



AOT Climate Change Management Disclosure

TCFD	Page / Section / AOT Website
Governance	
a) Describe the board’s oversight of climate related risks and opportunities.	AOT Website: AOT's Risk Management Structure Section
b) Describe management’s role in assessing and managing climate-related risks and opportunities.	This document PDF page 4
Strategy	
a) Describe the climate-related risks and opportunities the organization has identified over the short, medium, and long term.	This document PDF page 6 (Climate-related risks) This document PDF page 7 (Climate-related opportunities)
b) Describe the impact of climate-related risks and opportunities on the organization’s businesses, strategy, and financial planning.	
c) Describe the resilience of the organization’s strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.	Annual Report 2021 PDF page 13
Risk Management	
a) Describe the organization’s processes for identifying and assessing climate-related risks.	This document PDF page 5-7
b) Describe the organization’s processes for managing climate-related risks.	
c) Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organization’s overall risk management.	Annual Report 2021 PDF page 119 AOT Website: AOT's Risk Management Process Section
Metrics & Targets	
a) Disclose the metrics used by the organization to assess climate-related risks and opportunities in line with its strategy and risk management process.	This document PDF page 6 (Substantive Impact Criteria) AOT Environmental Performance
b) Disclose Scope 1, Scope 2, and if appropriate Scope 3 greenhouse gas (GHG) emissions, and the related risks.	This document PDF Page 23
c) Describe the targets used by the organization to manage climate-related risks and opportunities and performance against targets.	This document PDF Page 24

The Integration of TCFD Framework to Address Climate Related Risks



AOT recognizes environmental impacts resulted from airport operations and value chain, therefore we strive to conduct our business in the ways that are responsible for surrounding environment and communities. In terms of climate change , we emphasize on greenhouse gases reduction as well as climate risks and opportunity management. Hence, AOT is in process of integrating Task Force on Climate-Related Financial Disclosures (TCFD) into our corporate-wide risk management process.

TCFD Disclosure Pillars



Governance

The organization's governance around climate-related risks and opportunities

Strategy

The actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning

Risk Management

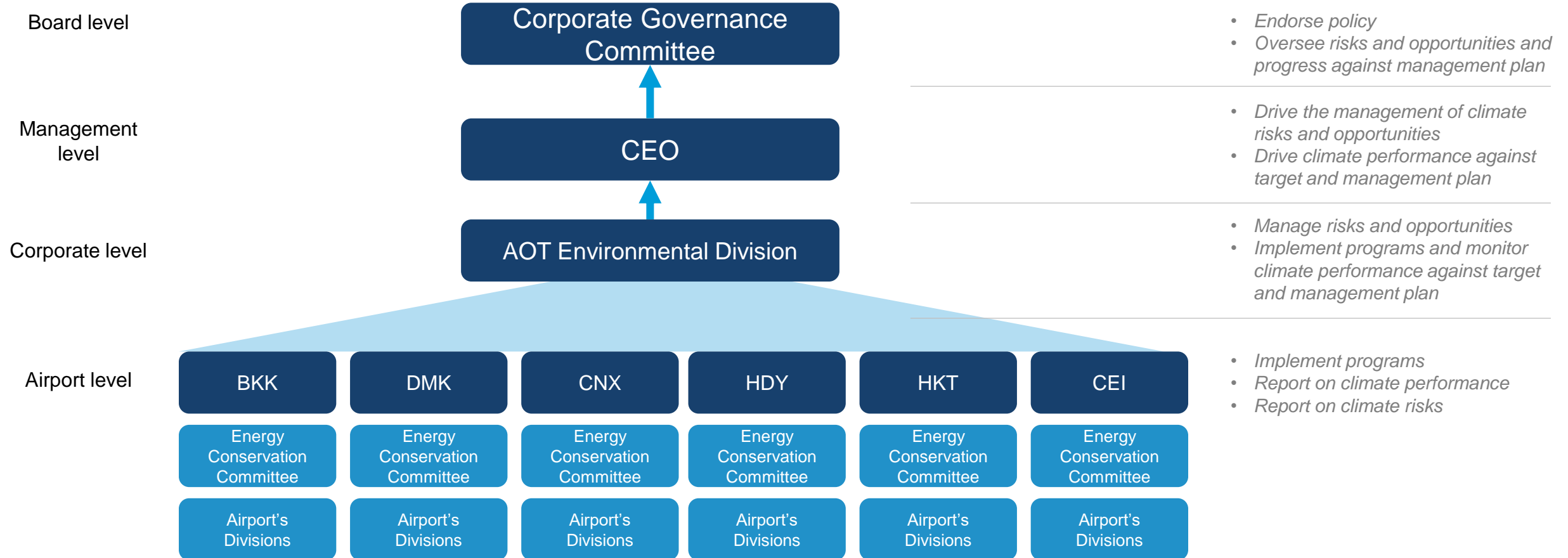
The processes used by the organization to identify, assess, and manage climate-related risks

