



# Linking the ICAO Global Market-Based Mechanism to REDD+ in Ethiopia

The International Civil Aviation Organization and its 191 member States agreed in October 2016 to implement a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to limit future increases in greenhouse gas emissions from the sector. This market-based scheme creates a potential global **demand of over 2 billion metric tons of investment-grade emissions reductions from 2021 to 2035.**

**Ethiopia could meet some of this demand with its current and projected supply from reducing emissions from deforestation and forest degradation and through forest restoration.** This report provides a quantitative analysis of Ethiopia's opportunities from making these emission reductions available to airlines in Ethiopia and beyond.

## KEY FINDINGS

1. Currently, Ethiopia has not chosen to opt-in to the pilot phase of CORSIA from 2021 to 2026. Should it decide to join CORSIA in 2021, Ethiopia's airlines would incur costs of up to \$33 million based on our analysis.
2. These costs are vastly outweighed by the potential benefits of marketing emission reductions from the forestry sector to airlines. Our analysis finds that the value to Ethiopia is, conservatively, \$47 million in additional private institutional investment between 2021 and 2026. If Ethiopia also opts in to the voluntary phase of CORSIA and encouraged its regional partners to do likewise, it will create a broader market into which it may market these reductions.
3. To facilitate this investment, the Ethiopian national government policy must deliver the necessary institutional and legal conditions for REDD to succeed, at national and subnational jurisdictional levels, building on those currently applied to existing programs and projects.

## BACKGROUND AND CONTEXT

The purpose of this paper is to quantify the potential benefits for Ethiopia to make available forest-based emission reductions to airlines through the Carbon Offsetting Reduction Scheme for International Aviation (CORSIA) under the International Civil Aviation Organization (ICAO), including the benefits of also opting-in to CORSIA's pilot phase.

The brief examines the potential demand from global airlines, the potential supply from REDD+ in Ethiopia, the costs of early participation in CORSIA's pilot phase to Ethiopian airlines, and the benefits to Ethiopia from marketing forestry emission reductions to airlines in Ethiopia and beyond. We also provide an analysis on how to structure transactions between airlines and Ethiopia. An Annex provides more detailed information on our methodology that informs the analysis.

This section provides an overview of CORSIA and the current state of Ethiopia's REDD+ policy, to provide context for our analysis.

### ICAO'S MARKET-BASED MEASURE

ICAO and its 191 member states agreed in October 2016 to implement a global market-based scheme (GMBM) in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to limit future increases in greenhouse gas emissions from international civil aviation to 2020 levels.

The CORSIA is implemented in three phases, reflecting a principle of common but differentiated responsibilities and respective capabilities, as follows:<sup>1</sup>

- **Pilot Phase 2021 to 2023:** States participate on a voluntary basis
- **First Phase 2024 to 2026:** States participate on a voluntary basis
- **Second Phase 2027 to 2035:** Applies to all States that have an individual share of international aviation activities above the specified threshold, except Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs) unless they volunteer to participate in this phase. The specified threshold refers to where the individual share in Route-Tonne-Kilometres (RTKs) in year 2018 is above 0.5 percent of the global total RTKs or whose cumulative share in the list of States from the highest to the lowest amount of RTKs reaches 90 percent of total RTKs.

As of May 31, 2017, 70 States, representing more than 87.7 percent of international aviation activity, intend to voluntarily participate in the CORSIA Pilot Phase. The Government of

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<sup>1</sup> ICAO website <http://www.icao.int/environmental-protection/Pages/market-based-measures.aspx>.

Ethiopia<sup>2</sup> has not opted-in thus far, to the voluntary Pilot Phase or First Phase, and Ethiopia is expected to be exempt from mandatory inclusion in the Second Phase based on the 2018 threshold described above. Although airlines registered in Ethiopia represent only a small fraction – estimated 0.22 percent – of international activity, their exclusion from the scheme has a substantial impact on the overall GHG effectiveness of the CORSIA due to the ICAO rule that restricts policies that discriminate among airlines traveling the same route.

Recognizing the current technological limits to reducing emissions within the sector itself, the CORSIA will allow airlines to meet their regulatory obligations through the acquisition of international verified emissions reductions achieved in other sectors. The ICAO members further agreed (in Assembly Resolution A39-3) to promote the use of emissions units that benefit developing nations, such as Ethiopia. Therefore, the CORSIA represents a significant opportunity to help solve one of the main challenges to achieving global and national REDD+ objectives – the mobilization of adequate and predictable financial support to catalyze REDD+, including through results-based payments, while generating economic growth opportunities for States, such as Ethiopia.

REDD+ is recognized in the 2015 UNFCCC Paris Agreement as an important emissions mitigation tool for developing countries. Recent analysis by Environmental Defense Fund and Climate Advisers concludes that:

- REDD+ could provide a significant source of emissions reductions to offset airlines' emissions above capped levels
- A challenge to realizing supply of REDD+ credits is the need for a strong market demand signal
- The ICAO CORSIA has could provide this necessary demand signal

### **ETHIOPIA'S REDD+ POLICY**

Ethiopia identifies in its nationally determined contribution (NDC) to the Paris Agreement which sectors it will rely upon to achieve reductions of 255 MtCO<sub>2</sub>e, or 64 percent, below Business as Usual (BAU) levels by 2030. The reductions will primarily come from the agricultural and forestry sectors, contributing 90 and 130 MtCO<sub>2</sub>e in emissions reductions respectively (over 80 percent of the reductions required to meet the NDC). The government also makes clear its intention to use market mechanisms:

*“The Government of the Federal Democratic Republic of Ethiopia intends to sell carbon credits during the period to contribute towards achieving its Green Economy Strategy. Ethiopia supports the development of effective accounting rules under the UNFCCC to guarantee the*

