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

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 tonnes of investment-ready emissions reductions from 2021 to 2035.**

Peru could meet some of this demand with its current and projected supply from reducing emissions from deforestation and forest degradation and through forest restoration. By choosing to participate in the early Phases of this scheme, starting in 2021, the Peruvian Government could generate more than **$500 million in additional investment** at an estimated cost of $24 million to its aviation industry, which represents a small fraction – less than 0.4 percent – of global emissions from international aviation.

Key Findings

1. The International Civil Aviation Organization (ICAO) in October 2016 created a potential global demand of more than 2 billion tonnes of investment-grade emissions reductions from 2021 to 2035 that could be partially met through continuing development of programs and projects in Peru.
2. The value to Peru of supplying the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is, conservatively, over US$500 million in additional private institutional investment. Higher prices and more ambitious supply projections indicate potential gains of over US$2.5 billion.
3. Peru has the potential to benefit by linking this market demand to domestic supply through eligible supply-side activities, including Reducing Emissions from Deforestation and Forest Degradation (REDD+), structured via existing World Bank and many other long-term international investment supply contracts for emissions reductions.
4. To facilitate this investment, the Peruvian national government policy must deliver the necessary institutional and legal conditions for jurisdictional REDD, building on those currently applied to existing programs and projects.
5. Peru can increase the impact of CORSIA and augment the associated demand for offset credits by opting-in to the scheme starting in 2021, and by encouraging others in the region to do the same.

Peru's airlines would incur an estimated additional cost of $24 to $57 million over the period 2021-2026, which is less the than marginal fuel price variability. The associated increase in demand and credit price could quadruple investment value.

Background and Purpose

The International Civil Aviation Organization (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:[1]

- **Pilot Phase 2021 to 2023**: States participate on a voluntary basis
- **First Phase 2024 to 2026**: Applies to States that have volunteered to participate
- **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 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 October 12, 2016, 66 States, representing more than 86.5 percent of international aviation activity, intend to voluntarily participate in the CORSIA Pilot Phase. The Government of Peru[2] has not yet opted-in to the voluntary Pilot Phase or First Phase and Peru is expected to be exempt from mandatory inclusion in the Second Phase based on the 2018 threshold described above. Although airlines registered in Peru represent only a small fraction – estimated 0.37 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

[1] ICAO website http://www.icao.int/environmental-protection/Pages/market-based-measures.aspx.

[2] Peru's Civil Aviation Authority is within the Ministry of Transportation and Communication: http://www.mtc.gob.pe/version_ingles/transportes/aeronautica_civil/index.html

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 Peru. 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 Peru. With the implementation of Peru's National Forest & Climate Change Strategy,[3] these economic growth opportunities translate to economic growth and diversification for rural economies, improving the livelihoods of local communities and indigenous peoples.

REDD+ is recognized in the 2015 UNFCCC Paris Agreement as an important 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 this supply is the need for a strong signal of market demand
- The ICAO CORSIA has the potential to provide this necessary demand signal

Based on the ICAO Assembly decision in October 2016, this brief takes a closer look at the potential demand from global airlines, the potential supply from REDD+ in Peru, and the current barriers to connecting the two. Analysis is presented demonstrating the benefits to Peru's early entry into the CORSIA Pilot Phase and First Phase (2021 to 2026) and compares them to the cost of participation for the country's airlines.

[3] http://www.bosques.gob.pe/enbcc/

Analysis

GLOBAL DEMAND FOR EMISSIONS REDUCTION (OFFSET) CREDITS

Estimates show that cumulative international aviation emissions may exceed 2020 levels by more than 500 million tonnes carbon dioxide equivalent (tCO_2)[4] 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_2 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_2. Covered routes are expected to represent at least 79 percent of these emissions, resulting in a global demand of 2,050 million tCO_2 or larger. These figures are summarized below in Table 1.

Table 1. Projected global demand for offset credits (million tCO_2)[5]

Phase	Timeline	Emissions Above 2020 Levels	Projected Demand
Pilot Phase and **First Phase**	2021 to 2026	500	≥ 325 (65%)
Second Phase	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).

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

Beginning in 2021, Peru's estimated average annual supply of REDD+ credits ranges from 35 to 170 million tCO_2. The low-supply scenario only includes Peru's five Amazon basin regions, while the

[4] Greenhouse gas emissions and removals are reported in metric tonnes of carbon dioxide equivalent, simplified as tCO_2 in this paper.

