

## **Green Finance Industry Taskforce**

### **Identifying a Green Taxonomy and Relevant Standards for Singapore and ASEAN**

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## Introduction and background

1. Addressing the challenges of climate change is a task of significant importance. The Paris Agreement specifies that countries should “limit warming to well below 2°C, and pursue efforts to limit it to 1.5°C”. The challenges around transition to a low-carbon economy, and doing this in a just way, are attracting attention in countries globally. In addition, awareness around the negative impact that business and society can have on the environment, and the associated need to transition to a low-impact, circular economy, is also growing.
2. Finance is a key enabler of economic activity and plays a critical role in facilitating and accelerating the transition to a low carbon economy. Financial market participants and their clients provide capital, either directly or indirectly, to economic activities which can help meet the challenge of limiting temperature rises, for example. At the same time, financial market participants sometimes provide capital to economic activities whose impacts are inconsistent with achieving these transitions.
3. There is also recognition that climate change can present material physical, liability and / or transition risk to the stability of financial markets. For example, stress in financial markets from extreme weather events, which are predicted to increase in both regularity and severity, could present significant systemic and systematic risks. These risks should be of interest to both providers of finance and providers of (re)insurance, as well as their regulators and stakeholders.
4. There is currently a focus from governments on the importance of incorporating environmental objectives into spending related to COVID recovery; for example, 30% of the EUR 750bn Next Generation recovery plan and the EUR 1,074.3bn Multiannual Financial Framework agreed on 21 July 2020 will target climate-related projects.
5. At the same time, there is increasing attention from consumers on financial products and services that are labeled as “green”, or “ESG”.<sup>1</sup> Products and services that identify as such have grown in popularity, and by 2020 USD 40.5 trillion worth of assets applied ESG data as part of investment decisions, double that of four years earlier.<sup>2</sup>
6. Despite this increasing interest in green / sustainable finance:
  - a) Consumers have different expectations: to express values (ethical, religious), to manage risk, or to send signals (impact, UN SDGs),

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<sup>1</sup> ESG = Environmental, Social, and Governance

<sup>2</sup> <https://www.pionline.com/esg/global-esg-data-driven-assets-hit-405-trillion>

- b) On the other hand, at the Financial Institution level different approaches exist: exclusions, ESG integration, best in class, thematic investment, impact investment, and engagement, for example. These are complementary, and oftentimes overlap, but there is little by way of recognizable framework or agreement on what green / sustainable finance is, what a green / sustainable product should do, and what outcomes a client should expect.
7. Given this wide spectrum of products and services, there have been concerns over greenwashing.<sup>3</sup> There is legitimate concern that, left unchecked, consumers may be misled and may purchase products and services that have a mismatch between name and process. This uncertainty may be inhibiting development of Green Finance.
8. There has therefore been a move in some markets, such as EU, China, Japan and Canada to create a system of classification or standards that will help financial market participants and their stakeholders communicate through a shared understanding, via a common vocabulary, to compare and assess products and services. One approach that has seen some recent interest is the creation of a taxonomy. These taxonomies are product / capital structure agnostic, but are instead a classification of activities. These taxonomies are created because it is believed that providers of products and services would in turn leverage the taxonomy to design and distribute products and services that are aligned with and build on the taxonomy.
9. This document discusses merits of a taxonomy for Singapore-based Financial Institutions, with particular relevance to those active across ASEAN, sets out a basic approach to a taxonomy, identifies economic sectors important to Singapore and ASEAN which would particularly benefit from such classification, and poses questions for follow up.

### **What is a taxonomy, and what is the purpose of a taxonomy?**

10. A taxonomy is a classification tool which, for these purposes, classifies economic activities into distinct groups, green, and otherwise, plus activities that are transitional. Taxonomies of this nature exist to support an overarching set of goals, in this instance environmental goals, and determine whether the activities are consistent with these environmental goals with reference to a threshold, or tolerance. Whilst the taxonomy does not explicitly reference social issues, green investment can have positive implications for employment, and it has been recently recognized that green

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<sup>3</sup> Greenwashing refers to the process of creating a false or misleading impression of the degree to which a company's products are environmentally sustainable.

stimulus policies for example have a higher ROI, are faster to enact, whilst being beneficial for the environment.<sup>4</sup>

11. By classifying activities as such, a taxonomy allows Financial Institutions to better understand the underlying activities within their product or service, and to better communicate the same. To that end, by signaling the “green” content of the product or service (for example, through aggregation in the case of a portfolio), and given the interest in financing “green” activities, taxonomies can help accelerate the provision of capital to economic activities deemed as green.
12. Note that the taxonomy would not identify those activities that are environmentally damaging; rather, it would focus on identifying those that are “green”.
13. By evaluating and classifying activities as “green”, based on tolerance thresholds, a taxonomy would:
  - a) establish clear criteria for determining activities as environmentally sustainable,
  - b) remove uncertainty as to whether certain activities are environmentally sustainable,
  - c) bring clarity to discussions around green and sustainable products, and
  - d) alleviate concerns on green-washing.
14. The end-goal of a taxonomy would be to provide a common framework for classification upon which financial products and services could be built. This common language should lead to growth in products and services if the ambiguity and uncertainty discussed above are alleviated, whilst also facilitating comparability with global products. A taxonomy would also facilitate reporting and classification of portfolios by Financial Institutions, which in turn may further stimulate demand for financial products and services.
15. On top of this, a taxonomy could also help Financial Institutions engage with issuers through a common language; the taxonomy would allow Financial Institutions and issuers to discuss with reference to a benchmark classification system, based in and informed by science, the contribution of their activities to sustainable development.
16. Finally, a taxonomy could be helpful for macro-prudential regulators that wish to understand potential risks to financial stability that stem from “unsustainable” activities.

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<sup>4</sup> See: <https://www.smithschool.ox.ac.uk/publications/wpapers/workingpaper20-02.pdf>

17. One important issue to consider is that the taxonomy should be usable, and not inconsistent with taxonomies elsewhere. Whilst this document later explores the taxonomies being developed in other jurisdictions, and considers areas of those taxonomies that are inconsistent with the context of Singapore/ASEAN, there is also an over-riding consideration in that a potential proliferation of taxonomies with multiple methodologies and approaches is potentially confusing for market participants. Given the global nature of capital, it should be considered desirable that the methodology and approach of any taxonomy for Singapore-based Financial Institutions should be consistent with other taxonomies, whilst being tailored for the unique context of the country and the region.
18. If the taxonomy is successful it should accelerate flows to sustainable economic activities, and reduce flows to activities that are not sustainable. In order to measure the building blocks of this success, we can consider several quantitative /qualitative measures against which we can evaluate the success or otherwise of the taxonomy.
19. There are a number of key stakeholders that need to embrace the taxonomy in order for it to be considered a success; the measures of success therefore relate to these stakeholders. In particular, the following could be considered as useful measures of success:
  - a) **The extent to which the taxonomy is compatible / consistent with other taxonomies.** Given capital is global, as are capital market participants, it is important that the taxonomy is compatible / consistent with other taxonomies. This does not mean that it is identical, more that the taxonomy should make use of a consistent approach and language, and be inter-operable with other taxonomies. There should not be elements that are incompatible. Efforts at tracking such developments are being conducted by the International Platform on Sustainable Finance.
  - b) **The extent to which new products are developed that (or existing products are modified to) align with the taxonomy.** Given the taxonomy sets the foundations for directing capital to activities that are demonstrably 'green', one measure of success is the extent to which capital market participants either develop (or modify existing) products to align with or map to the taxonomy. The number of products that align with or map to the taxonomy can be easily tracked.
  - c) **The extent to which regulators reference the taxonomy when approving products or services.** Given consumers of products and services have voiced concerns over 'greenwashing' of products, the ability of regulators to refer to a universal reference point (i.e. the taxonomy) in approving a product as green or otherwise would provide comfort to users. We could see, for example, the development of a labelling system that makes use of the taxonomy to

demonstrate the “green” credentials of a product or service. This can be easily tracked.

- d) **The extent to which other frameworks / standards reference the taxonomy.** Linking with the point below on the compatibility / consistency with other taxonomies, if this outcome can be achieved then one measure of success is the extent to which other frameworks / standards (as they relate to ‘green’ bonds etc.) reference the taxonomy. The taxonomy, if successful, should become the common language and architecture that underpins products and standards.
- e) **The extent to which the taxonomy is embedded within frontline regulatory disclosure requirements.** Given this paper identifies a lack of applicable data as a significant hurdle, one measure of success is the way frontline regulators (stock exchanges, for example) require corporate disclosure that directly maps to the requirements of the taxonomy. This should include, where possible, information on the “Do No Significant Harm” clause of the taxonomy. Disclosure requirements can be easily tracked.
- f) **The extent to which the disclosure requirements present an ‘undue burden’ on corporates.** Disclosing data and information that map to the requirements of the taxonomy will require effort from corporates; this cannot be avoided. However, one success of the taxonomy would be the extent to which this effort represents an undue burden. Every effort should be taken so as to ensure that tools and support are available for all issuers, including and in particular small and mid-sized enterprises. This is an issue which can and should be monitored at regular intervals.
- g) **The extent to which providers of data align with the taxonomy.** Many capital market participants make use of data provide by a third party research firm when considering their investments. These third party data providers collect and aggregate data disclosed by corporates, and then provide it to capital markets participants either as raw data or within a proprietary framework. Given capital market participants will look to these data providers for assistance in understanding activities as they relate to the taxonomy, it is important that these third party data providers align their products and services to the taxonomy, allowing for a fuller implementation of the taxonomy. This should, where possible, include information on the “Do No Significant Harm” clause of the taxonomy. This can be easily tracked.

**Question 1** – The workstream seeks comments on the useful measures of success, and whether other measures may be considered in addition when evaluating the implementation of a taxonomy.

**Question 2** – The workstream seeks specific feedback on the extent to which disclosure requirements may present an ‘undue burden’ on corporates.



## **What are the potential risks to consider?**

20. Whilst there are a number of positives associated with the development of a taxonomy, it must be recognized that certain disadvantages and challenges have also been raised.
21. There is concern that a static taxonomy would freeze once and for all the only 'acceptable' responsible investment approach, without taking into consideration the variety of existing (and future) initiatives and understandings. It risks creating a strict set of guidance that at best can inhibit evolution of approaches and at worst encourage and engender a potentially unwanted set of path dependencies.
22. On top of this, there are concerns that the use of fixed thresholds may not allow for sufficient flexibility of approaches, given that scientific understandings of the issues in question may evolve over time.
23. In addition, there is concern that the introduction of a taxonomy would – by its very nature – introduce additional cost and compliance burden to Financial Institutions. There is concern that the cost burden would be passed on to consumers.
24. Given the fact that a taxonomy relies on disclosure by corporates to determine and classify activities, concern has been expressed that it may be both challenging and expensive for issuers to produce the data necessary for investors to implement the taxonomy and populate the potential different reports. It should be noted that whilst the EU has the Non-Financial Reporting Directive (NFRD), which informs disclosure requirements across the EU, new rules around disclosure may be required in those markets where similar directives are not present. It should also be considered that, in order to prevent undue burden on issuers, these rules on disclosure should be consistent with, or at least not inconsistent with, other requirements around environmental disclosure.
  - a) If regulations encouraging such disclosure are not forthcoming, it would be incumbent on providers of capital to demand such disclosure as part of their engagement. This demand would in turn be driven from either:
    - i. Regulator-driven rules requiring disclosure of taxonomy-related information from Financial Institutions (for example, a labelling system), or
    - ii. Consumer demand for products and services that are aligned with a taxonomy.

25. The introduction of a taxonomy would focus on environmental sustainability. Any classification of activities as “green” would impact flows of capital – that is the aim of the taxonomy. However, altering flows of capital will lead to difficult questions around the potential economic development implications of altering flows of capital, as well as the potential social implications of altering flows of capital.
26. There are also concerns that, whilst a taxonomy may focus on classifying economic activities as “environmentally sustainable”, these classifications may not represent a meaningful impact, economically and/or environmentally, on climate change and environmental issues.
27. By focusing on those activities that are “environmentally sustainable”, a taxonomy could be thought to exclude a very sizeable majority of activities that are – by varying degrees – either neutral, or environmentally unsustainable, or are having a very serious environmental impact. For consumers, FIs, and for regulators, this lack of focus on “unsustainable” activities could present a serious weakness. In particular, macro-prudential regulators that wish to understand potential risks to financial stability may prefer to focus on behavior that is inherently “unsustainable”. This challenge can however be addressed in next iterations of a taxonomy by expanding the scope of the taxonomy.
28. Some concern has been voiced that, by identifying a set of activities that are “sustainable”, and by flagging that these activities merit further investment, these activities may attract more capital than is desirable, leading to potentially inflated and hence potentially unstable asset prices.

**Question 3** – The workstream seeks feedback on potential risk considerations around the development of a taxonomy, including other risk considerations not mentioned in this section.

**Question 4** – The workstream seeks specific feedback on the extent to which the introduction of a taxonomy would introduce additional cost and compliance burden to Financial Institutions.

## Who else is preparing a taxonomy?<sup>5</sup>

### *European Union*

29. Agreed by EU in December 2019, the EU taxonomy<sup>6</sup> classifies activities as environmentally sustainable based on whether an activity a) contributes to one of six environmental objectives, and b) does no significant harm to any other environmental objective.
30. The EU taxonomy is a broad and ambitious document, covering:
- a) **Six environmental objectives:** 1) climate mitigation, 2) climate adaptation, 3) sustainable use and protection of water and marine resources, 4) transition to a circular economy, 5) pollution prevention control, and 6) protection and restoration of healthy ecosystems
  - b) **Six macro-sectors:** 1) Agriculture and Forestry, 2) Manufacturing, 3) Electricity, gas, steam and air conditioning supply, 4) Water, Waste and Sewerage remediation, 5) Transport, and 6) Buildings
  - c) **One enabling sector:** Information and Communication Technologies (ICT)
  - d) **67 economic activities:** granular economic activities within the 6+1 sectors
31. Where are the gaps in the EU taxonomy?
- a) The EU taxonomy, in defining the 6+1 sectors, was primarily driven by the major economic exposures of and major emitting sectors within the EU
    - i. Any Singapore / ASEAN taxonomy would need to ensure the sectors / subsectors are the most relevant for Singapore / ASEAN in terms of contribution to economy / emissions
  - b) The EU uses NACE sectors

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<sup>5</sup> We are aware that the jurisdictions discussed within, as well as other jurisdictions, may evolve and iterate their taxonomies. This document would be updated to reflect changes in all taxonomies mentioned, and to incorporate other futures developments as appropriate.

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[https://ec.europa.eu/info/sites/info/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy\\_en.pdf](https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf)

- i. NACE ("nomenclature statistique des activités économiques dans la Communauté européenne"), is a European industry standard classification system established by EU Law
  - ii. The NACE classification system is less well-known outside of Europe. The EU Taxonomy Technical Report itself notes that: “the TEG acknowledged that some financial market participants use other classification systems, in particular the Global Industrial Classification System (GICS)”
  - iii. Whilst the EU Taxonomy Technical Report states that “The TEG believes that maps of NACE codes to GICS codes are readily available”, the Singapore / ASEAN taxonomy would use ISIC sector classification, which may be more familiar to a wider number of users, and in particular those in Singapore / ASEAN<sup>7</sup>
- c) The EU taxonomy has very clear thresholds for defining Green, with many coming from EU regulation / legislation / Paris climate goals.
  - i. Any Singapore / ASEAN taxonomy would need to make use of a different approach, using either global or regional standards

### ***Bank Negara Malaysia***

- 32. Bank Negara Malaysia released a “Climate Change and Principle-based Taxonomy Discussion Paper” in December 2019.<sup>8</sup> The document is focused on climate change rather than broader environmental sustainability.
- 33. The BNM Discussion Paper covers:
  - a) **Five guiding principles:** 1) Climate change mitigation, 2) Climate change adaptation, 3) No significant harm to the environment, 4) Transition and remedial efforts, and 5) Prohibited activities
  - b) **Six categories of activities:** Ranging from C1 to C6, these six categories including activities that at one end of the spectrum are for example supporting substantial reduction or avoidance of GHG emissions, and at the other include prohibited activities.

