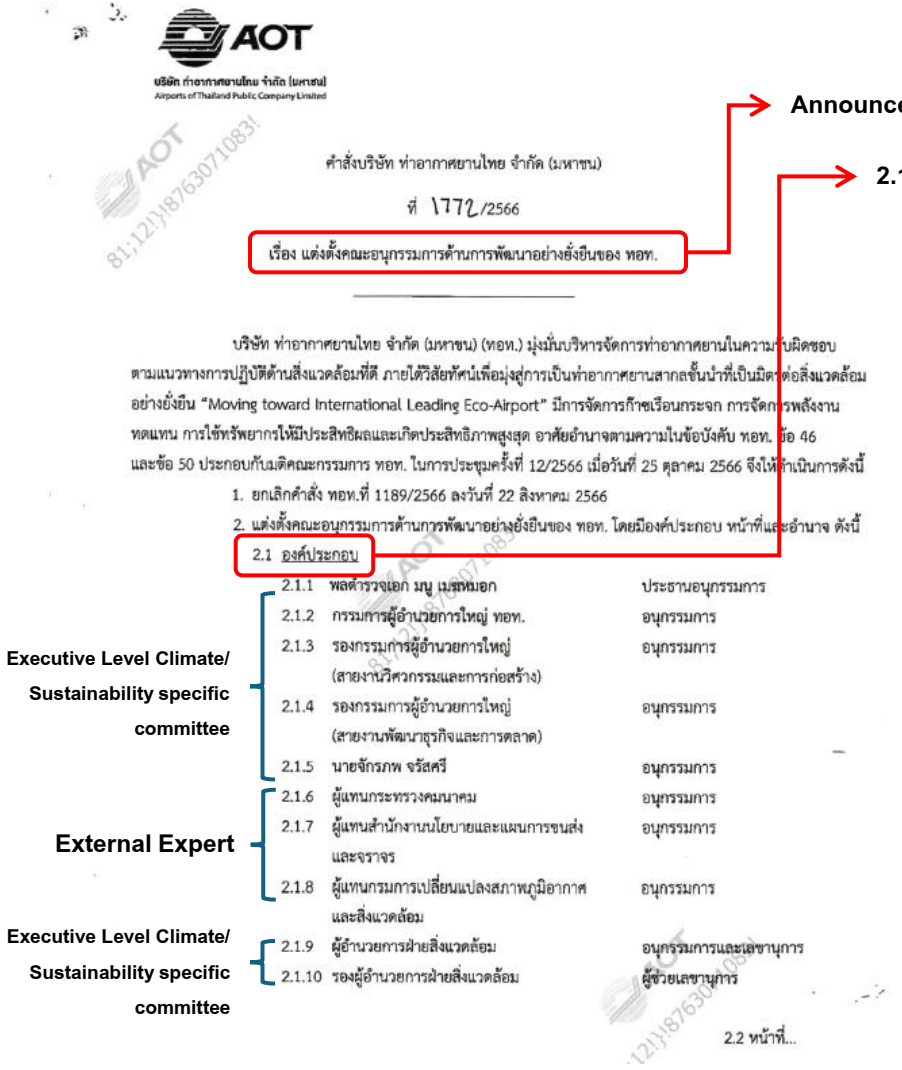
AOT Climate Change Management Disclosure

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.

Sustainability Development Committee Appointment



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

คำสั่งบริษัท ท่าอากาศยานไทย จำกัด (มหาชน)

ที่ 1772/2566

เรื่อง แต่งตั้งคณะอนุกรรมการด้านการพัฒนาอย่างยั่งยืนของ ทอท.

