

## เอกสารรับฟังความเห็น

### ร่างมาตรฐานการจัดกลุ่มกิจกรรมทางเศรษฐกิจที่คำนึงถึงสิ่งแวดล้อม (Thailand Taxonomy)

เผยแพร่เมื่อวันที่ 26 ธันวาคม 2565

คณะทำงาน Thailand Taxonomy\* ได้จัดทำเอกสารฉบับนี้ขึ้นเพื่อสำรวจ  
ความเห็นจากผู้เกี่ยวข้อง โดยท่านสามารถส่งความเห็นหรือข้อเสนอแนะให้  
ธปท. หรือ สำนักงาน ก.ล.ต. ได้ทางแบบสอบถามใน QR Code ด้านล่าง หรือ  
e-mail: [taxonomy@bot.or.th](mailto:taxonomy@bot.or.th) หรือ [debt@sec.or.th](mailto:debt@sec.or.th)



วันสุดท้ายของการแสดงความคิดเห็น วันพฤหัสบดีที่ 26 มกราคม 2566

ธปท. และ สำนักงาน ก.ล.ต. ในนามคณะทำงาน Thailand Taxonomy ขอขอบคุณทุกท่าน  
ที่เข้าร่วมแสดงความคิดเห็นและข้อเสนอแนะมา ณ โอกาสนี้

\* คณะทำงาน Thailand Taxonomy ประกอบด้วย ผู้แทนจาก ธปท. สำนักงาน ก.ล.ต. สำนักงานนโยบายและแผนทรัพยากรธรรมชาติและสิ่งแวดล้อม กรมพัฒนาพลังงานทดแทนและอนุรักษ์พลังงาน สำนักงานนโยบายและแผนพลังงาน สำนักงานนโยบายและแผนการขนส่งและจราจร องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน) สภาหอการค้าแห่งประเทศไทย สภาอุตสาหกรรมแห่งประเทศไทย สมาคมธนาคารไทย สมาคมนานาชาติ และสมาคมสถาบันการเงินของรัฐ

\*\* การจัดทำ Thailand Taxonomy ได้รับการสนับสนุนจาก International Finance Corporation (IFC) และมี Climate Bonds Initiative (CBI) เป็นที่ปรึกษาโครงการ ซึ่งทั้งสองหน่วยงานมีความเชี่ยวชาญและมีประสบการณ์ในการจัดทำ Taxonomy ให้กับหลายประเทศ

## ร่างมาตรฐานการจัดกลุ่มกิจกรรมทางเศรษฐกิจที่คำนึงถึงสิ่งแวดล้อม (Thailand Taxonomy)

เพื่อรับฟังความเห็นระหว่างวันที่ 26 ธันวาคม 2565 – 26 มกราคม 2566

### 1. เหตุผลความจำเป็น

สิ่งแวดล้อมถือเป็นประเด็นสำคัญที่กำลังมีผลกระทบต่อระบบเศรษฐกิจมากขึ้นต่อเนื่อง อย่างไรก็ตาม ปัจจุบันแต่ละภาคส่วนมีความเข้าใจเกี่ยวกับกิจกรรมที่เป็นมิตรกับสิ่งแวดล้อมแตกต่างกัน ทำให้การขับเคลื่อนการดำเนินงานด้านสิ่งแวดล้อม โดยเฉพาะการจัดสรรเงินทุนยังไม่ตรงจุดซึ่งอาจนำไปสู่การกล่าวอ้างเกินจริงว่ามีการดำเนินการด้านสิ่งแวดล้อมแล้ว (greenwashing) หรือการจัดสรรเงินทุนให้ภาคธุรกิจที่ต้องการปรับตัวโดยเฉพาะในช่วงเปลี่ยนผ่าน (transitional activities) ยังไม่เพียงพอ ดังนั้น จำเป็นต้องมีมาตรฐานการจัดกลุ่มกิจกรรมทางเศรษฐกิจที่คำนึงถึงสิ่งแวดล้อม (Taxonomy) เพื่อให้ภาคธุรกิจ และภาคการเงิน มีความเข้าใจตรงกันและมีจุดยึดโยงให้นำไปใช้อ้างอิงในการกำหนดนโยบายวางแผนเชิงกลยุทธ์ รวมถึงพัฒนาผลิตภัณฑ์และบริการของภาคธุรกิจได้อย่างมีมาตรฐานและสอดคล้องกัน ซึ่งจะช่วยให้แต่ละภาคส่วนสามารถประเมินสถานะการดำเนินการด้านสิ่งแวดล้อมและสามารถวางแผนรองรับการปรับตัวในช่วงเปลี่ยนผ่านที่สอดคล้องกับบริบทของไทยได้อย่างเหมาะสมและทันการณ์

**Thailand Taxonomy คือ มาตรฐานกลางที่ใช้อ้างอิงในการจำแนกและจัดกลุ่มกิจกรรมทางเศรษฐกิจที่เป็นมิตรต่อสิ่งแวดล้อมของไทย** โดย Thailand Taxonomy จะกำหนดคำนิยาม คำอธิบาย เงื่อนไข และตัวชี้วัดที่ชัดเจนเป็นรายกิจกรรมทางเศรษฐกิจ เพื่อเป็นคู่มือให้ทุกภาคส่วนเข้าใจและประเมินได้ตรงกันว่า กิจกรรมทางเศรษฐกิจนั้นมีการดำเนินการอย่างมีความรับผิดชอบต่อสิ่งแวดล้อมและสังคม หรือไม่และอยู่ในระดับใด โดยการพัฒนา Thailand Taxonomy ได้คำนึงถึงบริบทของประเทศและความสอดคล้องกับมาตรฐานต่างประเทศ (inter-operability) เพื่อสนับสนุนการปรับตัวของกิจกรรมทางเศรษฐกิจไปสู่ความเป็นมิตรต่อสิ่งแวดล้อมได้อย่างทั่วถึง

### 2. ภาพรวมการจัดกลุ่มกิจกรรมทางเศรษฐกิจ

การจัดกลุ่มกิจกรรมทางเศรษฐกิจจะคำนึงถึง 2 มิติ สำคัญ ได้แก่ วัตถุประสงค์ด้านสิ่งแวดล้อมและภาคเศรษฐกิจที่จะดำเนินการ

วัตถุประสงค์ด้านสิ่งแวดล้อม Thailand Taxonomy ประกอบด้วย 6 วัตถุประสงค์ ได้แก่

- (1) climate change mitigation (การลดปัญหาการเปลี่ยนแปลงสภาพภูมิอากาศ)
- (2) climate change adaptation (การปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ)
- (3) sustainable use and protection of marine and water resources (การใช้ทรัพยากรน้ำอย่างยั่งยืน)
- (4) resource resilience and transition to a circular economy (การใช้ทรัพยากรอย่างยั่งยืนและปรับตัวสู่เศรษฐกิจหมุนเวียน)
- (5) pollution prevention and control (การป้องกันและควบคุมมลพิษ)
- (6) protection and restoration of biodiversity (การอนุรักษ์ความหลากหลายทางชีวภาพของระบบนิเวศ)

โดยในการจัดทำ Thailand Taxonomy ระยะที่ 1 จะเริ่มจากวัตถุประสงค์ด้านสิ่งแวดล้อมเรื่อง climate change mitigation ก่อน อย่างไรก็ตาม กิจกรรมที่เกิดขึ้นจะต้องไม่ส่งผลกระทบต่อ 5 วัตถุประสงค์อื่นที่เหลือด้วยเช่นกัน (หรือที่เรียกว่า Do No Significant Harm)

ภาคเศรษฐกิจ Thailand Taxonomy ระยะที่ 1 จะครอบคลุมภาคพลังงานและภาคการขนส่งก่อน เนื่องจากเป็นภาคเศรษฐกิจที่มีส่วนสำคัญต่อปัญหาการเปลี่ยนแปลงของสภาพภูมิอากาศและมีการปล่อย

ก๊าซเรือนกระจกในสัดส่วนที่สูง โดยภายใต้ภาคพลังงานและภาคการขนส่ง จะแบ่งย่อยออกเป็นกิจกรรมต่าง ๆ รวมทั้งสิ้น 22 กิจกรรม และมีเกณฑ์ประเมินว่าแต่ละกิจกรรมสามารถลดก๊าซเรือนกระจกเพื่อช่วยลดปัญหาการเปลี่ยนแปลงของสภาพภูมิอากาศอยู่ในระดับใด สำหรับในระยะถัดไปจะพิจารณาจัดทำ Thailand Taxonomy สำหรับภาคการผลิตและภาคการเกษตรภายใต้วัตถุประสงค์ด้านสิ่งแวดล้อมเรื่อง climate change mitigation รวมถึงจะขยายไปสู่วัตถุประสงค์ด้านสิ่งแวดล้อมเรื่องอื่น อาทิ climate change adaptation ต่อไป

### 3. วิธีการ

ในการประเมินและจัดกลุ่มกิจกรรมทางเศรษฐกิจภายใต้ Thailand Taxonomy ระยะที่ 1 สำหรับภาคพลังงานและภาคการขนส่งภายใต้วัตถุประสงค์ด้านสิ่งแวดล้อมเรื่อง climate change mitigation มีขั้นตอนและวิธีการดังนี้

**3.1 ประเมินว่ากิจกรรมนั้นอยู่ภายใต้ขอบเขตกิจกรรมทางเศรษฐกิจในภาคพลังงานและภาคการขนส่งที่ระบุไว้หรือไม่** หากเข้าข่าย สามารถประเมินได้ตามเงื่อนไขและตัวชี้วัดที่ระบุไว้ในข้อ 3.2 หากไม่เข้าข่าย จะถือเป็นเพียงกิจกรรมที่ไม่เกี่ยวข้อง (Ineligible Activity / Not Listed Activity) และไม่ต้องประเมินตาม Taxonomy

**3.2 Thailand Taxonomy ใช้หลักการที่อ้างอิงหลักวิทยาศาสตร์สิ่งแวดล้อม โดยจะแบ่งการคำนึงถึงสิ่งแวดล้อมของกิจกรรมต่าง ๆ ออกเป็น 3 ระดับ (ระบบ Traffic-Light System) ได้แก่ สีเขียว สีเหลือง และสีแดง ดังนี้**

- **สีเขียว (green)** หมายถึง กิจกรรมที่ลดปัญหาการเปลี่ยนแปลงสภาพภูมิอากาศโดยมีการปล่อยก๊าซเรือนกระจกสุทธิใกล้เคียงหรือเท่ากับศูนย์ในปัจจุบัน โดยอ้างอิงตัวชี้วัดที่คาดการณ์จากแบบจำลองของสภายุโรปว่าจะสามารถบรรลุเป้าหมายการปล่อยก๊าซเรือนกระจกสุทธิเป็นศูนย์ในปี พ.ศ. 2593 (ค.ศ. 2050) เพื่อควบคุมอุณหภูมิโลกให้สูงขึ้นไม่เกิน 1.5 องศาเซลเซียสตามที่สมาชิกภายใต้ความตกลงปารีส (Paris Agreement) ตกลงร่วมกัน
- **สีเหลือง (amber)** หมายถึง กิจกรรมที่ยังไม่มีการปล่อยก๊าซเรือนกระจกสุทธิใกล้เคียงหรือเท่ากับศูนย์ในปัจจุบัน และอยู่ระหว่างปรับตัวเพื่อลดการปล่อยก๊าซเรือนกระจกซึ่งจะช่วยลดปัญหาการเปลี่ยนแปลงสภาพภูมิอากาศ โดยในปัจจุบันสามารถลดปัญหาได้บ้างแต่ยังสามารถปรับปรุงให้ดียิ่งขึ้นได้ ภายใต้การกำหนดเส้นทางการลดคาร์บอน (decarbonization pathways) และกรอบเวลาที่มีความน่าเชื่อถือ โดยการคำนวณตัวชี้วัดจะพิจารณาจากบริบทและแผนของประเทศเป็นสำคัญ ซึ่งเงื่อนไขการปล่อยก๊าซเรือนกระจกภายใต้กิจกรรมสีเหลืองจะอ้างอิงจากเป้าหมายการมีส่วนร่วมที่จะลดก๊าซเรือนกระจกของประเทศ (Nationally Determined Contribution: NDC)
- **สีแดง (red)** หมายถึง กิจกรรมที่ไม่สามารถถูกประเมินได้ว่าเป็นมิตรต่อการลดก๊าซเรือนกระจกสุทธิได้ และไม่เข้าข่ายตามเงื่อนไขและตัวชี้วัดสำหรับกิจกรรมในระดับสีเขียวหรือสีเหลือง

ทั้งนี้ กิจกรรมเหล่านี้จะต้องเป็นกิจกรรมที่ไม่สร้างผลกระทบเชิงลบอย่างมีนัยสำคัญ (Do No Significant Harm) ต่อการให้บรรลุวัตถุประสงค์ด้านสิ่งแวดล้อมอื่น ๆ และคำนึงถึงผลกระทบด้านสังคมไปพร้อมกัน (Minimum Social Safeguards)

#### 4. ผลลัพธ์ที่คาดหวังจากการนำ Thailand Taxonomy ไปใช้

Thailand Taxonomy เป็นมาตรฐานกลางสำหรับภาคส่วนต่าง ๆ ใช้อ้างอิงโดยการนำ Thailand Taxonomy ไปใช้ยังเป็นไปตามความสมัครใจ ซึ่งภาคส่วนต่าง ๆ สามารถใช้ประโยชน์จาก Thailand Taxonomy ได้ดังนี้

ภาคธุรกิจสามารถวางแผนการปรับตัว โดยสามารถใช้ Thailand Taxonomy อ้างอิงในการประเมินความเสี่ยง สถานะ และความพร้อมของตนเองในด้านการลดก๊าซเรือนกระจก เพื่อวางแผนการปรับตัวทางธุรกิจ ซึ่งจะช่วยให้เพิ่มโอกาสการเข้าถึงบริการทางการเงิน โดยเฉพาะเครื่องมือการเงินเพื่อความยั่งยืนต่าง ๆ ที่อ้างอิงกับคำนิยามสากลเกี่ยวกับกิจกรรมทางเศรษฐกิจที่เป็นมิตรต่อสิ่งแวดล้อม ดึงดูดเงินทุนรวมทั้งเงินลงทุนจากต่างประเทศที่จะสนับสนุนการปรับตัวในอนาคต และเตรียมพร้อมหากจำเป็นต้องเปิดเผยข้อมูลด้านการดำเนินงานที่เป็นมิตรต่อสิ่งแวดล้อม (Taxonomy-aligned disclosure)

ภาคการเงินสามารถจัดสรรเงินทุนได้ตรงจุดยิ่งขึ้น สถาบันการเงินสามารถอ้างอิง Thailand Taxonomy ในการออกแบบผลิตภัณฑ์และบริการทางการเงินที่ตอบโจทย์การปรับตัวของธุรกิจไทย รวมถึงประเมินความเสี่ยงในพอร์ตสินเชื่อได้เป็นระบบยิ่งขึ้น

ภาครัฐสามารถออกแบบมาตรการและนโยบายในทิศทางที่สอดคล้องกัน ภาครัฐสามารถนำ Thailand Taxonomy มากำหนดนโยบายหรือสร้างแรงจูงใจเพื่อให้ระบบเศรษฐกิจเตรียมพร้อมรับมือกับความเสี่ยงด้านการเปลี่ยนแปลงสภาพภูมิอากาศ รวมถึงสามารถปรับตัวและเติบโตได้อย่างยั่งยืน

#### 5. เนื้อหาของร่าง Thailand Taxonomy

ร่าง Thailand Taxonomy ระยะที่ 1 ฉบับนี้ ประกอบด้วย

บทที่ 1 กรอบแนวคิดและการกำหนดวัตถุประสงค์ด้านสิ่งแวดล้อมสำหรับการพัฒนา Thailand Taxonomy

บทที่ 2 การเลือกภาคเศรษฐกิจที่มีนัยสำคัญ

บทที่ 3 วิธีการประเมินรายการกิจกรรมทางเศรษฐกิจ (ภาคพลังงานและการขนส่ง)

บทที่ 4 เงื่อนไขและตัวชี้วัดสำหรับการประเมินรายการกิจกรรมทางเศรษฐกิจ (ภาคพลังงานและการขนส่ง)

บทที่ 5 กรอบหลักการประเมินผลกระทบต่อวัตถุประสงค์ทางสิ่งแวดล้อมด้านอื่นๆ และผลกระทบทางสังคม รวมถึงการประเมินว่ามีมาตรการหรือแผนการเยียวยาผลกระทบที่เกิดขึ้น

บทที่ 6 คำแนะนำสำหรับการทบทวน Taxonomy ให้สอดคล้องกับบริบทที่เปลี่ยนแปลงไปในอนาคต

#### 6. การเปิดรับฟังความเห็นต่อร่าง Thailand Taxonomy

คณะทำงาน Thailand Taxonomy เปิดรับฟังความเห็นต่อร่าง Thailand Taxonomy ระยะที่ 1 ระหว่างวันที่ 26 ธันวาคม 2565 – 26 มกราคม 2566 โดยคาดว่าจะออกฉบับสมบูรณ์ได้ภายในไตรมาส 1 ของปี 2566

ทั้งนี้ Thailand Taxonomy จะเป็นเอกสารที่มีการทบทวนเป็นระยะ (living document) เพื่อให้ทันต่อความก้าวหน้าของเทคโนโลยีและองค์ความรู้ใหม่ ๆ เชิงวิทยาศาสตร์สิ่งแวดล้อมที่เกิดขึ้น และสอดคล้องกับเป้าหมายและแผนของประเทศที่อาจมีการปรับเปลี่ยนในระยะข้างหน้า

# ร่าง Thailand Taxonomy ระยะที่ 1

# Thailand Taxonomy Paper

## Draft for public consultations

December 2022

Prepared by:



Supported by:

**GB-TAP** Green Bond Technical Assistance Program



## Table of Content

List of Abbreviations.....	4
List of Metrics Abbreviations.....	4
List of Figures.....	5
List of Tables.....	5
Thailand Taxonomy Development framework.....	7
1.1. The rationale for the development of national taxonomy.....	7
1.2. The world of green taxonomies.....	8
1.3. Key reference taxonomies.....	10
1.4. Taxonomy structure overview.....	11
1.5. Defining the objectives of the Thailand Taxonomy.....	12
1.6. National environmental objectives.....	13
1.7. The final list of the objectives and their description.....	16
2. Sectoral assessment.....	18
2.1. Economic Sectors Selection.....	18
2.2. Final sector breakdown and activities mapping.....	21
2.3. Transitional activities and traffic light system.....	24
2.3.1. Transition as a concept.....	24
2.3.2. Traffic light system for the Thailand Taxonomy.....	26
3. Models for activities assessment.....	26
3.1. Scope of emissions.....	28
3.2. Relevant decarbonization measures.....	28
3.3. NDC-based amber thresholds.....	28
3.4. Model for energy.....	28
3.4.1. Bioenergy.....	30
3.5. Model for transportation.....	32
3.5.1. Shipping Sector.....	32
3.5.2. Sectoral thresholds and metrics.....	35
4. Activities thresholds and criteria.....	36
4.1. Energy sector activities: an overview.....	36
4.1.1. Solar energy generation.....	38
4.1.2. Wind energy generation.....	38
4.1.3. Hydropower generation.....	39
4.1.4. Geothermal power generation.....	40
4.1.5. Bioenergy generation and production.....	40
4.1.6. Energy production from natural gas.....	41

4.1.7.	Ocean energy generation .....	42
4.1.8.	Electricity generation from renewable non-fossil gaseous and liquid fuels .....	42
4.1.9.	Production of heating and cooling using waste heat.....	42
4.1.10.	Installation and operation of electric heat pumps .....	43
4.1.11.	Heating and cooling distribution .....	43
4.1.12.	Transmission and distribution networks for renewable and low-carbon gases, including hydrogen .....	43
4.1.13.	Storage of electricity and thermal energy .....	44
4.1.14.	Transmission and distribution of electricity .....	44
4.2.	Transportation Sector: an overview .....	45
4.2.1.	Transport via railways.....	46
4.2.2.	Other passenger land transport .....	47
4.2.3.	Urban and suburban passenger land transport.....	48
4.2.4.	Freight transport by road .....	48
4.2.5.	Enabling infrastructure for low-emission transport .....	49
4.2.6.	Sea and coastal water transport.....	50
4.2.7.	Inland water transport .....	51
4.2.8.	Retrofitting of sea and coastal freight and passenger water transport.....	52
5.	Essential Criteria.....	52
5.1.	Do No Significant Harm .....	52
5.1.2	Classification of climate-related hazards.....	55
5.2.	Minimum Social Safeguards .....	55
6.	Grandfathering and review period .....	56
Appendix 1. Thailand and its climate policy in global and regional context .....		57
1.	Global context .....	57
2.	Thailand and climate change.....	57
3.	National context.....	58
4.	Need for more investment in climate change mitigation, adaptation and resilience .	59
5.	Local environmental issues, causes, and mitigation.....	61
6.	Vital national policies related to GHG reduction .....	62
7.	Thailand climate change mitigation strategies .....	63
8.	State of the local green finance market .....	66
Appendix 2. User Guidance and Application Navigation .....		68
A step-by-step guide .....		69
Appendix 3. Usability examples and case studies.....		71
Appendix 4. FAQs .....		74
Annex 5. Alignment with other taxonomies.....		76



## List of Abbreviations

<b>ADB</b>	Asian Development Bank
<b>AER</b>	Annual Efficiency Ratio
<b>ASEAN</b>	Association of Southeast Asian Nations
<b>BAU</b>	Business-as-usual
<b>BUR3</b>	Thailand’s Third Biannual Update Report
<b>CBI</b>	Climate Bonds Initiative
<b>CCMP</b>	Climate Change Master Plan (2015-2050)
<b>CSP</b>	Concentrated solar power
<b>DCS</b>	Fuel Oil Data Collection System
<b>EU</b>	European Union
<b>FDI</b>	Foreign direct investments
<b>GHG</b>	Greenhouse gases
<b>ICMA</b>	International Capital Market Association
<b>IEA</b>	International Energy Agency
<b>IPPU</b>	Industrial processes and products use
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IMO</b>	International Maritime Organisation
<b>IRENA</b>	International Renewable Energy Agency
<b>LCA</b>	Lifecycle Assessment
<b>LT-LEDS</b>	Long-Term Low Greenhouse Gas Emission Development Strategy
<b>LULUCF</b>	Land Use, Land-Use Change and Forestry Sector
<b>NDC</b>	Nationally Determined Contribution
<b>PED</b>	Primary energy demand
<b>PW</b>	Photovoltaic
<b>RCP</b>	Representative Concentration Pathway, a greenhouse gas concentration trajectory adopted by the IPCC
<b>SDG</b>	Sustainable Development Goals
<b>THB</b>	Thai baht
<b>TPI</b>	Transition Pathway Initiative
<b>WG-SF</b>	Working Group on Sustainable Finance

## List of Metrics Abbreviations

<b>GgCO<sub>2</sub>e or GgCO<sub>2</sub>eq</b>	<b>Greenhouse gases</b> in carbon dioxide equivalent
<b>MtCO<sub>2</sub>e/year</b>	<b>Gross emission</b> calculated as metric tons of carbon dioxide equivalent emitted per year
<b>MW</b>	<b>Megawatt</b>
<b>CO<sub>2</sub>e/kWh</b>	<b>Greenhouse gas emission intensity</b> calculated as amount of greenhouse gases in carbon dioxide equivalent per kilowatt hour
<b>EJ/year</b>	<b>Energy consumption</b> calculated as exajoules consumed per year
<b>ktoe</b>	<b>Thousand tons of oil equivalent</b>
<b>tkm or t-km</b>	<b>tonne-kilometre</b> is a unit of measure of freight transport which represents the transport of one tonne of goods by a given transport mode (road, rail, air, sea, inland waterways, pipeline etc.) over a distance of one kilometre

<b>pkm or p-km</b>	<b>passenger-kilometre</b> is the unit of measurement representing the transport of one passenger by a defined mode of transport (road, rail, air, sea, inland waterways etc.) over one kilometre
<b>RTK</b>	<b>Revenue-tonne-kilometre</b> , measures how much revenue a company makes per volume of freight transported

## List of Figures

Figure 1. Taxonomy development around the world .....	9
Figure 2. Total green bonds issuance by region .....	10
Figure 3. Key elements involved in taxonomy development.....	12
Figure 4. Example of the relationship between sectors, entities and activities.....	22
Figure 5. Types of activities in relation to their impact on the achievement of climate goals .....	25
Figure 6. A scheme of modelling and thresholds practical meaning .....	27
Figure 7. Thailand grid carbon intensity modelling 2018-2050 .....	29
Figure 8. Shipping sector decarbonisation pathways .....	34
Figure 10. Thailand’s energy-related objectives and targets under different plans .....	36
Figure 11. Thailand’s key transport-related objectives and targets .....	46
Figure 11: Countries most affected by extreme weather events, 2000-2019.....	58
Figure 12. Thailand GHG Emission Profile (Excluding LULUCF), 2018.....	59
Figure 13. Thailand’s potential loss in GDP per capita from climate change by 2100 compared to other ASEAN countries.....	60
Figure 15. Thailand’s Electricity Generation by Source of Energy (GWh), 1990–2019.....	64
Figure 16. Thailand’s Final Energy Consumption by Fuel Type, 2020.....	65
Figure 17. Thailand’s Final Energy Consumption by Economic Sector, 2020 .....	65
Figure 18. Thailand’s Renewable Power Installed Capacity, MW 2011–2020.....	66
Figure 19. Thailand’s Financing System Structure (in percent of total financial assets).....	67
Figure 19. Taxonomy alignment assessment scheme .....	69
Figure 20. Activity alignment check.....	70
Figure 21. Possible taxonomy applications.....	71

## List of Tables

Table 1. Examples of objectives from international and national taxonomies.....	13
Table 2. Thailand decarbonisation objectives grouping .....	15
Table 3. Thailand’s national environmental priorities matrix.....	15
Table 4. Thai Taxonomy objectives alignment.....	16
Table 5. GHG Emissions by sectors of the economy according to the Draft Fourth National Communication.....	19
Table 6. Major economic indicators and trends in carbon-intensive industries, USD bn .....	19
Table 7. Sector prioritisation matrix .....	20
Table 8. Sector prioritisation rationale .....	20
Table 9. Final set of the ISIC-4 code-based sectors to be included into the Thailand Taxonomy Pilot..	22
Table 10. Table of sectors and activities of the Thailand Taxonomy Pilot .....	22
Table 11. Thresholds for certain energy sector activities** .....	30
Table 12. Bioenergy criteria.....	31
Table 13. Decarbonisation pathways for different ship types .....	32
Table 14. Red (ineligible) activities for the shipping sector .....	34
Table 15. Transportation sector activities criteria and thresholds .....	35

Table 16. Do no significant harm table and criteria.....	53
Table 17. Classification of climate-related hazards .....	55
Table 18. GHG emission reduction measures under Thailand’s Nationally Determined Contribution (NDC) Action plan (2021-2030) .....	64
Table 19. Some definitions used in the guidance .....	68
Table 20. Taxonomy criteria alignment table .....	76

# Thailand Taxonomy Development framework

## 1.1. The rationale for the development of national taxonomy

Given the importance of private and public finance to combat the challenges of climate change, creating and transitioning to a dedicated green finance taxonomy is catalytic to a more vigorous and effective sustainable finance sector. A taxonomy aims to provide a common framework for classifying economic activities to enable stakeholders to gather investment information and mobilise green financing. Taxonomies help market participants, regulators, and policymakers understand risk management and promote investments that meet robust sustainability goals. This increases the level of transparency in financial market priorities and could give a government a tool to direct capital flows in the desired direction that delivers measurable environmental, social and governance (ESG) benefits and net zero emission target.

Taxonomies also facilitate the development of sustainable finance products, including green bonds, green loans, green asset-backed securities, and green indices. A granular taxonomy also allows investors and state authorities to measure the degree of decarbonisation of different sectors of the economy, the efficiency of their investments, and identify weak spots.

This taxonomy is a multipurpose tool that can be used for a variety of objectives. These could include:

- **To steer the market and provide guidance, frameworks and standards for the investors and stakeholders.** It helps to avoid greenwashing and increase capital flows to green projects as more and more people and institutions want their investments to be sustainable. It is also used to provide better clarity when complying with other frameworks such as the Taskforce on Climate-Related Financial Disclosures (TCFD) Recommendations.
- **To attract international climate-oriented capital.** A national taxonomy which is compatible with international standards and other recognised taxonomies can increase investment flow into the country and improve conditions for domestic borrowers operating on global markets.
- **To enable and harmonize data disclosure.** As the taxonomy is adopted by intermediaries, it will be possible to benchmark the share of green investments in portfolios of the banks, insurance companies, and non-financial entities, with a consistent set of nomenclature
- **To assess environmental risks and risk mitigation options.** Compliance with the taxonomy criteria can provide valuable information on climate-related risks for risk assessment specialists within the financial sector.
- **To modulate state policy in the desired manner.** Under the Paris Agreement and Nationally Determined Contribution (NDC), Thailand is committed to mitigating its GHG emissions. The Taxonomy provides the government with a tool to define target activities and develop support policies to achieve the emission reduction goals.
- **To serve as a basis for data collection.** Granular taxonomies are a valuable tool for understanding the situation in the economy related to GHG emissions and climate action.
- To enhance implementation plan including a monitoring framework for reducing Thailand's climate vulnerability, reflected by an improvement in Thailand's Global Climate Risk Index Ranking, and in carbon footprint of investments towards global standards.

This initiative is an extension of the work carried out by the Working Group on Sustainable Finance (WG-SF) of Thailand. This body includes the Bank of Thailand (BoT), the Fiscal Policy Office of the Ministry of Finance (MoF), the Securities and Exchange Commission (SEC), the Office of Insurance Commission (OIC) and the Stock Exchange of Thailand (SET). The work of this working group has also been supported by international partners including International Financial Corporation (IFC), Australian Aid, and GBRW. In light of Thailand's vulnerability to climate change and the pressing need to move to

a more sustainable economy, the WG-SF was established to develop a sustainable finance plan to support the Thai economy in achieving the Sustainable Development Goals (SDGs) and carbon emission reduction targets in line with the Paris Agreement goals.

The group's work resulted in the creation of the Sustainable Finance Initiatives, containing five key initiatives, the first of which was the task of creating the Thailand Taxonomy. The other four initiatives include improving the data environment, implementing effective incentives, creating demand-led products and services, and building human capital. According to the WG-SF members, the taxonomy will establish a common investment language for the Thai sustainable finance market and help to accelerate its development further. It could greatly facilitate the creation of innovative products and services (green bonds, loans, index-linked services, etc.) and serve the objective of developing a cohort of well-regarded monitoring, reporting, and verifying actors, thus enhancing the broader ecosystem of sustainable finance in Thailand. Creating a taxonomy will also facilitate all other initiatives proposed by the WG-SF.

