CIVIL AVIATION AUTHORITY OF THE PHILIPPINES

2022-2025

ACTION PLAN ON C02 EMISSION REDUCTION (#2)

29 JUNE 2022

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EXECUTIVE SUMMARY

This action plan describes the engagement of CAA Philippines with the relevant aviation stakeholders (i.e. airlines, air navigation service providers) to reduce and mitigate CO2 emissions from international aviation. In this edition, the ICAO Doc (9988) 3rd edition, was used as basis for the design of the baseline scenario without mitigation measures and the scenario with mitigation measures. Collaborative efforts from the aviation stakeholders supported the development of this plan. The engagement of the affected stakeholders allowed to identify applicable mitigation measures and indicators to be monitored within three years of SAP implementation.

The Action Plan sets an ambitious goal to reduce CO2 emissions through the implementation of the following mitigation measures:

(1) Single Engine Taxi In
(2) Reduced Acceleration Altitude (RAAL)
(3) Single Engine Taxi Out
(4) Idle Reverse Thrust (REVT)
(5) Minimize adding unnecessary extra fuel

The expected result in terms of emissions reduction in absolute value if the annual traffic increase by 2% and 5.8% respectively are the following:

Year	Annual Traffic Increase by 2%		Annual Traffic Increase by 5.8%	
	Emissions reduction (tCO2)	**Emissions reduction (%)**	**Emissions reduction (tCO2)**	**Emissions reduction (%)**
2021	4,058	0.26%	4,058	0.26%
2022	13,451	0.52%	13,605	0.53%
2023	15,172	0.37%	15,492	0.37%
2024	15,294	0.29%	15,794	0.30%
2025	15,613	0.24%	16,305	0.25%
2026	15,700	0.22%	16,599	0.24%
2027	16,014	0.22%	17,562	0.24%
2028	16,335	0.21%	18,581	0.24%
2029	16,661	0.21%	19,659	0.25%
2030	16,995	0.20%	20,799	0.25%
2031	17,334	0.20%	22,005	0.25%
2032	17,681	0.20%	23,281	0.26%

2033	18,035	0.19%	24,632	0.26%
2034	18,395	0.19%	26,060	0.27%
2035	18,763	0.18%	27,572	0.27%
2036	19,139	0.18%	29,171	0.27%
2037	19,521	0.17%	30,863	0.28%
2038	19,912	0.17%	32,653	0.28%
2039	20,310	0.17%	34,547	0.28%
2040	20,716	0.16%	36,551	0.29%
2041	21,131	0.16%	38,670	0.29%
2042	21,553	0.15%	40,913	0.29%
2043	21,984	0.15%	43,286	0.30%
2044	22,424	0.15%	45,797	0.30%
2045	22,872	0.14%	48,453	0.30%
2046	23,330	0.14%	51,263	0.31%
2047	23,797	0.14%	54,237	0.31%
2048	24,272	0.13%	57,382	0.32%
2049	24,758	0.13%	60,711	0.32%
2050	25,253	0.13%	64,232	0.32%

Furthermore, the Philippines is exploring other activities able to decarbonize the aviation sector aligned with the ICAO Long-Term Aspirational Goals and Net-Zero Target by 2050. Specifically, the Philippines has voluntary participated in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) since December 2018.

Approved By:

CAPTAIN JIM C. SYDIONGCO
Director General

Section 1: Background and contact information

1.1. CAAP Contact Information

1. Name of the Authority	CIVIL AVIATION AUTHORITY OF THE PHILIPPINES (CAAP)
2. Name of the Focal Point/s	Engr. Vincent Paul P. Galdones
3. Country	PHILIPPINES
4. Address	MIA ROAD, PASAY CITY, MANILA PHILIPPINES
5. Telephone Number E-mail Address	(02) 7944-2007 I galdz_vil@yahoo.com

