Green Finance Industry Taskforce

Identifying a Green Taxonomy and Relevant Standards for Singapore and ASEAN

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1. Introduction

This paper follows the consultation paper released in May 2022 entitled "Identifying a Green Taxonomy and Relevant Standards for Singapore and ASEAN", which contains the draft sector criteria for Phase 1 of the Singapore Taxonomy namely Energy, Transport and Buildings under the proposed broad approach in formulating technical criteria using a "traffic light" system for classification.

This Phase 2 paper proposes technical criteria for the remaining 5 focus sectors under Singapore's Green Finance Industry Taskforce (GFIT), namely:

- Industry (Chapter 3)
- Information and Communications Technology (Chapter 4)
- Waste & Water (Chapter 5 & 6)
- Agriculture & Forestry and (Chapter 7 & 8)
- Carbon Capture and Storage(Chapter 9)

Environmental objectives

As mentioned in previous consultation, GFIT has proposed for the taxonomy to cover both green and transition activities with the following five environmental objectives:

a) Climate change mitigation
b) Climate change adaptation
c) Protect biodiversity
d) Promote resource resilience and circular economy
e) Pollution prevention and control

For this phase of work, criteria and thresholds for economic activities are focused on contribution **climate change mitigation**. Other objectives may be added in future developments.

Globally, while taxonomies focus on slightly different objectives based on their jurisdictional context, they are broadly consistent with the six environmental objectives in the EU Taxonomy[1].

In the EU Taxonomy and others, environmental objectives are interlinked – i.e. an activity is included in the taxonomy if it contributes substantially to one of the objectives while not significantly harming any other objectives. The current version of the EU Taxonomy contains criteria for activities that contribute substantially to climate change mitigation and adaptation.

[1] The six objectives are: climate change mitigation, climate change adaptation, the sustainable use and protection of water and marine resources; The transition to a circular economy; Pollution prevention and control; The protection and restoration of biodiversity and ecosystems

Guiding principles for the development of the taxonomy

The aim of a taxonomy is to provide a common framework for the classification of economic activities to enable stakeholders in gathering information related to green financing, funding and investment, as well as gain an understanding of risk management and promote investments that meet robust sustainability goals. A taxonomy should allow stakeholders to determine which financial products and services can be classified as green, or environmentally sustainable, over the long term. Furthermore, it should enable transparent and consistent disclosures by corporates of their own economic activities and environmental profile, which then permits transparent and consistent classifications and disclosures for associated equity and debt investment, financing, and financial products. In doing so, a taxonomy would enable growth in sustainable products and services by removing ambiguity and uncertainty around classifications and labels, which in turn may stimulate demand for further environmentally sustainable financing and investment.

Science-based

The overall objective of the Taxonomy is to help identify investment consistent with achieving the necessary yet ambitious climate actions. The Taxonomy aims to draw a direct bridge between climate science and usable guidance for the financial sector. The criteria for the Taxonomy are hence based on science as far as possible, and on solid data, with references to data sources provided. In specific cases where a reference to scientific data cannot be provided, this is clearly signalled.

Singapore- focused

This version of the Taxonomy has been developed on the basis of Singapore-based activities, metrics and thresholds. Although different regions should pursue similar environmental objectives - as the environmental issues we face, such as climate change and biodiversity loss, are global challenges, specific pathways, resources, and transition plans will differ by nature of economic, geophysical, and meteorological realities. GFIT decided to first look at Singapore specific decarbonisation pathways and set up thresholds accordingly while also keeping in mind international interoperability and regional usability considerations.

While we appreciate that Singapore-based financial institutions have global portfolios, with notable investments in other ASEAN countries, GFIT has decided to focus on Singapore first and scope in activities in other countries at a later stage of development of the taxonomy.

Economic activity structure

To identify the economic activities to be covered by this Taxonomy, GFIT defined activities on the basis of ISIC codes (level 3 for activity) given the wide coverage and usage of ISIC. Moreover, this would enable interoperability with other taxonomies such as the Common Ground Taxonomy developed by the International Platform for Sustainable Finance which similarly uses ISIC codes. For this version of the Taxonomy which proposes activity-level criteria and thresholds for three of the eight focus sectors (energy, transport, and buildings),

GFIT decided to use a selection of ISIC codes within each of these three sectors. This selection was based on the importance to the Singapore and regional economy, the impact of each activity on GHG emissions (and emission reduction) as well as the ASEAN Taxonomy activity selection (which was also based on similar selection criteria pertaining to the region).

Globally interoperable

A key objective of the Taxonomy is to be as consistent as possible with other international taxonomies, with a particular focus on the EU Taxonomy. Capital is global, as are capital market participants, and it is important that the Singapore Taxonomy be both consistent and compatible with other taxonomies, particularly the EU Taxonomy and the ASEAN Taxonomy.

Traffic lights: green, amber, and red definitions

A key design principle of the Taxonomy has been to be as consistent as possible with the EU Taxonomy while also using other global taxonomies as references (e.g. ASEAN). At the same time, the objective of the Taxonomy is to differentiate between green, amber (transition), and red (harmful) activities under the traffic light system.

Green activities

The principle for building the traffic light system has been to consider the science-based 1.5 degree pathway and the EU Taxonomy criteria for substantial contribution to climate change mitigation as a first option for "green" criteria. In certain cases, the metric and thresholds have then been adapted to reflect Singapore specific circumstances. The "Green" category definition for the Taxonomy is activities that contribute substantially to climate change mitigation by operating at net zero, or are on a pathway to net zero by 2050. The pathway and accompanying thresholds are based on climate science.

Generally speaking, any new activities (e.g. new power plant, new building etc.) have to meet the green criteria. This is consistent with the need for transformational changes for all new infrastructure to meet the Paris Agreement.

Amber activities

The amber category in the Taxonomy includes activities that are not presently on a net zero pathway, but are either:

- Moving towards a green transition pathway within a defined time frame; or
- Facilitating significant emissions reductions in the short term with a prescribed sunset date.

The amber category is relevant only for transitioning of existing infrastructure and activities and does not apply to new projects.

Either way, the transition period cannot last indefinitely - an activity should be following an identified pathway to net zero by a specified sunset date. At the sunset date, there is no longer an amber category and either the activity is aligned with the Paris Agreement pathway or it is

downgraded to “Red”. Generally, the sunset date is 2030 and all amber traffic lights will disappear after this time unless stated otherwise in the criteria.

For some activities, there will be no amber threshold, meaning that the technological options to operate in line with the Paris Agreement are sufficiently developed. Hence the activity can reasonably meet criteria and thresholds to be considered green in line with the taxonomy.

All activities in amber must also demonstrate that they are in the process of improvement. Transition, by its very nature, it not static; it requires change over time. All eligible activities must demonstrate change over time and on the right pathway to green.

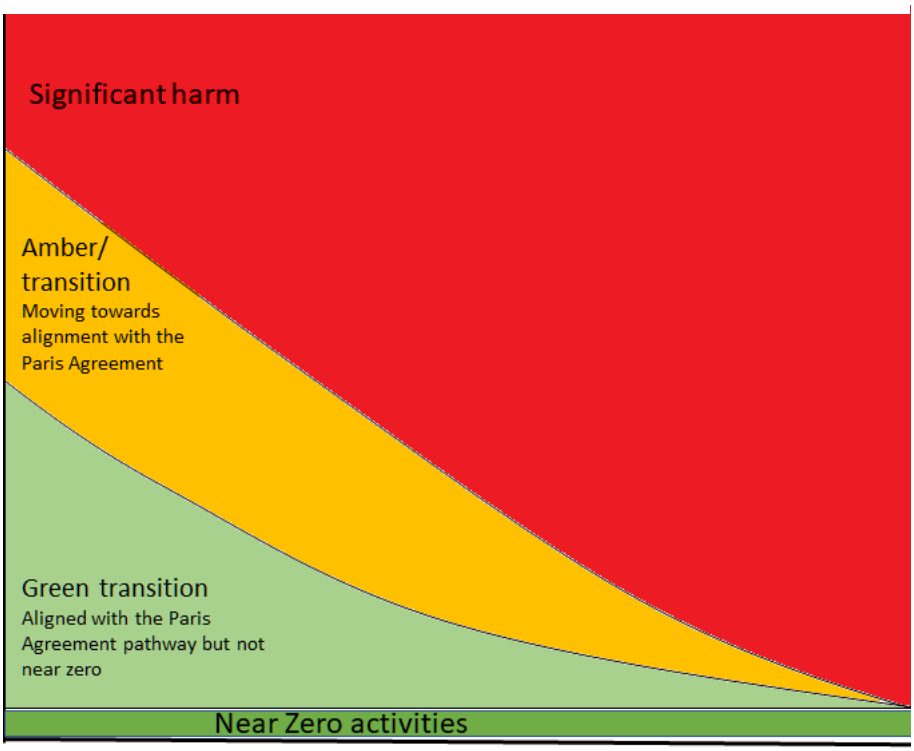
Red activities

The “Red” category concerns activities that are not currently compatible with a net zero trajectory. This means that they should either:

- be phased out if emissions (including Scope 3) cannot be reduced (e.g. most fossil fuels), or
- reduce emissions (incl. Scope 3) to be in line with a green transition pathway (e.g. high carbon cement producer)

Generally speaking, activities that do not comply with green or amber criteria are red are deemed as ‘significant harm’ and therefore not eligible for financing with this taxonomy.