According to the group's recommendations, the taxonomy shall be compatible with significant international taxonomies (especially ASEAN), reflecting both the global context and Thailand's specific circumstances. The WG-SF planned to work on a series of strategic questions needed to create a robust taxonomy, define its mission and vision, and utilise the best expertise available on the market to create a product that will best serve the outlined goals. The present document serves as an essential step in these discussions and proposes a taxonomy framework for the Thai green finance market that could be used for many purposes.

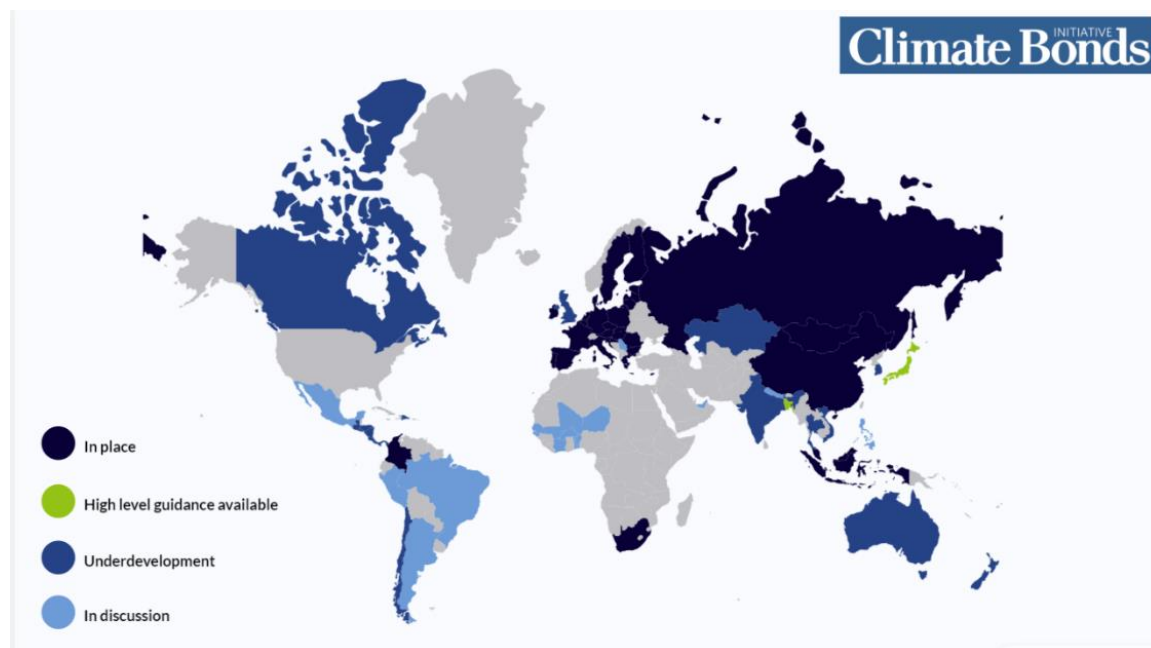
At the first stage of the taxonomy development, the WG-SF decided to conduct a pilot test on the reaction of the Thailand business community and collect feedback. Covering a green (e.g., climate change mitigation) aspect of sustainable finance, the pilot version of the taxonomy is limited in terms of environmental objectives and sectoral scope but, in all other senses, represents a working taxonomy suitable for use by local markets and regulators.

## 1.2. The world of green taxonomies

The green bond market has become a leading tool for mobilising and directing capital toward climate investment opportunities and driving policy action on climate change. The year 2021 saw an increase in the global sustainable finance market to USD 1.6 tn, with green bond issuance doubling in 2021 compared to 2020 to USD 640 bn<sup>i</sup>. Within ASEAN, cumulative green deals (bonds and loans) originating from the ASEAN-6 countries (Singapore, Thailand, Indonesia, Malaysia, Vietnam, and the Philippines) stood at USD 39.4bn at the end of 2021, contributing 72% to the cumulative total sustainable finance-themed issuances between 2016--2021.<sup>ii</sup>

The concept of green taxonomy was introduced in 2012 by the Climate Bonds Initiative (CBI) as a voluntary guideline for the green bond market<sup>iii</sup>. The taxonomy concept has since evolved from a voluntary market-led tool to a one that is increasingly led by governments. Currently, over 20 jurisdictions have or are in the process of establishing a green or sustainable finance taxonomy or similar classification scheme<sup>iv</sup>. These include the European Union<sup>v</sup>, ASEAN<sup>vi</sup>, China<sup>vii</sup>, Russia<sup>viii</sup>, South Africa<sup>ix</sup> and many others. The EU, Climate Bonds and ASEAN taxonomies usually serve as benchmarks with countries and regions adjusting their respective national schemes to be compatible with them.

Figure 1. Taxonomy development around the world



*Source: Climate Bonds Initiative, 2022*

As the taxonomies around the world multiple, there are concerns of market fragmentation pas. Capital from all over the world is critical to achieving climate goals, but discrepancies between taxonomies may confuse investors and disincentivise cross-border capital flows . To avoid this, efforts are being made to harmonise eligible assets and metrics covered by the different taxonomies across jurisdictions. The most prominent attempt in this sphere has been the development of a Common Ground Taxonomy between the EU and China by the International Platform on Sustainable Finance (IPSF)<sup>x</sup>.

The East and Southeast Asian regions have the largest number of national taxonomies developed or in development. China, Japan, Mongolia, South Korea, Indonesia, Malaysia and India, Vietnam, the Philippines, Singapore, and Sri Lanka have moved along this path.

A key feature of taxonomies is the criteria used to identify green activities and separate them from non-green activities. Globally, there are three different methods used to define green:

- **Whitelist-based taxonomies**, which identify eligible projects or economic activities under each sector or sub-sector (China, Russia, Mongolia)
- **Technical screening criteria-based taxonomies**, which define quantitative thresholds and screening criteria for economic activities and their compliance with the specific objectives (EU, Colombia, South Africa)
- **Principle-based taxonomies** define a set of core principles for the market without specifying eligible activities or thresholds (Japan, Malaysia, ICMA)

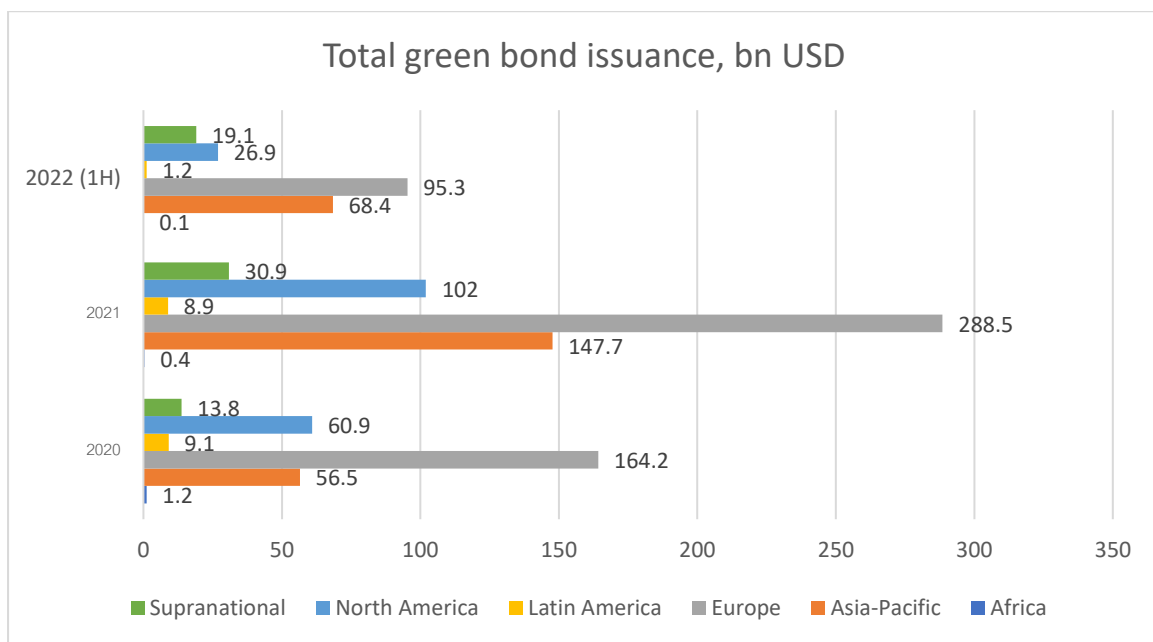
In this context, the ASEAN Taxonomy for Sustainable Finance (ASEAN Taxonomy), with which the Thailand Taxonomy is closely aligned, is being developed as a two-tier set of principles of sustainable development and a reference point for sustainable projects and activities in ASEAN. Its goal is to help issuers and investors understand the sustainability impact of a project or economic activity and its first version was published in November 2021. The ASEAN Taxonomy is meant to serve as an overarching guide to introduce a common language across the different jurisdictions to communicate and coordinate labelling for economic activities and financial instruments. It is expected that the second version will also include information on eligible activities and technical thresholds that will make this document more operational.

### 1.3. Key reference taxonomies

The EU Taxonomy is widely considered to be a global benchmark for taxonomies, given the large number of investors in the EU as well as its leadership in sustainable finance. As a result, investors regard compatibility with the EU Taxonomy as an important reference point to attract capital from the international market.

The Asia-Pacific region occupies the second place in the world in terms of volume of the green bond market and is a home region for Thailand and the majority of its key trade partners (13 of 15 top trade partners of Thailand are situated in the region)<sup>xi</sup>. The Chinese Green Bond Project Catalogue and ASEAN Taxonomy are dominant in the region and additionally serve as a reference point for investors. Finally, the Climate Bonds Taxonomy is incorporated into most existing taxonomies worldwide as it provides high quality, science-based and politically neutral technical screening criteria.

Figure 2. Total green bonds issuance by region



Source: CBI Interactive Market Data Platform

The EU taxonomy has the most advanced technical screening criteria and activity thresholds. Although many of the requirements include references to specific EU laws and regulations, many taxonomies (South African, Russian, Colombian, and others) use it as a reference point. It is also at the centre of IPSF efforts to build a Common Ground Taxonomy. However, the current version of the EU Taxonomy does not provide sufficient guidance on how to deal with

China has several documents that can be indicated as a part of taxonomies family. The China Green Bond Endorsed Project Catalogue is the biggest and the most important one of them, and for the sake of clarity, it is referred to as the Chinese Taxonomy throughout this document. Unlike the EU Taxonomy, it is a whitelist-based taxonomy that, in most cases, does not have specific thresholds, but it defines activities that are considered green. These definitions tend to be relatively broad and less stringent than those of the EU or CBI Taxonomy and, therefore, in general, if an activity is aligned with the EU taxonomy, then it is eligible under the Chinese Taxonomy as well. The Chinese Taxonomy (just as the EU one) contains a lot of references to domestic law.

The ASEAN Taxonomy does not yet have sectoral screening criteria but, it represents an overarching framework of guiding principles for decarbonisation and environmental objectives for the Thailand

Taxonomy. Its multi-tiered system allows countries at different economic development levels to co-exist within the same decarbonisation framework, adjusting it to their specific capabilities. It also employs a so-called traffic light system that distinguishes between green, amber (transitional), and red activities depending on their role in climate change mitigation. The traffic light approach will also be employed in the Thailand Taxonomy.

As the Thailand Taxonomy will be developed in close alignment with the ASEAN Taxonomy, it is essential to understand the key characteristics of the latter. The key feature of the ASEAN Taxonomy is its two-tier structure: the Fundamental Framework Tier and the Plus Standard Tier. The Taxonomy acknowledges the existence of unique differences among the member-states of the regional community and allows them to achieve their adopted environmental and climate goals at an individual pace. The Foundation Framework tier of the ASEAN Taxonomy is a single sector-agnostic decision tree to classify activities into three categories: green, amber (transitional), or red. It is intended to be a simple one-dimensional tool for those countries that consider having only an overarching guiding framework currently sufficient from the point of view of their capabilities and level of economic development.

The Plus Standard tier enables taxonomy users to assess economic activities further using activity-level threshold criteria to determine whether the activity falls into one of the three categories of the traffic light system. This option is more aligned with international best practices and applies to Thailand as a practical approach to achieving its climate policy objectives. As ASEAN's second-largest economy with developed manufacturing industries and the fourth biggest per capita GDP, Thailand is positioned as one of Asia's economic powerhouses because it has the necessary resources to fund an ambitious transition to a net-zero economy and to become one of the climate champions of the region.

The Climate Bonds Taxonomy is the first international taxonomy and was published in 2013. It includes the fundamental features that can be used to develop robust national taxonomies. First, it employs a traffic light system and pays special attention to transitional activities. Second, it is constantly updated based on the latest climate science, including research from the IPCC and the International Energy Agency (IEA) whilst also benefiting from the input of hundreds of technical experts worldwide. Finally, it is completely detached from any political or economic considerations and thus stands as a neutral benchmark for every country that wants to move along the path of decarbonisation. In other words, it does not contain references to any national documents and may be applied worldwide.

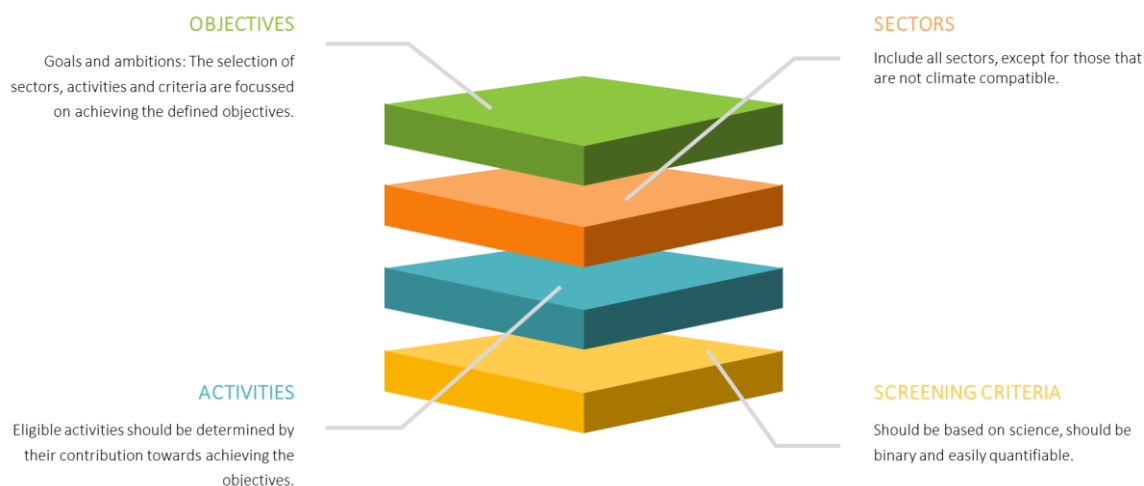
The Thailand Taxonomy is in most cases compatible with all above-mentioned taxonomies except for the Chinese Green Bond Projects Catalogue. On further guidance on compatibility please refer to the table in Annex 5 at the end of the paper.

#### **1.4. Taxonomy structure overview**

The structure of most of the taxonomies contains four layers: objectives, sectors, activities, screening criteria. This pattern is not universal (the Chinese Green Bond Project Catalogue or ICMA Green Bonds Principles are structured differently) but is most common and usable for the financial markets. It also provides a necessary degree of compatibility with other taxonomies and makes it easier for the taxonomy development committee to update it.



Figure 3. Key elements involved in taxonomy development



Source: Climate Bonds Initiative, 2022

The following sections discuss the processes and analyses that have informed the definition of TT’s objectives, the section of key economic sectors and activities, and the design of screening criteria and thresholds for the sectors and activities.

## 1.5. Defining the objectives of the Thailand Taxonomy

Objectives of the TT are the top-level criteria with which all green activities need to be aligned. The principles of the Paris Agreement and SDGs lie at the core of any set of objectives. In the case of national taxonomies like the Thailand Taxonomy, they are defined by a country’s policy, priorities, and environmental situation. Objectives one chooses affect the sectoral composition of the taxonomy as every single activity must lead to accomplishing at least one objective.

The primarily focus of the Thailand Taxonomy is to define activities that reduce GHG emissions to achieve the climate change mitigation objectives of the Kingdom of Thailand in line with its climate policy and international obligations. This is the most important objective that exists in all other taxonomies and leads to achieving one of the main goals of the Paris Agreement. This Taxonomy lists economic activities and relevant criteria to classify them as green, not green (red), or transitional (amber). It does not intend to single out “good” or “bad” actions or serves as a tool for assessing the possible financial performance of any enterprise. Its basic scope-related guiding principles are as follows:

- **Science-based.** The taxonomy is based on scientific findings and recommendations rather than considerations of a political or economic kind.
- **Aimed at achieving Paris Agreement targets.** The goal of the Paris Agreement, to which Thailand is a signatory, is to limit global warming by 2°C and ideally by 1.5°C compared to pre-industrial levels.
- **Technologically neutral.** The taxonomy does not rule out the use of any kind of technology as long as it makes the country closer to its mitigation target and meets established green or amber criteria.
- **Regularly revised.** The taxonomy will be subjected to regular updates to reflect the development of climate science and technology.

Table 1. Examples of objectives from international and national taxonomies

EU Taxonomy	ASEAN Taxonomy	Climate Bonds Taxonomy	ICMA Green Bonds principles	Colombian Taxonomy <sup>1</sup>
Climate change mitigation	Climate change mitigation	Climate change mitigation	Climate change mitigation	Climate change mitigation
Climate change adaptation	Climate change adaptation	Climate change adaptation	Climate change adaptation	Climate change adaptation
Sustainable use and protection of water resources	Preservation of healthy ecosystem & biodiversity		Natural resource conservation	Conservation of ecosystems and biodiversity
Transition to a circular economy			Biodiversity conservation	Water management
Pollution prevention and control	Promote resource resilience & transition to a circular economy			Land management
Protection and restoration of biodiversity and ecosystems			Pollution prevention and control	Circular economy
				Pollution prevention and control

The objectives of the Thailand Taxonomy are built around Thailand decarbonisation goals as well as objectives of international and regional taxonomies to which it is aligned.

## 1.6. National environmental objectives

In its Climate Change Master Plan (2015-2050)<sup>xii</sup>(CCMP), Thailand indicates three key strategies that translate into climate objectives:

- **Climate Change Adaptation**, which aims to build climate resilience by integrating adaptation and resilience objectives into policies and measures in all sectors,
- **Mitigation and Low Carbon Development**, which facilitates the development of mechanisms for GHG emissions reduction and leads to sustainable low carbon growth, and
- **Enabling Environment for Climate Change Management**, which seeks to build capacity around climate change by raising the awareness of relevant stakeholders as well as developing information-based tools and technologies to support climate change adaptation and mitigation

In the Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)<sup>xiii</sup> **mitigation** is a key priority. It is noted, however, that “*although Thailand’s LT-LEDS primarily focuses on GHG mitigation, Thailand recognises that **adaptation** and climate **resilience** are equally important. Thailand, therefore, looks forward to further elaborating its policies and priorities on climate change **adaptation** in future communications*”.

The updated NDC (2020) also states that “*in addition to its **mitigation** efforts, Thailand has placed **adaptation** as equally important*”.

In this context, Thailand’s National Strategy (2018-2037)<sup>xiv</sup> puts forward the following environment-related goals:

1. Promoting green growth and sustainable development

<sup>1</sup> Colombian taxonomy added as it’s the last taxonomy produced with CBI assistance that absorbed all the best practices existing in the world as of mid-2022.

2. Conserving and rehabilitating biological diversity
3. Conserving and restoring rivers, canals, and other natural water sources
4. Maintaining and expanding eco-friendly green areas
5. Promoting sustainable consumption and production
6. Promoting sustainable maritime-based economic growth
7. Increasing value of a maritime bioeconomy
8. Improving, rehabilitating, and developing the entire marine and coastal resource ecosystem
9. Rehabilitating tourist beaches, protecting and improving the entire coastal resource ecosystem, and setting out an integrated coastal management policy
10. Developing and increasing eco-friendly marine activities
11. Promoting sustainable, climate-friendly based society growth
12. Mitigating greenhouse gas emissions
13. Adapting to prevent and reduce losses and damages caused by natural disasters and impacts of climate change
14. Focusing on investment in public and private sectors' climate-friendly infrastructure development
15. Developing preparedness and response systems for emerging and re-emerging infectious diseases caused by climate change
16. Developing urban, rural, agricultural, and industrial areas with a critical focus on a sustainable growth
17. Establishing ecological landscape plans to promote urban, rural, agricultural, industrial, and conservation area development on an integrated basis in harmony with area capacity and suitability
18. Developing urban, rural as well as agricultural and industrial areas in line with the ecological landscape plans
19. Eliminating pollution and damaging agricultural chemicals in line with international standard
20. Sustainably conserving, rehabilitating, and developing natural resources, architectural heritage, art, and culture, as well as local identity and lifestyles
21. Developing networks of urban and community development institutions and volunteers through a mechanism of local sectors' involvement and participation
22. Strengthening public health and environmental health systems as well as enhancing capacity needed to address preventive and controlling measures of emerging and re-emerging infectious diseases
23. Creating eco-friendly water, energy, and agricultural security
24. Developing the entire river basin management system to ensure national water security
25. Enhancing the productivity of an entire water system to promote water-use efficiency and generate value added for water consumption adequate with international standard
26. Creating national energy security and promoting eco-friendly energy usage
27. Enhancing energy efficiency through energy intensity reduction
28. Developing agricultural and food security in terms of quantity, quality, pricing, and access at both national and community levels
29. Improving the paradigm for determining the country's future by promoting a sense of environmental stewardship among Thai people
30. Promoting desirable environmentally friendly characteristics and behaviours among Thai people that positively contribute to the environment and quality of life of Thai people
31. Developing tools, justice mechanisms, and systems, environmental democracy on efficient natural resources, and environment management
32. Establishing institutional structures to manage significant issues concerning natural resources and environmental management

33. Initiating projects that can improve a development paradigm to determine the country's future in terms of natural resource, environmental, and cultural sustainability based on public participation and good governance

If these goals are grouped according to the general categories that are used in the international practice of taxonomy development, the following six main taxonomy objectives can be identified for Thailand.

Table 2. Thailand decarbonisation objectives grouping

Point number	Potential taxonomy objective
12, 27	Climate change mitigation
13, 15,	Climate change adaptation
3, 6, 7, 8, 9, 10, 24, 25	Sustainable use and protection of marine and water resources
5, 26	Resource resilience and transition to a circular economy
19	Pollution prevention and control
2, 4, 20	Protection and restoration of biodiversity and ecosystems
1, 11, 14, 16, 17, 18, 21, 22, 23, 28, 29, 30, 31, 32, 33	Not targeting environmental objectives (out of scope)

This categorization enables the mapping of all important priorities reflected in the Thai strategic documents as per Table 3 below.

Table 3. Thailand's national environmental priorities matrix

National Strategy (thematical grouping)	CCMP	LEDS	NDC
Climate change mitigation	Mitigation and Low Carbon Development	Mitigation	Mitigation
Climate change adaptation	Climate Change Adaptation	Adaptation and Resilience	Adaptation
Sustainable use and protection of marine and water resources	Enabling Environment for Climate Change Management		
Resource resilience and transition to a circular economy			
Pollution prevention and control			
Protection and restoration of biodiversity and ecosystems			

Another consideration when developing the objectives for the Thailand Taxonomy would be to consider the decarbonisation objectives of key ASEAN strategic documents apart from the ASEAN Taxonomy. According to the ASEAN Socio-Cultural Community Blueprint 2025<sup>xv</sup>, ASEAN member states identify individual as well as typical climate and environment goals. Overall regional priorities include:

- “A resilient community with enhanced capacity and capability to adapt and respond to social and economic vulnerabilities, disasters, climate change as well as emerging threats and challenges.”
- To “protect, restore, promote sustainable use of terrestrial ecosystem sources, halt biodiversity loss and reserve land degradation.”
- “Sustainable forest management in the context of forest fire prevention and control.”
- “Protection, restoration and sustainable use of the coastal and marine environment, respond and deal with the risk of pollution and threats to marine ecosystems and coastal environment.”

- To “conserve, develop and sustainably manage marine wetlands, peatlands, biodiversity and land, and water resources.”

Finally, two significant aspects must be considered when finally outlining the Thailand Taxonomy objectives. Firstly, these objectives must reflect international obligations and national strategic documents. Secondly, they must be compatible with existing taxonomies to avoid market fragmentation. As such the following list of objectives for the Thailand Taxonomy have been identified:

Table 4. Thai Taxonomy objectives alignment

Alignment table			
Documents: Objectives:	Thailand’s National Priorities	EU Taxonomy	ASEAN Taxonomy
Climate change mitigation	+	+	+
Climate change adaptation	+	+	+
Sustainable use and protection of marine and water resources	+	+	+ <sup>2</sup>
Resource resilience and transition to a circular economy	+	+	+
Pollution prevention and control	+	+	+/-
Protection and restoration of biodiversity and ecosystems	+	+	+

It must be recognized that the ASEAN Taxonomy does not have any specific objectives of pollution prevention and water/marine resources management. However, those can be partially aligned with the existing objectives of resource resilience and the protection of ecosystems. In conclusion, as per Table 4 above, the identified six objectives of the Thailand Taxonomy give us 100% alignment with the EU taxonomy and 90-95% (depending on the final list of activities) alignment with the ASEAN Taxonomy on a broad level.

## 1.7. The final list of the objectives and their description

Based on the analysis in the previous section, it is proposed that the Thailand Taxonomy is designed to cover the following six environmental objectives: climate change mitigation, climate change adaptation, sustainable use and protection of marine and water resources, protection and restoration of biodiversity and ecosystems, pollution prevention and control, and resource resilience and transition to a circular economy. While this first version of the Thailand Taxonomy will only develop the screening criteria and thresholds for the climate change mitigation objective as a start, it incorporates the principles to ensure Do Not Significant Harm (DNSH) to the other five objectives. It is intended that future versions of the Thailand Taxonomy will be expanded to include the screening criteria and thresholds of other environmental objectives listed below as well.

<sup>2</sup> Means the objective is partially aligned

### *Climate change mitigation*

The objective of climate change mitigation demands the reduction of GHGs emitted as the result of human activity in the country, which is necessary to avoid catastrophic consequences of climate change.

An activity can be considered to have met this objective if it makes a substantial contribution to:

- **Avoidance of GHG emissions.** These are ‘green activities’ already having very low or near-zero emissions. More capital is required to increase their development and broader deployment.
- **Reduction of GHG emissions.** Some activities (the production of steel, cement, aluminium, etc.) are critical to the functioning of the modern economy but are carbon intensive. These activities are called transitional. The current level of technological development is insufficient to decarbonise them entirely in short term, but they must significantly improve their performance over time.
- **Enabling GHG-reducing activities.** These activities do not reduce GHG emissions but facilitate other mitigation activities. Examples are renewable power transmission, carbon capture, utilisation and storage, data-driven solutions etc.

According to Thailand’s Second Updated NDC, the country aims to increase emission reductions to 30-40% by 2030, in order to achieve carbon neutrality by 2050 and net zero GHG emissions by 2065. The long-term strategy to achieve carbon neutrality by 2050 will also largely depend on emission reductions in the energy sector, including using carbon capture, utilisation and storage (CCUS) technologies.<sup>xvi</sup> Sectoral decarbonisation strategies must also be developed to facilitate this task.

### *Climate change adaptation*

The objective of climate change adaptation demands Thailand to substantially reduce the adverse impact of climate change on its people, nature, and assets, as well as on economic activity itself. Climate change adaptation may also increase the country’s resilience to the adverse physical impact of current and future climate changes and/or capture new economic opportunities from climate change.

*To be developed further in the subsequent phases of the Thailand Taxonomy development.*

### *Sustainable use and protection of marine and water resources*

The objective of sustainable use and protection of marine and water resources deals with a broad range of issues important to Thailand, from sustainable development of coastal areas to retrofitting of water treatment facilities.

*To be developed further in the subsequent phases of the Thailand Taxonomy development.*

### *Protection and restoration of biodiversity and ecosystems*

The objective of ecosystems and biodiversity protection implies preventing the loss of plants and living species whilst also sustainably managing, conserving, and restoring their habitats. This is important not only for protecting Thailand’s unique landscapes and ecosystems but also for climate change mitigation because healthy habitats remove a substantial portion of carbon from the atmosphere.

*To be developed further in the subsequent phases of the Thailand Taxonomy development.*

### *Pollution prevention and control*

This objective leads to implementing activities that help the country to prevent and control pollution on all levels, including industrial, agricultural, and household pollution. It helps to improve the quality of air, soil, and water, as well as decrease the waste of valuable resources.

*To be developed further in the subsequent phases of the Thailand Taxonomy development.*

### *Promote resource resilience and transition to a circular economy*

The objective of promoting resource resilience and transition to a circular economy stems from necessity to maximise resource productivity. With the growth of the Earth's population and aggravating climate change effects, Thailand (as well as all other countries) will have to deal with the ever-increasing scarcity of natural resources (primarily food and water) and rising prices. The introduction of lean manufacturing and circular economy practices will benefit Thailand from environmental and economic perspectives.

*To be developed further in the subsequent phases of the Thailand Taxonomy development.*

## 2. Sectoral assessment

### 2.1. Economic Sectors Selection

In order to better define sectors that have the biggest potential to contribute to climate change mitigation, building a matrix of all country-level economic activities in the country with respect to their GHG emission profile and economic parameters. The International Standard Industrial Classification (ISIC) of economic activities was selected as a general framework for classifying all sector-specific processes. The ISIC framework was established by the United Nations; it is largely compatible with other international frameworks and provides a sufficient degree of granularity. There is also currently no ASEAN-specific industrial standard that is commonly adopted.

Therefore, the Thailand Taxonomy should include all economic sectors and activities in the economy that could be considered green and transitional, as well as providing the basis for the exclusion of red activities, i.e., those that are not climate-aligned (e.g., electricity generation from coal, manufacturing of single use plastics, transport of fossil fuels, timber production on peatland, waste transport to open dumpsites, landfill without gas capture). As a consequence, the sectors and activities covered by the taxonomy must be prioritised based on:

**The substantial contribution** of the sectors and activities to the key objectives of the taxonomy

**The evaluation of multiple parameters** such as (among others) their GHG emission profile, their contribution to the country's Gross Domestic Product (GDP), the share of Foreign Direct Investments (FDI), the use of proceeds and eligibility for green bonds (if data is available) and the technical viability for decarbonisation.

