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Opportunities For Turkey Under CORSIA

Final Report

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For: European Bank for Reconstruction and Development (EBRD)

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1. Setting the Scene

1.1 Introduction

The European Bank for Reconstruction and Development (EBRD) is promoting the acceleration and scale-up of sustainable energy investments in Turkey. Through the Mid-size Sustainable Energy Finance Facility (MidSEFF), EBRD provides close to EUR 1.5 billion in credit lines to finance mid-size investments in clean energy, waste-to-energy and industrial energy efficiency. To date, more than 60 projects have been financed under this facility.[1]

As part of MidSEFF, a dedicated carbon finance programme has been launched. The aim of this programme is to promote new financing mechanisms through the expansion and development of the carbon market in Turkey and to encourage the participation of Turkish banks and companies in engaging in the carbon market. The activities under this dedicated carbon finance programme include monetisation support to carbon projects. Numerous carbon projects that have been developed in this context in Turkey have contributed to the supply of carbon credits on the voluntary carbon market. Following the adoption of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in 2016, the carbon finance programme initiated discussions with the Turkish government concerning the implications this scheme could have on the domestic carbon market and the country's contribution towards the ambitions of the Paris Agreement (PA). To further inform these discussions and provide the Turkish government insight into the implications of using domestic carbon credits in the new post-2020 climate regime, this report was requested by the Ministry of Environment and Urban Planning and the Turkish Directorate General for Civil Aviation.

1.2 Objective of the Report

The objective of this report is to advise the Turkish government on the possible strategies to stimulate the supply position of the domestic carbon credit market towards CORSIA, while securing Turkey's capacity to meet its energy sector pledges under the PA in an environmentally integral way.

Chapter 1 provides the context in which this analysis is carried out. Chapter 2 analyses the demand and supply scenario by providing estimates on the maximum offsetting requirements for the Turkish aviation sector, and presents carbon credit supply scenarios from existing Turkish projects. Chapter 3 explores in further detail the issue of double counting and what strategies could be applied to mitigate this risk in the Turkish context. Chapter 4 ends with a set of considerations.

[1] www.midseff.com/portfolio.php

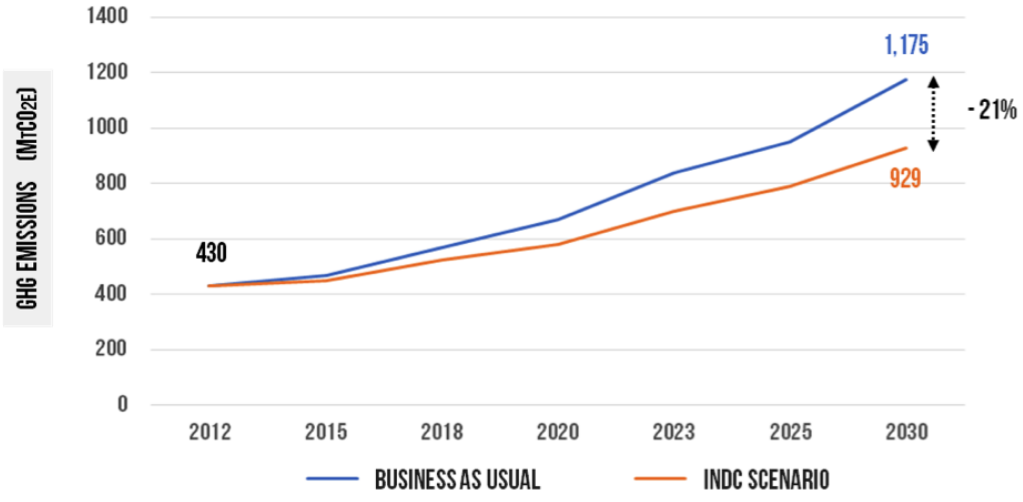
1.3 Turkey and the Paris Agreement

On 12 December 2015, 196 Parties to the UN Framework Convention on Climate Change (UNFCCC) adopted the PA, a new legally binding framework for an internationally coordinated effort to tackle climate change. The PA represents the culmination of six years of international climate change negotiations under the auspices of the UNFCCC. It requires countries to formulate progressively more ambitious climate targets, which are consistent with this goal.

To achieve the ambition of the PA – keeping global warming "well below" 2°C, or even 1.5°C – rapid implementation of large-scale mitigation action is urgently needed. According to the 2018 IPCC Special Report, human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. Pathways limiting global warming to 1.5°C will therefore require a rapid transition across all major sectors in the global economy, resulting in deep emission reductions.[2] Strengthening climate finance flows and leveraging carbon markets will be vital in leveraging the scale of finance needed to trigger the transition towards low carbon development pathways.

In the Intended Nationally Determined Contribution (INDC)[3] submitted by Turkey to the UNFCCC in September 2015, Turkey aims to reduce greenhouse gas (GHG) emissions by 21 per cent from a business-as-usual level by 2030, prioritising interventions in renewable energy, industrial efficiency, transport, buildings and agriculture. Turkey's signing of the PA in April 2016 marks the first step towards the implementation of the commitments reflected in the INDC.

Figure 1: GHG emissions trajectory of Turkey under a business-as-usual scenario and pathway per INDC



The PA entered into force on 4 November 2016, thirty days after a minimum of 55 Parties to the Convention accounting in total for at least 55 per cent of the total global GHG emissions ratified the PA. As Turkey has not ratified its INDC, the status of its contribution is still 'Intended'.

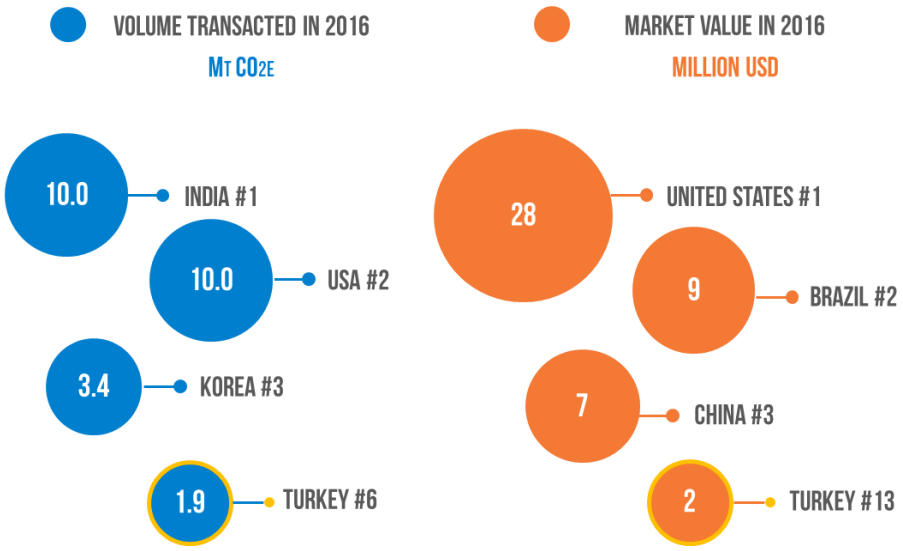
[2] IPCC Special Report (2018) Global Warming of 1.5°C.
[3] Turkey's INDC submission (2015) Available at www4.unfccc.int/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf.

1.4 Turkey and the carbon markets

Historically, Turkey plays a prominent role in the global voluntary carbon market. The voluntary carbon market relates to transactions in carbon credits that fall outside the compliance schemes created under the Kyoto Protocol. Companies that pursue voluntary GHG emissions targets and intend to demonstrate climate leadership within the industry largely drive demand for carbon credits in this market.

Turkey represents the largest seller of voluntary carbon credits in Europe. Over the period 2007 – 2016, Turkey transacted around 37 million tonnes of CO_2e valued at over US$ 200 million. This is equivalent to approximately 70 per cent of total market volume in Europe to date. In 2016, Turkey was responsible for over two-thirds of all primary transactions in Europe, amounting to 1.9 million tonnes of CO_2e. This made Turkey the sixth largest supplier of voluntary carbon offsets globally after India, the United States, Korea, China and Brazil, on par with other large players including Indonesia and Uganda. Despite high transaction volumes, however, the total value of these transactions declined from US$ 18.6 million in 2013 to US$ 2 million in 2016 due to a decline in the price of carbon in recent years. The majority of Turkey's voluntary carbon transactions were derived from sales of VERs generated by wind, hydro, and landfill methane projects.

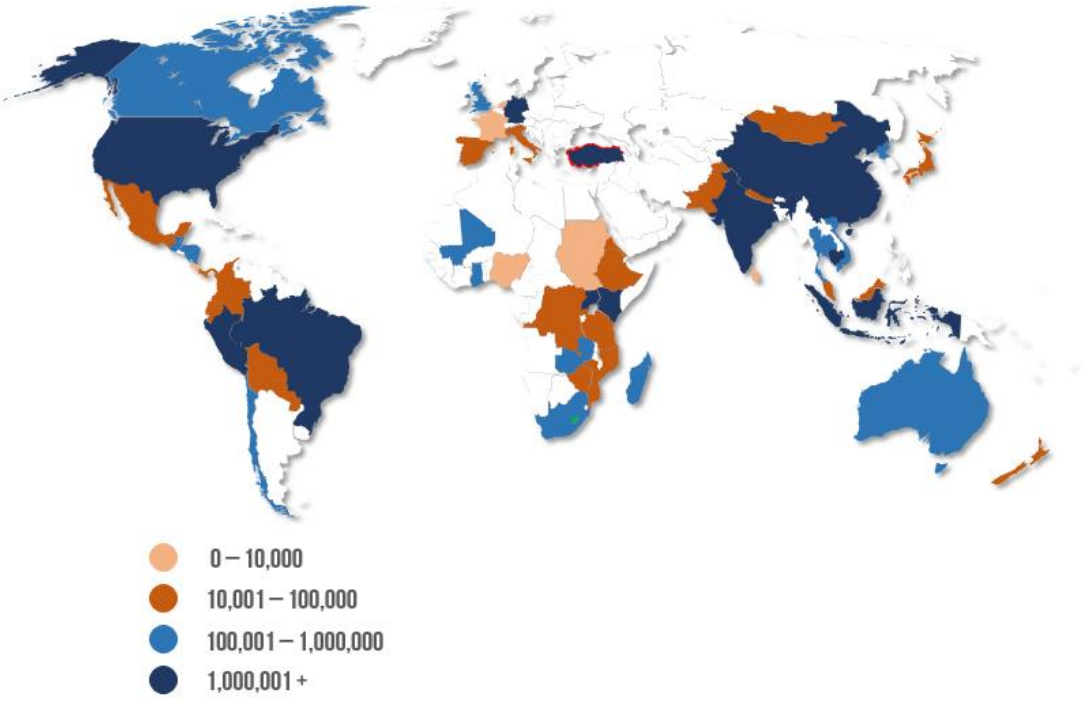
Figure 2: Top players in the voluntary carbon markets, including Turkey's role in terms of transacted volumes and valuation (2016 data)[4]



Turkish carbon projects are developed primarily under one of two standards: the Gold Standard and the Verified Carbon Standard (VCS) (recently re-branded to be Verra). As of May 2018, Turkey had 244 registered projects, 130 of which were under the Gold Standard and 114 under the VCS. Both standards stand out as internationally respected frameworks for the development and implementation of emission reduction projects and are transacted globally.

[4] Adapted from: Ecosystem Marketplace (2017) Unlocking Potential: State of the Voluntary Carbon Markets 2017.

Figure 3: Volume of offsets transaction by country (2015 data)[5]



Turkey's active presence in the voluntary carbon market is reflected in MidSEFF's portfolio of financed projects, many of which have been developed as carbon projects and are monetising carbon revenues.

1.5 Carbon Offsetting and Reduction Scheme for International Aviation

The carbon dioxide (CO_2) emissions from aviation account for approximately 2 per cent of the global greenhouse gas emissions. This amount is expected to grow around 3 to 4 per cent annually.[6] In 2016 the International Civil Aviation Organisation's (ICAO) General Assembly approved the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Along with other improvements in fuel efficiency, operations and infrastructure (ICAO's described "basket of measures"), CORSIA will enable the aviation sector to achieve carbon-neutral growth from 2020 onwards. At the heart of this market-based scheme is the possibility for airline companies to offset their future emissions growth through the purchase of international carbon credits, also called offsets.

The average level of CO_2 emissions from international aviation covered by the scheme between 2019 and 2020 represents the basis for carbon neutral growth from 2020, against which emissions in future years are compared. This means that any CO_2 emissions beyond this baseline, determined on an annual basis, will need to be offset by the airline industry every three years.

CORSIA will be implemented in phases, starting with participation of countries on a voluntary basis, followed by participation of all countries (except certain exempted nations) as follows:

[5] Adapted from Ecosystem Marketplace. Raising Ambition: State of the Voluntary Carbon Markets 2016. May 2016.
[6] ICAO. Aircraft Engine Emissions. Available at https://bit.ly/2tUt8wn.

- **A pilot phase (from 2021 through 2023)** that applies to countries that have volunteered to participate in the scheme and where there is flexibility towards defining the exact approach to the emissions offset calculation;
- **A first phase (from 2024 through 2026)** that applies to countries that have volunteered to participate in the scheme and where a sectoral approach is to be followed to determine the emissions offset obligation;
- **A second phase (from 2027 through 2035)** that applies to all countries that have an individual share of international aviation activities beyond a minimum share.[7]

Countries that voluntarily decide to participate in the CORSIA may join the scheme from the beginning of a given year, and will need to notify ICAO of their decision to join by June 30 the preceding year. All Member States of ICAO, including Turkey, will be required to make appropriate changes to the national regulations to align with the CORSIA relevant Standards And Recommended Practices (SARPs)[8]. To the extent possible, the provisions of the SARPs have been written in such a way as to facilitate incorporation, without major textual changes, into national legislation.

The SARPs will become applicable to Member States as of 2019 and, regardless of the participation in the voluntary phases of CORSIA, all Member States will need to start monitoring, reporting, and verifying CO_2 emissions from flights starting from January 1st 2019. In Turkey, the preparation for the transposition process of this requirement into national law has commenced and is being supported by the Turkish Directorate General for Civil Aviation. The law will determine which entities are to be responsible for verifying the emissions reports prepared by operators, handling of cancellations of eligible emission reductions units, and reporting of these emissions to ICAO.