[5] 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.]

high-supply scenario results from national scale REDD+, including significant gains from forest land restoration. 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. [The methodology to derive estimates of the supply of credits from REDD+ activities in Peru is described in the annex to this paper.]

Importantly, these three supply estimates do not consider the economic costs of the implementing REDD+ activities. They also do not account for emissions units that would be kept domestically to meet Peru's Nationally Determined Contribution (NDC), a requirement that would be necessary to avoid double counting. The uncertainties inherent in these projections are significant, but the applied methodology is both rigorous enough and sufficient to inform high-level policy decisions in the absence of projections published by the Peruvian national government.

The low-supply scenario limits the scope of activities to projects and programs in the regions, which are formally engaged in international partnerships focused on REDD+ in Peru:

- The Governors' Climate and Forest Task Force (GCF)
- Jurisdictional and Nested REDD+ programs of the Voluntary Carbon Standard (VCS JNR)
- The World Bank Carbon Fund Emissions Reduction Programme (ERP) currently under development, the ERP covers the regions of San Martin and Ucayali

The high-supply scenario covers all forest land in Peru and includes the sequestration potential from continuing forest land restoration (FLR) activities – primarily via afforestation and reforestation – taking into account Peru's historical average from 2001 to 2012, and Peru's current forest restoration target of 1,222,000 hectares.[6] This represents a portion of Peru's overall goal of restoring 3.2 million hectares of land, including reforestation, under Initiative 20x20.[7]

Short term, jurisdictional supply potential based only on existing projects

If REDD+ projects are ineligible sources for the CORSIA but there are no sub-national, jurisdictional scale programs actually delivering offset credits at this time, how can airlines be confident of short term supply? Table 2 below demonstrates the potential supply of emissions reduction units (tCO_2) that could be available from REDD+ or forest-based projects within regions of Peru. This bottom-up

[6] IUCN, Bonn Challenge Forest Land Restoration (FLR) Desk. Available at: http://www.bonnchallenge.org/flr-desk/peru

[7] http://www.wri.org/our-work/project/initiative-20x20/restoration-commitments - project-tabs

analysis is intended for illustrative purposes only, as the nesting[8] of such projects into a jurisdicational REDD+ program are likely to result in a reduction in project-level estimates as a result of aligning baselines or reference levels, distribution and allocation of accrued results, and/or other jurisdictional program considerations.

It is important to note that nesting of projects within jurisdictional programs has been effectively applied within the Andean region in Colombia and elsewhere. Nesting provides regulatory assurance and mitigates legal risk to investors, communities, and participating companies, while allowing for rigorous attestation, validation, and verification of emissions reductions and economically efficient cost-benefit sharing instruments.

A majority of the projects listed below in Table 2 have been registered by the Verified Carbon Standard (VCS)[9] and some have already been in operation for a few years. In the Region of San Martín, the projected emissions reductions from these projects amount to over 8.4 million tCO_2 per year, in aggregate, to 2020. About half of the projected supply from a project in San-Martín is expected to soon be under contract with the Forest Carbon Partnership Facility (FCPF) Carbon Fund for $5 per tCO_2 to 2020. A project in the same region is under contract with the Disney Corporation for $7 per tCO_2 to 2028. It is important to note, however, that inconsistency between Peru's national reference level (assesed by the UNFCCC) and regional or project reference levels, tends to show an overestimation of emissions reductions from the latter.

What do these projects mean for supply from sub-national, jurisdictional REDD+ programs? The Government of Peru, in a FCPF Carbon Fund Emission Reduction Program Idea Note (ER-PIN)[10] submitted in 2014, notes that a nested jurisdictional approach is being used to integrate and reconcile local REDD+ projects with data and estimates for the Amazon.