The first parameter that must be assessed is the share of GHG emissions produced by each different sector of the economy. It is important to notice, that emissions in the LULUCF sector, which serves both as a carbon emitter and as a carbon sink, are excluded if the amount of the carbon absorbed by the sink exceeds the carbon emitted by the sector, thus resulting in net removals. This sector in Thailand demonstrates a trend of increased net removals because the total removals exceeded the total emissions. In 2018, the LULUCF sector contributed to a net removal of 85968 GgCO<sub>2</sub>eq, accounting for an increase by two folds compared with the year 2000<sup>xvii</sup>.

Table 5. GHG Emissions by sectors of the economy according to the Draft Fourth National Communication

Subsector <sup>3</sup>	IPCC 2006 Code <sup>4</sup>	GHG Emission, total in GgCO <sub>2</sub> eq <sup>5</sup> (Share of total, %)
Energy industries	1A1	103,055.20 (28.51%)
Transport	1A3	75,029.65 (20.76%)
Manufacturing Industries and Construction <sup>6</sup>	1A2	52,078.20 (14.41%)
Rice Cultivation	3I	29,990.25 (8.30%)
Mineral Industry	2A	20,574.46 (5.69%)
Other Sectors within Energy	1A4	16,884.56 (4.67%)
Chemical Industry	2B	12,354.17 (3.42%)
Fugitive Emissions from Fuels	1B	10,293.28 (2.85%)
Enteric Fermentation	3A	10,052.24 (2.78%)
Solid Waste Disposal	5A	8,774.67 (2.43%)
Direct N <sub>2</sub> O Emission from Managed Soils	3F	8,715.01 (2.41%)
Wastewater Treatment and Discharge	5D	7,635.72 (2.11%)
Indirect N <sub>2</sub> O Emission from Managed Soils	3G	3,259.34 (0.90%)
Manure Management	3B	2,494.12 (0.69%)
Incineration and Open Burning of Waste	5C	180.54 (0.05%)
Biological Treatment of Solid Waste	5B	112.76 (0.03%)
<b>Total</b>		<b>361,483.58<sup>7</sup></b>

**Note:** This table uses the sector's classification according to Thailand's NDC, which lists sectoral emissions based on the IPCC's 2006 code. This system of classification is different from the ISIC system that form the basis on the Thailand Taxonomy. More explanation is provided further below.

In terms of contribution to the Thai GDP, the service sector makes the biggest contribution with more than 58% of GDP in 2021 followed by manufacturing (27.1%), which contains carbon-intensive industries representing between a quarter and a third of the country's economic activity. The TT should therefore be developed to cover these economically important sectors to facilitate their green transition. At the same time, the TT should also be developed to cover economic sectors where Direct Foreign Investment (DFI) plays an important role, or where there is potential to attract more DFI, particularly for sectors that are essential to accelerate the country's decarbonisation pathway.

Table 6. Major economic indicators and trends in carbon-intensive industries, USD bn

	Agriculture, forestry and fishing	Manufacturing of chemicals	Manufacturing without chemicals	Electricity, gas, steam, conditioning supply	Construction	Transportation and storage	Water Supply Sewerage, Waste & Remediation Activities
<b>Foreign Direct Investments, USD bn (share of total FDI, %)</b>							
2017	0.003 (0.04%)	-0.171	1.109 (13.4%)	0.640 (7.72%)	-0,035	-0,117	N/A
2021 (est.)	0,008 (0.07%)	0.725 (5.96%)	4.181 (34.39%)	0.139 (1.14%)	0.058 (0.48%)	0.113 (0.93%)	N/A
<b>Share of GDP, USD bn (share of total GDP, %)</b>							
2017	38.4 (8.41%)	123.4 (27.3%)	11.7 <sup>8</sup> (2.56%)	11.6 (2.54%)	27.1 (5.94%)	1.8 (0.39%)	
2021 (est.)	43.2 (8.54%)	136.6 (27.1%)	12.4 (2.45%)	13.7 (2.71%)	23.0 (4.55%)	2.2 (0.43%)	

**Source:** World Bank, BOT data

Based on the data and information provided above, it is therefore possible to derive a list of sectors to be initially covered by the Thailand Taxonomy. These sectors combined encompass the majority of the GHG emissions (more than 95% of GHG emissions) of the country and more than 40% of its economic

<sup>3</sup> Not all economically relevant sectors are included but only those having significant contribution to GHG emissions

<sup>4</sup> Calculations of the national GHG inventory have been made in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

<sup>5</sup> Data used is derived from Draft Fourth Thailand National Communication

<sup>6</sup> Includes "emissions from fuel combustion" in construction and manufacturing and thus counts as part of the "energy" basket

<sup>7</sup> Total GHG emission stood at 372,648.77 GgCO<sub>2</sub>eq in 2018 according to Draft NC4, so the table covers 97% of all non-LULUCF emissions in the country

<sup>8</sup> GDP for this sector given without petroleum refining



activity. In addition, these sectors consist of both sectors considered green as well as sectors that are in the process of transition. The ratio of emissions share to GDP share reflects the hard-to-abate industries that should be decarbonised first to achieve maximum results in terms of climate change mitigation.

It should be noted that the sectors that are in list above appear differently in the sector list of different official documents because they use different sector classification systems. More specifically, Thailand’s NDC document reports sector-based emissions by using the IPCC’s 2006 code for sector classification, while the Bank of Thailand and other Thai government agencies use the ISIC. To illustrate the comparability and discrepancy between the IPCC’s 2006 code and the ISIC code, the following matrix shows how the IPCC’s 2006 sectors can be mapped against the ISIC sectors, thus allowing users of the Thailand Taxonomy to relate the ISIC-based sectors in the TT to those in the NDC. The matrix is indicative in nature and is intended to provide guidance for further actions rather than precisely equate one groups with the others.

Table 7. Sector prioritisation matrix

Sector	IPCC 2006	ISIC 4	Share of GHG emission, % of country total (2018)	Share of FDI, % of total (2021)	Share of GDP, % of total (2021)	Emissions share to GDP share ratio	Comment
Agriculture, hunting, fishing, forestry	3A, 3B, 3G, 3F, 3I	A	15.08%	0.07%	8.54%	1.76	Huge contributor to GHG emissions, small ratio, the most complicated sector for emission reduction due to multiple factors
Industrials	2A, 2B	C, F	9.11%	40.35%	29.81%	0.30	Average emission, but low ratio. Large DFI Inflow of capital means increasing future emissions
Energy	1A2, 1A1, 1A4,	D	47.59%	1.14%	2.45%	19.45	Biggest ratio, biggest mitigation potential, a lot of available technologies
Transportation	1A3	H49, H50, H51, H52	20.76%	0.93%	4.55%	4.56	Average ratio, but large potential for decarbonisation due to a vast array of available technologies
Water Supply Sewerage, Waste & Remediation Activities	5A, 5B, 5C, 5D	E	4.62%	N/A	0.43%	10.70	High ratio, but small size and small gross emissions

Source: Bank of Thailand; Draft Fourth Thailand National Communication

It is important to note that this prioritisation exercise is based both on an expert assessment and quantitative measures as well as technological viability of decarbonisation. Thus, sectors have been prioritised as:

Table 8. Sector prioritisation rationale

Sector	Rationale
Energy	The most important sector both from a quantitative and a qualitative perspective. It is well-researched in terms of decarbonisation technologies and also underinvested. Its prioritization in the taxonomy must lead to greater accumulation of preferential green capital from international market due to a scientifically proven effect on climate change mitigation. The

Sector	Rationale
	sector is also prioritized in the Government of Thailand decarbonisation policies
<b>Transportation</b>	The sector is the second biggest in terms of emissions and prioritized by the Government of Thailand decarbonisation policies, but it is generally underinvested. The sector is well-researched and provides numerous technological opportunities for GHG emissions abatement, from electric cars to sustainable fuels
<b>Industrials</b>	The sector attracts the bulk of all investments in the country but also concentrates “red” and hard-to abate activities such as fossil fuels, production of steel and cement. Technologies are lacking in many cases, but the application of carbon capture and new energy sources such as hydrogen may lead to positive mitigation outcomes
<b>Agriculture</b>	Agriculture is one of the hardest sectors to decarbonise because of its intrinsic nature and technological processes. In particular, the units where activities are carried out are generally small and not always receptive to innovation. Nevertheless, thanks to carbon farming technologies, the right approach to decarbonising the sector can help to strengthen its component as a carbon sink.
<b>Water and Wastewater Supply, Processing and Remediation</b>	Although small in scale, this sector is very important for human well-being and quality of life. Its huge emissions-to-GDP share ratio makes it an important decarbonisation target, and in many cases the technologies applied for this decarbonisation have numerous positive side-effects on economy, ecology, and health

## 2.2. Final sector breakdown and activities mapping

For the pilot version of the Thailand Taxonomy, the Thailand Working Group on Sustainable Finance (WG-SF) decided to limit its scope to the first two sectors in the table above: energy and transportation. Based on the ISIC-4 Code System, the scope of the energy sector covered in this taxonomy refers primarily to the production of electricity from various sources, including related activities on heat and cooling, transmission, distribution and storage. The scope of the transport sector reflects to different modes of transport of passengers and freight from one point to another without covering the manufacturing of vehicles (according to ISIC this is a part of the manufacturing sector).

Energy and transportation are highlighted as being at the focus of Thailand’s government efforts to decrease emissions because, on one hand, the two sectors account for a significant share of the country’s GHG emissions and high energy intensity use but, on the other hand, a vast array of available technological solutions allow a shift decarbonisation sectoral pathway. Moreover, these two high-emitting sectors represent a small shares of the country’s FDI, which contributes to insufficient investments for decarbonisation. Therefore, a specific focus of the Taxonomy on both energy and transportation could help to establish an internationally interoperable green investment standards in these two sectors, thus helping Thailand attract additional green capital both from the domestic and international market.

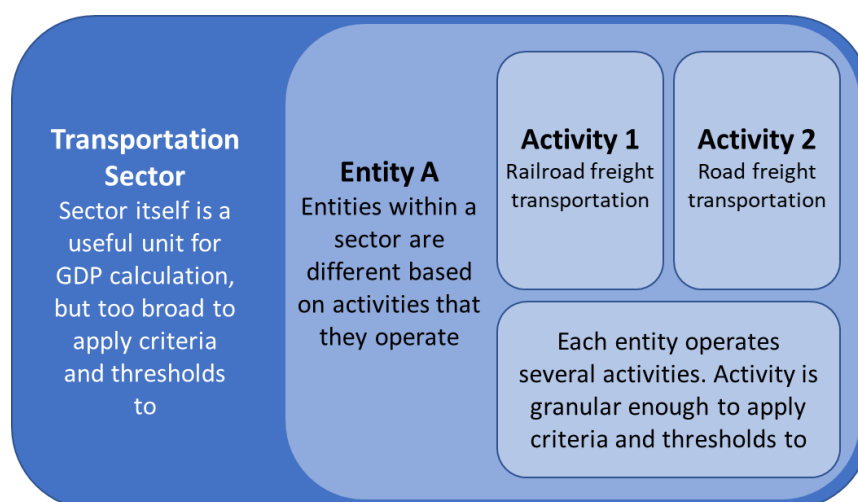
Based on the ISIC-4 code system, the energy and transport sectors could be further disaggregated into the main types of activities as shown in the Table 9 below. The Inclusion of these two sectors in the Thailand Taxonomy means that the taxonomy will be applied to economic activities covering 247046 GgCO<sub>2</sub>eq, or 66% of all emissions of Thailand (with total GHG emission in 2018 standing at 372648.77 GgCO<sub>2</sub>eq excluding LULUCF).

Table 9. Final set of the ISIC-4 code-based sectors to be included into the Thailand Taxonomy Pilot

Sector	Subsector by ISIC 4 Code
Transportation <sup>9</sup>	H491 - Transport via railways
	H492 - Other land transport
	H493 - Transport via pipeline
	H501 - Sea and coastal water transport
	H502 - Inland water transport
	C3312 - Repair of Machinery
Energy	D351 - Electric power generation, transmission and distribution
	D352 - Manufacture of gas; distribution of gaseous fuels through mains
	D353 - Steam and air conditioning supply

Activities are the processes to which specific thresholds are applied within this taxonomy. All major international taxonomies work with activities as operational taxonomical units and not, for example, sectors or entities. This is convenient because the activity is, on the one hand, large enough to be the object of a bond or loan issue and, on the other hand, granular enough to be separated from neighbouring activities. An entity comprises several activities, some of which can be decarbonised with significant emission reduction benefits (steelmaking, battery production, power generation), while the effect of others on climate is negligible (management, accounting etc.).

Figure 4. Example of the relationship between sectors, entities and activities



Source: Climate Bonds Initiative

Another two important factors to take into consideration when mapping out the final list of decarbonisation activities are their technological feasibility and their inclusion in other taxonomies. There is no point in adding activities that are either impossible to decarbonise (they must be phased out completely if they are high emitting such as thermal coal) or if they have never been included and described in other taxonomies. However, the latter would be uncommon because, over the last 10 years, all activities that could theoretically be decarbonized or that could enable decarbonisation to have been absorbed into the existing taxonomies.

Table 10. Table of sectors and activities of the Thailand Taxonomy Pilot

<sup>9</sup> Storage sector was removed from further calculations due to its negligible effect on climate. Repair of Machinery was added due to its high relevance to other sectors in the context of Taxonomy

ISIC Sector	ANDBI Sector <sup>10</sup>	Activity in the Section 4
H491 - Transport via railways	<ul style="list-style-type: none"> <li>H49101 Electrified rail and associated infrastructure</li> <li>H49102 Low emission rolling stock</li> <li>H49103 Improved railway efficiency measures</li> </ul>	Transport via railways
H492 - Other land transport	N/A	Other passenger land transport Urban and suburban passenger land transport Freight transport by road
H493 - Transport via pipeline	H49302 Gas transport (gas from renewable production)	Transmission and distribution networks for renewable and low-carbon gases
H501 - Sea and coastal water transport	<ul style="list-style-type: none"> <li>H50101 Low emission fossil powered vessels</li> <li>H50102 Electric vessels</li> <li>H50103 Other low-emissions vessels</li> </ul>	Sea and coastal water transport
H502 - Inland water transport	<ul style="list-style-type: none"> <li>H50201 Low emission fossil powered vessels</li> <li>H50202 Electric vessels</li> <li>H50203 Other low-emissions vessels</li> </ul>	Inland water transport
C3312 - Repair of machinery <sup>11</sup>	N/A	Retrofitting of sea and coastal freight and passenger water transport
Non-ISIC Transport Activities <sup>12</sup>	N/A	Enabling infrastructure for low-emission transport
D351 - Electric power generation, transmission, and distribution	D35104 Solar power gen generation	Solar energy
	D35105 Wind power generation	Wind energy
	D35106 Hydro power generation (incl. pump storage)	Hydropower
	D ANDBI 35107 Geothermal power generation	Geothermal power
	D35108 Bio power generation	Bioenergy
	D35101 Gas power generation	Natural gas
	D35109 Marine power generation	Ocean energy
	N/A	Electricity generation from renewable non-fossil gaseous and liquid fuels
	D35111 Energy storage (not incl. pump storage)	Storage of electricity and thermal energy
D35110 Transmission and distribution (incl. ICT and smart technology)	Transmission and distribution of energy	
D352 - Manufacture of gas; distribution of gaseous fuels through mains	D35110 Transmission and distribution (incl. ICT and smart technology) D 35203 Gas distribution	Transmission and distribution networks for renewable and low-carbon gases

<sup>10</sup> Based on ASEAN Taxonomy Version 1 (November 2021)

<sup>11</sup> An activity outside of chosen sectors is added due to its paramount importance to all other activities in the sector

<sup>12</sup> An activity outside of ISIC is added due to its paramount importance to all other activities in the sector

ISIC Sector	ANDBI Sector <sup>10</sup>	Activity in the Section 4
D353 - Steam and air conditioning supply	D35302 Provision of steam / air conditioning (renewable production)	Production of heating and cooling using waste heat Installation and operation of electric heat pumps Heating and cooling distribution

## 2.3. Transitional activities and traffic light system

### 2.3.1. Transition as a concept

“Transition” as a concept has multiple meanings and, therefore in order to avoid confusion, it is important to clearly differentiate among them. The shortest and the broadest definition is that **transition is a journey, over time, to green**. However, given the steep decarbonisation required to meet the goals of the Paris Agreement, this journey cannot last forever. The time component is critical to whether the world can stay within 1.5 degrees of warming by the end of the century. In this regard, it can be stated say that **all sectors of the economy must be in transition to net-zero by 2050**. This date has been established by the Intergovernmental Panel on Climate Change that includes world’s best experts on the issue from all continents<sup>xviii</sup>.

When descending from the sectoral level to the level of entities and activities, it is clear that **certain activities have a more difficult pathway to transition with significant economic and technological barriers to overcome than the others**. Such activities are also called “transitional” or “hard-to-abate”. The White Paper published by the Climate Bonds Initiative and entitled “Financing Credible Transitions” proposes that a “transition” label should also apply to interim activities or investments that are making a substantial contribution to halving global emissions by 2030 and reaching net zero by 2050 but do not have a long-term role to play post-2050.

To be considered as transitional, an activity must:

- Significantly improve its performance over time, demonstrated by tracking, monitoring, and disclosing CO<sub>2</sub> equivalent emissions. Alignment with a pathway to net-zero by 2050 must be the ending point of any transitional activity.
- Its investments must not lock in carbon-intensive assets or processes for the future. If it is impossible, the activity must be phased out.
- It must not hamper the development and deployment of low-carbon alternatives.
- It must demonstrate a pathway to approach the climate objectives of the country they are operating.

In short, green activities are aligned with 1.5 degrees while transitional activities are moving towards alignment. For example, electric power generation using photovoltaic energy is a clear example of the green activity as its lifecycle emissions are close to zero. Thus, in the case of the energy sector, transition is moving from fossil fuels-based power generation (fossil-based power plants must be phased out completely) to renewables based. Steel production, on the other hand, is the one that will require profound step-by-step improvement as no technological solution is readily available to quickly transition from high-emitting steel production to low-emitting.

The transition concept and label are not a catch-all for activities that are a light shade of green or represent only a slight change from business as usual. In fact, transitioning in line with the Paris Agreement requires a complete re-orientation of the global economy and, for some entities and activities, a complete transformation. The transition concept captures this ambitious journey that each activity and entity need to make for the world to avoid catastrophic climate change<sup>xix</sup>.

The overwhelming majority of taxonomies focus on green activities that have the most significant potential to mitigate GHG emissions. Some (e.g., EU) also include ‘green’ criteria for “hard-to-abate activities” such as cement or aluminium production; while the term transition is not used, these criteria act as the transitional criteria of the EU taxonomy. Such transitional, hard-to-abate sectors occupy an important place in modern economies, including Thailand. This means that criteria for activities to be considered transitional activities are an important part to be included in the Thailand Taxonomy. By including transitional activities, the Thailand Taxonomy will require adjustments of international best practices to the local context in order to create a workable document that would facilitate a smooth transition to net-zero.

The abovementioned paper “Financing credible transition” outlines five categories of activities:

*Figure 5. Types of activities in relation to their impact on the achievement of climate goals*

1.	<b>Near zero activities:</b> activities already at or near net-zero emissions that may require some further decarbonisation but not a significant transition (e.g., solar or wind power generation).
2.	<b>Pathway to zero activities:</b> activities needed beyond 2050 and have a clear 1.5-degree decarbonisation pathway to 2050 (e.g., shipping).
3.	<b>No pathway to zero activities:</b> activities that are needed beyond 2050 but at present, do not have a clear 1.5-degree decarbonisation pathway to 2050 (e.g., long-haul passenger aviation).
4.	<b>Interim activities:</b> activities currently needed but should be phased out by 2050 (e.g., production of energy from municipal waste or natural gas).
5.	<b>Stranded activities:</b> activities that cannot be brought into line with global warming targets and have an alternative, low-emissions substitute (e.g., electricity generation from coal or solid fossil fuels).

**Source:** *Climate Bonds Initiatives*

Activities 2 - 5 can be called “transitional”, although it must be noted that in case of the 5<sup>th</sup> category “transition” may undergo only in the form of decommissioning of these activities (e.g., coal power plants decommissioning).

In the case of Thailand, its heavy reliance on natural gas (59.1% of the power mix in 2020<sup>xx</sup>) is the most important example of interim transitional activities. Thailand Power Development Plan<sup>xxi</sup> sees natural gas to still represent 53% of total power generation by 2037 despite the country’s growing renewables capacity. Whilst climate science clearly states that fossil fuels must be phased out to meet the targets of the Paris Agreement, the IEA views low-emitting natural gas supplemented by carbon capture and storage technologies as an essential transition fuel<sup>xxii</sup>.

At the same time, the EU Taxonomy stipulates that specific thresholds and additional criteria must be applied when dealing with transitional activities. Here are some the examples that can be used together or individually when defining the parameters of transitional activities in the context of taxonomies:

- **Sunset dates.** The taxonomy establishes a date after which transitional activities cease to be eligible. For example, new amendments to the EU Taxonomy deem low-emitting (270g CO<sub>2</sub>e/kWh) gas power plants suitable if their construction permit is issued before 31.12.2030<sup>xxiii</sup>.
- **Best in class.** The threshold for the activity is established as representing the top 10-15% of best installations in the country, region, or globally. This method is widely used in sectors with no clear way to calculate a 1.5-degree aligned path such the manufacturing sector (Cement, Steel, Chemicals).

- **Percentage change.** If retrofitting or modernisation of the facility is discussed, a fixed percentage change may be an excellent way to establish a threshold. For example, in buildings renovation, the point is based on reducing Primary Energy Demand (PED) by at least 30%.

Reflecting on these international benchmarks, the Thailand Taxonomy will therefore employ the abovementioned definition of transition as well as traffic light system with separated taxonomy-aligned activities labelled as green, transitional activities labelled as amber, and activities that fall out of the scope of the credible transition, labelled as red.

### 2.3.2. Traffic light system for the Thailand Taxonomy

**Green activities** are substantially contributing to the goal of climate change mitigation goal by operating at or close to the net-zero goal by 2050. In most cases green thresholds are either EU Taxonomy or Climate Bonds Taxonomy-aligned because both taxonomies are based on extensive multiyear research by vast international technical expert groups. Two types of activities from Figure 5 are included into this category:

- **Near zero activities:** activities already at or near net-zero emissions that may require some further decarbonisation but not a significant transition (e.g. solar or wind power generation or operation of electric fleet-based transportation services).
- **Pathway to zero activities:** activities that are needed beyond 2050 and have a clear 1.5-degree decarbonisation pathway to 2050 (e.g. shipping).

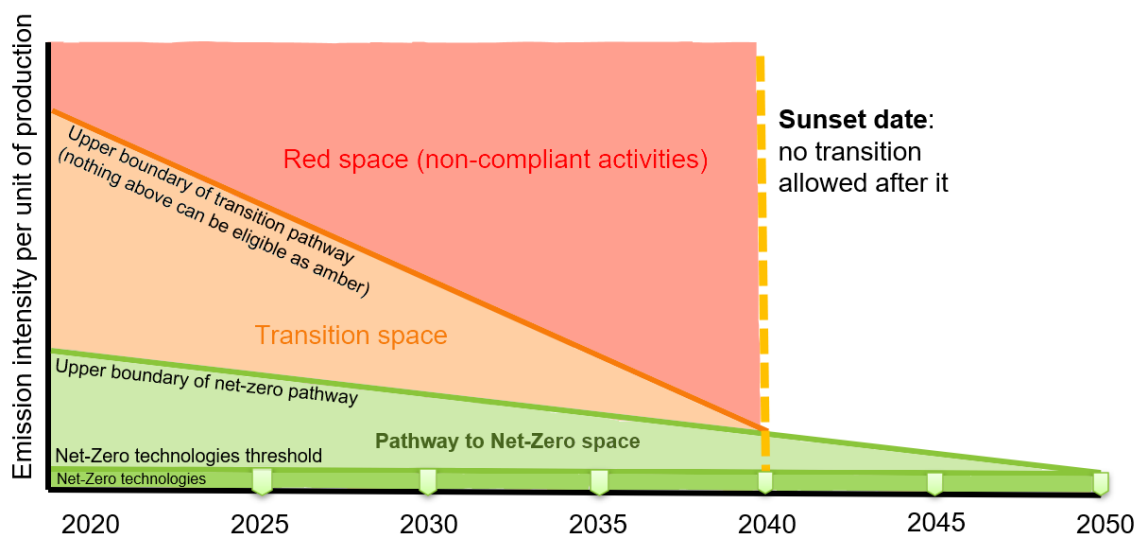
**Amber activities** can be roughly equalised with points 3 and 4 from the Figure 5 of the previous chapter (“No Pathway to Zero” and “Interim” activities). They are either facilitating significant emissions reductions in the short term with a prescribed sunset date. The amber category is generally relevant only for the existing infrastructure and activities that can be retrofitted, and cannot be applied to new ones to avoid locking-in unsustainable technologies in new projects. In some cases, enabling activities (those that serve as enabling other green activities but not green themselves, e.g., grid infrastructure) are also included in this category.

**Red activities** (“stranded” in Figure 5 terminology) are the ones that are currently not compatible with net-zero trajectory and are not going to become compatible anytime soon. For the transition to net zero by 2050 to happen, they should be phased out completely (for example, electricity generation from coal). It is very important to note that not all activities are assessed yet by international climate science, so the absence of activity in the green and amber categories does not mean that it is red.

## 3. Models for activities assessment

Modelling allows to create thresholds for activities that must transition to pathway to net-zero by 2050, but currently have a negative emission profile. In most cases these are transition (amber) activities as green activities are already near-zero or have a clear pathway alongside trajectory. All in all, some (but not all) activities will have two thresholds: the **green one**, representing the climate-aligned activities, and the **amber one**, representing activities, that are in transition towards this goal. Below is the general idea behind establishing pathways and thresholds that will be repeated for each single sector.

Figure 6. A scheme of modelling and thresholds practical meaning



For modelling credible transition pathways for the activities of this taxonomy the Sectoral Decarbonisation Approach (SDA) is applied, which is a widely adopted methodology used by the Transition Pathway Initiative (TPI) and the Science Based Targets Initiative (SBTi)<sup>xxiv</sup>. The SDA utilises data and scenarios developed by international organisations, such as IEA, IPCC, and International Institute for Applied System Analysis (IIASA). The present model will include the following scenarios:

- Nationally Determined Contribution scenario (based on the Thailand’s last NDC and other national documents)
- Below 2 Degrees Scenario (based on SDA calculations and consistent with Paris Agreement targets)
- 1.5 Degree Scenario (based on SDA calculations and fully consistent with Paris Agreement targets)
- International Organisations Scenario, calculated by respected international organisations based on data by national participants. Pathways created this way often represent internationally agreed scenarios rather than the most ambitious

The taxonomy threshold for green activities will be calculated strictly based on 1.5-degree scenario, meaning that all sectors must move to net-zero by 2050. We consider it to be much more in line with the latest climate science than the below 2-degree scenario that was considered sufficient in 2015 when the Paris Agreement was signed. There are several objective reasons for utilizing 1.5-degree for this taxonomy:

- **Alignment.** International taxonomies (EU, Climate Bonds, ASEAN) either directly postulate the need to pursue 1.5-degree pathway or consider it strongly preferable<sup>13</sup>.
- **Attractiveness.** International climate-aware investors want to see 1.5-degree compliant projects and this fact needs to be considered if an access to international financial market is a prerogative.
- **Closing the gap.** To stay within 1.5-degrees requires a 45-50% cut in global emissions by 2030. Right now, the world is on track to achieve 9% emission cut by 2030 – way off that requirement for even a 2 degree warming scenario. Setting the ambition of 1.5 degrees keeps that sense of urgency at the forefront of policy and decision making.

<sup>13</sup> ASEAN Taxonomy says that the goal is to “limit the global average temperature increase to well below 2°C, preferably 1.5°C, above preindustrial levels”.



- **Cost effectiveness.** The cost of aligning with 1.5 degrees is much lower than the cost of exceeding it.

### 3.1. Scope of emissions

For all activities emissions include only scope 1 and 2 emissions unless stated otherwise.

### 3.2. Relevant decarbonization measures

This taxonomy aims to reduce greenhouse gas emissions by various economic agents in Thailand as well as the Thailand economy as a whole. It is technology-neutral, i.e., it allows any means of achieving the below mentioned thresholds for compliance with green and amber criteria. These techniques can include complete replacement of relevant units, devices and machines with less emitting (if allowed by a specific article in Section 4), application of energy efficiency measures, installation of additional carbon capture and sequestration units, etc.

### 3.3. NDC-based amber thresholds

Thailand's NDC-based pathways and thresholds are applied as amber criteria for certain activities in order to consider national conditions of Thailand. They are calculated based on the best available sectoral data and are generally more precise than those calculated on "best-in-class" principle. In most cases amber thresholds for sectors and activities in the Thailand Taxonomy are calculated based on the best available data, submitted by the relevant Thailand authorities through the Bank of Thailand.

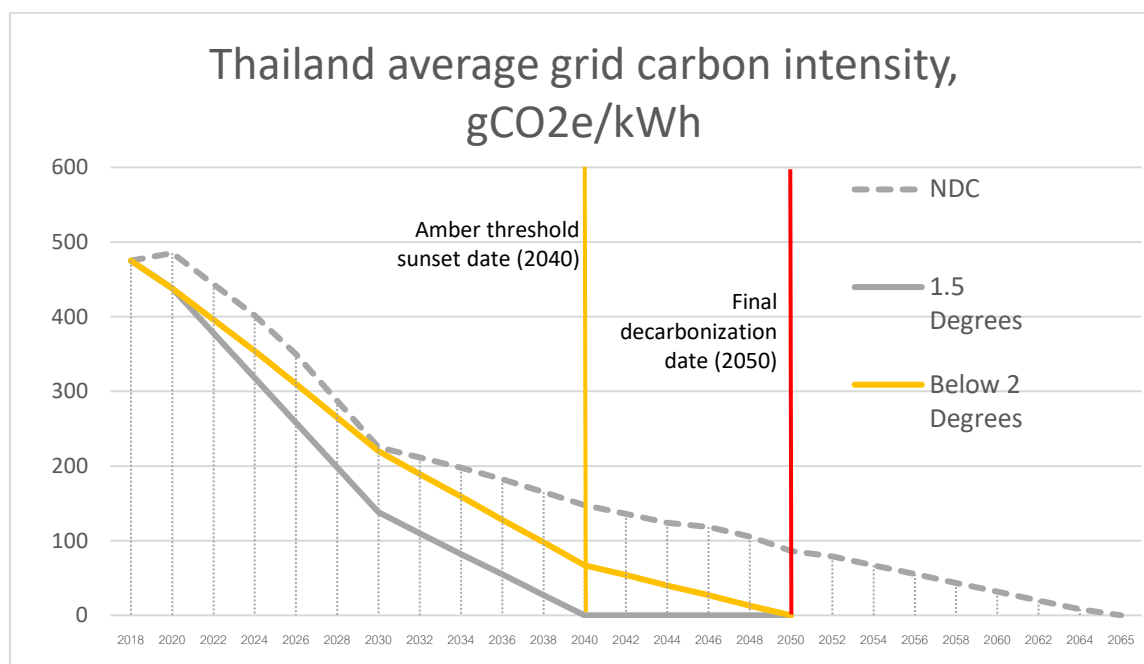
However, as was mentioned before, transition still means that the activity must be compliant with the 1.5-degree by 2050 goal, and thus all amber activities in this taxonomy have a sunset date of 2040. After this date, the amber category is not applicable anymore (only green activities that are aligned with the Thailand Taxonomy) because after 2040 there will be no more room for interim and gradual measures. According to the Climate Action Tracker, Net-Zero Target by 2065 means warming to 4 degrees by the end of the century instead of 1.5 degrees prescribed by the Paris Agreement<sup>xxv</sup>.