1.6 Turkish Renewable Energy and Energy Efficiency Policies and Measures

An upper middle-income country with a population of 75 million, Turkey boasts a growing economy with an average annual growth rate of nearly 5 per cent between 1999 and 2017. The country's rapid development has also increased GHG emissions across key economic sectors. Over the past decade, economy-wide GHG emissions increased by more than 35 per cent.

As the country further develops, more energy is needed to feed this growth. The government expects energy demand in Turkey "to double in the upcoming 10 years"[9] and plans on meeting parts of this increased demand by building new coal-fired power plants.[10] Turkey is also planning to add nuclear power to its energy mix. The Energy and Natural Resources

[7] Share should be above 0.5 per cent of total international Revenue Tonne-kilometres, except Least Developed Countries, Small Island Developing States and Landlocked Developing Countries unless these states volunteer to participate.
[8] Standards And Recommended Practices are technical specifications adopted by the Council of ICAO to achieve uniformity in regulations, standards, procedures and organisation in relation to the airline industry.
[9] Ministry of Environment and Urbanisation (2016). Sixth National Communication of Turkey. Available at https://bit.ly/2YNqI2n
[10] Istanbul Policy Center (2016). Coal Report. Turkey's coal policies related to climate change, economy and health

Minister announced that by 2030 Turkey would be able to meet 10 per cent of the country-wide electricity consumption with nuclear power.[11]

In response to the rapid increase in GHG emissions, Turkey is working towards developing new domestic policies that will facilitate the country's transition into a greener growth trajectory. In support of this effort the government published a new National Energy Efficiency Action Plan for 2017 to 2023. The plan includes a large number of measures, including increased use of renewable energy, district heating in buildings and encouraging the use of combined heat and power across industries. Sectoral measures will include industry, transport, construction, heating and cooling, agriculture and energy generation.

Turkey also aims to scale up its efforts to develop its potential in renewable sources of energy including wind, solar, hydro and geothermal energy generation. The country is seeking to develop 30 per cent of its total installed capacity from renewable sources by 2023. The objective is to add 34 GW of hydropower, 20 GW of wind energy, 5 GW of solar energy, 1.5 GW of geothermal and 1 GW of biomass. Turkey also aims to have 10 per cent of its transport sector needs met by renewable energy.

These national policies are reflected in Turkey's INDC.[12] The document presents an economy-wide intervention including energy, industrial processes and products use, agriculture, land use land-use change and forestry, and waste sectors.

In the energy sector, the INDC proposes the following goals:

- Increasing capacity of production of electricity from solar power to 10 GW by 2030;
- Increasing capacity of production of electricity from wind power to 16 GW by 2030;
- Tapping the full hydroelectric potential;
- Commissioning of a nuclear power plant by 2030;
- Reducing electricity transmission and distribution losses to 15 per cent at 2030.

Regarding industrial energy efficiency, the INDC stresses the following needs:

- Reducing emission intensity with the implementation of National Strategy and Action Plan on Energy Efficiency, and
- Increasing energy efficiency in industrial installations and providing financial support to energy efficiency projects.

The Investment Support and Promotion Agency of Turkey indicates that around USD 110 billion of investments will be needed to meet Turkey's expected energy demand by 2023.[13]

[11] Daily Sabah (2017) Turkey to expand capacity to meet energy needs with 3 nuclear power plants in action. Available at https://bit.ly/2FWUF93.
[12] Turkey's INDC submission (2015) www4.unfccc.int/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf.
[13] See www.invest.gov.tr/en-US/sectors/Pages/Energy.aspx.

1.7 Avoidance of Double Counting of Carbon Credits

If Turkey is to implement its INDC and airlines decide to purchase carbon credits from Turkish projects, there is a risk that the emission reductions generated through these projects will be double counted – i.e. once by the airline to compensate its obligations under CORSIA and again by Turkey if these emission reductions are also counted towards the country's INDC. In the context of climate change mitigation, double counting is widely used to describe situations where a single greenhouse gas emission reduction or removal is used more than once to demonstrate compliance with mitigation targets. Double counting becomes prominent where multiple mitigation mechanisms overlap over sources or sinks and when emission reductions are transferred among entities subject to mitigation targets and accounted towards them. Measures can be taken to avoid double counting to secure environmental integrity, as explored in this report.

2. Domestic Demand and Supply

2.1 Matching Domestic Demand with Supply

CORSIA is expected to grant individual aircraft operators a degree of flexibility with regards to the type of carbon credits that can be sourced for offsetting purposes. As such, airlines will be able to decide whether to source carbon credits domestically or through international channels. Buying strategies of aircraft operators will be cost-focused but will also be influenced by the origin and quality of the generated carbon credits. Countries that host large portfolios of carbon credit projects but lack effective and transparent approaches to dealing with the risk of double counting may be less attractive partners for the airline industry.

This chapter explores the relationship between the potential demand for carbon offsets coming from Turkish aircraft operators and the potential supply of eligible carbon credits from domestic carbon projects. The analysis serves to inform the Turkish government about the estimated domestic demand and supply dynamic. The results of the analysis for Turkey are also relevant to guide the strategic recommendations on how to mitigate the risk of double counting in the context of Turkey's INDC.

Whereas this analysis only looks at the Turkish supply and demand dynamics, it should be noted that CORSIA will operate as an international market and thereby deals with international supply and demand dynamics beyond the Turkish market.

2.2 Potential Demand from Turkish Aircraft Operators

Demand model

As of March 2019, 79 States, representing 76.63 per cent of international aviation activity, intend to voluntarily participate in the CORSIA scheme from its outset.[14] Turkey, as a Member State of the European Civil Aviation Conference, has agreed to partake in CORSIA from the very beginning as well.

Turkey counts more than 10 aircraft operators, of which four are purely cargo airlines and the remaining are either pure passenger airlines or service both passengers and cargo transport needs. All of these operators will be required to participate in all three phases of CORSIA and as such the complete national fuel data has been taken into account when preparing the demand calculation model for offsets over the period 2021 – 2035.

The total fuel used in the Turkish civil aviation sector in 2015 was more than 4.8 million tonnes of JET A1 fuel (See table 1 below). With a conversion

[14] See www.icao.int/environmental-protection/CORSIA/Pages/state-pairs.aspx.

factor of 1 tonne of JET A1 fuel to 3.16 tCO_2[15], this corresponds to total CO_2 emissions associated with all the international civil aviation flights of Turkish operating airline companies of 15,271,534 tonnes in 2015. This amount of emissions represents a 19.3 per cent increase compared to 2014.

Table 1: International fuel consumption and associated CO_2 emissions from the Turkish Aviation Sector

Year	International Fuel Consumption (tonne)	Total International emissions (tCO_2)
2014	4,052,756	12,806,709
2015	4,832,764	15,271,534

Source: The Turkish Directorate General for Civil Aviation (DGCA)

Only emissions from international flights where both the origin and destination states participate in the CORSIA are subject to offsetting requirements every year from 2021 onwards – the so called "route-based approach". As the international civil aviation CO_2 emissions represent 76.63 per cent of the total global aviation activity, the demand model applied this factor to determine the total emissions to be covered in Turkey.[16]

Next, the growth rates of CO_2 emissions from the Turkish civil aviation sector shared by the DGCA have been incorporated in the demand model, which is based on the calculation methodology as included in the ICAO Assembly Resolution 39.3.[17] These include 4 per cent per year in the low growth scenario, 8 per cent per year in the medium growth scenario and 12 per cent per year in the high growth scenario. These growth projections are in line with the growth in emissions observed between 2014 and 2015 (i.e. 19.3 per cent) and significantly exceed ICAO's forecast of annual global aviation emissions growth of 3 per cent. Turkey's aviation market is expected to continue to outpace the global average growth rate. Although increased traffic growth does not equal growth in emissions due to efficiency improvements in fleet, routes and other measures, it is an indicator. According to Turkish Airlines, annual growth of international traffic grew by 12.9 per cent per year between 2011 and 2017.[18] According to IATA, this growth is likely to continue given the strong favourable geographic location and opening of the new Istanbul Airport.[19]

As the demand model is based on the sum of all Turkey based aircraft operators, these growth rates have been applied for the determination of the baseline emissions (the average of forecasted 2019 and 2020 emissions) and the individual operator's growth rate (for the period 2021 – 2035). As such, the anticipated average emissions in the baseline years 2019 and 2020 are 14 $MtCO_2$ assuming a low growth scenario, 16.6 $MtCO_2$ assuming a medium growth scenario and 19.5 $MtCO_2$ given a high growth scenario (see table 2 below).

[15] Source: Directorate General of Civil Aviation (2018).
[16] Although more countries are expected to participate as of 2027, the demand model conservatively assumes that for the period 2027 – 2035 the same 87.7 per cent participation factor will apply.
[17] See formula for calculating offset requirements in section 11 in Resolution A39.3 Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme.
[18] Turkish Airlines (2016) Presentation available here: https://bit.ly/2JZOuVH
[19] IATA (2015) Air Passenger Forecasts Global Report. Available at https://bit.ly/2WO5n7r

Table 2: Average CO_2 emissions in baseline year under 3 growth scenarios

Growth scenario	Average 2019/2020 ($MtCO_2$)
Low	14.0
Medium	16.6
High	19.5

Based on the baseline emissions, the sectoral growth factor and the operator growth factor, the offset requirements can be calculated, as per the formula in paragraph 11 of the Assembly Resolution[20]. As per this formula, the demand model follows a concept of a "dynamic approach" for the calculation of the offset requirements. This approach allows to gradual move from the use of 100 per cent "sectoral approach" (and therefore 0 per cent individual approach) from 2021 to 2029, towards the use of "individual approach" of at least 20 per cent from 2030 to 2032; and at least 70 per cent from 2033 to 2035. "Sectoral approach" represents the international aviation sector's global average growth factor of emissions in a given year, while "individual approach" represents an individual operator's growth factor of emissions in a given year. Annual growth values for both approaches have been made available by the DGCA.[21, 22]

Results

The table below summarises the demand potential between 2021 and 2035 considering the three different growth scenarios. The offset requirements for the Turkish civil aviation sector for all three phases in total fall between 88.8 $MtCO_2$ in a low growth scenario and 405.2 $MtCO_2$ in a high growth scenario. For comparison reasons, a fourth scenario has been included. This scenario assumes the growth in emissions from Turkish aircraft operators to be equal to the medium global emissions growth rate as forecast by ICAO (i.e. on average 3 per cent). The offset requirements under this scenario are 53.2 $MtCO_2$, considerably lower due to the large difference in forecast growth rates.

The volumes of demand are split over the three CORSIA phases (pilot, phase 1 and phase 2) to show the implications of time on the overall demand.[23]

[20] The formula to calculate the offset requirements can be found here: www.icao.int/environmental-protection/Documents/Resolution_A39_3.pdf

[21] Whereas Turkey's "individual approach" assumes a constant growth rate under the three scenarios, the estimated growth factor that is to be applied in the "sectoral approach" varies between 2 and 3 per cent growth per year. There is a one-off spike in 2017 of 7 per cent per year. This is due to the start of the mandatory phase.

[22] The Resolution 39-3 Para 11. e), i), b) allows States to apply the sectoral growth rate to an aircraft operator's emissions covered by CORSIA in 2020 for the duration of the pilot phase (2021-2023). This would reduce the estimated offset requirements for the Turkish civil aviation sector with 230,000 in the low scenario and 1.1 million in the high scenario, equal to a reduction in offset requirements of respectively 7.5 per cent and 20.6 per cent.

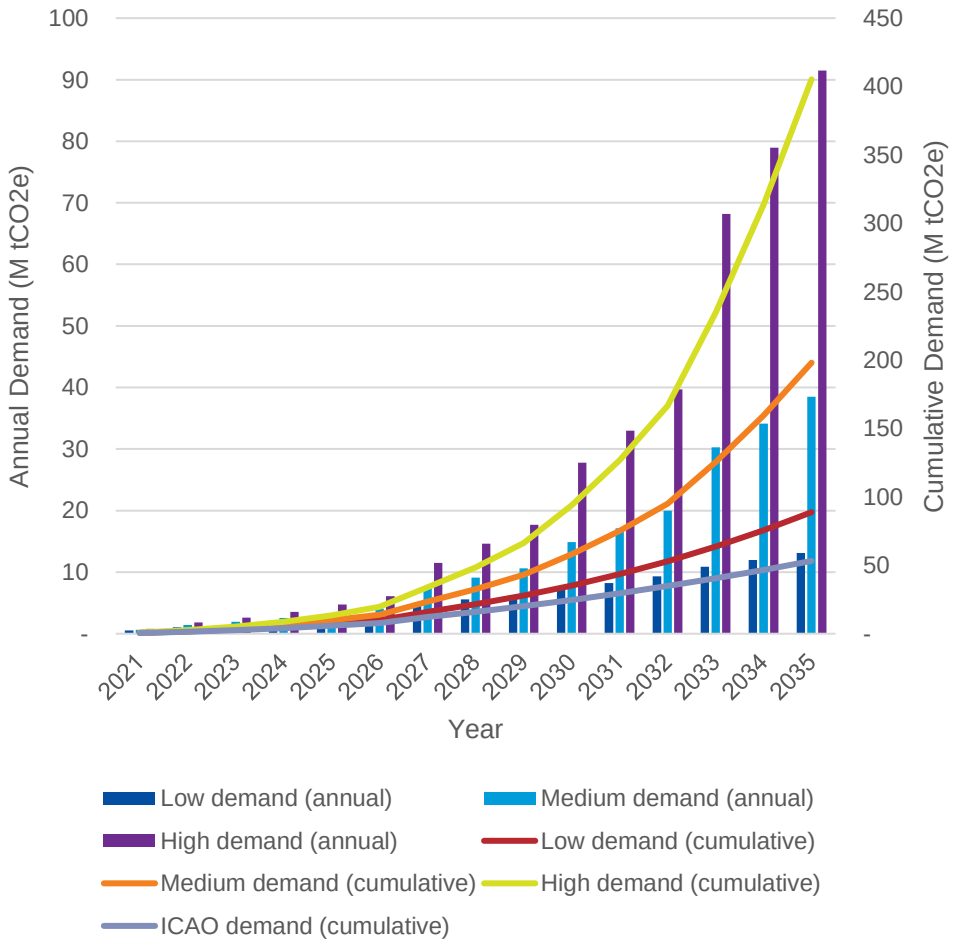
[23] Based on pricing scenarios of credits transacted under CORSIA prepared by CAEP for ICAO. Available at https://bit.ly/2HW2kgk. The value of the offset requirements for the Turkish aviation sector could range between $0.91 billion and $14,6 billion over the period 2021 - 2035. The pricing scenarios have been prepared applying the demand forecasts presented in table 3. These figures should be treated as indicative only.