> *"The issue of the alignment of the few existing REDD+ projects also needs to be addressed, from the viewpoints of both carbon accounting as well as benefit-sharing. With regards to carbon accounting, these projects will eventually transition towards the use of sub-national or national reference levels as a basis of calculating emissions reductions, but until that point is reached, their emissions reductions will be excluded from sub-national or national accounting. Benefits negotiated by projects with buyers*

[8] http://www.v-c-s.org/just-released-new-guidance-for-nesting-redd-projects/

[9] http://www.v-c-s.org

[10] Government of Peru, 2014. Forest Carbon Partnership Facility, Carbon Fund Emission Reduction Program Idea Note. (https://www.forestcarbonpartnership.org/sites/fcp/files/2014/september/PERU_ER-PIN_Sept.%2012.2014.pdf)

> *and accruing to these projects will pass through the National Forest and Climate Fund; the benefits entitled to these projects under their contracts are likely to be reduced to some degree in order to cover some of the costs of REDD+ at the national or regional jurisdictional levels.*[10]

There have been two significant developments since the submission of the ER-PIN – Peru's NDC and national forest reference level - that effectively amend the ER-PIN statement, suggesting that the Government of Peru *will* recognize emissions reductions from regional programmes whose reference levels are consistent with the one assessed by the UNFCCC. While a National Forest and Climate Fund is not yet in place, a financial mechanism is under development to support Peru's forest & climate and development strategies. This financial mechanism is specified in the implementation of the Joint Declaration of Intent (JDI) between the Governments of Norway, Germany and Peru, signed in 2014, which includes a US $215 million investment.[11]

Discussions with stakeholders to resolve outstanding issues are under way and are expected to be resolved by early 2018. While the stakeholders are many and diverse, it is encouraging to note the Government's view, expressed in the ER-PIN, that:

> *"the NGOs involved in the active REDD+ projects indicate a willingness of the projects to consider contributions to REDD+ costs at the national or regional levels."*[10]

In the case of the FCPF Carbon Fund ER Program, local REDD+ projects within the ER Proram intervention areas will be expected to align with the national REDD+ strategy[12] and benefit sharing arrangement. In addition, the requirement to register with the National REDD+ Initiatives Registry will mitigate:

- Double counting of the emission reductions
- Legal ambiguity regarding the ownership of the emission reductions and
- Inconsistencies between national GHG inventories and the general REDD+ accounting.

Table 2. Projected supply of REDD+ project emissions reduction units (tCO_2), by jurisdiction*

[11] NOK 1,800 million

[12] Estrategia Nacional sobre Bosques y Cambio Climático, 2016 (MINAM)

Region	Project Name	Project Crediting Period	Expected average emissions reductions (million tCO_2 per year)*
San Martin	Emissions reductions in the Peruvian Amazon (Carbon Fund ER Program)	2017 to 2020	7.7 (3.85 to CF)**
	Alto Mayo Conservation Initiative	2008 to 2028	0.5
	Biocorridor Martin Sagrado REDD+ Project	2010 to 2049	0.06 (low est.) 0.2 (high est.)
Madre de Dios	REDD+ project in Brazil Nut Concessions	2010 to 2040	2.1
	Evio Kuiñaji Ese´Eja Cuana	2011 to 2031	0.1
	Madre de Dios Amazon REDD Project	2009 to 2046	0.7
	Reduction of deforestation and degradation in Tambopata National Reserve and Bahuaja-Sonene National Park	2009 to 2030	0.5
Ucayali	Emissions reductions in the Peruvian Amazon (Carbon Fund ER Program)	2017 to 2020	5.1 (2.55)**
	Forest Management to reduce deforestation and degradation in Shipibo Conibo and Cacataibo Indigenous Peoples communities	2010 to 2030	0.6
Loreto	Yacumama Forest Carbon Project	2010 to 2039	0.7
Huanuco + Loreto + San Martin + Ucayali	Cordillera Azul National Park REDD Project	2008 to 2028	2.6

* Potentially available (greater than 100,000 tCO_2 per year) according to information published by project/program managers. See Registro Nacional REDD+ Piloto para demostración y prueba (https://mer.markit.com/br-reg/public/peru/index.jsp#/registry)

** Reductions assigned to the Carbon Fund of the FCPF, as described in Peru's ER-PIN, version September 12, 2014, and in the Letter of Intent signed on March 31, 2016. See https://www.forestcarbonpartnership.org/peru.

VALUE FOR PERU

What is the value for Peru of joining the CORSIA from 2021?

Peru 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 Peru 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, Peru can help increase the demand for offset credits and this analysis assumes that the market price for offset credits would increase accordingly. The country's airlines would bear the relatively small cost of early entry, but, as a large forest nation, Peru could reap the rewards of a higher offset credit price through the sale of REDD+ credits to airlines under the CORSIA. The airlines would also benefit from the tourism value associated with conserving or enhancing Peru's forests.