Metrics and Targets

The metrics and targets used to assess and manage relevant climate-related risks and opportunities



Roles and Responsibilities on Climate Change



Moreover, Risk Management Department and Corporate Strategy Department are involved in risks and opportunity identification prioritization and management process as well as the integration of climate topics in corporate strategy.

Integration Process of Climate Change Risks & Opportunities into Corporate-wide Risk Management Process in Alignment with TCFD



1. Identification of Climate Related Risks and Opportunities

- Climate related risks and opportunities identification from bottom up and top down approaches
 - Physical risks
 - Transition risks
 - Opportunities

2. Prioritization of Climate Related Risks and Opportunities

- Input gathering of the identified risks and opportunities in term of level of impact and likelihood including both financial and nonfinancial impact
- Risks and opportunities prioritization and analysis

3. Company's Centralized Enterprise Risk/Opportunity Management Process

- Results from the prioritization are integrated into the centralized enterprise risk/opportunity management process and reported to relevant executive-levels

Overview of AOT's Climate Risks and Opportunities



Time horizon: Short term (0-3 years) Medium term (3-6 years) Long term (6-12 years)

Scope: Own operation (6 Airports and Head Office)

Criteria for identifying risks and opportunities with substantive impact:

Upstream activities (Suppliers and other partners)

The topics that can potentially cause significant impact on AOT's strategy in terms of
(1) Level of Service (LoS), (2) compliance with safety and security standards, (3) financial return
and (4) cybersecurity

Downstream activities (Customers and other business partners)

Risks	Type	Time horizon	Implications for AOT	Management Measures
Extreme weather events (Flood)*	Acute Physical	Medium term	<ul style="list-style-type: none"> Operational disruption as extreme weather may interfere with take-off and landings Reduced tourism in times of extreme weather i.e. flood, storm, heat wave. Increased repair and maintenance costs of infrastructures 	<ul style="list-style-type: none"> Establish Business Continuity Plan (BCP) to ensure preparedness. Early warning systems Programs with community to ensure all drainage systems and infrastructures are in good condition
Water scarcity* (Water stress)	Chronic Physical	Long term	<ul style="list-style-type: none"> Increased procurement cost for water Potential conflict with local communities 	<ul style="list-style-type: none"> Engagement with water supplier in nearby provinces in advance Investment in water efficiency and recycling program within airport Community relation
Increased average temperature	Chronic Physical	Medium term	<ul style="list-style-type: none"> Increased energy cost especially for air conditioning 	<ul style="list-style-type: none"> Improve energy efficiency through Green Building Concept i.e. LEED Standard Procure energy efficient equipment and promote green behavior
Climate regulations *	Transitional	Medium term	<ul style="list-style-type: none"> Carbon Tax and/or Cap and Trade regulations might be enforced in the future leading to higher energy expense or carbon offset cost for AOT 	<ul style="list-style-type: none"> Under Green Airport Master Plan, AOT keeps track of GHG emission against target and implements emission reduction programs. Frequent monitoring of new climate-related regulations.

* Scenario Analysis Conducted

Overview of AOT's Climate Risks and Opportunities



Opportunities	Type	Time horizon	Implications for AOT	Management Measures
Energy efficient buildings	Resource efficiency	Short term	<ul style="list-style-type: none"> The increased energy consumption and cost can make energy efficiency programs more economically feasible 	<ul style="list-style-type: none"> Improve energy efficiency through Green Building Concept i.e. LEED Standard Procure energy efficient equipment and promote green behavior
Renewable energy expansion	Energy source	Medium term	<ul style="list-style-type: none"> Solar cell becomes cheaper more accessible due to technological development. This allows AOT to reduce its GHG emission more easily. 	<ul style="list-style-type: none"> Collaborate with energy providers to increase the share of renewable energy
Shifting customer preferences	Market	Medium term	<ul style="list-style-type: none"> Airlines and travelers are becoming more environmentally conscious. Being low carbon airport, can increase AOT's attractiveness in the market. 	<ul style="list-style-type: none"> Certified in Airport Carbon Accreditation Programme to enhance environmental reputation Runway expansion to reduce landing and take-off waiting time which are fuel intensive Expand business opportunity for Auxiliary Power Unit (APU) which saves aircraft fuel consumption Provide EV Taxi for travelers