บริษัท ท่าอากาศยานไทย จำกัด (มหาชน) (ทอท.) มุ่งมั่นบริหารจัดการท่าอากาศยานในความรับผิดชอบ ตามแนวทางการปฏิบัติด้านสิ่งแวดล้อมที่ดี ภายใต้วิสัยทัศน์เพื่อมุ่งสู่การเป็นท่าอากาศยานสากลชั้นนำที่เป็นมิตรต่อสิ่งแวดล้อม อย่างยั่งยืน "Moving toward International Leading Eco-Airport" มีการจัดการก๊าซเรือนกระจก การจัดการพลังงาน ทดแทน การใช้ทรัพยากรให้มีประสิทธิผลและเกิดประสิทธิภาพสูงสุด 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. แต่งตั้งคณะอนุกรรมการด้านการพัฒนาอย่างยั่งยืนของ ทอท. โดยมีองค์ประกอบ หน้าที่และอำนาจ ดังนี้

2.1 องค์ประกอบ

2.1.1	พลตำรวจเอก มนู เมธาพลอก	ประธานอนุกรรมการ
2.1.2	กรรมการผู้อำนวยการใหญ่ ทอท.	อนุกรรมการ
2.1.3	รองกรรมการผู้อำนวยการใหญ่ (สายงานวิศวกรรมและการก่อสร้าง)	อนุกรรมการ
2.1.4	รองกรรมการผู้อำนวยการใหญ่ (สายงานพัฒนาธุรกิจและการตลาด)	อนุกรรมการ
2.1.5	นายจักรภพ 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

2.2 หน้าที่...

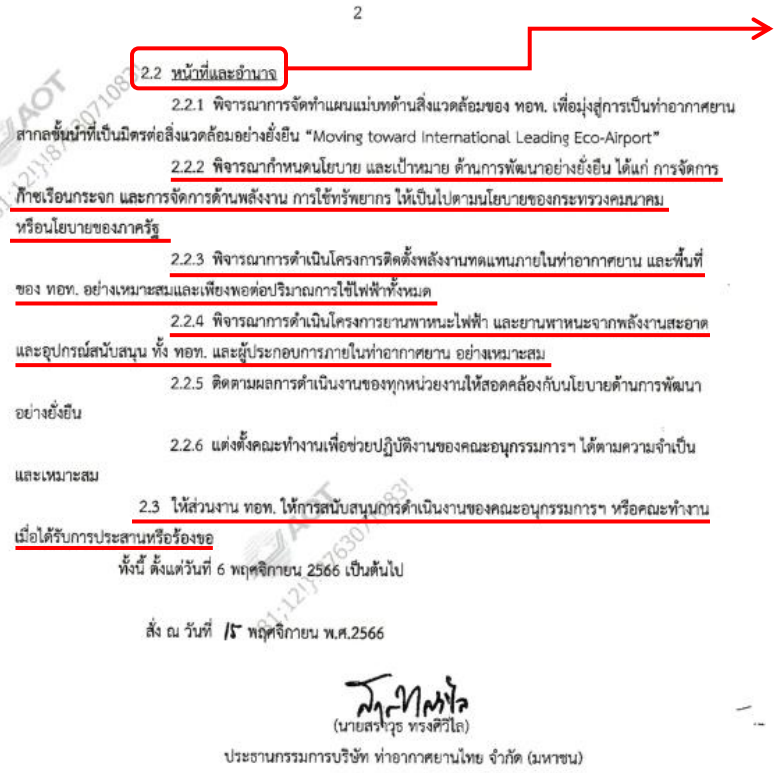
Executive Level Climate/ Sustainability specific committee

External Expert

Executive Level Climate/ Sustainability specific committee

Announcement of AOT Sustainability Development Committee (ESG Committee)

2.1 Sustainability Development Composition



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2.2 หน้าที่และอำนาจ

2.2.1 พิจารณาการจัดทำแผนแม่บทด้านสิ่งแวดล้อมของ ทอท. เพื่อมุ่งสู่การเป็นท่าอากาศยานสากลชั้นนำที่เป็นมิตรต่อสิ่งแวดล้อมอย่างยั่งยืน "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 แต่งตั้งคณะทำงานเพื่อช่วยปฏิบัติงานของคณะอนุกรรมการฯ ได้ตามความจำเป็นและเหมาะสม

