

AOT Climate Change Management Disclosure 2023

TCFD Disclosure: Governance

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



Sustainability Development Committee Appointment



บริษัท ท่าอากาศยานไทย จำกัด (มหาชน)
Airports of Thailand Public Company Limited

คำสั่งบริษัท ท่าอากาศยานไทย จำกัด (มหาชน)

ที่ 1772/2566

เรื่อง แต่งตั้งคณะกรรมการด้านการพัฒนาอย่างยั่งยืนของ ทอท.

Announcement of AOT Sustainability Development Committee (ESG Committee)

2.1 Sustainability Development Composition

บริษัท ท่าอากาศยานไทย จำกัด (มหาชน) (ทอท.) มุ่งมั่นบริหารจัดการท่าอากาศยานในความรับผิดชอบตามแนวทางการปฏิบัติงานด้านสิ่งแวดล้อมที่ดี ภายใต้วิสัยทัศน์ที่มุ่งสู่การเป็นท่าอากาศยานสากลชั้นนำที่มีมิติต่อสิ่งแวดล้อมอย่างยั่งยืน "Moving toward International Leading Eco-Airport" มีการจัดการก๊าซเรือนกระจก การจัดการพลังงานทดแทน การใช้ทรัพยากรให้มีประสิทธิภาพและเกิดประสิทธิผลสูงสุด อาศัยอำนาจตามความในข้อบังคับ ทอท. ข้อ 46 และข้อ 50 ประกอบกับมติคณะกรรมการ ทอท. ในการประชุมครั้งที่ 12/2566 เมื่อวันที่ 25 ตุลาคม 2566 จึงให้ดำเนินการดังนี้

1. ยกเลิกคำสั่ง ทอท.ที่ 1189/2566 ลงวันที่ 22 สิงหาคม 2566

2. แต่งตั้งคณะกรรมการด้านการพัฒนาอย่างยั่งยืนของ ทอท. โดยมีองค์ประกอบ หน้าที่และอำนาจ ดังนี้

2.1 องค์ประกอบ

2.1.1	พลตำรวจเอก มนุญ เมฆหมอก	ประธานอนุกรรมการ
2.1.2	กรรมการผู้อำนวยการใหญ่ ทอท.	อนุกรรมการ
2.1.3	รองกรรมการผู้อำนวยการใหญ่ (สายงานวิศวกรรมและการก่อสร้าง)	อนุกรรมการ
2.1.4	รองกรรมการผู้อำนวยการใหญ่ (สายงานพัฒนาธุรกิจและการตลาด)	อนุกรรมการ
2.1.5	นายจักรกฤษณ์ จรัสศรี	อนุกรรมการ
2.1.6	ผู้แทนกระทรวงคมนาคม	อนุกรรมการ
2.1.7	ผู้แทนสำนักงานนโยบายและแผนการขนส่งและจราจร	อนุกรรมการ
2.1.8	ผู้แทนกรมการเปลี่ยนแปลงสภาพภูมิอากาศและสิ่งแวดล้อม	อนุกรรมการ
2.1.9	ผู้อำนวยการฝ่ายสิ่งแวดล้อม	อนุกรรมการและเลขานุการ
2.1.10	รองผู้อำนวยการฝ่ายสิ่งแวดล้อม	ผู้ช่วยเลขานุการ

Executive Level Climate/
Sustainability specific
committee

External Expert

Executive Level Climate/
Sustainability specific
committee

2.2 หน้าที่และอำนาจ

2.2.1 พิจารณาการจัดทำแผนแม่บทด้านสิ่งแวดล้อมของ ทอท. เพื่อมุ่งสู่การเป็นท่าอากาศยานสากลชั้นนำที่มีมิติต่อสิ่งแวดล้อมอย่างยั่งยืน "Moving toward International Leading Eco-Airport"

2.2.2 พิจารณากำหนดนโยบาย และเป้าหมาย ด้านการพัฒนาอย่างยั่งยืน ได้แก่ การจัดการก๊าซเรือนกระจก และการจัดการด้านพลังงาน การใช้ทรัพยากร ให้เป็นไปตามนโยบายของกระทรวงคมนาคม หรือนโยบายของภาครัฐ

2.2.3 พิจารณาการดำเนินโครงการติดตั้งพลังงานทดแทนภายในท่าอากาศยาน และพื้นที่ของ ทอท. อย่างเหมาะสมและเพียงพอต่อปริมาณการใช้ไฟฟ้าทั้งหมด