Because Peru represents a small share of international aviation emissions – at 0.37 percent, other currently excluded countries would also have to opt in early to have a substantial impact on offset credit prices. Among its neighbors in the Latin America and Caribbean (LAC) region, Brazil, Costa Rica, Ecuador, Panama, and Colombia are also excluded from the first phase of the scheme. All are also forest countries and have a lot to gain from a higher offset credit price. Mexico has already indicated that it will opt-in voluntarily in 2021.

At a credit price of $21 to $28 per tCO_2, if all available offset credits are sold, Peru could earn $4.2 to $20.8 billion total during the six-year Pilot Phase and First Phase (2021 to 2026). Alternatively, with limited CORSIA participation and a credit price of $9 to $12 per tCO_2, Peru could earn $1.9 to $8.9 billion during that same time period. Therefore, *the additional revenue from early opt-in could be as high as $2.4 to $11.9 billion (Figure 1).* For a relevant comparison, Peru's GDP in 2015 was $189.1 billion. At the high-end of possible credit prices, Peru stands to make substantial economic gains from voluntarily joining the CORSIA in 2021.

This conclusion was also tested with a much lower and narrower range of possible credit prices: $6 to $9 per tCO_2 in a limited CORSIA scenario, increasing to $8 to $12 per tCO_2 with a higher demand scenario. In this case, Peru's airlines would incur an estimated additional cost from early opt-in of $24 million total over 2021 to 2026, while Peru would receive between $522 million to $2.6 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).

What is the cost to Peru of joining the CORSIA in the Pilot Phase?

Since 2010, Peru has been responsible for 0.37 percent of international aviation emissions.[13] [14] This analysis assumes that Peru's share of international aviation emissions is the same until 2016. If broad participation in the CORSIA encourages a starting price of $21 per tCO_2 in 2021 that gradually increases to $28 per tCO_2 in 2026, the net present value of Peruvian airlines' total cost over the entire six-year period would be $57 million. 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_2 in 2021 with a gradual increase to $12 per tCO_2 by the conclusion of the First Phase in 2026. Because Peru'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 $57 million*.

Table 3: Costs to Peru of joining CORSIA (millions US$, estimated)

Year	High Demand (High prices)	Low Demand (Low prices)
2021	$2.8	$1.1
2022	$5.9	$2.4
2023	$9.3	$3.9
2024	$13.0	$5.6
2025	$17.2	$7.5
2026	$22.1	$9.7
Total Cost of Early Opt-In*	$57.0	$24.0

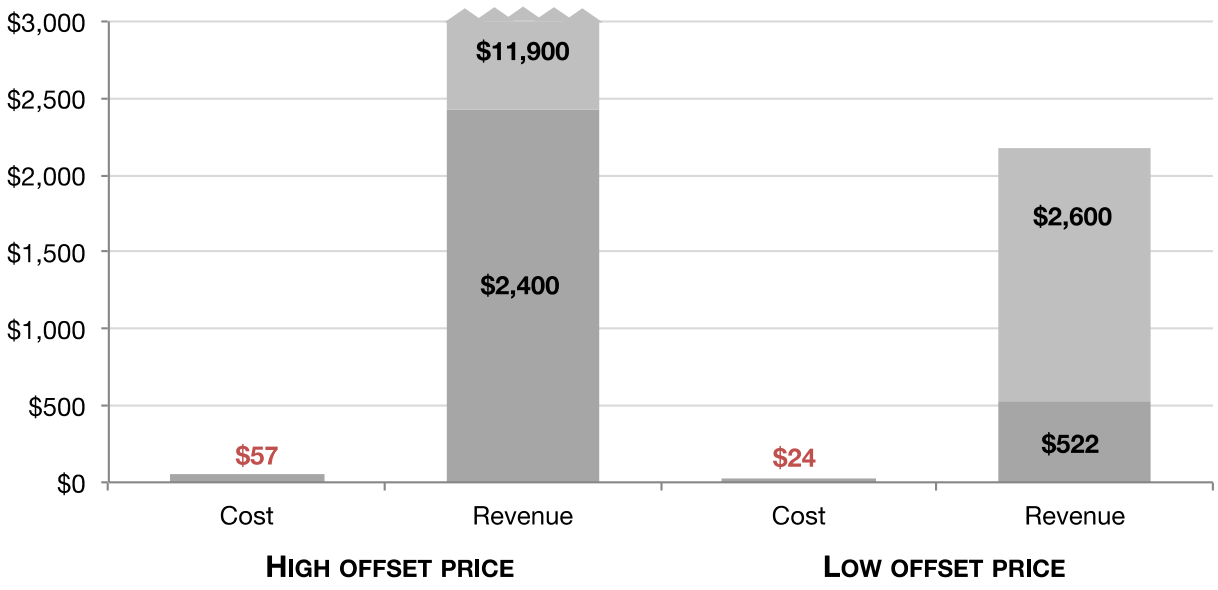
*NPV discounted at 5 percent. See Annex for detailed methodology.