Table 3: Forecast offset requirements of Turkish aircraft operators under CORSIA in each phase assuming four growth scenarios (tCO_2)

Phase	Pilot (Voluntary) ($MtCO_2$)	Phase 1 (Voluntary) ($MtCO_2$)	Phase 2 (Mandatory) ($MtCO_2$)	Total ($MtCO_2$)
Years	*2021-2023*	*2024-2026*	*2027-2035*	*2021-2035*
Low	3.08	6.79	77.53	87.39
Medium	4.02	9.95	182.10	196.06
High	5.20	14.40	382.81	402.41
Medium ICAO	2.65	5.17	44.26	52.07

Figure 4 below visualises the development of the annual and cumulative potential demand assuming the four growth scenarios.

Figure 4: Annual forecast offset requirements of Turkish aircraft operators under CORSIA

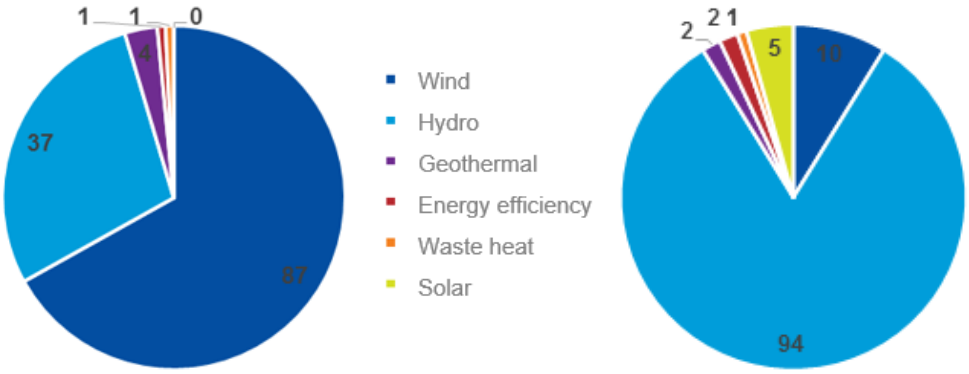


2.3 Potential Supply from Existing Turkish Carbon Projects

Carbon Project Overview

As of May 2018, Turkey had 244 registered projects, 130 of which were under the Gold Standard and 114 under the VCS. The break-downs per project type are presented in the figure below.

Figure 5: Overview of project types by standard – first pie chart for the Gold Standard (130) and the second pie chart for the VCS (114)



From these projects, 79 have successfully issued carbon credits (all but two of these are registered under the Gold Standard). The annual average ex-ante emission reduction potential of an individual project is 75,000 credits, with the largest registered project generating an estimated reduction of 580,000 tonnes of CO_2 per year (hydropower) while the smallest project achieving an annual mitigation of 2,600 tonnes of CO_2. The total installed capacity represented by all 244 registered projects is 8.9 GW, as per the table below.

Table 4: Overview of Turkish carbon projects by project type and installed capacities

Project type	Installed capacity (MW)
Hydro power	5,188
Wind power	3,629
Geothermal	104
Solar power	7.3
Total	**8,929**

From the projects listed above, 39 renewable energy projects are being supported through EBRD's MidSEFF Facility. Together, this inventory accounts for close to 900 MW installed capacity. The cumulative emission reduction potential of these projects reached around 2.9 million tCO_2e by 2018.[24] The supply model described below is based on Turkish renewable energy and energy efficiency projects currently registered under a voluntary carbon standard. The model therefore only forecasts the potential supply of carbon credits under different scenarios from existing projects and excludes possible projects registered after the date of this study.

[24] Carbon finance programme (2018) Inventory Survey Report 2018.

Supply model[25]

For the purpose of this report, a number of different supply scenarios have been prepared to provide insight into the potential carbon credit supply volumes under different CORSIA eligibility criteria restrictions. These include the following:

1. **No restrictions** (base case): this base case scenario assumes that CORSIA does not agree on any further details than the general Carbon Offset Credit Integrity Assessment Criteria currently featured in the CORSIA SARPs. Under this scenario, all carbon credits generated by Turkish carbon projects since their inception would be eligible, regardless of their start date, vintage, project type of carbon standard.

2. **Project start date restrictions:** this restriction relates to the date on which the project participants commit to making expenditures for the construction or modification of the main equipment or facility. The following two types of scenarios have been assessed:

    a) *Post-2012:* limiting the supply to carbon credits issued to projects that have a start date on or after 1 January 2013. The rationale for this cut-off date is alignment with the third trading period of the EU Emissions Trading Scheme (ETS) which restricts the use of emission reductions generated before 2012. The EU-ETS has introduced a number of restrictions with regards to the use of international carbon credits since that date, which CORSIA may refer to.
    b) *Post-2016:* limiting the supply to carbon credits issued to projects that have a start date on or after 1 January 2017. This date corresponds to the day after the passing of the ICAO CORSIA Resolution A39-3, which marks the adoption of CORSIA.

3. **Vintage year restrictions:** this restriction applies on the individual project level and relates to the year in which GHG emission reductions have been generated. The following two types of scenarios have been assessed:

    a) *Post-2012:* limiting the supply to carbon credits issued for emissions that took place on or after 1 January 2013, as per the rationale outlined above.
    b) *Post-2016:* limiting the supply to carbon credits issued for emissions that took place on or after 1 January 2017, as per the rationale outlined above.

4. **Project type restrictions:** while not implied in the draft SARPs, there is a possibility that the scheme will impose restrictions linked to particular project types. Although it is not expected that the scheme would go as far as differentiating between specific sub-types such as geothermal power or solar PV, restriction on large hydropower projects (exceeding 20 MW) could be considered due to their debated sustainability impacts. This is also in line with the

[25] For an overview of the assumed methodological approach to derive the supply model, please refer to the Appendix.

IATA Carbon Offset Programme guidelines, which also exclude HFC-23 projects.[26]

5. **Standard restrictions:** The draft SARPs focus on wider governing principles rather than specific certifications or offset project types, potentially opening the possibility for both established compliance and voluntary carbon standards as well as alternative mitigation schemes (like jurisdictional REDD initiatives) or future mechanisms that are to be operationalised under the PA. If carbon credits from voluntary markets are allowed, it is possible that CORSIA will make a distinction between different carbon standards. Furthermore, on the national level linkages between registries may not be extended to applicable standards. For the purpose of Turkey, the supply assessment therefore separates the volumes to be generated by the Gold Standard and the VCS to show what the potential impact on supply would be following the exclusion of one of the standards.

The supply scenarios visualised in this chapter do not reflect the amount of carbon credits that have been retired or cancelled between 2006 and 2018. Over the period 2006 – 2018, Turkey transacted around 40 million tonnes of CO_2e.[27] This figure is corrected for in writing in each of the supply scenarios to give insight into the actual amount of available emission reductions.

The supply scenarios presented in this analysis assume that voluntary carbon markets will continue to operate under the same regulatory regime as pre-2021. As such, the only discount factors that are applied to the supply forecasts relate to the impact of crediting period renewals (e.g. the associated baseline updates) and adjustments to the ex-ante GHG emission reduction estimates presented in publicly available PDDs based to historical issuance success rates of similar project types.[28]

There is however a risk that under the Paris regime host countries will institute limits or block the export of carbon credits issued by existing carbon projects post-2020. The rationale for this – as discussed in further detail in Chapter 4 of this report – is that the sale and export of carbon assets will make it more difficult for host countries to meet their NDC targets. This is particularly relevant for sectors already covered by a country's NDC. But given that NDCs are to be renewed once every five years, sectors initially falling outside the scope of an NDC may be still included in the future.

Turkey's first INDC already covers renewable energy generation and energy efficiency, meaning that the carbon projects assessed in this report may at some point encounter restrictions of such nature. Due to the current regulatory uncertainty about how carbon assets generated in the voluntary carbon markets will relate to NDC accounting, this report stresses such possibility as a risk but does not extrapolate possible regulatory interventions on domestic supply of carbon credits as there is no basis under which post-2021 supply scenarios can be defined. The only post-2021 restriction that has been modelled below relates to the exclusion of emission reductions generated by large-scale hydropower projects. These projects generally represent the cheapest abatement option within the assessed portfolio of renewable energy and energy efficiency activities, and

[26] More information in the IATA Carbon Offset Program available at https://bit.ly/2I8Hcw9
[27] Ecosystem Marketplace (2016) Raising Ambition: State of the Voluntary Carbon Markets 2016.
[28] To ensure conservativeness, an average issuance success rate of 85 per cent has been applied in the supply scenarios to reflect the likelihood that realised GHG emission reductions will be lower than the ex-ante estimations presented in the original PDDs.

could represent a project category that the Turkish government may consider counting towards its NDC implementation post-2021.

Result

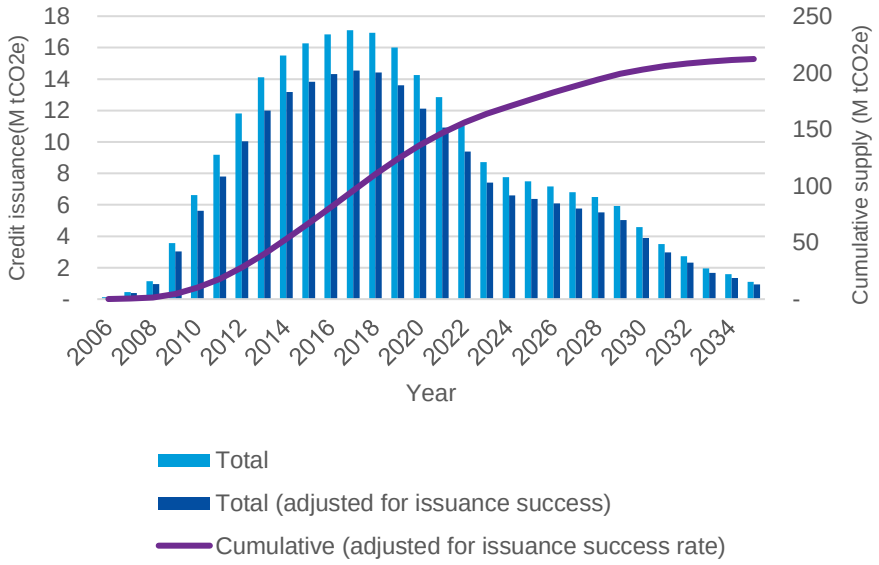
Scenario 1: No restrictions

Assuming that all carbon credits generated by Turkish carbon projects since their inception would be eligible, regardless of their start date, vintage, project type of carbon standard, the cumulative carbon credit supply would reach 212 million by 2035, as per Figure 6 below.

In this base case scenario, total supply appears to have peaked in 2017 with 14.5 million tonnes of CO_2 reduction being generated (after adjustment for issuance success)[29]. From 2018 onwards there is a steady drop due to either project crediting periods coming to an end (in the case of 10-year fixed crediting period), or due to projects with renewable crediting periods needing to re-adjust their baselines at renewal. By 2030, annual emission reductions being generated from the current portfolio of projects is foreseen to drop below 4 million tonnes annually. As explained in further detail in the Appendix, for the purpose of the supply scenarios, discount factors of 10 per cent have been applied upon renewal of each crediting period.[30]

The total amount of pre-2021 carbon credits is 135 million, in a scenario where post-2020 restrictions would apply to domestic projects. Correcting for the 40 million VERs already transacted between 2006 and 2018, the available amount is further reduced to 95 million in the base case.

Figure 6: Total credits supply from registered projects



[29] An average issuance success rate of 85 per cent has been applied in the modelling, based on the historical issuance success rate reported in the CDM UNEP DTU Database (2018)
[30] The applicable national grid emission factor – the key determinant of the GHG mitigation potential of one MWh generated by a renewable energy project - has been reduced by 10 per cent upon each crediting period renewal. This means that in its third crediting period a typical renewable energy project will generate 80 per cent of the emission reductions forecasted in the Project Design Document.

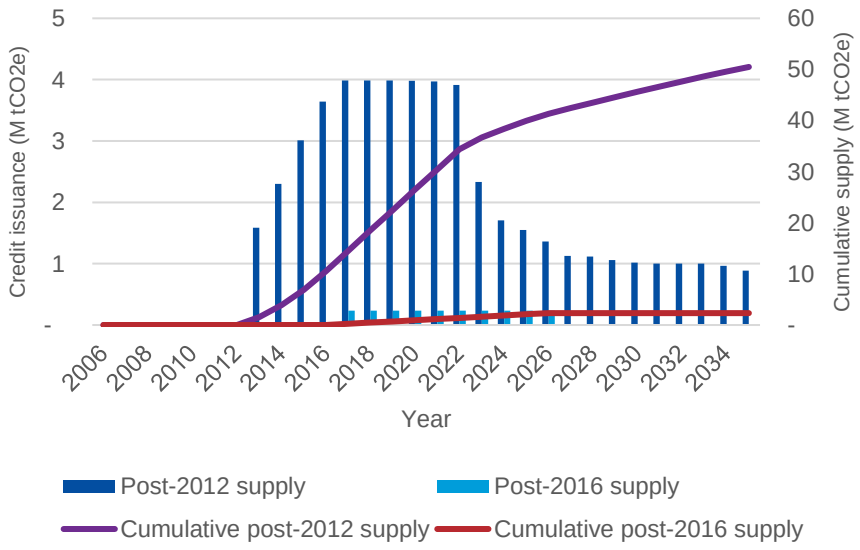
Scenario 2: Project start date restrictions

The second scenario considers that CORSIA may limit the types of credits eligible based on the project start date to all projects only from either a) post 2012 or b) post-2016. If all post-2012 projects are deemed eligible then credit supply will reach 50.5 million credits by 2035, whereby a peak of 4.6 million tonnes per year will be achieved by 2022, before sharply dropping to 2.3 million tonnes on an annual basis the following year. This is due to a number of projects with 10-year crediting periods coming to an end in 2023. After this date, the supply continues to drop steadily due to project crediting periods coming to an end or needing to renew their baselines.