1.2. Overview of Civil Aviation in the Philippines (structure)

1.3. Airlines (list and contact details)

Airline Operators	IATA	ICAO
1. Philippine Airlines	PR	PAL
2. Cebu Pacific Air	5J	CEB
3. Philippines Air Asia	AK	AXM
4. AirPhil Express	2P	GAP
5. Pan Pacific Air	8Y	AAV

1.4. Airports (list and contact details)

Name of Airport Authority	Number of Airports (Domestic and International)
1. Civil Aviation Authority of the Philippines	80
2. Other Airport Authorities	6

1.5. Air Traffic Management Infrastructure (contact details)

1. Air Traffic Service	A service directly reporting to the Deputy Director General for Operations and the Director General.
2. Air Navigation Service	

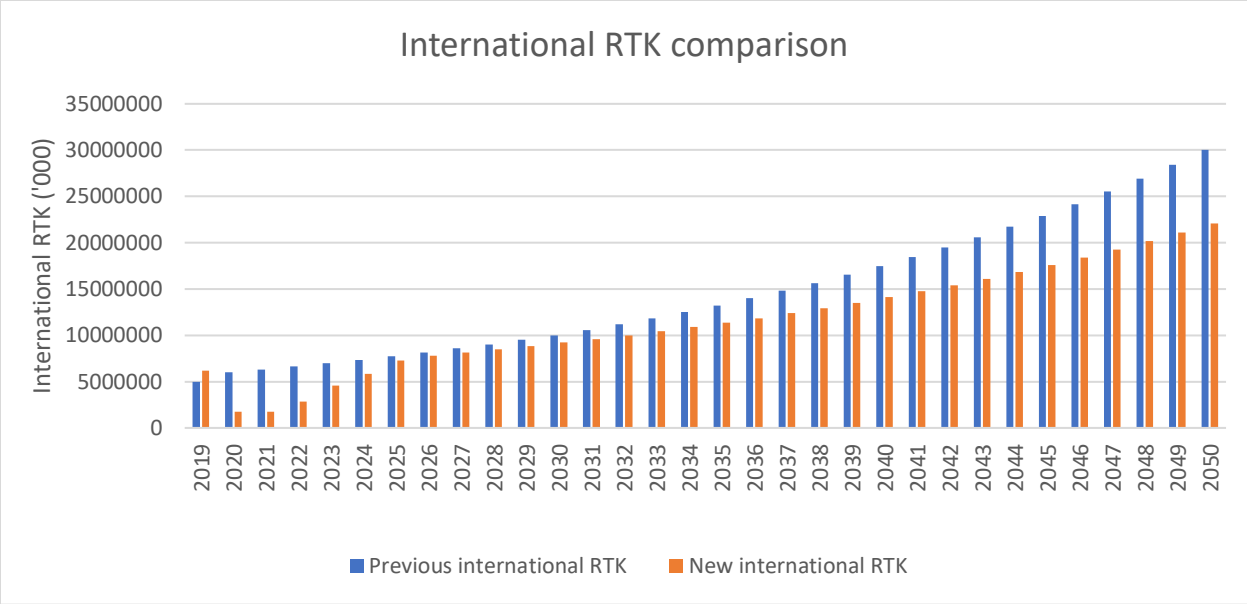
Section 2: Revision of the previous State Action Plan