2.2.4 พิจารณาการดำเนินโครงการยานพาหนะไฟฟ้า และยานพาหนะจากพลังงานสะอาด และอุปกรณ์สนับสนุน ทั้ง ทอท. และผู้ประกอบการภายในท่าอากาศยาน อย่างเหมาะสม

2.2.5 ติดตามผลการดำเนินงานของทุกหน่วยงานให้สอดคล้องกับนโยบายด้านการพัฒนาอย่างยั่งยืน

2.2.6 แต่งตั้งคณะทำงานเพื่อช่วยปฏิบัติงานของคณะกรรมการฯ ได้ตามความจำเป็น และเหมาะสม

2.3 ให้ส่วนงาน ทอท. ให้การสนับสนุนการดำเนินงานของคณะกรรมการฯ หรือคณะทำงานเมื่อได้รับการประสานหรือร้องขอ

ทั้งนี้ ตั้งแต่วันที่ 6 พฤศจิกายน 2566 เป็นต้นไป

สั่ง ณ วันที่ 15 พฤศจิกายน พ.ศ.2566

นายสุวิทย์ ทรงศิริโชติ
(นายสุวิทย์ ทรงศิริโชติ)

ประธานกรรมการบริษัท ท่าอากาศยานไทย จำกัด (มหาชน)

2.2 Roles & Responsibility of the Committee

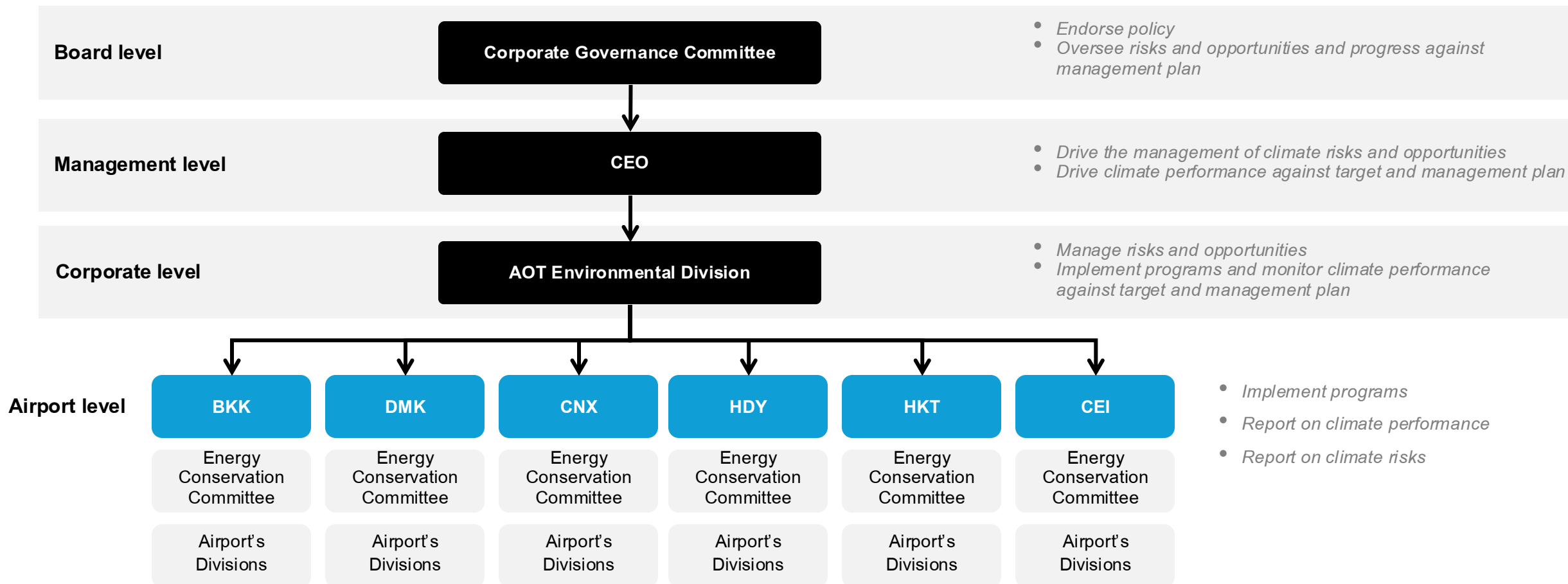
2.2.2 Set a policy and targets on sustainability development such as Greenhouse Gas Management, Energy Management, Resources Management to be followed with the Ministry of Transport's or government's policy.