Figure 1: Net zero pathway for green, amber, red



There are, however, some exceptions to this:

- certain industrial activities are not eligible for financing but are not designated as harmful due to the inherent transitional nature of the sector. These are not eligible for financing. See more information on this approach in Chapter 3).

- activities that are not yet assessed and fall outside the scope of this taxonomy are not eligible for financing but do not necessarily pose significant harm

Do No Significant Harm

A set of Do No Significant (DNSH) criteria have been proposed in a separate document which is also out for public consultation and feedback.

Note that, as below, the application of DNSH criteria have yet to be decided at this stage.

Application of the taxonomy

The application of the taxonomy to financial markets, green bonds, corporate disclosure regulations as well as its voluntary or mandatory status have not yet been decided or put forward for public consultation yet and are, therefore, at this stage beyond the scope of this consultation.

1. GFIT seeks feedback on the traffic light system usability and ease of navigation and usability

2. Questions for public consultation

Questions are posed throughout this document in orange boxes to elicit feedback.

GFIT seeks broad feedback on the thresholds and criteria proposed below regarding:

- ease of navigation
- traffic light approach
- usability of metrics and thresholds proposed
- ambition of metrics and thresholds proposed
- interoperability considerations

3. Industry

Sector overview

According to IPCC AR6 report, in 2019, about 24% of anthropogenic GHG emissions came from the industry sector.[2] Once indirect emissions from energy use are taken into account that share increases to 34%. Over the last decade emissions from the industry (and transport) sector increased most rapidly.

Industrial sectors are generally seen as the hardest to abate with processes requiring high heat that are not currently possible to electrify, hydrocarbon inputs which are difficult to replace and/or with technological solutions that are either not yet certain or at a very early stages of commercial development.

At the same time, most of the outputs of industrials sectors will be required in a low carbon future – steel will be required for wind turbines, cement for low carbon buildings etc. Therefore, the majority of activities will not be phased out (like coal) but will need to be decarbonized (green steel, green cement etc.). This is an important distinction in how criteria are being defined to enable the transition of such sectors.

The IPCC AR6 report highlights that the achievement of net-zero objective will pose an enormous challenge in the coming decade, however decarbonization will not be impossible. This is due to not only the dynamic technological development, but also to mainstreaming mitigation through coordinated action across value chains.

The primary levers for decarbonization include, among others:

- electrification,
- non-fossil based inputs,
- use of hydrogen for heat applications,
- use of Carbon Capture and Storage (CCS/CCUS).

Importantly, industry faces a dual challenge – on one hand, reducing its own emissions, and on the other hand, manufacturing the technological solutions that will play an enabling role in the emissions reduction in other areas of economy. Thus, it is necessary to steer financial flows both:

- to the activities that have **the highest share in the GHG emissions**, (referred to as hard-to-abate activities) e.g. manufacturing of iron and steel, of basic chemicals, cement, aluminium and hydrogen

[2] https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Full_Report.pdf

- and to these that **can ensure access to low and zero-carbon products and technologies** (referred to often as enabling activities) e.g. manufacturing of renewable energy technologies, low carbon technologies for transport, energy efficiency equipment for buildings, and production and use of hydrogen etc.

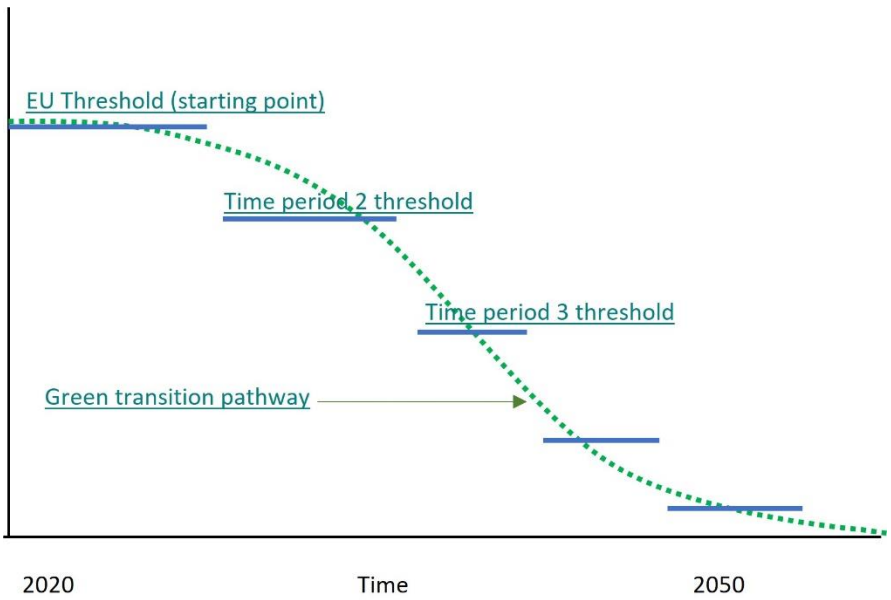
Thresholds and methodology[3]

High-emissions (hard-to-abate) sectors

Green criteria

Technical screening criteria (TSC) – emission thresholds for sectors that are characterized by high GHG emissions (basic chemicals, steel, cement, hydrogen, aluminium) have been developed based on the 1.5C science-based decarbonization pathways – an approach adapted from Climate Bonds Initiative's criteria. EU Taxonomy thresholds have been used as a starting point for a pathway and the sectoral decarbonisation pathway has been transposed to this starting point to reach net zero by 2050 at the activity level. As far as possible, the thresholds have been projected into the future so that the user can see how the thresholds will change over time as they ratchet down towards 2050 (see Figure 2). This is an extension of the EU approach where the EU criteria are put forward for the current period with the understanding that these will be reviewed (and potentially revised) every 3 years. The approach is intended to provide greater certainty for users to see how activities need to decarbonized to remain green although it is noted that thresholds, particularly those further in the future, are based on today's understanding of the future and what is possible, what may change as new technologies become available etc.

Figure 2. Theoretical example of creation of how thresholds are put forward based on



Transition pathway

Science-based transition pathways have been adopted from other initiatives where possible, which approach pathway development process with a high degree of scrutiny from academia

[3] Given the broad scope covered by the manufacturing sectors please refer to detailed sectoral criteria, given that there might be some deviations from the outlined approach and methodology

and industry experts such as these developed by the IEA or the Science Based Targets Initiative (SBTi).

Basic information about decarbonization pathways used is provided in the Table 1 – more details can be found in the Appendix 1.

Table 1. Decarbonisation pathways based on which Taxonomy criteria have been developed

Basic chemicals	Teske et al. (2022); ICF and Fraunhofer ISI study for the EC (2021)
Cement	Science Based Targets Initiative
Iron and Steel	IEA Net-Zero Emissions (IEA NZE)
Hydrogen	MIT Energy Initiative's SESAME platform
Aluminium	International Aluminium Institute based on IEA

Amber and Red categories

Given the scale of the challenge associated with the decarbonisation of the selected industry sectors and lack of certainty around technologically and economically feasible low-carbon alternatives, these sectors have been defined as inherently "in transition".

This means that while in other sectors, it makes sense to create a line between red and amber performance, for most industry sectors, this line is problematic for a few reasons:

1) there is no data available to create a line with any credibility or science basis meaning that the line between red and amber would be arbitrary;
2) for many activities, performance at the activity level (or, in the case of industry, a plant or facility) will vary significantly but the aim is for all facilities to move to a green transition pathway within a time period. The starting point is therefore **not** important compared to the movement towards green over time.
3) the activities are transitional by nature and therefore activity thresholds are insufficient to capture change over time

There are two ways that to classify and identify activities that are 'transitional' and therefore changing over time:

1) **Transition plans:** Rely on plans put in place at the company level towards net zero
2) **Measures based approach**: Put forward a list of eligible technologies or green/transition 'measures' that make a substantial contribution to reducing short term emissions.