Scenario Analysis: Physical Risks

Scope and focus of Assessment



Tool: CMIP 5 and CMIP 6

Scenarios:

- **Optimistic:** The "optimistic" scenario (SSP2 RCP4.5) represents a world with stable economic development and carbon emissions peaking and declining by 2040, with emissions constrained to stabilize at ~650 ppm CO₂ and temperatures to 1.1–2.6°C by 2100.
- **Business as usual:** The "business as usual" scenario (SSP2 RCP8.5) represents a world with stable economic development and steadily rising global carbon emissions, with CO₂ concentrations reaching ~1370 ppm by 2100 and global mean temperatures increasing by 2.6–4.8°C relative to 1986–2005 levels.
- **Pessimistic:** The "pessimistic" scenario (SSP3 RCP8.5) represents a fragmented world with uneven economic development, higher population growth, lower GDP growth, and a lower rate of urbanization, all of which potentially affect water usage; and steadily rising global carbon emissions, with CO₂ concentrations reaching ~1370 ppm by 2100 and global mean temperatures increasing by 2.6–4.8°C relative to 1986–2005 levels.

Scope:

- Assessment consistent with the expected lifetime of the assets or activities
- The scope of our assessment includes our upstream activities
- The scope of our assessment includes our downstream activities and clients

Study area:

- The study area covered Suvarnabhumi Airport, Phuket International Airport, Don Mueang International Airport & Head Office, Chiang Mai International Airport, Hat Yai International Airport and Mae Fah Luang-Chiang Rai International Airport. These also cover the operations and activities of the upstream (suppliers and contractors) and downstream (customer) activities situated in areas nearby the airport.

Acute Physical Risk: Water Stress



Airport	Scenario 1 SSP2 RCP 4.5 (1.1–2.6°C by 2100)		Scenario 2 SSP3 RCP 8.5 (2.6–4.8°C by 2100)	
	2030	2040	2030	2040
	Suvarnabhumi Airport	Medium-high	Medium-high	Medium-high
Don Mueang International Airport & Head Office	Medium-high	Medium-high	Medium-high	Medium-high
Chiang Mai International Airport	Medium-high	Medium-high	Medium-high	Medium-high
Hat Yai International Airport	Low – medium	Low – medium	Low – medium	Low – medium
Phuket International Airport	Low	Low	Low	Low
Mae Fah Luang-Chiang Rai International Airport	Low	Low	Low	Low

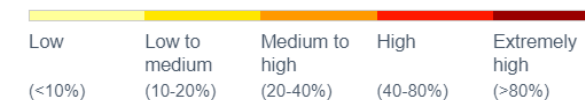
Scenario 1: SSP2 RCP 4.5
(1.1–2.6°C by 2100)



Scenario 2: SSP3 RCP 8.5
(2.6–4.8°C by 2100)



Water Stress



Adaptation Plan: Water Stress



Risks	Implication of Risks to AOT	Adaptation Plan
Water Stress	- Lack of water for utilization in the airport	- Have back-up emergency storage for 3 days of operations. - Creates a water management plan to prepare for risky events related to water resource such as secure contract of demineralized water from other suppliers.

Acute Physical Risk: Inland Flood



Climate change projections over Thailand for **average annual rainfall and extreme precipitation** showed **increasing trend** as presented in Table below.