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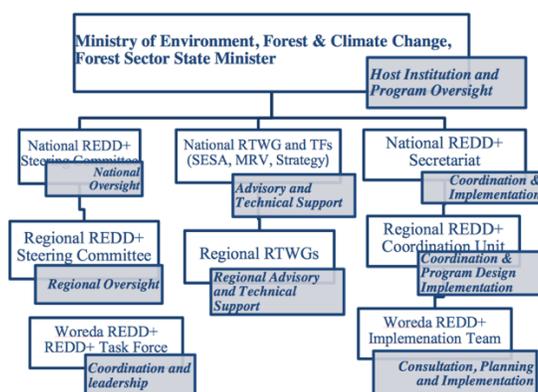
<sup>2</sup> Ethiopian Civil Aviation Authority is within the Ministry of Transportation: <http://www.ecaa.gov.et>

environmental integrity of market mechanisms.”<sup>3</sup>

In accordance with the Paris Agreement, and with the provisions of the CORSIA, the host country must ensure that any emissions reduction units transferred outside of the country will not be double counted. The Government of Ethiopia has indicated in its NDC its desire to use market mechanisms to contribute to its Climate Resilient Green Economy Strategy and the importance of developing accounting rules that ensure the environmental integrity of those mechanisms.

In 2013, Ethiopia established a National REDD+ Secretariat to coordinate its readiness activities under the FCPF. This forms part of the institutional structure Ethiopia has put in place to manage oversight, technical support, and coordination and implementation for REDD+. Figure 1 illustrates the institutional structure.

**Figure 1: Institutional structure for REDD+ in Ethiopia**



(Source: National REDD+ Secretariat)

These institutions receive input from relevant ministries, institutions, academia, NGOs and community based organizations.<sup>4</sup> However, there are also regional steering committees (RSC) for the REDD+ pilot states of Oromia, Amhara, Tigray and SNNP – the Oromia RSC has been operational since 2014.

The Government of Ethiopia has developed strategies, policies and plans that provide the requisite high-level direction and administrative framework for implementing and reporting REDD+ activities at sub-national levels, including:

<sup>3</sup> UNFCCC, Nationally Determined Contribution – Federal Democratic Republic of Ethiopia, <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Ethiopia%20First/INDC-Ethiopia-100615.pdf>

<sup>4</sup> [http://www.forestcarbonpartnership.org/sites/fcp/files/2015/November/Ethiopia%20MTR\\_Final%20Version.pdf](http://www.forestcarbonpartnership.org/sites/fcp/files/2015/November/Ethiopia%20MTR_Final%20Version.pdf)

- The Forest Management, Development and Utilization Policy (2007) is the main policy for the forestry sector. It promoted the development of the economic potential of the forestry sector and established an autonomous forestry institution to implement the policy.<sup>5</sup>
- 2011 Climate Resilient Green Economy (CRGE) framework which identifies 130 MtCO<sub>2</sub>e of abatement in the forestry sector to meet its 2025 goal of 255 MtCO<sub>2</sub>e across the economy. CRGE identifies the need for an MRV framework for agriculture, livestock and forestry emissions.
- The Oromia Forested Landscape Program (OFLP) which includes enhanced coordination between relevant bodies and upgrading data collection for MRV and forest management information.

In addition, there are other regional REDD+ programs currently in their preparatory phases. The World Bank FCPF is supporting activities in Amhara, Southern Nations, Nationalities and Peoples (SNNP), and Tigray regional states.<sup>6</sup> UN-REDD is also financing a pilot project in the Benishangul Gumuz region.<sup>7</sup>

The national REDD+ registry, currently under development as part of Ethiopia's readiness activities under the FCPF, will be a key tool in preventing double-counting and providing the transparency of information necessary for the effective nesting of projects within jurisdictional and national systems.<sup>8</sup> A requirement to register with the National REDD+ Registry would also help to mitigate legal ambiguity regarding the ownership of the emission reductions and inconsistencies between national GHG inventories and the general REDD+ accounting.

Ethiopia's REDD+ activities are supported by finance from developed country governments. For example, in August 2017, Norway signed a \$80 million investment agreement with Ethiopia to support these activities that contribute towards both protecting and transforming the forest sector.<sup>9</sup>

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<http://theredddesk.org/countries/ethiopia/plans-policies>

<sup>6</sup> World Bank Forest Carbon Partnership Facility, documents available at:

<https://www.forestcarbonpartnership.org/ethiopia-redd-strategy-pilot-projects-safeguards-consultations>

<sup>7</sup> UN-REDD Programme, <http://www.unredd.net/announcements-and-news/2302-ethiopia-s-benishangul-gumuz-redd-pilot-region-trains-60-stakeholder-representatives-for-redd-strategy-design-consultations.html>

<sup>8</sup> Ethiopia Ministry of Environment, Forestry and Climate Change, Mid-Term Progress Report 2012-2015 submitted to the World Bank Forest Carbon Partnership Facility, available:

[https://www.forestcarbonpartnership.org/sites/fcp/files/2015/November/Ethiopia%20MTR\\_Final%20Version.pdf](https://www.forestcarbonpartnership.org/sites/fcp/files/2015/November/Ethiopia%20MTR_Final%20Version.pdf)

<sup>9</sup> Ethiopian Embassy to the European Union, August 16, 2017: <http://ethiopianembassy.be/en/2017/08/17/ethiopia-norway-sign-80-million-forest-protection-restoration-agreement/>

## ANALYSIS

This section provides the findings of our quantitative analysis. Firstly, we estimate demand for emission reductions from CORSIA based on prior studies. Secondly, using a model developed by Climate Advisers, we calculate potential supply from REDD+ and forest restoration. Using this data, we calculate first the potential costs to Ethiopian airlines from opting-in to CORSIA from 2021-2026. Finally, we compare this to the benefits for Ethiopia from marketing its emission reductions to airlines.