2.3 ให้ส่วนงาน ทอท. ให้การสนับสนุนการดำเนินงานของคณะอนุกรรมการฯ หรือคณะทำงาน เมื่อได้รับการประสานหรือร้องขอ

ทั้งนี้ ตั้งแต่วันที่ 6 พฤศจิกายน 2566 เป็นต้นไป

สั่ง ณ วันที่ 15 พฤศจิกายน พ.ศ.2566

(นายสรวุธ ทรงศิริไล)
ประธานกรรมการบริษัท ท่าอากาศยานไทย จำกัด (มหาชน)

2.2 Roles & Responsibility of the Committee

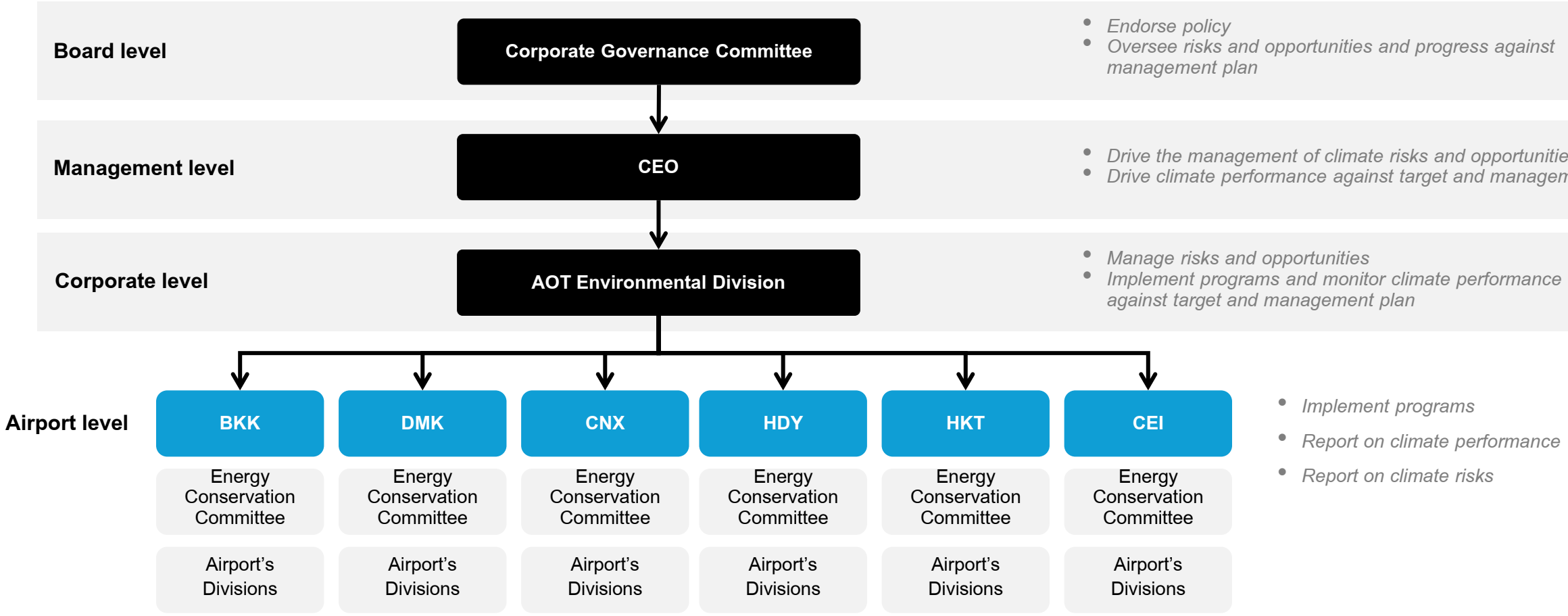
2.2.2 Set a policy and targets on sustainability development such as Greenhouse Gas Management, Energy Management, Resources Management to be followed with the Ministry of Transport's or government's policy.