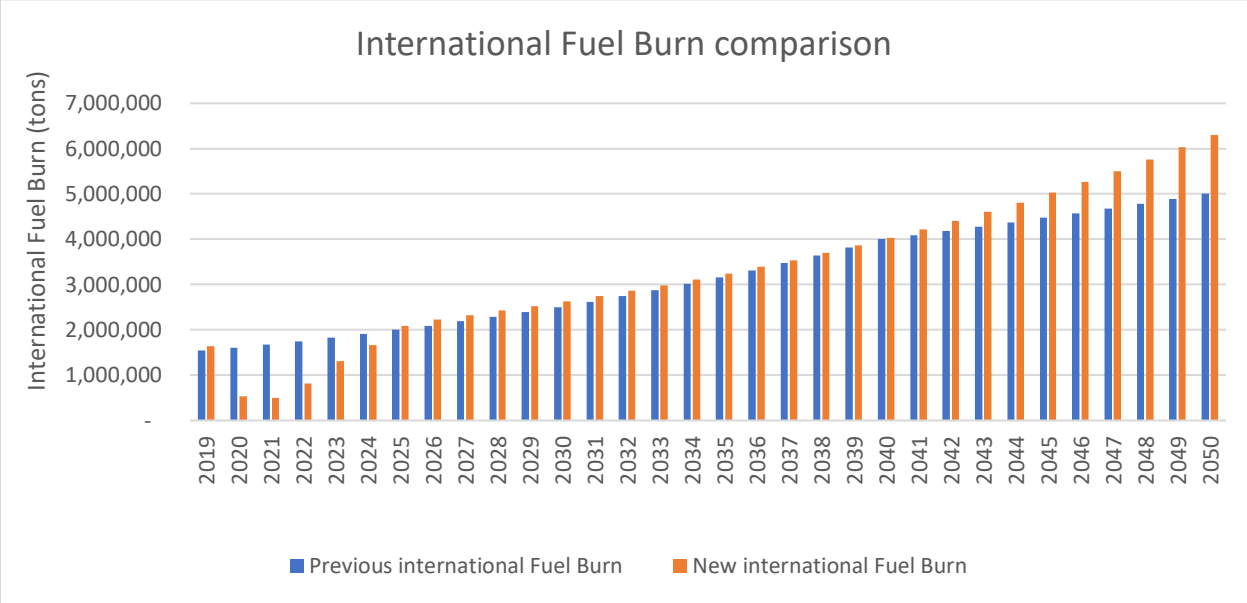
2.1. Revision of the previous State Action Plan

The Civil Aviation Authority of the Philippines has decided to prepare a brand-new version of the State Action Plan.

The previous State Action Plan was developed based on international Revenue Tonnes Kilometer (RTK) and international fuel consumption estimated by ICAO. International RTK was estimated based on Official Airline Guide (OAG) data for the two main airlines registered in the Philippines, while the fuel consumption was derived from the ICAO Carbon Calculator. Therefore, a new baseline was developed based on actual historical data (i.e., international RTK and international fuel burn) shared by the three main operators. This new baseline also takes into consideration the impact of the Covid-19 pandemic crisis.

The two following graphics show the difference between the two State Action Plans in terms of international RTK and international Fuel Burn. More information on the development of the international fuel burn and international RTK projections is provided in Section 3.





2.2. Previous mitigation measures

Regarding the lists of mitigation measures, it has been decided to narrow down the number of mitigation measures to better track the benefit resulting from the implementation of the actions. Furthermore, the Covid-19 pandemic crisis impacted some of the mitigation measures previously selected which led to the addition and removal of mitigation measures. Operational mitigation measures, such as single-engine taxiing, have been prioritized instead of medium/long-term mitigation measures.

Section 3: Baseline scenario

3.1. Baseline scenario development

The development of the baseline scenario is one of the most important steps while preparing a State Action Plan. Indeed, the baseline will be the reference against which the State will assess the impact of implementing mitigation measures and against which the progress will be monitored.

To develop a baseline scenario, two essential inputs are required: the historical international RTK and the historical international fuel consumption. By using these two pieces of information, the historical international fuel efficiency can be calculated and forecasted on one side and another side, it is important to forecast the international RTK. Eventually, by combining the international fuel efficiency and international RTK forecasted, international fuel consumption forecasted can be derived.

The baseline scenario is based on three airlines covering 2019 to 2020 (even though 2018 data was available for one operator).

Data collected from FORMs M included international fuel consumption and international RTK. Based on this aggregated information (i.e. the sum of international fuel consumption and international RTK), international fuel efficiency has been calculated on an annual basis by dividing international fuel consumption per international RTK.