Our analysis focuses on three main variables. We model participation in the pilot and first phase of CORSIA under two scenarios: high participation and low participation. Secondly, credit price reached in the market vary both between scenarios and over time depending on the level of participation. Finally, the available supply of REDD+ credits has three scenarios where the activities eligible to be sold into CORSIA vary.

### INTERNATIONAL AVIATION: DEMAND FOR EMISSIONS REDUCTION CREDITS

Estimates show that cumulative international aviation emissions may exceed 2020 levels by more than 500 million metric tons carbon dioxide equivalent (tCO<sub>2</sub>)<sup>10</sup> during the Pilot Phase and First Phase of the CORSIA (2021 to 2026). Countries responsible for 65 percent of these emissions have voluntarily opted into the scheme, implying a global demand from their airline companies of at least 325 million tCO<sub>2</sub> over the first five years during the Pilot Phase and First Phase. Projected excess emissions during the Second Phase (2027 to 2035) are higher still: about 2,600 million tCO<sub>2</sub>. Covered routes are expected to represent at least 79 percent of these emissions, resulting in a global demand of 2,050 million tCO<sub>2</sub> or larger. These figures are summarized below in Table 1.

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<sup>10</sup> Greenhouse gas emissions and removals are reported in metric tons of carbon dioxide equivalent, simplified as tCO<sub>2</sub> in this paper.

**Table 1. Projected global demand for offset credits (million tCO<sub>2</sub>)<sup>11</sup>**

Phase	Timeline	Emissions Above 2020 Levels	Projected Demand
<b>Pilot Phase and First Phase</b>	2021 to 2026	500	≥ 325 (65%)
<b>Second Phase</b>	2027 to 2035	2,600	≥ 2,050 (79%)

Source: ICAO's Market-Based Measure, Environmental Defense Fund

It is important to note the uncertainty in estimating the demand for GHG emissions reduction units under the CORSIA, as it requires making assumptions about the growth of the international aviation sector over the next 10 years; of fuel efficiency, technological improvements; and of the impact of other sources of supply of emissions reductions (e.g. from other sectors and countries).

ICAO has yet to decide the types of emission reductions which will be eligible for compliance with CORSIA, or the programs that can deliver such units. Decisions on Emissions Unit Criteria (EUC) and eligibility criteria for offsetting programs are expected no later than the end of 2018. There is a possibility that issues specific to the land-use sector could present challenges for eligibility, but it is the authors' understanding that EUC shall not prejudice particular sectors. We expect CORSIA's rules to be consistent with UNFCCC rules and guidelines, which includes the Warsaw Framework for REDD+ and any relevant provisions of the Paris Agreement, including those addressing international co-operative approaches (Article 6). **It is our view that this means that, to be eligible under CORSIA, the scope of REDD+ activities must be national or, as an interim measure, sub-national.**

Therefore, by following the relevant UNFCCC decisions the EUC could preclude eligibility of REDD+ offsets generated at a scale smaller than state-level jurisdictions. Any connection between 'project activities' that contribute to REDD+ would be through their contribution to, and possible benefit-sharing arrangement within, a national or state jurisdictional program. It should be noted that the jurisdictional approach used for REDD+ in the Oromia program would nest existing REDD+ projects in the region (Bale and Nonno Sale), but nesting has not yet been applied in a regulatory market.<sup>12</sup>

## **ETHIOPIA'S SUPPLY OF REDD+ CREDITS**

Airlines that will be participating in the CORSIA scheme as of 2021 are currently seeking opportunities to manage their liabilities with short- to long-term supply contracts. Airlines have expressed interest in forest-based climate programs because these represent large-scale

<sup>11</sup> Based on Environmental Defense Fund (EDF), 2016. ICAO's Market-Based Measure. Available at: <https://www.edf.org/climate/icaos-market-based-measure>. [Accessed: 23 Dec 2016.]

<sup>12</sup> <https://reddplusethiopia.files.wordpress.com/2017/02/oflp-pf-updated-8-feb-2017-clean-wb-rev.pdf>

supplies of emissions reduction units that also meet their corporate social responsibility and marketing needs.

Our analysis estimates the total potential available supply of forestry-based emission reductions in Ethiopia under different scenarios using a top-down supply model. Ethiopia's government has made clear its desire to use market mechanisms, and therefore making emission reductions available would be consistent with government policy. Ethiopia would need to consider the potential impact on achieving its NDC target for 2030. Box 1 addresses Ethiopia meeting its NDC while transferring emission reductions to CORSIA.

The low-supply scenario only includes Ethiopia's Oromia region, based on its international partnerships focused on REDD+. These include:

- The World Bank BioCarbon Fund's Initiative for Sustainable Forest Landscapes (ISFL) has a program in the Oromia region, with results-based payments for emission reductions negotiated over a ten-year period.
- Bale Mountains REDD+ project and Nono Sele Participatory Forest Management REDD+ projects, both located within woredas in the Oromia region.
- The Humbo Assisted Natural Regeneration project registered with the Clean Development mechanism (CDM) and supported by the BioCarbon Fund, with annual reductions of approximately 29,000 metric tons of CO<sub>2</sub> and a crediting period up to 2030.<sup>13</sup>

The high-supply scenario covers all forest land in Ethiopia and includes the sequestration potential from continuing forest land restoration (FLR) activities – primarily via afforestation and reforestation – considering Ethiopia's historical average rate from 1990 to 2010, and Ethiopia's current forest restoration target of 14,302,200 hectares.<sup>14</sup> A third mid-range supply scenario includes national scale REDD+ *without* restoration. The three supply scenarios have been selected to represent a range of potentially available offset credits that could be purchased by airlines with short- to long-term supply contracts.<sup>15</sup>