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

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
  - Current Regulation
  - Emerging Regulation
  - Technology Risk
  - Legal Risk
  - Market Risk
  - Reputational Risk
  - Acute Physical Risk
  - Chronic Physical Risk

Assessment and 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: short/medium/long term

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

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

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)

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

Scope: Own operation (6 Airports and Head Office)

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 • Emergency plan • 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.

** Scenario Analysis Conducted*

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)

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

Scope:

Own operation (6 Airports and Head Office)

Upstream activities (Suppliers and other partners)

Downstream activities (Customers and other business partners)

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 Risks and 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.

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

Climate Related Management Incentives

CEO	Business Unit Manager	Employees
Mr. Sarawut Songsivilai 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 **"Innolution 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:

- 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:

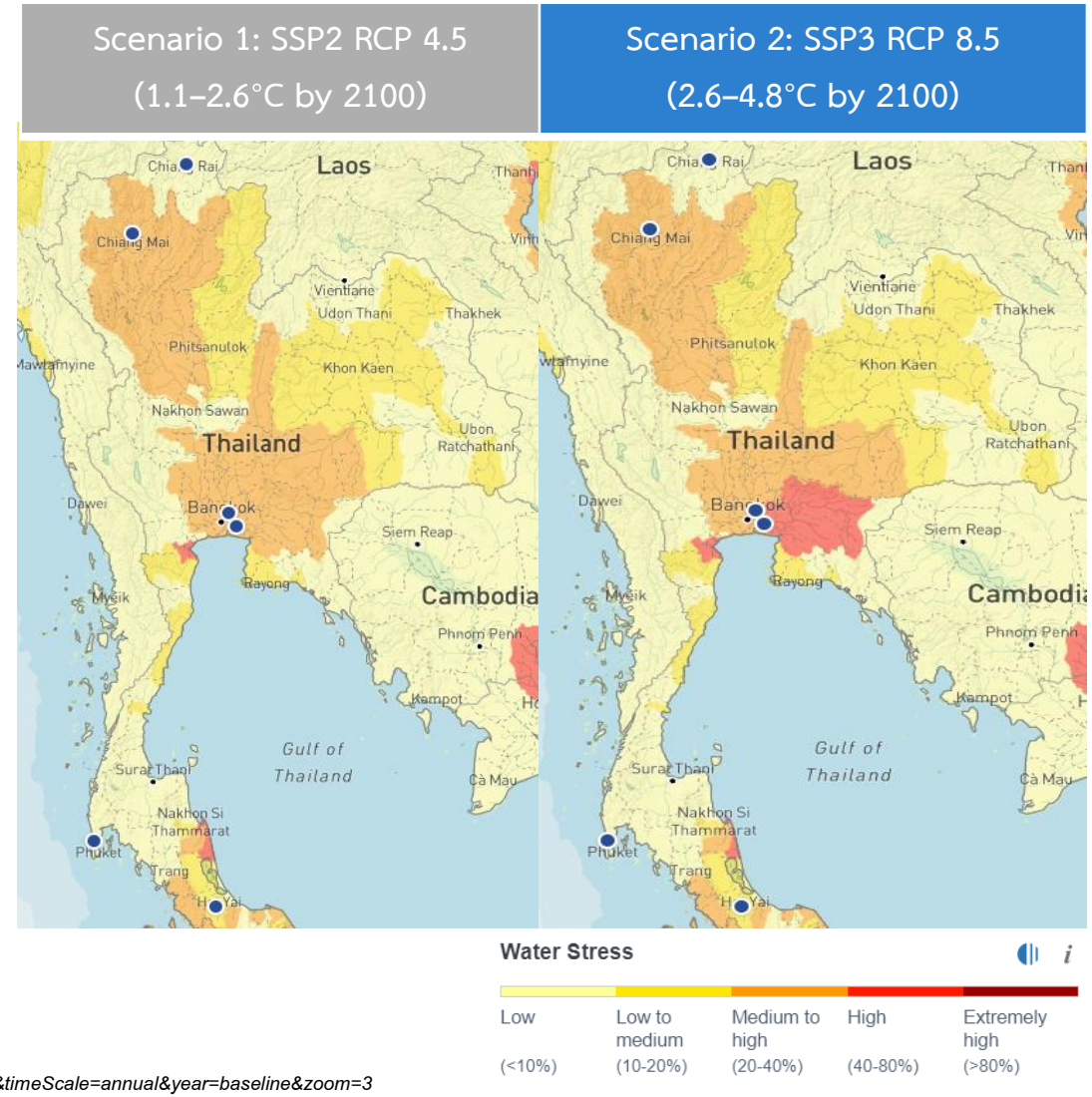
- Assessment consistent with the expected lifetime of the assets or activities
- The scope of our assessment includes our upstream activities
- The scope of our assessment includes our downstream activities and clients