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<sup>7</sup> For more on ISIC see para 76-78

<sup>8</sup> [https://www.bnm.gov.my/index.php?ch=en\\_announcement&pg=en\\_announcement&ac=767](https://www.bnm.gov.my/index.php?ch=en_announcement&pg=en_announcement&ac=767)

34. The document does not include granular detail on thresholds for classification, instead flagging that “Supervised institutions can leverage on third party verification or recognized certifications by local agencies, national authorities or globally accepted standards to provide assurance on environmentally sustainable practices”
35. Where are the gaps in the BNM taxonomy?
  - a) The BNM document is more high-level than the EU Taxonomy, and does not include guidance on sectors, or prescriptions on measurements or thresholds.
  - b) The BNM document is only applicable to: 1) Licensed banks, 2) Licensed investment banks, 3) Licensed Islamic banks, 4) Licensed international Islamic banks, 5) Licensed insurers, 6) Licensed takaful operators, 7) Professional reinsurers, 8) Professional retakaful operators, and 9) Prescribed development financial institutions.
    - i. The document flags that it can be used as a reference by other players in the financial system such as asset management companies, rating agencies and research houses.

## ***China***

36. The NDRC Green Industry Guiding Catalogue was developed by China to facilitate and promote investment in identifiably green industries.
37. The Industry Catalogue has a focus on pollution prevention and control, rather than the broader environmental focus of the EU Taxonomy, and the narrower climate change focus of the Bank Negara Malaysia document.
38. Where are the gaps?
  - a) Unlike both the EU Taxonomy and the Bank Negara Malaysia document, the Industry Catalogue does not define any specific environmental objective, other than “pollution prevention and control”
  - b) The Industry Catalogue does not contain granular guidance on industry or sector classification (e.g. EU Taxonomy makes use of NACE)
  - c) The Industry Catalogue does not contain a clear approach to determining the environmental sustainability of activities; rather, it appears the Industry Catalogue is a list of eligible industries and projects

- d) The Industry Catalogue does not include clear criteria or metrics relating to emissions or climate change mitigation
39. We also note that Japan and Canada are developing “transition taxonomies”, with a focus on activities that aid in the transition from high to low carbon intensity, as opposed to focusing on activities that are demonstrably green.

**Should Singapore consider its own taxonomy? What would be different if we did?**

40. This document has thus far considered the merits of a taxonomy, as well as the potential disadvantages.
41. Whilst the disadvantages are clearly material, and require careful consideration, it is believed that there is merit to progressing towards the development of a taxonomy for Singapore-based Financial Institutions, with particular relevance to those active across ASEAN.
42. Given comments earlier around the importance of consistency and compatibility, it is envisaged that a taxonomy for Singapore-based Financial Institutions would draw on the theoretical underpinnings of the EU taxonomy, including for example the six environmental objectives (which are relevant and hence applicable across geographies), and the broad approach to classification of economic activities.
- a) The EU Taxonomy is a highly detailed and rigorous document, and there is merit in building on this work rather than designing a new approach.
  - b) Considering that the EU taxonomy has been more developed than the Chinese or the BNM taxonomies, it appears to be a deeper benchmark to follow in the construction process of Singapore’s taxonomy. One has to consider that a taxonomy too specific can be a threat to financial products circulation and alignment. An example is the importation of Luxembourg funds in the private banking and asset management industry that could be slowed down if the two taxonomies are too different.
  - c) Another issue to consider here is the fact that the alignment of taxonomies worldwide is far from over. Considering the EU taxonomy as a benchmark, one has to be careful not to be too restrictive, as global alignment would be key for some cross-border aspects.

43. The EU taxonomy framework is useful in providing a base structure and methodology. In particular:

- a) the over-arching six environmental objectives,
- b) the rigorous approach to the inclusion of sectors and activities,
- c) the use of thresholds for inclusion as sustainable, and
- d) the use of a “Do No Significant Harm” clause

44. However, there are gaps as discussed earlier

- a) Any potential taxonomy for Singapore-based financial institutions would need to consider carefully the **sectors and activities** to be included, based on economic importance and contribution to emissions and have significant coverage of transition sectors and activities, to ensure relevance and alignment.
- b) The EU Taxonomy recognizes that **disclosure** is a challenge. The document itself flags that: “Disclosure on climate-related and environmental metrics varies significantly from company to company”, and that “there is no standardization or homogenization on corporate environmental disclosures”. Any taxonomy for Singapore-based Financial Institutions needs to carefully consider the availability of (and hence new regulatory requirements around) data and disclosures required so as to implement the taxonomy effectively, in the absence of mandated disclosure standards such as the EU Non-Financial Reporting Directive (NFRD).
- c) Any taxonomy for Singapore-based Financial Institutions would need to consider carefully the use of **thresholds** to determine whether an activity is environmentally sustainable, given the absence of ASEAN-wide rules & regulations (in contrast to the EU which has a very detailed and sophisticated body of regulation around these issues). One approach may be to reference globally recognized standards, for example.
- d) The taxonomy for Singapore-based Financial Institutions would need to consider the **targets** within the EU Taxonomy, and whether the level of ambition is compatible with the social and economic context of Singapore and the region.
- e) A common taxonomy within ASEAN countries would ease the circulation of cross-boarders financial products in the region, in a similar way as already mentioned in section 39 with EU. But Singapore might have several differences

in terms of sectors and industries (level of evolutions, type of industries, for example), requiring a specific taxonomy vs its ASEAN peers, and vice versa.

- f) A regional target could try to identify the largest common denominator within the ASEAN countries, but this would reduce the precision, and the impacts of the Singaporean taxonomy.

**Question 5** – The workstream seeks feedback on this proposed approach. If you disagree, please comment on alternative options, including:

- 1) alternate approaches to the development of a Singapore taxonomy,
- 2) an option where Singapore does not develop a taxonomy and makes no further contribution, or,
- 3) an option whereby Singapore does not develop a taxonomy but instead provides transparency and guidance around existing taxonomies to the market.

**Question 6** – The workstream seeks feedback on ways in which a taxonomy can recognize and support transition efforts by, and specify pathways for, companies currently in activities that may currently be causing significant harm to be able to move to less harmful activities, and from less harmful to ultimately sustainable levels of environmental performance.

### **Key overarching principles**

45. The potential challenges and criticisms discussed in this document merit further consideration. They may not be reason enough to not proceed with a taxonomy, but they should certainly inform the development of the taxonomy. To that end, we suggest that in developing a taxonomy, the following principles should be adhered to:

- a) Ensure that the environmental targets, and thresholds for classification, are based in and supported by science.
- b) Ensure that the standards/requirements can be met by issuers in various ASEAN countries. This includes a recognition of the varying stages of economic and institutional development within ASEAN.
- c) Ensure that the taxonomy is not static, but provides for evolution in approaches and understandings.
- d) Ensure that the taxonomy is clear and accessible, and does not represent an undue burden on issuers. This includes ensuring that additional disclosure requirements which may stem from the introduction of a taxonomy are



compatible with existing disclosure obligations. This in turn allows issuers to translate the taxonomy at their level in the disclosure they publish, in a transparent and comparable manner.

- e) Ensure that the taxonomy can be leveraged by a variety of capital market participants, including for example credit, public equity, private equity, infrastructures, real estate, and so on.
- f) Ensure that the taxonomy is consistent with the goals of existing initiatives, including for example the Green Bond Principles, the SDGs and the UN Global Compact, at global level.

## **Next steps**

46. This document provides an introduction to the directional design of a taxonomy. It discusses the environmental objectives of the taxonomy, the sectors which may be covered, the economic activities within those sectors, and the general approach to classification. At every step the document poses questions for response, and these responses will inform follow-up work which will come after this document.

## Environmental Objectives

### Context for Setting Environmental Objectives

47. The key purpose of developing a green taxonomy for Singapore-based Financial Institutions (FIs) is to encourage the flow of capital to support the low carbon transition needed to avoid catastrophic climate change, as well as the environmental objectives of Singapore and the ASEAN nations, which are serviced by Singapore-based FIs. The UN Environment Inquiry and the Development Bank of Singapore estimate that ASEAN needs about US\$3 trillion in green finance between 2016 to 2030. These opportunities are in four sectors including infrastructure, renewable energy, energy efficiency and food, agriculture and land use<sup>9</sup>. Over time green taxonomies can be harmonized across the ASEAN countries to avoid fragmentation of the green finance market.
48. The key purpose of developing a green taxonomy for Singapore-based Financial Institutions (FIs) is to encourage the flow of capital to support the low carbon transition needed to avoid catastrophic climate change, as well as the environmental objectives of Singapore and the ASEAN nations, which are serviced by Singapore-based FIs.
49. This chapter sets out the environmental objectives for the taxonomy. Environmental objectives help to define the types of activities that can support the transition to a low emissions, climate-resilient economy. However, the nature of the transition in each country or region is influenced by the evolution of the entire system, including local strategies and policies.
50. The EU Taxonomy is a key reference document in developing the environmental objectives for this taxonomy document. In the EU's Taxonomy, the six environmental objectives were set by the European Commission based on Europe's environmental policies<sup>10</sup>. These were given to the Technical Working Group (TEG) designing the EU Taxonomy. Given Europe's policy commitment to achieve next zero carbon emissions by 2050 and the starting energy mix in Europe, and the net zero carbon policy objectives, it was reasonable that fossil fuels were not part of the green taxonomy in Europe.

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<sup>9</sup> DBS and UNEP Inquiry, Green Finance Opportunities, [http://www.dbs.com/iwov-resources/images/sustainability/img/Green\\_Finance\\_Opportunities\\_in\\_ASEAN.pdf](http://www.dbs.com/iwov-resources/images/sustainability/img/Green_Finance_Opportunities_in_ASEAN.pdf)

<sup>10</sup> The 6 EU environmental objectives are: (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) transition to a circular economy, waste prevention and recycling, (5) pollution prevention and control, and (6) protection of healthy ecosystems.

51. As the ASEAN region undergoes rapid urbanization and economic development, it is currently expected to depend on fossil fuels at least in the medium term, with coal as the main energy source to meet the growth of electricity demand<sup>11</sup>. Indeed, the total power demand in ASEAN is expected to double from 1.05 petawatts per hour (PWh) in 2018 to 2.46 PWh by 2040<sup>12</sup>. Under current forecasts, Southeast Asia's coal-fired generation is set to grow faster than every other source of energy, increasing by 218% in 2030 compared to 2014. From 2016 to 2030, 135 GW of coal capacity will be added in 6 key energy consumers (Cambodia, Indonesia, Malaysia, Philippines, Thailand and Vietnam)<sup>13</sup>. The region's rising fossil fuel demand will increase greenhouse gas emissions and exacerbate local air pollution. Hence, economic activities that enable the transition from fossil fuels to sustainable energy sources are essential to mitigate climate change. Beyond the energy sector, the de-carbonization of key industry segments for which no technologically or financially feasible alternatives currently exist is important for an orderly transition to a lower carbon economy. This is important to consider because the de-carbonization of sectors such as steel, aluminum, and cement may constitute a large part of ASEAN green/transition financing opportunities due to the required infrastructure buildout.
52. Thus, the policy contexts in Singapore and ASEAN countries are different from the EU. A key consideration in setting the environmental objectives for a taxonomy in this region to accelerate the flow of financing to support a low carbon transition is aligning them with Singapore's and the ASEAN's environmental objectives.

### **Singapore's Environmental Objectives**

53. Singapore has committed to peak emissions at 65MtCO<sub>2</sub>e around 2030. In its long-term emissions development strategy, Singapore also pledged to halve its emissions by 50% from the peak to 33MtCO<sub>2</sub>e by 2050, with a view to achieving net zero emissions as soon as viable in the second half of the century<sup>14</sup>. The strategy will focus on three areas:
- a) **Transformations in industry, economy and society**, including increasing renewable energy, greater energy efficiency, reducing energy consumption.

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<sup>11</sup> Source : Renewable Energy Outlook for ASEAN by ASEAN Centre for Energy (ACE) and International Renewable Energy Agency (IRENA)

<sup>12</sup> ASEAN Centre for Energy: How does ASEAN Coal Sector Look In The First Quarter of 2019, April 2019

<sup>13</sup> The Impact of Nationally Determined Contributions on the Energy Sector, ADB Sustainable Development Working Paper Series, July 2018

<sup>14</sup> Charting Singapore's Low-Carbon and Climate Resilient Future, March 2020.

- b) **Adoption of advanced low-carbon technologies** such as carbon capture, utilization and storage and the use of low-carbon hydrogen.
  - c) **Effective international collaboration**, including international climate action, regional power grids, market-based mechanisms.
54. Given that a small island nation like Singapore will be adversely affected by physical climate change, the government will continue to invest in **climate change adaptation** including coastal protection, conservation of biodiversity and greenery and enhancing food security. The government had committed S\$100 billion for climate resilience over the next 50-100 years.
55. In addition, the Ministry of Sustainability and the Environment in Singapore have identified three strategic objectives<sup>15</sup> for its environmental policies:
- a) **Climate Resilience:** To address existential threats of climate change, especially rising sea levels, rising temperatures, changing rainfall patterns to sustain a loveable environment.
  - b) **Economic Resilience:** To ensure the future of Singapore economy remains competitive by overcoming carbon and resource constraints and to rally stakeholders towards sustainable economic growth.
  - c) **Resource Resilience:** To ensure safe and secure supply of critical resources (i.e. water and food) and to overcome global resource constraints by maximizing resource efficiency and closing our resource loops.

#### **ASEAN's Nationally- Determined Commitments (NDCs) under Paris Agreement**

56. ASEAN nations have pledged different GHG emissions reduction targets under the Paris Agreement:
- **Indonesia:** To cut emissions by 29% (unconditional) to 41% (conditional) by 2030 compared to a business as usual (BAU) scenario in 2010. The upper end of the range is conditional on international aid and co-operation.
  - **Malaysia:** To reduce GHG emissions intensity by 35% (unconditional) to 45% (conditional) by 2030 compared to 2005 levels.
  - **Thailand:** To reduce GHG emissions by 20% (unconditional) and up to 25% (conditional) by 2030 compared to a BAU scenario.

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<sup>15</sup> See [www.mewr.gov.sg/about-us](http://www.mewr.gov.sg/about-us), 7 July 2020.

- **Philippines:** To reduce GHG emissions by 70% by 2030 compared to a BAU scenario over 2000-2030.
- **Vietnam:** To reduce GHG emissions by 8% (unconditional) and up to 25% (conditional) by 2030 compared to a BAU scenario.
- **Cambodia:** To reduce GHG emissions by 27% (conditional) by 2030 compared to a BAU scenario.
- **Laos, Myanmar, Brunei:** No GHG emissions targets.

57. A number of the ASEAN countries identified various activities to achieve their commitments. For instance:

<b>Indonesia</b>	<p>Increase energy efficiency by 1% annually until 2025</p> <p>Increase renewable energy to 23% of its power source by 2025 and 31% by 2030</p> <p>Oil to be less than 25% of its power source by 2025 and less than 20% by 2050</p> <p>Coal to remain at a minimum of 22% in 2025 and 24% in 2050</p>
<b>Thailand</b>	<p>Reduce energy intensity by 30% by 2036 against a 2010 baseline</p> <p>Increase national forest cover to 40%</p> <p>Target 20% share of power generation from renewables</p>
<b>Vietnam</b>	<p>Increase forest cover to 45% by 2030</p>
<b>Laos</b>	<p>Increase forest cover to 70%</p> <p>Increase share of renewables to 30% of energy consumption by 2025</p> <p>Increase share of biofuels to meet 10% demand for transport fuels by 2025</p>

58. In addition, as a group, ASEAN's energy ministers have agreed to energy policy initiatives<sup>16</sup> including:

- a) Achieving a renewables target of 23% in the total primary energy supply by 2025.
- b) Reducing energy intensity by 20% in 2020 and 30% by 2025 (based on 2005 levels).
- c) Natural gas will continue to play a significant role in ASEAN's energy future.
  - i. Power generation from coal will continue to rise in the region until 2040, but ASEAN should step up on promoting clean coal technologies, including carbon capture storage and utilization technologies.

59. In the Socio-Cultural Community Blueprint 2025, ASEAN member states have also stated their vision of sustainable development, which includes the following key characteristics relevant for understanding the environmental objectives of ASEAN:

- a) "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." (*Blueprint, pg. 3*)
- b) "... protect, restore, promote sustainable use of terrestrial ecosystem sources, halt biodiversity loss and halt reserve land degradation..." (*Blueprint, pg. 10*)
- c) ".... Sustainable forest management in the context of forest fire prevention and control..." (*Blueprint, pg. 10*)
- d) ".... Protection, restoration and sustainable use of coastal and marine environment, respond and deal with risk of pollution and threats to marine ecosystems and coast environment..." (*Blueprint, pg. 11*)
- e) "... conserve, develop and sustainably manage marine wetlands, peatlands, biodiversity and land and water resources..." (*Blueprint, pg. 11*)

### **What types of activities qualify as environmentally sustainable activities?**

60. Given the above policy contexts in Singapore and ASEAN, we propose for the taxonomy to cover both green and transition activities with the following four environmental objectives:

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<sup>16</sup> Joint Ministerial Statement of the 37<sup>th</sup> ASEAN Ministers on Energy Meeting, 4 September 2019, Bangkok, Thailand.