### 3.4. Model for energy

Energy activities in the present taxonomy can be largely divided into two parts: those associated with the production of energy (wind, solar, ocean energy-based generation etc.) and those that are not (energy storage, energy transmission etc.). Eligibility criteria for the first group usually include adherence to the decarbonization pathway presented below (Figure 7). Criteria for the second group are usually unique for every activity and are based on characteristics of each individual activity.

Electricity generation is a key part of energy production in any country. As a sector, its carbon emission reduction is at the core of decarbonisation efforts worldwide. In the Figure 7 below, thresholds for alignment with the 1.5 and 2 degrees are calculated based on science-based and country-neutral decarbonisation pathways. The dotted line corresponds to the NDC-based pathway and is meant to provide data for building of the Amber thresholds. Thailand's Updated NDC presumes lowering the overall volume of emitted carbon by 40% by 2030<sup>xxvi</sup> from a baseline of 2005 (that is 555 MtCO<sub>2</sub>) and then achieving Net-Zero emissions by 2065.

Figure 7. Thailand grid carbon intensity modelling 2018-2050



Source: TPI, BOT data

As it is seen from the modelling above, for Thailand to be able to go along the 1.5-degree pathway greed carbon intensity must reach on average 138 grams CO<sub>2</sub> per kilowatt-hour by 2030 and net-zero by 2040. For a minimal 2-degree scenario the corresponding figures are 220 grams CO<sub>2</sub> per kilowatt-hour by 2030 and net-zero by 2050. Achieving this will require major changes to electricity production, including the use of renewable technologies, adoption of the CCS and the reconfiguring of existing fossil fuel facilities to increase renewable uptake.

For **green activities** the threshold in the Thailand Taxonomy will be established as 100 gCO<sub>2</sub>e/kWh until 2040 with net-zero emissions afterwards. This threshold is justifiable from the point of view of international compatibility as both EU and Climate Bonds taxonomies consider it appropriate. It is an ambitious threshold that allows the state and the market to bring emissions down rapidly.

For **amber activities** the threshold is defined following the NDC-based pathway. It is recommended to establish 2040 as a sunset date for the amber threshold. After this date only green thresholds and criteria are applicable for all activities.

**Red activities** can under no circumstances be considered contributing to climate change mitigation. In some cases, there are no such circumstances (for example, if the activity is unequivocally green and there are no old installations that may be too emitting to retrofit), and in this case the activity is marked as N/A.

Table 11. Thresholds for certain energy sector activities\*\*

	2022-2025	2026-2030	2031-2035	2036-2040	2041-2045*	2046-2050*
<b>Green Activities</b>	100	100	100	100	50	
<b>Amber Activities</b>	381	225	191	148	N\A	N\A
<b>Red Activities</b>	>381g	>225g	>191g	>148g	>50g	>50g

**NB:** all thresholds are subject to review every five years in accordance with new data and technological development

\* Post-sunset dates, amber certification is no longer available

\*\* Energy efficiency measures are covered under these energy sector criteria by the very means of establishing thresholds using emission intensity (gCO<sub>2</sub> per unit of production). In order to achieve a certain threshold, the activity must reduce its emission intensity, including by implementing measures to improve efficiency efficiency as an option.

To clarify, amber thresholds are necessary to facilitate the transition to sustainable economy, but there is no place for them after 2040. By that period all new installations must be compliant with the green threshold or be phased out completely.

### 3.4.1. Bioenergy

While many energy activities in the Section 4.1 below will refer to the above table for sectoral energy thresholds (Table 11), it should be noted that bioenergy, due to its unique characteristics, has its own screening thresholds that do not follow Table 11. The screening table on Bioenergy in Section 4.1. will refer to the specific Bioenergy Thresholds presented here.

Bioenergy green thresholds have been calculated separately according to the CBI Biomass criteria<sup>xxvii</sup> build up to the latest scientific and technological data. These Criteria apply to assets and projects relating to:

- Facilities producing biomass/biofuel
- Heating/cooling, and co-generation facilities using biofuel/biomass
- Bio-refinery facilities
- Supporting infrastructure associated with the above

For facilities producing biomass/biofuel as a final product, including liquid biofuel, solid and gaseous biomass for heating and co-generation, and biofuel for transport, the biomass/biofuel produced needs to meet specific GHG emissions thresholds in terms of gCO<sub>2</sub>e/kWh (converted from the original gCO<sub>2</sub>e/MJ (primary energy) for compatibility purposes).

For heating/cooling, and co-generation (combined heat and power – CHP) facilities using biofuel/biomass, the biofuel/biomass being used needs to meet specific GHG emissions thresholds in terms of gCO<sub>2</sub>e/kWh, and the facilities are required to achieve energy conversion efficiency of 80%. Note that CHP facilities need to meet requirements when they are in CHP mode.

Table 12 provides the summary of these thresholds. The rationale of determining these specific thresholds can be found in the Climate Bonds Bioenergy Criteria Background Paper<sup>xxviii</sup>.

Table 12. Bioenergy criteria

Asset type	Thresholds for biofuel/biomass produced/used (primary energy)	Energy efficiency thresholds
Facilities producing liquid biofuel, solid and gaseous biomass for heating and co-generation	57.6g CO <sub>2</sub> e/ kWh	N/A
Facilities producing biofuel for transport	67.7g CO <sub>2</sub> e/ kWh	N/A
Heating/cooling, and co-generation facilities using biofuel/biomass	57.6g CO <sub>2</sub> e/kWh	80%

Source: Climate Bonds Initiative

To demonstrate they meet this threshold, issuers are required to conduct a life cycle assessment (LCA) of GHG emissions from their bioenergy.

The scope of the LCA should include:

- Feedstock production
- Feedstock processing
- Biofuel/bioenergy production
- Biofuel storage and blending
- Intermediate and final transport steps: transportation of feedstock to processing facilities to fuel production facilities, and transportation of fuel to the point of consumption

For facilities producing both biomass-based products for energy purpose (power and heat), and for non-energy use (such as food and feed ingredients, pharmaceuticals, chemicals, materials and minerals), issuers are required to allocate GHG emissions to the biomass for energy purpose based on energy content of the biomass-based products. For such facilities, only the biomass for energy purposes need to meet the GHG emissions thresholds detailed in Table 12 above. That is, currently no additional GHG emissions thresholds for biomass products for non-energy use. However, users of these Criteria are reminded that if biomass products for energy use accounts for less than 50% of feedstock inputs then the facility is not aligned with this Taxonomy.

To check the compliance with the threshold it is required to use [RSB GHG Calculator Tool](#)<sup>xxix</sup> for GHG emissions calculation.

### Eligible feedstock

Under the present Criteria, all types of feedstocks are eligible with three exceptions:

- Wood (and all woody biomass)
- Third generation biofuels (algae)
- Biodegradable Municipal Solid Waste (MSW), including sewage sludge and food waste

Feedstock used for production of bioenergy should comply with one of the following:

- Forest Stewardship Council (FSC);
- Biomass Biofuels voluntary scheme (2BSvs);
- Bonsucro; International Sustainability and Carbon Certification (ISCC Plus);
- Roundtable of Sustainable Biomaterials (RSB)
- Round Table on Responsible Soy (RTRS)

### 3.5. Model for transportation

The decarbonisation of transportation is critically important for the overall climate strategy of Thailand. Thresholds and screening criteria for the activities in this sector are primarily based upon the developments of the Climate Bonds and EU taxonomies, but also consider national targets as well as the specific conditions of Thailand and ASEAN in general.

It is impossible to make a single model for transportation emissions mitigation due to the diverse nature of the sector itself. There are also limited opportunities to improve existing assets with regards to energy efficiency measures or reduction of GHG emissions (the car is not a factory; it can be replaced but not retrofitted). The decarbonisation strategy here relies on the fast replacement of internal combustion engines with zero-emission solutions and phase-out of carbon-intensive technologies. Hence, most activities within the transport sector do not have an amber category, especially activities for which zero-emission alternatives exist.

The following section discusses specific considerations in establishing threshold for shipping before presenting the overall Sectoral Criteria and Thresholds for the transport sector, which contain relevant information for shipping and other transport activities in section 3.3.3.

#### 3.5.1. Shipping Sector

The shipping sector is global, and vessels produced in different parts of the world possess roughly similar characteristics. This allows to use global data to calculate thresholds for the Thailand Taxonomy. Ships, however, is a very diverse class of objects, both in terms of sizes and in terms of purposes, and any eligibility criteria for them must be granular enough to encompass all of them.

**Green threshold** for the shipping sector is calculated according to the Climate Bonds Initiative Shipping Criteria<sup>xxx</sup>. In essence, for the shipping activity to be considered green, the expected carbon-equivalent intensity of the ship must be aligned with the decarbonisation trajectory (emissions intensity threshold) of the ship’s type/size category reaching zero emissions by 2050.

Ships below 5000 GT with zero emissions (propelled and powered by batteries or zero-emissions fuels) not violating any conditions in the Table 14 are automatically eligible.

The related measurement metric for shipping criteria is the Annual Efficiency Ratio (AER) and it measures carbon emissions associated with transport work, but it uses a ship’s size (deadweight) as a proxy for cargo carried and assumes that the ship is fully loaded on all journeys. Any vessel 5,000 GT and above must report using International Maritime Organisation Data Collection System. Mandatory collection and universal applicability of this data allows us to use AER measurement.

*Table 13. Decarbonisation pathways for different ship types*

No	Type	Size	Target AER 2020-2029	Target AER 2030-2039	Target AER 2040-2049	Target AER 2050
1	Bulk carrier	0-9999 DWT	24.6	16.4	8.2	0
2	Bulk carrier	10000-39999 DWT	6.6	4.4	2.2	0
3	Bulk carrier	35000-59999 DWT	4.6	3.1	1.5	0
4	Bulk carrier	60000-99999 DWT	3.6	1.4	1.2	0
5	Bulk carrier	100000-199999 DWT	2.4	1.6	0.8	0
6	Bulk carrier	200000+ DWT	2.3	1.5	0.8	0

No	Type	Size	Target AER 2020-2029	Target AER 2030-2039	Target AER 2040-2049	Target AER 2050
7	Chemical tanker	0-4999 DWT	35.4	23.6	11.8	0
8	Chemical tanker	5000-9999 DWT	19	12.7	6.3	0
9	Chemical tanker	10000-19999 DWT	11.9	7.9	4	0
10	Chemical tanker	20000+ DWT	6.5	4.3	2.2	0
11	Container	0-999 TEU	16.9	11.3	5.6	0
12	Container	1000-1999 TEU	14.8	9.9	4.9	0
13	Container	2000-2999 TEU	10	6.7	3.3	0
14	Container	3000-4999 TEU	8.3	5.5	2.8	0
15	Container	5000-7999 TEU	7.8	5.2	2.6	0
16	Container	8000-11999 TEU	6.7	4.5	2.2	0
17	Container	12000-14500 TEU	4.6	3.1	1.5	0
18	Container	14500+ TEU	4.6	3.1	1.5	0
19	General cargo	0-4999 DWT	24.2	16.1	8.1	0
20	General cargo	5000-9999 DWT	16.7	11.1	5.6	0
21	General cargo	10000+ DWT	13.1	8.8	4.4	0
22	Other liquid tanker	0+ DWT	97.6	65.1	32.5	0
23	Refrigerated bulk	0-1999 DWT	48.7	32.5	16.2	0
24	Ro-Ro	0-4999 GT	212.4	141.6	70.8	0
25	Ro-Ro	5000+ GT	45.9	30.6	15.3	0
26	Vehicle	0-3999 vehicles	46	30.7	15.3	0
27	Vehicle	4000+ vehicles	13.8	9.2	4.6	0
28	Cruise	60000-99999 GT	1738613.6	1159075.7	579537.9	0
29	Cruise	100000+ GT	1337274.9	891516.6	445758.3	0
30	Ferry-RoPax	0-1999 GT	822123.9	548082.6	274041.3	0
31	Ferry-RoPax	2000+ GT	1137003.8	758002.5	379001.3	0
32	Ferry-pax only	0-1999 GT	1272135.8	848090.5	424045.3	0
33	Ferry-pax only	2000+ GT	1740606.6	1160404.4	580202.2	0
34	Cruise	0-1999 GT	2044403.4	1362935.6	681467.8	0
35	Cruise	2000-9999 GT	1286641.3	857760.8	428880.4	0
36	Cruise	10000-59999 GT	1495064.7	996709.8	498354.9	0

Source: CBI Green Shipping Criteria

AER for cargo ships (lines 1-27) is measured in **gCO<sub>2</sub>-e/tonne-nm**. In the case of passenger ships (lines 28-39) **gCO<sub>2</sub>-e/GT** is used instead.

- DWT – Dead Weight Tonnes (the weight of the cargo);
- TEU – Twenty-foot Equivalent Unit
- GT – Gross tonnage, a proxy for the number of passengers

The following types of ships are automatically ineligible regardless of their compatibility with the thresholds from Table 13:

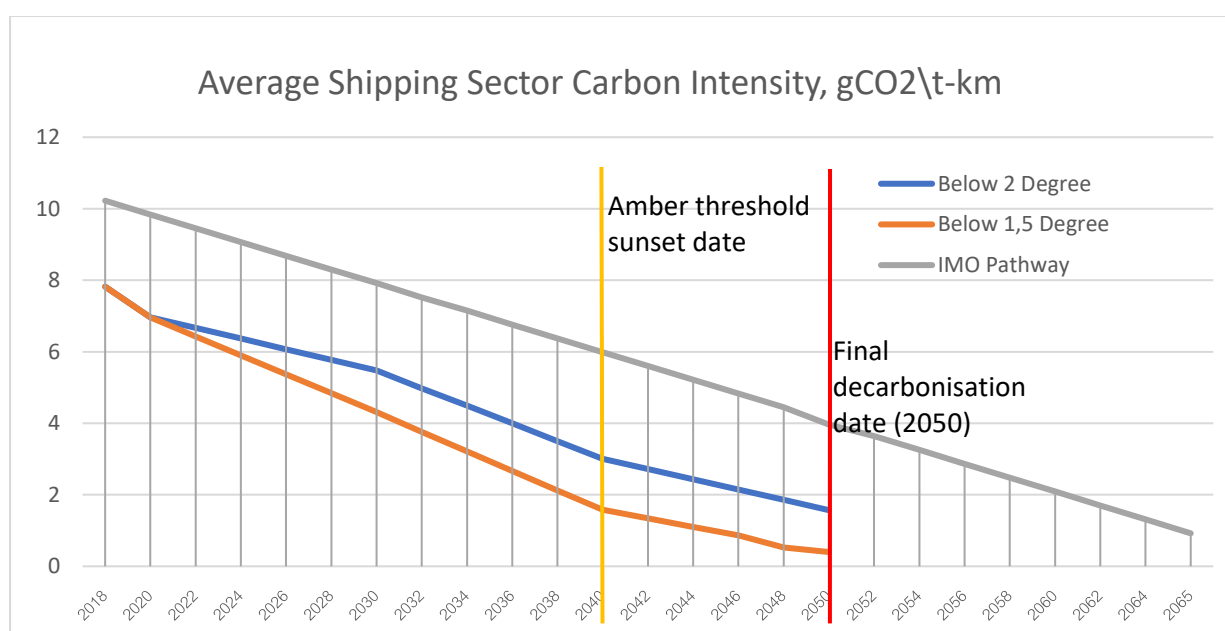
Table 14. Red (ineligible) activities for the shipping sector

Assets	Explanation
Crude Oil Tankers and Liquefied Gas Tankers	Assets which are dedicated to transporting fossil fuels are not eligible under the criteria. This is applicable to ships which are classified as liquefied natural gas (LNG) Carriers or Crude Oil Tankers.
Dry Bulk Carriers IF transporting more than the maximum threshold of coal	Assets where more than 25% of tonnage transported annually is coal or other fossil fuels. This threshold declines geometrically at 5.3% from the year 2020 onwards.
Assets dedicated to supporting the fossil fuel sector	Assets used for the exploration or production of fossil fuels are not eligible under the criteria. This includes but is not limited to: Floating Production, Supply and Offloading (FPSO) Vessels; Subsea, Umbilicals, Risers, Flowlines (SURF) Vessels; Drilling Units; Platform Supply Vessels; Well Intervention Vessels.

For the activity of ship exploitation to be eligible as green, the ship must comply with the threshold for the time of the particular period (bond or loan period, data collection timeframe etc.). Ships that are not zero-emissions must provide a managed reduction plan (MRP) that shows how the ship can remain under the emissions intensity threshold during the operational life of the ship.

Concerning the **amber threshold**, it was considered appropriate to apply the International Maritime Organisation decarbonisation pathway metrics. They are relatively less stringent but are suitable for the purpose of retrofitting existing ships. According to the IMO, the average emission of ships must fall by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008<sup>xxxi</sup>. In 2008 Thailand, average emissions were 13.2 gCO<sub>2</sub>/t-km<sup>xxxii</sup>. Subtracting of 40% gives 7.92 gCO<sub>2</sub>/t-km by 2030 while subtracting 70% gives us 3.96 gCO<sub>2</sub>/t-km by 2050.

Figure 8. Shipping sector decarbonisation pathways



Source: TPI; Thailand Ministry of Transportation

**NB:** all the thresholds after 2030 are indicative and will be subject to change due to the development of science and technology.

### 3.5.2. Sectoral thresholds and metrics

While the principles by which the green criteria and thresholds for Shipping were explained above, the green thresholds for railway and non-railway transport are set to be in line with the EU Taxonomy. Table 15 provides a summary of the overall transport sector’s criteria and thresholds. Some specific transport activities discussed in Section 4.2. will cross-reference with this Table.

Table 15. Transportation sector activities criteria and thresholds

Thresholds and criteria for activities in the transportation sector							
	Main threshold						Additional Criteria
	2022-2025	2026-2030	2031-2035	2036-2040	2041-2045	2046-2050	
Green Activities							
<i>Railway; Non-Railway</i>	0	0	0	0	0	0	New projects only
<i>Shipping, gCO<sub>2</sub>/t-km</i>	Declining threshold for different ship classes according to Table 14						
Amber Activities							
	2022-2025	2026-2030	2031-2035	2036-2040	2041-2045*	2046-2050*	
<i>Railway Non-Railway</i>	0	0	0	0	0	0	
<i>Shipping, t-km</i>	8.9	7.92	7	6	N/A	N/A	
<b>Red Activities</b>	<b>The activities carried out with the ships, that belong to the categories from Table 15 as well as those that exceed the thresholds for amber and green are not eligible</b>						

**NB:** all thresholds are subject to review every five years in accordance with new data and technological development

\* Post-sunset dates, amber certification is no longer available



## 4. Activities thresholds and criteria

While the previous section presented general Sectoral thresholds and criteria for the energy and transport sectors, this section presents specific thresholds and criteria for each individual activity within each sector. It should be noted that for some individual activities (such as solar energy generation, hydropower generation etc.), their own screening tables below will contain complete information on eligibility criteria for green and amber activities, and can thus be used independently without having to refer back to the table of sectoral thresholds and criteria in the previous section. But for other activities, such as natural gas and bioenergy, their screening tables will contain information which needs to be used in conjunction with the table of sectoral thresholds and criteria (Table 11) in the previous section. The cross-referencing situation is also applicable for many of the transport activities presented in Section 4.2 as well.

### 4.1. Energy sector activities: an overview

Based on the most recent data, Thailand's total installed generation capacity was 47 GW in 2019, with peak electricity demand around 30 GW.<sup>xxxiii</sup> Thailand has achieved near complete access to energy, with 99.21% of Thai households having access to electricity in 2020. This results from the country's efforts to promote local energy generation in far off areas and to increase the efficiency of energy generation throughout the energy chain.<sup>xxxiv</sup> In 2020, energy intensity (EI) in Thailand also significantly improved, with a decrease to 7.53 KOTE/bn baht from 8.54 KOTE/bn in 2010.<sup>xxxv</sup>

#### Renewable energy

At present, Thailand primarily generates electricity from natural gas, followed by coal. Renewables and other types of fuels still account for a relatively small share (23.3%) of electricity generation in 2020.<sup>xxxvi</sup> Since 2016, Thailand has set a policy objective of reducing reliance on fossil fuels and established several renewable energy and energy efficiency targets. The NDC Sectoral Action Plan for the Energy Sector 2021 – 2030 aims to reduce GHG emissions from sector by at least 82 million tCO<sub>2</sub> by 2030, compared to a business-as-usual case.<sup>xxxvii</sup> Moving towards carbon neutrality in 2050, the Ministry of Energy is developing details in the National Energy Plan 2022, consisting of five key plans: Power Development Plan 2018-2037 (PDP2018), Alternative Energy Development Plan 2018-2037 (AEDP2018), Energy Efficiency Plan 2018-2037 (EEP2018), Gas Plan 2018-2037 (See Figure 10 below), and Oil Plan 2018-2037. Overall, the policy direction of the new National Energy Plan is anchored around achieving four overarching goals<sup>xxxviii</sup>:

- 1) Increasing renewable energy to at least 50%;
- 2) Transitioning the energy used in transportation to green energy by promoting electric vehicles (EV);
- 3) Increasing energy efficiency by 30 % by utilizing technology and innovation
- 4) Modifying the energy business structure to embrace energy transition according to the 4D1E framework (Decarbonisation, Digitalisation, Decentralisation, Deregulation, and Electrification).

Figure 9. Thailand's energy-related objectives and targets under different plans

#### Power Development Plan 2018-2037 (PDP)

The PDP2018 projects that Thailand will reach power generation from renewable energy at 36% by 2037. The government is developing a new national power development plan to increase the proportion of renewable energy used to generate electricity to 50% of all energy types by 2050.<sup>xxxix</sup>

### **Alternative Energy Development Plan 2018-2037 (AEDP)**

The AEDP 2015 aims to increase the share of renewable energy consumption by considering the potential for renewable energy sources that can be developed in the form of electricity, heat, and biofuels, accounting for 30% of final energy consumption by 2036.

The Draft AEDP 2018 aims to achieve the following renewable power capacities by 2037: 15.6 GW for solar, 5.8 GW for biomass, 3 GW for wind, 3 GW for hydro including imports from Laos, 0.9 GW from waste. The aggregate target of 29.4 GW under the latest plan is a major leap from the earlier target of 19.7 GW by 2036. The Draft AEDP 2018 also increases power production capacity from bio-methane gas and includes the Community Power Plants for the Local Economy Project.

### **Energy Efficiency Plan 2018-2037 (EEP)**

The EEP 2018 aims to reduce energy intensity (EI) by 30% in 2036 compared to 2010, which will be implemented in four economic sectors: industrial sectors, business and government buildings, residential sector, and transportation sector.

### **Gas Plan 2018-2037**

The plan's targets include enhancing LNG importation and management; promoting LNG use in industrial and transportation sectors; developing capacity assessment and management system; and managing land-based and marine-based gas sources.

### **Oil Plan 2018-2037**

The plan intends to improve the standard of an oil refinery to EURO 5 and 6 and LNG and NGV management; promote proper biofuel utilization in the transportation sector; develop an oil database and control system; reconstruct oil price and reduce biofuel cost; and manage oil industry to accommodate EV utilization.

**Sources:** ONEP. 2022. Draft Thailand's Fourth National Communication. (Consultation Draft – Unpublished), <https://uk.practicallaw.thomsonreuters.com/> , <https://climatepolicydatabase.org/policies/alternative-energy-development-plan-2018-2037>

In practice, the PDP 2018 has opened more windows for the development of renewable energy in Thailand by promoting new business opportunities for private investment and leveraging modern technologies.<sup>xi</sup> With the cost reduction of various types of renewable technologies and supportive policies, Thailand's power generation has started to witness a gradual shift towards renewable energy. Key developments and trends in solar, wind, and waste to energy in the medium term are summarized below:

**Solar.** Solar energy is the renewable energy source of which Thailand has the most comparative advantage. The northeast and central regions are well suited to develop solar PV systems with high irradiance levels all year round.<sup>xli</sup> Solar is the largest expected renewable energy source for electricity generation in the PDP 2018, with the target of 15,574 MW under the plan. The government subsidy to solar energy through the Feed-in Tariff (FIT) scheme started in 2014.

**Wind.** Wind power has experienced steady growth over the past 5 years. In 2019, installed onshore wind capacity reached 1,507 MW, which is equivalent to 50% of the target set under the PDP 2018. According to Thailand Wind Energy Association, the sector could harness wind energy technologies to enable a potential installed capacity of 13000–17000 MW by 2037, subject to government wind energy development policy.<sup>xlii</sup>

## Legal framework

The energy sector in Thailand is governed by the Ministry of Energy and managed by the National Energy Policy Council (NEPC), with the Energy Policy and Planning Office (EPPO) as its secretariat. The sector is regulated by the independent Energy Regulatory Commission (ERC), which monitors energy market conditions, reviews tariffs, issues licenses, approves power purchases, and reviews development planning and investment in the electricity industry.<sup>xliii</sup> The electricity industry is structured under an “enhanced single-buyer model”, with the government-owned Electricity Generating Authority of Thailand (EGAT) being solely responsible for transmission system operation and electricity generation. EGAT also acts as the single buyer, purchasing bulk electricity from private power producers and sells wholesale electricity to Thailand’s two distribution utilities, the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA), as well as a small number of direct industrial customers and utilities in neighbouring countries.<sup>xliv</sup>

The primary legislation governing the electricity sector is the Energy Industry Act B.E. 2550 (2007), which established the ERC. In addition, the Electricity Generating Authority of Thailand Act, B.E. 2511 (1968) permits the EGAT to promulgate regulations in accordance with its objectives, relating primarily to the purchase of electricity from independent producers and the operation of the transmission system network.<sup>xlv</sup> The Thai government also promotes private investment in the electricity generation business through the independent power producer (IPP) program, which was set up in 1994 and allows private developers to build, own, and operate power plants with generating capacity greater than 90 megawatts (MW) and to enter long-term (20–25 years) power purchase agreements with the EGAT.<sup>xlvi</sup>

The following sections present the screening criteria and thresholds for the different activities within the energy sector.

### 4.1.1. Solar energy generation

Sector classification and activity		
Sector and activity	Energy generation with solar technologies	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity, heating and cooling from Solar Photovoltaic, Concentrated Solar Power (CSP) or any other types of solar energy-based technologies	
Scope	Construction and operation (electricity generation)	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	All energy generation is eligible
	Amber	N/A
	Red	Power plants dedicated to support fossil fuel infrastructure

### 4.1.2. Wind energy generation

Sector classification and activity	
Sector and activity	Wind energy generation
ISIC CODE	3510
Description	Construction and operation of electricity generation facilities that produce electricity, heating and cooling from Wind Power
Scope	Construction and operation (electricity generation)

The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	All electricity generation activities from onshore and offshore wind power plants are directly eligible.
	Amber	N/A
	Red	Power plants dedicated to support fossil fuel infrastructure are excluded.