While GFIT is generally supportive of transition plans, an entity-based approach relying on transition plans is not easy to implement within a taxonomy. Taxonomies are more granular in nature, focusing on activity-level criteria which can be used to inform and enhance entity transition plans. Taxonomies are also, in general, reliant on current performance to prove

eligibility rather than future performance. Transition plans are an indicator of future performance but it is not easy to ascertain how feasible it is to meet plans at a point in time.

Therefore, it has been proposed to utilize the measures-based approach to positively reinforce decarbonisation efforts by establishing of an amber category for identifying measures that support emissions reduction, rather than specific economic activities alone.

Figure 4. Theory of change behind measures-based approach

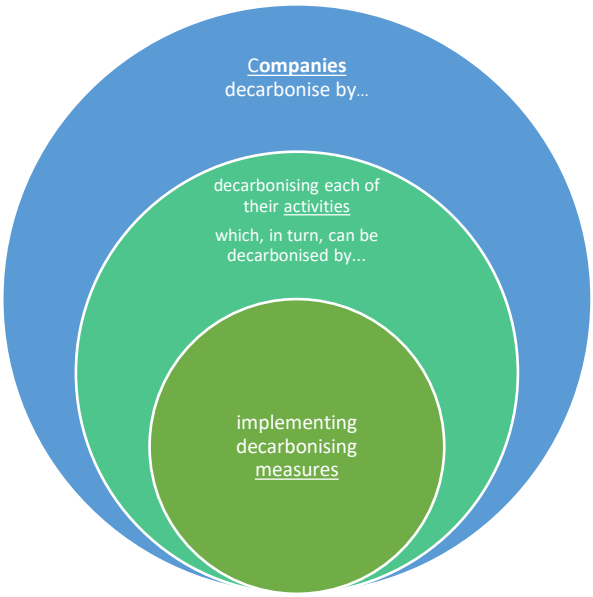
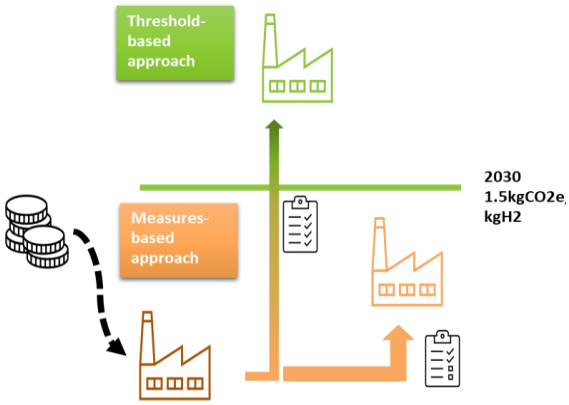


Figure 3. Measures-based approach for amber category for selected sectors

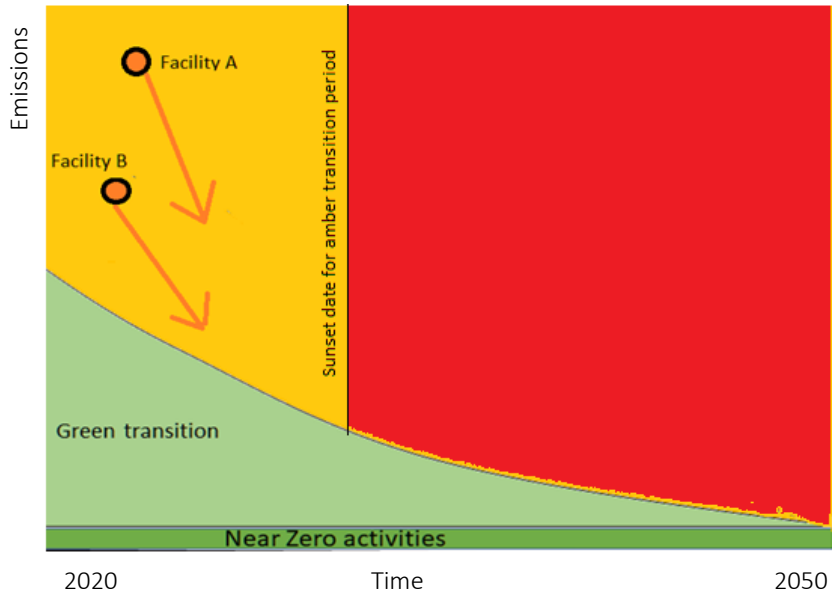


The assumed approached aims to recognize those that are changing sufficiently over time irrespective of their starting point as demonstrated below. This means that individual measures or bundles of measures are eligible for all facilities and activities regardless of starting point.

The approach is demonstrated inFigure 2 Figure 5 below where there is neither Facility A or Facility B are eligible as amber as they are – there is also no arbitrary line separating them. Instead, either facility may implement decarbonising measures (as specified in this taxonomy) that will move them towards green. Such measures are eligible on their own irrespective of the emissions of facility to begin with.

As with all amber transition zones in this taxonomy, the zone is phased out at a sunset date stated. This is to ensure that transition does not last forever but there is movement towards green (Figure 5). For these reasons, in industry sectors, in the short term, the amber zone is not bounded by a red zone

Figure 5. Amber category for industry sectors



Impact on application of measures-based approach – promoting transition of hard-to-abate sectors

The amber category that applies to investment measures cannot, however, be used to assess revenues. It can only be used for the purpose of defining the alignment of capex. Such an approach has a major upside in that by acknowledging individual decarbonisation efforts rather than solely end-effects, it could help fast-track emissions reduction from hard to abate sectors. To further leverage that effect, TSC require that measures are implemented by 2035, limiting the timeframe for enabling meaningful, but nevertheless insufficient, from the net-zero perspective, improvements. This short-term period aims to offer an opportunity to reward positive climate impacts, while low and zero-emission technologies remain under-developed and expensive.

Table 2. Usability implications of measures-based approach to amber category

	Criteria for amber measures	***Criteria for amber facilities***	***Criteria for green activity***
Taxonomy end-use: Capex	*Specific measures (each of them might have additional measure-specific criteria)*	*Capex is eligible if a given activity currently meets the amber criteria, and the measure will help to achieve green criteria (so assume need to assess transition plan/ capex plan)*	*Capex is eligible if a given activity currently meets the green criteria, and the measure will help to keep below the future green criteria (so assume need to assess transition plan/ capex plan)*
Taxonomy end-use: Revenue	*n/a*	*Revenue is eligible if activity meets the amber criteria*	*Revenue is eligible if activity meets green criteria*

Manufacturing of low and zero carbon products and technologies

Green category

The enabling sectors, i.e. these focused on manufacturing of net-zero aligned products and technologies, have TSC that are more qualitative and less dynamic – not associated directly with decarbonisation pathway, often introducing the links to criteria established for the associated economic activities. The green thresholds for these activities have been in most cases adopted from the EU Taxonomy.

Amber and Red categories

In most cases, there is no amber category for new activities, and thus manufacturing of associated new products and technologies, must meet thresholds set for green category. Activities that do not meet green TSC are classified as Red.

Table 3. Overview of the traffic-lights approach

Type of activities	Activities	Green (facility based)	Amber (measures based)	Red
Highly emissive activities	*Manufacture of basic chemicals*	X	X	X
	Manufacture of cement	X	X	X
	Manufacture of aluminium	X		
	Manufacture of hydrogen	X	X	X
Enabling activities	*Manufacture of plastics in primary form*	X		X
	Manufacture of batteries	X		X
	Manufacture of renewable energy technologies	X		X
	Manufacture of equipment for the production and use of hydrogen	X		X
	Manufacture of low carbon technologies for transport	X		X
	Manufacture of energy efficiency equipment for buildings	X		X
	Manufacture of other low carbon technologies	X		X

Alignment with EU and Climate Bonds Taxonomies

In most cases, for enabling activities, TSC have been adapted from the EU Taxonomy. However, given that EU thresholds are highly EU-specific, and that they lack forward-looking emissions reduction pathways, Climate Bonds criteria have been used for the development of TSCs for highly emissive sectors.

Uptake of global decarbonisation pathways (e.g. IEA's) by Climate Bonds criteria helps to ensure their universal application and thorough engagement of technical and industry experts in the criteria development process enhances their usability by stakeholders.

However, to increase interoperability between taxonomies, EU thresholds have been used as a starting point for ratcheting ambition up to net-zero. Such set-up encourages also pro-active approach given that EU thresholds have been based on achievements of best performers. Additionally, Climate Bonds criteria offer increased stringency due to the presence of cross-cutting requirements focused on e.g. feedstock or energy-used.