If CORSIA restricts projects to only post-2016 the number of carbon credits available from Turkish projects will be considerably lower, at only 232 thousand tonnes per year issued annually between 2017 and 2026. These are generated by only two projects – both VCS registered and both large scale hydropower – and will deliver a cumulative of 2.7 million credits by 2026. After 2026, no further Turkish credits would be available from the current project pipeline due to expirations of crediting periods.

For projects with a start date after 2012, the total amount of pre-2021 carbon credits is 26 million, in a scenario where post-2020 restrictions would apply to domestic projects. For projects with a start date after 2016, the pre-2021 volume declines to 1 million. It was not possible to factor in the impact of the already transacted VERs on this figure as it is not known which individual projects have sold credits.

Figure 7: Total credits supply from projects with a post-2012 or post 2016 start date (adjusted for issuance success rate)

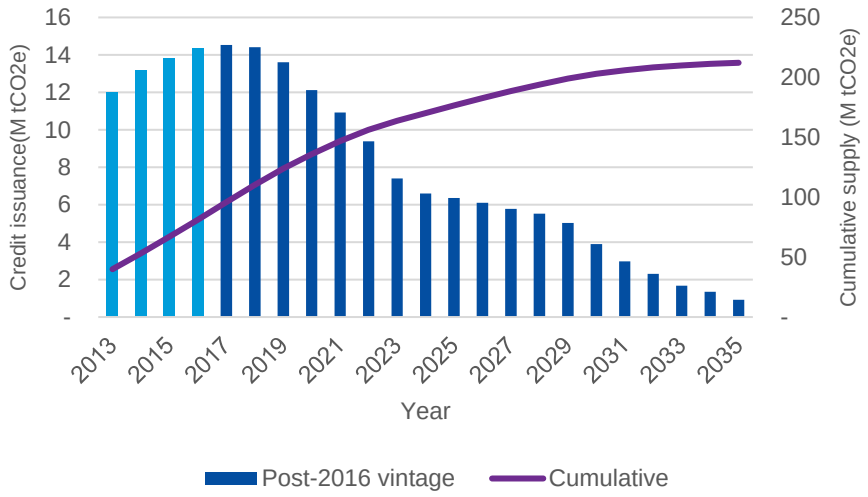


Scenario 3: Vintage year restrictions

Assuming that CORSIA limits eligibility to the year (vintage) in which emission reductions have been generated to either post-2012 or post-2016, the total carbon credit supply would be as per Figure 8 below.

In this scenario, the total credit supply follows that of the 'no restrictions' scenario above as no other restrictions apply.

Figure 8: Total credits supply from projects with emission reductions are generated either post-2012 or post-2016 (adjusted for issuance success rate). Post 2012 supply in shown in light blue

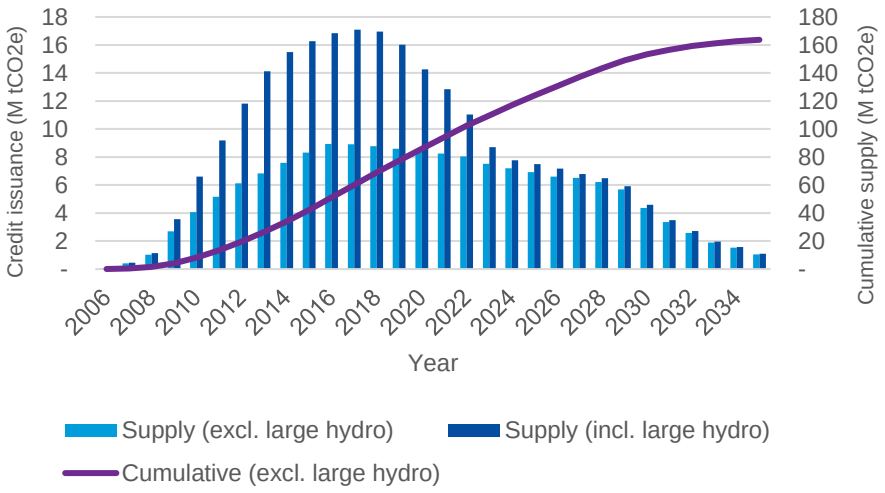


Scenario 4: Project type restrictions

If the CORSIA scheme chooses to impose restrictions linked to project types and excludes large scale hydropower projects (exceeding 20 MW) as per the IATA Carbon Offset Programme guidelines, the total carbon credit supply is expected to almost halve between 2012 and 2019, after which point the large scale hydropower projects begin to drop out of the pipeline (see Figure 9). By 2024 this project type accounts for only 7 per cent of total supply, leaving this restriction with limited impact in later years. Overall, until 2035 a cumulative volume of 163 million credits is forecasted from the current portfolio of projects.

The total amount of pre-2021 carbon credits is 86 million under this scenario when post-2020 restrictions would apply to domestic projects.

Figure 9: Credit supply, excluding large-scale hydropower

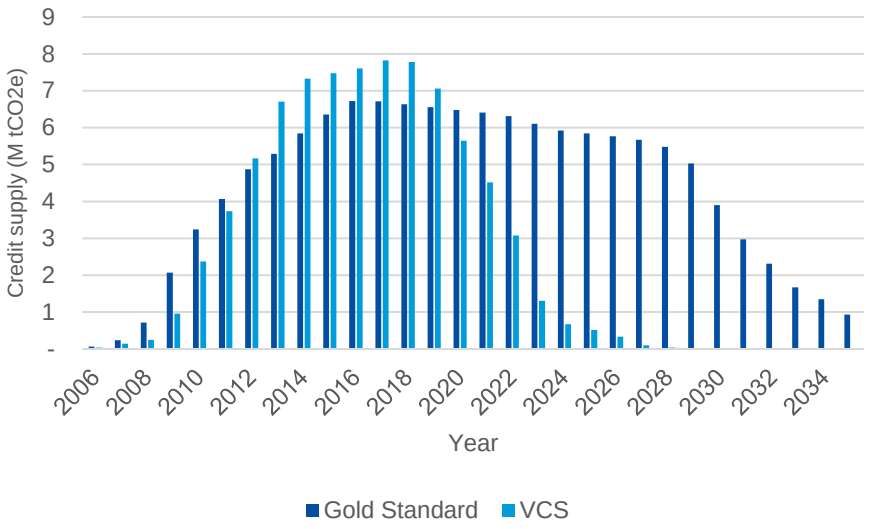


Scenario 5: Carbon standard restrictions

Turkey hosts both carbon projects registered under the Gold Standard and the VCS. The credit volumes issued through these respective standards are forecasted in Figure 10. If CORSIA were to restrict eligibility only to the Gold Standard, or the Turkish registry would only be linked with the Gold Standard's, Turkey would be able to supply volumes up until 2035. If, however, CORSIA were to allow only VCS credits or the registry linkages would only connect to the VCS's, then the ability to supply would rapidly drop over a five-year period from 2019 to 2025 assuming the domestic project pipeline does not grow from 2018 onwards.

The total amount of pre-2021 carbon credits is 65 million under the Gold Standard and 70 million under the VCS, in a scenario where post-2020 restrictions would apply to domestic projects. Correcting for the 40 million VERs already transacted between 2006 and 2018, the available amount is further reduced to 25 million and 30 million for the two standards, respectively. The difference between the supply from projects under the Gold Standard and projects under the VCS is that most VCS projects opted for a one-time 10 year baseline while most GS projects apply a seven-year baseline that can be renewed twice.

Figure 10: Credit supply from registered projects under the Gold Standard and VCS



Below features a summary of the pre-2021 carbon credit supply volumes in each one of the five assessed scenarios. The reported figures present total volumes, including the 40 million carbon credits that have already been transacted between 2006 and 2018.

Table 5: Overview of the pre-2021 and cumulative 2035 carbon credit supply volumes under the five assessed scenarios ($MtCO_2e$)

Scenario	Type	Pre-2021 carbon credit supply	Cumulative supply by 2035
Scenario 1	No restrictions	135 $MtCO_2e$	212 $MtCO_2e$
Scenario 2	Project start date restrictions	26 $MtCO_2e$	50.5 $MtCO_2e$
Scenario 3	Vintage year restrictions	135 $MtCO_2e$	212 $MtCO_2e$
Scenario 4	Project type restrictions	86 $MtCO_2e$	163 $MtCO_2e$
Scenario 5	Carbon standard restrictions	135 $MtCO_2e$	212 $MtCO_2e$

2.4 Potential Supply from New Turkish Carbon Projects Commissioned post-2020

Growth projections

Turkish energy demand growth is expected to average 4 – 6% annually until 2023. Combined with the government's ambitions to accelerate the transition towards low-carbon development, investments in new renewable energy generation are expected to grow substantially in the years to come.[31] The Ministry of Energy and Mineral Resources (MENR) estimates an additional USD 110 billion in renewable energy investments will be needed to meet the growing demand, more than double the total amount invested between 2005 and 2015.[32] According to the government's vision 2023, this is to lead to a share of renewables of 30% by that year.

[31] C. Erdin and G. Ozkaya (2019) Turkey's 2023 Energy Strategies and Investment Opportunities for Renewable Energy Sources. Sustainability Journal, 11, 2136
[32] Embassy of the Kingdom of the Netherlands (2015) Renewable Energy Turkey: Opportunity?

The previous section of this report presented potential supply scenarios of carbon offsets from existing carbon projects in Turkey. To establish a complete picture of the supply side over the timeframe of CORSIA, in this section the potential additional supply from new renewable energy projects to be commissioned post-2020 is estimated.

Supply model

The modelling of the potential supply of offsets generated by renewable energy projects commissioned post-2020 has been based on implementation forecasts presented in (i) the Vision 2023 strategy plan prepared by MENR and (ii) independent research conducted by the SHURA Energy Transition Center. Projections from both sources have been used to establish an average implementation trajectory between covering the period 2020 – 2035.

Data from Vision 2023

The Vision 2023 strategy plan adopts the following implementation targets per technology type:

- 34 GW capacity of hydro power plants;
- 20 GW capacity of wind power plants;
- 5 GW of solar power plants;
- 1 GW of geothermal energy; and
- 1 GW of installed capacity for biomass energy.

Based on the growth rates assumed in the Visions 2023 plan per technology category in the periods 2015 – 2019 and 2020 – 2023, an extrapolation of a growth trajectory has been made up until the end of 2035. As summarised in Table 6, the results of this extrapolation indicate a total installed capacity of renewables of 88.41 GW is expected to be reached by 2035, with close to half of the capacity being represented by hydropower projects.[33]

Table 6: Overview of historical (*) and forecasted installed capacity values for renewable energy in Turkey (GW)

Technology	2015*	2023	2030	2035
Hydro	25.52	34.00	35.86	37.25
Wind	5.66	20.00	27.82	36.77
Solar	0.30	5.00	7.67	10.92
Geothermal	0.41	1.00	1.33	1.77
Biomass	0.38	1.00	1.37	1.70
Total	32.27	61.00	74.05	88.41

Source: 2015 values represent historical records reported by MENR; 2023 values are taken from the Vision 2023 strategy plan; 2030 and 2035 values have been extrapolated by the Consultant.

[33] A conservative approach has been taken for estimating the installed capacity for the year 2030. The model assumes that the year-on-year growth in investments slows after 2023, and averages at half the growth rate that the government assumes for the period running up to 2023.

Data from the SHURA Energy Transition Center

The SHURA Energy Transition Center provides independent research on Turkey's renewable energy developments and development scenarios. The platform was founded by a partnership of the European Climate Foundation, Germany's Agora Energiewende and the Istanbul Policy Center, and is regarded as a reputable think tank.

Data of future renewable energy generation trends by the SHURA Center[34] has been used in the supply model for the purpose of presenting an alternative data set to the forecasts presented in the Vision 2023 strategy plan. Given that the SHURA report only presents a forecast up to 2026, the supply model has extrapolated growth until the end of 2035 in a similar fashion to how data by MENR was analysed. The results presented in Table 7 show that while the forecasted capacities per technology type differ, this deviation is not considerable overall. Extrapolated data from MENR result in an expected installed capacity of 88.41 GW, whereas data from the SHURA Center lead to a total potential installed capacity of 83.45 GW by the end of 2035.

Table 7: Overview of forecasted installed capacity values for renewable energy (GW)

Technology	2016*	2026	2030	2035
Hydro	26.70	37.50	41.82	47.22
Wind	5.80	14.00	17.28	21.38
Solar	0.60	6.00	8.16	10.86
Geothermal	0.80	1.45	1.71	2.04
Biomass	0.46	1.24	1.55	1.95
Total	34.36	60.19	70.52	83.45

Source: 2016 values represent historical records obtained from MENR; 2026 values are taken from the SHURA Center report; 2030 and 2035 values have been extrapolated by the Consultant.

Potential additional supply

To derive data on potential additional supply of carbon offsets generated by new renewable energy projects in the period 2020 – 2035, power generation data (in GWh) has been estimated from the forecasted installed capacities per technology type. The assumed capacity factors are: [35]

- 32% for hydro power projects;
- 30% for wind power projects;
- 20% for solar power projects;
- 96% for geothermal;
- 75% for biomass.

To convert the resulting power generation data into tonnes of CO_2e avoided, a grid emission factor of 0.390 tCO_2e / MWh[36] has been assumed for the year 2018, declining in a linear fashion to 0.260 tCO_2e / MWh by the end of 2035 (reflecting the renewable energy capacity additions during that period).

Carbon projects will need to comply with additionality requirements as applicable under the different Carbon Standards and possible Article 6 guidelines. It is assumed that post-2020 projects with insufficiently attractive

[34] SHURA Energy Transition Center (2018) Increasing the Share of Renewables in Turkey's Power System: Options for Transmission Expansion and Flexibility
[35] Idem
[36] IEA Statistics Methodology (2017) Interim Harmonised Baselines

risk-return characteristics (due to less favourable locations or higher investment cost) will persist, and that a share of the newly developed projects may be eligible for certification and issuance of carbon credits or emission reduction units. Given the difficulty in quantifying the degree to which new capacity additions will be additional and recognising the risk that not all renewable energy projects will be able to generate carbon credits in the context of Turkey's NDC, the following three scenarios for crediting have been assumed:

- Lower-end scenario, whereby 10% of the new installed capacity is credited under a carbon standard;
- Current carbon market coverage scenario, whereby 21% of the new installed capacity is credited under a carbon standard;[37]
- Higher-end scenario, whereby 30% of the new installed capacity is credited under a carbon standard.