This figure can be considered as the ceiling of a possible cost range as a starting price of $21 per tCO_2 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.[10] These are higher than current levels of what donors governments have been generally willing to pay – from $5 per tCO_2 - 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, past experience of other voluntary and regulatory markets are informative but may not be accurate predictors of offset credit prices under the CORSIA.

[13] 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

[14] Dave Southgate, 2013. Aviation Carbon Footprint. https://southgateaviation.files.wordpress.com/2013/09/global-domestic-footprint-finalv6.pdf

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



BARRIERS: Real & Perceived

Airline companies have expressed interest in sourcing offset credits from REDD+ activities, particularly due to the broader social and environmental benefits and marketing opportunities, yet there are barriers that will need to be addressed. If Peruvian government and decision makers do not address these barriers, airline companies will source from other sectors and/or countries.

Uncertainty of supply from eligible REDD+ programs

The CORSIA must be consistent with UNFCCC rules and guidelines, which includes the Warsaw Framework for REDD+. This means that the scope of activities must be national or, as an interim measure, sub-national. 'Sub-national' is commonly understood as regional, provincial or state jurisdictions, one level of government below the national level. This could also apply to a grouping of jurisdictions that encompass an entire ecological region within a country. This effectively excludes direct investment in and sales from discrete 'projects' despite their inclusion or eligibility in current voluntary carbon markets. While there is a recent positive record of accomplishment from 'REDD+ projects', sub-national or jurisdictional (e.g. state or province) supply estimates vary. Assuming the CORSIA represents a long-term demand that will significantly exceed the current prices in the voluntary market,[15] there is an incentive for REDD+ project 'owners' to nest their projects within a

[15] Ecosystem Marketplace, 2016. State of the Voluntary Carbon Market 2016. (http://www.forest-trends.org/documents/files/doc_5242.pdf)

jurisdictional REDD+ program due to demand from airlines. Such nesting arrangements will be specific to each jurisdiction and require GHG accounting alignment of baselines or reference levels and agreed share of decreases (and increases) in GHG emissions resulting from activities within the program area.

Government policy and institutional arrangements

Policy questions arising from the Paris Agreement create a degree of uncertainty for potential buyers of emissions reduction units, particularly within a regulated, compliance system such as the CORSIA. Firstly, national 'host' government approval is required, as it is currently for projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol. Is the government of Peru still open to participating in such a mechanism, specifically supplying emissions reductions units to airlines under the CORSIA? The difference now is that Peru has committed to a target, or Nationally Determined Contribution (NDC)[16], under the Paris Agreement and any emission reduction that is transferred or assigned to a country or entity outside of Peru cannot be used against its own target. Such transfers can be considered as Internationally Transferred Mitigation Outcomes (per Article 6.2 of the Paris Agreement) which serve to enhance Peru's mitigation ambition and contribute to sustainable development objectives. If Peru does confirm its interest in taking advantage of such cooperative, market-based approaches, it may wish to withhold a portion of the emissions reductions to use against its own target and to buffer against other liabilities.

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. If Peru does not wish to establish its own national GHG registry and tracking system at this time, there are international institutions that could take on this responsibility. For example, the World Bank offers this service for participants in the Carbon Fund of the FCPF.

Jurisdictional REDD+ programs have a higher degree of complexity and risk than smaller REDD+ projects, which, by their nature, tend to be located and designed to minimize risks and maximize potential gains. Therefore, the official support and participation of regional and local government can be key to the establishing and maintaining the local institutions and relationships necessary for the REDD+ program activities to be implemented as planned.