#### 4.1.3. Hydropower generation

Sector classification and activity		
Sector and activity	Hydropower	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity, heating and cooling from Hydropower	
Scope	Construction and operation (electricity generation)	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green <sup>14</sup>	<p>A hydropower facility in operation before 2020 is eligible if it has either:</p> <ul style="list-style-type: none"> <li>• A power density &gt; 5W/m<sup>2</sup></li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• GHG emissions intensity &lt; 100g CO<sub>2</sub>e/kWh.</li> </ul> <p>A hydropower facility commencing operation in 2020 or after is eligible if it has either:</p> <ul style="list-style-type: none"> <li>• A power density &gt; 10W/m<sup>2</sup></li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• GHG emissions intensity &lt; 50g CO<sub>2</sub>e/kWh.</li> </ul> <p>In addition, pumped storage facilities must also meet one of the following criteria:</p> <ul style="list-style-type: none"> <li>• The facility is demonstrably purposefully built in conjunction with intermittent renewables</li> </ul> <p>AND / OR</p> <ul style="list-style-type: none"> <li>• The facility is contributing to a grid which already has a share of intermittent renewables deployment of at least 20% or has credible evidence of programmes in place that increase the share of intermittent renewables to this level within the next 10 years.</li> </ul>

<sup>14</sup> For clarification of criteria for this activity you can check <https://www.climatebonds.net/files/files/Hydropower-Criteria-doc-March-2021-release3.pdf>

		<p>Evidence of such programmes might be the current development of renewable energy facilities that are due to come online in the near term, or the auction of PPAs for renewables.</p> <p>AND / OR</p> <ul style="list-style-type: none"> <li>The facility can credibly demonstrate that the pumped storage will not be charged with an off-peak grid intensity that is higher than the intensity of the electricity that it will displace when it is discharged. For example, demonstrating that there is no combination of the following in the merit order: (1) mid-merit coal and (2) gas used at times of peak demand.</li> </ul>
	Amber	Retrofitting that improves either power density or decreases emission intensity by at least 15% is eligible
	Red	The activity does not meet green or amber criteria

#### 4.1.4. Geothermal power generation

Sector classification and activity		
Sector and activity	Geothermal power	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity, heating, and cooling from geothermal power	
Scope	Construction and operation (electricity generation)	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	New facilities meeting declining green threshold for the Energy Sector (Table 11)
	Amber	Existing facilities meeting declining amber threshold for Energy Sector with a prescribed sunset date (Table 11)
	Red	The activity does not meet green or amber criteria

#### 4.1.5. Bioenergy generation and production

Sector classification and activity		
Sector and activity	Bioenergy	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity, heating and cooling from Bioenergy (Biomass, Biogas and Biofuels).	
Scope	<p>Construction and operation (electricity generation). These Criteria apply to assets and projects relating to:</p> <ul style="list-style-type: none"> <li>Facilities producing biomass/biofuel</li> <li>Heating/cooling, and co-generation facilities using biofuel/biomass</li> </ul>	

	<ul style="list-style-type: none"> <li>• Bio-refinery facilities</li> <li>• Supporting infrastructure associated with the above</li> </ul>	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>• Existing facilities meeting the threshold for Bioenergy (3.4.1 Bioenergy)</li> <li>• Feedstock used for production of bioenergy should comply with one of the following: <ul style="list-style-type: none"> <li>• Forest Stewardship Council (FSC);</li> <li>• Biomass Biofuels voluntary scheme (2BSvs);</li> <li>• Bonsucro; International Sustainability and Carbon Certification (ISCC Plus);</li> <li>• Roundtable of Sustainable Biomaterials (RSB)</li> <li>• Round Table on Responsible Soy (RTRS)</li> </ul> </li> </ul>
	Amber	<ul style="list-style-type: none"> <li>• Only existing facilities are eligible</li> <li>• Lifecycle emission intensity meets amber thresholds for Energy Sector (Table 11)</li> <li>• Bioenergy produced from waste (e.g., agriculture, municipal sources) are eligible.</li> <li>• Feedstock used for production of bioenergy should comply with one of the following: <ul style="list-style-type: none"> <li>• Forest Stewardship Council (FSC);</li> <li>• Biomass Biofuels voluntary scheme (2BSvs);</li> <li>• Bonsucro; International Sustainability and Carbon Certification (ISCC Plus);</li> <li>• Roundtable of Sustainable Biomaterials (RSB)</li> <li>• Round Table on Responsible Soy (RTRS)</li> </ul> </li> </ul>
	Red	Activities that are not compliant with green or amber criteria

#### 4.1.6. Energy production from natural gas

Sector classification and activity		
Sector and activity	Energy production from natural gas	
ISIC CODE	3510	
Description	Production of energy from natural gas	
Scope	Conversion and retrofitting projects only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	Conversion of natural gas plants to use green hydrogen leading to an emission intensity of less than 100gCO <sub>2</sub> e/kWh measured during the life cycle
	Amber	Retrofit of existing natural gas plants that leads to life cycle emission intensity meets declining amber thresholds for the Energy Sector with a prescribed sunset date (Table 11)
	Red	New natural gas-based power plants are excluded

#### 4.1.7. Ocean energy generation

Sector classification and activity		
Sector and activity	Ocean energy	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity, heating, and cooling from Ocean Energy.	
Scope	Construction and operation (electricity generation)	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	All energy generation activities from ocean energy are directly eligible
	Amber	N/A
	Red	N/A

#### 4.1.8. Electricity generation from renewable non-fossil gaseous and liquid fuels

Sector classification and activity		
Sector and activity	Electricity generation from renewable non-fossil gaseous and liquid fuels	
ISIC CODE	3510	
Description	Construction and operation of electricity generation facilities that produce electricity using gaseous and liquid fuels of renewable origin. This activity does not include electricity generation from the exclusive use of biogas and bioliquid fuels	
Scope	Construction and operation (electricity generation)	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>Life-cycle GHG emissions from the generation of electricity using renewable gaseous and liquid fuels are lower than 100 g CO<sub>2</sub>e/kWh. Life-cycle GHG emissions are calculated based on project-specific data, where available, using ISO 14067:2018 or ISO 14064-1:2018.</li> <li>Quantified life-cycle GHG emissions are verified by an independent third party.</li> </ul>
	Amber	Lifecycle emission intensity meets declining amber thresholds for the Energy Sector with a prescribed sunset date (Table 11)
	Red	The activity does not meet green or amber criteria

#### 4.1.9. Production of heating and cooling using waste heat

Sector classification and activity	
Sector and activity	Production of heating or cooling using waste heat
ISIC CODE	3530
Description	Production of heating and cooling using waste heat
Scope	Operations only
The activity makes significant contribution to climate change mitigation	

Metrics and thresholds	Green	The activity produces heating/cooling from waste heat
	Amber	N/A
	Red	N/A

#### 4.1.10. Installation and operation of electric heat pumps

Sector classification and activity		
Sector and activity	Installation and operation of electric heat pumps	
ISIC CODE	3530	
Description	Installation and operation of electric heat pumps	
Scope	Installation and operations	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>Refrigerant GWP <math>\leq</math> 675;</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>A minimum requirement is the implementation and adherence to a recognised environmental management system (ISO 14001 or equivalent)</li> </ul>
	Amber	N/A
	Red	N/A

#### 4.1.11. Heating and cooling distribution

Sector classification and activity		
Sector and activity	Heating/Cooling Distribution	
ISIC CODE	3530	
Description	Operation of pipelines and associated infrastructure for distribution of heating and cooling, ending at the sub-station or heat exchanger.	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	The system uses at least 50% renewable energy or 50% waste heat or 75% cogenerated heat or 50% of a combination of such energy and heat.
	Amber	N/A
	Red	N/A

#### 4.1.12. Transmission and distribution networks for renewable and low-carbon gases, including hydrogen

Sector classification and activity		
Sector and activity	Transmission and distribution networks for renewable and low-carbon gases, including hydrogen	
ISIC CODE	3520, 4930	
Description	<ul style="list-style-type: none"> <li>Repurposing of gas networks for the distribution of gaseous fuels through a system of mains.</li> <li>Repurposing of gas networks for long-distance transport of renewable and low-carbon gases by pipelines.</li> </ul>	



	<ul style="list-style-type: none"> <li>Construction or operation of transmission and distribution pipelines dedicated to the transport of hydrogen or other low-carbon gases.</li> </ul>	
Scope	Construction, operations, and retrofitting	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>Transmission and distribution networks of low-carbon gases and hydrogen are eligible.</li> <li>Retrofit of natural gas distribution lines to allow 100% hydrogen or other low carbon gases is eligible</li> <li>The activity includes leak detection and repair of existing gas pipelines and other network elements to reduce methane leakage.</li> </ul>
	Amber	N/A
	Red	N/A

#### 4.1.13. Storage of electricity and thermal energy

Sector classification and activity		
Sector and activity	Storage of electricity and thermal energy	
ISIC CODE	No specific ISIC Code	
Description	Construction and operation of facilities that store electricity and thermal energy and return it later	
Scope	Construction and operations	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>All electricity storage systems are eligible.</li> <li>All thermal energy storage systems where the generated energy falls below 100 g CO<sub>2</sub>e/kWh measured on life cycle emission basis are eligible (including geothermal energy storage)</li> </ul>
	Amber	N/A
	Red	N/A

#### 4.1.14. Transmission and distribution of electricity

Sector classification and activity		
Sector and activity	Transmission and distribution of electricity	
ISIC CODE	3510	
Description	<ul style="list-style-type: none"> <li>Construction and operation of transmission systems that transport the electricity on the extra high-voltage and high-voltage interconnected System.</li> <li>Construction and operation of distribution Systems that transport electricity on high-voltage, medium-voltage and low-voltage distribution Systems.</li> <li>Construction and operation of interconnections that transport electricity between separate systems.</li> </ul>	
Scope	Construction and operations	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>Transmission and distribution infrastructure dedicated to a direct connection or an expansion of connection between power plants with</li> </ul>

		<p>energy intensities less than 100 g CO<sub>2</sub>e/kWh (life cycle emissions).</p> <ul style="list-style-type: none"> <li>• Transmission and distribution infrastructure that is on a decarbonisation trajectory where at least 67% of the newly connected generation capacity in the system is below the generation threshold value of 100 gCO<sub>2</sub>e/kWh measured on a Product Carbon Footprint (PCF) basis, over a rolling five-year period; or the average System grid emissions factor is below the threshold value of 100gCO<sub>2</sub>e/kWh measured on a PCF basis, over a rolling five-year average period</li> <li>• Includes all enabling ICT systems and smart management systems for the eligible infrastructure</li> </ul>
	Amber	N/A
	Red	Construction and operation of transmission and distribution infrastructure where the share of fossil fuels in the grid/

## 4.2. Transportation Sector: an overview

The transport sector in Thailand is significantly more developed than its Southeast Asian neighbours. Road transport is the dominant subsector in terms of investment, traffic flow, national coverage, and economic impact, accounting for 98% of passenger traffic and 95% of the country's freight traffic.<sup>xlvii</sup> Despite the developed transport infrastructure network, access to the public transportation system is limited only to city centres. Overall, only 24 per cent of the urban population has convenient access to the public transportation system.<sup>xlviii</sup> Other key problems of the sector include road safety, inefficient highway network, and low road infrastructure competitiveness measured in terms of logistics costs.<sup>xlix</sup> In terms of carbon footprint, the transportation sector contributed the largest share (38.40%) of final energy consumption in 2020.<sup>l</sup>

Transport has been the dominant sector in the Infrastructure Development Master Plan (IDMP) 2015–2022, which prioritised five transport sectors: (1) inter-link railway network, (2) road networks, (3) mass transit in Bangkok and neighbouring cities, (4) enhancement for highway network to link with key areas in the country and with the regional countries in the Greater Mekong Subregion and ASEAN, and (5) water and air transport.<sup>li</sup> The estimated Investment for the IDMP reached THB3.4 trillion (USD100 bn), of which planned spending on major projects on railway and mass transit networks in Bangkok are dominant.<sup>lii</sup>

### Sustainable transport

Environmental sustainability has become an increasingly important consideration in the transport sector in Thailand. Through a short-term programme (2013–2017), and a long-term plan (2018–2030), the Environmental Sustainable Transport Master Plan (2013) aims to reduce energy intensity, GHG emissions, and air pollution from transport, with the development of public transportation and mass rapid transit systems as one of the key implementation strategies.<sup>liii</sup> In 2019, the Ministry of Transport (MoT) published the 20-year Transport System Development Strategy (2018–2037), which includes green and safe transport as a key pillar.<sup>liv</sup>

The Thailand Transport Investment Action Plan 2017 has also prioritised sustainable transport projects. The Plan outlined (1) 10 projects for Double Track Rail Network (USD11.67 bn); (2) two projects for

Commuter Train (USD4.78 bn); (3) six projects for Mass Transit Development (USD6.32 bn); and (4) one project for public bus procurement and stations (USD64.92 m).<sup>lv</sup> The Thai Board of Investment (BOI) offers tax and non-tax incentives to domestic and international investors to invest in sustainable transport in Thailand, including rail development<sup>lvi, lvii</sup>. The Government also implements a number of several public transportation development projects in provincial areas.

The NDC Sectoral Action Plan for Transport Sector 2021 – 2030 aims to reduce GHG emissions from the sector, with an emphasis on developing efficient and sustainable transportation systems to reduce energy consumption, lessen traffic congestion, and create liveable cities. Four key strategies include:

1. supporting and promoting the planned implementation of relevant agencies in the transport sector;
2. developing and improving laws supporting GHG reduction;
3. developing measurement, reporting and verification (MRV); and
4. engaging and strengthening the capacity of all agencies to reduce GHG emissions.

Figure 10. Thailand’s key transport-related objectives and targets

- Reduce 31.0 MtCO<sub>2</sub>eq from mitigation measures in the transport sector (Thailand’s NDC Roadmap 2021-2030), especially in energy efficiency in transportation
- The NDC Action Plan in the transport sector, 2021 – 2030 identifies measures of green transport, transport efficiency, and inclusive transport and is expected to contribute to the GHG emissions reduction of 35.42 MtCO<sub>2</sub>eq in 2030.<sup>lviii</sup>
- Increase to 1.2 million electric vehicles and 690 charging stations by 2036<sup>lix</sup>

## Legal framework

All national transport-related agencies are under the control of the Ministry of Transport. The Department of Highways (DOH) is responsible for national roads and highways, while key local roads are the responsibility of the Department of Rural Roads. Around 365,000 km of other local roads are under municipal and district jurisdictions. The Expressway Authority of Thailand (EXAT) is responsible for urban express ways, presently confined to Bangkok Metropolitan Region (BMR) and its environs. Bangkok Metropolitan Administration (BMA) is responsible for urban road development in the BMR. The Office of Transport and Traffic Policy and Planning (OTP) is the national transport planning office.

Key transport-related laws include the Land Transport Act, B.E. 2522 (1979), which governs registration of vehicles, vehicle dimensions, operation of freight and passenger transport, and annual taxation and inspection; the Highway Act, B.E.2535 (1992), which governs road design, vehicle and axle weight regulations; and the Industrial Product Standards Act, B.E. 2511 (1968) which governs product standard regulations, and emission standard of vehicles (in compliance with the National Pollution Control Board’s Order).<sup>lix</sup>

The following sections present the screening criteria and thresholds for the different activities within the transport sector.

### 4.2.1. Transport via railways

Sector classification and activity	
Sector and activity	Transport via railways
ISIC CODE	491
Description	Rail transportation of passengers and/or freight using railroad rolling stock on mainline networks, usually spread over an extensive geographic area. Freight rail transport over short-line freight railroads is included

Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<p><b>The activity complies with one of the following criteria:</b></p> <ul style="list-style-type: none"> <li>the trains and passenger coaches/wagons have zero direct (tailpipe) CO<sub>2</sub> emissions;</li> <li>the trains and passenger coaches/wagons have zero direct (tailpipe) CO<sub>2</sub> emission when operated on a track with necessary infrastructure, and use a conventional engine where such infrastructure is not available (bimodal)</li> </ul> <p>AND</p> <p>The trains and wagons are not dedicated to the transport of fossil fuels.</p>
	Amber	<ul style="list-style-type: none"> <li>Passenger rolling stock is eligible if its direct emissions are below 50 gCO<sub>2</sub>e/pkm until 2025 (after this year only rolling stock with zero direct emissions will be eligible).</li> <li>As for freight transport by rail, it is eligible if direct emissions are below 25 gCO<sub>2</sub>/tkm until 2025 (after this year only rolling stock with zero direct emissions will be eligible).</li> </ul>
	Red	The activity does not meet green or amber criteria

#### 4.2.2. Other passenger land transport

Sector classification and activity		
Sector and activity	Other passenger land transport	
ISIC CODE	4922	
Description	<p><b>This class includes:</b></p> <ul style="list-style-type: none"> <li>scheduled long-distance bus services;</li> <li>charters, excursions and other occasional coach services;</li> <li>taxi operation;</li> <li>airport shuttles.</li> <li>other renting of private cars with driver;</li> <li>operation of school buses and buses for transport of employees;</li> <li>passenger transport by man- or animal-drawn vehicles.</li> </ul>	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	Direct (tailpipe) CO <sub>2</sub> emissions of the vehicle are zero
	Amber	N/A
	Red	The activity does not meet green criteria

### 4.2.3. Urban and suburban passenger land transport

Sector classification and activity		
Sector and activity	Urban and suburban passenger land transport	
ISIC CODE	4921	
Description	<p>This class includes land transport of passengers by urban or suburban transport systems. This may include different modes of land transport, such as:</p> <ul style="list-style-type: none"> <li>• by motorbus,</li> <li>• tramway,</li> <li>• streetcar,</li> <li>• trolley bus,</li> <li>• underground</li> <li>• elevated railways etc.</li> </ul> <p>The transport is carried out on scheduled routes normally following a fixed time schedule, entailing the picking up and setting down of passengers at normally fixed stops.</p> <p>The class also includes:</p> <ul style="list-style-type: none"> <li>• town-to-airport or town-to-station lines</li> <li>• operation of funicular railways, aerial cableways etc. if part of urban or suburban transit systems.</li> </ul>	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<p>For scheduled passenger road transport, the activity complies with the following criteria:</p> <ul style="list-style-type: none"> <li>• the activity provides urban or suburban passenger transport, and its direct (tailpipe) CO<sub>2</sub> emissions are zero</li> </ul> <p>For scheduled passenger urban suburban rail transport, the activity complies with one of the following criteria:</p> <ul style="list-style-type: none"> <li>• the trains and passenger coaches have zero direct (tailpipe) CO<sub>2</sub> emissions;</li> <li>• the trains and passenger coaches have zero direct tailpipe CO<sub>2</sub> emission when operated on a track with necessary infrastructure, and use a conventional engine where such infrastructure is not available (bimode).</li> </ul>
	Amber	N/A
	Red	The activity does not meet green criteria

### 4.2.4. Freight transport by road

Sector classification and activity	
Sector and activity	Freight transport by road
ISIC CODE	4923
Description	<p>This class includes:</p> <ul style="list-style-type: none"> <li>• all freight transport operations by road</li> <li>• logging haulage</li> <li>• stock haulage</li> <li>• refrigerated haulage</li> </ul>

	<ul style="list-style-type: none"> <li>• heavy haulage</li> <li>• bulk haulage, including haulage in tanker trucks</li> <li>• haulage of automobiles</li> <li>• transport of waste and waste materials, without collection or disposal</li> </ul> <p>This class also includes:</p> <ul style="list-style-type: none"> <li>• furniture removal</li> <li>• renting of trucks with driver</li> <li>• freight transport by man or animal-drawn vehicles</li> </ul>	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<p>The activity complies with the following criteria:</p> <ul style="list-style-type: none"> <li>• direct (tailpipe) CO<sub>2</sub> emissions of the vehicle are zero</li> </ul> <p>AND</p> <p>Vehicles are not dedicated to fossil fuel transport</p>
	Amber	<p>Amber category available only for vehicles dedicated to freight transport having a maximum mass exceeding 3.5t<sup>15</sup></p> <p>The activity complies with the amber criteria if a vehicle fits into 15% best available in Thailand in terms of GHG emissions per tkm. Amber category is available until 2030, after it only green category is available for this article.</p>
	Red	The activity does not meet green or amber criteria

#### 4.2.5. Enabling infrastructure for low-emission transport

Sector classification and activity		
Sector and activity	Enabling infrastructure for low-emission transport	
ISIC CODE	No specific code available	
Description	Various types of infrastructure and activities that enable and support low-carbon transportation	
Scope	Construction and operations	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	<ul style="list-style-type: none"> <li>• Infrastructure for personal mobility, cycling logistics - construction, modernisation, maintenance and operation of infrastructure for personal mobility, including the construction of roads, motorways bridges and tunnels and other infrastructure that are dedicated to pedestrians and bicycles, with or without electric assist.</li> </ul>

<sup>15</sup> This is noted as the limit because there are limited technological options available for zero tail pipe emissions for vehicles in this category.

		<ul style="list-style-type: none"> <li>• Infrastructure for rail transport - construction, modernisation, operation and maintenance of railways and subways as well as bridges and tunnels, stations, terminals, rail service facilities, safety and traffic management systems including the provision of architectural services, engineering services, drafting services, building inspection services and surveying and mapping services and the like as well as the performance of physical, chemical and other analytical testing of all types of materials and products.</li> <li>• Infrastructure enabling low-carbon road transport and public transport construction, modernisation, maintenance and operation of infrastructure that is required for zero tailpipe CO2 operation of zero-emissions road transport, as well as infrastructure dedicated to transshipment, and infrastructure required for operating urban transport.</li> <li>• Infrastructure enabling low carbon water transport - construction, modernisation, operation and maintenance of infrastructure that is required for zero tailpipe CO2 operation of vessels or the port's own operations, as well as infrastructure dedicated to transshipment.</li> <li>• Low carbon airport infrastructure - Construction, modernisation, maintenance, and operation of infrastructure that is required for zero tailpipe CO2 operation of aircraft or the airport's own operations, as well as for provision of fixed electrical ground power and preconditioned air to stationary aircraft.</li> </ul>
	Amber	N/A
	Red	<p>Infrastructure dedicated to the transport or storage of fossil fuels, including:</p> <ul style="list-style-type: none"> <li>• Parking facilities;</li> <li>• Fossil fuel filling stations.</li> </ul>

#### 4.2.6. Sea and coastal water transport

Sector classification and activity	
Sector and activity	Sea and coastal water transport
ISIC CODE	501
Description	<p>This class includes transport of passengers or freight overseas and coastal waters, whether scheduled or not:</p> <ul style="list-style-type: none"> <li>• operation of excursion, cruise or sightseeing boats;</li> <li>• operation of ferries, water taxis etc.;</li> </ul>

	<ul style="list-style-type: none"> <li>• transport of freight overseas and coastal waters, whether scheduled or not;</li> <li>• transport by towing or pushing of barges, oil rigs etc.</li> </ul> <p>This class also includes:</p> <ul style="list-style-type: none"> <li>• rental of pleasure boats with crew for sea and coastal water transport.</li> </ul>	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	The activity complies with the green thresholds established for the specific kinds of ships (Table 15) as well as additional criteria in the Section 4.3.2
	Amber	The activity complies with the amber threshold established for the Shipping Sector with a prescribed sunset date (Table 15)
	Red	The activity does not meet green or amber criteria or is one of the activities mentioned in Table 15

#### 4.2.7. Inland water transport

Sector classification and activity		
Sector and activity	Inland water transport	
ISIC CODE	502	
Description	<p><b>This class includes:</b></p> <ul style="list-style-type: none"> <li>• transport of passenger or freight via rivers, canals, lakes, and other inland waterways, including inside harbours and ports</li> </ul> <p><b>This class also includes:</b></p> <ul style="list-style-type: none"> <li>• rental of pleasure boats with crew for inland water transport</li> </ul>	
Scope	Operations only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	The activity complies with the following criteria: vessels have zero direct (tailpipe) CO <sub>2</sub> emissions
	Amber	The activity complies with the amber threshold established for the Shipping Sector with a prescribed sunset date (Table 15)



		AND
		Vessels are not dedicated to fossil fuel transport.
	Red	The activity does not meet green or amber criteria

#### 4.2.8. Retrofitting of sea and coastal freight and passenger water transport

Sector classification and activity		
Sector and activity	Retrofitting of sea and coastal freight and passenger water transport	
ISIC CODE	3312	
Description	Retrofitting of vessels that leads to their compliance with amber threshold	
Scope	Retrofitting only	
The activity makes significant contribution to climate change mitigation		
Metrics and thresholds	Green	Retrofitting of vessels that leads to their compliance with the green threshold for the Shipping Sector (Table 15)
	Amber	Retrofitting of vessels that leads to their compliance with amber threshold for the Shipping Sector with a prescribed sunset date (Table 15)
	Red	Retrofitting of fossil fuels carrying vessels

## 5. Essential Criteria

### 5.1. Do No Significant Harm

The “Do No Significant Harm” (DNSH) principle is applied to the taxonomies with multiple objectives in order to make sure that one objective does not cause damage to other objectives. As the pilot version of the Thailand Taxonomy has only one objective (climate change mitigation), a set of generic DNSH criteria was created to ensure compliance with internationally recognized principles and conventions, and relevant Thailand laws. On later stages of development of the Taxonomy activity-specific DNSH may also be added.

Any activity owner who may want to utilize the present taxonomy must abide by the following set of international norms, rules and regulations (including, but not limited to):

- Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal
- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- Convention on Biological Diversity

It is very important to note that in complying with all the rules of this taxonomy, the entity being evaluated **must first comply with all laws, regulations and requirements established by the law of Thailand or the law of the country where the activity takes place**. The criteria below are additional to all these laws and may in no way conflict with them.

Table 16. Do no significant harm table and criteria

GENERIC DNSH REQUIREMENTS	
OBJECTIVE	DESCRIPTION
Climate change adaptation	<p>The physical climate risks that are material to the activity must be identified from those listed in the table in the Section 5.1.2 by performing a robust climate risk and vulnerability assessment with the following steps:</p> <ul style="list-style-type: none"> <li>• screening of the activity to identify which physical climate risks from the list in the section 5.1.2 may affect the performance of the economic activity during its expected lifetime;</li> <li>• where the activity is assessed to be at risk from one or more of the physical climate risks listed in the section 5.1.2, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity;</li> <li>• an assessment of adaptation solutions that can reduce the identified physical climate risk.</li> </ul> <p>The climate risk and vulnerability assessment must be proportionate to the scale of the activity and its expected lifespan. The assessment must be performed using the highest available resolution projections across the existing range of future scenarios<sup>16</sup> consistent with the expected lifetime of the activity.</p> <p>The climate projections and assessment of impacts must be based on best practice and available guidance and take into account the state-of-the-art science for vulnerability and risk analysis and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports<sup>17</sup>, scientific peer-reviewed publications, and open source or paying models.</p> <p>For existing activities and new activities using existing physical assets, the economic operator must implement physical and non-physical solutions, over a period of time of up to five years, that reduce the most important identified physical climate risks that are material to that activity. An adaptation plan for the implementation of those solutions is drawn up accordingly.</p> <p>For new activities and existing activities using newly built physical assets, the economic operator integrates the adaptation solutions that reduce the most important identified physical climate risks that are material to that activity at the time of design and construction and must implement them before the start of operations.</p>
Sustainable use and protection of marine and water resources	<p>Risks associated with water consumption and water quality must be identified, assessed and managed. Water risk analysis tools must be used for this purpose (e.g. risk assessments by national environmental authorities, water footprint, WWF Water Risk Filter<sup>lxix</sup>, WRI Aqueduct etc<sup>lxii</sup>).</p> <p>If assets or activities are located in water-stressed areas, ensure that water use and conservation management plans, developed in consultation with relevant local entities, have been implemented.</p>

<sup>16</sup> Future scenarios include Intergovernmental Panel on Climate Change representative concentration pathways RCP2.6, RCP4.5, RCP6.0 and RCP8.5.

<sup>17</sup> Assessments Reports on Climate Change: Impacts, Adaptation and Vulnerability, published periodically by the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change produces, <https://www.ipcc.ch/reports/>

GENERIC DNSH REQUIREMENTS	
OBJECTIVE	DESCRIPTION
Resource resilience and transition to a circular economy	<p>National regulations associated with retirement and dismantlement plans for plants and infrastructure related to economic activity in question must be applied.</p> <p>Ambition to maximise the efficient use, reduction, repair, recycling and reuse of materials during the activity operational life cycle (e.g. through contractual agreements with recycling companies and integration of the cost of recycling), proper treatment and waste disposal (e.g. proper end-of-life management of batteries) and compliance, as a producer, with Extended Producer Responsibility standards must be demonstrated.</p> <p>The ambition that new installations are designed and manufactured for high durability, easy to dismantle, refurbishment and recycling must be demonstrated. Proper repair of facilities and equipment, and the accessibility and interchangeability of the activity's equipment components must be ensured.</p>
Pollution prevention and control	<p>Discharges to water bodies must comply with water discharge permits from the relevant local authorities.</p> <p>Emissions that pollute the air must have the required permits and comply with relevant regulations (with particular focus on hazardous waste).</p> <p>Integrated management of the waste generated must be carried out by duly authorised waste managers.</p>
Protection and restoration of biodiversity and ecosystems	<p>New financed facilities and infrastructure should not be located in ecosystems that are strategic for food security, rich in biodiversity, or that serve as habitat for endangered species (flora and fauna) that are in the list of nationally protected areas or on the IUCN Red List<sup>lxiii</sup>. Museums or technical facilities are exempt from this requirement.</p> <p>For sites and operations located in or near biodiversity sensitive areas (UNESCO World Heritage Sites, key Biodiversity Areas, as well as those defined by the National Protected Areas Systems), an appropriate assessment must be carried out in line with the criteria set by IFC Performance Standard No6<sup>lxiv</sup>. For these sites, a long-term biodiversity monitoring and assessment programme must be implemented.</p>

If the activity, project or company in question does not comply with the DNSH criteria but otherwise passes relevant technical screening criteria and metrics, it may be considered eligible for the corresponding green or amber category if the operating company submits an additional plan indicating how it will correct the deficiencies.

## 5.1.2 Classification of climate-related hazards<sup>18</sup>

Table 17. Classification of climate-related hazards

	Temperature-related	Wind-related	Water-related	Solid mass-related
<i>Chronic</i>	<ul style="list-style-type: none"> <li>• Changing temperature (air, freshwater, marine water)</li> <li>• Heat stress</li> <li>• Temperature variability</li> <li>• Permafrost thawing</li> </ul>	<ul style="list-style-type: none"> <li>• Changing wind patterns</li> </ul>	<ul style="list-style-type: none"> <li>• Changing precipitation patterns and types (rain, hail, snow/ice)</li> <li>• Precipitation or hydrological variability</li> <li>• Ocean acidification</li> <li>• Saline intrusion</li> <li>• Sea level rise</li> <li>• Water stress</li> </ul>	<ul style="list-style-type: none"> <li>• Coastal erosion</li> <li>• Soil degradation</li> <li>• Soil erosion</li> <li>• Solifluction</li> </ul>
<i>Acute</i>	<ul style="list-style-type: none"> <li>• Heat wave</li> <li>• Cold wave/frost</li> <li>• Wildfire</li> </ul>	<ul style="list-style-type: none"> <li>• Cyclone, hurricane, typhoon</li> <li>• Storm (including blizzards, dust and sandstorms)</li> <li>• Tornado</li> </ul>	<ul style="list-style-type: none"> <li>• Drought</li> <li>• Heavy precipitation (rain, hail, snow/ice)</li> <li>• Flood (coastal, fluvial, pluvial, ground water)</li> <li>• Glacial lake outburst</li> </ul>	<ul style="list-style-type: none"> <li>• Avalanche</li> <li>• Landslide</li> <li>• Subsidence</li> </ul>

## 5.2. Minimum Social Safeguards

The eligible asset or activity must ensure that it does not generate a negative social impact. For this, **they must adhere to the relevant local regulatory framework and policies, relevant internationally recognized principles and conventions**, and have a social management system in place. These minimum social safeguards (MSS) must also be in line with the following IFC Performance Standards<sup>lv</sup>:

- Performance Standard 1: Assessment and management of environmental and social risks and impacts.
- Performance Standard 2: Labour and working conditions
- Performance Standard 4: Community Health and Safety
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

<sup>18</sup> Developed by EU Technical Expert Group [https://www.openriskmanual.org/wiki/Climate-Related\\_Risk\\_Taxonomy](https://www.openriskmanual.org/wiki/Climate-Related_Risk_Taxonomy)

If the activity, project or company in question do not comply with MSS criteria but otherwise passes relevant technical screening criteria and metrics, it may be considered eligible for the corresponding green or amber category if the operating company submits an additional plan indicating how it will correct the deficiencies.

## 6. Grandfathering and review period

It is highly recommended to update the taxonomy every 3 years to ensure the incorporation of best practices and standards into the activities criteria.

The taxonomy allows a partial grandfathering in case of loans or bonds issuance, meaning that if the criteria are updated, the bond/loan that is certified under the previous version of the taxonomy continues to be eligible as green or amber even after the criteria have changed. However, after 5 years new criteria must be applied and if the bond doesn't pass the new threshold, eligibility must be revoked.

## Appendix 1. Thailand and its climate policy in global and regional context

### 1. Global context

Climate emergency is one of the most pressing issues the world is facing today. Global net anthropogenic greenhouse gas (GHG) emissions were about 12% higher in 2019 than in 2010 and 54% higher than in 1990<sup>lxvi</sup>. According to the Intergovernmental Panel on Climate Change (IPCC), current world policies on GHG emission mitigation announced before the COP 26 conference in November 2021 are unlikely to lead us to limiting global warming to 1.5°C during the 21st century. Even limiting it to 2°C will require tremendous efforts from all members of the world community. IPCC climate modelling shows that in order to maintain temperatures below 1.5°C, it is necessary to reduce anthropogenic emissions at least by 45% compared to 2010 before 2030 and to reach net-zero emissions by 2050.

