i>Not quantified</i>
4 (Operations)	Engine core wash	1977	Cont	<i>Not quantified</i>	<i>Not quantified</i>
4 (Operations)	To maximise aircraft capacity by improving RPK and RTK	1977	Cont	<i>Not quantified</i>	<i>Not quantified</i>
4 (Operations)	To have unwanted weight removed from aircraft before comencing flight e.g Fly without flight kit, less portable water, no life raft in the flying over water	2009	Cont	22878	<i>Not quantified</i>
4 (Operations)	Aircraft body wash (exterior wash) Rigging of flaps and slat Aircraft reliability	1977	Cont	23398	<i>Not quantified</i>
6 (Regulations)	Publishing of AIC for aviation CO ₂ emission data collection	2015	2015	0	0
6 (Regulations)	To keep stakeholders informed and Improve on capacity buildings in aviation environment	2015	Cont	0	0
7 (Airports)	Use of alternative sources of power generation (Solar Power)	2017	2020	0	3861
TOTAL				251,002	3,861



COUNTRY FICHE SAO TOME AND PRINCIPE

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Mr. Júlio Morais Pinheiro

ICAO-EU Project Focal Points:

- Mr. Marcos A Vaz da Conceicao
- Mr. Júlio Morais Pinheiro

Environmental Unit at the CAA: None

ICAO-EU Project seminars attended:

- 24-27 Nov 2015: Second Capacity Building Seminar in Nairobi.
- 31 Oct-04 Nov 2016: Third Capacity Building Seminar in Libreville.
- 12-14 Dec 2018: Fourth Capacity Building Seminar in Mombasa.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

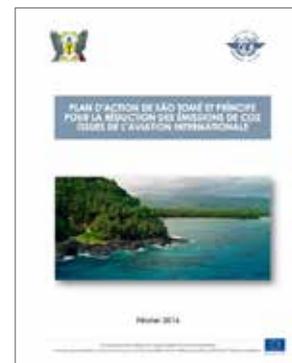
Commission for the Action Plan

Date of creation of the NAPT: 22 June 2015

Frequency of meetings: Bimonthly

Number of meeting held as of 31 Dec 2019: 12 meetings

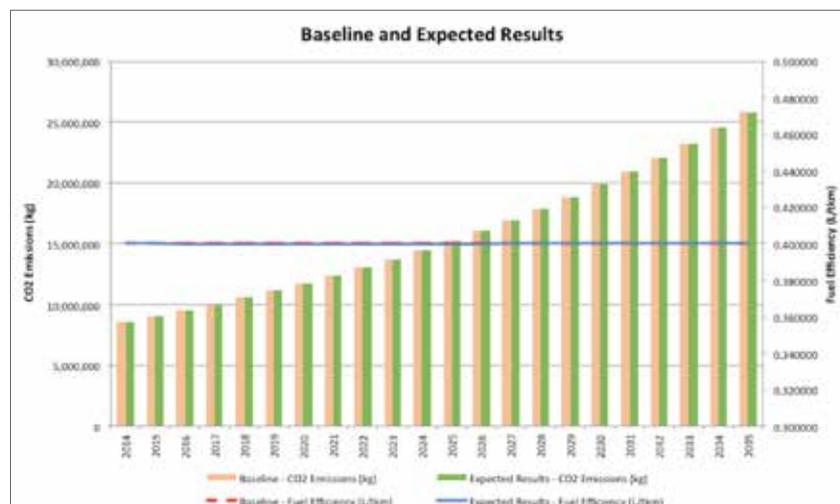
Date of submission of the Action Plan: :
March 2016.



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 27 Aug 2015
AES installation date: 27 Aug 2015

Data Providers:
 • STP Airways

Current version: Last AES release from 22 Mar 2019

AES interfaces: None

Regulatory Measure

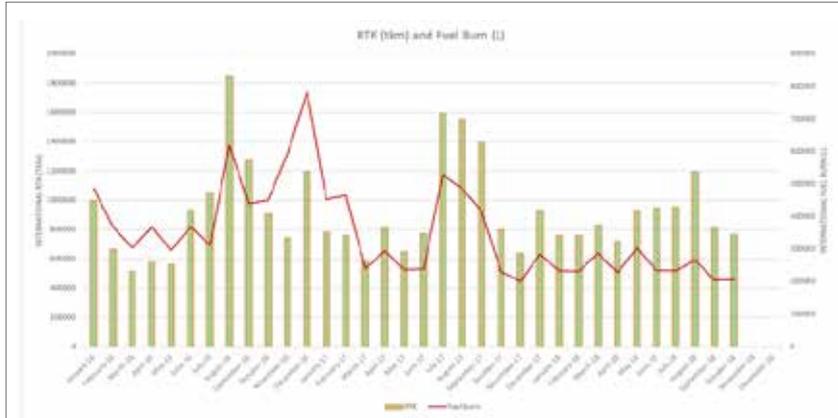
Regulatory measure to support the periodic data submission by airlines: On 6th July 2015, the CAA of Sao Tome and Principe issued a “Circular Tecnica” (CT-CO2-01) to require periodic data submission from national airlines through the format Form ENV1.