1. GFIT seeks feedback on the traffic light system as it applies to the industry sector
2. GFIT seeks feedback on proposed measures approach
3. GFIT seeks feedback on the level of ambition for Industry criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Manufacture of basic chemicals

Sector	Industry
Activity	**Manufacture of basic chemicals**
ISIC code	C 2011
ISIC description	Manufacture of basic chemicals
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: The proposed approach is adapted from Climate Bonds' Criteria for Basic Chemicals sectors. Pathway followed and relevant references for projection of the thresholds has been described in detail in section 4.2.2. of the Climate Bonds' Basic Chemicals Criteria Background Paper. Wherever applicable, the EU Taxonomy thresholds have been used as a starting point for the decarbonisation pathway. **Amber:** The proposed approach is adapted from Climate Bonds' Criteria for Cement sector. Detailed methodology can be found in the Climate Bonds' Basic Chemicals Criteria Background Paper.
Traffic light	Threshold
Green	Facility must comply with the following **headline requirements:** ● Activities need to meet specific carbon or energy intensity thresholds defined in the Table 4, AND ● At least 50% of annual production is on the list of basic chemicals in scope, AND ● Facilities using low carbon process technologies do not release direct process CO_2 emissions, e.g. methane pyrolysis, catalytic partial oxidation of methane to methanol. And if facilities are **commencing operation in 2023 or after**, they are eligible only if they: ● Implement technologies which avoid or reduce direct process emissions in order to prevent carbon lock-in. (e.g. methane pyrolysis does not generate CO_2 in the reaction) AND ● Do not use virgin fossil feedstock if process emissions are directly released into the atmosphere AND ● Do not use fossil fuels. And if facilities are using hydrogen, CO_2 or biomass as **feedstock**, they are eligible only if they meet the following criteria: ● **Hydrogen** meets the Taxonomy criteria (green category) for hydrogen production.

- **Biomass** complies with the criteria applicable for biomass sourcing set out in the Taxonomy Bio-energy criteria (green category).
- **CO_2** used satisfies the criteria described in Table 1.1 (e.g. CO2 from ammonia production should not be used for urea production)

And if

Facilities are using fossil gas, CO_2 or biomass as a **fuel source,** they are eligible only if they meet the following criteria:

- **Fossil gas**: Only eligible for existing facilities prior to 2030.
- **Hydrogen**: The hydrogen used meets the Taxonomy criteria for hydrogen production (green category).
- **Biomass**: The bio-energy complies with the Taxonomy Bio-energy criteria (green category). Only secondary organic streams are eligible.
- **Facilities using heat supplied from alternative sources**, such as geothermal, solar thermal, and waste heat recovery: The heat source must comply with the Taxonomy most up to date criteria for each source of energy (green category).

Table 4: **Basic chemical-specific carbon and energy intensity thresholds (see Appendix 1 for further details)**

Asset type	**Criteria**			
Production of…	**2022 – 2029**	**2030-2039**	**2040-2049**	**2050-**
Ammonia	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category) or ammonia is recovered from wastewater. CO2 from ammonia production should not be used for urea production.	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category) or ammonia recovered from wastewater. CO_2 from ammonia production should not be used for urea production.	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category) or ammonia recovered from wastewater. CO_2 from ammonia production should not be used for urea production	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category) or ammonia recovered from wastewater. CO_2 from ammonia production should not be used for urea production
Nitric acid	0.038 t CO_2e/t nitric acid	0.021 t CO_2e/t nitric acid	0.011 t CO_2e/t nitric acid	0.007 t CO_2e/t nitric acid
Chlorine	2.45 MWh electricity/t chlorine	1.85 MWh electricity/t chlorine	Carbon intensity of the electricity used meets the	Carbon intensity of the electricity used

			or carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation (green category)	or carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation (green category)	Taxonomy criteria for electricity generation (green category)	meets the Taxonomy criteria for electricity generation (green category)	
		Carbon black	1.141 t CO_2e/t carbon black	0.63 t CO_2e/t carbon black	0.34 t CO_2e/t carbon black	0.20 t CO_2e/t carbon black	
		Disodium carbonate/ soda ash	0.789 t CO_2e/t disodium carbonate/ soda ash and carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation (green category)	0.44 t CO_2e/t disodium carbonate/ soda ash and carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation (green category)	0.23 t CO_2e/t disodium carbonate/ soda ash and carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation green category)	0.14 t CO_2e/t disodium carbonate/ soda ash and carbon intensity of the electricity used meets the Taxonomy criteria for electricity generation (green category)	
		High value chemicals (ethylene, propylene, butadiene)	0.51 t CO_2e/t high value chemical	0.28 t CO_2e/t high value chemical	0.15 t CO_2e/t high value chemical	0.09 t CO_2e/t high value chemical	
		Aromatics BTX (benzene, xylene and toluene)	0.0072 t CO_2e/t aromatics BTX[4]	0.0040 t CO_2e/t aromatics BTX[4]	0.0021 t CO_2e/t aromatics BTX[4]	0.0012 t CO_2e/t aromatics BTX[4]	
		Methanol	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category)	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category)	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category)	Uses hydrogen, as feedstock, that meets the Taxonomy criteria for hydrogen production (green category)	

[4] BTX measured as complex weighted throughput. Refer to: https://www.concawe.eu/publication/report-no-912/

	The following emissions should be accounted for when comparing to the thresholds in **Table 4** • **Nitric Acid, and Soda Ash:** Scope 1 emissions which include all direct emissions from the production processes: emissions generated during the chemical reactions, emissions from fuel combustion on-site. • **Carbon black, HVC and aromatics:** Scope 1 as defined above, plus Scope 2 emissions which includes indirect emissions from the energy imported from off-site. • **Methanol and Ammonia:** GHG emissions are for the life cycle emissions of hydrogen used as feedstock. • **Chlorine:** The benchmark is for the electricity intensity of the process. No GHG accounting is required for chlorine. Electricity must be from renewable sources.
Amber (measures)	Amber category is applicable until 2035 – all eligible decarbonisation measures must be implemented prior to 2035 **Criteria:** • Eligible measures are listed in Appendix 2 together with the associated criteria AND Criteria are applicable within production facility where: • At least 50% of annual production is on the list of basic chemicals in scope AND • Company has a transition plan aligned with 1.5 degrees.
Red	Facilities or measures in which: • The energy source is coal or coal derivatives or ddedicated crops, primary organic streams, and wood and/or • The feedstock is coal or coal derivatives.

Manufacture of cement

Sector	Industry
Activity	Manufacture of cement
ISIC code	C2394
ISIC description	Manufacture of cement, lime and plaster
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Pathway based on a starting point (in 2020) of the EU Taxonomy thresholds for cement. Sectoral decarbonisation pathway from Science-Based Targets Initiative has been applied to this starting point to reach net zero by 2050. Pathway followed and relevant references for projection of the thresholds has been described in detail in section 4.3.1. of the Climate Bonds' Cement Criteria Background Paper **Amber:** The proposed approach is adapted from Climate Bonds' Criteria for Cement sector. Detailed methodology can be found in the Climate Bonds' Cement Criteria Background Paper

<table>
<tr><th>Traffic light</th><th>Threshold</th></tr>
<tr><td rowspan="2">Green</td><td>Facility must comply with the following headline requirements:
• Activities need to meet specific emissions intensity thresholds defined in the Table 5. More detailed calculations and methodology can be found in Appendix 3.
<u>And if</u>
facilities are using biomass, hydrogen, or waste as a fuel source they are eligible only if they meet the following criteria:
• Hydrogen: The hydrogen used meets the Taxonomy criteria (green category) for hydrogen production.
• Biomass: The biomass used complies with the criteria applicable for biomass sourcing set out in the Taxonomy Bio-energy criteria (green category).
• Waste-Derived Fuels, including Municipal Solid Waste (MSW) must meet Taxonomy criteria (green category) and
1) All waste of recycling potential must be removed prior to burning in line with the waste hierarchy AND
2) Municipal solid waste will not be eligible as a fuel type after 2035
<u>And if</u>
the plant uses Carbon Capture and Storage (CCS) equipment on site, it must comply with Taxonomy criteria for CCS (green category)</td></tr>
<tr><td>Table 5: Selected threshold values forming the emissions pathway for cement production facilities (t CO2/ t cementitious product)
<table>
<tr><td>Cement class</td><td>2025</td><td>2030</td><td>2040</td><td>2050</td></tr>
<tr><td>32.5</td><td>0.341</td><td>0.298</td><td>0.222</td><td>0.073</td></tr>
<tr><td>42.5</td><td>0.416</td><td>0.363</td><td>0.271</td><td>0.089</td></tr>
<tr><td>52.5</td><td>0.470</td><td>0.410</td><td>0.306</td><td>0.101</td></tr>
</table>
More detailed information, thresholds for other years and methodology can be found in Appendix 3: Cement additional methodology and tables3.</td></tr>
<tr><td>Amber (measures)</td><td>Eligible decarbonisation measures or retrofitting activities (capital investments) must be implemented prior to 2035