For these three scenarios it is assumed that the credits generated are in addition to the proposed contribution of Turkey as described in its INDC. For example, the INDC refers to a target capacity for wind power of 16 GW, whereas the model uses a figure of 22 GW (average of the figures reported by MENR and the SHURA Center). Double counting and double use will need to be adequately accounted for – see Chapter 3 for further details.

Figure 11: Potential credit supply from new projects (period 2020 – 2035)

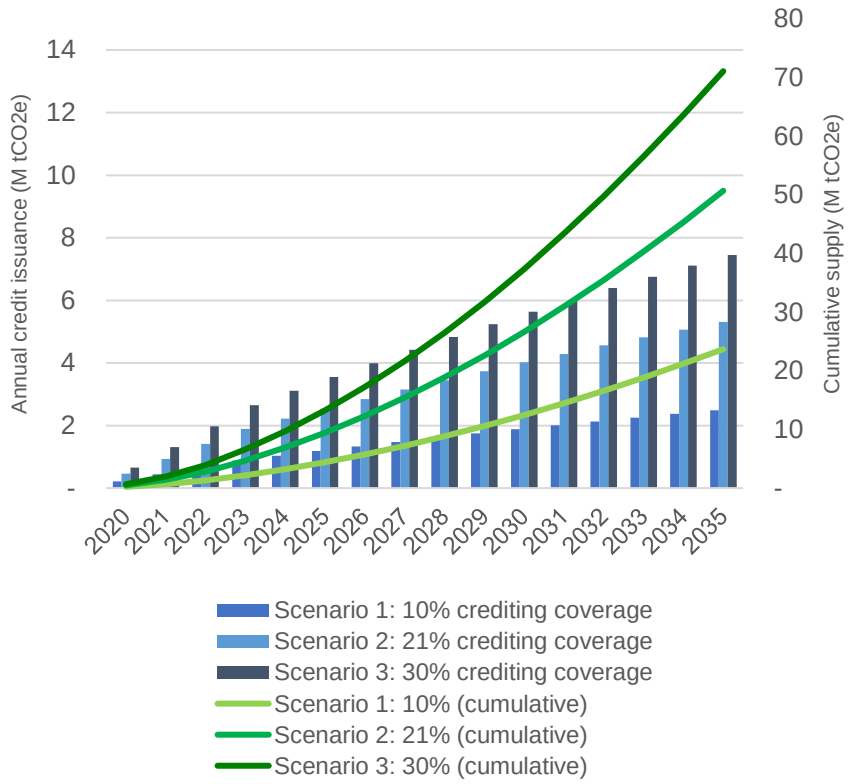


Figure 11 presents the results of the supply model, highlighting both the expected annual generation volumes of carbon offsets, as well as cumulative results over the period 2020 – 2035. In the low-end scenario, cumulative supply of carbon offsets is estimated to reach 23.7 million tonnes by the end of 2035. Assuming a scenario where the current carbon

[37] As indicated on p.13 of this report, the total installed capacity represented by all 244 registered projects in Turkey is 8.9 GW. In 2018, Turkey had a total installed capacity of nearly 42 GW. This implies that around 21% of all renewable energy projects are currently registered under a carbon standard.

market coverage rate of 21% is maintained, the cumulative supply reaches 50.7 million tonnes. In the high-end scenario, the cumulative issuance amounts to 71.1 million tonnes. In a scenario where carbon offsets from hydropower projects are excluded under CORSIA, potential supply is reduced by approximately half under each of the three scenarios.

Whereas the installed capacity grows steadily throughout the period 2020 – 2035, it is noteworthy that the accumulation of carbon offsets is slower than the trend observed in projects that are currently registered. The reason for this is the declining grid emission factor, which in existing carbon projects has been fixed for a period of 7 to 10 years, and is as high as 0.600 tCO2e / MWh.

3. Carbon Accounting in Turkey

Turkey is in a strong position to become a supplier of carbon credits and internationally transferred mitigation outcomes in a post-2020 regime (see text box 1). For the sale of carbon credits through CORSIA, enough information should be available to assure confidence amongst potential buyers that emission reductions stemming from Turkey are of high environmental integrity and therefore eligible for use under the scheme. In particular, Turkey must be able to manage its emissions reductions in a way that double counting is avoided. If not managed and prevented, double claiming could lead to a global increase of GHG emissions.[38] Preventing double counting of emission reductions is therefore a crucial aspect of securing environmental integrity of any trading system.[39]

Double counting can occur in the event of a double issuance (two units are issued for a single emission reduction), double claiming (two entities claim or use the same emission reduction for achieving their targets), or double payment (where the same emission reduction is paid for twice). This study is restricted to double counting risks (a) originating from double issuance and double claiming for credits generated in the Turkish energy sector, as such contribute to Turkish mitigation efforts under the PA and at the same time used by aircraft operators to meet emission reduction obligations under CORSIA. These considerations are based on the following key assumptions; and (b) associated with CORSIA and the Paris regime, thus, from 2021 onwards.

These considerations are based on the following key assumptions:

- Turkey ratifies the PA and its INDC becomes the country's official NDC;
- Turkey's NDC continues to have an economy-wide scope, thereby covering the energy sector; and
- Turkey's NDC target is below business as usual (BAU);
- Finally, this analysis discusses the issue of potential double counting from 2021 onwards.[40]

[38] Schneider and La Hoz Theuer (2017) Using the Clean Development Mechanism for Nationally Determined Contributions and International Aviation. Assessment of impacts on global GHG emissions. Available at https://bit.ly/2LJm0fA

[39] Other elements considered in the context of environmental integrity include ensuring emission reductions are real, verified, long-term, additional and make use of a conservative baseline. These aspects are, however, outside the scope of this assessment.

[40] While listed as an Annex-I country under the Kyoto Protocol, Turkey does not have a pre-2020 emission reduction target, nor did it host any JI projects. As such, no pre-2020 double counting can take place. Whether or not pre-2020 vintages will be eligible under CORSIA is an issue of unit eligibility rather than double counting, and will therefore not be discussed in this chapter.

Text box 1: Internationally Transferred Mitigation Outcomes (ITMOs)

Parties to the PA can support the mitigation efforts of other Parties as part of voluntary partnerships. This can include the transfer of mitigation outcomes 'that can also be used by another party to fulfil its nationally determined contribution' (Article 6.2). Such transfers can take place as part of a formal emission trading arrangement (with the issuance and transfer of a carbon unit) or in the context of results-based payments without a transfer of a carbon unit.

The PA also defines a sustainable development mechanism that allows private and public entities to support mitigation projects that generate transferrable GHG emissions (Article 6.4). Programmes and projects developed under this new mechanism can issue tradable carbon units, which feature recalls the operations of the Clean Development Mechanism. Programmes and projects will need to have a net positive mitigation effect, which means that not all emission reductions generated can be used to offset emissions generated elsewhere.

3.1 Risks of Double Counting

3.1.1 Scenarios of Double Counting Considered for Turkey

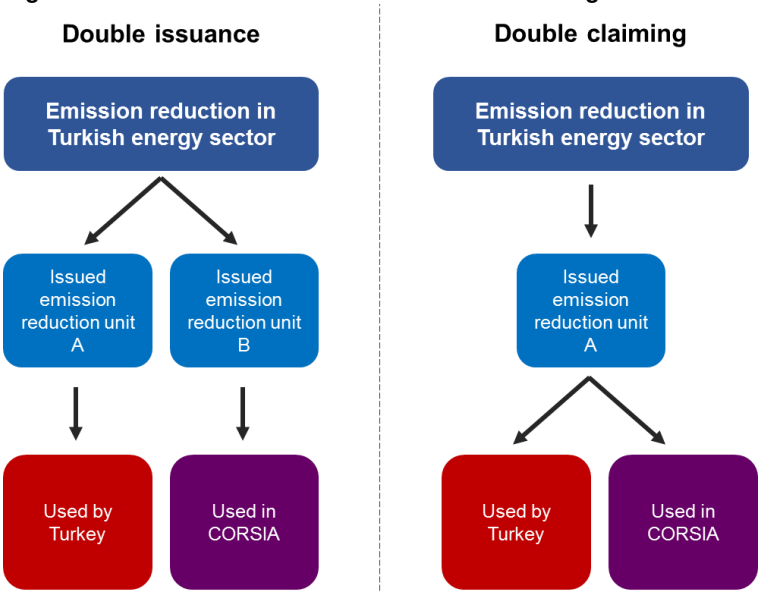
There are two general scenarios through which double counting may occur in Turkey in the context of CORSIA: double issuance and double claiming.

Double issuance can materialise in two scenarios: within one programme or mechanism, or between multiple GHG offsetting programmes or mechanisms that cover the same emission reductions. Double issuance would occur if, for instance, an emission reduction generated in the energy sector in Turkey results in a unit that is issued by both the Gold Standard and the VCS. Solid mechanism design[41] and checks by verifiers, as well as consistent tracking and recording of units are instrumental to avoid double issuance.[42] A registry design, which allows for the tracking and recording of units, is discussed in more detail in Section 3.2.2.

Double claiming, in turn, occurs if the same emission reduction is claimed both by a host country where the emission reduction took place, and a party that purchases the emission reduction unit to achieve its mitigation target. In the considered scenario, the risk for double claiming would materialise if Turkey uses an emission reduction unit for compliance with the country's NDC targets, while the same unit is claimed by an aircraft operator for compliance with CORSIA offsetting obligations. Solid accounting rules and the use of a credit and debit approach (in line with guidance on "corresponding adjustments" to be operationalised by the PA) can help avoidance of double claiming. These are discussed in Section 3.2.1.

[41] This could include, for example, contracts signed by project owners, which state that no emission reduction crediting is sought by a project under another crediting mechanism.
[42] Schneider (2018) Options for UNFCCC to avoid double counting with CORSIA. PowerPoint for the workshop "Robust accounting under Article 6 of the PA".

Figure 12: Considered situations of double counting



3.1.2 Existing and Emerging International Guidance on Double Counting

The need to avoid double counting of emission reductions is fully recognised in existing and emerging international carbon market mechanisms and regimes, both mandatory and voluntary.[43] Below we provide an overview of the rules designed to prevent double counting in key regimes.

Joint Implementation (Kyoto Protocol)

Under Joint Implementation, part of the Kyoto Protocol, Annex I countries can acquire emission reduction credits through a project in another Annex I country. To participate, each country calculates a budget of Assigned Amount Units (AAUs), based on their emission reduction commitments under the Kyoto Protocol. An emission reduction project generates Emission Reduction Units (ERUs), which are converted from the pool of AAUs in the host country. This ensures that emission reductions are only counted against one Party's target, avoiding double counting.

Article 6 market-based approaches (PA)

Ongoing negotiations on the new cooperative and market mechanisms under Article 6 of the PA are shaping guidance to avoid double counting. Article 4.13 of the PA requires parties to account for their NDCs in a manner that promotes environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensures the avoidance of double counting. Similarly, Article 6.2 provides that voluntary cooperation among parties shall apply robust accounting to ensure the avoidance of double counting. The Paris Decision clarifies that avoidance of double counting is to be prevented on the basis of "corresponding adjustments".[44]

Moreover, Article 6.5 of the PA also prohibits a host-country to use Article 6.4 emissions reductions to demonstrate the achievement of its NDC, if these are used by another party to demonstrate achievement of the other

[43] The Kyoto Protocol establishes accounting rules, through economy-wide targets and emission budgets that avoid double counting. The PA, too, requires countries to avoid double counting (Article 4.13; Article 6.2; Article 13).
[44] UNFCCC COP Decision 1/CP.21, para 36.

party's NDC, thereby preventing an emission reduction or removal is double claimed.

CORSIA

For CORSIA, the principle to avoid double counting is mentioned as part of its core elements in ICAO Resolution A39-3 Art. 21 and 25. CORSIA restricts the use of emission reduction units to those units that comply with ICAO rules on double counting,[45] requiring participating programmes to provide safeguards to avoid double counting, issuance and claiming, as recommended by the ICAO Council Committee on Aviation Environmental Protection (CAEP).[46] These double counting requirements will be developed as part of the Eligible Emissions Unit Criteria (EUC), which determine the eligibility of units for CORSIA offsetting obligations.[47] The EUC will take into account relevant developments in the Article 6 negotiations.[48]

In the first draft of the EUC,[49] eligibility criteria are applied at the programme level, meaning that full programmes could be labelled eligible for participation in CORSIA.[50] Examples of programmes are the Gold Standard and the VCS. The criteria cover both programme design elements, such as governance requirements, as well as criteria on avoidance of double counting, issuance and claiming of offsets, in the context of evolving national and international regimes for carbon markets and emissions trading. Finally, the EUC require that "eligible offset programs demand and demonstrate that the host countries of emission reduction activities agree to account for any offsets units issued as a result of those activities such that double claiming does not occur between the aeroplane operator and the host country of the emissions reduction activity." [51,52]

Voluntary standards

Voluntary standards have been applying double counting safeguards as part of their core elements. For example, Gold Standard does not allow its projects to register with other standards, and a geographical project area cannot overlap with the geographical boundary of another, similar project under any compliance standard.[53] To ensure this, a project developer is required to confirm it hasn't sought registration with any other standard.

The VCS concentrates on preventing double counting in the form of double selling and double payment. Its revised double counting rules from 1 February 2012 determine that, a situation of double counting is considered only if a GHG emission reduction or removal is monetised by two entities.[54] Projects registered under the VCS are required to provide evidence that their emission reductions are not counted or used under any other mechanism that includes GHG allowance trading.

[45] ICAO Resolution A39-3 Art. 21: "emission units generated from mechanisms established under the UNFCCC and PA are eligible in use for CORSIA, provided that they align with decisions by the Council […] including on avoiding double counting […]".
[46] CAEP (2016) CAEP/10 Recommendations.
[47] The EUC are developed by the ICAO Council, with the technical contribution of CAEP, and will be finalised no later than 2021. See https://bit.ly/2LMTxp5.
[48] ICAO Assembly Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme. Para 20. Available at https://bit.ly/2LbDxfn.
[49] The EUC draft was circulated for feedback amongst ICAO members in December 2017.
[50] Carbon Market Watch, Transport and Environment (2018) Briefing for ENVI MEPS on Draft Rules for ICAO's Global Offsetting Mechanism (CORSIA). Available at https://bit.ly/2xtND9k.
[51] ICSA (2018) Understanding the CORSIA Package. Available at https://bit.ly/2L5O6kb.
[52] Biniaz (2017) ICAO's CORSIA and the PA: Cross-Cutting Issues. C2ES. Available at: https://bit.ly/2sk12f9.
[53] Gold Standard (2017) Gold Standard for Global Goals Principles and Requirements, para 2.2 d. Available at https://bit.ly/2J2y7XH.
[54] VCS (2012) VCS Policy Brief. Double Counting. Available at https://bit.ly/2Ja0sLr.