Financial risk management

[16] UNFCCC NDC Registry.
http://www4.unfccc.int/ndcregistry/PublishedDocuments/Peru%20First/iNDC%20Perú%20english.pdf

Standardized financial risk mitigation tools exist and have been widely applied to meet the requirements for investors globally to invest in Peru and enable them to expand their investments in Peru.[17] For example, there are numerous U.S. Government investment, insurance, and finance facilities actively supporting global investment in Peru. In June 2012, the Overseas Private Investment Corporation (OPIC) approved a $185 million loan to enable New York-based private equity investment firm Conduit Capital Partners to finance the construction and operation of two 20 megawatt solar facilities in southern Peru.[18]

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[19]. This allows programs to sell future emissions reductions today as a means 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 investment possible include Emissions Reduction Purchase Agreements (ERPA), equity investment, loan financing, and insurance. Standardized approaches exist for each of these four tools.[17] 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_2 and securing significant community and biodiversity co-benefits.[20]

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

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[17] Gabriel Thoumi, Cameron Prell and Gus Kent, Revista EcoSostenible, October 2011. Gestionando los riesgos financieros del carbon forestal.

[18] https://www.opic.gov/press-releases/2012/opic-board-approves-185-million-two-solar-power-projects-peru

[19] http://www.fcmcglobal.org/documents/FIELD_Report_No_16_REDD+_Guide.pdf

[20] https://www.opic.gov/press-releases/2012/opicterra-global-redd-insurance-project-cambodia-wins-sustainable-forestry-award

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 the REDD+ sector.

Who to purchase from and how?

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 government participation, if not leadership, by sub-national and national governments. Where 'host governments' have an ERPA with an international institution, such as the World Bank's Carbon Fund, it is possible that the World Bank could serve as the agent to sell additional or unallocated units to airline companies.[21]

From the Peruvian perspective, the Government of Peru could signal that they are interested in securing international financing via developing an investment vehicle or window, in conjunction with a multilateral development bank (e.g. World Bank's FCPF) or with support of the insurance tools available from the U.S. Government (e.g. OPIC) or other institution. The Government of Peru 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 Peruvian regional REDD+ programs.

[21] Donna Lee and Charlotte Streck, 2016. REDD+ ER Transactions and the Paris Agreement [DRAFT]

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 finding, 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 Peru and will be written by Peruvian attorneys according to Peruvian 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 Peru of developing 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.

Recommendations

Part A

To remove the four main barriers linking Peru's REDD+ Strategy to the airlines' demand for emissions reductions, as part of the broader financing strategy for achieving Peru's climate change and development goals, we recommend the following:

1. In the context of ICAO CORSIA, or more broadly, the Government of Peru 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. The Government of Peru announces its plans regarding a national registry and tracking system, noting, if appropriate, the linkage to Peru's *Registro Nacional REDD+ Piloto para demostración y prueba*[22]

3. Sub-national governments overseeing jurisdictional REDD+ programs announce their support of the national government's REDD+ strategy and their interest in supplying REDD+ emissions reductions units originating in their jurisdictions to airline companies.

4. The Government of Peru facilitates up-front, private investment by establishing or clarifying the necessary institutional and legal conditions, including development of a standardized ERPA for jurisdictional REDD+ programs.

Part B

We recommend that Peru voluntarily join the ICAO CORSIA beginning in 2021 and actively rally others in the LAC region to do the same. Given the country's leadership in climate diplomacy, within the LAC region and the UN community, its 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.

[22] https://mer.markit.com/br-reg/public/peru/index.jsp#/home

Given the Peruvian government's interest in market instruments to aid in achieving its climate change targets, participation in ICAO's technical discussions[23] is recommended to ensure appropriate eligibility for REDD+ in the ICAO CORSIA.

[23] http://www.icao.int/ENVIRONMENTAL-PROTECTION/Pages/CAEP.aspx

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

In this brief, we compare the cost to Peru'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_2, 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
2022	$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 Peru's Airlines

The portion of international aviation emissions attributable to Peru was used to estimate the cost to Peru's airlines. Based on data from 2010 and 2012, this proportion is approximately 0.37 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 Peru.