AND

Constitute one or more of the following measures:
• Installation, upgrade and operation of precalciners
• Installation, upgrade, and operation of heat recovery systems
• Installation, upgrade, and operation of digitized control equipment or infrastructure. This may include:
o Sensors and measurement tools (including software to allow real-time and close control of processes to improve efficiency)
o Communication and control (including advanced software and control rooms, and automation of plant processes)
• Installation, upgrade, and operation of testing equipment. For example:
o Automated XRD systems
• Electrification of heat (for example, electrified kiln processes)
• Installation, upgrade, retrofit and operation of measures which achieve emissions savings equivalent to the emissions decrease for facilities over the lifespan of the debt instrument
• Installation, upgrade, and operation of carbon capture and storage equipment that is aligned with Taxonomy criteria (green category)
• Infrastructure, revamps or modifications of equipment needed for the production of cement using hydrogen as a fuel, that is aligned with Taxonomy criteria for hydrogen (green category)

AND</td></tr>
</table>

	Measures are applicable within production facility where company has a transition plan aligned with 1.5 degrees.
Red	Facilities or measures in which: • The energy source is coal or coal derivatives or dedicated crops, primary organic streams, and wood

Manufacture of basic iron and steel

Context and methodology notes

Most new steel plants built today will still be online in 2050. There are already low carbon steel production technologies available, and it is expected that more will become commercially ready before and beyond 2030.

Since steel production facilities can operate for many years, new facilities should already be built with CO_2 emissions mitigation technologies in place or avoiding CO_2 generation entirely by limiting the use of fossil fuels. The technical challenges are such that this is very important at the design stage – if a plant is not designed to have, for example, CCS implemented, it is very difficult to retrofit later.

To acknowledge and promote the decarbonization efforts, (new and existing) facilities that do not meet criteria designed for green category at the outset ***but have been designed to*** and envisage full alignment by 2030, can be classified as amber.

At the same time, current technologies for refurbishment ***cannot*** bring long-existing Blast Furnace-Basic Oxygen Furnace (BF-BOF) plants in line with the requirements of the Paris Agreement. These are old technologies and retrofit opportunities are limited. Such plants will need to be phased out in the long term. However, in many cases, short term emissions can be reduced to the levels required in 2030 – these should be maximized. When looking at existing facilities, the criteria below aim to avoid investments that would lock-in heavy emitting technologies, without overlooking producers that will make credible efforts to reduce their current emissions.

Literature review shows that around 71% of steel's global coal-based capacity will require reinvestment by 2030.[5] Steel producers can either invest in 'relining' (extension of a lifespan of the investment) or switch to alternative technologies. Relining is discouraged within these criteria as it risks locking-in assets that are not compatible with a low carbon future. Consequently, we have limited the age of eligible blast furnaces for 'measures' aimed at increasing energy efficiency (subject to meeting the criteria) to only those that started operation from 2007.

The principle behind this is to allow "newer" facilities that are still not going for relining (because they have not reached the relining age yet), to reach 2030 emissions intensity targets by implementing a bundle of mitigation measures. These investments in emissions reduction in "newer" facilities can only take place until 2030, which is before the asset reaches the relining age. After 2030, these facilities need to decarbonize more aggressively.

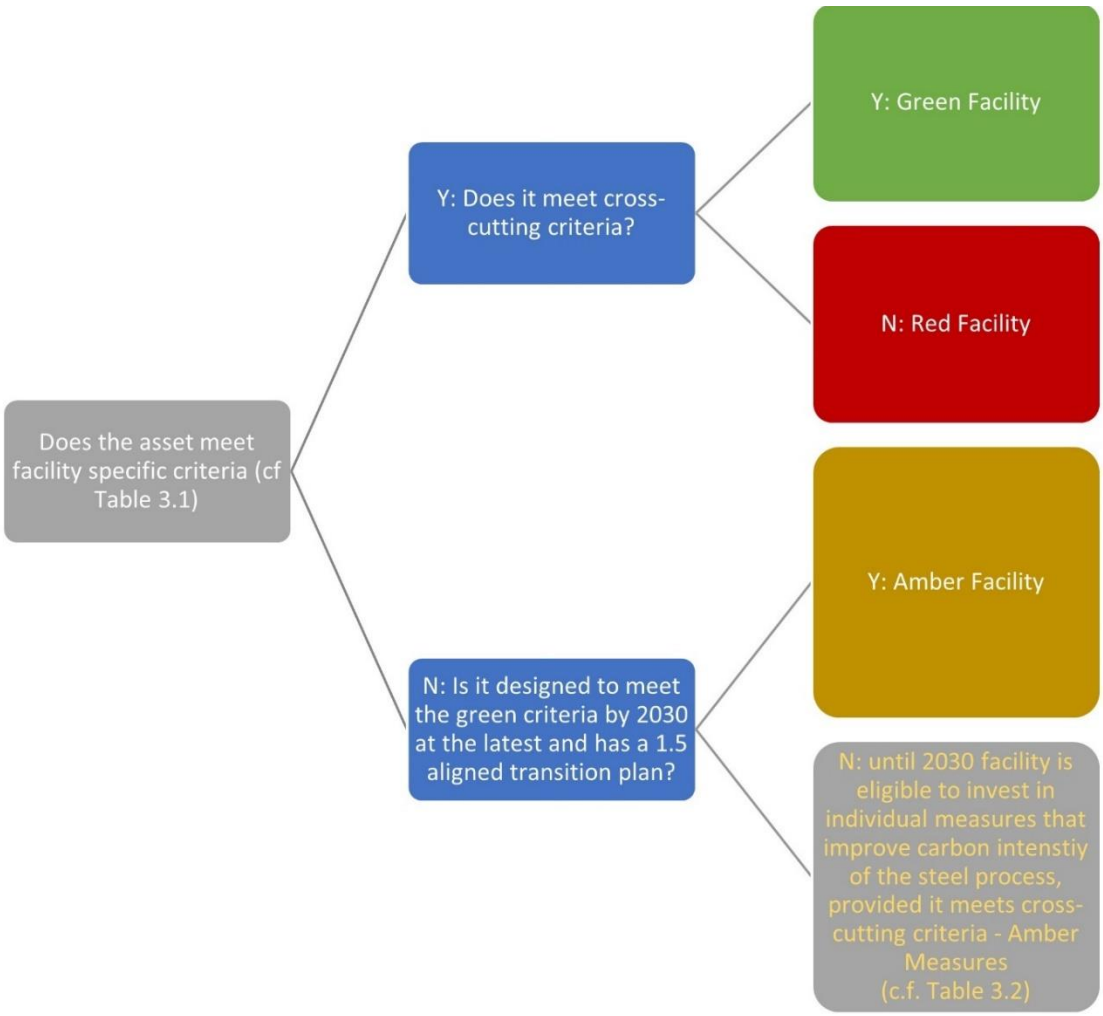
Whereas older facilities, that should get a significant investment in relining, cannot qualify unless the investment will entail a major retrofit to reduce emissions by more than 50%. What

[5] https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-EW_236_Global-Steel-at-a-Crossroads_WEB_V2.pdf

this suggests is that blast furnaces that don't retrofit to significantly mitigate carbon emissions with, for example, CCS by 2030, will most likely become stranded assets.

Given the above features of steel manufacturing, the criteria have been designed to achieve and encourage deep emissions reductions at the facility level in the short to medium term while also encouraging all short-term measures to maximise emissions reductions in the interim. The decision tree below (Figure 6) demonstrates how this works in practice where the facility is eligible for green if it meets green criteria. If it does not yet meet these criteria, there is an option for that facility (through design and planning) to use the amber category to raise finance. If, however, it does not meet the amber facility criteria, it may still raise finance for specific interim measures that will reduce the carbon footprint in the short term.