Without ambitious climate change mitigation actions, the world will experience negative consequences of climate change on a scale never envisioned before, and some of this change will be irreversible. Increased heatwaves, droughts and floods are already exceeding plants' and animals' tolerance thresholds, driving mass mortalities in species such as trees and corals<sup>lxvii</sup>. Hundreds of millions of people living in the coastal areas will be among the first to experience worsening living conditions, but the rest will follow soon. Acute food and water shortages all over the world will change the lives of billions and seriously undermine the prospects of future generations.

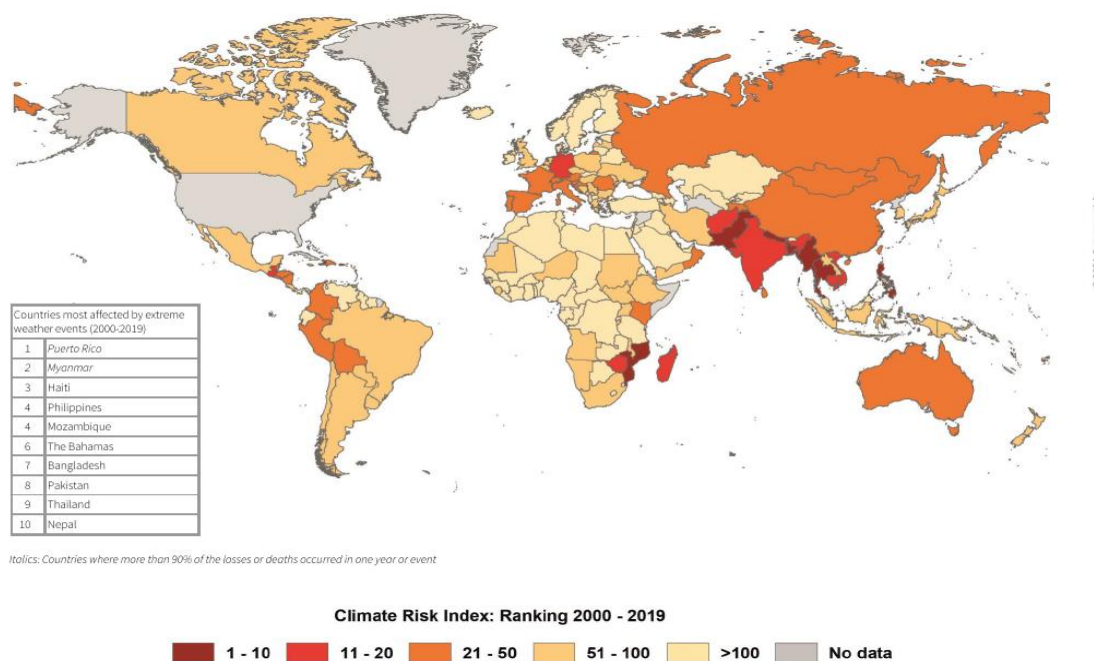
In this context, climate change also causes economic impacts which translate into financial risks. A recent risk survey by the World Economic Forum found that 3 out of the top 5 perceived most important global risks in terms of impact are climate-related (i.e., climate action failure, biodiversity loss, and extreme weather)<sup>lxviii</sup>. More than 200 of the world's largest firms estimate that climate change will generate a total cost of USD 1 tn in damage to economy and people's livelihood if appropriate actions are not taken. Consequently, insurances could become unaffordable or unavailable for several businesses and individuals. In 2018, the global "catastrophe protection gap", referring to assets that should have been insured but were not, equalled almost USD 280 bn<sup>lxix</sup>.

The Association of Southeast Asian Nations (ASEAN) region and its 640 million people are particularly vulnerable to the consequences of climate change, given that 450 million live near retreating shorelines. The Asian Development Bank (ADB) estimates that Southeast Asia needs USD210 bn annually till 2030 for investments in climate-resilient infrastructure and notes the private sector's important role in closing gaps in public finance for these investments<sup>lxx</sup>.

### 2. Thailand and climate change

Evidence shows that Thailand is highly vulnerable to the negative impacts of climate change and heavy rainfalls, floods, droughts, cyclones, and storm surges are among the country's significant extreme hazards. Floods, including riverine, flash, and coastal flooding, are by far the most significant hazard in terms of economic and human impacts<sup>lxxi</sup>, followed by droughts and cyclones.<sup>lxxii</sup> Reflecting very high exposure to these hazards, Thailand was ranked the 9th most affected country globally by extreme weather events between 2000–2019<sup>lxxiii</sup>. These events may intensify under future climate scenarios. For example, it is projected that the number of people in Thailand affected by an extreme river flood could grow by over 2 million during 2035–2044, and coastal flooding could involve a further 2.4 million people during 2070–2100<sup>lxxiv</sup>.

Figure 11: Countries most affected by extreme weather events, 2000-2019



**Source:** Data from GermanWatch and Munich Re NatCatSERVICE. Graphic from GermanWatch. 2021

Thailand is also exposed to slow-onset climate change impacts from rising sea levels, rising temperatures, and fluctuations in precipitation regimes. Observations show temperature increases across Thailand since the mid-20th century and an increase in annual precipitation, with most of this increase occurring during the wet season<sup>lxxv</sup>. Thailand’s Third Biannual Update Report (BUR3) (2020) highlighted Thailand's coastal zone as one of the most vulnerable areas at greater risk of intensive flooding resulting from sea-level rise and coastal erosion<sup>lxxvi</sup>. In addition to sinking land, the combination of rising seas and potential cyclone-induced storm surges threaten large amounts of Thailand’s critical public and private infrastructure in low-lying areas, including Bangkok, which is often ranked among the most climate vulnerable cities in the world<sup>lxxvii</sup>.

### 3. National context

Thailand has been an upper middle-income country since 2011 and has experienced successive decades of remarkable economic and social development, including substantial progress toward Sustainable Development Goals (SDGs)<sup>lxxviii</sup>. The coronavirus disease (COVID-19) pandemic crisis severely impacted the country, given its high dependence on trade and tourism.

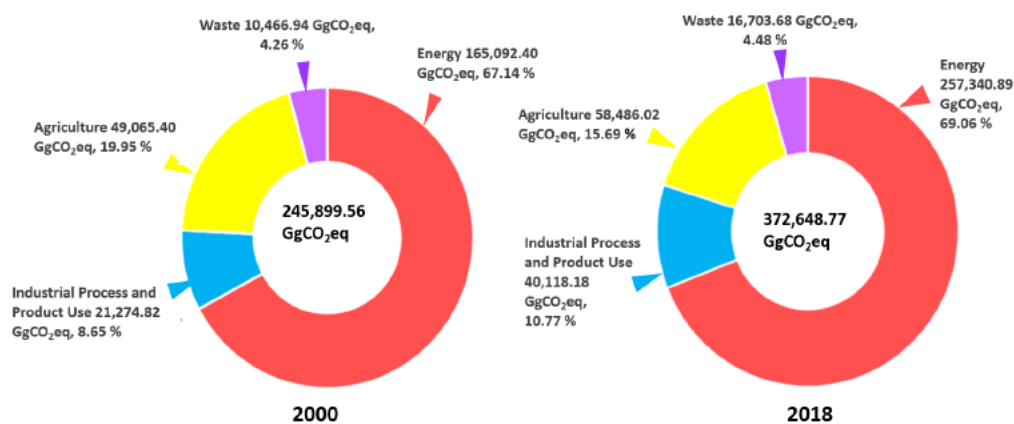
According to the World Bank, the economy expanded by 1.6% in 2021 amid four waves of the pandemic and is not expected to recover to pre-COVID-19 levels until 2023<sup>lxxix</sup>. Thailand is addressing the twin challenges of accelerating post-COVID-19 recovery and making climate-resilient and low-carbon development a key pillar of long-term sustainable economic growth.

While adapting to these impacts of climate change is a priority, Thailand also needs to simultaneously engage in ambitious climate mitigation actions by reducing GHG emissions across key economic sectors. According to the Draft Fourth National Communication (NC4) report, between 2000-2018, the main source of GHG emissions in Thailand was the energy sector, which saw an increase of 55.88% from 165092 GgCO<sub>2</sub>eq in 2000 to 257341 GgCO<sub>2</sub>eq in 2018.

In 2018, total GHG emissions (excluding those from the Land Use and the Land-Use Change and Forestry (LULUCF) sector) were 372649 GgCO<sub>2</sub>eq and net GHG emissions were 286680 GgCO<sub>2</sub>eq (including

those from LULUCF, which contributes to a net removal of 85968 GgCO<sub>2</sub>eq. in 2018<sup>lxxx</sup>). The energy sector remains the most significant contributor to Thailand’s GHG emissions in 2018, accounting for 69 % of the total GHG emissions, making it the most important sector for Thailand’s climate change mitigation actions. The share of emissions from the Agriculture, IPPU, and Waste sectors in 2018 were 16%, 11 %, and 4%, respectively.

Figure 12. Thailand GHG Emission Profile (Excluding LULUCF), 2018



Source: ONEP. 2022. Draft Thailand’s Fourth National Communication

#### 4. Need for more investment in climate change mitigation, adaptation and resilience

Among the significant extreme hazards, flooding accounts for nearly 100% of the average annual loss associated with hazards.<sup>lxxxii</sup> Major flood events in Thailand have affected the entire economy in the past. For example, a single flood in 2011 caused a total loss and damages cost of THB1.43 tn (USD46.5 bn), or equivalent to roughly a 1.1% loss in real GDP in 2011.<sup>lxxxii, lxxxiii</sup> Overall, the 2011 floods affected more than 13 million people and resulted in more than 680 deaths. The damage to buildings, equipment and machinery in the industry sector alone amounted to THB 513.9 bn.<sup>lxxxiv</sup>

Storms and droughts have also caused some significant negative impacts on Thailand’s economy. Droughts occur almost every year, affecting more than 10 million people, resulting in average economic damages of THB 0.6 bn (USD 20 m) annually and could cause financial losses of up to 0.1% of GDP. Thailand also incurs an average of THB 0.2 bn (USD 6 m) in damages annually from storms that lead to nationwide floods and landslides.<sup>lxxxv</sup> Apart from extreme events, Thailand also faces the effects of long-term incremental changes from climate change. For example, projections suggest that Thailand’s agriculture sector could be significantly affected by a changing climate due to its location in the tropics, where agricultural productivity is particularly vulnerable to temperature rises, rice yields, and the eastern, south-central, and north-eastern areas are most likely to be negatively impacted.<sup>lxxxvi</sup>

In term of sectoral impacts, given that around 47% of land use in Thailand is dedicated for agriculture and around 30% of the Thai labour force still participate in the agricultural sector, the vulnerability of the agricultural sector to climate change is a key concern. Apart from agricultural sector, other climate vulnerable sectors are water resource management, public health, tourism, natural resource management and human settlement and human security.<sup>lxxxvii</sup>

In terms of vulnerable groups, studies highlighted that climate change's highest economic and social impacts would likely fall disproportionately on the poorest and marginalised groups and regions.<sup>lxxxviii</sup>

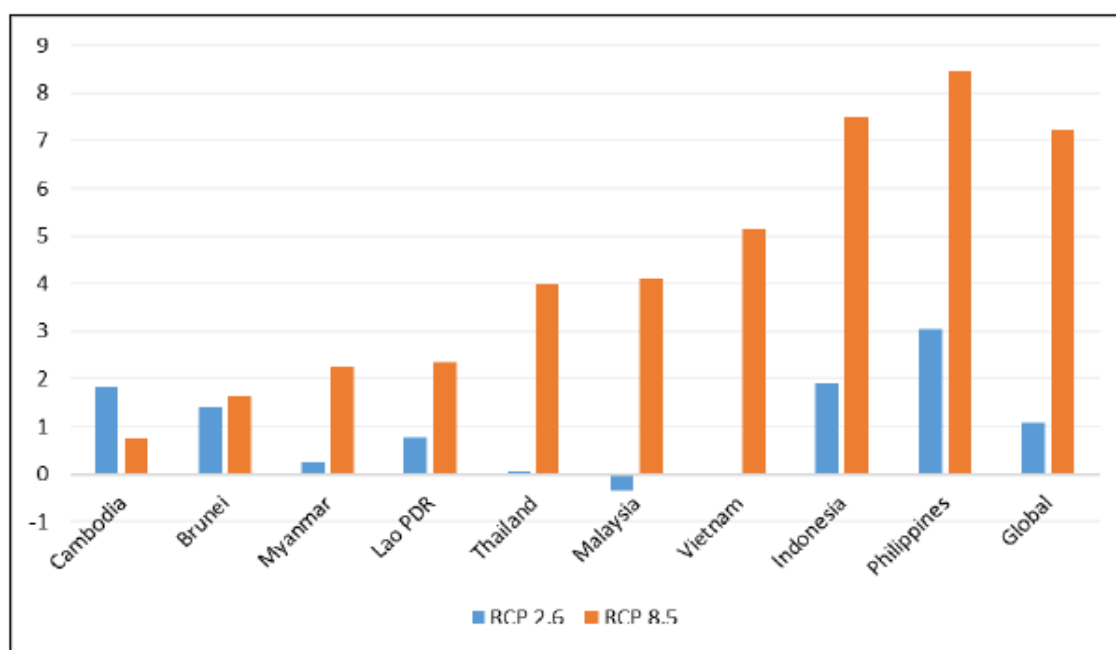


As Thailand is an aging society which projected to be a “super-aged society” by 2035, the country will be home a large segment of aged population who will be particularly vulnerable to the impacts of climate change.<sup>lxxxix</sup> From the human health perspective, the effects of temperature rise and heat stress in urban areas, compounded by the phenomenon of Urban Heat Island, as well as the impacts of climate change on vector-borne diseases, food security, and nutrition, are also of particular concern. These climate change impacts on public health could negatively affect Thailand’s economy through channels such as reduced labour productivity and human capital accumulation.<sup>xc</sup>

With accelerating global temperatures and the increased frequency of extreme events, future impacts from climate change on Thailand are likely to intensify. Therefore, more investments in adaptation and resilience are needed to address the effects of climate-related hazards on the Thai economy. Without adequate adaptation and resilience investments, Thailand could see severe dents to GDP per capita due to climate change, with potential losses up to 4% of GDP in the year 2100, depending on future emission scenarios and the breadth and depth of adaptation actions taken.

On the other hand, more investments adaptation and resilience could provide new economic opportunities for Thailand in the post-COVID era to attract new capital towards innovative projects, for examples, in smart water management, climate-smart agriculture, coastal rehabilitation and climate-resilient infrastructure. Apart from bringing new green jobs, these investments are consistent with Thailand’s NDC, which emphasises the opportunity from pandemic recovery to “build back better” an ecosystem and economy that is climate-resilient and sustainable.<sup>xcii</sup>

Figure 13. Thailand’s potential loss in GDP per capita from climate change by 2100 compared to other ASEAN countries



Source: Anwar et al. (2020)<sup>xcii</sup>

Note: RCP 2.6 corresponds to the Paris Agreement’s 2-degree goal achieved; RCP 8.5. is an unmitigated scenario in which emissions continue to rise throughout the 21st century.

Current efforts to accelerate the decarbonisation of the economy present both challenges and opportunities for Thailand. On the one hand, the country is facing key constraints and gaps in decarbonisation efforts, including high investment costs, particularly costs of technologies and infrastructure, and a high level of technical capacity and effective coordination needed across different sectoral agencies.<sup>xciii</sup> Given these constraints, there has been concern about the potential impacts of

GHG emission reduction actions on the country's economic growth, with some predicting slight GDP losses (-0.3 to -0.5%) from 25-40% GHG emission reductions compared to a BAU scenario.<sup>xciv</sup>

On the other hand, studies also highlighted the potential positive economic effects of transition to a net-zero economy. For example, a World Bank study predicts that a shift towards a circular economy could increase Thailand's GDP by about 1.2% and create nearly 160,000 additional jobs by 2030, representing approximately 0.3% of total employment.<sup>xcv</sup> A KPMG study also ranks Thailand among seven countries to watch globally regarding net-zero readiness, as Thailand has significant opportunities to decarbonise through large-scale projects and emerging initiatives, including green industry standards, public transport, and the manufacturing of electric vehicles.<sup>x cvi</sup> In the long term, the net effects of the transition to net-zero on the Thai economy will likely depend, among others, on access to financing for green investments, the adoption of appropriate technologies across economic sectors, and the ability to create co-benefits from GHG reductions (such as green jobs, reduced public health burden from pollutions etc.).

## 5. Local environmental issues, causes, and mitigation

Thailand also faces multiple local environmental issues such as pollution, including air and water quality, waste management, and management and conservation of natural resources and biodiversity.

### Air

- While overall air quality in the country was better in April 2020 than the previous year, there were critical areas where air pollution still caused problems. These include the problems of PM2.5 in Bangkok and its vicinity, of volatile organic compounds (VOCs) in industrial areas, and of haze in Northern provinces, resulting from agricultural burning in combination with dry weather leading to the rapid spread of forest fire.<sup>xcvii</sup>

### Water

- Out of the water quality of 59 water sources and 6 still water resources, 2% was in excellent quality (equal to 2019), 37% was in good quality (9% increased from 2019), 43% was in fair quality (7% decreased from 2019), and 18% was in poor quality (equal to 2019).
- The overall coastal water quality was better in 2020 than in the past 10-year period, except in the Gulf of Thailand, which continues to face poor water quality problems.<sup>xcviii</sup>
- Key measures being implemented to address the water quality, air and pollution problems include improvements in guidelines and standards, inspection and enforcement of pollution sources, and incorporating of management standards as a criterion for business permits etc.<sup>xcix</sup>

### Waste

- Waste generation in Thailand averages 1.13 kg per capita per day, leading to 27.8 million tons of solid waste produced per year.<sup>c, ci</sup> In the Bangkok Metropolitan Region, plastic waste accounts for 20% of the total of 10500 tons of waste per day, of which only 25% is recycled.<sup>cii</sup>
- Thailand averages plastic waste generation of 74 kg per capita per year, which is much higher than the world average of 29 kg in 2018. In general, plastic waste is not fully and properly collected and managed. As result about 336,000 tons of plastics leak into the oceans annually, amounting to 4.8 kg per capita per year.<sup>ciii</sup>
- Compared to energy, agriculture, and transport, the waste GHG emissions remained small but steadily increased from 10.83 tons of CO2 equivalent in 2010 to 12.58 tons of CO2 equivalent in 2016.
- The pandemic also created a new crisis of surging medical and plastic waste<sup>civ</sup>. The amount of plastic waste generated during pandemic was approximately 6300 tons per day, equivalent to a 15% increase from regular periods with about 5500 tons per day.<sup>cv</sup>

- The Government of Thailand has considered environmental problems from solid waste generation more than ever before, especially as the country is adopting the circular economy approach. Recently, the Government has also approved the Roadmap on Plastic Waste Management 2018–2030 with an ambition to recycle all plastic waste by 2027.<sup>cxvi</sup>

Thailand is endowed with rich ecosystems and biodiversity, but these resources face threats from unsustainable practices and inadequate conservation and management in some key respects.

### Forests

- For example, while total forest area in Thailand has been recently relatively stable, accounting for 31.68%, 31.67%, and 31.63% of total country area in 2018, 2019 and 2020 respectively, deforestation and forest fires remain a problem.<sup>cxvii</sup>
- To address this, the 5<sup>th</sup> strategy of the 20-Year National Strategy (2018-2037)—*environmentally growth for sustainable development*—aims to prevent deforestation and increase forest areas to 55% by 2037.
- In 2020, Thailand also expanded forest conservation from 105696 km<sup>2</sup> in 2006 to 116304 km<sup>2</sup>, equivalent to 23 % of the total land area, including 22 national parks extending across 6,416 km<sup>2</sup>.<sup>cxviii</sup>

### Coasts

- Coastal resource management and conservation are also key challenge for Thailand. The country's coastal resources and wetlands have degraded, with some 77% of the coral reefs being devastated by activities linked to tourism, rising from 30% a decade ago.<sup>cxix</sup>
- In 2018, 30% of the coastlines were at critical levels of erosion, with more than 5 meters of erosion per year.<sup>cx</sup> Land subsidence, land use change from aquaculture and residential expansion, and mass tourism are all driving coastal erosion in Thailand.<sup>cx, cxii</sup> Climate change is also exacerbating these erosions through its effects on sea level rise and intensified storms.<sup>cxiii</sup>

### Mangroves

- Thailand has good achievements regarding mangrove conservation, but more resources are needed to sustainably manage these coastal resources. Even though Thailand had lost 56% of its mangrove cover during 1961–1996, the effects of coverage loss were mitigated by the government policy shift from mangrove exploitation towards mangrove conservation and restoration in 1998.<sup>cxiv</sup>
- During 2002–2012, the rate of mangrove loss was significantly slower in Thailand compared to other Southeast Asian countries.<sup>cxv</sup> Thailand has also been uniquely successful in implementing community-based mangrove management, that can be primarily attributed to internal community capacity, government support, and promotion of community-based models.<sup>cxvi</sup>
- While solid policy measures to expand mangrove restoration exist, there is still under-investment in sustainable coastal management projects involving nature-based solutions, particularly when compared to the extensive ecosystem benefits they bring, especially in avoiding long-term physical and financial losses.<sup>cxvii</sup>
- More investment in sustainable coastal management projects—particularly in the mangrove areas—presents a promising opportunity to promote green COVID-19 recovery with solid involvement from coastal communities while contributing to climate adaptation and mitigation goals under the NDC.

## 6. Vital national policies related to GHG reduction

Thailand's NDC has established the country's emission reduction targets. Thailand submitted its first NDC to the United Nations Framework Convention on Climate Change (UNFCCC) in 2016 and updated it in 2020. Through the NDC, Thailand was committed to reducing its GHG emissions by 20% compared to the projected business-as-usual by 2030, using 2005 as the baseline year.<sup>cxviii</sup>

This contribution could be increased up to 25% through enhanced technology development and transfer access, more financial resources, and capacity-building support. The updated NDC highlights the need for financial support mechanisms for technical assistance for the energy sector.<sup>cxi</sup>

Thailand has implemented through the NDC Roadmap on Mitigation 2021 – 2030 and the NDC Action Plan. It also submitted the Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) to the UNFCCC at the end of October 2021, stating the country's aims to peak its GHG emissions in 2030, with the original ambition to move towards net-zero greenhouse gas emissions as early as possible within the second half of this century, and towards carbon neutrality by 2065.<sup>cxx</sup>

However, the emission reduction target, as well as the carbon neutrality and net-zero GHG ambitions, were recently raised in November 2021. During COP26 in Glasgow, the Prime Minister announced that Thailand will now aim to achieve carbon neutrality by 2050 and net zero GHG emissions by 2065. With financial and technological support and capacity building, Thailand can increase emission reductions to 40% by 2030 under the new NDC commitments.<sup>cxi</sup>

Following the Glasgow announcement, Thailand's Ministry of Natural Resources and Environment (MONRE) commissioned a study to inform the revision of the LT-LEDS and the NDC, to submit both updated documents to the UNFCCC before the COP27 Conference in Egypt in November 2022. Initial study results suggest that Thailand could aim for 30% unconditional emission reductions and 10% conditional upon support. The long-term strategy to achieve carbon neutrality by 2050 and net zero GHG emissions by 2065 will also depend mainly on emission reductions in the energy sector, including using carbon capture, utilisation and storage (CCUS) technologies.<sup>cxxii</sup>

## **7. Thailand climate change mitigation strategies**

Like other ASEAN countries, Thailand must engage in ambitious climate change mitigation actions commensurate with the scale of the climate threats facing the country and the region. To accelerate the decarbonisation of its economy, Thailand has identified a set of mitigation actions in the energy, transportation, IPPU and waste management sectors.

Table 18. GHG emission reduction measures under Thailand’s Nationally Determined Contribution (NDC) Action plan (2021-2030)

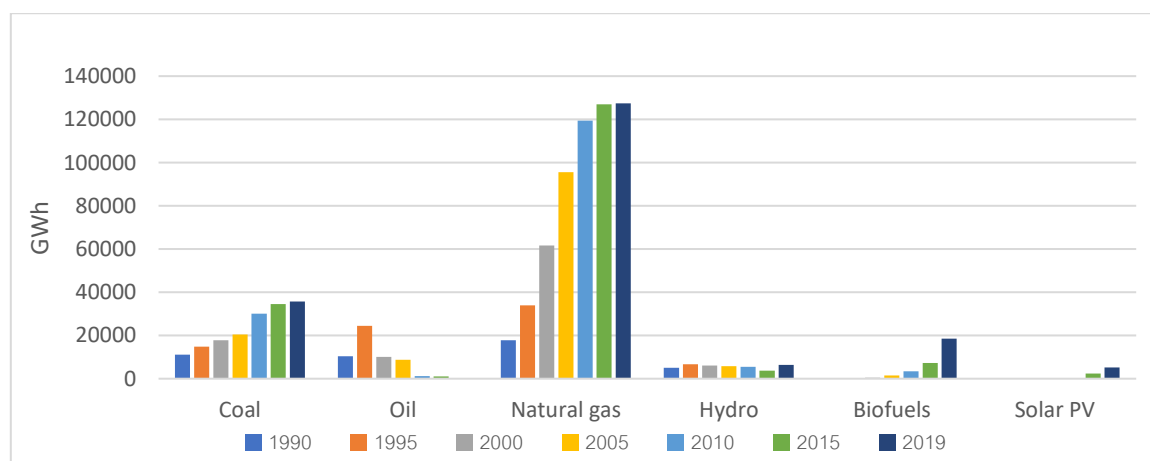
Sector	Mitigation measure
1. Energy	A total of 5 measures are as follows: <i>Energy Generation</i> 1. Increase power generation efficiency 2. Renewable energy generation <i>Energy Consumption in Households</i> 3. Increase energy efficiency in households 4. Renewable energy in households <i>Energy Consumption in Buildings (Commercial and Public)</i> 5. Increase energy efficiency in buildings
2. Transportation	A total of 3 measures are as follows: 1. Avoid/Reduce traveling 2. Shift/Maintain travel modes 3. Improve energy efficiency in transport
3. IPPU and Industrial Wastewater	A total of 3 measures are as follows: 1. Clinker substitution 2. Refrigerant replacement/modification 3. Industrial wastewater management
4. Municipal Waste Management	A total of 4 measures are as follows: <i>Waste Management</i> 1. Reducing the amount of waste (e.g. reducing disposal rates, increasing recycling and waste utilization, etc.) <i>Wastewater Management</i> 2. Increasing biogas production from industrial wastewater through re-utilization of methane 3. Industrial wastewater management 4. Municipal wastewater management

Source: ONEP. 2020a. BUR3

Given Thailand’s emission profile, the energy transition will play a predominant role in Thailand’s journey towards a net-zero economy in line with the Paris Agreement targets. While Thailand’s overall GHG emissions represent less than 1% of global emissions and are lower than the world average<sup>cxiii</sup>, the country’s key challenge in decarbonisation comes from its heavy reliance on fossil fuels to meet energy demand.

Specifically, fossil fuels have been the primary type of fuel used in electricity generation in Thailand in the past three decades (1990-2019). In the decade of 2011–2019, natural gas accounted for—on average—66% of electricity generation, followed by coal (18.6%) and oil (6.3%). Renewables—including hydropower, biofuels, and solar PV—occupied a small proportion, approximately 8%.<sup>cxiv</sup> Over the years, Thailand has also relied on hydrocarbon imports in the context of declining domestic crude oil reserves.<sup>cxv</sup>

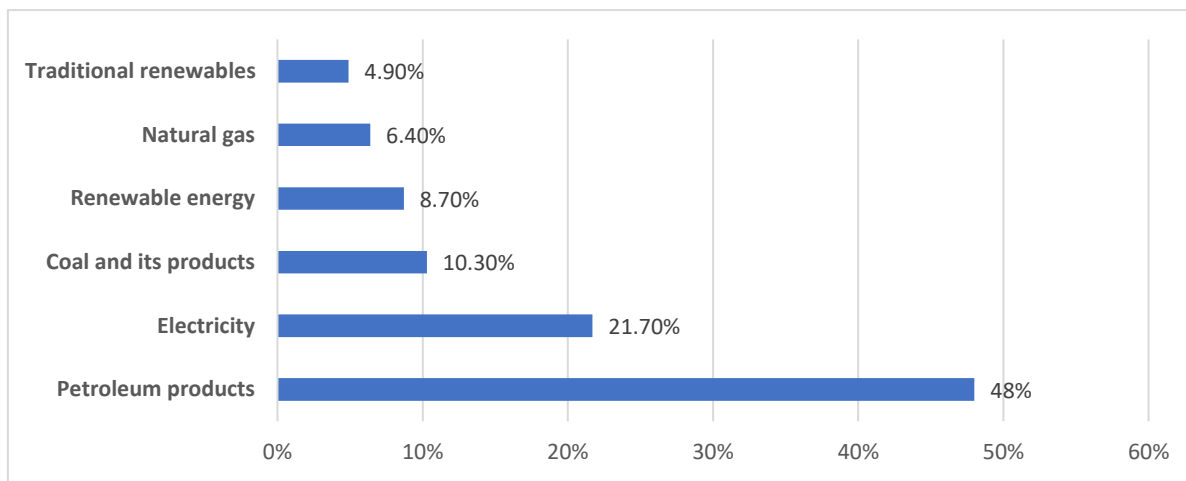
Figure 14. Thailand’s Electricity Generation by Source of Energy (GWh), 1990–2019



Source: IEA, Key Energy Indicators<sup>cxvi</sup>

The energy landscape remained broadly similar in 2020 to the historical picture, with natural gas accounting for the largest share (59.1%) of electricity generation, followed by coal/lignite (17.6%).<sup>cxxvii</sup> While Thailand’s final energy consumption in 2020 (77340 ktoe) decreased 9.8% from the previous year, consumption of petroleum products was still dominant, accounting for the most significant proportion (48.0%) of the total final energy consumption, followed by electricity (21.7%), coal and its products (10.3%), renewable energy (8.7%), natural gas (6.4%) and traditional renewable energy (4.9%).<sup>19</sup>

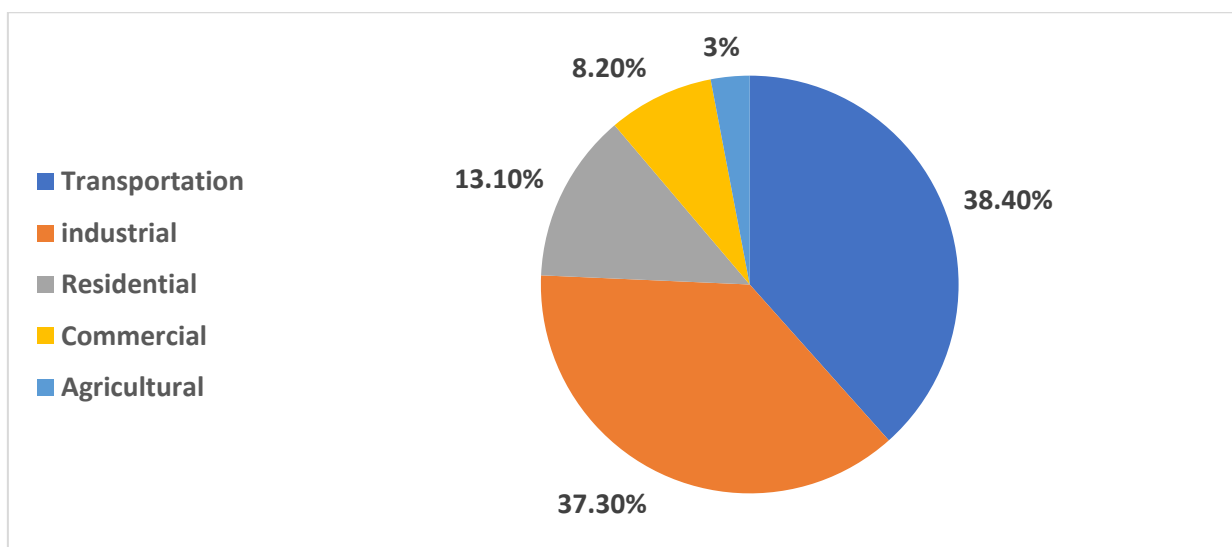
Figure 15. Thailand’s Final Energy Consumption by Fuel Type, 2020



Source: Department of Alternative Energy Development and Efficiency (DEDE), 2020: Energy Balance of Thailand 2020

In terms of economic sectors, the transport sector consumed in the largest share of energy (38.4%) in 2020 and followed by the industrial sector (37.3%), residential sector (13.1%), commercial sector (8.2%) and agricultural sector (3.0%), respectively.