Data Submission to ICAO (as of 31 Dec 2018)

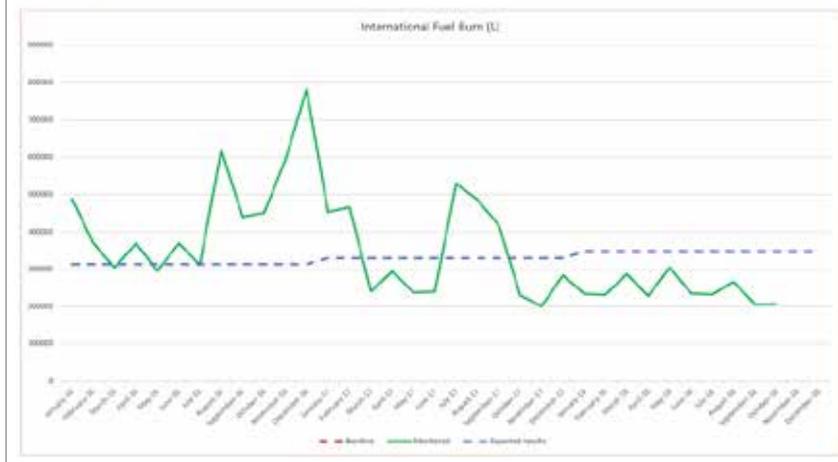
Monthly CO2 reports submitted:

Year	Number of monthly CO2 reports submitted	Comments
2016	12	
2017	12	
2018	10	Delay in data submission from the airline.

Monitored data trends since 2016:



Monitored CO2 emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

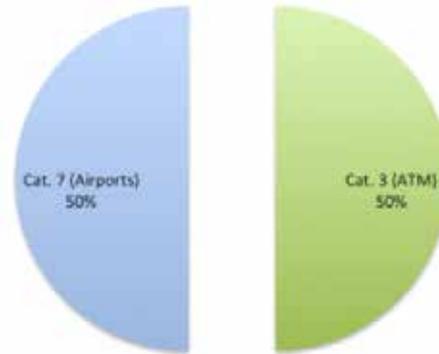
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
4

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	0
Cat. 2 (Alt. Fuels)	0
Cat. 3 (ATM)	2
Cat. 4 (Operations)	0
Cat. 5 (MBM)	0
Cat. 6 (Regulatory)	0
Cat. 7 (Airports)	2
TOTAL	4

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	0
Ongoing	3
Completed	1
TOTAL	4

Mitigation measures funded by the project:

None

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
7 (Airports)	Installation of LED lighting in the main airport	2016	2017	Not quantified	134.8
TOTAL					135



COUNTRY FICHE TRINIDAD AND TOBAGO

LAST UPDATED: 15 MAY, 2019

OBJECTIVE 1

CAPACITY BUILDING AND ACTION PLAN

National Focal Points

Action Plan Focal Point:

- Ms. Areefa Khan
- Mr. Henry Ricardo
- Ms. Hema Dass

ICAO-EU Project Focal Points:

- Ms. Areefa Khan
- Mr. Henry Ricardo
- Ms. Hema Dass

ICAO-EU Project seminars attended:

- 11-12 Dec 2014: Kick-off Seminar in Santo Domingo;
- 13-15 Oct 2015: Second Capacity Building Seminar in Port of Spain;
- 14-16 Dec 2016: Third Capacity Building Seminar in Punta Cana;
- 12-13 July 2018: Fourth Capacity Building Seminar in Punta Cana.

Environmental Unit at the CAA: Permanent Environmental Committee established and one full-time staff dedicated to environment recruited at TTCAA.