Climate Index	Baseline (mm)	Absolute Change (mm)		Percentage of Change (%)	
		2030	2050	2030	2050
Annual Rainfall	1495.3 - 1850.2 (1627.8)	-3.0 -2.2 (0.2)	63.6 - 71.1 (68.4)	-0.2 -0.1 (0.0)	3.7 -4.8 (4.2)
One Day Maximum Rainfall (mm)	61.6 -66.5 (64.1)	3.3 -4.3 (4.0)	6.4 -7.8 (7.0)	5.4 -6.9 (6.4)	10.6 - 12.0 (11.2)
Maximum Consecutive five days Rainfall (mm)	158.0 -171.4 (165.4)	7.6 -9.5 (8.4)	15.5 - 20.5 (17.8)	4.7 -5.5 (5.1)	9.1 -12.1 (10.8)

Source: *WRI-Aqueduct Flood*

Emma L. Gale, and Mark A. Saunders (2013), The 2011 Thailand Flood: Climate Causes and Return Period, Weather (Royal Meteorological Society): <https://rmets.onlinelibrary.wiley.com/doi/10.1002/wea.2133>

Adaptation: Inland Flood



Risks	Implication of Risks to AOT	Adaptation Plan
Inland Flood	<ul style="list-style-type: none">- Employee cannot come to work.- Flood leading airports to temporary stop the operation- If the airport shuts down, AOT might be penalized and the revenue will be affected.	<ul style="list-style-type: none">- Implemented back-up procedure in order to response to the emergency incidents.- Employees are trained for airport crisis adaptation plan in order to prepare for crisis situation and to limit the consequences of an emergency incidents from getting out of control.- Takes a proactive approach to handling potential crisis by developing a business continuity management (BCM) system which covers major operations.

Chronic Physical Risk: Long-term Increase in Intensity and Frequency of Tropical Cyclone



Projected Changes at Site

- The recent study by Knuston et. al. (2020)¹ indicated a likely changes for occurrences of tropical cyclone over north-west Pacific ocean as following
- Overall frequency of tropical cyclone by -30 to 20% with median change of -12%,
- Changes in frequency of category 4-5 cyclone between -25 to 40% with median change of -5%
- However intensity of cyclone indicated likely increase of 1 to 9% with median of 5% increase
- Increase in precipitation is likely to be in the range of 5-25% with a median of 15% **under 2°C scenario** by end of century
- Although, climate change projections for cyclones indicate likely increase frequency and intensity, considering no direct impacts at the project Site the hazard due to cyclones is considered to be ‘Low’.

- Wind speed projections for maximum wind speed and gust speeds from Regional Climate Model (RCM) - REMO 2009 were evaluated.
- Horizontal **winds** (also known as “crosswinds”) in excess of 30-35 kts (about 34-40 mph or **18 m/s**) are generally prohibitive of take-off and landing.
- Gust speeds exceeding 21 m/s of wind speed indicate high hazard.
- **Both Average Maximum wind speed and gust speed still do not exceed the prohibitive of take off and landing regulation**

Statistics	Maximum Wind (m/s)		Gust Speed (m/s)	
	2030	2050	2030	2050
Min	1.6	1.4	3.4	2.8
Max	18.2	18.0	33.4	33.0
Average	5.9	6.0	10.9	11.1

Thomas Knutson, Suzana J. Camargo, Johny C. Chan, Kerry Emanuel, Chang-Hoi Ho, James Kossin, Mruthunjay Mohapatra, Masaki Satoh, Masato Sugi, Kevin Walsh, and Ligiang Wu (2020). Tropical Cyclones and Climate Change Assessment: Part II: Projected Response to Anthropogenic Warming. Jr. Bulletin of American Meteorological Society. 101 (3). <https://journals.ametsoc.org/bams/article/101/3/E303/345043/Tropical-Cyclones-and-Climate-Change-Assessment>

Adaptation Plan: Long-term Increase in Intensity and Frequency of Tropical Cyclone



Risks	Implication of Risks to AOT	Adaptation Plan
Increased Maximum Wind Speed & Increased intensity and frequency of tropical cyclone	<ul style="list-style-type: none">- Maximum wind speed that exceed 18 m/s can be prohibitive of take-off and landing.- Increase the chance of the occurrence of run-way accidents	<ul style="list-style-type: none">- Implemented back-up procedure in order to response to the emergency incidents.- Employees are trained for airport crisis adaptation plan in order to prepare for crisis situation and to limit the consequences of an emergency incidents from getting out of control.