**Our three supply estimates do not consider the economic costs of implementing REDD+ activities** (i.e., implementation, opportunity and transaction costs associated with generating the results). They also do not account for emissions units that would be kept domestically to meet Ethiopia's Nationally Determined Contribution (NDC), a requirement that would be necessary to avoid double counting. Finally, a consideration in the low-supply scenario is whether emission reductions through the World Bank ISFL program could be made available

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<sup>13</sup> UNFCCC CDM Project Registry: <https://cdm.unfccc.int/Projects/DB/JACO1245724331.7/view>

<sup>14</sup> IUCN, Bonn Challenge Forest Land Restoration (FLR) Desk. Available at: <https://infoflr.org/countries/ethiopia>

<sup>15</sup> The methodology to derive estimates of the supply of credits from REDD+ activities in Ethiopia is described in the annex to this paper.

under CORSIA as a secondary transaction to the results-based payments made for those emission reductions. Alternatively, emission reductions in addition to the 10MTCO<sub>2</sub> contracted could be made available under CORSIA. The low-supply scenario includes all potential emission reductions within Oromia, including those under the ISFL program.

### **Box 1: Meeting Ethiopia's NDC and Transferring Emission Reductions to CORSIA**

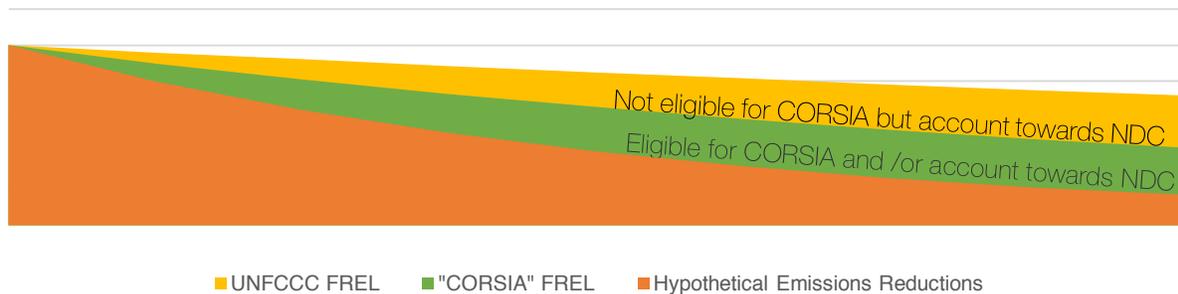
Ethiopia's NDC represents a conditional commitment under the Paris Agreement, subject to finance, technology transfer and capacity building support. Another important consideration is that any emission reduction that is transferred or assigned to a country or entity outside of Ethiopia cannot be used against its own target.<sup>16</sup> Such transfers can be considered as Internationally Transferred Mitigation Outcomes (per Article 6.2 of the Paris Agreement) which serve to enhance Ethiopia's mitigation ambition and contribute to sustainable development objectives. There may be concern about allowing emission reductions (particularly 'low cost' reductions) to "leave" the country, thereby making it more difficult to achieve the NDC target. However, there are options for managing this risk, which warrant consideration:

- a. A Forest Reference Emission Level (FREL) used under an ICAO-compliant methodology may differ from the national FREL submitted to the UNFCCC, similar to the Forest Carbon Partnership Facility (FCPF) Carbon Fund. This difference in accounting approach could mean not all REDD+ emission reductions would be available for transfer to CORSIA (but could be accounted towards Ethiopia's NDC). Figure 1 illustrates this.
- b. The government could consider marketing REDD+ emission reductions to airlines as a "premium product" that helps airlines to meet CORSIA requirements while also contributing to multiple non-carbon benefits such as biodiversity, water management and local livelihoods. The premium would, in effect, involve the application of a discount factor, whereby each CORSIA-eligible credit sold represents more than one metric ton of verified emission reductions, the remainder of which would be accounted towards Ethiopia's NDC.
- c. Ethiopia could establish an "NDC reserve" based on a percentage of all verified emissions reductions from REDD+ activities or programs prior to international sales. The reserve could be retained by the government to contribute to the NDC target or released for sale at a later date if no longer needed to meet the target.
- d. Ethiopia could impose a price floor applicable only to international transfers, so that emission reductions below a certain price level are available only for domestic use towards fulfilment of Ethiopia's NDC.

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<sup>16</sup> UNFCCC INDC Submissions Portal. Available at: <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20iNDC%20english%20FINAL.pdf>

**Figure 1: Indicative “CORSIA FREL” and UNFCCC FREL against Hypothetical Emissions Reductions (illustrative)**



### COSTS TO ETHIOPIAN AIRLINES OF JOINING CORSIA IN THE PILOT PHASE

In 2010, Ethiopia was responsible for approximately 0.22 percent of international aviation emissions.<sup>17,18</sup> This analysis assumes that Ethiopia’s share of international aviation emissions remains constant.

If broad participation in the CORSIA encourages a starting price of \$21 per tCO<sub>2</sub> in 2021 that gradually increases to \$28 per tCO<sub>2</sub> in 2026 when more countries join, the net present value of Ethiopian airlines’ total cost over the entire six-year period would be \$33 million. A 2016 International Air Transport Association (IATA) study finds that the costs of offsetting to airlines will be less than marginal [fuel price variability](#). A CORSIA with more exclusions, which means fewer airlines and routes included in the Pilot and First Phases, however, could result in prices as low as \$9 per tCO<sub>2</sub> in 2021 with a gradual increase to \$12 per tCO<sub>2</sub> by the conclusion of the First Phase in 2026. Because Ethiopia’s airlines would not have to purchase offset credits at this lower price, *the additional cost of joining the CORSIA in its Pilot Phase would be approximately \$14 million.*

<sup>17</sup> ICAO Environment Advisory Group Meeting, 2016. Results of Technical Analyses by CAEP. [http://www.icao.int/Meetings/HLM-MBM/Documents/EAG15\\_CAEP%20Technical%20Analyses.pdf](http://www.icao.int/Meetings/HLM-MBM/Documents/EAG15_CAEP%20Technical%20Analyses.pdf)

<sup>18</sup> Dave Southgate, 2013. Aviation Carbon Footprint. <https://southgateaviation.files.wordpress.com/2013/09/global-domestic-footprint-finalv6.pdf>

**Table 3: Costs to Ethiopia of joining CORSIA** (millions US\$, estimated)

Year	High Demand (High prices)	Low Demand (Low prices)
2021	\$ 1.5	\$ 0.6
2022	\$ 3.2	\$ 1.2
2023	\$ 5.5	\$ 2.3
2024	\$ 7.8	\$ 3.5
2025	\$ 10.3	\$ 4.5
2026	\$ 13.0	\$ 5.7
Total Cost of Early Opt-In*	\$33.3	\$ 14.3

\*Net Present Value discounted at 5 percent. See Annex for detailed methodology.