3.2. Fuel efficiency forecast

The international fuel efficiency has been forecasted up to 2050 by using the 2019-2020 fuel efficiency average. Other forecasting technics such as Linear trend, Logarithmic trend or Exponential trend were discarded because only two years of data were available (not statistically viable) and because between 2019 and 2020, it has been noticed a deterioration in the fuel efficiency. Indeed, it is not realistic to assume that fuel efficiency will deteriorate every year until 2050.

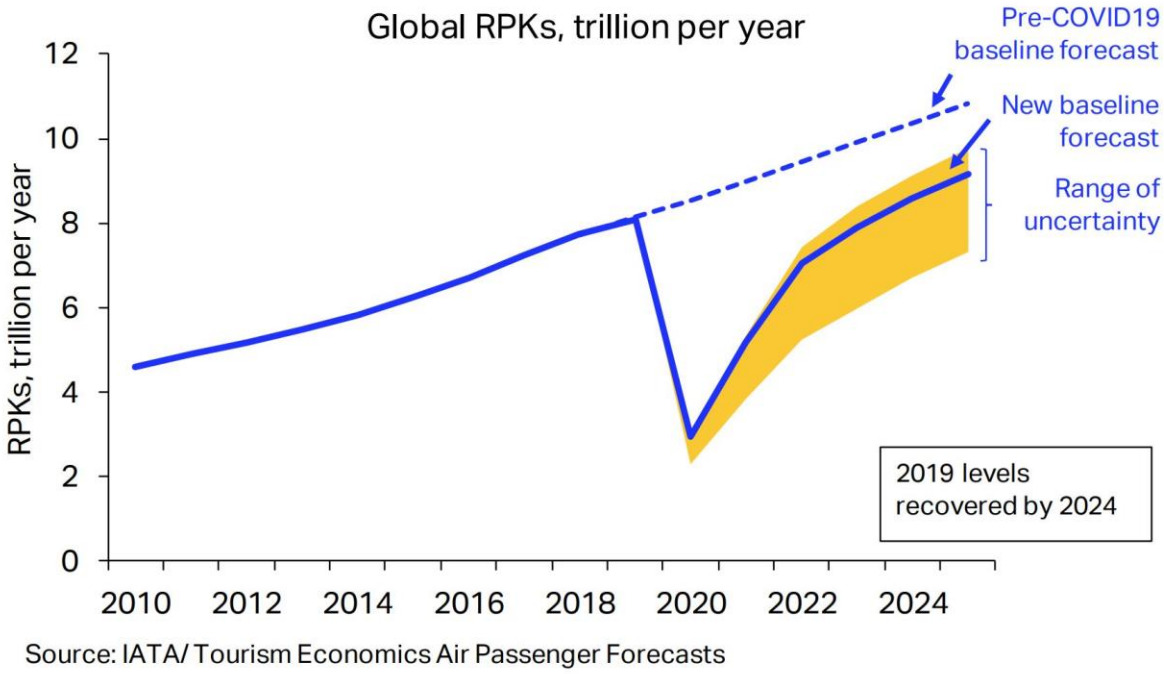
Therefore, the approach that has been selected was to calculate the average fuel efficiency based on the 2019-2020 period and assume it as constant up to 2050. In the case of the Philippines, the average fuel efficiency calculated is equal to 0.286.

3.3. International RTK forecast

The second step consisted of forecasting international RTK up to 2050. Two airlines out of three shared their international RTK projection. Amongst the two airlines having shared their forecast, one airline shared the total RTK (i.e., international and domestic RTK). Based on the ICAO FORMs M received, it was noticed that on average, international traffic accounted for

approximately 55%. The share was assumed constant up to 2050 and therefore, the international RTK was derived from this assumption.