- a) Climate change mitigation
  - b) Climate change adaptation
  - c) Protect biodiversity
  - d) Promote resource resilience
61. There are different types of economic activities which qualify as environmentally sustainable activities under the taxonomy. For an action to meet the definition of an 'environmentally sustainable economic activity', it must contribute to one or more of the four environmental objectives.
62. In addition to contributing to one of the four environmental objectives described above, in order to qualify as an environmentally sustainable economic activity under the taxonomy, the activity must not:
- a) Significantly harm any of the environmental objectives above.
  - b) Impose negative impact on communities' social and economic well-being, unless the trade-offs can be justified in the long run.
  - c) Breach local laws and regulations.
63. **Do no significant harm to any other environmental objective.** The implication is that economic activities, even when making a substantial contribution to climate change mitigation and/or adaptation, will not be eligible for the taxonomy if they cannot be performed in a way which avoids significant harm to the four stated environmental objectives.
64. **No negative impact on communities' social and economic well-being.** In the context of ASEAN, environmental objectives should also be balanced with social and economic objectives. An activity that contributes significantly to one of the listed environmental objectives but has negative impact on well-being of the communities in ASEAN would not be included in the taxonomy. Some reference standards that could be used to benchmark the social and economic impact of business activities are OECD Guidelines on Multilateral Enterprise, and the UN Guiding Principles on Business and Human Rights. As and when the ASEAN region develop their own guidelines and standards to better define social and economic well-being, these could be incorporated in the implementation of the taxonomy.
65. **Comply with local laws.** Activities supported by the taxonomy should also comply with local legislations that financial institutions are operating in and extending finance to. Minimally, in Singapore, green activities should be aligned with the Environmental

Protection and Management Act (Chapter 94A) that governs air, water, land and noise pollution controls as well as management of hazardous wastes.

### **Objective 1: Climate change mitigation**

66. Mitigating climate change requires reducing the release of GHG emissions in the atmosphere. It is a key environmental objective for Singapore and the ASEAN nations as seen in their nationally determined commitments (NDCs) under the Paris Agreement. As highlighted in the earlier part of this chapter, Singapore has committed to peaking its emissions at 65Mt CO<sub>2</sub>e by 2030, and to halving its GHG emissions from peak levels to 33Mt CO<sub>2</sub>e by 2050. The purpose of climate mitigation is to enact measures to limit the extent of climate change. An activity can be considered to have met this objective if it makes substantial contribution to:

- a) Avoid GHG emissions: These are ‘green activities’, which are already having very low or near zero emissions. More capital is required to increase their development and wider deployment.
- b) Reduce GHG emissions: These are transition activities that are currently high carbon and critical to the functioning of the economy but are in transition to less carbon intensive business models. Unlike the EU Taxonomy which excludes fossil fuels, this taxonomy contemplates including activities involving fossil fuels, albeit limited to abated natural gas. This is because ASEAN governments have highlighted that, whilst fossil fuels will remain important energy sources for the foreseeable future, companies involved in these activities need to find ways to lower the carbon intensity of their activities. They must significantly improve their performance over time, demonstrated by tracking, monitoring and disclosing CO<sub>2</sub> equivalent emissions, and their investments must not lock-in carbon intensive assets or processes for the future. They must demonstrate a pathway to approach climate objectives of the country they are operating. Abated natural gas is a relatively clean fossil fuel, as compared to oil or coal, and burning gas results in materially lower emissions of CO<sub>2</sub> (and other air pollutants) for an equivalent amount of energy produced.<sup>17</sup> It has consequently been argued that, in certain circumstances, abated gas will play a role as a transition fuel for some coal-heavy economies. We recognize that this proposed inclusion will generate substantial interest, and so we seek and welcome feedback on this point in Question 7.

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<sup>17</sup> It is recognized that there is also considerable discussion around the issue of methane leakage and natural gas, with scientific evidence growing over time. This is an issue that requires consideration and monitoring.



- c) Enable activities that facilitate low carbon performance or substantial emissions reduction.
- d) Enable activities that are engaged in transiting to cleaner energy either through the renewable power generating sources or via de-carbonization technologies:

- i. Diversify to renewable energy sources (i.e. solar, wind).

Diversification was seen a key solution for the region to keep pace with the increasing energy needs in secure and sustainable ways and remains relevant for a smooth transition from major fossil fuel use to clean energy.

- ii. Accelerate clean energy innovations (i.e. battery storage, electrification of transport, carbon capture utilization and storage).

This includes the development and deployment of carbon capture and sequestration in the fossil fuel-driven energy generation process.

## **Objective 2: Climate change adaptation**

- 67. Climate change adaptation refers to activities that substantially reduce the adverse impact of the current and expected future climate on either (i) other people, nature or assets or (ii) the economic activity itself, in each case without increasing the risk of an adverse impact on other people, nature and assets.
- 68. Adaptation responds to physical risk that are mostly location and context specific, hence, it is impossible to produce a stand-alone and exhaustive list of activities. As such, the adaptation approach is a set of guiding principles, which can be applied in any sector.
- 69. An economic activity can be considered to meet climate adaptation through the following:
  - a) **Principle 1:** The economic activity implements measures to increase own resilience. E.g. raising building heights above projected sea level rises, installing more efficient cooling facilities in anticipation of an increase in the number of warmer days.
  - b) **Principle 2:** The economic activity enables other economic activities to adapt to climate change. E.g. providers of cooling systems for buildings, sensors for flood monitoring.

- c) **Principle 3:** The economic activity does not adversely affect adaptation efforts by others. E.g. water storage solutions should not deprive others in the communities from accessing water during dry weather.

### **Objective 3: Protect Biodiversity**

- 70. Biodiversity can support efforts to reduce the negative effects of climate change. Conserved or restored habitats can remove carbon dioxide from the atmosphere, thus helping to address climate change by storing carbon.
- 71. Ecosystem restoration is not only important in terms of reducing the carbon load in the atmosphere. It is also important to protect water basins and support biodiversity, both of which are crucial for food and water security. Ecosystem-based adaptation uses biodiversity and ecosystem services in an overall adaptation strategy. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change.
- 72. Examples of ecosystem-based adaptation activities include:
  - a) Coastal defense through the maintenance and/or restoration of mangroves and other coastal wetlands against flooding and protection of natural carbon sinks.
  - b) Promote protection, restoration and sustainable use of coastal and marine environment, which provide essential ecological, economic and social services in the ASEAN region.
  - c) Enhancing sustainable forest management including afforestation, reforestation and maintenance of forest ecosystem health and vitality to increase carbon storage capacity in forest ecosystems.
  - d) Establishment of diverse agroforestry systems to cope with increased risk from changed climatic conditions.
  - e) Conservation of agrobiodiversity to provide specific gene pools for crop and livestock adaptation to climate change.

### **Objective 4: Promote Resource Resilience**

- 73. Resource resilience is to ensure the safe and secure supply of critical resources like food and water, and to overcome resource constraints by maximizing resource efficiency and closing resource loops through the circular economy and waste management.

74. Examples of activities that could contribute significantly to resource efficiency and resilience include:

- a) Management of wastes from chemicals, plastics, packaging, electronics, textiles, construction materials, food as well as from oil & gas mining
- b) Promote water pollution control measures and cross-border cooperation prioritising water-related development activities
- c) Eco-friendly consumer packaging
- d) Sustainable food and agriculture technologies to increase shelf life, reduce wastage from farm to table

**Question 7** – The workstream seeks and welcomes feedback on the inclusion of transition fuels such as natural gas in the proposed taxonomy. In particular, the workstream seeks views on whether:

- a) There are certain types of activities involving transition fuels and chemicals which should be included in the taxonomy- eg. natural gas, lower emissions shipping, aviation fuel which are blended with fossil fuels, less emissions intensive petrochemicals, and under what circumstances,
- b) Natural gas could be included as a transition fuel, on an abated basis, and only where it plays a role in materially lowering the carbon emissions of a company (e.g. as it moves away from coal / oil and towards abated natural gas),
- c) Such inclusion would necessarily need to be accompanied by clear alignment with, and trajectory towards, science-based low-carbon scenarios at a national or international level, alongside investment-specific emissions targets that are necessarily disclosed, *and / or*
- d) Abated natural gas could be included as a transition fuel, including where a company *is an existing natural gas operator and has no existing coal / oil exposure* (ie natural gas investment is not part of a transition towards a lower carbon footprint)

The workstream welcomes any other views / suggestions on this issue, including:

- e) Thoughts around the level of abatement or intensity thresholds for natural gas that may be required, *and*
- f) The degree to which Nationally Determined Contributions (NDCs) should be included in assessments of transition, or whether alternate transition goals (eg other international transition / climate guidance) would be preferable

**Question 8** – The workstream seeks specific feedback on four environmental objectives identified, namely:

- a) Climate change mitigation
- b) Climate change adaptation
- c) Protect biodiversity
- d) Promote resource resilience

**Question 9** – The workstream seeks specific feedback on the negative requirements identified, ie that an activity must not:

- a) Impose negative impact on communities' social and economic well-being in the long-term
- b) Impose negative impact on communities' social and economic well-being, unless the trade-offs can be justified in the long run
- c) Breach local laws and regulations

## Economic Sector Selection

### Objectives

75. To identify economic sectors to date that have the potential to make a substantial contribution to climate change mitigation or climate change adaptation in ASEAN. Countries include the 10 member states: Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei, Laos, Myanmar, Cambodia and Vietnam. Sectors were selected based on 2 criteria – (1) contribution to climate change, and (2) contribution to economic activity.

## Selection of Industry Classification System for the Taxonomy

### Various Industry Classification Systems

Industry classification systems		Coverage	Classification Structure	General Information
ISIC	International Standard Industrial Classification	<b>Worldwide</b>	4 levels  21 sections, 88 divisions, 238 groups, 419 classes	<ul style="list-style-type: none"> <li>Maintained by the <b>United Nations</b></li> <li>Has a <b>central</b> position among existing classifications</li> <li>Used in the data compilation of various economic, social, health and demographic statistics</li> </ul>
NACE	Statistical Classification of Economic Activities in the European Community	EU	4 levels ( <b>references ISIC rev. 4</b> )  21 sections, 88 division, 272 groups, 615 classes	<ul style="list-style-type: none"> <li>Used for the EU Taxonomy (Annex 3)</li> </ul>
NAICS	North American Industry Classification System	USA	20 industrial sectors subdivided into subsectors, industry groups and industries	<ul style="list-style-type: none"> <li>Used by the US Federal statistical agencies for gathering classifying statistical data on the US economy</li> </ul>
CSIC	China Classification National Activities	People's Republic of China	4 levels ( <b>references ISIC rev. 4</b> ), 20 industries, 97 principle activities...	<ul style="list-style-type: none"> <li>Used for national management of census, planning, tax reporting, etc.</li> </ul>
GICS	Global Industry Classification System	<b>Financial Industry</b>	11 sectors  24 industry groups, 69 industries, 159 sub-industries	<ul style="list-style-type: none"> <li>Common global classification standard by major groups involved in investing: asset managers, brokers, custodians, consultants, research teams and stock exchanges</li> </ul>

76. The taxonomy aims to define which economic activities can be considered environmentally sustainable. Over time, it intends to be as comprehensive as possible and cover all relevant parts of the economy. As such, it is first necessary to establish a sector framework.
77. The ISIC industrial classification system of economic activities is recommended as it was established by the United Nations and is largely compatible with international frameworks. It is noted that ISIC does not record greenhouse gas-emitting activities where they are not monetised. It can neither capture activities which have been avoided, nor individual behavioural choices. Nonetheless, the ISIC system has been selected as a starting point for taxonomy development as it is comprehensive in its coverage of economic sectors worldwide. There is also currently a lack of an ASEAN-specific industrial standard that is commonly adopted. Being managed by the United Nations, ISIC is better aligned with international emissions data such as CAIT, which classifies its emissions data according to IPCC sector categories.
78. In some areas, such as land-use change, the sector framework cannot fully address location and context-specific considerations, nor does it possess sufficient granularity to enable the full evaluation of compliance with environmental objectives. Hence, the existing sector frameworks used to classify economic activities can present challenges when assessing the systemic dimensions of land use, transport or energy systems. These issues should perhaps be accounted for by adding more categories after further technical screening.
79. It is also acknowledged that many financial market participants use other classification systems, in particular, the Global Industrial Classification System (GICS). Although GICS is commonly used in the financial industry, there is a lack of comprehensive GHG emission data in ASEAN countries by sector that refer to GICS, and hence GICS cannot be used directly. The Singapore Standard Industrial Classification (SSIC) system could also be used to provide a sector classification that is more aligned to Singapore's economy, however ISIC allows for better compatibility with the EU Taxonomy and possibly other taxonomies in future given its global nature. Further work can be done in the future to map the selected ISIC sectors to equivalent sectors in GICS or SSIC.

## **Sector Breakdown by GHG Emissions**

80. The table below illustrates the percentage weightage of annual GHG emissions from the ASEAN countries from various sectors. The following steps were taken in drafting this table:

81. **Data Obtained:** Using the latest available GHG emissions data provided by the World Resources Institute's CAIT tool<sup>18</sup>, aggregated GHG emissions by each sector from 2011 onwards was collated. Data for GHG emissions in year 2000 which are available up to sub-sectoral level was extracted and collated from the UNFCCC website<sup>19</sup> - this is available in the full table which can be found in Annex 1. The CAIT subsectors were then mapped to its equivalent IPCC sectors in the first and third column.
82. **Mapping CAIT to IPCC, then to ISIC:** For the information to be applicable to organisations in ASEAN, there was a need to map the sectoral data attained from CAIT to its ISIC sectors. After identifying the IPCC categories that the sectors referenced to in CAIT according to the publication by the WRI<sup>20</sup> on the sources and methods used for CAIT's GHG Emissions data, details of each IPCC sector and its subsectors were obtained from the Revised IPCC Guidelines for National Greenhouse Gas Initiatives<sup>21</sup>. This document was used as the main reference for mapping the IPCC categories to ISIC sectors (From ISIC Revision 3<sup>22</sup>). While it did directly provide some of the ISIC categories that match various IPCC categories, this information was incomplete. Hence, the rest of the mappings had to be done manually by looking at the description of each IPCC subcategory and matching it with ISIC categories that seem to align with it.
83. Note that ISIC Revision 3 was used instead of the latest Revision 4, as the Revised IPCC Guidelines for National Greenhouse Gas Initiatives document made direct reference to ISIC 3.

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<sup>18</sup> World Resources Institute's CAIT tool. <https://www.climatewatchdata.org/ghg-emissions>

<sup>19</sup> UNFCCC GHG Emissions of Non Annex 1 Countries. [https://di.unfccc.int/ghg\\_profile\\_non\\_annex1](https://di.unfccc.int/ghg_profile_non_annex1).

<sup>20</sup> World Resources Institute. (2015). CAIT Country Greenhouse Gas Emissions: Sources & Methods. Pg 16. Retrieved from: [http://cait.wri.org/docs/CAIT2.0\\_CountryGHG\\_Methods.pdf](http://cait.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf)

<sup>21</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Retrieved from: <https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ri.pdf>.