Figure 16. Thailand’s Final Energy Consumption by Economic Sector, 2020



Source: Department of Alternative Energy Development and Efficiency, 2020. Energy Balance of Thailand 2020

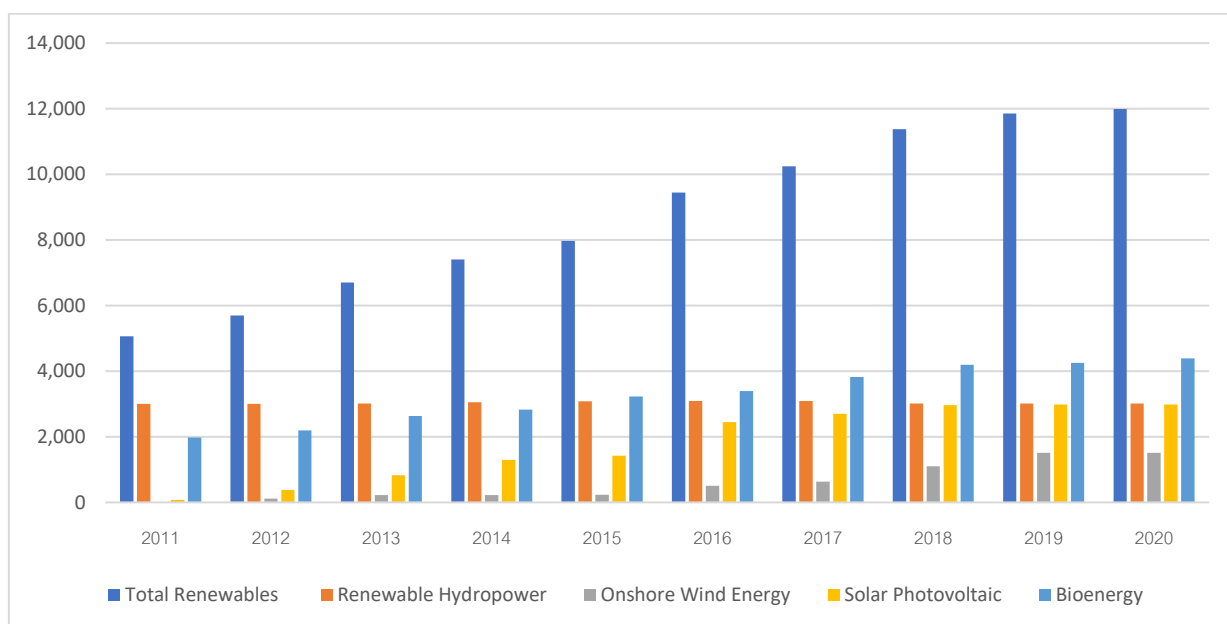
<sup>19</sup> Defined as fuel wood, charcoal, paddy husk and agricultural waste.

Thailand’s current energy policies and strategies include key priorities on energy security, alternative energy development to reduce reliance on natural gas, energy prices, and moves towards environmental sustainability.<sup>cxxviii</sup> The Alternative Energy Development Plan encourages the development of renewable energy—for instance, from municipal waste, biomass, biogas, wind, and solar—while the Power Development Plan (PDP) 2018-2037 sets the target for power generation from renewable energy at 37% by 2037.

In 2016, the Government of Thailand adopted the Energy 4.0 policy with Electricity 4.0, Fuel for Transportation 4.0, and Heat 4.0 components.<sup>cxxix</sup> This policy guides the transition to a low carbon economy by boosting renewable energy, energy efficiency, intelligent energy management, and energy storage capabilities. In recent years, the country has shifted policy focus towards energy efficiency and clean energy and made promising progress in decreasing energy and CO<sub>2</sub> emission intensity.<sup>cxxx</sup>

Reflecting the policy direction, installed power capacity from renewables continued to increase over the past ten years, from 5061 megawatts (MW) in 2011 to 11991 MW in 2020, compared with the broader renewable energy target of 19,684 MW by 2036 under the Alternative Energy Development Plan 2015.<sup>cxxxi</sup> Bioenergy contributed 37.5% of the total power production, while the share of hydropower declined from 30% in 2011 to 25.3% in 2020. The shares of solar photovoltaic (PV) and wind power are smaller than bioenergy and hydropower, but they began to catch up in 2020 with the development of 2,983 MW (solar PV) and 1507 MW (onshore wind power).<sup>cxxxi</sup>

Figure 17. Thailand’s Renewable Power Installed Capacity, MW 2011–2020



Source: IRENA, Renewable energy statistics, 2021

## 8. State of the local green finance market

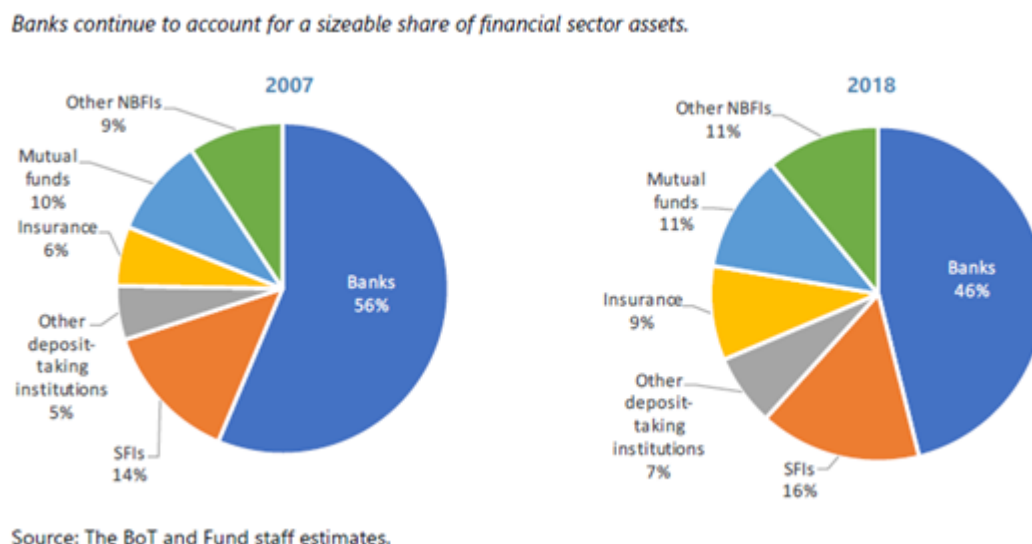
Based on data sourced from International Monetary Fund (IMF) and the World Bank, Thailand has a deep, diverse, and inclusive financial sector, supported by strong regulation and supervision in addition to a high level of alignment with international standards. Financial sector assets grew to 271 percent of GDP at the end of 2017 from 183 percent in 2007, with assets of banks representing 46 percent of total financial sector assets at the end of 2017.

While banks continue to account for a sizable share of the financial sector, the role of Specialized Financial Institution (SFIs)<sup>1</sup>, other deposit-taking institutions, and non-bank financial institutions (NBFIs) has grown. Financial inclusion has continually improved, with 82 percent of adults in Thailand having a formal financial

account as of 2017, compared with 71 percent in the East Asia and the Pacific region and 73 percent among upper middle-income countries.

There is also an active FinTech ecosystem, resulting in a proliferation of new payments companies and instruments, enabled by regulatory sandboxes that enable financial innovation. Despite relatively high household indebtedness and some signs of weaknesses in corporates and small-and-medium enterprises, the banking sector is resilient to potential shocks, including severe shocks.<sup>2</sup>

Figure 18. Thailand’s Financing System Structure (in percent of total financial assets)



**Graphic source:** IMF and World Bank. 2019

Thailand also has a rapidly growing sustainable finance markets, enabled by supportive financial sector policies and regulations that promote the channelling of capital flows in the real economy towards sustainable development. Cumulatively between 2016-2021, Thailand is the second largest issuer of green, social and sustainability (GSS) debts<sup>3</sup> in ASEAN after Singapore, with the total GSS debt issuances from

Thailand in 2021 standing at USD4.4bn, dominated by the sustainability theme.<sup>4</sup> Thailand is also the ASEAN leader in the issuance of unlabelled climate-aligned bonds, and has witnessed a rapid growth of sustainability-linked bonds and loans (SLBs and SLLs).<sup>5</sup> Private banks in Thailand have led on green finance by issuing green and sustainability bonds to fund and refinance green assets. Thai banks that have issued green and sustainability bonds are TMB Bank and Kasikorn Bank, for USD160 m.<sup>6</sup>

Many banks are also providing green loans and other tools for green projects, i.e., renewable energy and energy efficiency. Since 2015, 11 banks have participated in the Energy Efficiency Revolving Fund (EERF), including Bangkok Bank, Bank of Ayudhya, CIMB Thai, TMB Bank, Siam City Bank, Siam Commercial Bank, Kasikorn Bank, Exim Thai Bank, SME Bank, and UOB.<sup>7</sup> Another example is the “SME Go Green” scheme initiated by Siam Commercial Bank, which provides green loans to green SMEs to cover their long-term and working capital to finance clean energy and pollution management projects which will help to reduce energy consumption.<sup>8</sup>

Building on the above momentum, the Sustainable Finance Initiatives for Thailand envision a commercially viable and sustainable Thai financial sector by 2025.<sup>9</sup> As a key component of the sustainable finance ecosystem, the Thai Taxonomy can play instrumental roles in achieving this vision. In particular, the Thai Taxonomy will:



- Establish a common language among Thai financial institutions about the classification of green financial flows, thus facilitating the creation of green finance standards within the financial sector;
- Support better-informed and more efficient decision-making by financial institutions to respond to investment opportunities that contribute to achieving green and sustainable development objectives;
- Inform the development of new products and services such as green bonds, loans, and index-linked capital market investment products;
- Form the basis for the government to design incentive measures to further promote green finance;
- Create stronger awareness of green and sustainable economic activities among different stakeholders, which can further stimulate demand and supply for green and sustainable financial products.

Given its interoperability with other major international taxonomies, the Thai Taxonomy will also help raise the international profile of Thai green financial products, and could, therefore, help stimulate more inflows of international green and sustainable capital into the country.

## Appendix 2. User Guidance and Application Navigation

Effective decarbonisation of Thailand and maximizing the opportunities offered by green technologies are only possible if the government, industry, financial sector, citizens, and non-profit organizations work together and within a common conceptual framework. Therefore, the country's Taxonomy can provide such a framework whilst also making the rules of the game transparent as well as serving as the core of a mechanism that can be applied by all market players.

In order to begin assessing the application process, it is very important to sort out the definitions in the present guidance first.

*Table 19. Some definitions used in the guidance*

<p><b>What is revenue?</b></p> <p>Revenue or net turnover means the amounts derived from the sale of products and the provision of services after deducting sales rebates and value added tax and other taxes directly linked to turnover. Overall turnover is equivalent to a firm's total revenues over a defined period. Turnover ratios are used by financial analysts to understand a company's efficiency and profitability based on data found in financial statements.</p> <p><b>Use:</b> The primary way of aggregating an economic activity to a company level. Some companies may need to aggregate from asset to economic activity level.</p>
<p><b>What is CapEx?</b></p> <p>Capital expenditure (CapEx) is a payment for goods or services recorded, or capitalised, on the balance sheet instead of expensed on the income statement.</p> <p><b>Use:</b> Aside from helping investors analyse a company's investment in its existing and new fixed assets, capital expenditures can give an indication of a company's strategy for improving environmental performance and resilience.</p>
<p><b>What is OpEx?</b></p> <p>Operating expenses (OpEx) are shorter-term expenses required to meet the ongoing operational costs of running a business. While revenue is an indicator of ongoing operations and activities, and is the primary indicator for alignment, where new investment is being made in a technology to better align an issuer,</p> <p>then CapEx would be a more appropriate indicator. The use of revenue, CapEx, or OpEx is dependent on the vehicle being financed. In particular, where capital is being extended to fund a particular activity or project, then CapEx would be more appropriate.</p>

### What is an activity?

When a company offers goods or services, it is performing an economic activity. The universe of economic activities is described using ISIC4 codes, which cover 21 broad sectors and with four further levels of differentiation. At the fourth level, 615 classes of economic activity are identified.

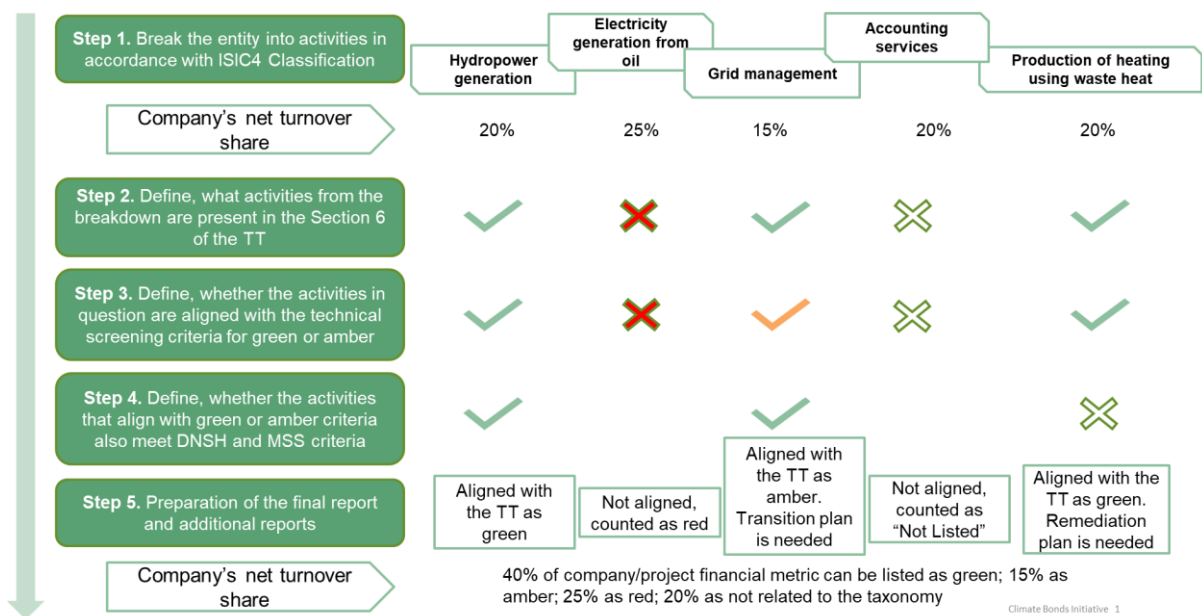
**Use:** activity is the basic unit of the taxonomy to which criteria and metrics are applied.

### What is a project?

A project refers to a smaller undertaking that is carried out within the context of an activity. Many activities that are limited in time can be structured in real economy as separate time-bound projects. This is especially true for the amber category, where most activities focus on the time-limited movement of an activity toward a trajectory compatible with the green pathway. Thus, in the following guidance the word “activity” will be used, but one must bear in mind, that the activity may exist in the form of a project.

For such projects, following completion, the company can claim 100% of the turnover associated with the project as being aligned with the Taxonomy if it meets the technical screening criteria for green or amber. During the project, it is only the project itself which is considered to be aligned with the Taxonomy and so the turnover associated with the project cannot be classed as aligned until completion.

Figure 19. Taxonomy alignment assessment scheme



## A step-by-step guide

- Break down company/project operations into different economic activities according to the ISIC4 classification

The entity is the main actor of the real economy, but the Thailand Taxonomy’s operational unit is the activity, not the entity. In order to assess the eligibility of the activity under the Thailand Taxonomy, one must first dissect an entity into separate activities that generate value or have environmental impact. Ideally, the activities must correspond to the relevant ISIC4 codes, then it will be easier to measure them against the Thailand Taxonomy which also employs the ISIC4 codification. However, it is not always a simple process. Some interpretation may be necessary, but any assessment should be clear about the base assumptions made.

- Align the resulting activities with the table of economic activities from Section 4

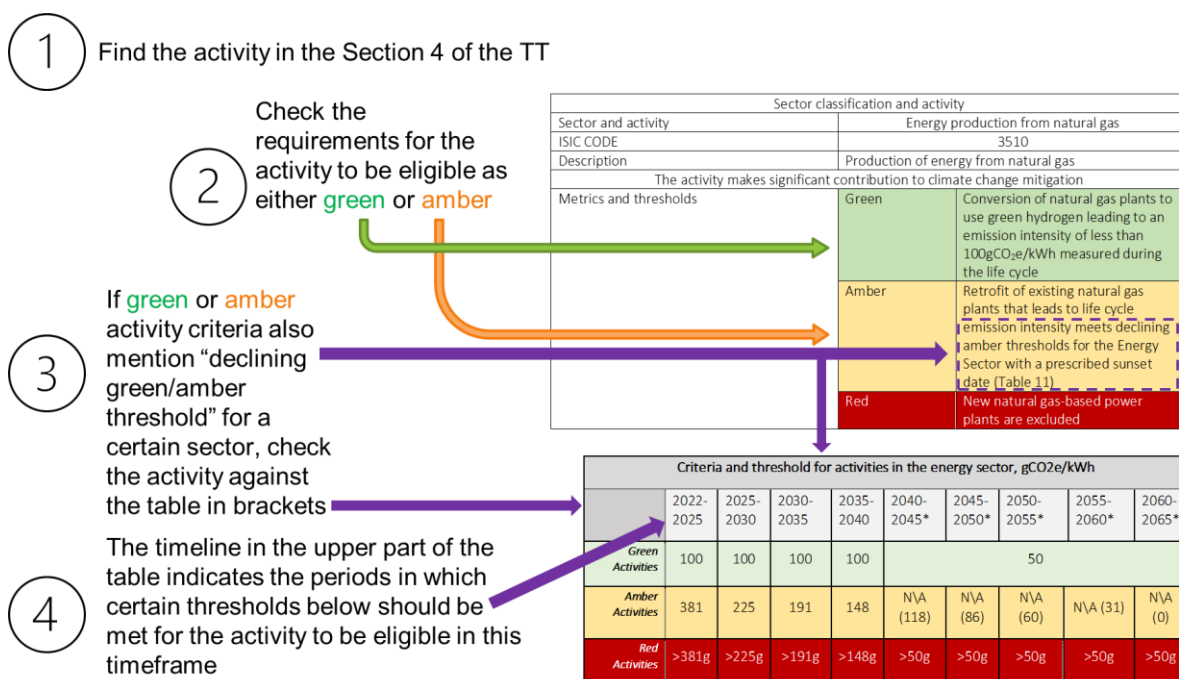
The evaluator must compare the resulting list of activities of the enterprise/project with the list of activities included in the taxonomy and select those that are present in the Section 4 of the TT. The activities that are present in the list may be assessed while others will be included into the Not Listed category. In this case, taxonomy-alignment assessment of these activities is not possible. However, this does not automatically mean that all of the Not Listed activities fall into red activities category because it is a simple indication that they are not currently covered by the taxonomy but may in the future.

- Assess activities' performance against the technical screening criteria

The evaluator should collect and process information that allows them to evaluate the selected activities against the technical screening criteria specified in Section 4 of the Thailand Taxonomy. Testing alignment to the technical screening criteria requires robust and granular data. A combination of third-party data providers together with in-house research can ease the process.

The evaluator must then decide whether each individual activity is **green**, **amber**, **red**, or **not yet covered** by the existing version of the taxonomy. If the economic activity under consideration meets the relevant metrics and thresholds, it is considered either **green** or **amber**. If the economic activity under consideration falls into the red category of the activity article in the Section 4, then it is counted as **red**.

Figure 20. Activity alignment check



- Assess activities' compliance with the DNSH and minimum social safeguards

The evaluator needs to assess whether the activity is consistent with DNSH principles (Section 5.1) and whether minimum social safeguards (5.2) are met. The evaluator should accompany the final report with a separate section on DNSH/Social Safeguards compliance. If the activity, project, or company in question do not comply with DNSH or MSS criteria but otherwise pass relevant technical screening criteria and metrics, it may be considered eligible for the corresponding green or amber category if the operating company submits an additional plan indicating how it will correct the deficiencies.

At present, the Thailand Taxonomy only covers climate change mitigation as an environmental objective, with the remaining five expected to be added in future iterations of the Thailand Taxonomy. As such,

activities, projects, and a company/issuer can only currently be classified as being aligned with climate change mitigation, although DNSH requirements should be considered all of the remaining five Environmental Objectives. While DNSH requirements have not been detailed in the present draft of the Taxonomy, they will be developed further in future iterations.

- **Prepare a report for the relevant task/audience on the assessment of the entity/activity**

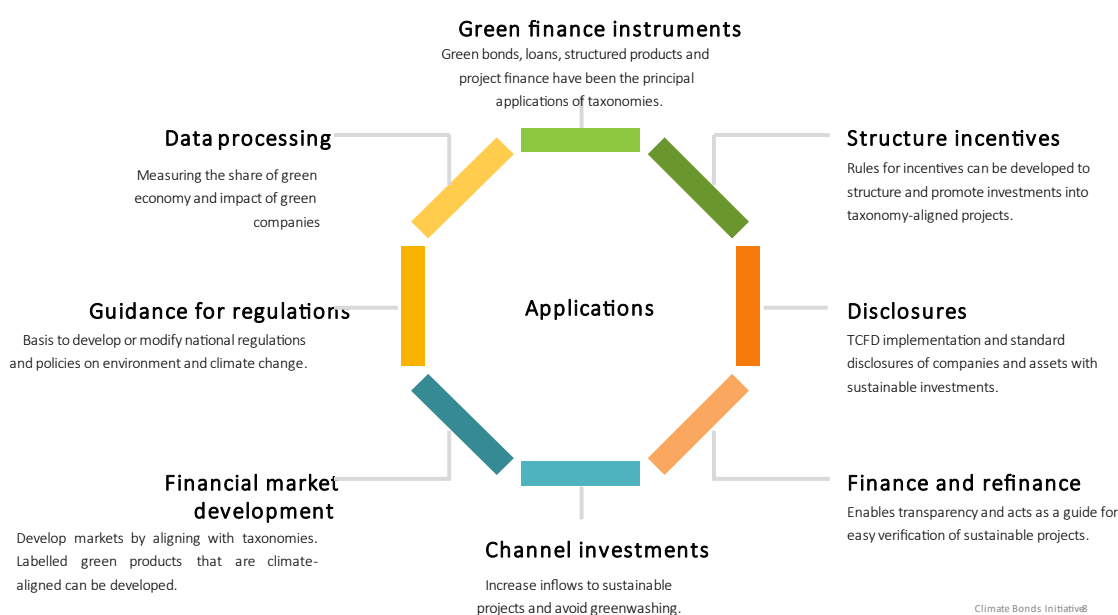
The final report (it may differ in name and structure depending on the nature of the application) must contain:

- A decision on whether the activity/activities or project/projects in question are recognized as green or amber under the criteria of the Thailand Taxonomy
- All relevant collected information, assumptions, and data for the addressee (whether it's a certifier, a bank, a government, or general public) of the report to be able to verify information through an independent third party.
- If all or some part of the activities in question are designated as amber, it must be accompanied by the plan describing how this activity will exercise transition towards net-zero pathway in the timeframe designated by the Thailand Taxonomy (by no later than 2040)
- Additional reporting on compliance with the DNSH and MSS must be done and attached to the main report on eligibility with the Thailand Taxonomy criteria. If the activity does not comply with DNSH or MSS criteria, in order for the opinion on the overall compliance to be completed a plan of remedial measures must be included into the final report. Without this plan the final report cannot be considered complete.

### Appendix 3. Usability examples and case studies

The Thailand Taxonomy may be used for a variety of different purposes associated with confronting climate change and moving the economy towards a more sustainable model. However, it is important to notice that a separate set of legislation is needed to make the taxonomy usable in each sphere of application. The taxonomy is an “engine” or a “soul” of the green finance system, but it needs supplementary documents, instructions, or pieces of national/international legislation to be connected to the real economy and financial market (For further details look at the Appendix 3 Question 4).

Figure 21. Possible taxonomy applications



Source: CBI. CONSTRUCTION OF DATABASE OF GREEN ACTIVITIES

Here are some of the examples how the taxonomy can be used with case studies:

- The Taxonomy can be used for **issuing green finance instruments**, such as bonds<sup>20</sup>, loans<sup>21</sup>, structured products etc. This is its main sphere of application. For making this possible the country needs Green Bond\Loan Standards.

<p><b>Case study: Rapid transit lines for a city Financed through a bond issuance</b></p>	<p><b>Case study: Expansion of the company's solar infrastructure Financed through a loan</b></p>
<p><b>Environmental objective:</b> climate change mitigation. The company will allocate the green bond proceeds with the aim to support the urban densification of a certain region around the cluster of electrified metro lines and thus help contribute to lower the carbon footprint of the region.</p>	<p><b>Environmental objective:</b> climate change mitigation. The company will utilize the loan proceeds with the aim to increase its solar power generation segment and supply more renewable electricity into the grid</p>
<p>The company X is intending to issue green bonds in order to finance or refinance, in whole or in part, existing and future projects that improve mobility services and related infrastructure, namely the:</p> <ul style="list-style-type: none"> <li>• Construction of new lines and line extensions: almost 200 km of new automatic metro lines supplementing the 400 km of existing lines</li> </ul> <p>The Company X confirmed to The Verifier that all its Eligible Assets (metros, metro lines and the supporting infrastructure such as the stations and technical centres) are fully electrified and support electric assets uniquely.</p> <p>Article 4.2.5 Enabling infrastructure for low emitting transport supports the construction of the zero-emitting electrical railway transportation as well as supporting infrastructure. The bond is thus eligible under Article 4.2.5 criteria if the DNSH Criteria and MSS are observed.</p> <p>The management systems for internal processes and controls for the Eligible Assets was established, including:</p> <ul style="list-style-type: none"> <li>• tracking of proceeds, managing unallocated proceeds and Earmarking funds to Eligible Assets</li> <li>• the details of commitments for reporting prior to issuance, including investment areas, management of unallocated proceeds and frequency of periodic Assurance Engagements</li> </ul>	<p>The proposed investment consists in a corporate facility of up to US\$400 million to a Company X, which specializes in providing power.</p> <p>Proceeds will be used to fund Company's expansion into the solar power generation segment, including the financing of four solar power generation plants with a total installed capacity of 350 MW.</p> <p>Solar generation is directly eligible under the Energy criteria, so the loan may be qualified as green is DNSH Criteria are observed.</p> <p>In accordance with the loan facility agreement, the funds will be disbursed in tranches on an ongoing basis whenever the borrower will incur expenses directly related to the expansion into the solar power generation segment</p> <p><b>Portfolio reporting:</b></p> <p>For Bank A the loan comprises 10% of his portfolio. In this case, 10% of his portfolio can be marked as green.</p>

<sup>20</sup> Reference document: <https://www.climatebonds.net/climate-bonds-standard-v3>

<sup>21</sup> Reference document: <https://www.lsta.org/content/green-loan-principles/#>

- The taxonomy can be used for **financing and refinancing** green projects and **properly reporting their share**

Case study: Off-shore wind farm, equity investment from a financial institution	Case study: Freight transportation, equity investment from a financial institution
<b>Environmental objective:</b> substantial contribution to climate mitigation	<b>Environmental objective:</b> substantial contribution to climate mitigation
<p>Off-shore wind energy is considered to make a substantial contribution to climate change mitigation by providing zero emission energy and are classified as green under the Thailand Taxonomy. Company A makes 20% of its revenue from off-shore wind farms and 80% of its revenue from thermal coal-fired power stations.</p> <p>As the offshore wind farm activity automatically falls under the green classification, the financial institution then needs to satisfy itself that the company does not breach the DNSH requirements to classify this company’s offshore wind farm activity as green under the Taxonomy.</p>	<p>Freight transportation currently accounts for a significant proportion of carbon emissions from transportation in Singapore and the wider ASEAN region so reducing tailpipe emissions from this source would make a substantial contribution to climate change mitigation.</p> <p>Company B makes 100% of its revenues from freight transportation, with 10% from its local, electric-powered delivery fleet and 90% from its revenues from energy-efficient long distance delivery trucks.</p> <p>The Taxonomy classifies freight transportation with zero direct tailpipe emissions as green, as long as the vehicles are not used to transport fossil fuels, while heavy-duty vehicles that have specific CO2 emissions of less than half of the reference CO2 emissions of all vehicles in the vehicle sub-group to which the heavy-duty vehicle belongs are classified as amber, as long as they are also not used to transport fossil fuels.</p>
<p><b>Portfolio reporting:</b></p> <p>For company A, which makes 20% of its revenue from its offshore wind farm activity and 80% from its thermal coal-fired power station activity, 20% of its revenue will be classified as green and the remainder as red. For portfolio reporting, if this company accounts for 5% of the financial institution’s equity portfolio, then the financial institution will report 1% of its portfolio as green and 4% as red (weight in portfolio x % of green revenues).</p>	<p><b>Portfolio reporting:</b></p> <p>As the electric-powered transportation activity automatically falls under the green classification, the Financial Institution then needs to satisfy itself that the company does not breach the DNSH requirements on pollution and the circular economy to classify this company’s activity as green under the Taxonomy. For the truck delivery activity, the company needs to provide both current CO2 emissions as well as a credible transition pathway for its delivery fleet to reach zero tailpipe emissions by the sunset date in order to be classified as amber under the Taxonomy (see pp 52-53). The financial institution also needs to satisfy itself that the company does not breach the DNSH requirements on pollution and the circular economy for this activity. In total, for company B, 10% of its revenue will be classified as green and the remainder as amber.</p>

- The taxonomy can be used to facilitate **reporting and disclosures**<sup>22</sup> by financial market participants. In this case, it increases transparency of the market and creates an opportunity for the government to assess the share of green products and companies on the country’s financial market and in economy in general.