For the airline with no RTK forecast, two assumptions were made. The first one was to forecast the international RTK up to 2050 without considering the impact of the Covid-19. The annual growth factor used was 4.6%. This factor comes from ICAO statistical analysis for the entire world. The factor of 5.8% set for the APAC region was not considered to be on the conservative side because of the Covid-19. The second assumption was to take into consideration the Covid-19 pandemic crisis. The following study developed by IATA [1]was used:



Source: IATA/ Tourism Economics Air Passenger Forecasts

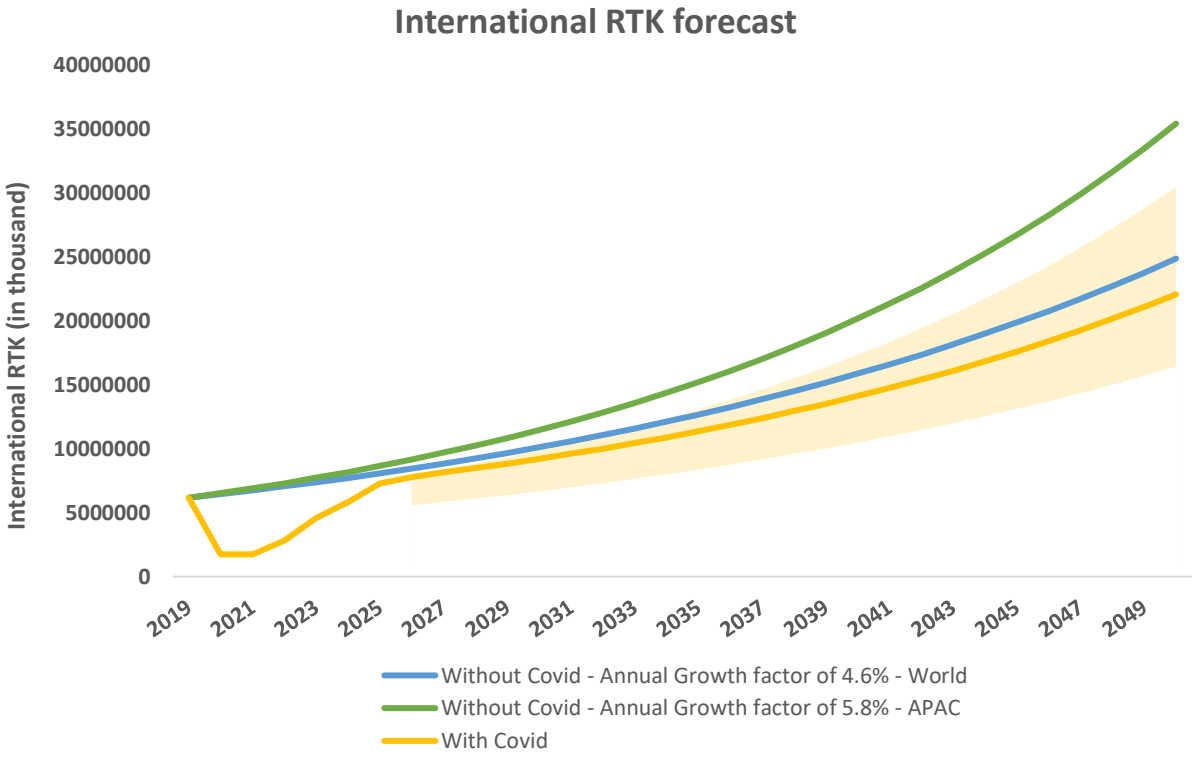
In order to take into consideration, the level of uncertainty, the average impact has been calculated. For example, in 2024 the traffic was assumed to be around 11 trillion of Revenue Per Kilometer (RPK) (without Covid-19). By taking into consideration the Covid-19, RPK is expected to be somewhere between 7.3 and 9.5 trillion of RPKs. In the worst-case scenario, traffic will be recovered at 66% (7.3/11 = 0.66 = 66%) and in the best-case scenario, traffic will be recovered at 86% (9.5/11 = 0.86 = 86%). The recovery assumption was to assume an average of 76% starting from 2024 until 2050. The same exercise has been done using 2020 data and the average was estimated at 34%. For the year 2021, it was assumed 40%, 50% in 2022, and 60% in 2023.

The percentages have been applied to the forecasted RTK (without Covid-19) as calculated above.