2.2.3 Carry out renewable energy-related projects in the airport and appropriate areas around AOT.

2.2.4 Carry out electric vehicles and renewable energy sources vehicles and others support equipment for AOT and entrepreneurs in the airport.

2.3 Climate issues are on the agenda of the board of directors.

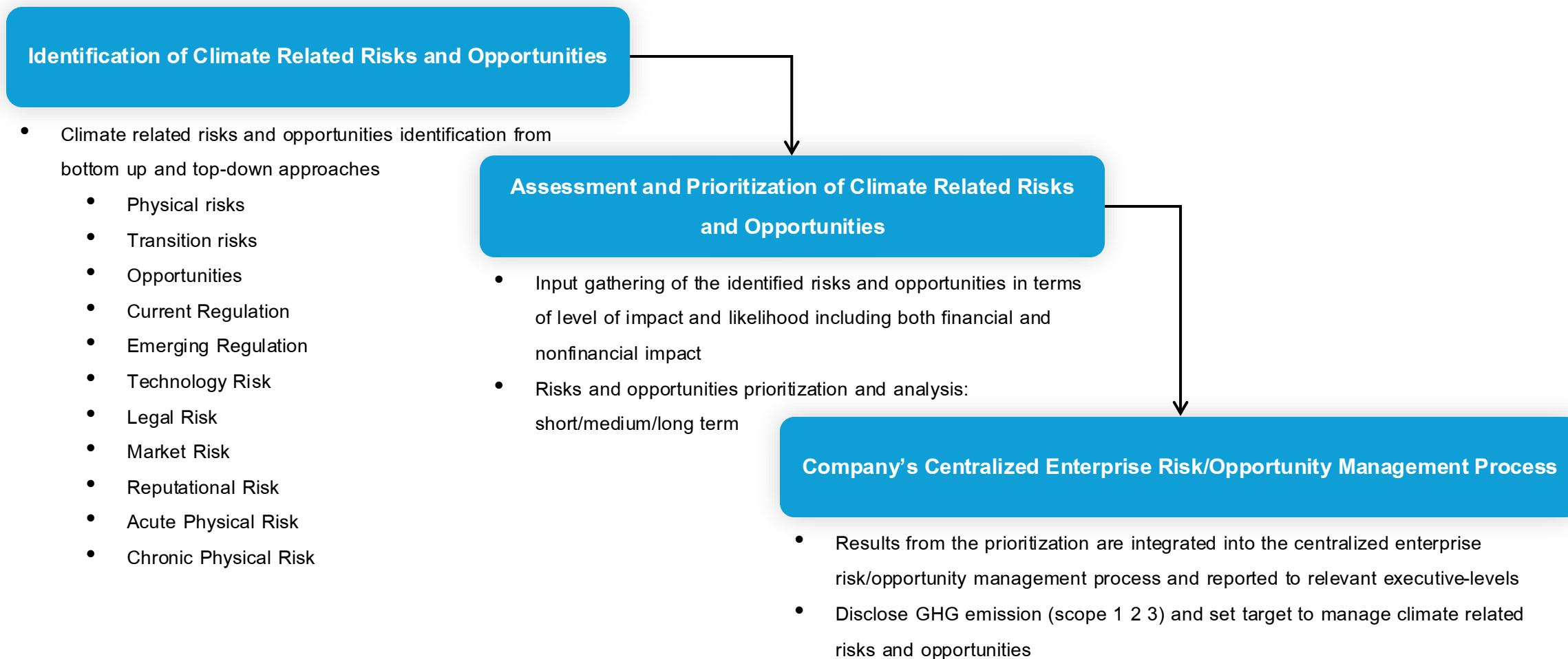
Roles and Responsibilities on Climate Change



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.

TCFD Disclosure: Strategy, Risk & Targets

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



Note: Climate risk/opportunity assessment cover AOT own operation, upstream and downstream

Overview of AOT's Climate Risks

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:
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

Upstream activities (Suppliers and other partners)

Downstream activities (Customers and other business partners)

Risks	Type	Time horizon	Implications for AOT	Management Measures
Extreme weather events (Flood)*	Acute Physical, Operational Risk	Medium term	- 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	- 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 - Barrier installation - Emergency plans and drills - Monitor water level
Water scarcity* (Water stress)	Chronic Physical	Long term	- Increased procurement cost for water - Potential conflict with local communities	- 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	Increased energy cost especially for air conditioning	- Improve energy efficiency through Green Building Concept i.e. LEED Standard - Procure energy efficient equipment and promote green behavior
Climate regulations *	Transitional	Medium term	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	- 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.