Figure 6 Eligible categories for iron and steel production – a high level overview



<table>
<tr><td>Sector</td><td>Industry</td></tr>
<tr><td>Activity</td><td>Manufacture of basic iron and steel</td></tr>
<tr><td>ISIC code</td><td>C2410</td></tr>
<tr><td>ISIC description</td><td>Manufacture of basic iron and steel</td></tr>
<tr><td>Objective</td><td>Climate Change Mitigation</td></tr>
<tr><td>Alignment with international best practice / reference from other taxonomies or methodologies</td><td>Green: The proposed approach is adapted from Climate Bonds' Criteria for Steel sector. Pathway followed and relevant references for projection of the thresholds has been described in detail in section 3.4.1. of the Climate Bonds' Steel Criteria Background Paper
Amber: The proposed approach is adapted from Climate Bonds' Criteria for Steel sector. Detailed methodology can be found in the Climate Bonds' Steel Criteria Background Paper.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Traffic light</td><td>Threshold</td></tr>
<tr><td>Green</td><td>Facilities must comply with:
- the facility specific mitigation criteria in Table 6
AND
- comply with applicable cross-cutting criteria listed in Appendix 4 Table 16
AND
- Facilities using hydrogen as a fuel or reductive agent, are eligible only if hydrogen complies with Taxonomy criteria for hydrogen (green category)

Table 6: Eligible iron and steel production facilities
<table>
<tr><th>Eligible Assets</th><th>Facility specific mitigation criteria</th></tr>
<tr><td>BF-BOF (Blast Furnace – Basic Oxygen Furnace)</td><td>• Has to have Carbon Capture Utilisation and Storage (CCUS) meeting taxonomy criteria for transport and storage (green) ; AND
• CCUS should capture at least 70% of all emissions</td></tr>
<tr><td>Smelting reduction</td><td>• Has to have Carbon Capture Utilisation and Storage (CCUS) meeting taxonomy criteria for transport and storage (green) ; AND
• CCUS should capture at least 70% of all emissions</td></tr>
<tr><td>Direct Reduced Iron (DRI)</td><td>• if fossil gas based:
a) Has to have Carbon Capture Utilisation and Storage (CCUS) meeting taxonomy criteria for transport and storage (green) ; AND
b) CCUS should capture at least 70% of all emission
• if 100% hydrogen based: hydrogen meets carbon intensity thresholds and specific Taxonomy criteria for hydrogen (green category)</td></tr>
<tr><td>DRI - EAF</td><td>• if fossil gas based:
a) Has to have Carbon Capture Utilisation and Storage (CCUS) meeting taxonomy criteria for transport and storage (green) ; AND
b) CCUS should capture at least 70% of all emissions
• if 100% hydrogen based: hydrogen meets carbon intensity thresholds and specific Taxonomy criteria for hydrogen (green category)</td></tr>
<tr><td>Electric Arc Furnace (EAF)</td><td>• Needs to use 70% of scrap as total annual inputs; OR
• The combined scrap and (100%) Hydrogen based DRI meeting taxonomy criteria for DRI (green category) should add to at least 70% of the EAF total annual inputs</td></tr>
<tr><td>Electrolysis of iron ore steelmaking</td><td>No additional criteria</td></tr>
</table></td></tr>
<tr><td>Amber (facilities)</td><td>Eligible assets that are listed in Table 6 and that are not meeting the criteria identified in the table can be classified as amber only if:</td></tr>
</table>

<table>
<tr><td></td><td>
- The facility has been designed to and is implementing all necessary actions to meet criteria for green category by 2030 at the latest
AND
- The facility is currently capturing at least 20% of emissions
AND
- Facility has a transition plan aligned with 1.5 degrees.
</td></tr>
<tr><td>Amber (measures)</td><td>
All eligible decarbonisation measures must:
- be implemented prior to 2030
AND
- enable the eligible assets to meet criteria identified in Error! Reference source not found.
AND
- comply with applicable cross-cutting criteria listed in Appendix 4 Table 16

AND
- Measures are applicable within production facility where company has a transition plan aligned with 1.5 degrees.

Table 7. Criteria for capital investments in decarbonisation measures for steel facilities
<table>
<tr><th>Eligible Assets</th><th>Facility specific mitigation criteria</th></tr>
<tr><td>Blast Furnace</td><td>No relining;

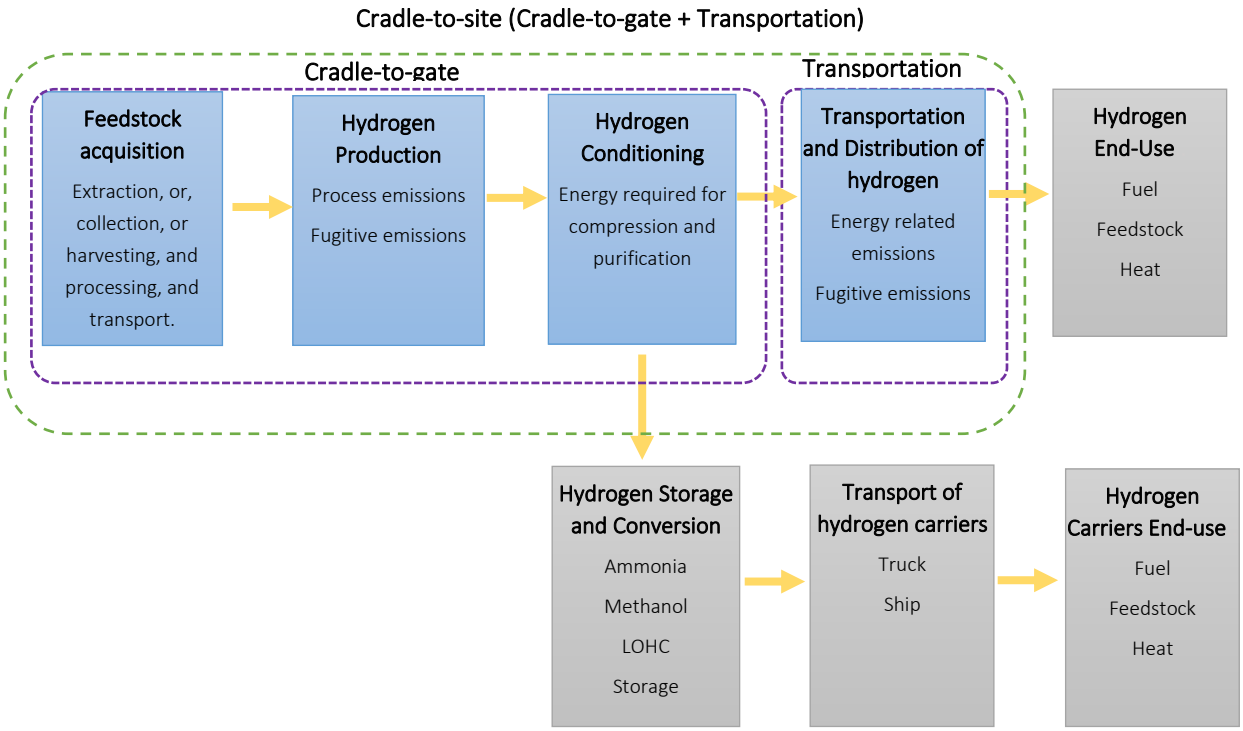
AND
The emissions intensity of the facility should be below 1.8 tCO_2/t steel by 2030;

AND
Decarbonization measures should decrease emissions (tCO_2/t steel) between 2022 and 2030 by:
- by 15% if emissions < 2 tCO_2/t steel and if the production line with BF became operational in 2007 or later ;
OR
- by 20% if emissions >2 tCO_2/t steel and if the production line with BF became operational in 2007 or late ;
OR
- at least 50% if the production line with BF became operational prior to 2007.</td></tr>
<tr><td>Production line with a DRI</td><td>Implement decarbonization measures to decrease emissions (tCO_2/t steel) between 2022 and 2030 by:
a) If fossil gas based: 20%;
OR
b) If coal based: 40%.</td></tr>
<tr><td>Electric Arc Furnace (EAF)</td><td>Implement decarbonisation measures that enable the facility to increase the scrap total annual input</td></tr>
</table>
</td></tr>
<tr><td>Red</td><td>
Facilities not complying with cross-cutting criteria (see Appendix 4), incl. facilities using:
• coal for on-site electricity generation.
• Dedicated crops, primary organic streams, and wood when using biomass as a reducing agent and/or for energy generation
• CCUS for production of products that release the CO_2 immediately when these are used (such as in urea, carbonated beverages, or fuels), or for enhanced oil recovery, and the production of other forms of fossil energy sources.
</td></tr>
</table>

Manufacture of hydrogen

Note: Life cycle GHG assessment for hydrogen production must be conducted for a cradle-to-site system boundary, which includes cradle-to-gate emissions plus any transportation emissions to the site where a product will be used. It means that the GHG accounting includes scope 1, 2 and partial scope 3 emissions. System boundaries are shown in Figure 7 below.

Figure 7. Systems Boundaries for GHG Accounting



Sector	Industry
Activity	Manufacture of hydrogen
ISIC code	C2011
ISIC description	Manufacture of basic chemicals
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: The proposed approach is adapted from Climate Bonds' Criteria for hydrogen sector. Pathway followed and relevant references for projection of the thresholds has been described in detail in section 4.3.2. of the Climate Bonds' Hydrogen Criteria Background Paper. EU Taxonomy thresholds have been adapted as a starting point for the decarbonisation pathway. **Amber**: The proposed approach is adapted from Climate Bonds' Criteria for hydrogen sector. Detailed methodology can be found in the Climate Bonds' Hydrogen Criteria Background Paper.
Traffic light	Threshold
Green	Facility must comply with the following requirements: • Hydrogen production must meet specific carbon intensity thresholds (**Table 8**) AND

<table>
<tr><td></td><td>

To demonstrate compliance with any of the emissions intensity thresholds set in Table 8Table 8, issuers are required to carry out a life cycle assessment (see Appendix 5)

AND

Use of fossil gas as a feedstock by facilities is only eligible until 2030

AND

Facilities must meet the requirements listed in Table 17 in Appendix 5 depending on the feedstock and :
a. The feedstock is not coal or coal derivatives.
b. Biomass from primary sources is not eligible as a feedstock. Wood and other dedicated crops are not eligible (only waste biomass sources are eligible).