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



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&predefined=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://rmets.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 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	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:

- 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 (tCO2e)	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.

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

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)

https://www.iea.org/articles/putting-a-price-on-carbon-an-efficient-way-for-thailand-to-meet-its-bold-emission-target

https://assets.ctfassets.net/v228i5y5k0x4/21ENNPXF97D12uNS8Deoqk/f0add64cfdf53929912207051dc2648f/2020_TCFD_Report.pdf

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 Impact:
Financial Risks & Opportunities

Transition Risk

(Nationally Determined Contributions: NDC)

Impact	Adaptation Plan
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.	**49,729,680 THB (Financial Impact)** • Potential amount of carbon tax payment for AOT based on its GHG emission **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	Adaptation Plan
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).	**1,700,000,000 THB (Financial Impact)** • The estimated restoration cost to resume the operations at Don Mueang Airport and head office **159,200,000 THB (Management Cost)** • Investment on new phase of airport infrastructure • Investment on infrastructure maintenance

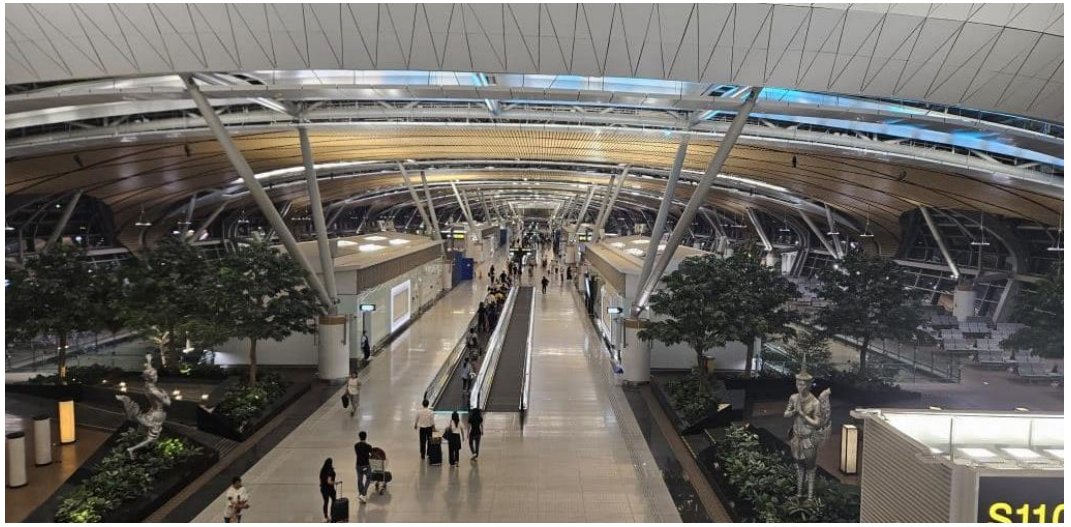
Climate Related Opportunities

Impact	Adaptation Plan
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.	**28,989,180,000 THB (Annual financial positive impact)** • More passenger's capacity and higher revenue generation **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