As a final step, international RTK has been consolidated by summing the international RTK on annual basis from all three airlines.

[1] IATA - Economics

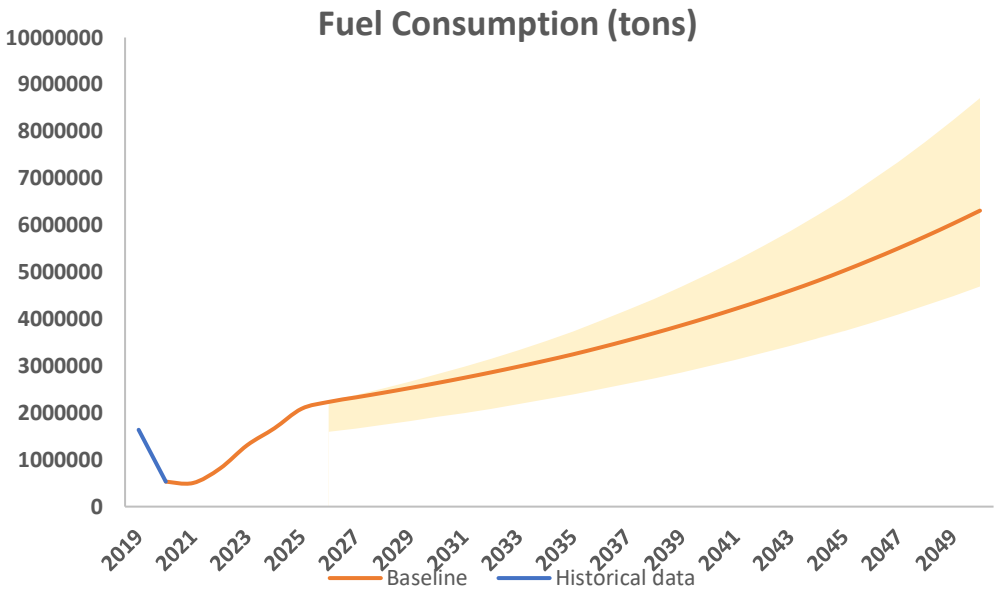
The following graphic shows different scenarios. Two "without Covid" scenarios have been developed. The first scenario is based on the ICAO projections showing the international RTK forecast up to 2050 using an annual RTK growth factor of 4.6% (World projection) and the second scenario is based on the projection of the APAC region (5.8%). The last scenario is the RTK projection with the impact of the Covid-19. An uncertainty range has been added to the graphics to highlight the margin of error.



3.4. Result

The fuel consumption was forecasted by combining the forecasted international RTK and the forecast international fuel efficiency.

The following graphic shows the results by also taking into consideration the uncertainty related to the traffic as explained in the previous section.



Section 4: Mitigation Measures

Quantified emissions reduction information has been received from two airlines. It is worth noting that the local Air Navigation Service Provider (ANSP) is working on the implementation of two mitigation measures that will be fully implemented in the next five years. The first measure is to improve the fuel efficiency of the departure and approach procedures (i.e., continuous descent operation – CDO, and continuous climb operation – CCO), while the second measure aims to fully utilize ADS-B surveillance (i.e., direct route).

The airline operators propose the implementation of the following mitigation measures:

(1) Single Engine Taxi In: This measure allows reducing the fuel consumption during the taxiing in phase by shutting down one engine after the cool-down time.

(2) Reduced Acceleration Altitude (RAAL) – which allows for reducing the fuel consumption during the climb phase by accelerating the aircraft at an altitude lower than what is usually done.

(3) Single Engine Taxi Out – This allows for reducing the fuel consumption during the taxiing out phase by shutting down one engine before engine warm-up.

(4) Idle Reverse Thrust (REVT) – This allows for reducing the fuel consumption during landing by not applying full-reverse (when applicable).

(5) Minimize adding unnecessary extra fuel – This allows for reducing the fuel consumption by carrying the necessary amount of fuel as per plan.