AND

Facilities must meet the requirements listed in Table 17 in Appendix 5 for different electricity sources.

AND

Facilities using CCS or CCU must meet the criteria in Table 17 in Appendix 5. Capture rate does not have to be met.

</td></tr>
<tr><td></td><td>
Table 8. Hydrogen carbon intensity thresholds (see Appendix 1 for references and further details)
<table>
<tr><th rowspan="2">Asset Type</th><th colspan="4">Criteria</th></tr>
<tr><td>2022</td><td>2030</td><td>2040</td><td>2050</td></tr>
<tr><td>Production of hydrogen</td><td>3 kgCO2e/kgH2*</td><td>1.5 kgCO2e/kgH2*</td><td>0.6 kgCO2e/kgH2*</td><td>0 kgCO2e/kgH2*</td></tr>
<tr><td colspan="5">*To demonstrate compliance with any of the emissions intensity thresholds set in Table 8, the life cycle assessment in line with the methodological notes provided in the Appendix 5.</td></tr>
</table>
</td></tr>
<tr><td>Amber (eligible decarbonisation measures)</td><td>Amber category is applicable until 2035 – all eligible decarbonisation measures must be implemented prior to 2035.

AND

Criteria: Eligible measures are listed in Appendix 5 (Table 17) together with the associated criteria.

AND

Criteria are applicable within production facility where company has a transition plan aligned with 1.5 degrees.</td></tr>
<tr><td>Red</td><td>Facilities or measures for which:

The energy source is oil, coal, or coal derivatives and/or
The feedstock is coal or coal derivatives and/or
The energy source is biomass from primary sources and/or
The use of wood and other dedicated crops is enabled.

</td></tr>
</table>

Manufacture of Aluminium

<table>
<tr><td>Sector</td><td>Industry</td></tr>
<tr><td>Activity</td><td>Manufacture of Aluminium</td></tr>
<tr><td>ISIC code</td><td>C2420</td></tr>
<tr><td>ISIC description</td><td>Manufacture of basic precious and other non-ferrous metals</td></tr>
<tr><td>Objective</td><td>Climate Change Mitigation</td></tr>
<tr><td>Alignment with international best practice / reference from other taxonomies or methodologies</td><td>Green: Pathway based on a starting point (in 2020) of the EU Taxonomy thresholds for Aluminium. 1.5C-aligned sectoral decarbonisation pathway of the of the International Aluminium Institute has been applied to this starting point focusing on the emissions scope by the EU Taxonomy. Pathway followed and relevant references for projection of the thresholds have been described in detail in IAI model.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Traffic light</td><td>Threshold</td></tr>
<tr><td>Green</td><td>The activity complies with one of the following criteria:
Primary Aluminium where the economic activity complies with two of the following criteria until 2025 and with all of the following criteria after 2025:
○ the GHG emissions do not exceed CO_2e emissions intensity thresholds presented in Table 9.
○ the average carbon intensity for the indirect GHG emissions does not exceed green criteria set in the Taxonomy for green category.
○ the electricity consumption for the manufacturing process does not exceed 14.86 MWh/t Al.
or Secondary Aluminium – all eligible.</td></tr>
<tr><td></td><td>Table 9 Aluminium carbon intensity thresholds
<table>
<tr><th rowspan="2">Asset Type</th><th colspan="5">CO2e emissions intensity (tonnes CO2e per tonne of Aluminium manufactured)</th></tr>
<tr><th>2018</th><th>2030</th><th>2035</th><th>2040</th><th>2050</th></tr>
<tr><td>Production of Primary Aluminium through electrolysis process</td><td>1.484</td><td>1.185</td><td>0.826</td><td>0.520</td><td>0.311</td></tr>
</table></td></tr>
<tr><td>Amber</td><td>N/A</td></tr>
<tr><td>Red</td><td>Activities that do not meet the criteria outlined in the green category</td></tr>
</table>

Manufacture of plastics in primary form

Sector	Industry
Activity	Manufacture of plastics in primary form
ISIC code	C2013
ISIC description	Manufacture of plastics and synthetic rubber in primary forms
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach adapted from the EU and South African taxonomies
Traffic light	Threshold
Green	The activity complies with one of the following criteria: • the plastic in primary form that is fully manufactured by mechanical recycling of plastic waste is directly eligible, without any further requirements incl. these focused on GHG emissions accounting; • where mechanical recycling is not technically feasible or economically viable, the plastic in primary form is fully manufactured by chemical recycling of plastic waste and the life-cycle GHG emissions of the manufactured plastic, excluding any calculated credits from the production of fuels, are lower than the life-cycle GHG emissions of the equivalent plastic in primary form manufactured from fossil fuel feedstock. Life-cycle GHG emissions are calculated using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. • derived wholly or partially from renewable feedstock and its life-cycle GHG emissions are lower than the life-cycle GHG emissions of the equivalent plastics in primary form manufactured from fossil fuel feedstock. Life-cycle GHG emissions are calculated using ISO 14067:2018 or ISO 14064-1:2018. Quantified life-cycle GHG emissions are verified by an independent third party. AND Food or feed crops are not used as bio-based feedstock for the manufacture of plastic in primary form. AND At least 90% of the produced plastic must not be used for single use consumer products.
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category

Manufacture of batteries

Sector	Industry
Activity	Manufacture of batteries
ISIC code	C2720
ISIC description	Manufacture of rechargeable batteries, battery packs and accumulators for transport, stationary, on-grid, and off-grid energy storage, and other industrial applications. Manufacture of respective components (battery active materials, battery cells, casings, and electronic components). And Recycling of end-of-life batteries. And Where economic activity enables repurposing of batteries into facilities that store electricity, the technical screening criteria outline in the Taxonomy for energy storage apply.
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach adapted from the EU Taxonomy taking into account emerging level of regulatory ambition in the EU regarding the recycled materials content
Traffic light	Threshold
Green	The activity complies with one of the following criteria: • The economic activity manufactures rechargeable batteries, battery packs and accumulators (and their respective components), including from secondary raw materials, that result in substantial GHG emission reductions in transport, stationary, on grid and off-grid energy storage and other industrial applications. • Recycling of end-of life batteries. AND From 2025[6] at least 4% the electrode raw materials used in the battery cells must be obtained from the recycled materials.
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category.

[6] Note: EU threshold of 2030 was adapted to reflect strong progress in local context

Manufacture of renewable energy technologies

Sector	Industry
Activity	Manufacture of renewable energy technologies
ISIC code	ISIC codes associated. with the following divisions: C25, C27, C28
ISIC description	ISIC codes associated. with the following divisions: Manufacture of fabricated metal products, except machinery and equipment (C25); Manufacture of electrical equipment (C27); Manufacture of machinery and equipment n.e.c (C28)
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach adapted from the EU Taxonomy
Traffic light	Threshold
Green	The economic activity manufactures renewable energy technologies meeting the criteria set out in the Taxonomy (green category).
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category.

Manufacture of equipment for the production and use of hydrogen

Sector	Industry
Activity	Manufacture of equipment for the production and use of hydrogen
ISIC code	ISIC codes associated with the following divisions: C25, C27, C28
ISIC description	ISIC codes associated with the following divisions: Manufacture of fabricated metal products, except machinery and equipment (C25); Manufacture of electrical equipment (C27); Manufacture of machinery and equipment n.e.c (C28)
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach adapted from the EU Taxonomy
Traffic light	Threshold
Green	The economic activity manufactures equipment for the production of hydrogen compliant with the Hydrogen criteria set out in the Taxonomy (green category).
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category.

Manufacture of low carbon technologies for transport

Sector	Industry
Activity	Manufacture of low carbon technologies for transport
ISIC code	ISIC codes associated with the following divisions:C2910; C3010; C3020; C3090; C3315
ISIC description	ISIC codes associated with the following divisions: Manufacture of motor vehicles (C2910); Building of ships and boats (C3010); Manufacture of railway locomotives and rolling stock (C3020); Manufacture of transport equipment n.e.c (C3090); Repair of transport equipment, except motor vehicles (C3315)
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	Approach adapted from the EU Taxonomy
Traffic light	Threshold
Green	**Green**: The economic activity manufactures low carbon transport vehicles and their respective key components, fleets and vessels meeting the criteria set out in the Taxonomy (green category).
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category.