Suvarnabhumi Airport: SAT-1 Terminal

To meet the increasing number of tourists from around the world at Suvarnabhumi Airport, AOT has developed the **Secondary Satellite Building 1 (SAT-1) project**, upgrading the capacity of Suvarnabhumi Airport to a world-class airport. The SAT-1 can accommodate an increase of passengers from 45 million to 60 million per year with a project area of over 216,000 square meters. It is a 4-storey building with 28 exit doors connecting to the parking area . From AOT's determination to push Suvarnabhumi Airport to be a Greet Airport prototype airport and AOT's determination to promote the sustainability of the organization and the country, the SAT-1 building has been designed to be a **sustainable building** through a **universal design** for users of all ages, such as meditation rooms, separate male and female prayer rooms, mother and child rooms, and a children's area. In addition, AOT has developed efficient structures and management by applying technology, along with supporting the country's local arts by combining architecture and art that reflects Thai identity to blend with the modern building structure, such as woven fabrics and Thai silk patterns, and the use of Thai patterns and patterns. And to ensure the confidence of all passengers and stakeholders, AOT has conducted a trial operation and continuously prepared, with personnel who have been trained according to standard criteria, and has inspected safety according to international standards by relevant regulatory and supervisory agencies.



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)	CO_2 savings = 0.4 * kWh * kg of CO_2/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 tonnes CO_2 saved
		Construction of runways (ICAO Secretariat)	Use IFSET or FS = $\sum$[time savings$_i$ (min) * FB$_i$ /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 tonnes fuel saved — departures: 5 * 0.012 * 100,000 = 6,000 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 Suvernabhumi 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

วิธีการคำนวณปริมาณคาร์บอนไดอออกไซด์เทียบเท่า ที่ลดลง Emission Reduction from Fuel saving

ปริมาณน้ำมัน * Emission Factor = จำนวนปริมาณตันคาร์บอนไดอออกไซด์เทียบเท่า

หมายเหตุ ค่า Emission Factor อ้างอิงจาก Airport Carbon and Emission Reporting Tool (ACERT) version 4.0, ACI มีค่าเท่ากับ 3.1528 $kgCO_2e/kg$

ปริมาณคาร์บอนไดอออกไซด์เทียบเท่า ที่ลดลง Total GHG Reduction

สำหรับโครงการสร้างทางวิ่งที่ 3 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2565 เท่ากับ 15,957 * 3.1528 = 50,309 ตันคาร์บอนไดอออกไซด์เทียบเท่า
สำหรับโครงการสร้างทางวิ่งที่ 4 ของสนามบินสุวรรณภูมิแล้วเสร็จในปี 2573 เท่ากับ 24,544 * 3.1528 = 77,382 ตันคาร์บอนไดอออกไซด์เทียบเท่า

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

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*Singapore carbon tax **Link** 5 SGD / tCO2e = 115 THB/tCO2e Conversion rate: 23.07 THB / 1 SGD as of 30 Sep 2020*

AOT's Positioning on Trade Associations for Climate Alignment

AIRPORT OF THAILAND

Statement of AOT’s Positioning

Climate change has been addressed as potential issues to AOT in various areas of work for AOT’s operation. The topic under the obligation of Paris Agreement can be implementing through Thailand’s Nationally Determined Contributions (NDCs) in advocating the alleviation of climate change impact. In essence, AOT realized that supporting the relative trade associations on climate topic is vital to AOT with respect to the overall emission reduction at the national level. Contributing the influent trade associations can accelerate and drive is covered all jurisdictions of AOT

Governance framework for public policy engagement with clear accountabilities

AOT contributes to the external organization through the expenditure in supporting the sustainable development with regard to various topic issues. Climate alignment with the Paris Agreement as part of commitment and core activity of national and international trade associations have accounted in the contribution list of AOT to drive the meaningful policy and accelerate the overall movement on climate change agenda. In supporting AOT on climate change position through trade association, AOT structuralized the governance framework for public policy engagement with clear accountabilities up to executive level toward any active action in which trade association AOT has joined with.