National Action Plan Team

Name of the National Action Plan Team (NAPT):

Aviation Environmental Working Group (AEWG)

Date of submission of the Action Plan:

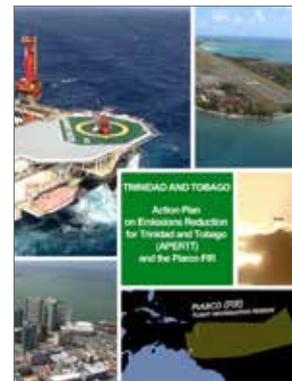
January 2013

Date of creation of the NAPT: 2012, enhanced in 2015

Updated Action Plan submitted in August 2015

Frequency of meetings: Quarterly

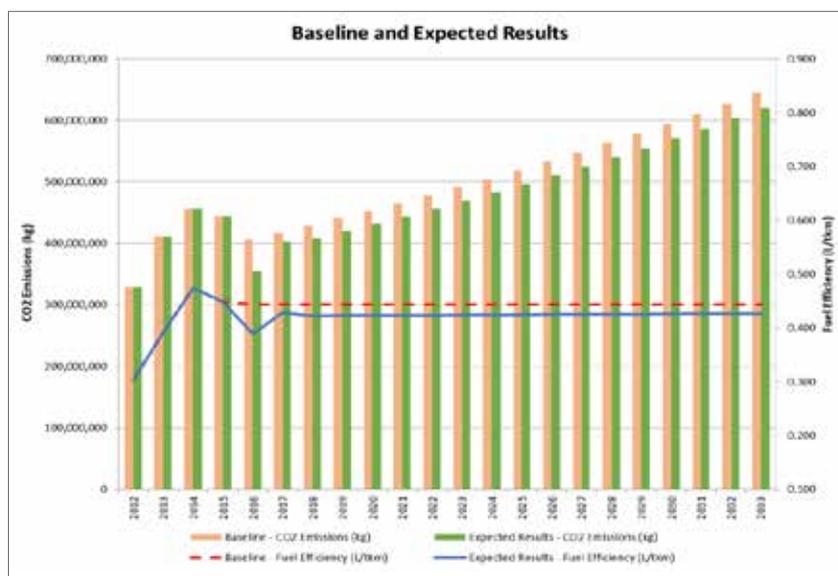
Number of meeting held as of 31 Dec 2019: 16 Meetings and 3 workshops



National Action Plan Team

Definition for international flights: ICAO

Baseline and expected results in the submitted Action Plan:



OBJECTIVE 2

AVIATION ENVIRONMENTAL SYSTEM

Installation and Configuration

ICT equipment installation date: 07 Oct 2015
AES installation date: 07 Oct 2015
Current version: Last AES release from 22 Mar 2019

Data Providers:
 • Caribbean Airlines Limited (CAL)
AES interfaces: • Interface for Caribbean Airlines delivered in July 2016

Regulatory Measure

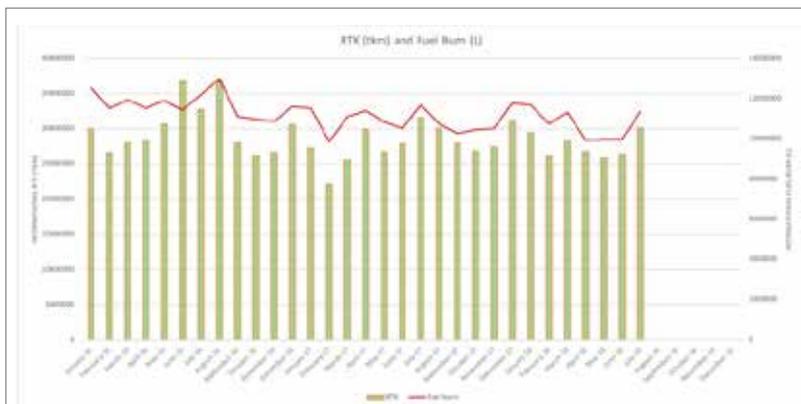
Regulatory measure to support the periodic data submission by airlines:
 • Legal Notice No. 182 of 2016

Data Submission to ICAO (as of 31 Dec 2018)

Monthly CO₂ reports submitted:

Year	Number of monthly CO ₂ reports submitted	Comments
2016	12	
2017	12	
2018	7	Delay in data submission from the national airline

Monitored data trends since 2016:



Monitored CO₂ emissions compared to the baseline and expected results:



OBJECTIVE 3

IMPLEMENTATION OF MITIGATION MEASURES

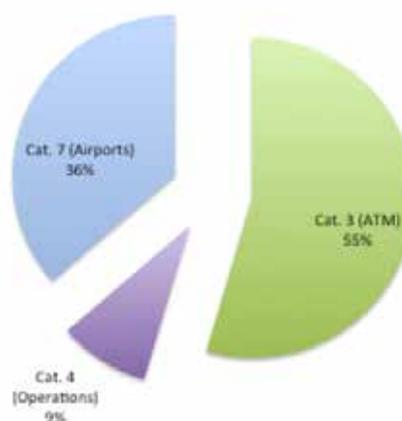
Overview of Selected Mitigation Measures

Number of mitigation measures in the latest Action Plan:
28

Number of measures by category:

	Number of Measures
Cat. 1 (Aircrafts)	3
Cat. 2 (Alt. Fuels)	1
Cat. 3 (ATM)	3
Cat. 4 (Operations)	10
Cat. 5 (MBM)	1
Cat. 6 (Regulatory)	5
Cat. 7 (Airports)	5
TOTAL	28

Distribution of measures per category:



Implementation Plan and Overall Progress

Progress as of 31 January 2019:

Status	Number of Mitigation Measures
Not started	2
Ongoing	2
Completed	24
TOTAL	28

Mitigation measures funded by the project:

- Feasibility study for the development of Sustainable Aviation Fuels in Trinidad and Tobago (50,000 EUR)
- Feasibility study for the adoption of renewable energy (Solar at the gate) at the Port of Spain International Airport in Trinidad and Tobago (50,000 EUR)

Mitigation measures mentioned in the action plan that were completed in the timeframe of the project:

Category	Description	Start date	End date	Expected results (tCO ₂ /year)	Cobenefits (tCO ₂ /year)
1 (Technology)	The airline acquired and implemented a data transfer system through automated FOQA in order to optimize the data exchange from aircraft to ground systems.	2016	2017	0	0
1 (Technology)	The airline will implement a cockpit technology for a better decision making process about the ground movements and flight data. This measure consists in tablet-technology to implement e-Manuals and moving maps in cockpit.	2016	2017	1740	675
1 (Technology)	The airline will implement a Fuel Management System (FMS) for measuring and managing fuel usage at every stage of flights.	2016	2017	3000	675
2 (Sust. Aviation Fuels)	Research on development of alternative fuels and standards/requirements for alternative fuel use.	2016	2017	0	0
3 (ATM)	Introduction of RNAV10 to allow for the reduction of the lateral separation between flights to SONM in short term (Mid 2016).	2016	2017	0	0

Category	Description	Start date	End date	Expected results (tCO2/year)	Cobenefits (tCO2/year)
4 (Operations)	Establish a procedure to select the aircraft best suited on mission based and adopt a corporate policy to achieve and maintain an 80% of load factor.	2017	2018	0	0
4 (Operations)	Implement a cruise performance monitoring and wind forecasting to optimize the speed from 2016	2016	2017	0	0
4 (Operations)	Improved Ground Operations including flight management with minimal delays, optimize the time to shutting down the engine after landing and introduce the cost of the ground operations within the COST INDEX FLIGHT PLANNING of its B-737 fleet	2016	2017	0	0
4 (Operations)	Reduce at least 60 kg/flight with the weight management and fuel reserves monitoring.	2016	2017	427	
4 (Operations)	Reduce aircraft weight and fuel burn by removal of flight spares kit, in 2015	2016	2017	1243	
4 (Operations)	• Review the procedures to minimizing/eliminate the reverse use in short term (2017) and implement the full use of idle thrust use	2017	2018	940	592
4 (Operations)	Implement a program to optimize the aircraft maintenance including engine and/or aircraft wash by 2016	2016	2017	890	720
4 (Operations)	Implement Single Engine taxi in all the fleet to support the gradually implementation of eTaxi	2016	2017	1618	360
4 (Operations)	Review and improvement the procedures to reduce thrust on take-off for the departures procedures, minimising flaps on take-off and landing from 2016. Optimize the Flaps use on landings and take-off for all the fleet: 737 (15), 727 (2) and ATRs (5)	2016	2017	1766	283
5 (Economic)	Adopt an international voluntary off-set program or design a local program by 2017.	2017	2018	0	0
6 (Regulations)	Require transparent Carbon Reporting to all the airlines from 2016.	2016	2017	0	0
6 (Regulations)	Conduct workshop and conferences to support the transfer of capacities on Climate Change in Trinidad and Tobago from 2016.	2016	2017	0	0
6 (Regulations)	The TTCAA and / or AATT will adopt a regulation to limit the use of the APU from 2017.	2016	2017	0	0
6 (Regulations)	Implement a national award to recognize efforts from the airlines and airports that operate in the country by 2020.	2017	2018	0	0
6 (Regulations)	Establish an environmental unit within the TTCAA to support the implementation of the APERTT	2017	2018	0	0
7 (Airports)	Reduce 5% of the electricity consumption in the main airports (POS and TAB) by 2016.	2015	2016	0	274.5
7 (Airports)	Implement maintenance and monitoring systems for airport vehicles and GSE by 2017.	2017	2018	0	0
7 (Airports)	Boarding Bridge Maintenance to assurance the all PCA and GPU units are fully functional from 2016.	2018	2019	3086	0
7 (Airports)	Conduct feasibility study to analyse and explore the possibilities to implement and use solar energy at the international airports	2017	2018	0	0
TOTAL				14,710	3,580



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