This figure can be considered as the ceiling of a possible cost range as a starting price of \$21 per tCO<sub>2</sub> is relatively high. This range of price estimates comes from the International Energy Agency's 2013 World Energy Outlook and reflects the prices used in the [January 2016 Presentation](#) of Technical Analysis Results by CAEP to the ICAO Environment Advisory Group.<sup>10</sup> These are higher than current levels of what donor governments have been generally willing to pay – from \$5 per tCO<sub>2</sub> - for REDD+ results (not necessarily as transferrable offset credits), through several bilateral and multilateral arrangements, including the World Bank's Carbon Fund and Norway's bilateral agreement with Brazil and its Amazon Fund. As CORSIA is a nascent regulated market, prior experience of other voluntary and regulatory markets is informative but may not be accurate predictors of offset credit prices under the CORSIA.

## **BENEFITS OF MARKETING FORESTRY EMISSION REDUCTIONS TO AIRLINES**

Ethiopia will be able to sell eligible emission reduction credits (offset credits) into the CORSIA without formally "opting in" to the Pilot Phase and First Phase. In this case, the country can essentially benefit from the mechanism without incurring any cost. However, an early entry by Ethiopia and its international airlines can provide considerable financial benefits at a relatively low cost. Specifically, by opting in during either the Pilot Phase or First Phase, Ethiopia can help increase the demand for offset credits, which will increase the market price for offset credits according to assumptions in the model. The country's airlines would bear the relatively small cost of early entry (see next section), but, as a large forest nation, Ethiopia could reap greater rewards of receiving a higher offset credit price from selling REDD+ credits to airlines under the CORSIA.

However, in order to increase offset credit prices significantly other currently excluded countries would also have to opt in to CORSIA early. On its own, Ethiopia represents a small

share of international aviation emissions – at 0.22 percent,<sup>19</sup> making up a very small share of global demand for offset credits. Among its neighbors in the Africa region, Angola, Botswana, the Democratic Republic of Congo, Ghana, Senegal, South Africa and others have also declined to participate from the first phase of the scheme. Like Ethiopia, these are also forest countries which could benefit from higher offset credit prices. Burkina Faso, Gabon, Kenya, and Nigeria have already indicated that it will opt-in voluntarily in 2021.<sup>20</sup> Egypt, which has the largest share of international aviation emissions in Africa, will join CORSIA starting in its second phase in 2024.

In addition, other REDD+ countries Brazil, Chile, Costa Rica, El Salvador, Guatemala, Indonesia, Papua New Guinea, Thailand and Vietnam will join CORSIA in either its first or second phase.

If Ethiopia's participation can convince its regional partners to join CORSIA, our analysis shows that greater participation could have a significant impact on credit prices. Our analysis includes a high participation scenario, with credit prices of \$21 to \$28 per tCO<sub>2</sub>, so that if all available offset credits are sold Ethiopia could earn a total of between \$380 million to \$9.5 billion during the six-year Pilot Phase and First Phase (2021 to 2026). Alternatively, in a scenario with limited CORSIA participation would generate credit prices of between \$9 to \$12 per tCO<sub>2</sub>, Ethiopia could earn \$160 million to \$4 billion during that same period. Therefore, *the additional revenue from Ethiopia and other's early opt-in to CORSIA could be as high as \$1.2 to \$5.5 billion (Figure 1)*. For a relevant comparison, Ethiopia's GDP in 2016 was \$72 billion. At the high-end of possible credit prices, Ethiopia stands to make substantial economic gains from voluntarily joining the CORSIA in 2021.

The analysis was also replicated using a much lower and narrower range of possible credit prices: \$6 to \$9 per tCO<sub>2</sub> with limited participation in CORSIA, increasing to \$8 to \$12 per tCO<sub>2</sub> in the higher participation scenario. In this case, Ethiopia's airlines would incur an estimated additional cost from early opt-in of \$14.3 million total over 2021 to 2026, while Ethiopia would receive between \$47 million to \$1.2 billion in additional revenue over 2021 to 2026. Even in this low-demand scenario, the added revenue (to government) from early entry far outweighs the cost (to industry, see below).

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<sup>19</sup> CAEP, 2016. Presentation of Technical Analysis Results to the ICAO Environment Advisory Group. 20-21 January. Available at: [https://www.icao.int/Meetings/HLM-MBM/Documents/EAG15\\_CAEP%20Technical%20Analyses.pdf](https://www.icao.int/Meetings/HLM-MBM/Documents/EAG15_CAEP%20Technical%20Analyses.pdf).

<sup>20</sup> ICAO Carbon Offsetting Reduction Scheme for International Aviation (CORSIA): <https://www.icao.int/environmental-protection/Pages/market-based-measures.aspx>

Figure 1. Early opt-in cost versus revenue (millions US\$)



## TRANSACTIONING BETWEEN ETHIOPIA AND AIRLINES

Airline companies have expressed interest in sourcing offset credits from REDD+ activities, particularly due to the broader social and environmental benefits and marketing opportunities. Given the alignment with national policy and potential economic interest discussed earlier in this paper, we now consider **how** Ethiopia could make its forest-based emission reductions available to airlines. This section examines risk management options available to facilitate transactions with airlines, and how a transaction could be structured.