<sup>22</sup> International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3. (1989). Retrieved from: [https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC\\_Rev\\_3\\_english\\_structure.txt](https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC_Rev_3_english_structure.txt)



## GHG Emissions from sectors under CAIT

GHG Emissions	IPCC/CAIT sector and subsectors <sup>23</sup> 24	Mapped ISIC	NACE	ASEAN GHG Emissions (% Total)					
Sectors		Category <sup>25</sup>	Mapping	2011	2012	2013	2014	2015	2016
Total Emissions (in MtCO <sub>2</sub> )				3,664	3,753	3,792	4,288	4,388	3,897
Agriculture (IPCC Category 4)	4A Enteric Fermentation <sup>24:pg 11</sup> 4B Manure Management <sup>7:pg 11</sup>	<ul style="list-style-type: none"> <li>A012</li> <li>A013</li> <li>A014</li> <li>A050</li> </ul>	<ul style="list-style-type: none"> <li>A1.2</li> <li>A1.3</li> <li>A1.4</li> <li>B5</li> </ul>	13.5%	13.4%	13.1%	11.6%	11.4%	13.0%
	4C Rice Cultivation <sup>7:pg 12</sup> 4D Agricultural Soils <sup>7:pg 12</sup>	<ul style="list-style-type: none"> <li>A011</li> <li>A013</li> </ul>	<ul style="list-style-type: none"> <li>A1.1</li> <li>A1.3</li> </ul>						
	4E Prescribed Burning of Savannas <sup>7:pg 13</sup>	No direct mapping under ISIC, but can be put under ISIC categories mapped to CAIT 4A – 4D as savannah burning is both for crop	Same as ISIC						

<sup>23</sup> World Resources Institute. (2015). CAIT Country Greenhouse Gas Emissions: Sources & Methods. Pg 16. Retrieved from:

[http://cait.wri.org/docs/CAIT2.0\\_CountryGHG\\_Methods.pdf](http://cait.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf)

<sup>24</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Retrieved from: <https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ri.pdf>.

<sup>25</sup> International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3. (1989). Retrieved from: [https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC\\_Rev\\_3\\_english\\_structure.txt](https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC_Rev_3_english_structure.txt)

		and livestock growth							
	<b>4F Field Burning of Agricultural Residues</b> <sup>7: pg 13</sup>	Same as ISIC mappings for CAIT 4C and 4D (as it is related to the growing of crops)	Same as ISIC						
	<b>4G Other</b> <sup>7: pg 13</sup>	Any other emission source/ sink from agricultural activities							
Bunker Fuels  (Not considered a sector under IPCC) <sup>4:pg 21</sup>	<b>1A3ai Aviation Bunkers</b>  <b>1A3di Marine Bunkers</b>	<ul style="list-style-type: none"> <li>▪ I611</li> <li>▪ I621</li> <li>▪ I622</li> </ul>	<ul style="list-style-type: none"> <li>▪ I61.1</li> <li>▪ I62.1</li> <li>▪ I62.2, I62.3</li> </ul>	5.0%	4.9%	4.9%	4.4%	4.5%	5.5%
Industrial Processes  (IPCC Category 2)	<b>2A Mineral Products</b> <sup>26</sup>	<ul style="list-style-type: none"> <li>▪ D26</li> </ul>	<ul style="list-style-type: none"> <li>▪ D26</li> </ul>						
	<b>2B Chemical Industry</b> <sup>13</sup>	<ul style="list-style-type: none"> <li>▪ D24</li> </ul>	<ul style="list-style-type: none"> <li>▪ D24</li> </ul>						
	<b>2C Metal Production</b> <sup>27</sup>	<ul style="list-style-type: none"> <li>▪ D27</li> </ul>	<ul style="list-style-type: none"> <li>▪ D27</li> </ul>						
	<b>2D Other Production</b> <sup>14</sup>	<ul style="list-style-type: none"> <li>▪ D15</li> <li>▪ D29</li> </ul>	<ul style="list-style-type: none"> <li>▪ D15</li> <li>▪ D29</li> </ul>						
	<b>2E Production of Halocarbons and Sulphur Hexafluoride</b> <sup>8</sup>  <b>2E Consumption of Halocarbons and Sulphur Hexafluoride</b> <sup>8</sup>  (ISIC category not stated <sup>7</sup> )	<ul style="list-style-type: none"> <li>▪ D2411</li> <li>▪ D2429</li> </ul>	<ul style="list-style-type: none"> <li>▪ D24.11, D24.12, D24.13, D24.14</li> <li>▪ D24.61, D24.62,</li> </ul>						

<sup>26</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Pg 8.

<sup>27</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Pg 8 & 9

			D24.63, D24.64, D24.65, D24.66						
	<b>2G Other<sup>8</sup></b>	ISIC category not stated <sup>8</sup>	-						
Land-Use Change and Forestry  (IPCC Category 5)	<b>Total emissions and removals from forest and land use change activities<sup>8</sup></b>  <b>5A Changes In Forest And Other Woody Biomass Stocks<sup>8</sup></b>  <b>5B Forest and Grassland Conversion)</b>  <b>5C Abandonment of Managed Lands</b>  <b>5D CO<sub>2</sub> Emissions and Removals from Soil</b>  <b>5E Other</b>	<ul style="list-style-type: none"> <li>A020</li> </ul>	<ul style="list-style-type: none"> <li>A2</li> </ul>	39.9%	39.8%	38.6%	43.7%	43.3%	34.4%
Waste  (IPCC Category 6)	<b>6A Solid Waste Disposal on Land</b>  <b>6B Wastewater Handling</b>  <b>6D Other</b>	<ul style="list-style-type: none"> <li>O90</li> </ul>	<ul style="list-style-type: none"> <li>O90</li> </ul>	5.2%	4.9%	5.0%	4.6%	4.6%	5.2%
Energy (o/w) (IPCC Category 1)	<b>Divided into the subcategories below<sup>11</sup>:</b>			33.3%	33.8%	34.7%	32.3%	32.7%	37.5%
Electricity and Heat <sup>11</sup>	<b>1A1a Public plants<sup>11</sup></b>	<ul style="list-style-type: none"> <li>E40</li> </ul>	<ul style="list-style-type: none"> <li>E40</li> </ul>	13.4%	13.3%	13.8%	13.2%	13.5%	15.5%

(IPCC Category 1A1)	<b>1A Autoproducers<sup>11</sup></b>	<ul style="list-style-type: none"> <li>▪ E401</li> <li>▪ E402</li> <li>▪ D232</li> <li>▪ D233</li> </ul>	<ul style="list-style-type: none"> <li>▪ D23.2</li> <li>▪ D23.3</li> </ul>						
	<b>Other Energy Industries<sup>17</sup></b> <b>(fossil fuels)</b> <b>(IPCC 1A1b, 1A1c)</b>  <b>1A1b Petroleum Refining<sup>18</sup></b> <b>1A1c Manufacture of Solid Fuels and Other Energy Industries<sup>12</sup></b>								
Manufacturing & Construction (IPCC Category 1A2)	<b>1A2 Manufacturing Industries &amp; Construction<sup>17</sup></b>	<ul style="list-style-type: none"> <li>▪ D271</li> <li>▪ D2731</li> <li>▪ D272</li> <li>▪ D2732</li> <li>▪ D24</li> <li>▪ D21</li> <li>▪ D22</li> <li>▪ D15</li> <li>▪ D16</li> </ul> <ul style="list-style-type: none"> <li>▪ F45</li> <li>▪ Any other fuel combustion under ISIC category D (Manufacturing)</li> </ul>	<ul style="list-style-type: none"> <li>▪ D27.1, D27.2, D27.3</li> <li>▪ D27.51, D27.52</li> <li>▪ D27.4</li> <li>▪ D21</li> <li>▪ D22</li> <li>▪ D15</li> <li>▪ D16</li> </ul> <ul style="list-style-type: none"> <li>▪ F45</li> </ul>	6.2%	6.2%	6.2%	5.9%	6.2%	6.7%
Transportation <sup>18</sup>	<b><u>1A3 Transport<sup>18</sup></u></b>	<ul style="list-style-type: none"> <li>▪ I60</li> <li>▪ I61</li> </ul>	<ul style="list-style-type: none"> <li>▪ I60</li> <li>▪ I61</li> </ul>	7.7%	8.2%	8.7%	7.8%	7.5%	9.1%

(IPCC Category 1A3)	<b>1A3aii Civil Aviation (Domestic)</b> <b>1A3b Road Transportation</b> <b>1A3c Railways</b> <b>1A3d Navigation</b> <b>1A3e Other Transportation</b>	<ul style="list-style-type: none"> <li>▪ I62</li> </ul>	<ul style="list-style-type: none"> <li>▪ I62</li> </ul>							
Other Fuel Combustion <sup>18</sup> (IPCC Category 1A4, 1A5)	<b>1A4 Other Sectors (fossil fuels)<sup>18</sup></b>	<ul style="list-style-type: none"> <li>▪ Any carbon dioxide, methane or nitrous oxide emissions resulting from the combustion of fossil fuels for the following possible activities 12:</li> <li>▪ ISIC Category A</li> <li>▪ ISIC Category B</li> <li>▪ Any other fuel-burning activity not mentioned in other sections</li> </ul>	Same as description for ISIC, for: <ul style="list-style-type: none"> <li>▪ NACE Category A</li> <li>▪ and NACE Category B</li> </ul>	2.0%	2.0%	2.0%	1.8%	1.8%	2.0%	
	<b>1A5 Other (not elsewhere specified)</b>									
Fugitive Emissions <sup>18</sup> (IPCC Category 1B1, 1B2)	<b>1B2 Oil and Natural Gas<sup>18</sup></b>	Fugitive emissions from the following oil and gas activities: <ul style="list-style-type: none"> <li>▪ C11</li> <li>▪ D232</li> </ul>	<ul style="list-style-type: none"> <li>▪ C11</li> <li>▪ D23.2</li> </ul>	2.6%	2.6%	2.6%	2.3%	2.3%	2.5%	
Building (Absent in CAIT document <sup>28</sup> )	<b>1A4a Commercial/ Institutional</b> (All activities included in ISIC 4103, 42, 6, 719, 72, 8, 91-96) <sup>29</sup>	ISIC 4103, 42, 6, 719, 72, 8, 94, 96 mentioned in Revised IPCC Guidelines document <sup>30</sup> cannot be	-	1.4%	1.4%	1.4%	1.2%	1.2%	1.4%	

<sup>28</sup> World Resources Institute. (2015). CAIT Country Greenhouse Gas Emissions: Sources & Methods. Pg 16.

<sup>29</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Pg 6

		<p>found</p> <ul style="list-style-type: none"> <li>▪ K72</li> <li>▪ O91</li> <li>▪ O92</li> <li>▪ O93</li> <li>▪ P95</li> </ul>								
	<p><b>1A4b Residential</b></p> <p>(Activities included in ISIC 5, 11, 12, 1302)<sup>14</sup></p>	<p>ISIC 1302 mentioned in Revised IPCC Guidelines document<sup>31</sup> cannot be found</p> <ul style="list-style-type: none"> <li>▪ M05</li> <li>▪ C11</li> <li>▪ C12</li> </ul> <p>***The above ISIC categories didn't seem to be a good match</p>								

<sup>30</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Pg 6

<sup>31</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Pg 6

84. Based on the above table of GHG data, it can be concluded that the sectors with the largest GHG emissions as of 2016 are:
- a) Land-Use Change and Forestry (34.4%)
  - b) Electricity/Heat (15.5%)
  - c) Agriculture (13.0%)
  - d) Transportation (9.1%)
  - e) Manufacturing/Construction (6.7%)
85. We also note the following points from both the above table as well as GHG emissions data from the individual countries<sup>32</sup>:
- a) Overall GHG emissions slowly increasing, except for spike in 2014 and 2015 due to forest fires and haze
  - b) Land-Use Change and Forestry GHG emissions decreasing sharply after spike in 2014 and 2015 due to forest fires
  - c) GHG emissions from transportation showing an increasing trend across ASEAN
  - d) Land-Use Change and Forestry is especially important for Indonesia, contributing >60% in 2016
  - e) Bunker Fuels contribute >70% GHG emissions for Singapore in 2016

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<sup>32</sup> See Annex 2 for GHG emission data for individual countries

## Sector Breakdown by Economic Activity

86. After identifying the sectors that contribute to GHG emissions in the ASEAN region, we perform a cross check on the largest sectors / economic activities in ASEAN. The table below illustrates the % share contributed to economic activity of the ASEAN countries from various sectors, sorted by descending order of share of economic activity. The following steps were taken in drafting this table.
87. **Data Obtained:** The latest available data (2017) was obtained from the Asian Development Bank's (ADB) Multiregional Input-Output Database, which contains 35 sectors, and details the economic value add by demand contributed by each sector. The economic value add contributed by each sector was then weighted according to each country's economic activity, and aggregated across the ASEAN region to give the final share of ASEAN economic activity for each sector.
88. **Mapping to ISIC:** Like the table on GHG emissions, there was a need to map the sectors used in the ADB Multiregional Input-Output database to the ISIC sectors. Since the sector aggregation in the ADB Multiregional Input-Output database is based exactly on the World Input-Output Database (WIOD)<sup>33</sup>, we first obtained a mapping table of the 35 sectors to NACE Rev 1 provided by the WIOD<sup>34</sup>. We then use a correspondence table mapping the NACE Rev 1 classification to ISIC 3 available on the Eurostat website to obtain the ISIC 3 classifications. Although the ISIC 3 has 4 levels, only the first 2 levels of ISIC 3 are used in this mapping.

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<sup>33</sup> ADB Multi-Region Input-Output Database: Sources and Methods. Pg 2.

<sup>34</sup> Appendix Table 2 of the World Input-Output Database (WIOD): Contents, Sources and Methods. Pg 70.



### Share of Economic Activity by Sector (2017)

Code	Sector Name	NACE	Mapping to ISIC 3		Share of ASEAN
		Rev 1	Section	Division	Economic Activity 2017 (in %)
c18	Construction	F	F		14.0
c3	Food, beverages, and tobacco	15t16	D	15/16	11.9
c22	Hotels and restaurants	H	H		7.0
c20	Wholesale trade and commission trade, except of motor vehicles and motorcycles	51	G	51	6.5
c31	Public administration and defense; compulsory social security	L	L		6.1
c32	Education	M	M		4.6
c1	Agriculture, hunting, forestry, and fishing	AtB	A/B		4.0
c14	Electrical and optical equipment	30t33	D	30/31/32/33	3.9
Code	Sector Name	NACE	Mapping to ISIC 3		Share of ASEAN
		Rev 1	Section	Division	Economic Activity 2017 (in %)
c15	Transport equipment	34t35	D	34/35	3.8
c28	Financial intermediation	J	J		3.6
c21	Retail trade, except of motor vehicles and motorcycles; repair of household goods	52	G	52	3.5
c33	Health and social work	N	N		2.8
c30	Renting of M&Eq and other business activities	71t74	K	71/72/73/74	2.7

c34	Other community, social, and personal services	O	O		2.7
c29	Real estate activities	70	K	70	2.5
c27	Post and telecommunications	64	I	64	2.4
c4	Textiles and textile products	17t18	D	17/18	1.9
c23	Inland transport	60	I	60	1.8
c2	Mining and quarrying	C	C		1.7
c25	Air transport	62	I	62	1.4
c8	Coke, refined petroleum, and nuclear fuel	23	D	23	1.4
c9	Chemicals and chemical products	24	D	24	1.3
c10	Rubber and plastics	25	D	25	1.2
c16	Manufacturing, nec; recycling	36t37	D	36/37	1.1
c12	Basic metals and fabricated metal	27t28	D	27/28	1.1
c19	Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel	50	G	50	1.0
c5	Leather, leather products, and footwear	19	D	19	0.8
c13	Machinery, nec	29	D	29	0.7
c24	Water transport	61	I	61	0.6
c17	Electricity, gas, and water supply	E	E		0.6
c26	Other supporting and auxiliary transport activities; activities of travel agencies	63	I	63	0.6
c6	Wood and products of wood and cork	20	D	20	0.3
c7	Pulp, paper, paper products, printing, and publishing	21t22	D	21/22	0.3
c11	Other nonmetallic minerals	26	D	26	0.2
c35	Private households with employed persons	P	P		0.0

**Source: ADB Multiregional Input-Output Database (2017)**

## **Finalized List of Proposed Sectors**

89. Based on the data and information provided above, we derived the finalized list of sectors, along with a short write up of our rationale. These sectors cover the majority of the GHG emissions across ASEAN, and also play an important role in economic activity, representing 90% of GHG emissions across the ASEAN region, and more than 40% of economic activities. The sectors selected consist of both sectors considered green as well as sectors that are in the process of transition. A grading/rating of the level of sustainability for each chosen sector or sub-sector could be developed in the future in order to better guide users.<sup>35</sup>

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<sup>35</sup> Note that the tourism sector may be evaluated for inclusion in phase 2.