Scenario Analysis: Transition Risks

Scope and focus of Assessment



Scenarios:

- National Determine Contribution (NDC) Scenario: AOT evaluate the assumptions including the projection of energy demand/production and renewable energy under National Determine Contribution of Thailand (NDC) (40% GHG reduction against BAU in 2030 and climate neutrality by 2050). The early stage of scenario analysis focused on the legislation of carbon price mechanism in Thailand in next 5 years. This legislation will affect AOT financially. The change in customer's behavior under selected scenarios have influenced AOT to specify new strategy and implementation.
- IEA NZE 2050 in alignment with SBTi Corporate Net Zero Standard. The early stage of scenario analysis focused on the carbon price applied in 2030 and 2050

Scope:

- Assessment consistent with the expected lifetime of the assets or activities base on legislation, technological development
- The scope of our assessment includes our upstream activities
- The scope of our assessment includes our downstream activities and clients

Timeframe: Short term (0-3 years) Medium term (3-6 years) Long term (6-12 years)

Study area:

- The study area covered all 6 AOT airports which operates in Thailand; Suvarnabhumi Airport, Phuket International Airport, Don Mueang International Airport, Chiang Mai International Airport, Hat Yai International Airport and Mae Fah Luang Airport

Scenario analysis result: Impact of Carbon Price

List	NDC		IEA NZE 2050	
	2030	2050	2030	2050
Emission surplus in scope 1+2 (tCO ₂ e)	137,675	323,209	144,558	754,155
Estimated carbon price (million THB)	182.8	1,716.7	192.0	4,006.0

Government climate change regulation may;

- Limit air travel emissions
- Increase cost pass through and change travel patterns resulting in reductions in anticipated passenger volumes and associated revenue

Timeframe: Medium-term (3-6 years)

The exact area of financial impact remains to be determined due to the policy uncertainty. For example, the carbon price may be embedded in the electricity price from upstream electricity provider. It might be in the form of carbon tax or offset cost for AOT. Some part of the cost might be passed through to our airline customers as a service cost.

Remark Financial impact is estimated based on IEA's Announced Pledge Scenario carbon price in 2030 at 1,327.86 THB/tCO₂ and in 2050 at 5,311.42 THB/tCO₂. **NDC scenario:** 40% scope 1+2 emission reduction from BAU in 2030 and Net Zero (100% GHG reduction) in 2065. **IEA NZE 2050 scenario:** 42% scope 1+2 emission reduction by 2030 and 100% GHG reduction by 2050. AOT 2019 GHG intensity per revenue is used for baseline (the year before COVID-19). 4% CAGR revenue projection is assumed for 2015-2050 based on ICAO's growth projection in aviation.

Management Plan



Risks	Implication of Risks to AOT	Responses
The Legislation of Carbon Price Mechanism in Thailand	<ul style="list-style-type: none">- Limit air travel emissions- Increase cost pass through and change travel patterns resulting in reductions in anticipated passenger volumes and associated revenue	<ul style="list-style-type: none">- Participate in Thailand Voluntary Emission Reduction (T-VER) program to implement emission reduction projects to earn carbon credit and trade in carbon market

Regulation: Mandate Low Carbon Design Building



Government climate change regulation may:

- Influenced all operated airport to follow sustainable design guideline
- Increase development costs and delivery timeframes

Timeframe: Medium-term (3-5 years)



Management Plan



Risks	Implication of Risks to AOT	Responses
Mandate Low Carbon Design Building	<ul style="list-style-type: none">- Influenced all operated airport to follow sustainable design guideline- Increase development costs and delivery timeframes	<ul style="list-style-type: none">- Conduct the research on sustainable building and how to certify sustainable building- Reserve budget for developing sustainable building through the utilization of renewable energy, energy efficiency design and technology



AOT Environmental Performance 2022

GHG Emissions



GHG Emissions	Unit	2019	2020	2021	2022
Direct GHG emissions (Scope 1)	tCO2e	3,184.23	3,201.97	2,499.25	2,819.64
Indirect GHG emissions from electricity (Scope 2) – Market Based	tCO2e	214,710.81	171,166.09	178,974.37	224,506.94
Indirect GHG emissions from electricity (Scope 2) – Location Based	tCO2e	214,710.81	171,166.09	178,974.37	224,506.94
Indirect Greenhouse Gas Emissions (Scope 3)	tCO2e	2,554,050.20	2,554,050.20	1,718,167.28	-

Remark - Data is based on calendar year
- Data in covers 6 airports (100%).

GHG Emissions Reduction Targets

AOT has set a corporate carbon reduction target on average of 2% per year (intensity per passenger). A reduction of 16% in 2023 compared to the 2015 level.

Moreover, AOT is in process of Net Zero Target setting in alignment with the pledge from the Government of Thailand – to be carbon neutral in 2050 and net zero in 2065.