3.2 Considerations on Addressing Double Counting

Effective procedures and/or mechanisms to avoid double counting should cover the entire life-cycle of a unit, including issuance, transfer and final use.[55] The different risks of double counting as identified above should be addressed with appropriate counter measures. This section considers relevant elements of approaches adopted or being designed under the UNFCCC, as well as at domestic level by countries making use of (mandatory or voluntary) crediting systems. The section starts with the debit and credit approach to address double claiming of emission reductions, and then considers the use of registry systems to avoid double issuance and use of emission reduction units.

3.2.1 Addressing Double Claiming: Debit and Credit approach

A credit and debit or double-entry bookkeeping approach, whereby emission reductions or units transferred between parties are debited by one party and credited by the other, are the central means to avoid double counting in cooperative approaches under Art. 6 of the PA.[56] This debit and credit system is known as corresponding adjustments in the PA jargon and is expected to be fully operationalised by the end of 2019, at COP 25, in Chile.

The debit and credit system is also applied, for instance, by the Kyoto Protocol and by the VCS. Under Kyoto, Annex I countries with a commitment inscribed in Annex B of the Protocol were allocated a pool of serialised electronic units (Assigned Amount Units – AAUs) equivalent to the countries' emissions budget calculated for each commitment period. Whenever a host country opted to make use of the Joint Implementation mechanism and authorised the issuance of an Emission Reduction Unit (ERU) for a mitigation project, an equivalent amount of AAUs to the JI project emission reductions are converted into ERUs for the host country. The ERU could, therefore, be transferred out of the host country without leading to a double counting of units. Similarly, the VCS determines that, when a mitigation activity takes place in an Annex I/B country, AAUs equivalent to the number of VCUs being requested must be cancelled before VCUs are issued.

The use of corresponding adjustments under the Paris regime is necessary to avoid that two country parties claim the same emission reduction towards their respective NDCs. Guidance is also being considered to avoid the use of an emission reduction towards achievement of a country's NDC and the use of the same emission reduction for a purpose other than towards achievement of its NDC, such as under CORSIA. A number of alternatives for the method and timing of corresponding adjustments are being discussed under the UNFCCC, including:

1. When corresponding adjustments are needed (the moment in time they should be applied and for which instances), and how these corresponding adjustments need to be reported by countries;
2. Whether countries transacting mitigation outcomes need apply corresponding adjustments on the same accounting basis;

[55] Schneider, Kollmus and Lazarus (2014) Addressing the risk of double counting emission reductions under the UNFCCC. Stockholm Environment Institute (SEI). Available at https://bit.ly/2H7yyK7.
[56] Schneider, Kollmus and Lazarus (2014) Addressing the risk of double counting emission reductions under the UNFCCC. Stockholm Environment Institute (SEI). Available at https://bit.ly/2H7yyK7.

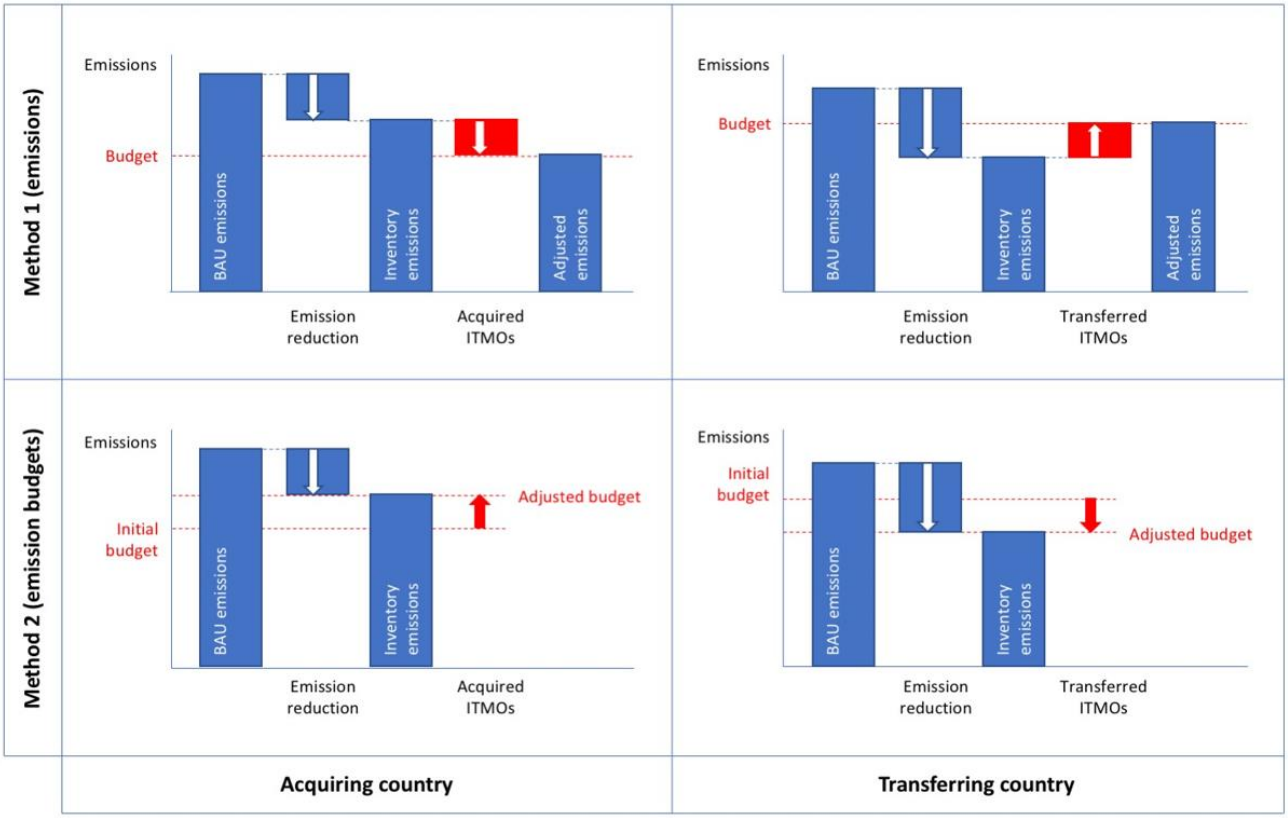
3. Whether participation in Art. 6.2 cooperative approaches will require countries to have their own registry system in place or if access to a central registry or a distributed ledger suffices;
4. Whether Article. 6.4 units must be subject to corresponding adjustments, including in situations of first international transfer and the use of crediting to achieve the conditional component of NDCs of host countries, and cancellation for voluntary climate action or as results-based climate finance.[57]

Below features an overview of the possibilities and alternatives being considered for method and timing for effecting corresponding adjustments.

Method for corresponding adjustments

Two main methods for ensuring corresponding adjustment are considered. From an accounting perspective, both methods equally ensure environmental integrity by guaranteeing that no increase in emission reductions will take place as a result of a transferred emission reduction (see Figure 13).

Figure 13: Methods for corresponding adjustments for Internationally Transferred Mitigation Outcomes (ITMOs)



Source: Climate Focus, Koru Climate, Perspectives (2017) Features and Implications of NDCs for Carbon Markets

- **Emission-level adjustments (method 1),** where the GHG inventory of the participating country is the starting point for the calculations. The adjustment does not change the inventory itself, rather, parallel tables in the inventory show an adjustment to the 'inventory emissions', resulting in the 'accounted emissions'. Emission-level adjustments are

[57] SBSTA 48 Revised draft elements of guidance on cooperative approaches referred to in Article 6, paragraph 4, of the PA. Version of 8 May 2018.

relatively simple as they are based directly on a GHG inventory and do not require calculating an emissions budget.

- **Budget-based adjustments (method 2),** where NDCs are converted into emission budgets and adjustments are made directly to these budgets. The resulting 'adjusted budget' represents the emissions of a country including transferred emission reductions. Opting for budget-based adjustments requires the calculation of an emissions-budget based on the NDC.

The two accounting methods are not mutually-exclusive, and countries may eventually be free to adopt either approach, or a mix of approaches for internal or bilateral purposes.[58]

Timing of corresponding adjustments

Four alternatives are being considered under the Paris Rulebook negotiations for the timing of corresponding adjustments. Corresponding adjustments could be made at the moment of *creation or issuance of a unit,* or when recorded in the centralised accounting database.

A second option would be to apply the corresponding adjustment at the moment of *transfer of a unit* to a recipient party. By applying a corresponding adjustment at the moment of transfer, the transferring party recognizes that it will no longer use the emission reduction, independent of how the acquiring party will use the unit. This approach requires a relatively simple accounting process, as little communication between the transferring and acquiring party is required.[59] Moreover, there would be an atmospheric benefit if the unit were not used by the acquiring party.

A third option would be to have a corresponding adjustment at the moment of *use of an acquired unit* by the recipient for compliance with its NDC. This would require a process that informs a host country that a transferred unit is used by the acquiring party. Until this happens, the host country has no certainty over whether it may use the emission reduction.

Finally, corresponding adjustments could occur periodically, for example at the time a country is *submitting its national GHG inventory report*, as per Article 13.7 of the PA, or when demonstrating NDC achievement.

3.2.2 Addressing Double Issuance and Use: Full-Fledge Registry

Accurate and transparent tracing of emission reduction units is a second element to address double counting. A registry system contributes to avoiding double issuance of units and can facilitate the use of corresponding adjustments.

A system used to register emission reduction units can take a variety of forms, ranging from credit registries that have a bookkeeping function, to databases or a collection of information on the rules and procedures of a programme. A broad distinction between a "register" and a "registry" can be made. A register is a data and reporting management tool, recording information specific to a carbon unit such as serial numbers, identity or location. A full-fledge registry or "transaction registry", on the other hand, is

[58] Climate Focus, Koru Climate, Perspectives (2017) Features and Implications of NDCs for Carbon Markets. For SEA, BMUB and FOEN. Available at https://bit.ly/2Jf0npf.
[59] *Ibid*

a more elaborate system that functions as a transaction platform. It is often an online database that records emission reduction units and has the capacity to transfer carbon units between account holders within the registry or to other transaction registries or a trading platform. Importantly, the credits held in a transaction registry are normally treated as financial assets, resulting in more stringent governing rules and regulations.[60]

Emerging requirements from CORSIA and the Article 6 negotiations give insight into what should be considered in designing a national registry which is both nationally appropriate as well as internationally compatible, so that can be linked with the central CORSIA registry.

CORSIA

The set-up of CORSIA requires that participating states develop (individually or in cooperation with others) a registry system that can safely store and process information related to offset transactions, and importantly, that can communicate with the central CORSIA registry.[61] This registry will provide records of international aviation emissions, operator's offsetting requirements, and records on the purchase, ownership, transfer and surrender of emission units within the registry.[62] Registries of parties wishing to interact with the CORSIA central registry should be compatible with its features.

The ICAO Council will develop policies and guidance material to support the establishment of registries by 2018 as Member States are requested to develop 'necessary arrangements' for the establishment of their own registries or participation in group registries, following ICAO guidance.[63]

For a national registry to be able to communicate with the CORSIA central registry, it will need to have an electronic database that stores the information that is compatible with the information stored in the CORSIA database. Moreover, the registry should be equipped and authorised to transfer units to an external registry. Finally, the registry should record MRV information on emission reduction units that enables public verification of the transferred units. This may include project documentation and verification reports for the relevant emission reductions.

UNFCCC and the PA

As part of the ongoing negotiations on cooperative approaches and market mechanisms in Article 6 of the PA, Parties are negotiating required elements of registries as a possible participation requirement for market-based approaches. If registries are eventually required by CMA guidance, they would likely be required to perform some, or all, of the functions below:[64]

- Creation, issuance, transfer and acquiring of units, and, to facilitate this, have an issuance, holding, transfer, acquisition, cancellation, retirement and share of proceeds account. Optionally, registries could be required to have a cancellation account for overall

[60] Partnership for Market Readiness (PMR) and Forest Carbon Partnership Facility (FCPF) (2016) Emissions Trading Registries: Guidance on Regulation, Development, and Administration. World Bank, Washington, DC.
[61] ICAO Seminar on CORSIA: Emissions Units and Registries. Available at: https://bit.ly/2sgthbr.
[62] ICAO Secretariat (2017) CORSIA. 5. Emission Units and Registries. PowerPoint presentation. Available at https://bit.ly/2J2CXDW.
[63] ICAO Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme. Para 20. Available at https://bit.ly/2LbDxfn.
[64] SBSTA 48 Revised draft elements of guidance on cooperative approaches referred to in Article 6, paragraph 2, of the PA. Version of 8 May 2018.

mitigation of global emissions. This is a political decision to be made by the negotiating parties;
- Determining unique serial number for each unit;
- Demonstrating that units have been used towards achievement of an NDC;
- Ensuring the avoidance of double counting.

Box 2: Features of Existing Registries

Existing registries give insight into the different elements that can be considered when assessing the options to mitigate the risk of double counting in the Turkish context:

- **National registries under the UNFCCC.** The Kyoto Protocol introduced emissions trading into the international climate regime and required developed countries to set up national registries to account for their emission allowances. The registries have to be able to process different types of carbon units (AAUs, ERUs, CERs and RMUs), and contain accounts in which units are held by the government, or an entity authorised to hold and trade the units. The registries are able to 'settle' emission trades by moving units between sellers and buyers, and are linked to the International Transaction Log, which registers transactions in real time.[65]

- **Emission Trading System (ETS) registries** are designed as a central registry that holds different accounts for parties participating in the scheme.[66] The registry tracks the exchange and surrender of units by entities operating under the scheme. An additional transaction log can serve as an additional system to the registry, to automatically check and record transactions between the accounts, with the specific aim of avoiding double counting.[67]

- **Registries of project mechanisms** serve specific emission trading mechanisms.[68] These registries normally include accounts into which units are issued and then transferred outward (e.g. to an account in a national registry or registry under an emission trading scheme). No inward transfers are typically permitted.