Overview of AOT's Climate Risks

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 and (4) cybersecurity

Risks	Type	Time horizon	Implications for AOT	Management Measures
Earthquake	Acute Physical, Operational Risk	Long term	- Disruption operation of business - Lack of electricity	Install electrical wire that immune to earthquake

* Scenario Analysis Conducted

Overview of AOT's Climate Opportunities

Opportunities	Type	Time horizon	Implications for AOT	Management Measures
Energy efficient buildings	Resource efficiency	Short term	The increased energy consumption and cost can make energy efficiency programs more economically feasible	- 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	Solar cell becomes cheaper more accessible due to technological development. This allows AOT to reduce its GHG emission more easily.	Collaborate with energy providers to increase the share of renewable energy
Shifting customer preferences	Market	Medium term	Airlines and travelers are becoming more environmentally conscious. Being low carbon airport, can increase AOT's attractiveness in the market.	- 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

GHG Emission Targets

GHG Emissions Reduction Targets

AOT has set a corporate carbon reduction target, including all scope 1, 2, and 3 emissions, on average of 2% per year (intensity per passenger). A reduction of 16% in 2023 compared to the 2015 level.

Net Zero and Carbon Neutral Commitment

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 **2030 and net zero in 2032**.

The Airports of Thailand (AOT) has outlined its strategy to achieve carbon neutrality goal by 2030 and net zero carbon emission by 2032.

In the first four years, the AOT, which runs the country's six major airports, aims to cut 50% of its annual carbon emission of 300,000 tons.

"The AOT has to take a role in reducing carbon emissions in the Thai aviation industry," said Kirati Kitmanawat, AOT's CEO.

AOT charts out its flight path to net-zero carbon emissions (nationthailand.com)



AOT Sustainable Development Master Plan 2024-2028



	Unit	Target				
		2024	2025	2026	2027	2028
Greenhouse Gases Emissions Reduction	tCO2e	-	5%	10%	15%	20%
Carbon Absorption (base year: 2024)	tCO2e	-	5%	10%	15%	20%



Forestation Project

72,000 trees Total 360 rai.

We intent to monitor the carbon absorption for future carbon offsetting. In addition, we are researching the financial cost for carbon removal.

บรรพ. เข้าร่วมโครงการ AOT อาสาปลูกป่าเฉลิมพระเกียรติพระบาทสมเด็จพระเจ้าอยู่หัว เนื่องในโอกาสพระราชพิธีมหามงคลเฉลิมพระชนมพรรษา 6 รอบ 28 กรกฎาคม 2567 ณ พื้นที่ต้นน้ำเหนือเขื่อนวชิราลงกรณ์ จังหวัดกาญจนบุรี - AOTAVSEC

Climate Related Management Incentives

CEO	Business Unit Manager	Employees
Mr. Kirati Kijmanawat, our President (CEO equivalent), is entitled to monetary incentives from climate change management	AOT Senior Executives and member of Energy Conservation Committee are entitled to monetary incentives from eco-efficiency program	All employees are eligible to monetary incentives from proposing energy efficiency or GHG reduction ideas.
Type of incentive: Monetary Incentivized KPI: Emission reduction	Type of incentive: Monetary Incentivized KPI: Eco-efficiency	Type of incentive: Monetary Incentivized KPI: Efficiency
The performance of emission reduction and climate change management are KPIs as a part of corporate sustainability performance. The improvement of sustainability performances, according to S&P Global Corporate Sustainability Assessment is set as CEO's KPIs which ties to monetary incentives upon the achievement.	Monetary incentives are available for AOT Senior Executives and Energy Conservation Committee, who successfully drive eco-efficiency program and contribute to energy reduction according to the plan	Monetary incentives and awards are available for employee(s) across the organization who win the "Innovation idea contest" to improve operational efficiency including energy efficiency and GHG reduction. This is included the success of Airport Carbon Footprint Monitoring according to Airport Carbon Accreditation for 6 airports as KPIs.



Submit your innovative ideas to the contest. The winners get 400,000 THB in total.