Both operators shared quantified mitigation measures. However, no mitigation measures have been quantified up to 2050. One airline has quantified the benefits of the implementation of the mitigation measures for the year 2021 only, while the other airline has quantified them until 2026. Therefore, two assumptions were made to forecast the fuel reduction for all mitigation measures up to 2050:

(a) Two scenarios were developed. The first scenario assumes a 2% traffic increase while the second scenario assumes a 5.8% traffic increment (pre-Covid, ICAO forecasted an increment of 5.8% in terms of international RTK for the APAC region).
(b) It is assumed that the fleet structure (i.e., the share of turboprops, narrow-body, and wide-body aircraft) remains identical up to 2050.

The following tables summarize the total emissions reductions per mitigation measure aggregated per operator.

Mitigation Measures	**Emissions reductions (tCO2) - scenario at 2% annual traffic increment**	**Emissions reductions (tCO2) - scenario at 5.8% annual traffic increment**
Reduced Acceleration Altitude	293,665	468,095
Single-Engine Taxi-In	178,084	304,409
Single Engine Taxi Out	47,221	88,848
Idle Reverse Thrust (REVT)	26,978	50,759
Minimize adding unnecessary extra fuel	20,527	38,623

Table 1: Mitigation Measures

Section 5: Expected Results

The following table shows the expected results (i.e., emissions reduction in absolute value and percentage) if the annual traffic increase by 2%.

Year	**RTK ('000)**	**Fuel Burn (tons)**	**Emissions (tCO2)**	**Fuel Burn reduction (tons)**	**Emissions reduction (tCO2)**	**Emissions reduction (%)**
2021	1,760,129	502,996	1,589,467	1,284	4,058	0.26%
2022	2,845,314	813,112	2,569,433	4,257	13,451	0.52%
2023	4,580,239	1,308,905	4,136,140	4,801	15,172	0.37%
2024	5,835,574	1,667,645	5,269,758	4,840	15,294	0.29%
2025	7,290,648	2,083,465	6,583,748	4,941	15,613	0.24%
2026	7,802,559	2,229,755	7,046,025	4,968	15,700	0.22%
2027	8,141,129	2,326,508	7,351,767	5,068	16,014	0.22%
2028	8,483,337	2,424,302	7,660,795	5,169	16,335	0.21%
2029	8,840,889	2,526,481	7,983,678	5,273	16,661	0.21%

2030	9,214,495	2,633,247	8,321,060	5,378	16,995	0.20%
2031	9,604,899	2,744,813	8,673,610	5,486	17,334	0.20%
2032	10,012,879	2,861,403	9,042,033	5,595	17,681	0.20%
2033	10,439,251	2,983,248	9,427,064	5,707	18,035	0.19%
2034	10,884,868	3,110,593	9,829,474	5,821	18,395	0.19%
2035	11,350,624	3,243,693	10,250,070	5,938	18,763	0.18%
2036	11,855,727	3,388,038	10,706,199	6,057	19,139	0.18%
2037	12,383,799	3,538,946	11,183,069	6,178	19,521	0.17%
2038	12,935,900	3,696,721	11,681,638	6,301	19,912	0.17%
2039	13,513,140	3,861,680	12,202,909	6,427	20,310	0.17%
2040	14,116,681	4,034,156	12,747,932	6,556	20,716	0.16%
2041	14,747,741	4,214,495	13,317,804	6,687	21,131	0.16%
2042	15,407,592	4,403,062	13,913,675	6,821	21,553	0.15%
2043	16,097,566	4,600,237	14,536,750	6,957	21,984	0.15%
2044	16,819,060	4,806,420	15,188,288	7,096	22,424	0.15%
2045	17,597,376	5,028,841	15,891,139	7,238	22,872	0.14%
2046	18,411,869	5,261,601	16,626,659	7,383	23,330	0.14%
2047	19,264,229	5,505,182	17,396,374	7,531	23,797	0.14%
2048	20,156,222	5,760,089	18,201,880	7,681	24,272	0.13%
2049	21,089,700	6,026,851	19,044,848	7,835	24,758	0.13%
2050	22,066,600	6,306,022	19,927,028	7,991	25,253	0.13%

Table 2: Expected Results with the assumption of a 2% annual traffic increase

The following table shows the expected results (i.e., emissions reduction in absolute value and percentage) if the annual traffic increase by 5.8%.