For simplicity, Peru's emission reduction responsibility was calculated as a constant percentage of 0.37 percent[24] 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_2)

	Limited CORSIA		Expanded CORSIA	
	Low Demand	Peru's share	High demand	Peru's share
2021	28	0	35	0.13
2022	57	0	70	0.26
2023	85	0	105	0.39
2024	114	0	140	0.52
2025	142	0	175	0.65
2026	171	0	215	0.80

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

The annual cost is then estimated by simply multiplying Peru's share of the demand for offset credits by its price. The total cost is then calculated by summing across the chosen time 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	$2.8	$1.1
2022	$0	$5.9	$2.4
2023	$0	$9.3	$3.9
2024	$0	$13.0	$5.6
2025	$0	$17.2	$7.5
2026	$0	$22.1	$9.7

[24] This assumes that Peru'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 Peru 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 Peru's airlines may be expected to pay barring any large increases in future emissions.

Total Cost of Early Opt-In (NPV discounted at 5 percent)	$57.0	$24.0

Peru's REDD+ Supply

Estimates of the supply of offset credits from REDD+ activities in Peru are based on the methodology used for the study by Grillo-Avila et al. (2016)[25] of global REDD+ supply for the ICAO CORSIA. However, for the purposes of this country-specific analysis, Peruvian 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 Peru'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 jurisdictions which are formally engaged in international partnerships focused on REDD+ in Peru: The Governors' Climate and Forest Task Force (GCF), Jurisdictional and Nested REDD+ pilot programs of the Voluntary Carbon Standard (VCS JNR), and the Emissions Reduction Programme (ERP) under development for consideration by the World Bank Carbon Fund. These programs and projects are focused on the Peruvian amazon region. The ERP covers the provinces of San Martin and Ucayali. A **high supply scenario** covers all forest land in Peru. A **third supply scenario** includes the sequestration potential from continuing forest land restoration (FLR) activities (primarily afforestation and reforestation) taking into account the historical average (2001 to 2012) and Peru's current 1,222,000 hectare forest restoration target.[26] This represents a portion of Peru's overall goal of restoring 3.2 million hectares of land, including reforestation, under Initiative 20x20.[27]

Peru's Forest Reference Emission Level, as submitted to the UNFCCC in November 2015, has been used as the basis for calculating estimates of reduced emissions from deforestation in the amazon region. For the remainder of the country, the Global Forest Watch data has been used to calculate a reference level based on average emissions from 2001 to 2014. Tree cover loss data from Global Forest Watch was used to estimate both BAU forest emissions.

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[25] 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.

[26] IUCN, Bonn Challenge FLR Desk. Available at: http://www.bonnchallenge.org/flr-desk/peru

[27] http://www.wri.org/our-work/project/initiative-20x20/restoration-commitments#project-tabs

Table 4. Supply from REDD+ (million tCO_2) under three scenarios*

	Low: Jurisdictional	High: National	Forest Land Restoration	High +FLR: National
2021	31.5	53.8	87.0	140.9
2022	32.6	62.8	91.1	153.9
2023	33.6	71.8	94.5	166.2
2024	34.6	80.8	97.2	178.0
2025	35.6	89.7	97.7	187.5
2026	36.6	89.7	93.2	182.9
Average	35.3	76.9	93.4	170.3

**Note:* These estimates do not take into account REDD+ units that may be retained to meet Peru's NDC.

Limited vs. Expanded CORSIA: Peru's Revenue from Selling REDD+ Credits

To calculate the additional revenue to Peru 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	$397.4	$678.3	$1775.0	$72.5	$123.8	$324.0
2022	$429.7	$829.1	$2031.6	$84.6	$163.3	$400.2
2023	$463.2	$990.6	$2294.1	$97.3	$208.2	$482.1
2024	$497.8	$1162.9	$2563.0	$110.6	$258.4	$569.6
2025	$533.7	$1345.9	$2811.8	$124.5	$314.0	$656.1
2026	$570.8	$1399.7	$2853.2	$139.1	$341.0	$695.0
Revenue from early Opt-in (NPV at 5 percent discount rate)	$2,422	$5,309	$11,956	$522	$1,159	$2,589

Results

The potential benefit from the sale of offset credits from Peru's REDD+ activities through the ICAO CORSIA ranges from $489 million to $11.9 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	$57	$24
Revenue	$2,422 - $11,956	$522 - $2,589
Net	$2,365 - $11,900	$498 - $2,565