Innovative ideas to improve operational efficiency including energy efficiency and GHG reduction. (internal employees)



Open-innovation Innovative ideas for better airport (Airport workers)

Scenario Analysis: Physical Risks

Scope and focus of Assessment

Tool: CMIP 5 and CMIP 6

Scenarios (Above 2C):

- 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:

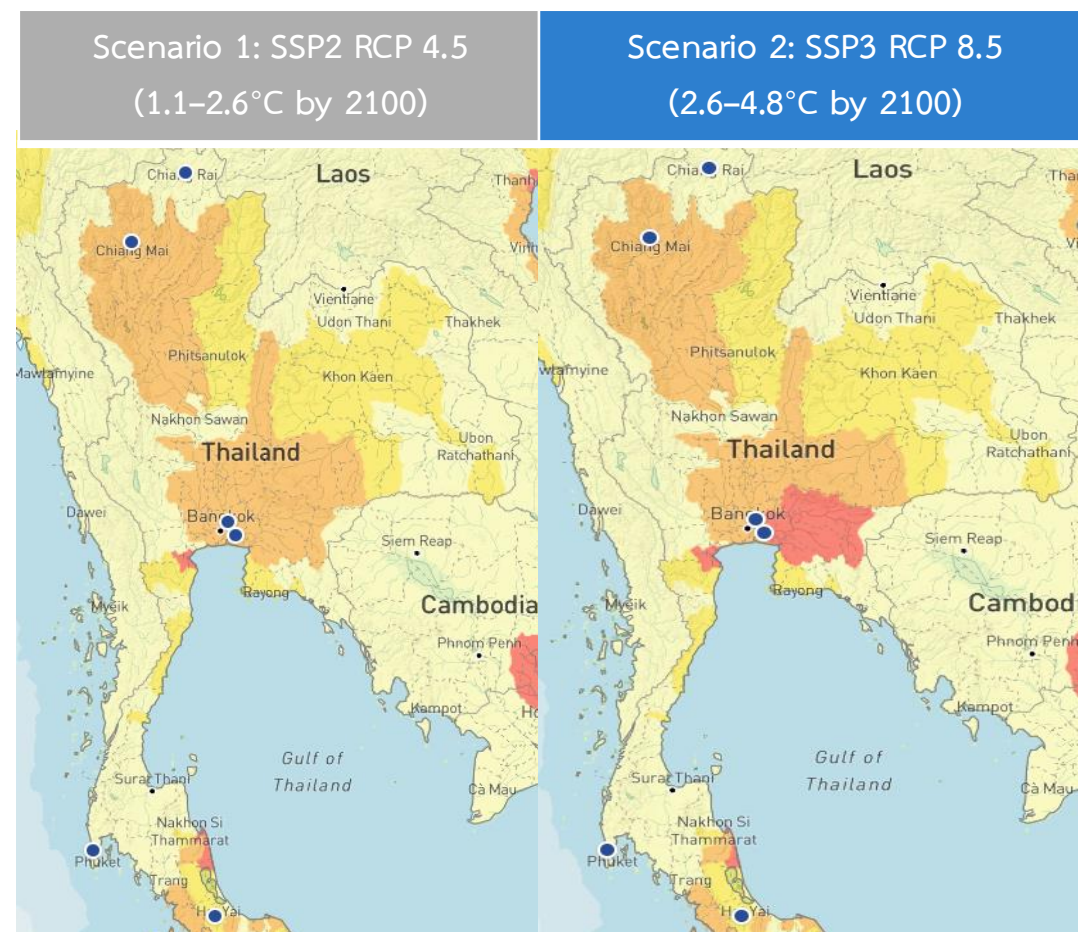
- Assessment consistent with the expected lifetime of the assets or activities
- The scope of our assessment includes our upstream activities
- The scope of our assessment includes our downstream activities and clients

Study area:

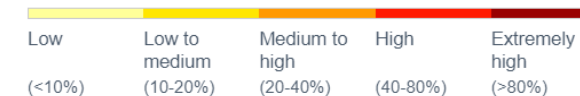
- The study area covered Suvarnabhumi Airport, Phuket International Airport, Don Mueang International Airport & Head Office, Chiang Mai International Airport, Hat Yai International Airport and Mae Fah Luang-Chiang Rai International Airport. These also cover the operations and activities of the upstream (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	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