### FINANCIAL RISK MANAGEMENT

Standardized financial [risk mitigation tools](#) exist and have been widely used to meet the requirements for investors to invest in or expand their investments in Africa.<sup>21</sup> For example, there are numerous U.S. Government investment, insurance and finance facilities actively supporting global investment in Ethiopia. In 2016, the Overseas Private Investment Corporation (OPIC) provided a \$15 million senior loan over a five-year term to SunFunder Inc. to develop renewable energy projects across numerous countries including Ethiopia.<sup>22</sup>

Investment grade jurisdictional REDD+ programs need to demonstrate commercial viability. In other words, program revenues need to cover program costs while providing returns commensurate to the risk for investment capital provided, alongside required co-benefits. A program's ability to achieve registration and deliver verified emissions reductions on a predictable schedule while achieving desired risk and return requirements of a typical investor is referred to as being "[investment grade](#)"<sup>23</sup>. This allows programs to sell future emissions reductions today to secure upfront financing to fund project implementation and management, regardless of whether the program is public, private, or public-private partnership managed and / or funded. The better the commercial preparedness demonstrated by a program, the more likely the program will succeed in obtaining favorable and longer-term investment terms.

Some of the types of possible investment include Emissions Reduction Purchase Agreements (ERPA), equity investment, loan financing and insurance. [Standardized approaches](#) exist for each of these four tools.<sup>13</sup> In fact, the OPIC REDD+ emissions reduction [insurance launch](#) in 2011 received numerous awards. OPIC provided \$900,000 in political risk insurance to a US-based private investment fund to support the conservation of 64,318 ha of Cambodian forests while sequestering up to 8.7 million tCO<sub>2</sub> and securing significant community and biodiversity

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<sup>21</sup> Gabriel Thoumi, Cameron Prell and Gus Kent, Revista EcoSostenible, October 2011. Gestionando los riesgos financieros del carbon forestal.

<sup>22</sup> Overseas Private Investment Corporation, <https://www.opic.gov/sites/default/files/files/INFORMATION%20SUMMARY%20FOR%20THE%20PUBLIC%20-%20SunFunder.pdf>

<sup>23</sup> [http://www.fcmcglobal.org/documents/FIELD\\_Report\\_No\\_16\\_REDD+\\_Guide.pdf](http://www.fcmcglobal.org/documents/FIELD_Report_No_16_REDD+_Guide.pdf)

co-benefits.<sup>24</sup>

ERPAs can function using two models – a pre-payment approach or a pay-on-delivery approach. In a pre-payment approach, funds are dispersed upfront based on expected emissions reductions (which produce offset credits), making funds available for program development. This upfront payment, usually at a discounted price per credit, may signal to other investors that the program is investment grade. The risk of program failure is with the buyer. In a pay-on-delivery ERPA, the sales contract may be agreed before the program begins, but the payment for the credits occurs only once the emissions reductions are verified and the offset credits are issued. The transaction's terms are pre-agreed and described in a term sheet, which, in the context of financial risk management, provides certainty of timing and value of future cash flows to participants.

Program financing approaches that do not require ERPAs include equity investment and loans. Institutional investors are often strategic investors who develop a relationship with a program during its initial stages, with the aim of accruing financial benefits as the program matures. The investor usually receives equity in the program in return for putting capital at risk upfront. Institutional investors seek long-term relationships which allow them to assume risk commiserate with returns. This makes them comfortable with fluctuations in performance as a program matures. Yet in an equity investment relationship, there is no predetermined buyer of future offset credits. However, an equity investor may seek to obtain a dividend that is a portion of the program's annual profits.

In a loan financing approach, a loan is made to the program so that it receives an early injection of funding. Loan agreement terms typically have operating and financial performance benchmarks and criteria that the program must achieve. Loan interest rates are typically fixed and must be paid, regardless of program performance, with seniority over the demands of other shareholders, including equity investors. Development finance banks are strong candidates to lend to REDD+ sector.

## **STRUCTURING TRANSACTIONS**

Airline companies would prefer to interact with other businesses, rather than governments, when negotiating the terms of contracts to supply emissions reductions units. However, REDD+ programs necessarily involve sub-national and national government participation, if not leadership. Where 'host governments' have an ERPA with an international institution, such as the World Bank's Carbon Fund or BioCarbon Fund ISFL, it is possible that the World Bank

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<sup>24</sup> <https://www.opic.gov/press-releases/2012/opicterra-global-redd-insurance-project-cambodia-wins-sustainable-forestry-award>

could serve as the agent to sell additional or unallocated units to airline companies.<sup>25</sup>

From the Ethiopian perspective, the Government of Ethiopia could signal that they are interested in securing international financing in conjunction with a multilateral development bank (e.g. World Bank's BioCarbon Fund or FCPF) or with support of the insurance tools available from the U.S. Government (e.g. OPIC) or other institution. The Government of Ethiopia can achieve this by developing a standardized ERPA to transfer their emissions reductions via this investment vehicle or window allowing simple and easy investment by global airlines in Ethiopian REDD+ programs.

Global investors could signal their interest first via a Term Sheet and then later via an ERPA. As introduced above, a Term Sheet is a preliminary document that is a written summary of negotiating points agreed between seller and purchaser, but not a contract and not necessarily legally binding - although some components may be legally binding such as exclusivity and confidentiality. The Term Sheet helps the program secure other funding, such as development bank loans, because it demonstrates investor interest as a possible "investment-grade" program.