Sectors Chosen	ISIC 3 Mapping	NACE Rev 1 Mapping	Share of GHG Emissions (2016)	Share of Economic Activity (2017)	Comments/Remarks
Agriculture and Forestry/Land Use	A, B	A, B	47.4%	4.0%	<ul style="list-style-type: none"> <li>• Largest contributor to ASEAN GHG Emissions</li> <li>• 7th largest contributor to economic activity</li> </ul>
Construction/Real Estate	F, K60	F, K60	8.1%	16.5% <sup>36</sup>	<ul style="list-style-type: none"> <li>• Largest economic sector across ASEAN</li> <li>• GHG emissions data for construction includes manufacturing and buildings</li> </ul>
Transportation and Fuel	I60, I61, I62	I60, I61, I62	14.6%	3.8% <sup>37</sup>	<ul style="list-style-type: none"> <li>• Aviation/Marine fuels contribute &gt;70% of GHG emissions in Singapore</li> <li>• Transportation and fuel combined is 3rd largest contributor to GHG emissions in ASEAN, and shows an increasing trend</li> </ul>
Energy, including upstream	D232, D233, E401, E402	D23.2, D23.3, E40.1, E40.2	15.5%	2.0% <sup>38</sup>	<ul style="list-style-type: none"> <li>• Electricity and Heat is the 2nd largest contributor to GHG emissions in ASEAN</li> <li>• Inclusive of renewable energy, however lack of specific ISIC subsectors</li> <li>• Economic activity data includes water supply and production of coal used in smelting</li> </ul>
Industrial	D15, D24, D26, D27, D29	D15, D24, D26, D27, D29	4.4%	15.1% <sup>39</sup>	<ul style="list-style-type: none"> <li>• Significant contribution to economic activity</li> <li>• GHG emissions data refer to industrial processes</li> </ul>

<sup>36</sup> Sum of c18 and c29

<sup>37</sup> Sum of c23, c24, and c25

<sup>38</sup> Sum of c8 and c17

<sup>39</sup> Sum of c3, c9, c11, c12, and c13

Total			90.0%	41.4%	
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90. In addition, we have included some sectors that we believe to be important to climate change mitigation and adaptation, although the quantitative screening conducted with GHG emission and economic data did not highlight these sectors. Such sectors are either enablers or sectors that provide goods and services that allow climate change mitigation. The table below details the sectors we would like to highlight, the ISIC and NACE mappings, as well as our rationale and remarks.

Sectors Chosen	ISIC 3 Mapping	NACE Rev 1 Mapping	Share of GHG Emissions (2016)	Share of Economic Activity (2017)	Comments/Remarks
Information and Communications Technology	I642	I64.2	-	-	<ul style="list-style-type: none"> <li>ICT sector is critical in mitigation of environmental risks and climate change through dissemination of information, monitoring of environment, education and raising awareness, improving efficiency and reducing waste</li> <li>Note: ISIC and NACE mapping are incomplete, only represents telecommunications</li> </ul>
Waste/Circular Economy	O90	O90	5.2%	-	<ul style="list-style-type: none"> <li>5.2% represents share of GHG emissions only from waste management</li> <li>Transition to a circular economy is highly important for climate change mitigation</li> <li>Note: ISIC and NACE mappings represent waste management, however circular economy involves every part of the economy</li> </ul>
Carbon Capture and Sequestration	-	-	-	-	<ul style="list-style-type: none"> <li>No direct mapping available</li> <li>These activities can help reduce CO<sub>2</sub> emissions by capturing, storing, or sequestering.</li> <li>The impact of these activities cuts across all sectors, impacting carbon levels across the entire economy, and are hence presented here as a standalone sector</li> <li>Referenced from the EU Taxonomy (Annex 3)</li> </ul>



91. Based on the above, here we present the ISIC sub-sectors (Class or Group) mapped to the sectors chosen above, including a brief description of the activities belonging to the sub-sectors. Do note that this is not a complete list of sub-sectors that should be considered under the chosen sectors, and represents only the sub-sectors that can be readily mapped from ISIC 3. This provides us a base to work from, and more work needs to be done to properly define the sub-sectors.

Sectors Chosen	ISIC Sub-Sectors	Description
Agriculture and Forestry/Land Use	A 0111	Growing of cereals and other crops n.e.c.
	A 0112	Growing of vegetables, horticultural specialties and nursery products
	A 0113	Growing of fruit, nuts, beverage and spice crops
	A 0121	Farming of cattle, sheep, goats, horses, asses, mules and hinnies; dairy farming
	A 0122	Other animal farming; production of animal products n.e.c.
	A 0130	Growing of crops combined with farming of animals (mixed farming)
	A 0140	Agricultural and animal husbandry service activities, except veterinary activities
	A 0150	Hunting, trapping and game propagation including related service activities
	A 0200	Forestry, logging and related service activities
	B 0500	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
Construction/Real Estate	F 4510	Site preparation
	F 4520	Building of complete constructions or parts thereof; civil engineering
	F 4530	Building installation
	F 4540	Building completion
	F 4550	Renting of construction or demolition equipment with operator
	K 7010	Real estate activities with own or leased property
	K 7020	Real estate activities on a fee or contract basis
Transportation and Fuel	I 6010	Transport via railways
	I 6021	Other scheduled passenger land transport

	I	6022	Other non-scheduled passenger land transport
	I	6023	Freight transport by road
	I	6030	Transport via pipelines
	I	6110	Sea and coastal water transport
	I	6120	Inland water transport
	I	6210	Scheduled air transport
	I	6220	Non-scheduled air transport
Energy, including upstream	D	2320	Manufacture of refined petroleum products
	D	2330	Processing of nuclear fuel
	E	4010	Production, collection and distribution of electricity
	E	4020	Manufacture of gas; distribution of gaseous fuels through mains
Sectors Chosen	ISIC Sub-Sectors		Description
Industrial	D	151	Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats
	D	152	Manufacture of dairy products
	D	153	Manufacture of grain mill products, starches and starch products, and prepared animal feeds
	D	154	Manufacture of other food products
	D	155	Manufacture of beverages
	D	241	Manufacture of basic chemicals
	D	242	Manufacture of other chemical products
	D	243	Manufacture of man-made fibres
	D	261	Manufacture of glass and glass products

	D	269	Manufacture of non-metallic mineral products n.e.c.
	D	271	Manufacture of basic iron and steel
	D	272	Manufacture of basic precious and non-ferrous metals
	D	273	Casting of metals
	D	291	Manufacture of general purpose machinery
	D	292	Manufacture of special purpose machinery
	D	293	Manufacture of domestic appliances n.e.c.
Information and Communications Technology	I	6420	Telecommunications
Waste/Circular Economy	O	9000	Sewage and refuse disposal, sanitation and similar activities
Carbon Capture and Sequestration	-	-	-

92. Similarly, we provide a table showing the NACE Rev 1 sub-sectors that can be mapped to the sectors chosen previously in the appendix.

**Question 10** – The workstream seeks feedback on the process for identifying sectors, as well as the sectors identified.

## Approach to High-level Classification of Environmental Activities' Green Contribution

93. A robust and transparent approach to the classification of economic activities' green contribution includes both:
- a) An entity's performance on set of activity specific numeric metrics (e.g. carbon emissions per unit of electricity generated for the power sector); and
  - b) Consideration of negative externalities to ensure that a 'green' business also 'does no significant harm' as set out in the environmental objective segment (e.g. environmental damage associated with the development of a hydropower project).
94. These two building blocks can help facilitate direct comparison between entities, green financial products and could contribute to convergence of international standards. However, this approach to classification of economic activities may be dependent on:
- a) Determining activity specific metrics to evaluate performance;
  - b) Establishing appropriate thresholds for these metrics above or below which an activity is considered green;
  - c) Setting criteria and objectives to underpin the 'do no significant harm' requirement that are appropriate for Singapore and ASEAN; and
  - d) High quality, consistent and comparable disclosure of the required metrics by issuers.
95. The current level of data availability in ASEAN (and Asia Pacific more broadly) makes the adoption of a classification system that relies on activity specific numeric metrics challenging. This introduces the need for a phased approach.

**Question 11** – The workstream seeks feedback on this proposed approach.

### Adopting a 'traffic light system' as an intermediate step

96. As the taxonomy will be developed in phases, in this first phase a traffic light system is proposed as a broad conceptual framework to differentiate green, yellow, and red groups of activities within the focus sectors defined in section III. This would enable the taxonomy to:

- a) balance near-term implementation with the long-term objective of a robust, transparent, and, where appropriate, globally harmonized approach, based on current availability of corporate- and/or asset-level data
- b) define a bucket of transition (yellow) activities for which to develop more granular thresholds and requirements in the next phase.

97. This could potentially be established by a three-step process:

- a) **Identify the ‘end state’** to achieve such as activity based classifications using hard data on a set of activity specific metrics to determine eligibility as outlined above. This approach would be consistent with the building blocks of the EU Taxonomy and help facilitate transparency and comparability.
- b) **Adopt a ‘traffic light classification system’** as a broad conceptual framework by grouping activities by characteristics into 3 different classifications:
  - **Green** – This category includes activities / companies clearly aligned with the objectives of the green taxonomy (i.e. mitigation/adaptation/biodiversity/resource resilience), or undertaking a transition consistent with emissions-reduction pathways aligned with meeting the objectives of the taxonomy.
  - **Yellow** – This category includes activities / companies with quantifiable and time-bound pathways towards either green (if the technology exists), or significant de-carbonization that will contribute to the objectives of the Taxonomy (e.g. steel, cement for which no feasible alternative technologies currently exist). Activities / companies in this classification are not yet undertaking a transition consistent with emissions-reduction pathways aligned with meeting the objectives of the taxonomy.
  - **Red** – This category includes activities / companies that are inconsistent with the objectives of the taxonomy. This may include: a) activities / companies that are carbon intensive and where viable alternatives exist (i.e. coal-fired power generation, thermal coal mining); and b) activities / companies that fail to meet the criterion of ‘do no significant harm’ (i.e. agricultural commodity businesses that do not meet NDPE commitments).
- c) **Establish more granular criteria and a timeline for transition.** To ensure that yellow (transition) activities/companies are contributing to the environmental objectives of the taxonomy, more granular criteria for activities and industries should be developed in the next phase. The criteria should have time bound and quantifiable elements that demonstrate convergence towards a well below 2



degrees emissions pathway, taking into account availability of alternative technologies.

98. Three examples of how the traffic-light system could be applied are set out below. Note that the activities highlighted are drawn from section III of the document.

- a) A power generation company in ASEAN with significant coal-fired power generation assets seeks to raise capital to fund the transition towards lower carbon power generation. Under the 'traffic light classification system' the company's activities are reviewed and determined to be on an emissions-reduction pathway that is not aligned with meeting the objectives of the taxonomy. Therefore the company is not eligible for classification as 'green'.
- b) An auto-manufacturer's primary production is internal combustion engine vehicles, and tail-pipe emissions for the fleet are currently relatively high compared to both peers and the current level required to meet a 2 degree transition pathway. However, the company has committed to transitioning 100% of production to electric vehicles by 2030. Under the 'traffic light classification system' the company's activities are considered to be in transition, and meeting the requirements of a 'yellow' classification.

99. The use of third party opinion providers, certification and industry body memberships can be considered in this process and their findings and ratings may be relevant for the traffic light grading in some sectors.

100. In summary, this approach is a blend of the NDRC's Green Industry Catalogue and the EU Taxonomy's specific classification system – with the ultimate aim of transitioning towards a specific system more closely aligned with the metrics used in the EU Taxonomy, but with thresholds and criteria set at levels appropriate for ASEAN.

**Question 12** – The workstream seeks feedback on the use of a traffic-light system, including suggestions for expansion and granularity in any subsequent taxonomy.

### **International convergence and the choice of metrics vs. thresholds**

101. The work done by the European Commission's Technical Expert Group for the EU Taxonomy could be leveraged to help identify activity specific metrics for the classification of economic activities in Singapore and ASEAN.

102. To be clear, we see an important distinction between the selection of metrics (which could be consistent globally) and the selection of appropriate thresholds for these metrics (which could be based on the same science based targets, but set with regard to different regions). For example, the CO2 emissions per unit of energy generated is a metric that can be used globally to evaluate the carbon efficiency of power generation. However, the same climate change scenario may include different thresholds for different regions. The IEA's Sustainable Development Scenario, which sets out a pathway to limit warming to well below 2 degrees, includes a target for global emissions intensity of 327g/kwh by 2025 - but includes different thresholds for different regions which take into account the regional base-line (i.e. current carbon intensity and pathway to transition).
103. It will be necessary to establish regional or country level thresholds for each metric that use science based targets – to aid comparability with the EU Taxonomy we should adopt IPCC 1.5 and IEA 2018 report targets for determining sector appropriate climate mitigation thresholds. Under the same climate change scenario, we could take a global position based on science or the transition pathway could be different for different countries that will difficult harmonization yet, possible under a common framework– it is critical to reflect this in the methodology to aid implementation and transition. For environmental areas such as biodiversity and water, local objectives and circumstances might influence threshold selection.
104. Criteria and objectives that underpin the ‘do no significant harm’ component of the taxonomy will need to be translated into local regulation and/or evaluated with respect to international standards. This could be achieved by creating an ‘equivalence table’ to help map the regulations in the EU to regulation in different regions in ASEAN that could be used as a reference point to determine the criteria of the ‘do no significant harm’ requirement.

**Question 13** – The workstream seeks feedback on this proposed approach.

### **Classification of transition, enabling technology or circular economy businesses**

105. The treatment of transitioning sectors or businesses that enable transition will be a critical component of the classification system in ASEAN. This is an important issue given the need to support transition in the region, but needs to be balanced by not diluting the thresholds of the classification system to allow a wide range of potentially questionable activities to be classified as ‘green’.

## External Standards & Verification

### Industry Standards

106. To achieve the **Do No Significant Harm (DNSH)** performance principle, there is a fundamental need for baseline performance, particularly with respect to the management of environmental and social risks. Such risks may be relevant to the enterprise's own operations, its supply chain and other business relationships – where failure to effectively manage these risks effectively may lead to adverse impacts on people, the environment, or assets, including legal, financial and reputational risks for related parties.
107. To support achievement of the DNSH performance principle, we recognise the value of defining and complying with **Minimum Safeguards**, such as the standards embedded in the OECD Guidelines on Multinational Enterprises (MNEs), and the UN Guiding Principles on Business and Human Rights, with specific reference to the ILO Core Labour Conventions. These guidelines and principles recommend standards of responsible business conduct, consistent with applicable laws and internationally recognised standards.
108. In addition to the Minimum Safeguards, we recognise the benefits of using **internationally recognised standards and certifications**, and the role they play in defining industry specific risk controls and good practices. While in most cases these industry standards are complementary to the DNSH principle and Minimum Safeguards, they can help to provide a structured, internationally consistent, and verifiable means of industry certification, acting as a 'vehicle' to help demonstrate achievement of the DNSH principle and Minimum Safeguards.
109. Accordingly, this section provides reference to example international standards and certifications we have identified which may support enterprises' transition toward achievement of the stated objectives. This is not an exhaustive list but aims to highlight the highest environmental and social performance standards in the market for those sectors identified as being most relevant to Singapore and the ASEAN region. We also recognise that locally relevant standards may reasonably be applied when considering either substantial contribution to an objective, or DNSH performance. In such circumstances, the enterprise should demonstrate that local or national standards / schemes are equivalent to, or materially aligned with internationally recognised standards.
110. The key **benefits** of using international standards include improved access to global markets, where international standards are well known and understood, enhancing information and exchange between enterprises, their customers and market

participants. Independent verification by approved auditors provides assurance and confidence that market participants can rely upon for decision making, particularly where detailed due diligence on an underlying enterprise may be difficult to complete. For certain products there is strong customer demand for compliance with specific industry standards, and certification may attract a market premium since this demonstrates strong environmental and social performance for production of the underlying good or service. This is consistent with ever increasing expectations by governments, civil society and the community more broadly, with a strong focus on sustainable production.

111. While there are numerous benefits to an enterprise aligning with international standards, we do acknowledge that such processes are not without their **limitations**. Certain standards may be criticised over their effectiveness and reach. Membership and verification can be expensive, which may exclude certain enterprises from participating – this is particularly relevant for smaller companies in emerging markets. While we remain thoughtful about accessibility, the benefits of using internationally recognized standards – particularly when comparing performance and alignment with other international criteria or thresholds – means they are the preferred vehicle for demonstrating environmental and social performance in a given sector.