Water Stress



https://www.wri.org/applications/aqueduct/water-risk-atlas/#?advanced=false&basemap=hydro&indicator=w_awr_def_tot_cat&lat=30&lng=-80&mapMode=view&month=1&opacity=0.5&ponderation=DEF&predefine=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=3

80&mapMode=view&month=1&opacity=0.5&ponderation=DEF&predefine=false&projection=absolute&scenario=optimistic&scope=baseline&timeScale=annual&year=baseline&zoom=3

Adaptation Plan: Water Stress

Risks	Implications for 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://onlinelibrary.wiley.com/doi/10.1002/wea.2133>

Adaptation: Inland Flood

Risks	Implications for AOT	Adaptation Plan
Inland Flood	• 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.	• 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 Knutson 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

Adaptation Plan:

Long-term Increase in Intensity and Frequency of Tropical Cyclone

Risks	Implications for AOT	Adaptation Plan
Increased Maximum Wind Speed & Increased intensity and frequency of tropical cyclone	- 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	- 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 (2C or Below 2C):

- 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

Regulation:

The Legislation of Carbon Price Mechanism in Thailand

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.

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

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	Implications for AOT	Adaptation Plan
The Legislation of Carbon Price Mechanism in Thailand	• Limit air travel emissions • Increase cost pass through and change travel patterns resulting in reductions in anticipated passenger volumes and associated revenue	• 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	Implications for AOT	Adaptation Plan
Mandate Low Carbon Design Building	- Influenced all operated airport to follow sustainable design guideline - Increase development costs and delivery timeframes	- 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



Significant Financial Impacts: Financial Risk & Opportunities

Transition Risk

(Nationally Determined Contributions: NDC)

Impact

AOT is aware of Thailand's Nationally Determined Contributions (NDC) aiming to reduce 20-25 % of GHG by 2030 compared to Business-As-Usual (BAU), which can result in the enforcement of carbon tax or cap and trade scheme, adding more costs to the companies that have high GHG emission.

Adaptation Plan

49,729,680 THB (Financial Impact)

- Potential amount of carbon tax payment for AOT based on its GHG emission (average estimate time = 5 years)

47,000,000 THB (Management Cost)

- Investment of emission reduction technology
- Investment on renewable energy source to meet sustainable design building

Physical Risks

(Flood)

Impact

High precipitation not only caused aviation problem but also delay of landing and departure due to flooding at the taxiway (which could possibly occur due to higher volume of precipitation in the future with the current condition of airport's infrastructure).

Adaptation Plan

1,700,000,000 THB (Financial Impact)

- The estimated restoration cost to resume the operations at Don Mueang Airport and head office (average estimate time = 5 years)

159,200,000 THB (Management Cost)

- Investment on new phase of airport infrastructure
- Investment on infrastructure maintenance

Climate Related Opportunities

Impact

The construction of additional runways at Suvarnabhumi Airport does not only benefit AOT in terms of larger service capacity to accommodate more passengers and generate more income but also reduces emission by shortening taxi time for landing and taking off. As AOT is the largest state-owned airport operator of Thailand, this contributes substantially to emission reduction of the airport, airlines and the aviation sector of the country.

Adaptation Plan

28,989,180,000 THB (Annual financial positive impact)

- More passenger's capacity and higher revenue generation (estimate time = 4 years)

5,448,985,250 THB (Management Cost)

- Investment on new phase of airport infrastructure
- Investment on renewable energy source and infrastructure to meet sustainable design building

Low Carbon Product

Emission reduction from airport improvement:

Construction of the third and the fourth runway of Suvarnabhumi Airport

Airport improvements	Airfield improvements	Installation of LED instead of classic light (ICAO Secretariat)	$\text{CO}_2 \text{ savings} = 0.4 * \text{kWh} * \text{kg of CO}_2/\text{kWh}$	An airport uses 600,000 kWh per year for light. CO_2 released per 1 kWh produced is 0.3 kg (0.0003 tonnes) The annual CO_2 savings can be estimated as: $0.4 * 600,000 * 0.0003 = 72 \text{ tonnes CO}_2 \text{ saved}$
		Construction of runways (ICAO Secretariat)	Use IFSET or $\text{FS} = \sum [\text{time savings}_i (\text{min}) * \text{FB}_i / \text{min}]$	An airport with an average of 100,000 arrivals and 100,000 departures annually is building an additional runway. On average, aircraft are expected to save 3 minutes on arrival and 5 minutes on departure from the additional runway. Arriving aircraft typically burn 35 kg (0.035 tonnes) per minute and departing aircraft burn 12 kg (0.012 tonnes) per minute during taxi. The annual fuel savings can be estimated as: — arrivals: $3 * 0.035 * 100,000 = 10,500 \text{ tonnes fuel saved}$ — departures: $5 * 0.012 * 100,000 = 6,000 \text{ tonnes fuel saved}$ Total: 16,500 tonnes fuel saved