Management Level	At the management level of AOT, the responsibility and accountability are representative of AOT in joining the relevant conference and contributing the relative agenda as membership to trade association to tackle the crucial issues. i.e., climate change, as committed by the positioning of trade association. Additionally, building the networking across related organization or external parties to drive and raise the progress on climate change.
Operational level	The operational level of AOT has to comply with the direction and implementation plan to accomplish the commitment and AOT's positioning on contributed trade association in practice. Furthermore, monitoring and reporting the progress are two significant steps that are required to be tracked and to be reported to the management level.

A Clear framework for reviewing, monitoring, and misalignment processes for AOT in trade association contribution

In advocating the expenditure through trade association that constitutes the policy enacting for climate change, AOT established the stepwise processes for trade association contribution, including reviewing, monitoring, and a clear framework for addressing misalignments between climate change policy positions of trade associations and AOT climate position. These are the process step regarding the management system in place of AOT.

Reviewing	AOT conducts the review process to consider the trade association that constitutes an alignment for climate change and Paris agreement. The commitment and relevant activities have prioritized to be the key point in contributing the trade association of AOT.
Monitoring	In monitoring process, AOT considers the results after joining in order to ensure an alignment whether trade association can deliver the value related to the commitment and target. An alignment between consequence and target is crucial in the monitoring process owing to the further decision in contributing trade association or conducting misalignment framework in case the results cannot be met with the commitment. The results are reviewed and reported to the executive level in accordance with the management system in place for the reporting to governance framework.
Misalignment	Apart from monitoring outcome in contributing climate change through trade association, AOT established a clear framework for addressing misalignments between climate change policy positions of trade associations and AOT's positioning. This process will be conducted for the further consideration regarding AOT' s positioning in each trade association to decide whether AOT will be participating with trade association, leaving trades, or distancing the company from the misalignment. These actions are the occurred consequences after the monitoring process once the outcome is inconsistent with the AOT's position on climate change.

Reporting on Climate policy positions and activities of trade associations

AOT is a membership of Airports Council International Asia-Pacific (ACI APAC) and ACI World Governing Board (ACI WGB). Being part of membership in these trade associations to focus on the crucial topic, i.e., climate change, AOT can do the effective practice relevant to the approach that can tackle the climate issue in the context of AOT by adopting the acquired information. The encouragement of AOT through trade associations can accelerate and drive the key change associated with the climate issues among the airport groups. This can catalyze the movement of awareness regarding the organization plan to integrate the urgent issues as part of operation and strategic plans. It is addressing and accounting the climate change and emerging issues across all AOT's operation with these contributions.

Reporting on Climate policy positions and activities of trade associations - Airports Council International (ACI)

Climate Policy Position	Airports Council International (ACI) contributes the impact reduction from climate change with the environmental advocacy program namely Airport Carbon Accreditation (ACA). This is the program that advocate airport to reduce the CO2 emission to retrieve the certified levels of accreditation. Besides, this organization encourage the members to invest in long-term capacity by adopting clean technologies, reducing carbon and greenhouse gas emissions, and exploring new market opportunities.
Area of Activity	• Contributing airport to reduce the carbon emission toward climate change tackling. • Advocating airport to implement clean technologies to decarbonize the emission. • Aiming long-term carbon goal with respect to climate change impact alleviation. • Focusing on Climate change adaptation and resilience

AIRPORTS COUNCIL INTERNATIONAL

ASIA-PACIFIC AIRPORTS COUNCIL INTERNATIONAL

WORLD AIRPORTS COUNCIL INTERNATIONAL

AOT contribution: AOT gain and exchange knowledge regarding airport operations, as well as forming relationships with the executives from other regional airports. This provides an opportunity to increase marketing channels or trade amongst business allies, further enhancing AOT's image as the leader in air freight logistics, especially climate change toward net zero agenda. Being the membership in trade association that committed the focus area on climate issues is deemed AOT's positioning in the international level in supporting the approaches, policies, and activities to tackle climate change.