**Table – Examples of industry standards and certifications with independent verification**

Sector Group	Sub-sector	Standard or Certification title	Relevant objectives	Independent verification?
<b>Cross-sector</b>				
Management Systems and Reporting	-	ISO 14001:2015 Environmental Management Systems	Multiple	Yes – formal audit and certification process by independent auditors.
	-	ISO 45001:2018 Occupational health and safety management systems	Multiple	Yes – formal audit and certification process by independent auditors.
	-	GHG Protocol	Multiple	No – but widely adopted international accounting tool to understand, quantify and manage greenhouse gas emissions.
<b>Macro Sectors</b>				
Agriculture, Forestry and Land Use	Agriculture – Palm Oil	Roundtable on Sustainable Palm Oil (RSPO)	Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being	Yes – formal membership and certification process by independent certification bodies approved by the RSPO.
	Agriculture – Food products, animal feed and biofuels	International Sustainability & Carbon Certification (ISCC)	Climate change mitigation Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by ISCC.
	Agriculture – Cotton	Better Cotton Initiative (BCI)	Protect biodiversity	Yes – formal membership and certification

			Resource resilience No negative impact on communities' social and economic well-being	process by independent third-party verifiers approved by the BCI.
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	Agriculture – Rubber	Forest Stewardship Council (FSC) Certified Natural Rubber	Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by Assurance Services International (ASI) for FSC.
	Agriculture – Sugar	Bonsucro Certification (Production and Chain of Custody)	Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being Comply with law	Yes – formal registration and certification process by independent certification bodies approved by Bonsucro.
	Agriculture – Coffee, Cocoa, Tea, Hazelnut	UTZ Certified	Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by UTZ (applicable to both UTZ and Rainforest Alliance certification).
	Agriculture – Food and farmed products Incl. Coffee, Cocoa, Tea	Rainforest Alliance	Climate change adaption Protect biodiversity Resource resilience No negative impact on communities' social and economic well-being	

	Agriculture – Food and farmed products Incl. Coffee, Cocoa	Fairtrade Certified	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent certification body FLOCERT for Fairtrade.
	Agriculture – Soy	Roundtable for Responsible Soy (RTRS)	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent accreditation and certification bodies, approved by RTRS.
	Forestry	Forest Stewardship Council (FSC) Forest Management Certification and Chain of Custody Certification	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being Comply with law	Yes – formal registration and certification process by independent certification bodies approved by Assurance Services International (ASI) for FSC.
	Forestry	Programme for the Endorsement of Forest Certification (PEFC)	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by PEFC.  Available in countries with PEFC-endorsed national certification systems.



	Fisheries – Capture	Marine Stewardship Council (MSC) Certification	Protect biodiversity Resource resilience Comply with law	Yes – formal registration and certification process by independent Conformity Assessment Bodies (CABs) approved by MSC.
	Fisheries – Capture	Fairtrade Fisheries Standard	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being Comply with law	Yes – formal registration and certification process by independent certification body FLOCERT for Fairtrade.

	Fisheries – Aquaculture	Aquaculture Stewardship Council (ASC) Certification	Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by Assurance Services International (ASI) for ASC.
Construction and Real Estate	Buildings – Construction and real estate	Building Research Establishment Environmental Assessment Method (BREEAM)	Climate change mitigation Climate change adaption Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent certification bodies approved by BREEAM.
	Buildings – Construction and real estate	Leadership in Energy and Environmental Design (LEED)	Climate change mitigation Climate change adaption Protect biodiversity Resource resilience No negative impact on communities’ social and economic well-being	Yes – formal registration and certification process by independent certification bodies administered by the Green Business Certification Inc. for LEED.
	Buildings – Construction and real estate	Excellence in Design for Greater Efficiencies (EDGE)	Climate change mitigation Resource resilience	Yes – formal registration and certification process by Green Business Certification Incorporated (GBCI). EDGE established by the International Finance Corporation (IFC).

Transportation and Fuel	Transport – General	Science Based Targets Initiative (SBTI) Transport Sector Guidance & Tools	Climate change mitigation Climate change adaption	No – voluntary initiative adopted by companies to reduce GHG emissions in line with Paris-aligned, science-based targets.
Energy, including upstream	Electricity production – General	Science Based Targets Initiative (SBTI) Power Sector Guidance & Tool	Climate change mitigation Climate change adaption	No – voluntary initiative adopted by companies to reduce GHG emissions in line with Paris-aligned, science-based targets.
	Electricity production – Hydropower	International Hydropower Association (IHA) Hydropower Sustainability Assessment Protocol (HSAP)	Climate change adaption Protect biodiversity No negative impact on communities’ social and economic well-being	Accredited assessor qualification managed by the IHA for auditors conducting project assessment.
	Electricity production – Nuclear power	International Atomic Energy Agency (IAEA) Safety Standards and Nuclear Security Series	No negative impact on communities’ social and economic well-being Comply with law	The IAEA Safety Standards support the implementation of binding international instruments and national safety infrastructure, typically ratified via national nuclear safety law and regulation.
Industrial	Manufacturing – Apparel and home goods	Fairtrade Certified	Resource resilience No negative impact on communities’ social and economic well-being Comply with law	Yes – formal registration and certification process by independent certification body FLOCERT for Fairtrade.

	Manufacturing – Chemicals	Responsible Care	Protect biodiversity  No negative impact on communities' social and economic well-being	Responsible Care is a voluntary initiative under which companies, through their National Associations work together to continually improve their performance – refer to national schemes recognised under the Responsible Care program.
<b>Enabling Sectors</b>				
Information and Communications Technology	-	-	Multiple	-
Waste and Circular Economy	-	-	Climate change mitigation Resource resilience	-
Carbon Capture and Sequestration	-	-	Climate change mitigation	-

## Financial Product Standards, Guidelines & Principles

112. This section provides reference to those market standards and guidelines have been identified for labelling financial products as green or sustainable. This is not an exhaustive list but aims to highlight key example standards that are currently available in the market and relevant to Singapore and ASEAN.

Table 2.1 – Examples of market standards and guidelines for green and sustainable financial products

Product Type	Standard or Guideline title
Capital Markets	ICMA Green Bond Principles (GBP)
	ICMA Social Bond Principles (SBP)
	ICMA Sustainability-Linked Bond Principles (SLBP)
	ICMA Sustainability Bond Guidelines (SBG)
	CBI Climate Bonds Standard
	ASEAN Green Bond Standards
	ASEAN Social Bond Standards
	ASEAN Sustainability Bond Standards
Lending	LMA Green Loan Principles (GLP)
	LMA Sustainability-Linked Loan Principles (SLLP)

## Role of Verifiers & Second Party Opinion Providers

113. The requirement for verification or second party opinion varies between the standards and product types. We recognise that verifiers and specialised external parties can play an important role in providing opinions and ensuring integrity in the market, and that this is particularly important in a market like Singapore and the ASEAN region, where regulation pertaining to the classification of activities as green or sustainable may not yet be developed or implemented.



## Conclusion

114. This document set out consider whether a taxonomy for Singapore-based Financial Institutions, with particular relevance to those active across ASEAN, would have merit. In doing so, the document recognised whilst there is accelerating interest in green finance, there is a very real risk that a proliferation of products, terminologies, and understandings would potentially lead to confusion in the market, potentially hindering the development of Green Finance in Singapore and broader ASEAN region. Whilst the document recognise the many risks to be aware of, and questions to be answered, it is our proposal that there is merit to progressing towards the development of a taxonomy for Singapore-based Financial Institutions, with particular relevance to those active across ASEAN.
115. By evaluating and classifying activities as “green”, based on tolerance thresholds, a taxonomy would:
  - a) establish clear criteria for determining activities as environmentally sustainable,
  - b) remove uncertainty as to whether certain activities are environmentally sustainable,
  - c) bring clarity to discussions around green and sustainable products, and
  - d) alleviate concerns on green-washing.
116. It is hoped that such a document would facilitate the sustainable growth of Green Finance in Singapore and the broader ASEAN region.

## Next steps

117. It is proposed that, following this process of feedback and consultation, a taxonomy would be produced, were there to be sufficient support for such a document. This taxonomy would:

- a) incorporate thinking from industry around identifying a base level, including the difference between green and yellow, as well as a view on transition activities,
- b) include further granularity through:
  - i. classification of activities into each bucket,
  - ii. outlining the quantitative thresholds where possible, or in the absence of it, some other qualitative reasons why these activities fall into those buckets, and
  - iii. finalizing and iterating the traffic light classification system discussed in this document.



## Annexures

## Annex 1 – Detailed mapping of CAIT to ISIC

GHG Emissions  Sectors <sup>40</sup>	Data source <sup>40</sup>	IPCC/CAIT sector and subsectors <sup>40 41</sup>	Mapped ISIC  Category <sup>42</sup>	2000  (sect or)	2000  (sub- secto r)	ASEAN GHG Emissions (% Total)					
						2011	2012	2013	2014	2015	2016
Total Emissions (in MtCO2)						3,664	3,753	3,792	4,288	4,388	3,897
Agriculture  (IPCC Category 4)	FAO <sup>40</sup>	<b>4A Enteric Fermentation</b> <sup>41:pg 11</sup>  (Methane production from herbivores as a by-product of digestive and microbial activity inside the animal’s gut)	<b>A012 Farming of animals</b>  A0121 Farming of cattle, sheep, goats, horses, asses, mules and hinnies; dairy farming  A0122 Other animal farming; production of animal products	16.0 %	2.0%	13.5 %	13.4 %	13.1 %	11.6 %	11.4 %	13.0 %
		4A1 Cattle (a. Dairy; b. Non-dairy)									
		4A2 Buffalo									
		4A3 Sheep									
		4A4 Goats									
		4A5 Camels and Llamas	<b>A013 Growing of crops combined with farming of animals (mixed farming)</b>								

<sup>40</sup> World Resources Institute. (2015). CAIT Country Greenhouse Gas Emissions: Sources & Methods. Pg 16. Retrieved from: [http://cait.wri.org/docs/CAIT2.0\\_CountryGHG\\_Methods.pdf](http://cait.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf)

<sup>41</sup> Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reporting Instructions. Retrieved from: <https://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ri.pdf>.

<sup>42</sup> International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3. (1989). Retrieved from: [https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC\\_Rev\\_3\\_english\\_structure.txt](https://unstats.un.org/unsd/classifications/Econ/Download/In%20Text/ISIC_Rev_3_english_structure.txt)

		4A6 Horses 4A7 Mules and Asses 4A9 Swine 4A10 Poultry 4A10 Other	<u><b>A014 Agricultural and animal husbandry service activities, except veterinary activities</b></u>								
		<u><b>4B Manure Management</b></u> <sup>41:pg 11</sup> <b>(Methane and nitrous oxide produced from the decomposition of manure)</b>  4B1 Cattle (a. Dairy; b. Non-dairy) 4B2 Buffalo 4B3 Sheep 4B4 Goats 4B5 Camels and Llamas 4B6 Horses 4B7 Mules and Asses 4B8 Swine 4B9 Poultry 4B10 Anaerobic 4B11 Liquid Systems 4B12 Solid Storage and Drylot	<u><b>A050 Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing</b></u>		1%						

4B13 Other									
<b>4C Rice Cultivation</b> <sup>41:pg 12</sup> <b>(Methane emitted from anaerobic decomposition of organic material in flooded rice fields)</b>  4C1 Irrigated (a. continuously flooded; intermittently flooded) 4C2 Rainfed 4C3 Deepwater (a. 50-100cm; 100am water depth) 4C Other		<b>A011 Growing of crops; market gardening; horticulture</b>  A0111 Growing of cereals and other crops  A0112 Growing of vegetables, horticultural specialties and nursery products  A0113 Growing of fruit, nuts, beverage and spice crops		6%					
<b>4D Agricultural Soils</b> <sup>41:pg 12</sup> <ul style="list-style-type: none"> <li>Emission and removal of methane/ nitrous oxides from agricultural soil</li> <li>Nitrous oxide emissions from fertilizers</li> <li>Nitrogen fixation</li> </ul>		<b>A013 Growing of crops combined with farming of animals (mixed farming)</b>		4%					
<b>4E Prescribed Burning of Savannas</b> <sup>7:pg 13</sup> <b>(Burning of savannas to control the growth of vegetation, remove pests and weeds, promote the</b>	Other Agricultural Sources <sup>40</sup>	No direct mapping under ISIC, but can be put under ISIC categories mapped to CAIT 4A – 4D as savannah burning is both for crop and livestock growth		0%					

		<p><b>nutrient cycle and to encourage the growth of new grass for animal grazing)</b></p> <ul style="list-style-type: none"><li>CH<sub>4</sub>, CO, N<sub>2</sub>O, and NO<sub>x</sub> emitted</li></ul>										
		<p><b><u>4F Field Burning of Agricultural Residues</u></b><sup>41: pg 13</sup></p> <p>4F1 Cereals</p> <p>4F2 Pulse</p> <p>4F3 Tuber and Root</p> <p>4F4 Sugar Cane</p> <p>4F5 Other</p>		<p>Same as ISIC mappings for CAIT 4C and 4D (as it is related to the growing of crops)</p>		0%						
		<p><b><u>4G Other</u></b><sup>41: pg 13</sup></p>		<p>Any other emission source/ sink from agricultural activities</p> <p>(Does this mean all the remaining sectors under ‘Agriculture’ in ISIC can be mapped here?)</p>		0%						
Bunker Fuels	IEA <sup>40</sup>	<p><b>1A3ai Aviation Bunkers</b></p> <p><b>1A3di Marine Bunkers</b></p>		<p><b><u>I611 Sea and coastal water transport</u></b></p>	-	-	5.0%	4.9%	4.9%	4.4%	4.5%	5.5%

<p>(Referred to as 'International Bunkers') in CAIT document<sup>40</sup></p> <p>(Not a sector under IPCC)<sup>41:pg 21</sup></p>		<ul style="list-style-type: none"> <li>In CAIT, emissions from Aviation and Marine Bunkers are summed into a single yearly estimate for International Bunkers<sup>41:pg 21</sup></li> <li>International Bunkers are shown as a sector, but not included in total national emissions, in accordance with IPCC Guidelines<sup>41:pg 16</sup></li> <li>Note that IEA reported transport emissions for world total includes <i>international marine bunkers</i> and <i>international aviation bunkers</i>, which are not included in <i>transport</i> at a national or regional level<sup>41:pg 16</sup></li> </ul>	<p><b><u>I621 Scheduled air transport</u></b></p> <p><b><u>I622 Non-scheduled air transport</u></b></p> <p>Note that the Bunker Fuels sector refers only to emissions released when fuel is used for international bunkers<sup>40,41:pg 4</sup></p> <p>I612 Inland water transport is excluded as being inland, it likely only refers to domestic water transport</p>									
<p>Industrial Processes (IPCC Category 2)</p> <p>While the document by the World Resources Institute<sup>6</sup> states that data under CAIT in in the</p>	<p>CDIAC (for cement)<sup>40</sup></p>	<p><b><u>2A Mineral Products</u></b><sup>41:pg 8</sup></p> <p><b>2A1 Cement production</b></p> <p>2A2 Lime Production</p> <p>2A3 Limestone and Dolomite</p> <p>2A4 Soda Ash Production and Use</p>	<p><b>Cement</b><sup>40</sup></p>	<p><b>ISIC Division 26</b><sup>41:pg8</sup></p> <p><b><u>D26 Manufacture of other non-metallic mineral products</u></b></p> <p>D261 Manufacture of glass and glass products</p> <p>269 Manufacture of non-</p>	5.1%	3.1%	3.2%	3.3%	3.6%	3.3%	3.5%	4.4%

Industrial sector only includes cement, adipic acid, etc., the IPCC Guidelines document <sup>7</sup> includes the full range of IPCC subsections		2A5 Asphalt Roofing 2A6 Road Paving with Asphalt 2A7 Other		metallic mineral products  D2691 Manufacture of non-structural non-refractory ceramic ware  D2692 Manufacture of refractory ceramic products  D2693 Manufacture of structural non-refractory clay and ceramic products  D2694 Manufacture of cement, lime and plaster  D2695 Manufacture of articles of concrete, cement and plaster  D2696 Cutting, shaping and finishing of stone  D2699 Manufacture of other non-metallic mineral products n.e.c.								
	EPA <sup>40</sup>	<b>2B Chemical Industry</b> <sup>41:pg8</sup> 2B1 Ammonia Production 2B2 Nitric Acid Production	Adipic and Nitric Acid Producti	<b>ISIC Division 24</b> <sup>41:pg8</sup>  <b>D24 Manufacture of chemicals and chemical</b>		0.7%						