Reference: ICAO Doc 9988 , Guidance on the development of State's Action Plans on CO2 Emission Reduction Activities

Example of calculation for AOT's construction of the third and the fourth runway of Suvarnabhumi Airport

การคาดการณ์จากสมมุติฐานดังกล่าวสรุปได้ว่า **Assumptions on fuel consumption in take-off and landing at Suvarnabhumi Airport**

สำหรับโครงการสร้างทางวิ่งที่ 3 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2565 จะช่วยลดการใช้น้ำมันของ

สายการบินของไทย เข้า-ออก ของสนามบินสุวรรณภูมิ ประมาณ $(96,710 * 3 * 0.035) + (96,710 * 5 * 0.012) = 15,957$ ตัน

สำหรับโครงการสร้างทางวิ่งที่ 4 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2573 จะช่วยลดการใช้น้ำมันของ

สายการบินของไทย เข้า-ออก ของสนามบินสุวรรณภูมิ ประมาณ $(148,751 * 3 * 0.035) + (148,751 * 5 * 0.012) = 24,544$ ตัน

วิธีการคำนวณปริมาณคาร์บอนไดออกไซด์เทียบเท่า ที่ลดลง **Emission Reduction from Fuel saving**

ปริมาณน้ำมัน * Emission Factor = จำนวนปริมาณตันคาร์บอนไดออกไซด์เทียบเท่า

หมายเหตุ ค่า Emission Factor อ้างอิงจาก Airport Carbon and Emission Reporting Tool (ACERT) version 4.0, ACI มีค่าเท่ากับ 3.1528 kgCO₂e/kg

ปริมาณคาร์บอนไดออกไซด์เทียบเท่า ที่ลดลง **Total GHG Reduction**

สำหรับโครงการสร้างทางวิ่งที่ 3 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2565 เท่ากับ $15,957 * 3.1528 = 50,309$ ตันคาร์บอนไดออกไซด์เทียบเท่า

สำหรับโครงการสร้างทางวิ่งที่ 4 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2573 เท่ากับ $24,544 * 3.1528 = 77,382$ ตันคาร์บอนไดออกไซด์เทียบเท่า

หมายเหตุ ¹ Airport Carbon and Emission Reporting Tool (ACERT) version 4.0, ACI

Ground Powering and Cooling System for Aircraft

Calculation is based on emission avoidance from fuel combustion by aircraft to generate electricity which has higher emission factor compared to grid electricity

5.2 Auxiliary Power (APU) and engine testing

5.2.1 Auxiliary Power Unit

The actual fuel flow rate of all APU models operated at BKK and actual running time of each APU operated were not accessible. Therefore, emission of all APU was calculated using numbers of flights, and distance of each flight to identify estimated APU fuel consumption of each flight. The fuel consumption was multiplied by emission factors.

Distance criteria for short-haul and light-hail flight

TGO provides emission factors for short-haul flight and long-haul flight but does not provide the definition of these two classification. As a result, the distance criteria defined by EUROCONTROL, as shown in Table 13, are used for classifying distance of each flight.

Table 13: Distance criteria for short-haul and long-haul flight

Type of flight	Distance
Short-haul flight	Less than or equal to 1,500 kilometres
Long-haul flight	Greater than 1,500 km

Internal Carbon Price

Internal Carbon Price is applied in financial impact assessment on transitional risk: Climate regulation (Carbon Tax)

Application of Internal Carbon Price

The emerging regulations to reduce GHG as part of NDC may lead to an implementation of carbon tax in Thailand.

AOT's internal carbon price is a shadow price based on Singapore carbon tax as it is the first country in Southeast Asia (same region as Thailand) to enforce this regulation. The carbon tax rate of (5 SGD/tCO₂e or 115 THB/CO₂e) is internally used to support decision making for executives in terms of energy efficiency and other low carbon projects

Singapore carbon tax [Link](#) 5 SGD / tCO₂e = 115 THB/tCO₂e Conversion rate: 23.07 THB / 1 SGD as of 30 Sep 2020