An ERPA is a legally binding contract between an investor and program for pre-payment or pay-on-delivery of emissions reductions. It is subject to the laws of Ethiopia and will be written by Ethiopian attorneys according to Ethiopian laws. A typical ERPA will have sections describing conditions, precedent, prices, delivery, milestones for project development, representations and warranties, liabilities and indemnities, termination events and other sections. The World Bank and many other institutions have standardized ERPAs available.

The benefit to the Government of Ethiopia of developing the Carbon Market Platform into a standardized investment vehicle or window supported by a multilateral development bank or other institution is that it will clarify the roles of the seller and the buyer. This will develop into a standardized ERPA allowing for ease of transaction, assurance of contract completion, liquidity, clear cost-benefit sharing agreements and well-described community and biodiversity co-benefits.

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<sup>25</sup> Donna Lee and Charlotte Streck, 2016. REDD+ ER Transactions and the Paris Agreement [DRAFT]

## RECOMMENDATIONS

Based on our analysis, we find that the Government of Ethiopia could generate significant economic benefit from making forest-sector emission reductions available for airlines to purchase under CORSIA. Based on this finding, we offer the following recommendations:

1. In the context of ICAO CORSIA, or more broadly, the Government of Ethiopia announces its willingness to offer or approve the transfer of GHG emissions reduction credits (i.e. offset credits) resulting from REDD+ activities, consistent with its national REDD+ strategy and the Paris Agreement.
2. Ethiopia should voluntarily join the ICAO CORSIA beginning in 2021 and actively rally others in Africa to do the same. Ethiopia's diplomatic influence could be effectively extended to gain support of other developing nations to volunteer for early participation in the CORSIA, partly based on the opportunity to support REDD+ goals. Additionally, given the Ethiopian government's interest in market instruments to aid in achieving its climate change targets, participation in ICAO's [technical discussions](#) is recommended to ensure appropriate eligibility for REDD+ in the ICAO CORSIA.
3. The Government of Ethiopia announces its plans regarding the REDD+ national registry and tracking system, a policy for nesting project activities within sub-national or jurisdictional REDD+ programs, and noting, as appropriate, linkages to the Ethiopian Voluntary Carbon Market Platform and World Bank BioCarbon Fund. This includes developing a standardized ERPA between the national government and interested airlines to transact REDD+ emission reductions achieved by Ethiopia.

## ANNEX: Detailed Methodology for Estimating Financial Cost and Benefit of Opting-in to the CORSIA

In this brief, we compare the cost to Ethiopia’s aviation industry of opting-in to the pilot and first phases of the ICAO Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) relative to the benefit from the sale of REDD+ into the CORSIA. This analysis focuses only on the **Pilot Phase** and **First Phase**, 2021 to 2026.

### The Price of Emissions Offset Credits

The range of possible credit prices, expressed in US\$ per tCO<sub>2</sub>, is taken from the International Energy Agency’s 2013 World Energy Outlook and reflects the prices used in the [January 2016 Presentation](#) of Technical Analysis Results by CAEP to the ICAO Environment Advisory Group.

**Table 1. Credit price range (\$)**

	Alt Low	Low	High
2020	\$6.00	\$8.00	\$20.00
2021	\$6.40	\$8.70	\$21.30
2022	\$6.80	\$9.40	\$22.60
2023	\$7.20	\$10.10	\$23.90
2024	\$7.60	\$10.80	\$25.20
2025	\$8.00	\$11.50	\$26.50
2026	\$8.40	\$12.20	\$27.80

To estimate both the cost and revenue in the limited CORSIA case, the analysis adopts the “low” emissions credit price during 2021 to 2026. This reflects the impact of low airline participation and thus a reduced demand for credits. In the expanded CORSIA case, the analysis uses the “high” price range. The higher value is intended to model the maximum possible impact of increased demand for credits that may result from an expanded participation in the CORSIA. We also test our results with a much narrower range of possible credit prices, using the “alternative low” in the limited CORSIA scenario, and the “low” in the expanded CORSIA case.

### Limited vs. Expanded CORSIA: The Cost to Ethiopia’s Airlines

The portion of international aviation emissions attributable to Ethiopia was used to estimate the cost to Ethiopia’s airlines. Based on data from 2010 and 2012, this proportion is approximately 0.22 percent, on average. This percentage was not further segregated into the portion that will be subject to the CORSIA based on the assumption that a more inclusive scheme would cover most of the destinations served by flights to and from Ethiopia.

For simplicity, Ethiopia’s emission reduction responsibility was calculated as a constant percentage of 0.22 percent<sup>26</sup> of future estimated demand for offset credits based on low and high demand scenarios from CAEP’s Technical Analysis (table below). The “low demand” figures are used in the limited CORSIA scenario to reflect the decreased need for offset credits in a scheme with lower airline participation; the “high demand figures” are used to model the expanded CORSIA case.

**Table 2. Final quantity to offset (million tCO<sub>2</sub>)**

	Limited CORSIA		Expanded CORSIA	
	Low Demand	Ethiopia’s share	High demand	Ethiopia’s share
2021	28	0	35	0.07
2022	57	0	70	0.14
2023	85	0	105	0.23
2024	114	0	140	0.31
2025	142	0	175	0.39
2026	171	0	215	0.47

*Note: When Ethiopia’s airlines do not participate in first phase of CORSIA, Ethiopia’s share of offsets is effectively zero.*

The annual cost is then estimated by simply multiplying Ethiopia’s share of the demand for offset credits by its price. The total cost is then calculated by summing across the chosen period, 2021 to 2026 and applying a 5 percent discount rate. Results are presented below in Table 3.