			<p>D2424 Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations</p> <p>D2429 Manufacture of other chemical products</p> <p>D243 Manufacture of man-made fibres</p>		
	<p><b><u>2C Metal Production</u></b><sup>41:pg8</sup></p> <p>2C1 Iron and Steel Production</p> <p>2C2 Ferroallloys Production</p> <p>2C3 Aluminium Production</p> <p>2C4 SF6 Used in Aluminium and Magnesium Founders</p> <p>2C5 Other</p>	<p>Other Industrial Non-Agriculture<sup>40</sup></p>	<p><b>ISIC Division 27</b><sup>41:pg8</sup></p> <p><b><u>D27 Manufacture of basic metals</u></b></p> <p>D271 Manufacture of basic iron and steel</p> <p>D2710 Manufacture of basic iron and steel</p> <p>D272 Manufacture of basic precious and non-ferrous metals</p> <p>D2720 Manufacture of basic precious and non-ferrous metals</p> <p>D273 Casting of metals</p> <p>D2731 Casting of iron</p>	0.5%	

		and steel D2732 Casting of non-ferrous metals		
<b>2D Other Production</b> <sup>41:pg9</sup> 2D1 Pulp and Paper 2D2 Food and Drink		<b>ISIC Division 15 and 29</b> <sup>41:pg9</sup>  <b><u>D15 Manufacture of food products and beverages</u></b>  D151 Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats  D1511 Production, processing and preserving of meat and meat products  D1512 Processing and preserving of fish and fish products  D1513 Processing and preserving of fruit and vegetables  D1514 Manufacture of vegetable and animal oils and fats  D152 Manufacture of dairy		0.0%

		products D1520 Manufacture of dairy products D153 Manufacture of grain mill products, starches and starch products, and prepared animal feeds D1531 Manufacture of grain mill products D1532 Manufacture of starches and starch products D1533 Manufacture of prepared animal feeds D154 Manufacture of other food products D1541 Manufacture of bakery products D1542 Manufacture of sugar D1543 Manufacture of cocoa, chocolate and sugar confectionery D1544 Manufacture of macaroni, noodles, couscous and similar							
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		<p>D2924 Manufacture of machinery for mining, quarrying and construction</p> <p>D2925 Manufacture of machinery for food, beverage and tobacco processing</p> <p>D2926 Manufacture of machinery for textile, apparel and leather production</p> <p>D2927 Manufacture of weapons and ammunition</p> <p>D2929 Manufacture of other special purpose machinery</p> <p>D293 Manufacture of domestic appliances</p> <p>D2930 Manufacture of domestic appliances.</p>		
<p><b><u>2E Production of Halocarbons and Sulphur Hexafluoride</u></b><sup>41:pg9</sup></p> <p>2E1 By-Product Emissions</p>	<p>All Fluorinated Gases</p>	<p>Possibly ISIC Class 2411 or 2429<sup>41:pg9</sup></p> <p>D2411 Manufacture of</p>		0.0%

		2E2 Fugitive Emissions 2E3 Other		basic chemicals, except fertilizers and nitrogen compounds  D2429 Manufacture of other chemical products n.e.c.									
		<b><u>2E Consumption of Halocarbons and Sulphur Hexafluoride</u></b> <sup>41:pg9</sup>  2F1 Refrigeration and Air Conditioning  2F2 Foam Blowing  2F3 Fire Extinguishers  2F4 Aerosols  2F5 Solvents  2F6 Other		ISIC category not stated <sup>41:pg9</sup>		0.0%							
		<b><u>2G Other</u></b> <sup>41:pg9</sup>		ISIC category not stated <sup>41:pg9</sup>		0.0%							
Land-Use Change and Forestry  (IPCC Category 5)	FAO <sup>40</sup>	<b>Total emissions and removals from forest and land use change activities</b> <sup>41:pg14</sup>  Land Use Total (Forest land, cropland, grassland and biomass		A020 Forestry, logging and related service activities	20.2 %	(-) 20.3 %	39.9 %	39.8 %	38.6 %	43.7 %	43.3 %	34.4 %	

		burning) <sup>40</sup>  <u><b>5A Changes In Forest And Other Woody Biomass Stocks</b></u> <sup>41:pg14</sup>  <b>(Emissions and removals of CO2 from decreases or increases in biomass stocks due to forest management, logging, fuelwood collection, etc.)</b>  5A1 Tropical Forests  (a. Wet/ very moist, b. Moist, short dry season, c. Moist, long dry season, d. Dry, e. Mountain moist, f. Mountain dry, g. Plantations, h. Other)  5A2 Temperate Forests  (a. Coniferous, b. Broadleaf, c. Plantations, d. Other)  5A3 Boreal Forests .  (a. Mixed Broadleaf/Coniferous, b. Coniferous, c. Forest Tundra)  5A4 Grasslands/ Tundra  5A5 Other									
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**5B Forest and Grassland Conversion**

**(Burning and decay of biomass from the conversion of existing forests and natural grasslands to other land uses)**

## 5B1 Tropical Forests

(a. Wet/ very moist, b. Moist, short dry season, c. Moist, long dry season, d. Dry, e. Mountain moist, f. Mountain dry, g. Plantations, h. Other)

## 5B2 Temperate Forests

(a. Coniferous, b. Broadleaf, c. Plantations, d. Other)

## 5B3 Boreal Forests .

(a. Mixed Broadleaf/Coniferous, b. Coniferous, c. Forest Tundra)

## 5B4 Grasslands/ Tundra

## 5B5 Other

**5C Abandonment of Managed Lands**

**(Removal of CO<sub>2</sub> from the abandonment of formerly managed lands, e.g. croplands and pastures)**

	46.0 %
	(-) 13.2 %



**6A Solid Waste Disposal on****Land**<sup>41:pg17</sup>

Only applicable for methane gas released by soiled waste in landfills<sup>10</sup>

6A1 Managed Waste Disposal on Land

6A2 Unmanaged Waste Disposal Sites

6A3 Other

**6B Wastewater Handling**<sup>41:pg17</sup>

Methane from wastewater treatment and nitrous oxides from human sewage<sup>10</sup>

6B1 Industrial Wastewater

6B2 Domestic and Commercial Wastewater

6B3 Other

6C Waste Incineration is not listed under CAIT<sup>40</sup>

**6D Other**<sup>41:pg17</sup>

	0.4%						
	0.2%						
	7.3%						

		Applies to other non-agricultural sources of methane and nitrous oxides										
Energy (o/w) (IPCC Category 1)	IEA <sup>40</sup>	<b>Divided into the subcategories below<sup>40</sup>:</b> <ul style="list-style-type: none"><li>▪ Electricity and Heat</li><li>▪ Manufacturing and Construction</li><li>▪ Transportation</li><li>▪ Other Fuel Combustion</li><li>▪ Fugitive Emissions</li></ul>		46.8 %		33.3 %	33.8 %	34.7 %	32.3 %	32.7 %	37.5 %	
Electricity and Heat <sup>11</sup> (IPCC Category 1A1)	IEA <sup>40</sup>	<b><u>Electricity &amp; heat plants (fossil fuels)</u></b> <ul style="list-style-type: none"><li>▪ <b>1A1a Public plants<sup>40</sup></b> (electricity, heat, CHP)  <b>Public Electricity and Heat Production:</b> The sum of emissions from public electricity generation, public combined heat, power generation and public heat plants<sup>41:pg3</sup></li><li>▪ <b>1A Autoproducers<sup>40</sup></b> (electricity, heat, CHP)  Autoproducers may be in public or private ownership, and should be assigned to the sector where they were generated<sup>41:pg3</sup></li></ul>	<b><u>E40 Electricity, gas, steam and hot water supply</u></b>  <b><u>E401 Production, collection and distribution of electricity</u></b>  <b><u>E402 Manufacture of gas; distribution of gaseous fuels through mains</u></b>  <b><u>D232 Manufacture of refined petroleum products</u></b>		14.2 %	13.4 %	13.3 %	13.8 %	13.2 %	13.5 %	15.5 %	

		This contradicts the allocation of autoproducers to the electricity and heat category by CAIT <sup>40</sup>	<b>D233 Processing of nuclear fuel</b>								
		<b>Other Energy Industries<sup>40</sup></b> <b>(fossil fuels)</b> <b>(IPCC 1A1b, 1A1c)</b>  <b>1A1b Petroleum Refining<sup>41:pg3</sup></b> All combustion activities supporting the refining of petroleum products  <b>1A1c Manufacture of Solid Fuels and Other Energy Industries<sup>41:pg3</sup></b> Combustion emissions from fuel use during the manufacture of secondary and tertiary products from solid fuels including production of charcoal									
Manufacturing & Construction (IPCC Category 1A2)	IEA <sup>40</sup>	<b>1A2 Manufacturing Industries &amp; Construction<sup>40</sup></b> Emissions from combustion of fuels in industry including combustion for the generation of electricity and heat <sup>41:pg4</sup>	<b>D271 Manufacture of basic iron and steel<sup>41:pg4</sup></b>  <b>D2731 Casting of Iron and Steel</b>  <b>D272 Manufacture of basic</b>		7.2%	6.2%	6.2%	6.2%	5.9%	6.2%	6.7%



			<b>(Manufacturing)</b>								
Transportation (IPCC Category 1A3)	IEA <sup>40</sup>	<b>1A3 Transport</b> <sup>40,41:pg4</sup> Emissions from the combustion and evaporation of fuel for all transport activities <sup>41:pg4</sup>  NOTE: Excludes fuel used in international transport (international bunker fuels) <sup>41:pg4</sup>  <b>1A3aii Civil Aviation (Domestic)</b> <sup>41:pg4</sup>  <b>1A3b Road Transportation</b> All combustion and evaporative emissions arising from fuel use in road vehicles, including the use of agricultural vehicles on highways <ul style="list-style-type: none"> <li>i. Cars</li> <li>ii. Light Duty Trucks</li> <li>iii. Heavy Duty Trucks and uses</li> <li>iv. Motorcycles</li> <li>v. Evaporative Emissions from Vehicles</li> </ul>	<b>I60 Land transport; transport via pipelines</b> I601 Transport via railways I602 Other land transport <ul style="list-style-type: none"> <li>I6021 Other scheduled passenger land transport</li> <li>I6022 Other non-scheduled passenger land transport</li> <li>I6023 Freight transport by road</li> </ul> I603 Transport via pipelines  <b>I61 Water transport</b> I611 Sea and coastal water transport I6110 Sea and coastal water transport I612 Inland water transport  <b>I62 Air transport</b>		8.5%	7.7%	8.2%	8.7%	7.8%	7.5%	9.1%

		<p><b>1A3c Railways</b></p> <p>Includes emissions from both freight and passenger traffic routes</p> <p><b>1A3d Navigation</b></p> <p>Emissions from fuels used to propel water-borne vessels, including hovercraft and hydrofoils</p> <p>ii. National Navigation (Emissions from fuel used for navigation of all vessels not engaged in international transport, except fishing)</p> <p><b>1A3e Other Transportation</b></p> <p>Combustion emissions from all remaining transport activities including pipeline transportation, ground activities in airports and harbours</p> <p>i. Pipeline Transport</p> <p>ii. Off-road</p>	<p>I621 Scheduled air transport</p> <p>I622 Non-scheduled air transport</p>									
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Other Fuel Combustion  (IPCC Category 1A4, 1A5)	IEA <sup>40</sup>	<u>1A4 Other Sectors (fossil fuels)</u> <sup>41:pg6</sup>  Emission from combustion activities as described below  <div>We have made the assumption that 1A4a and 1A4b have been placed under te ‘Building’ emissions category instead (last row of this table)</div>  1A4c Agriculture/ Forestry/ Fishing <sup>41:pg6</sup> <div><div>i. Stationary</div><div>ii. Off-road Vehicles and Other Machinery</div><div>iii. Fishing</div></div>	Any carbon dioxide, methane or nitrous oxide emissions resulting from the combustion of fossil fuels for the following possible activities <sup>40</sup> :  ISIC Category A: Agriculture, hunting and forestry  ISIC Category B: Fishing  Any other fuel-burning activity not mentioned in other sections									
	EPA <sup>40</sup>	Biomass Combustion (considered under IPCC 1A5 <sup>40</sup> )  <u>1A5 Other (not elsewhere specified)</u> <sup>41:pg6</sup>  All remaining emissions from non-specified fuel combustion				2.0%	2.0%	2.0%	1.8%	1.8%	2.0%	

	EPA <sup>40</sup>	<div>1A5 Stationary and Mobile Sources<sup>40</sup></div> <div><u>1A5 Other (not elsewhere specified)</u></div> <div>41:pg6</div> <div><div>a. Stationary</div><div>b. Mobile (vehicles and other machinery, marine and aviation not included elsewhere)</div></div>									
Fugitive Emissions <sup>18</sup> (IPCC Category 1B1, 1B2)	EPA <sup>40</sup>	<div>1B2c Gas Venting/ Flaring<sup>40</sup></div> <div>1B2 Oil &amp; Natural Gas Systems</div> <div>1B1 Coal Mining</div> <div>1B1, 1B2 Other Energy Sources</div> <div><u>1B2 Oil and Natural Gas</u><sup>41:pg7</sup></div> <div>Total fugitive emissions from oil and gas activities. Fugitive emissions may arise from equipment exhaust (non-combustion), leakages, upsets and mishaps at any point in the chain from production through final use</div> <div>1B2a Oil</div> <div>Fugitive emissions from the</div>	<div>Fugitive emissions from the following oil and gas activities:</div> <div><u>C11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying</u></div> <div><u>D232 Manufacture of refined petroleum products</u></div>		3.6%	2.6%	2.6%	2.6%	2.3%	2.3%	2.5%

		<p>following activities in the oil industry:</p> <ul style="list-style-type: none"> <li>i. Exploration</li> <li>ii. Production</li> <li>iii. Transport</li> <li>iv. Refining/ Storage</li> <li>v. Distribution of Oil Products</li> <li>vi. Other</li> </ul> <p>1B2b Natural Gas</p> <ul style="list-style-type: none"> <li>i. Production/ Processing</li> <li>ii. Transmission/ Distribution</li> <li>iii. Other Leakage</li> </ul> <p>1B2c Venting and Flaring</p> <p>The release/ combustion of excess gas at facilities for the production of oil or gas and for the processing of gas</p> <ul style="list-style-type: none"> <li>i. Oil</li> <li>ii. Gas</li> <li>iii. Combined (in cases where oil and gas cannot be separated)</li> </ul>									
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Building (Absent in CAIT document <sup>40</sup> )	?	<p>Possibly:</p> <p><b><u>1A4a Commercial/ Institutional</u></b><sup>41:pg6</sup></p> <p>Emission from fuel combustion in commercial and institutional buildings</p> <p>(All activities included in ISIC 4103, 42, 6, 719, 72, 8, 91-96)</p>	<p>ISIC 4103, 42, 6, 719, 72, 8, 94, 96 mentioned in Revised IPCC Guidelines document<sup>41</sup> cannot be found</p> <p>K72 Computer and related activities</p> <p>O91 Activities of membership organizations</p> <p>O92 Recreational, cultural and sporting activities</p> <p>O93 Other service activities</p> <p>P95 Private households with employed persons</p>			1.4%	1.4%	1.4%	1.2%	1.2%	1.4%
		<p><b><u>1A4b Residential</u></b></p> <p>All emissions from fuel combustion in households</p> <p>(Activities included in ISIC 5, 11, 12, 1302)<sup>14</sup></p>	<p>ISIC 1302 mentioned in Revised IPCC Guidelines document<sup>41</sup> cannot be found</p> <p>M05 Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing</p> <p>C11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction</p>								



<b>Total Emissions in Mt</b>	<b>61</b>	<b>61</b>	<b>62</b>	<b>62</b>	<b>61</b>	<b>63</b>
Agriculture	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%
Bunker Fuels	71.4%	71.5%	71.3%	71.2%	72.6%	73.4%
Industrial Processes	4.9%	5.2%	5.4%	5.7%	5.7%	5.6%
Land-Use Change and Forestry	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Waste	1.2%	1.3%	1.3%	1.3%	1.3%	1.3%
Energy (o/w)	22.4%	22.0%	22.0%	21.8%	20.3%	19.6%
Building	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Electricity/Heat	13.1%	12.8%	12.4%	12.3%	11.2%	10.8%
Fugitive Emissions	0.3%	0.4%	0.4%	0.4%	0.4%	0.4%
Manufacturing/Construction	4.9%	4.9%	5.4%	5.4%	5.3%	5.2%
Other Fuel Combustion	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Transportation	3.5%	3.4%	3.3%	3.2%	2.9%	2.7%