Year	RTK ('000)	Fuel Burn (tons)	Emissions (tCO2)	Fuel Burn reduction (tons)	Emissions reduction (tCO2)	Emissions reduction (%)
2021	1,760,129	502,996	1,589,467	1,284	4,058	0.26%
2022	2,845,314	813,112	2,569,433	4,305	13,605	0.53%
2023	4,580,239	1,308,905	4,136,140	4,903	15,492	0.37%
2024	5,835,574	1,667,645	5,269,758	4,998	15,794	0.30%
2025	7,290,648	2,083,465	6,583,748	5,160	16,305	0.25%
2026	7,802,559	2,229,755	7,046,025	5,253	16,599	0.24%
2027	8,141,129	2,326,508	7,351,767	5,558	17,562	0.24%
2028	8,483,337	2,424,302	7,660,795	5,880	18,581	0.24%
2029	8,840,889	2,526,481	7,983,678	6,221	19,659	0.25%
2030	9,214,495	2,633,247	8,321,060	6,582	20,799	0.25%
2031	9,604,899	2,744,813	8,673,610	6,964	22,005	0.25%
2032	10,012,879	2,861,403	9,042,033	7,368	23,281	0.26%
2033	10,439,251	2,983,248	9,427,064	7,795	24,632	0.26%

2034	10,884,868	3,110,593	9,829,474	8,247	26,060	0.27%
2035	11,350,624	3,243,693	10,250,070	8,725	27,572	0.27%
2036	11,855,727	3,388,038	10,706,199	9,231	29,171	0.27%
2037	12,383,799	3,538,946	11,183,069	9,767	30,863	0.28%
2038	12,935,900	3,696,721	11,681,638	10,333	32,653	0.28%
2039	13,513,140	3,861,680	12,202,909	10,933	34,547	0.28%
2040	14,116,681	4,034,156	12,747,932	11,567	36,551	0.29%
2041	14,747,741	4,214,495	13,317,804	12,237	38,670	0.29%
2042	15,407,592	4,403,062	13,913,675	12,947	40,913	0.29%
2043	16,097,566	4,600,237	14,536,750	13,698	43,286	0.30%
2044	16,819,060	4,806,420	15,188,288	14,493	45,797	0.30%
2045	17,597,376	5,028,841	15,891,139	15,333	48,453	0.30%
2046	18,411,869	5,261,601	16,626,659	16,223	51,263	0.31%
2047	19,264,229	5,505,182	17,396,374	17,164	54,237	0.31%
2048	20,156,222	5,760,089	18,201,880	18,159	57,382	0.32%
2049	21,089,700	6,026,851	19,044,848	19,212	60,711	0.32%
2050	22,066,600	6,306,022	19,927,028	20,327	64,232	0.32%

Table 3: Expected Results with the assumption of a 5.8% annual traffic increase

Section 6: Conclusion

The CAAP is committed to addressing the climate change impacts of commercial aviation and achieving greenhouse gas (GHG) emissions reductions through an integrated strategy of technology, operations and policy framework as evident with the CAAP's voluntary participation in Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) since December 2018.

The Philippines in its commitment to ensure safe, green Philippine sky has improved its level of data accuracy and completeness aligned with the ICAO statistical forms (A, M and C). Moreover, the Philippine stakeholder's voluntary engaged in collaborative efforts and initiatives to further reduce and mitigate the C02 emission from the international aviation.

Thus, the Philippines is exploring other activities able to decarbonize the aviation sector aligned with the ICAO Long-Term Aspirational Goals and Net-Zero Target by 2050.