- **Registries of voluntary carbon markets** often co-exist with compliance markets and have established their own registries. The infrastructure for these registries is often provided externally, and consists of a web-based platform, an account management tool for registration, numbering, tracking and retirement of offset units.

Institutional and legal considerations

Following Article 6 guidance and emerging CORSIA requirements, as well as experience with existing registry systems, institutional and legal considerations are relevant in designing an appropriate registry system. The institutional set-up of a registry determines the allocation of responsibilities amongst the different participating stakeholders: the regulator, the administrator and the account holders. The responsibilities of each stakeholder can be allocated through legislation or contractual

[65] UNFCCC Registry Systems under the Kyoto Protocol. Available at https://bit.ly/2LbEft3 Accessed 17 May 2018.
[66] For example, the EU ETS has a Union registry that is managed and operated by the European Commission, and each participating country has a national registry section. More information available at https://bit.ly/2L8XnI5.
[67] See, for example, the transaction log of the EU ETS. More information available at https://bit.ly/2L8XnI5.
[68] See, for example, the CDM registry, which issues and registers CERs that could be transferred to national registries.

agreements,[69] for example, contracts with parties that wish to hold an account in the registry. Table 8 gives an overview of the different entities and roles involved.

Table 8: Entities involved in a registry[70]

STAKEHOLDER	RESPONSIBLE ENTITY	TASKS
Registry regulator	• Public authority that has power and resources to investigate and intervene when appropriate	Ensuring the correct functioning of the system; ensuring that the registry complies with national regulation; deciding over the allocation of carbon units
Registry administrator	• Government entity or an independent (private) third party, specialised in markets and related infrastructure • Can be the same entity as the registry regulator	In charge of the management, operational and supporting processes on a day-to-day basis, such as monitoring transfers
Account holders	• Responsible entity and owner of the units held in the account	Transfer and cancellation of units

In turn, the legal framework covering the registry system is dependent on the type of system that is preferred – a transaction registry requires a more complex legal framework than a register, given that the units in a transaction registry can be treated as financial assets, requiring a more stringent supportive legal framework. Importantly, legal rights to carbon units should be treated similarly among linked registries to avoid legally incompatible platforms. Table 9 gives an overview of primary and secondary legislation that should be considered when setting up a full fledge registry. Importantly, a transparent and sound legal framework enhances the confidence of investors to participate in the mechanism.

[69] Partnership for Market Readiness (PMR) and Forest Carbon Partnership Facility (FCPF) (2016) Emissions Trading Registries: Guidance on Regulation, Development, and Administration. World Bank, Washington, DC.
[70] Partnership for Market Readiness (PMR) and Forest Carbon Partnership Facility (FCPF) (2016) Emissions Trading Registries: Guidance on Regulation, Development, and Administration. World Bank, Washington, DC.

Table 9: Legal framework of a registry system[71]

LEVEL	SCOPE
National, primary legislation	Establishing the legal status of the registry Authorisation of body to develop necessary rules and tools, including the database, and the legal status of the registry administrator Monitoring, reporting and verification obligations for domestic programs Transparency requirements Regulating the use of data, including protection of personal and confidential information If required, adaptation of existing laws and regulations on: • Property law, including legal nature of a carbon unit • Enabling electronic and automated trading of units • Financial instruments to cover carbon credits • Tax provisions • Insolvency
Secondary legislation	Regulation of the use of data Data formatting Data reporting requirements Account holder rights

3.3 Emission Reductions Management to Avoid Double Counting in Turkey

As discussed in the previous sections, negotiations on the rules and procedures governing Article 6 of the PA are ongoing and are expected to be finalised by the end of 2019. Likewise, the CORSIA SARPs are still to be adopted by the ICAO Council. Based on the ongoing negotiations in both fora, and on existing practice of the Joint Implementation, voluntary carbon markets and existing ETS, the following components are likely to be needed to prevent double counting:

- a debit and credit approach will be required for internationally transferred emission reductions that take place in a sector covered by the host country's NDC.
- the establishment of a registry for those countries willing to engage more meaningfully with markets (as opposed to sporadic one-off transactions on a government-to-government basis).
- participation in CORSIA will also require the establishment of a registry system.

Turkey established a national registry for voluntary carbon markets in 2010. Launched by the Turkish Ministry of Environment and Forestry, the registry is regulated by the Communiqué on Procedures for Registration of Greenhouse Gas Emission Reduction Projects.[72] While Turkey has long been engaged in trading certificates for carbon projects in the voluntary

[71] Ibid
[72] Çevre ve Orman Bakanlığı (2010) Sera Gazi Emisyon Azaltımı Sağlayan Projelere: İlişkin Sicil İşlemleri Tebliği. Resmî Gazeteç Available at: https://bit.ly/2xIsZCx.

carbon markets (since 2005), the registration of projects was dispersed (projects were registered under the Gold Standard and VCS with no centralised overview of the number of projects and their emission reductions in place).[73] The national voluntary carbon registry serves to register and monitor voluntary carbon projects and record transactions.[74] Thus far, there are 14 projects registered in the national voluntary carbon registry, while around 300 Turkish carbon projects have been registered in the two registries used by the two carbon standard (Markit and APX).

Whereas accounting through corresponding adjustments and the establishment of a registry system comprise the elements to address double counting, as required for participation of the Turkish energy sector in CORSIA, Turkey can consider to implement additional regulations to facilitate the avoidance of double counting and more quickly position the country as a credible and robust supplier of offsets.

The usage of Turkish emission reductions domestically and internationally could be regulated by establishing an emission reduction management system (see Table 10).[75] The management system would determine the use of which type of emission reduction units is limited to domestic use and NDC compliance, and which emission reductions can be transferred or traded internationally. Such a system would contribute to eliminating double claiming, as each emission reduction is transparently earmarked for either domestic or international use, excluding the possibility of claiming the unit both by the host country and acquiring party. Moreover, having in place a transparent management system for the usage of emission reductions creates predictability for investors looking to finance renewable energy and energy efficiency projects and technologies in Turkey. As such, the regulated system can steer investments in the Turkish energy sector.

Table 10: Regulating the use of emission reductions post 2020/2021

Crediting pre-2020/2021	Crediting post 2020/2021
Context: Under this scenario, these credits relate to emission reductions realised before the start of the Turkish NDC. As such, there is no risk of double claiming in the context of NDC compliance.	**Context**: Under this scenario, credits relate to emission reductions realised after the start of the Turkish NDC. There is therefore a risk of double claiming.
Implication: Credits can be used for offsetting if allowed by CORSIA's eligibility criteria.	**Implication:** **Scenario 1:** no restrictions. Voluntary carbon project portfolio will remain in position to issue carbon credits that can be purchased under CORSIA. **Scenario 2:** Management through a set-aside. Can also include (national or international) restrictions on types of projects, vintages, etc.

[73] UNDP (2010) Türkiye'nin artık bir karbon sicili var. Available at https://bit.ly/2J9XJBD [English and Turkish].

[74] Çevre ve Orman Bakanlığı (n.d) Gönüllü Karbon Piyasalarında Kayıt Sistemleri. Available at https://bit.ly/2kDNU0r [English and Turkish].

[75] This management system could form an integral part of the legal framework that will regulate NDC implementation in Turkey.

In light of the above, different regulatory arrangements for managing emission reductions can be considered.

I. **Allow the private sector to continue engaging in international transfers with an obligation to report such transfers, and without any regulatory import or export restrictions.** To avoid double counting, Turkey essentially needs to ensure that upon receiving the unit transfer information an accounting adjustment (a debit or credit, as applicable) is made for each emission reduction or mitigation outcome transferred internationally and then used by another country or entity under e.g. CORSIA or the UNFCCC. A registry system can ensure this is achieved in a consistent and transparent manner, facilitating tracking and reporting of a high volume of transactions and units.

Restrictions may however be relevant and needed if Turkey opts to establish an emissions management strategy that secures achievement of its NDC, while tapping into new international carbon market revenue streams:

II. **Create a separate account for ERs that may be sold to CORSIA.** A second consideration foresees the creation of a “separate account” or “set aside” for emission reductions that are earmarked for CORSIA. This management system would be modelled after the Joint Implementation set-aside, where participating countries have chosen to create a set aside amount of ERUs. This reserve is then cancelled progressively while the ERUs are issued. In this scenario, Turkey would determine a set amount of emission reductions that is to be exclusively used for CORSIA, based on considerations such as technologies most likely to be eligible for CORSIA, abatement costs, and likelihood of impacting negatively on the country’s own NDC achievement, among others. The credits in this separate account are cancelled progressively while they are issued to project developers that implement eligible projects. The emission reduction units in the set aside are earmarked for CORSIA usage, and as such cannot be used for domestic compliance purposes and avoids double claiming of these units. Moreover, the set aside will create competition amongst investors that look to sell credits for CORSIA compliance want to participate in CORSIA as credits are allocated on a first-come first-served basis. This could accelerate sustainable energy investments in the Turkish energy sector.

In both scenarios, Turkey has the option to buy international credits in case of an NDC shortfall. Applying similar reporting procedures and accounting adjustments that provide for environmental integrity in an export scenario, Turkey could source international credits from the international market for the purposes of meeting its NDC obligation.

4. Considerations

The considerations presented in this final chapter are grouped around (i) understanding the implications CORSIA will have and can have on the Turkish carbon market; (ii) management of emission reductions generated pre- and post-2021; and (iii) the steps to be taken by the Turkish government to ensure environmental integrity of its climate actions.

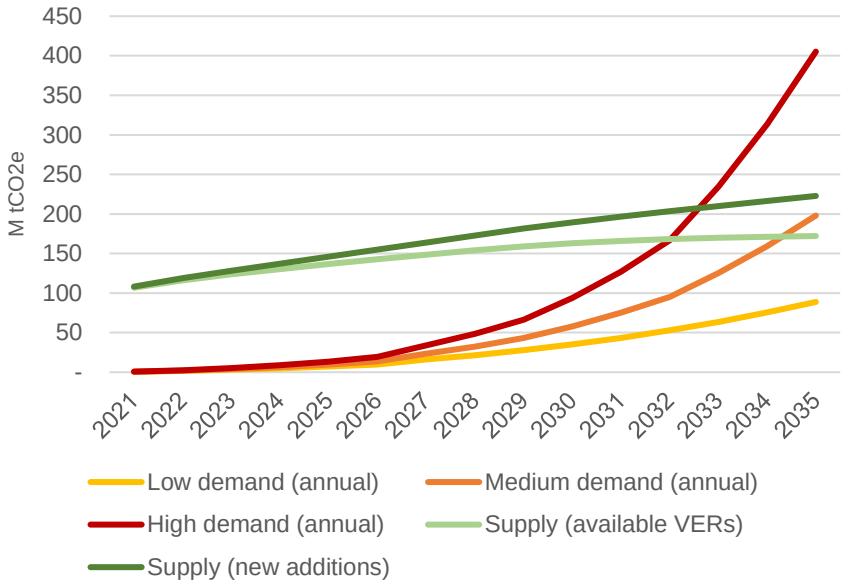
4.1 CORSIA and the Turkish Carbon Market

The implications of the final offset eligibility criteria agreed under CORSIA on the domestic carbon credit supply

CORSIA is expected to impose wider governing principles for eligible offsets rather than defining specific eligibility criteria on the individual project level. This implies that voluntary schemes including the Gold Standard and the VCS will likely be included, and that at least a share of the emission reductions generated by Turkish carbon projects will be eligible for compliance.

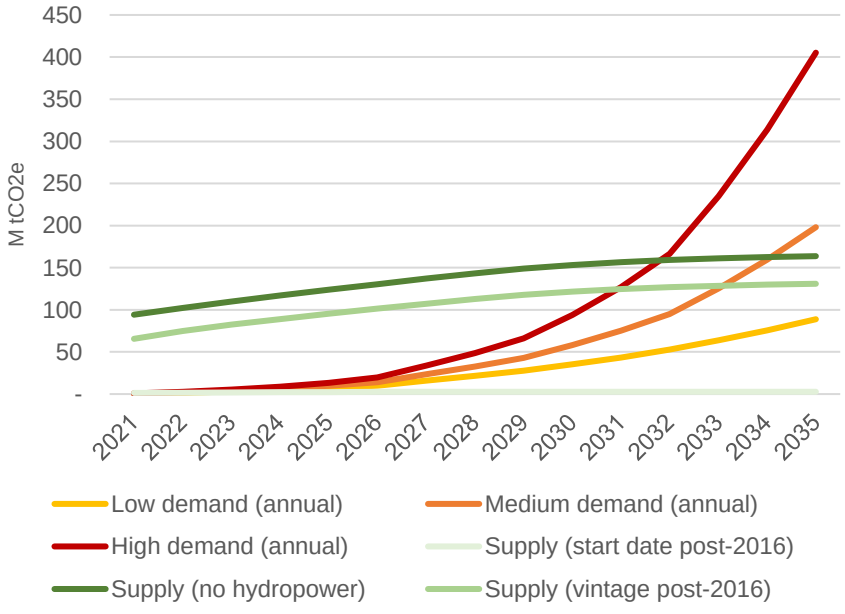
The different scenarios presented in Chapter 2 provide insight into how existing domestic supply will compare against the expected demand coming from the Turkish aviation industry. The outcome indicates that when the base case scenario supply is adjusted for the volumes of Turkish VERs already transacted (c.a. 40 million in the period covering 2006 to 2018), the current portfolio of projects will not be sufficient to meet the domestic demand of the Turkish airline operators that will be covered under CORSIA. As illustrated in Figure 14, the total cumulative supply of available credits reaches 170 million by 2035 (light green line), against the 196 million demanded by the domestic airline industry under the medium growth scenario (orange line) and 402 million under the high growth scenario (red line). This outcome is based on a legacy supply of projects and therefore would allow for opportunities for additional credit supply from new projects – domestically or abroad. When potential supply from new renewable energy capacities installed between 2020 – 2035 is included in the supply model, under the medium scenario an additional 50.7 million tonnes could be added (dark green line). Similarly, demand scenarios are considered only from the Turkish domestic perspective, while international aircraft operators may also represent a source of demand for Turkish carbon credits.