<b>% of total emissions</b>	<b>Indonesia</b>	<b>Indonesia</b>	<b>Indonesia</b>	<b>Indonesia</b>	<b>Indonesia</b>	<b>Indonesia</b>
<b>Sectors</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Total Emissions in Mt</b>	<b>2,277</b>	<b>2,320</b>	<b>2,294</b>	<b>2,732</b>	<b>2,779</b>	<b>2,229</b>
Agriculture	7.6%	7.7%	7.6%	6.6%	6.6%	8.5%
Bunker Fuels	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
Industrial Processes	1.1%	1.2%	1.3%	1.1%	1.2%	1.5%

Land-Use Change and Forestry	66.4%	65.9%	65.2%	68.9%	69.2%	61.1%
Waste	5.3%	5.0%	5.2%	4.6%	4.6%	5.8%
Energy (o/w)	19.4%	20.2%	20.6%	18.7%	18.4%	23.0%
Building	0.9%	0.9%	1.0%	0.8%	0.9%	1.0%
Electricity/Heat	7.4%	7.3%	7.3%	7.1%	7.0%	9.3%
Fugitive Emissions	1.3%	1.4%	1.5%	1.2%	1.2%	1.5%
Manufacturing/Construction	3.7%	3.6%	3.5%	3.4%	3.8%	3.8%
Other Fuel Combustion	1.3%	1.3%	1.3%	1.1%	1.0%	1.4%
Transportation	4.8%	5.6%	6.0%	5.1%	4.5%	6.0%
<b>% of total emissions</b>	<b>Malaysia</b>	<b>Malaysia</b>	<b>Malaysia</b>	<b>Malaysia</b>	<b>Malaysia</b>	<b>Malaysia</b>
<b>Sectors</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Total Emissions in Mt</b>	<b>128</b>	<b>129</b>	<b>147</b>	<b>179</b>	<b>163</b>	<b>161</b>
Agriculture	9.3%	10.2%	8.4%	7.1%	7.8%	7.8%
Bunker Fuels	5.0%	4.6%	5.3%	4.4%	5.0%	4.8%
Industrial Processes	10.9%	11.4%	10.2%	8.8%	9.9%	10.4%
Land-Use Change and Forestry	-97.4%	-100.4%	-86.1%	-61.1%	-76.5%	-77.0%
Waste	12.9%	13.3%	12.0%	10.3%	11.4%	11.8%
Energy (o/w)	159.4%	161.0%	150.2%	130.5%	142.4%	142.1%
Building	3.8%	3.3%	2.9%	2.2%	2.3%	2.4%
Electricity/Heat	81.7%	80.7%	73.2%	63.6%	71.8%	70.0%

Fugitive Emissions	15.8%	15.9%	13.8%	11.4%	12.4%	12.5%
Manufacturing/Construction	21.1%	23.7%	18.7%	15.3%	16.8%	17.5%
Other Fuel Combustion	4.0%	4.3%	3.8%	3.2%	3.3%	2.5%
Transportation	33.0%	33.1%	37.6%	34.9%	35.7%	37.1%

% of total emissions	Thailand	Thailand	Thailand	Thailand	Thailand	Thailand
Sectors	2011	2012	2013	2014	2015	2016
<b>Total Emissions in Mt</b>	<b>377</b>	<b>401</b>	<b>412</b>	<b>409</b>	<b>411</b>	<b>417</b>
Agriculture	20.1%	18.9%	17.9%	16.6%	15.2%	14.7%
Bunker Fuels	3.6%	3.2%	3.3%	3.4%	3.7%	3.8%
Industrial Processes	7.5%	8.0%	9.0%	9.8%	10.7%	12.4%
Land-Use Change and Forestry	3.8%	4.2%	3.8%	4.5%	4.1%	4.6%
Waste	3.1%	3.0%	2.9%	2.9%	2.9%	2.9%
Energy (o/w)	61.9%	62.8%	63.1%	62.7%	63.4%	61.5%
Building	2.1%	2.3%	1.8%	1.6%	1.5%	1.5%
Electricity/Heat	24.9%	25.6%	27.0%	26.8%	25.9%	25.4%
Fugitive Emissions	3.1%	3.0%	3.0%	3.0%	3.1%	3.0%
Manufacturing/Construction	11.3%	11.8%	11.9%	12.0%	12.7%	11.4%
Other Fuel Combustion	5.0%	4.9%	4.9%	5.0%	5.0%	4.3%
Transportation	15.4%	15.2%	14.7%	14.3%	15.2%	16.0%



% of total emissions	Vietnam	Vietnam	Vietnam	Vietnam	Vietnam	Vietnam
Sectors	2011	2012	2013	2014	2015	2016
<b>Total Emissions in Mt</b>	<b>235</b>	<b>237</b>	<b>249</b>	<b>263</b>	<b>292</b>	<b>314</b>
Agriculture	28.1%	28.3%	28.2%	26.1%	24.3%	22.3%
Bunker Fuels	1.1%	1.0%	1.1%	1.1%	1.1%	1.6%
Industrial Processes	10.2%	9.9%	10.0%	10.0%	9.9%	10.7%
Land-Use Change and Forestry	-9.3%	-8.8%	-7.7%	-7.5%	-7.1%	-6.5%
Waste	7.7%	7.8%	7.6%	7.3%	6.7%	6.2%
Energy (o/w)	62.2%	61.7%	60.9%	63.0%	65.0%	65.8%
Building	4.5%	4.1%	4.3%	3.9%	3.6%	3.9%
Electricity/Heat	16.9%	17.3%	17.7%	20.0%	24.9%	23.1%
Fugitive Emissions	8.3%	8.4%	8.1%	7.7%	7.0%	6.3%
Manufacturing/Construction	18.1%	17.7%	17.7%	18.7%	17.3%	19.5%
Other Fuel Combustion	1.8%	1.8%	1.7%	1.6%	1.4%	1.3%
Transportation	12.7%	12.4%	11.4%	11.1%	10.9%	11.6%

% of total emissions	Philippines	Philippines	Philippines	Philippines	Philippines	Philippines
Sectors	2011	2012	2013	2014	2015	2016
<b>Total Emissions in Mt</b>	<b>103</b>	<b>108</b>	<b>120</b>	<b>128</b>	<b>137</b>	<b>149</b>
Agriculture	54.5%	52.7%	48.5%	45.9%	42.1%	38.4%

Bunker Fuels	3.6%	3.4%	3.1%	2.6%	2.6%	2.7%
Industrial Processes	8.4%	9.5%	9.4%	9.8%	10.3%	10.3%
Land-Use Change and Forestry	-56.2%	-53.7%	-48.7%	-45.7%	-42.6%	-38.9%
Waste	11.4%	11.1%	10.2%	9.8%	9.3%	8.7%
Energy (o/w)	78.3%	77.1%	77.5%	77.6%	78.3%	78.8%
Building	5.1%	4.7%	4.7%	5.0%	4.6%	5.1%
Electricity/Heat	33.5%	34.4%	36.1%	36.6%	36.9%	36.5%
Fugitive Emissions	0.9%	0.7%	0.6%	0.5%	0.4%	0.4%
Manufacturing/Construction	11.6%	10.3%	10.6%	10.6%	10.0%	10.9%
Other Fuel Combustion	5.2%	5.1%	4.7%	4.5%	4.3%	4.1%
Transportation	22.0%	21.9%	20.7%	20.3%	21.9%	21.7%

### Annex 3 – NACE Rev 1 Finalized Sectors

Sectors Chosen	NACE Sub-Sectors		Description
Agriculture and Forestry/Land Use	A	1.11	Growing of cereals and other crops n.e.c.
	A	1.12	Growing of vegetables, horticultural specialties and nursery products
	A	1.13	Growing of fruit, nuts, beverage and spice crops
	A	1.21	Farming of cattle, dairy farming
	A	1.22	Farming of sheep, goats, horses, asses, mules and hinnies
	A	1.23	Farming of swine
	A	1.24	Farming of poultry

	A	1.25	Other farming of animals
	A	1.30	Growing of crops combined with farming of animals (mixed farming)
	A	1.41	Agricultural service activities
	A	1.42	Animal husbandry service activities, except veterinary activities
	A	1.50	Hunting, trapping and game propagation, including related service activities
	B	2.01	Forestry and logging
	B	2.02	Forestry and logging related service activities
	B	5.01	Fishing
	B	5.02	Operation of fish hatcheries and fish farms
Construction/Real Estate	F	45.11	Demolition and wrecking of buildings; earth moving
	F	45.12	Test drilling and boring
	F	45.21	General construction of buildings and civil engineering works
	F	45.22	Erection of roof covering and frames
	F	45.23	Construction of highways, roads, airfields and sport facilities
	F	45.24	Construction of water projects
	F	45.25	Other construction work involving special trades
	F	45.31	Installation of electrical wiring and fittings
	F	45.32	Insulation work activities
	F	45.33	Plumbing
	F	45.34	Other building installation
	F	45.41	Plastering
	F	45.42	Joinery installation

	F	45.43	Floor and wall covering
	F	45.44	Painting and glazing
	F	45.45	Other building completion
	F	45.50	Renting of construction or demolition equipment with operator
	K	70.11	Development and selling of real estate
	K	70.12	Buying and selling of own real estate
	K	70.20	Letting of own property
	K	70.31	Real estate agencies
	K	70.32	Management of real estate on a fee or contract basis
Sectors Chosen	NACE Sub-Sectors		Description
Transportation and Fuel	I	60.10	Transport via railways
	I	60.21	Other scheduled passenger land transport
	I	60.22	Taxi operation
	I	60.23	Other land passenger transport
	I	60.24	Freight transport by road
	I	60.30	Transport via pipelines
	I	61.10	Sea and coastal water transport
	I	61.20	Inland water transport
	I	62.10	Scheduled air transport
	I	62.20	Non-scheduled air transport
	I	62.30	Space transport
Energy, including upstream	D	23.20	Manufacture of refined petroleum products

	D	23.30	Processing of nuclear fuel
	E	40.10	Production and distribution of electricity
	E	40.20	Manufacture of gas; distribution of gaseous fuels through mains
Industrial	D	15.1	Production, processing and preserving of meat and meat products
	D	15.2	Processing and preserving of fish and fish products
	D	15.3	Processing and preserving of fruit and vegetables
	D	15.4	Manufacture of vegetable and animal oils and fats
	D	15.5	Manufacture of dairy products
	D	15.6	Manufacture of grain mill products, starches and starch products
	D	15.7	Manufacture of prepared animal feeds
	D	15.8	Manufacture of other food products
	D	15.9	Manufacture of beverages
	D	24.1	Manufacture of basic chemicals
	D	24.2	Manufacture of pesticides and other agro-chemical products
	D	24.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
	D	24.4	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
	D	24.5	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
	D	24.6	Manufacture of other chemical products
	D	24.7	Manufacture of man-made fibres
	D	26.1	Manufacture of glass and glass products
	D	26.2	Manufacture of non-refractory ceramic goods other than for construction purposes;

	D 26.3	manufacture of refractory ceramic products
	D 26.4	Manufacture of ceramic tiles and flags
		Manufacture of bricks, tiles and construction products, in baked clay
<b>Sectors Chosen</b>	<b>NACE Sub-Sectors</b>	<b>Description</b>
Industrial	D 26.5	Manufacture of cement, lime and plaster
	D 26.6	Manufacture of articles of concrete, plaster and cement
	D 26.7	Cutting, shaping and finishing of stone
	D 26.8	Manufacture of other non-metallic mineral products
	D 27.1	Manufacture of basic iron and steel and of ferro-alloys
	D 27.2	Manufacture of tubes
	D 27.3	Other first processing of iron and steel and production of non-ECSC26 ferro-alloys
	D 27.4	Manufacture of basic precious and non-ferrous metals
	D 27.5	Casting of metals
	D 29.1	Manufacture of machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines
	D 29.2	Manufacture of other general purpose machinery
	D 29.3	Manufacture of agricultural and forestry machinery
	D 29.4	Manufacture of machine-tools
	D 29.5	Manufacture of other special purpose machinery
	D 29.6	Manufacture of weapons and ammunition
	D 29.7	Manufacture of domestic appliances n.e.c.
Information and Communications Technology	I 64.20	Telecommunications

Waste/Circular Economy	O	90.00	Sewage and refuse disposal, sanitation and similar activities
Carbon Capture and Sequestration	-	-	-

## Annex 4 – EU Taxonomy Sectors





## Detailed list of the 67 activities reviewed by the TEG

 <b>Agriculture and Forestry</b>	 <b>Electricity, gas, steam and air conditioning supply</b>	 <b>Water, Waste and Sewerage remediation</b>	 <b>Transport</b>
<ul style="list-style-type: none"> <li>Growing of perennial crops</li> <li>Growing of non-perennial crops</li> <li>Livestock production</li> <li>Afforestation</li> <li>Rehabilitation, Restoration</li> <li>Reforestation</li> <li>Existing forest management</li> </ul>	<ul style="list-style-type: none"> <li>Production of Electricity from Solar PV</li> <li>Production of Electricity from Concentrated Solar Power</li> <li>Production of Electricity from Wind Power</li> <li>Production of Electricity from Ocean Energy</li> <li>Production of Electricity from Hydropower</li> <li>Production of Electricity from Geothermal</li> <li>Production of Electricity from Gas Combustion</li> <li>Production of Electricity from Bioenergy</li> <li>Transmission and Distribution of Electricity</li> <li>Storage of Energy</li> <li>Manufacture of Biomass, Biogas or Biofuels</li> <li>Retrofit of Gas Transmission and Distribution Networks</li> </ul>	<ul style="list-style-type: none"> <li>Water collection, treatment and supply</li> <li>Centralized wastewater treatment systems</li> <li>Anaerobic digestion of sewage sludge</li> <li>Separate collection and transport of non-hazardous waste in source segregated fractions</li> <li>Anaerobic digestion of bio-waste</li> <li>Composting of bio-waste</li> <li>Material recovery from waste</li> <li>Landfill gas capture and energetic utilization</li> <li>Direct Air Capture of CO<sub>2</sub></li> <li>Capture of anthropogenic emissions</li> <li>Transport of CO<sub>2</sub></li> <li>Permanent Sequestration of captured CO<sub>2</sub></li> </ul>	<ul style="list-style-type: none"> <li>Passenger Rail Transport (Interurban)</li> <li>Freight Rail Transport</li> <li>Public transport</li> <li>Infrastructure for low carbon transport</li> <li>Passenger cars and commercial vehicles</li> <li>Freight transport services by road</li> <li>Interurban scheduled road transport</li> <li>Inland passenger water transport</li> <li>Inland freight water transport</li> <li>Construction of water projects</li> </ul>
 <b>Manufacturing</b>		 <b>Information and Communication Technologies (ICT)</b>	 <b>Buildings</b>
<ul style="list-style-type: none"> <li>Manufacturing of low carbon technologies</li> <li>Manufacture of Cement</li> <li>Manufacture of Aluminium</li> <li>Manufacture of Iron and Steel</li> <li>Manufacture of hydrogen</li> <li>Manufacture of other inorganic basic chemicals</li> <li>Manufacture of other organic basic chemicals</li> <li>Manufacture of fertilizers and nitrogen compounds</li> <li>Manufacture of plastics in primary form</li> </ul>	<ul style="list-style-type: none"> <li>District Heating/Cooling distribution</li> <li>Installation and operation of Electric Heat Pumps</li> <li>Cogeneration of Heat/Cool and power from Concentrated Solar Power</li> <li>Cogeneration of Heat/Cool and power from Geothermal Energy</li> <li>Cogeneration of Heat/Cool and power from Gas Combustion</li> <li>Cogeneration of Heat/Cool and power from Bioenergy</li> <li>Production of Heating and Cooling from Concentrated Solar Power</li> <li>Production of Heating and Cooling from Geothermal Energy</li> <li>Production of Heating and Cooling from Gas Combustion</li> <li>Production of heating and cooling from Bioenergy</li> <li>Production of Heating and Cooling using Waste Heat</li> </ul>	<ul style="list-style-type: none"> <li>Data processing, hosting and related activities</li> <li>Data-driven solutions for GHG emissions reductions</li> </ul>	<ul style="list-style-type: none"> <li>Construction of new buildings</li> <li>Renovation of existing buildings</li> <li>Individual renovation measures, installation of renewable on-site and professional, scientific and technical activities</li> <li>Acquisition of buildings</li> </ul>