**Table 3. Final Costs (millions \$)**

	Limited CORSIA	Expanded CORSIA (High prices)	Expanded CORSIA (Low prices)
2021	\$0	\$ 1.5	\$ 0.6
2022	\$0	\$ 3.2	\$ 1.2
2023	\$0	\$ 5.5	\$ 2.3
2024	\$0	\$ 7.8	\$ 3.5
2025	\$0	\$ 10.3	\$ 4.5
2026	\$0	\$ 13.0	\$ 5.7
Total Cost of Early Opt-In (NPV discounted at 5 percent)		\$33.3	\$ 14.3

<sup>26</sup> This assumes that Ethiopia’s international aviation emissions would grow at the same rate as global aviation emissions. We recognize that this method does not account for the possibility that Ethiopia will lower its airline emissions over time, and therefore may overestimate the true future cost. Given this caveat, we can look at such a calculation as a maximum of what Ethiopia’s airlines may be expected to pay barring any large increases in future emissions.

## Ethiopia's REDD+ Supply

Estimates of the supply of offset credits from REDD+ activities in Ethiopia are based on the methodology used for the study by Grillo-Avila et al. (2016)<sup>27</sup> of global REDD+ supply for the ICAO CORSIA. However, for the purposes of this country-specific analysis, Ethiopian government data was used wherever possible and three scenarios have been selected to represent a range of potential availability. Importantly, these estimates do not consider the economic costs of the implementing the REDD+ activities. Our estimates of supply also do not account for emissions units that would be kept domestically to meet Ethiopia's emission reduction target, which would be necessary to avoid double counting in estimating the supply available to the ICAO CORSIA. The uncertainties inherent in these projections are significant but the applied methodology is sufficient to inform the high-level policy decision, in the absence of projections published by the national government.

A **low supply scenario** estimate limits the scope of activities to the jurisdiction participating in the World Bank BioCarbon's Initiative for Sustainable Forest Landscapes (ISFL) program - the Oromia region. A **high-level scenario** covers all the forest land in Ethiopia. A **third scenario** includes the sequestration potential from continuing forest land restoration (FLR) activities taking into account the historical average (2001-2012) and Ethiopia's current [15 million](#) hectares forest restoration target

Ethiopia submitted its National Forest Reference Emission Level (FREL) to the UNFCCC in March 2017. Its proposed FREL is based over a period of 2000-2013 with annual average emissions of 17.9 million tCO<sub>2</sub>/yr., and annual average removals of 4.8 million tCO<sub>2</sub>/yr.<sup>28</sup> It is valid for at least five years, though it may be completed more frequently. A Regional Forest Reference Level for the Oromia Regional State was submitted by the Government of Ethiopia in August 2017. The methodology is consistent with the national level FREL and shows annual average emissions of 5.1 million tCO<sub>2</sub>/yr., and annual average removals of 0.7 million tCO<sub>2</sub>/yr.<sup>29</sup>

**Table 4. Supply from REDD+ (million tCO<sub>2</sub>) under three scenarios\***

	Low: Jurisdictional	High: National	Forest Land Restoration	High +FLR: National
2021	2.4	7.9	55.0	62.9

<sup>27</sup> R. Grillo Avila, M. Wolosin, A. Roth, R. Lubowski, P. Piris-Cabezas, and G. Russo. "REDD+ in ICAO: Ready for Takeoff." *Draft submitted for publication*. July 2016.

<sup>28</sup> Ethiopia's Forest Reference Level submission to the UNFCCC, March 2017.  
[http://redd.unfccc.int/files/ethiopia\\_frel\\_3.2\\_final\\_modified\\_submission.pdf](http://redd.unfccc.int/files/ethiopia_frel_3.2_final_modified_submission.pdf)

<sup>29</sup> Oromia National State Regional Forest Reference Level (Draft) published by the Government of Ethiopia, August 2017.

2022	2.6	9.2	58.7	67.9
2023	2.8	10.5	61.9	72.4
2024	3.0	11.8	64.7	76.5
2025	3.3	13.1	67.1	80.2
2026	3.5	13.1	69.2	82.3
Average	2.9	10.9	62.8	73.7

\*Note: These estimates do not consider REDD+ units that may be retained to meet Ethiopia’s NDC. Numbers may not add up exactly due to rounding.

### Limited vs. Expanded CORSIA: Ethiopia’s Revenue from Selling REDD+ Credits

To calculate the additional revenue to Ethiopia from an early opt-in to the CORSIA, the price differential between the “high” and “low” offset credit prices was multiplied by the range of supply in each year. The total revenue is then calculated by summing across 2021 to 2026 and applying a 5 percent discount rate. Results are presented below in Table 5.

**Table 5. Additional Revenue from Early Opt-In** (millions US\$)

	High Offset Credit Prices			Low Offset Credit Prices		
	Low: Jurisdictional	High: National	High+FLR National	Low: Jurisdictional	High: National	High +FLR: National
2021	\$30.11	\$99.04	\$792.04	\$5.50	\$18.08	\$144.58
2022	\$34.41	\$121.04	\$895.88	\$6.78	\$23.84	\$176.46
2023	\$38.97	\$144.62	\$998.84	\$8.19	\$30.39	\$209.90
2024	\$43.80	\$169.78	\$1,101.46	\$9.73	\$37.73	\$244.77
2025	\$48.88	\$196.50	\$1,203.00	\$11.41	\$45.85	\$280.70
2026	\$54.23	\$204.36	\$1,283.88	\$13.21	\$49.78	\$312.74
Revenue from early Opt-in (NPV at 5 percent discount rate)	\$218.77	\$813.94	\$5,498.38	\$47.52	\$177.67	\$1,190.44

## Results

The potential benefit from the sale of offset credits from Ethiopia's REDD+ activities through the ICAO CORSIA ranges from \$9.7 million to over \$5 billion, depending on demand and price.

**Table 6. Total Additional Cost and Benefit of Early Opt-In** (millions US\$)

	Expanded CORSIA (High prices)	Expanded CORSIA (Low prices)
Cost	\$33.3	\$14.3
Revenue	\$219 - \$5,498	\$47.5 - \$1,190
Net	\$185.5 - \$5,465	\$33 - \$1,176