Figure 14: Comparing expected domestic demand for carbon credits from Turkish aircraft operators and base case supply adjusted for already transacted volumes (in cumulative terms)



When the volumes from the more restrictive supply models are assumed, it becomes evident that existing domestic supply will not meet the future demand projections from Turkish aircraft operators. These operators will also be able to source from carbon projects abroad.

Figure 15: Comparing expected domestic demand for carbon credits from Turkish aircraft operators against more restrictive supply scenarios



Impact of the assumed growth rate of emissions from Turkish aircraft operators

The analysis presented in this report builds on the CO_2 emissions growth rates shared by the DGCA. These include 4 per cent per year in the low growth scenario, 8 per cent per year in the medium growth scenario and 12 per cent per year in the high growth scenario. These growth projections

considerably exceed ICAO's medium scenario forecast of annual global aviation emissions growth of approximately 3 per cent.

Current projections suggest around 3 to 3.5 billion tonnes of CO_2 may need to be offset under CORSIA globally between 2021 and 2035. Taking the DGCA's growth projections, it appears that Turkey would be responsible for over 10 per cent of total demand under the high growth scenario, or 6 per cent when the medium growth scenario is used. This is on the high end. While it is recognised that growth of Turkey's aviation is expected to outperform this global average growth rate, the DGCA should evaluate whether these growth projections are realistic. It would be advisable for the DGCA to consider preparing more detailed scenario models assessing the impact of lower growth rates in future years combined with the effect of efficiency measures, such as fuel and operational improvements.

To provide insight into the potential range of domestic demand, Chapter 2 extrapolates the demand coming from Turkish aircraft operators assuming ICAO's 3 per cent medium growth trajectory. Under such assumption, total demand from Turkey is expected to reach 32.4 million tCO_2, versus the 196 million tCO_2 projected under the medium growth rate scenario provided by the DGCA. This would be equivalent to 1 per cent of total global demand foreseen under CORSIA, and could be fully met by domestic carbon projects under most supply scenarios.

4.2 Issues to be Considered in Management of Emission Reductions

Distinction between pre- and post-2021 emission reductions

This report makes a distinction between emission reduction units that are generated prior to the end of 2020 and those that are created from 2021 onwards. The reason for this separation is Turkey's NDC implementation timeline, which covers the period 2021 to 2030.

Crediting pre-2021
While the use of Turkish carbon credits generated from the start of 2021 may introduce double counting risks in the context of the NDC, emission reductions generated prior to 2021 do not. Depending on the final eligibility criteria to be agreed by the ICAO Council later this year, currently registered renewable energy and energy efficiency projects in Turkey would be able to generate up to 170 million tCO_2 (base case scenario adjusted for issuance success and the volumes already transacted). Both Turkish and international aircraft operators would be able to use these eligible credits for offsetting.

Once the offset eligibility criteria are approved by ICAO, aircraft operators around the world will start implementing offset purchase strategies that take into account both the timing and certainty of delivery and the associated purchase cost. To incentivise sourcing of Turkish carbon credits by aircraft operators, the Turkish Government could consider the organisation of a targeted campaign that communicates the quality of the Turkish emission reduction projects over international counterparts. This could be linked to the higher-level ambition of Turkey in the context of its PA pledges, or in relation to its renewable energy targets or National Energy Efficiency Action Plan. A functioning registry and accounting system will also need to be put

in place to properly track units and avoid the risk of double counting issues (see further below).

Crediting post-2021
Countries are currently in the process of negotiating a new rulebook under the Paris regime. This includes guidance for bilateral cooperative approaches between governments (Article 6.2 of the PA) and modalities for a new centralised mechanism (Article 6.4 of the PA). Whereas these mechanisms may at some point replace the current carbon market infrastructure, there is likely to be a transition period during which carbon markets operating as we know today will continue to exist once the NDC compliance cycle starts (2020 for most countries, 2021 in the case of Turkey).

One possible scenario is that the current voluntary carbon project portfolio will remain in the position to issue emission reduction offsets post-2021, which in turn may be purchased by compliance buyers covered under CORSIA. Alternatively, to meet its NDC commitments the Turkish government may need to impose certain restrictions that would limit carbon projects from generating transferrable emission reduction units post-2021, which in turn would reduce the potential supply coming from the Turkish energy sector and could restrict the crediting of new projects. Restrictions on the transferability of project types could relate to the project start date, project types, and the degree to which these activities are covered under Turkey's NDC. Whether Turkey imposes such restrictions will depend on the country's ability to achieve its current NDC target, as well as the potential for increased ambition if the NDC is updated. It will also depend on the actual demand for carbon offsets being generated by the Turkish airline industry, which could be material.

While the use of carbon credits with future vintages will likely need to be accounted for (i.e. deducted) in the country's NDC accounting, there is value in maintaining the option to allow for transferability of carbon credits to schemes like CORSIA. In this case, Turkey's energy sector will remain a beneficiary of domestic and international carbon revenues, which may contribute positively towards the achievement of the energy capacity and renewable energy targets.

4.3 Environmental Integrity

Fully-fledged domestic registry compatible with CORSIA and the PA
Turkey established a national registry for voluntary carbon markets in 2010, serving to register and monitor voluntary carbon projects and record associated transactions. Further developing the existing registry system into a fully-fledged registry compatible with CORSIA will be essential to help Turkey in successfully supplying credits towards the scheme as well as the new market mechanisms that are to be operationalised under the PA.

Under the PA, NDCs are self-determined and therefore there will be no trade in 'allowances' that will need to be transferred between registries post-2021. The registry should therefore be tailored to a baseline-and-credit system, with emissions reduction units being generated against a defined baseline. This is comparable to carbon market activities where emission reductions are calculated against a baseline scenario, in contrast to a system based on 'allowances' whereby emission caps are allocated on the national level (as was the case under the Kyoto Protocol). This implies that

the registry will need to have the capacity to both issue and transfer units, similar to the Markit Environmental Registry used by the Gold Standard.

The registry should also be linked to the national accounting system to monitor and report on its emissions and removals. When such linkage is established, any transfers of emission reductions post-2021 will need to be adjusted to avoid double counting. This should cover both project-level activities that transition from the current carbon market and new projects developed under Article 6.4 of the PA, or emission reductions generated under cooperative approaches as defined by Article 6.2. Given the expanded scope and the enhanced volumes traded through such registry, an electronic registry system with sufficient safeguards to prevent hacking can be considered minimum requirements. On the regulatory side, decisions will also need to be made concerning the legal nature of hosted emission reduction units and the tax implications of domestic and international transfers, amongst others. This is also crucial in relation to the role that Turkish financial institutions could play in trading carbon credits. Classification would determine how these financial institutions are regulated.

The extent of effort that is to be dedicated to the establishment of a registry will depend on whether Turkey decides to implement its own IT infrastructure, or whether it will opt to join other jurisdictions and adopt already existing registry processes. In either case, the operationalisation of a robust registry system will boost the position of Turkey as a seller of emission reduction units internationally, and should be considered a priority issue.

An immediate consideration for Turkey could be to start with updating the existing registry by coordinating linkages with the existing GS and VCS registries.

Transparent system for corresponding adjustments

Aircraft operators covered under CORSIA will consider certainty of timing and delivery and purchase cost when devising their offset purchase strategies. Countries that can timely establish a transparent system for corresponding adjustments will be considered as attractive sources of supply of offsets.

For participation in an international transaction under CORSIA it is instrumental to establish a transparent, publicly available and timely procedure of applying an accounting adjustment at the moment of the transfer of a unit. Turkey's accounting adjustment is as such made irrespective of how the unit is used by the acquiring party at a later stage. Often, compliance buyers will prefer engaging with systems that offer clear and predictable rules to dealing with uncertain regulations, largely informal procedures, and the risk of constant changes to the rules. Buyers under CORSIA would be a case point, where aviation companies would likely be more attracted to offset suppliers that can clearly and timely secure corresponding adjustment upon transfer of the emission reductions. Moreover, a corresponding adjustment at the moment of transfer ensures clarity and predictability to the international community scrutinising CORSIA. This consideration should be taken into account when designing the registry infrastructure discussed in the previous point.

Article 6 pilot in the energy sector

Countries have agreed on the majority of the Paris Rulebook during the 24th session of the Conference of the Parties (COP 24) in Katowice, Poland. However, agreement on the final text concerning Article 6 of the PA and the role of market mechanisms has been postponed to the next COP session, which will be held in Chile in December 2019. Once there is further clarity on Article 6 implementation modalities, the government of Turkey could consider piloting a possible Article 6 transaction in the renewable energy sector in Turkey to test the grounds for post-2021 emission reduction strategies.

Given the significant emission reduction potential of the existing carbon project pipeline, the possibility of a carbon portfolio transition into the PA provides an opportunity for Turkey to use existing activities and capacities to generate – and receive finance for – emission reductions in the energy sector. This is also in line with Turkey's NDC, which aims to use carbon credits from international market mechanisms to achieve its 2030 mitigation target in a cost effective manner.

A pilot Article 6 initiative targeting the renewable energy sector could generate emission reduction units that could attract different buyers. For instance, emissions reductions generated by the existing carbon projects finding their way to CORSIA. In turn, units generated by new investments could be transacted bilaterally between countries in the form of Internationally Transferred Mitigation Outcomes. Such pilot would also be instrumental in establishing and testing a national registry and related institutional processes. Once tested, the registry could then be expanded to include activities in other sectors covered by the NDC.

5. Appendix

Appendix A: Methodology used to determine the potential supply of carbon offsets from Turkish carbon projects

The supply scenarios presented in Chapter 3 have been calculated using all Turkish renewable energy and energy efficiency projects registered under two voluntary carbon standards, Gold Standard and the VCS. Both carbon standards make use of Markit and in the case of the VCS also APX for their registry services. The information used has been obtained from Markit's online project database[76], the VCS online database[77] and through direct communication channels with both standards for completion of any data gaps.

The total number of projects registered under the two carbon standards is 244. The Project Design Document of these projects was used as the primary source of information. The following data was extracted from each project:

(i) **Applied carbon standard:** distinguishing between the Gold Standard or the VCS;
(ii) **Project type:** distinguishing between Renewable Energy (e.g. hydropower, wind power, geothermal power, solar PV) and Energy Efficiency (e.g. waste heat recovery);
(iii) **Installed capacity in MW:** for renewable energy projects only;
(iv) **Project status:** two main categories of projects have been included in this assessment. These include projects that have reached registration and activities that have successfully issued carbon credits;
(v) **Project start date:** this marks the date that the project initiates GHG mitigation activities. Due to the incompleteness of the Markit and APX project databases and lack of information on project registration dates, the project start date has been used as a proxy for the date from which carbon credits can be issued;
(vi) **Duration of the crediting period:** carbon projects typically apply a single 10 year crediting period or a 7 year crediting period that can be renewed twice (e.g. 21 years in total). Upon renewal of the crediting period, a project's baseline scenario has to be updated to reflect the passage of time. The most relevant update applicable to the projects assessed in this report is the change in the national grid emission factor, which can drop over time as more renewable energy generation capacity is added. In the Turkish project pipeline, most registered apply a 7 year crediting period and therefore renewals are applicable and will impact the emission reduction potential of these projects. For the purpose of the supply scenarios, discount factors of 10 per cent have been applied upon renewal of each crediting period[78];

[76] https://mer.markit.com/br-reg/public/index.jsp?entity=project&nam
[77] http://vcsprojectdatabase.org/#/home
[78] The applicable national grid emission factor – the key determinant of the GHG mitigation potential of one MWh generated by a renewable energy project - has been reduced by 10 per cent upon each crediting period renewal. This means that in its third crediting period a typical renewable energy project will generate 80 per cent of the emission reductions forecasted in the PDD.

(vii) **Emission reduction potential:** to establish the overall supply potential of Turkish VERs from renewable energy and energy efficiency projects, the annual emission reduction volumes in tonnes of CO_2 equivalent listed in the listed PDDs have been assumed. To ensure conservativeness, an average issuance success rate of 85 per cent has been applied in the supply scenarios to reflect the likelihood that realised GHG emission reductions will be lower than the ex-ante estimations presented in the original PDDs.[79]

As 34 projects did not contain a Project Design Document on the registry, secondary documents such as Gold Standard Passports or Stakeholder Consultation Reports have been used instead to collect the above data. As project start dates are lacking in these documents, other events have been used as proxies to determine a plausible starting date for the projects. Most commonly the stakeholder consultation date was used to estimate the project start date (assumed 6 months before consultation) and the first year of the crediting period (assumed 12 months after the consultation).

The online databases also include some information on projects that are under validation or validated. However, as in most cases not enough information was available and the likelihood that these projects would be able to generate credits would be lower, these projects have been excluded from the scenario calculations.

Appendix B: Calculating offset requirements

The following formulas defined in Paragraph 11 of Assembly Resolution A39-3 are to be used to calculate the offset requirements for airlines covered under CORSIA:[80]

a) an aircraft operator's offset requirement = [% Sectoral × (an aircraft operator's emissions covered by CORSIA in a given year × the sector's growth factor in the given year)] + [% Individual × (an aircraft operator's emissions covered by CORSIA in a given year × that aircraft operator's growth factor in the given year);
b) where the sector's growth factor = (total emissions covered by CORSIA in the given year – average of total emissions covered by CORSIA between 2019 and 2020) / total emissions covered by CORSIA in the given year;
c) where the aircraft operator's growth factor = (the aircraft operator's total emissions covered by CORSIA in the given year – average of the aircraft operator's emissions covered by CORSIA between 2019 and 2020) / the aircraft operator's total emissions covered by CORSIA in the given year;
d) where the % Sectoral = (100% – % Individual) and;
e) where the % Sectoral and % Individual will be applied as follows:
f) from 2021 through 2023, 100% sectoral and 0% individual, though each participating State may choose during this pilot phase whether to apply this to:
g) an aircraft operator's emissions covered by CORSIA in a given year, as stated above, or an aircraft operator's emissions covered by CORSIA in 2020.

[79] Issuance success rates are based on the historical issuance rates from the CDM. These include 84 per cent for hydropower, 85 per cent for wind power, 89 per cent for geothermal, 95 per cent for solar PV, 86 per cent for industrial energy efficiency.
[80] An Airline Handbook on CORSIA (2018) Third edition. Revised, November 2018.