<sup>22</sup> Reference document: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088&from=EN>

- Companies can use the criteria contained in the Taxonomy as **an input to their environmental and sustainability transition strategies and plans**.
- The Taxonomy can be used by **insurance companies** to manage insurance assets and to allocate funds to external fund managers that are aligned with its green activities. It can also help the insurance companies to reach its internal environmental objectives, as well as offering insurance products that are aligned with it
- Taxonomy can be used to **tie incentives and support measures**<sup>23</sup> for market participants. It helps to shape the policy of the country in a desired manner.

Among the government incentives to support the development of the green finance market and transition of the economy the following may be considered:

- The provision of government guarantees to de-risk green bond issuance, allowing institutional investor participation. This encourages green bond issuance over vanilla issuance
- Encourage the use of green financial instruments through subsidies and incentives which reduce cost of green capital and ensure attractive returns
- Provide targeted subsidies are crucial to enable cost competitiveness of specific green technologies and to enable industrial transitions, for example, the US subsidies for low-carbon hydrogen production
- Central banks can adjust risk weightings for capital and reserve requirements and collateral frameworks to incorporate climate risks

Other policies and measures can be found in the Climate Bonds Initiative report “101 sustainable finance policies for 1.5°C”<sup>cxxxiii</sup>

## Appendix 4. FAQs

### 1. What is the present paper about?

The present document represents the Thailand Taxonomy Paper, a foundation of the Thailand Taxonomy. It is based on the work carried out by the Working Group on Sustainable Finance of Thailand. It aimed to engage all relevant stakeholders and public into a common discussion about the pathways of sectors of the Thai economy towards decarbonisation, the relevant criteria for considering certain activities within these sectors beneficial or harmful to the goal of climate change mitigation as well as any additional measures that could make Thailand’s climate policy more sustainable.

### 2. What is a Green Taxonomy?

A Green Taxonomy is a guide to climate aligned projects and assets. It is a tool for bond issuers, financial institutions, statistical agencies, investors, governments and municipalities to help them understand what the key investments are that will deliver a low carbon economy. Taxonomies protect investors from greenwashing, put pressure on companies to become climate aligned and steer investment towards more sustainable initiatives. Taxonomies also create a common reference for comparing the social and environmental impacts of different investments. A robust taxonomy is transparent, grounded in the latest climate science aligned with the goal of reaching net-zero emissions by 2050 as prescribed by the relevant UN bodies.

It must be noted that the economic activities that are not included in the Green Taxonomy as substantially contributing to climate objectives are not necessarily environmentally harmful or unsustainable. They may be just irrelevant to the field or not researched well enough to be considered beneficial or harmful. For example, many activities in the services sector fall into this category.

<sup>23</sup> Reference document: [https://www.climatebonds.net/files/reports/cbi\\_101\\_policy\\_01b\\_1.pdf](https://www.climatebonds.net/files/reports/cbi_101_policy_01b_1.pdf)

### 3. Can the taxonomy damage the economy? What will happen to the activities that are not aligned with the Green Taxonomy?

No, the taxonomy itself is not jeopardizing any sectors of the economy. It is not a mandatory list of economic activities for investors to invest in. Nor does it set mandatory requirements on environmental performance for companies or for financial products. Investors are free to choose what to invest in. The taxonomy can be viewed as a labelling system to give the people a clear understanding of which activities are green, and which are not. Certain additional measures to support green activities and hinder the development of non-aligned activities can be implemented by relevant national bodies, but this in no way happens automatically just because the taxonomy came into being.

### 4. Is the Taxonomy alone enough to use in the real economy?

In most cases no. The Green Taxonomy is an “engine” or a “soul” of the green finance system, but it needs supplementary documents, instructions or pieces of national/international legislation to be connected to the real economy and financial market:

- In order to **issue green bonds**, a green bond standard/framework must be applied. This defines the proper process for the use and management of proceeds, process for evaluation and selection of projects, disclosure rules and regulations etc. Among the prominent examples of standards/framework are CBI Green Bonds Standard<sup>cxix</sup>, China Green Bond Principles<sup>cxv</sup>, ICMA Green Bond Principles<sup>cxvi</sup>, Asian Development Bank Green Bond Framework<sup>cxvii</sup> etc.
- In order to **issue green loans**, a green loan standard/framework is needed. In essence, it is similar to a green bond standard (for instance, that’s why Russia unites them into one document called the Green Finance Standard<sup>cxviii</sup>), but contains a few distinct features mostly attributed to the fact that loans issuance does not usually require the same level of transparency like Loan Markets Association Green Loan Principle<sup>cxix</sup> and Green Finance Guidelines for the Banking and Insurance Industry of China<sup>cxl</sup>.
- In order to facilitate **disclosure** by national companies, certain reporting guidelines should be established in Thailand. Generally, bond standards include rules for disclosures but, it may be insufficient if the goal is to measure the climate-aligned economy beyond issuers of green financial instruments. In this case, specific Taxonomy-linked regulations may help and examples include the “Sustainable Finance Disclosure Regulation<sup>cxli</sup> and the “Corporate Sustainability Reporting Directive”<sup>cxlii</sup> issued by the European Union.
- In order to make the Green Taxonomy a successful instrument of Thailand’s government climate policy, a set of **support measures** must also be adopted to nudge the investors in the right direction. The main goal of these measures is to direct domestic and foreign capital towards green projects. Examples of these measures can be found in Climate Bonds Initiative report “101 sustainable finance policies for 1.5°C”<sup>cxliii</sup>.

### 5. Why does the Green Taxonomy exclude activities such as coal/oil extraction or coal/oil-powered plants? They are still important for the economy.

The international climate science, which serves as the basis of the present Taxonomy, is very clear: in order to achieve the goals of the Paris Agreement and, therefore, to avoid catastrophic consequences of climate change, all fossil fuels must be phased out as soon as possible. The taxonomy includes only the activities that are relevant for stated climate goals (e.g. climate change mitigation), but not economic development or political agenda. However, there is no obligation that prevents investors from working with activities outside of the scope of the taxonomy.

### 6. Why do both green and amber sectoral decarbonisation pathways end at 2050 while Thailand NDC establishes 2065 as a Net-Zero Year?

Thailand’s NDC is a complex and comprehensive political pledge that covers many aspects of economic as well as climate policy of the country. It is based on many important concepts, including the concept of



common, but differentiated responsibility for tackling climate change. The taxonomy, however, is based on scientific climate data that is always the same regardless of the territory where it's applied. The TT incorporates certain aspects of Thailand NDC: amber threshold is calculated based on NDC-aligned data. Nevertheless, the decarbonisation pathways described in this Taxonomy do not in 2065 but rather in 2050, and sunset dates for the NDC-aligned Amber threshold have been established for 2040. If NDC-based thresholds were to be extended until 2065 so that companies were allowed to transition up to that date then, according to the Climate Action Tracker, it would mean a, that Thailand would essentially move along the 4-degree pathway<sup>cxliv</sup> and not the 1.5-degree pathway prescribed by the Paris agreement.

## Annex 5. Alignment with other taxonomies

Compatibility of criteria in the Thailand Taxonomy and other major taxonomies is very important for various reasons outlined in Section 1. However, it must always be kept in mind that full literal compatibility between any two taxonomies is unachievable due to the following factors:

- **Widely used references to national regulations.** Every national taxonomy is built for its domestic market and often refers to national laws and regulations unapplicable in other countries
- **Difference in DNSH criteria.** DNSH is an important part in many taxonomies, but unlike the eligibility criteria that are in most cases scientifically calculated, DNSH criteria are more arbitrary and have wider
- **Absence of amber category.** Most of the taxonomies have no amber category and this it's impossible to compare the Thailand Taxonomy to them

Thus, the following compatibility table must be assessed bearing these factors in mind. In most cases compatibility will mean "general compatibility in terms of green threshold". Green means "mostly compatible", orange – "mostly incompatible", N/A – activity is not present in the assessed taxonomy.

Table 20. Taxonomy criteria alignment table

Thailand Taxonomy	EU Taxonomy	China Taxonomy	CBI Taxonomy	South Africa
Solar	Green	Green	Green	Green
Wind	Green	Green	Green	Green
Hydro	Green	Green	Green	Green
Geothermal	Green	Green	Green	Green
Bioenergy	Orange	Green	Green	Orange
Natural Gas	Orange	N/A	N/A	N/A
Ocean Energy	Green	Green	Green	Green
Renew. Non-Fossil	Green	Green	N/A	Green
Heat\Cool Waste Heat	Green	Green	Green	Green
Electric Heat Pumps	Green	Green	N/A	Green
Heat\Cool Distribution	Orange	Green	N/A	Green

Thailand Taxonomy	EU Taxonomy	China Taxonomy	CBI Taxonomy	South Africa
Gas Transmission Networks			N/A	
Storage Electr.\Thermal				
Transmission Of Electr.				
Transport via Railways				
Other Passenger Land Tr.				
Urban\Suburban Pass. Tr				
Road Freight				
Enabling Infrastructure				
Sea\Coastal Water Tr.		N/A		N/A
Inland Water		N/A		
Retrofitting Water Tr.	N/A		N/A	N/A
Freight Air	N/A	N/A	N/A	N/A
Passenger Air	N/A	N/A	N/A	N/A

## List of references

- 
- <sup>i</sup> <https://about.bnef.com/blog/1h-2022-sustainable-finance-market-outlook/>
- <sup>ii</sup> [https://www.climatebonds.net/files/reports/cbi\\_asean\\_sotm2022\\_final.pdf](https://www.climatebonds.net/files/reports/cbi_asean_sotm2022_final.pdf)
- <sup>iii</sup> <https://www.climatebonds.net/standard/taxonomy>
- <sup>iv</sup> [https://www.climatebonds.net/files/reports/cbi\\_taxonomy\\_ukpact\\_2022\\_01f.pdf](https://www.climatebonds.net/files/reports/cbi_taxonomy_ukpact_2022_01f.pdf)
- <sup>v</sup> <https://ec.europa.eu/sustainable-finance-taxonomy/>
- <sup>vi</sup> <https://asean.org/wp-content/uploads/2021/11/ASEAN-Taxonomy.pdf>
- <sup>vii</sup> <https://www.climatebonds.net/files/files/the-Green-Bond-Endorsed-Project-Catalogue-2021-Edition-110521.pdf>
- <sup>viii</sup> <http://publication.pravo.gov.ru/Document/View/0001202109240043>
- <sup>ix</sup> [http://www.treasury.gov.za/comm\\_media/press/2022/SA%20Green%20Finance%20Taxonomy%20-%201st%20Edition.pdf](http://www.treasury.gov.za/comm_media/press/2022/SA%20Green%20Finance%20Taxonomy%20-%201st%20Edition.pdf)
- <sup>x</sup> [https://ec.europa.eu/info/sites/default/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/211104-ipsf-common-ground-taxonomy-instruction-report-2021\\_en.pdf](https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/211104-ipsf-common-ground-taxonomy-instruction-report-2021_en.pdf)
- <sup>xi</sup> <https://www.worldstopexports.com/thailands-top-import-partners/>
- <sup>xii</sup> [https://climate.onep.go.th/wp-content/uploads/2019/07/CCMP\\_english.pdf](https://climate.onep.go.th/wp-content/uploads/2019/07/CCMP_english.pdf)
- <sup>xiii</sup> [https://unfccc.int/sites/default/files/resource/Thailand\\_LTS1.pdf](https://unfccc.int/sites/default/files/resource/Thailand_LTS1.pdf)
- <sup>xiv</sup> <http://nscr.nesdb.go.th/wp-content/uploads/2019/10/National-Strategy-Eng-Final-25-OCT-2019.pdf>
- <sup>xv</sup> <https://www.asean.org/wp-content/uploads/2012/05/8.-March-2016-ASCC-Blueprint-2025.pdf>
- <sup>xvi</sup> Thammasart University. 2020. The revision and update of Thailand’s Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand’s National Determined Contribution (NDC).
- <sup>xvii</sup> Draft Fourth Thailand National Communication
- <sup>xviii</sup> <https://www.ipcc.ch/sr15/chapter/spm/>
- <sup>xix</sup> [https://www.climatebonds.net/files/reports/cbi\\_asean\\_centralbanks\\_02b.pdf](https://www.climatebonds.net/files/reports/cbi_asean_centralbanks_02b.pdf)
- <sup>xx</sup> <https://webkc.dede.go.th/testmax/node/5736>
- <sup>xxi</sup> <https://policy.thinkbluedata.com/sites/default/files/Thailand%E2%80%99s%20Power%20Development%20Plan%20%28PDP%29%20%282018%E2%80%932037%29%20%28TH%29.pdf>
- <sup>xxii</sup> <https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions>
- <sup>xxiii</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R1214&from=EN>
- <sup>xxiv</sup> Full methodology can be found here:  
<https://transitionpathwayinitiative.org/publications/94.pdf?type=Publication>
- <sup>xxv</sup> <https://climateactiontracker.org/countries/thailand/>
- <sup>xxvi</sup> Draft Fourth Thailand National Communication
- <sup>xxvii</sup> <https://www.climatebonds.net/files/files/Bioenergy%20Criteria%20Document%20Aug%202022.pdf>
- <sup>xxviii</sup> <https://www.climatebonds.net/files/files/standards/Bioenergy/Background%20paper%20for%20bioenergy%20%28not%20inc%20wood%29.pdf>
- <sup>xxix</sup> <https://rsb.org/services-products/ghg-calculator/>
- <sup>xxx</sup> <https://www.climatebonds.net/files/files/standards/Waterborne%20Transport%20%28Shipping%29/CBI%20Certification%20-%20Shipping%20Criteria%20V1b%2020211215.pdf>
- <sup>xxxi</sup> [https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Resolution%20MEPC.304%2872%29\\_E.pdf](https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Resolution%20MEPC.304%2872%29_E.pdf)
- <sup>xxxii</sup> <https://datagov.mot.go.th/dataset/ghg-water>
- <sup>xxxiii</sup> <https://iea.blob.core.windows.net/assets/19f9554b-f40c-46ff-b7f5-78f1456057a9/ThailandPowerSystemFlexibilityStudy.pdf>
- <sup>xxxiv</sup> Thailand’s Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2021, Ministry of Foreign Affairs
- <sup>xxxv</sup> Department of Alternative Energy Development and Efficiency 2021. Energy Balance of Thailand 2020.
- <sup>xxxvi</sup> Department of Alternative Energy Development and Efficiency 2021. Energy Balance of Thailand 2020.
- <sup>xxxvii</sup> The Energy Policy and Planning Office. 2019. The NDC Sectoral Action Plan for the Energy Sector 2021 – 2030
- <sup>xxxviii</sup> Draft Thailand’s Fourth National Communication. (Consultation Draft – Unpublished)
- <sup>xxxix</sup> link:<https://www.bangkokpost.com/business/2281002/plan-aims-for-50-renewable-by-2050>.
- <sup>xl</sup> <https://www.climatescorecard.org/2019/11/the-government-is-taking-steps-to-increase-renewable-energy-but-must-do-more-to-engage-key-stakeholders-in-the-process/>

- 
- xii [https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA\\_Outlook\\_Thailand\\_2017.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Nov/IRENA_Outlook_Thailand_2017.pdf)
- xiii <https://gwec.net/wind-industry-calls-for-additional-7-gw-of-wind-energy-to-be-installed-in-thailand-by-2037/>
- xiii <https://www.adb.org/sites/default/files/linked-documents/53239-001-so.pdf>
- xiv <https://iea.blob.core.windows.net/assets/19f9554b-f40c-46ff-b7f5-78f1456057a9/ThailandPowerSystemFlexibilityStudy.pdf>
- xlv [https://uk.practicallaw.thomsonreuters.com/1-628-5906?transitionType=Default&contextData=\(sc.Default\)&firstPage=true](https://uk.practicallaw.thomsonreuters.com/1-628-5906?transitionType=Default&contextData=(sc.Default)&firstPage=true)
- xlvi <https://www.adb.org/sites/default/files/linked-documents/53239-001-so.pdf>
- xlvii <https://www.adb.org/sites/default/files/linked-documents/41682-039-ssa.pdf>
- xlviii Thailand’s Voluntary National Review on the Implementation of the 2030 Agenda for Sustainable Development 2021, Ministry of Foreign Affairs
- xlix <https://www.adb.org/sites/default/files/linked-documents/41682-039-ssa.pdf>
- l Energy Balance of Thailand 2020, Department of Alternative Energy Development and Efficiency
- li [https://www.boi.go.th/upload/content/5.%20Enhancing%20Infrastructure%20Development%20f\\_92919.pdf](https://www.boi.go.th/upload/content/5.%20Enhancing%20Infrastructure%20Development%20f_92919.pdf)
- lii <https://oxfordbusinessgroup.com/overview/path-prosperity-infrastructure-improvements-are-heart-plans-connect-thailand-rest-asia-0>
- liii <https://www.uncrd.or.jp/content/documents/7EST-B1G4-6.pdf>
- liv [https://www.unescap.org/sites/default/files/Country%20presentation%20-%20Thailand\\_3.pdf](https://www.unescap.org/sites/default/files/Country%20presentation%20-%20Thailand_3.pdf)
- lv [https://www.otp.go.th/uploads/tiny\\_uploads/PDF/2560-11/25601124-RaiwalDevOTP.pdf](https://www.otp.go.th/uploads/tiny_uploads/PDF/2560-11/25601124-RaiwalDevOTP.pdf)
- lvi [http://www.boi.go.th/upload/content/TIR6\\_2019\\_5e2e956d55219.pdf](http://www.boi.go.th/upload/content/TIR6_2019_5e2e956d55219.pdf)
- lvii [https://www.boi.go.th/index.php?page=add\\_investment](https://www.boi.go.th/index.php?page=add_investment)
- lviii The NDC Action Plan in the transport sector, 2021 –2030
- lix <https://www.aseanbriefing.com/news/thailand-issues-new-incentive-package-for-electric-vehicle-industry/>
- lx [https://www.unescap.org/sites/default/files/Thailand\\_18.pdf](https://www.unescap.org/sites/default/files/Thailand_18.pdf)
- lxi <https://waterriskfilter.org/>
- lxii <https://www.wri.org/aqueduct>
- lxiii <https://www.iucnredlist.org/>
- lxiv [https://www.ifc.org/wps/wcm/connect/topics\\_ext\\_content/ifc\\_external\\_corporate\\_site/sustainability-at-ifc/policies-standards/performance-standards/ps6](https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps6)
- lxv [https://www.ifc.org/wps/wcm/connect/Topics\\_Ext\\_Content/IFC\\_External\\_Corporate\\_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards](https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards)
- lxvi [https://report.ipcc.ch/ar6wg3/pdf/IPCC\\_AR6\\_WGIII\\_SummaryForPolicymakers.pdf](https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf)
- lxvii <https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/>
- lxviii <https://www.weforum.org/agenda/2022/01/global-risks-report-climate-change-covid19/>
- lxix Ibid.
- lxx <https://www.adb.org/news/videos/accelerating-sustainable-development-after-covid-19-role-sdg-bonds>
- lxxi World Bank and Asian Development Bank (ADB). 2021. Climate Risk Country Profile Thailand. [https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15853-WB\\_Thailand%20Country%20Profile-WEB\\_0.pdf](https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15853-WB_Thailand%20Country%20Profile-WEB_0.pdf)
- lxxii European Commission. 2022. INFORM Index for Risk Management. Thailand – Country Profile 2022 Scores (<https://web.jrc.ec.europa.eu/dashboard/INFORMRISK/?no-header=1&v-vISO3=AFG&no-scroll=1>)
- lxxiii [https://germanwatch.org/sites/default/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020\\_14.pdf](https://germanwatch.org/sites/default/files/20-2-01e%20Global%20Climate%20Risk%20Index%202020_14.pdf)
- lxxiv World Bank and Asian Development Bank (ADB). 2021.
- lxxv World Bank and Asian Development Bank (ADB). 2021.
- lxxvi Office of Natural Resources and Environmental Policy and Planning (ONEP) 2020a. Thailand Third Biennial Update Report (BUR). Ministry of Environment, Thailand (<https://unfccc.int/documents/267629>).
- lxxvii <https://www.bangkokpost.com/thailand/general/1785569/revised-forecast-puts-bangkok-underwater-by-2050>
- lxxviii [www.worldbank.org/en/country/thailand/overview](http://www.worldbank.org/en/country/thailand/overview)
- lxxix <https://www.worldbank.org/en/country/thailand/overview>
- lxxx ONEP. 2022. Draft Thailand’s Fourth National Communication. (Consultation Draft – Unpublished)
- lxxxi World Bank and Asian Development Bank (ADB). 2021.
- lxxxii World Bank. 2012. Thai Flood 2011 : Rapid Assessment for Resilient Recovery and Reconstruction Planning. World Bank, Bangkok (<https://documents1.worldbank.org/curated/en/677841468335414861/pdf/698220WP0v10P106011020120Box370022B.pdf> )
- lxxxiii <https://www.worldbank.org/en/news/feature/2011/12/13/world-bank-supports-thailands-post-floods-recovery-effort>

- lxxxiv World Bank. 2012.
- lxxxv UNDP and Fiscal Policy Research Institute. 2022. Final Report: Conducting a Country Diagnostic on Inclusive Insurance and Risk Finance for Thailand. UNDP, Bangkok.
- lxxxvi World Bank and Asian Development Bank (ADB). 2021.
- lxxxvii ONEP. 2022. Draft Thailand's Fourth National Communication. (Consultation Draft – Unpublished)
- lxxxviii World Bank and Asian Development Bank (ADB). 2021.
- lxxxix ONEP. 2022. Draft Thailand's Fourth National Communication. (Consultation Draft – Unpublished)
- xc World Bank and Asian Development Bank (ADB). 2021.
- xci  
<https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand%20Updated%20NDC.pdf>
- xcii Anwar, R.S., Mohamed, M., Hamzan, S.M., Malek, N.S.A., Zain, M.H.M., Jaafar, M.H., Sani, S., Brazil-De Vera, R.M., Desquitado, M. C. T., Praneerachachon, V., Wong, D., Lim, B. A., Goh, G., Tan, W., and Hong, J. (2020). *Report on The Roles of ASEAN Central Banks in Managing Climate and Environment-related Risks*. Kuala Lumpur ([https://asean.org/?static\\_post=report-roles-asean-central-banks-managing-climate-environment-related-risks](https://asean.org/?static_post=report-roles-asean-central-banks-managing-climate-environment-related-risks))
- xciii ONEP. 2020a. Thailand Third Biennial Update Report
- xciv Thammasart University. 2020. The revision and update of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's National Determined Contribution (NDC). Document distributed as part of public consultation organized on July 18, 2022. Centara Grand at Central Ladphrao Hotel, Bangkok.
- xcv World Bank. 2022. Thailand Economic Monitor June 2022: Building Back Greener: The Circular Economy. Bangkok.
- xcvi KPMG International. 2021. Net Zero Readiness Index 2021. (<https://home.kpmg/xx/en/home/insights/2021/09/net-zero-readiness-index.html>)
- xcvii Pollution Control Department (PCD). 2021. Thailand State of Pollution 2020 (B.E. 2563) (Volume 26, 5 March 2021 (B.E. 2564). Ministry of Natural Resources and Environment, Thailand ([https://www.pcd.go.th/wp-content/uploads/2021/03/pcdnew-2021-04-07\\_06-55-47\\_218070.pdf](https://www.pcd.go.th/wp-content/uploads/2021/03/pcdnew-2021-04-07_06-55-47_218070.pdf))
- xcviii Pollution Control Department (PCD). 2021. Thailand State of Pollution 2020 (B.E. 2563)
- xcix Pollution Control Department (PCD). 2021. Thailand State of Pollution 2020 (B.E. 2563)
- c Simachaya, Wijarn. 2020. [http://www.tei.or.th/en/blog\\_detail.php?blog\\_id=49](http://www.tei.or.th/en/blog_detail.php?blog_id=49)
- ci [https://unfccc.int/sites/default/files/resource/BUR3\\_Thailand\\_251220%20.pdf](https://unfccc.int/sites/default/files/resource/BUR3_Thailand_251220%20.pdf)
- cii [http://www.tei.or.th/en/blog\\_detail.php?blog\\_id=49](http://www.tei.or.th/en/blog_detail.php?blog_id=49)
- ciii [https://www.iucn.org/sites/dev/files/content/documents/thailand\\_final-report\\_2020\\_compressed.pdf](https://www.iucn.org/sites/dev/files/content/documents/thailand_final-report_2020_compressed.pdf)
- civ Pollution Control Department (PCD). 2021. Thailand State of Pollution 2020 (B.E. 2563)
- cv Pollution Control Department (PCD). 2021. Thailand State of Pollution 2020 (B.E. 2563)
- cvi [https://thailand.prd.go.th/1700/ewt/thailand/ewt\\_news.php?nid=7831&filename=index](https://thailand.prd.go.th/1700/ewt/thailand/ewt_news.php?nid=7831&filename=index)
- cvii ONEP. 2022. Draft Thailand's Fourth National Communication. (Consultation Draft – Unpublished)
- cviii ONEP. 2022. Draft Thailand's Fourth National Communication. (Consultation Draft – Unpublished)
- cix UNDP. 2021. The Biodiversity Finance Plan – The Biodiversity Finance Initiative (BIOFIN) – Thailand. <https://www.nationthailand.com/national/30339814>
- cx [https://openjicareport.jica.go.jp/pdf/12015442\\_03.pdf](https://openjicareport.jica.go.jp/pdf/12015442_03.pdf)
- cxii [https://link.springer.com/chapter/10.1007/978-3-030-04417-6\\_28](https://link.springer.com/chapter/10.1007/978-3-030-04417-6_28)
- cxiii <https://www.ipcc.ch/srocc/chapter/chapter-4-sea-level-rise-and-implications-for-low-lying-islands-coasts-and-communities/>
- cxiv <http://www.mangrovealliance.org/wp-content/uploads/2018/05/MFTF-Pakistan-thailand-vietnam.pdfm>
- cxv Richards and Friess. 2016. Rates and drivers of mangrove deforestation in Southeast Asia, 2000–2012. <https://www.pnas.org/content/113/2/344>
- cxvi <https://www.bangkokpost.com/thailand/general/2188615/10-more-areas-picked-to-be-developed-into-smart-cities>  
[https://www.researchgate.net/publication/333558689\\_Explaining\\_success\\_in\\_community\\_based\\_mangrove\\_management\\_Four\\_coastal\\_communities\\_along\\_the\\_Andaman\\_Sea\\_Thailand](https://www.researchgate.net/publication/333558689_Explaining_success_in_community_based_mangrove_management_Four_coastal_communities_along_the_Andaman_Sea_Thailand)
- cxvii <https://www.mangrovealliance.org/wp-content/uploads/2021/07/The-State-of-the-Worlds-Mangroves-2021-FINAL-1.pdf>
- cxviii [https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand\\_INDC.pdf](https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand_INDC.pdf)
- cxix  
[https://wwf.panda.org/discover/our\\_focus/climate\\_and\\_energy\\_practice/ndcs\\_we\\_want/reviewed\\_ndcs\\_/thailand/](https://wwf.panda.org/discover/our_focus/climate_and_energy_practice/ndcs_we_want/reviewed_ndcs_/thailand/)
- cxix  
[https://unfccc.int/sites/default/files/resource/Thailand\\_LTS1.pdf](https://unfccc.int/sites/default/files/resource/Thailand_LTS1.pdf)
- cxix

- 
- cxix <https://www.thaipbsworld.com/thailand-vows-to-reach-net-zero-carbon-emissions-by-2065-at-cop26/>
- cxixii Thammasart University. 2020. The revision and update of Thailand's Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) and Thailand's National Determined Contribution (NDC).
- cxixiii Office of Natural Resources and Environmental Policy and Planning (ONEP) 2020a.
- cxixiv <https://www.iea.org/countries/thailand>
- cxixv <https://www.eia.gov/international/analysis/country/THA>
- cxixvi <https://www.iea.org/countries/thailand>
- cxixvii Department of Alternative Energy Development and Efficiency (DEDE), 2020. Energy Balance of Thailand 2020. Ministry of Energy (<https://webkc.dede.go.th/testmax/node/5736>)
- cxixviii <https://www.iea.org/countries/thailand>
- cxixix [https://iecc.energy.go.th/wp-content/uploads/2019/03/00\\_Energy-4.pdf](https://iecc.energy.go.th/wp-content/uploads/2019/03/00_Energy-4.pdf)
- cxixxx <https://www.iea.org/articles/putting-a-price-on-carbon-an-efficient-way-for-thailand-to-meet-its-bold-emission-target>
- cxixxxi <https://aseanenergy.org/the-current-status-of-re-and-its-target-in-asean-member-states/>
- cxixxxii <https://www.irena.org/publications/2021/Aug/Renewable-energy-statistics-2021>
- cxixxxiii <https://www.climatebonds.net/policy/101-policymakers>
- cxixxxiv <https://www.climatebonds.net/files/files/climate-bonds-standard-v3-20191210.pdf>
- cxixxxv <http://nafmii.org.cn/ggtz/gg/202207/P020220801631427094313.pdf>
- cxixxxvi [https://www.icmagroup.org/assets/documents/Sustainable-finance/2022-updates/Green-Bond-Principles\\_June-2022-280622.pdf](https://www.icmagroup.org/assets/documents/Sustainable-finance/2022-updates/Green-Bond-Principles_June-2022-280622.pdf)
- cxixxxvii <https://www.adb.org/sites/default/files/adb-green-bonds-framework.pdf>
- cxixxxviii <https://veb.ru/files/?file=b5409866c0b23504e0b497ea37cb4c3d.pdf>
- cxli [http://www.gov.cn/zhengce/zhengceku/2022-06/03/content\\_5693849.htm](http://www.gov.cn/zhengce/zhengceku/2022-06/03/content_5693849.htm)
- cxlii [https://finance.ec.europa.eu/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector\\_en](https://finance.ec.europa.eu/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector_en)
- cxliii [https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting\\_en](https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en)
- cxliiii <https://www.climatebonds.net/policy/101-policymakers>
- cxliiv <https://climateactiontracker.org/countries/thailand/>