Manufacture of energy efficiency equipment for buildings

Sector	Industry
Activity	Manufacture of energy efficiency equipment for buildings
ISIC code	ISIC codes associated with the following divisions:C1623; C2310; C2391; C2393; C2395; C2511; C2512; C2731; C2732; C2733; C2740; C2750; C2811; C2812; C2813
ISIC description	ISIC codes associated with the following divisions: Manufacture of wooden containers (C1623), Manufacture of glass and glass products (C2310), Manufacture of refractory products (C2391); Manufacture of other porcelain and ceramic products (C2393); Manufacture of articles of concrete, cement and plaster (C2395); Manufacture of structural metal products (C2511); Manufacture of tanks, reservoirs and containers of metal (C2512); Manufacture of fibre optic cables (C2731); Manufacture of other electronic and electric wires and cables (C2732); Manufacture of wiring devices (C2733); Manufacture of electric lighting equipment (C2740); Manufacture of domestic appliances (2750); Manufacture of engines and turbines, except aircraft, vehicle and cycle engines (2811); Manufacture of fluid power equipment (2812); Manufacture of other pumps, compressors, taps and valves (C2813)
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach adapted from the EU Taxonomy to account for potential geographical differences
Traffic light	Threshold
Green	The economic activity manufactures one or more of the following products and their key components: a) household appliances falling into the highest two populated classes of energy efficiency in accordance with local market standards b) light sources rated in the highest two populated classes of energy efficiency in accordance with local market standards c) space heating and domestic hot water systems rated in the highest two populated classes of energy efficiency in accordance with local market standards d) cooling and ventilation systems rated in the highest two populated classes of energy efficiency in accordance with local market standards e) presence and daylight controls for lighting systems; f) heat pumps compliant with the technical screening criteria set out in the Taxonomy (green category); g) façade and roofing elements with a solar shading or solar control function, including those that support the growing of vegetation; h) energy-efficient building automation and control systems for residential and non-residential buildings; i) zoned thermostats and devices for the smart monitoring of the main electricity loads or heat loads for buildings, and sensor equipment; j) products for heat metering and thermostatic controls for individual homes connected to district heating systems, for individual flats connected to central heating systems serving a whole building, and for central heating systems; k) district heating exchangers and substations compliant with the district heating/cooling distribution activity set out in the Taxonomy (green category); l) products for smart monitoring and regulating of heating system, and sensor equipment.
Amber	N/A
Red	Activities that do not meet the criteria outlined in the green category.

Manufacture of other low carbon technologies

Sector	Industry
Activity	Manufacture of other low carbon technologies
ISIC code	ISIC codes associated with the following divisions: C22, C25, C26, C27, C28
ISIC description	ISIC codes associated with the following divisions: Manufacture of rubber and plastics products (C22); Manufacture of fabricated metal products, except machinery and equipment (C25); Manufacture of computer, electronic and optical products (C26) Manufacture of electrical equipment (C27); Manufacture of machinery and equipment n.e.c (C28)
Objective	Climate Change Mitigation
Alignment with international best practice / reference from other taxonomies or methodologies	**Green**: Approach aligned with the energy rating system introduced by the National Environment Agency of Singapore for regulated goods[7]
Traffic light	Threshold
Green	Manufacturing of regulated goods that meet the highest performance level for a given good in the energy rating system introduced by the National Environment Agency of Singapore or internationally available equivalent.
Amber	NA
Red	Activities that do not meet the criteria outlined in the green category.

[7] https://www.nea.gov.sg/our-services/climate-change-energy-efficiency/energy-efficiency/household-sector

4. Information and Communications Technology

Sector overview

ICT is one of the key enabling sectors in the ASEAN, EU, SA, Indonesian and other taxonomies. Although not usually high-emitting itself (there is almost no Scope 1 emission, only Scope 2 and 3 emission), this sector is important for digital transformation and the improvement of efficiency of activities in emissions-intensive sectors. Today roughly over 2% of all emissions in the world can be attributed to ICT sector, but this figure will grow in the future as demand increases. Even as emissions from the sectors rise, a report by the Global e-Sustainability Initiative estimates that IT solutions can help cut nearly 10 times more CO_2 than they emit[8].

Under the ISIC code, Section J, ICT includes publishing activities, telecommunications and data processing and hosting activities. Most ICT activities have limited climate impact and they are not generally included in major taxonomies. For the Singapore Taxonomy, the GFIT selected data centres as the most important activities within the ICT sector for emission reductions within the Singapore Taxonomy.

Data centres are an important part of the Singaporean as well as regional economy. As of 2021, Singapore had more than 70 operational data centres which amounts to 60% of all data centres in Southeast Asia. Together they consume almost 7% of the country's total energy requirements. This number is expected to hit 12% by 2030.

In simple terms, data centre activities can be divided into two parts: the hardware and software.

The hardware component covers construction, as well as **storage, manipulation, management, movement, control, display, switching, interchange, transmission, or processing of data through data centres.**

The software component consists of two main activities:

- **Development of software and solutions that help tackle emission in other sectors** (development or use of ICT solutions that are aimed at collecting, transmitting, storing data and at its modelling and use where those activities are predominantly aimed at the provision of data and analytics enabling GHG emission reductions)
- **Development of software modification and solutions that lower the emission of this or other software** (for example, by optimizing its architecture)

[8] Global e-Sustainability Initiative & Accenture Strategy (2015) ICT Solutions for 21st Century Challenges.. https://smarter2030.gesi.org/downloads/Full_report.pdf

Thresholds and methodology

Data centres

Singapore context

As noted above, Singapore has, in the last decade, become a major hub for data centres within the ASEAN region, accounting for 7% of energy requirements. Following the booming demand for energy, the Singapore government placed a three-year moratorium (mid 2019-mid 2022) on the building of new data centres to constrain demand on the energy system.

In a recent Data Center – Call for Applications exercise, the Singaporean government has stated a new set of criteria for data centres that established a stringent threshold (PUE of 1.3 or lower; a Platinum rating under the Green Mark Scheme for New Data Centres). These requirements have been taken into account when developing thresholds for the sector.

Decarbonisation options for data centres

There are several aspects that affect emissions profile of a data centre:

Energy efficiency. Energy efficiency of data centres is usually measured in power usage effectiveness (PUE) ratio. It is determined by dividing the total amount of power entering a data centre by the power used to run the IT equipment within it. PUE is expressed as a ratio, with overall efficiency improving as the quotient decreases toward 1.0.

Energy sourcing. Replacement of fossil fuels generation with renewables generations can help further reduce scope 2 emissions, especially once marginal efficiency gains become more expensive to improve.

Cooling and refrigeration efficiency. Refrigerants that are used within data centres are liquids or a gas with a very low boiling point. Refrigerants such as hydrofluorocarbons are powerful greenhouse gases with global warming potential (GWP) hundreds to thousands of times more potent per unit than carbon dioxide. Their effect on climate is measured in GWP units where lower GWP refrigerants can reduce the emissions of a data centre.

Water usage efficiency. Singapore's non-domestic sector uses about 55% of its current water supply and this is projected to increase to 70% of its future water demand by 2060. Water Usage Effectiveness (WUE) indicator is computed using the data centre's annual water consumption (in cubic meters) divided by the annual operating IT equipment load (in MWh). As of 2021, the median WUE for data centres in Singapore was 2.4[9] while the lowest was 2.0 and the highest was around 4.8.

Architecture, design, and maintenance efficiency. Sustainable construction materials, proper organization of space within the data centre, efficient lighting and air cooling can reduce the consumption of energy and refrigerants thus improving the emissions profile of the facility.

[9] https://www.pub.gov.sg/Documents/PUB_WaterEfficiencyBenchmark_DataCentre_2021.pdf

All these criteria will be addressed by creating thresholds for the activities of the sector.

Software

Software is not, in itself, the source of material emissions, but it can drastically improve the emission profile of other activities ("greening by IT") – i.e. it is an enabling activity. Thus, the only metrics that can be applied is the metrics of **efficiency** with which the emission management software fulfills its mission.

Recent developments in the IT sector also launched a movement for "greening of IT" itself in order to improve energy efficiency of the IT solutions, maximize their use, minimize their carbon footprint and meet compliance requirements. Development of such software is a nascent field. These solutions make lesser impact on taxonomy's objectives but is also important. Thus, it is added as amber criteria-compliant activity without any additional thresholds.

Green threshold

- **PUE of the new facilities operating at full capacity must be no higher than 1.3.** The number should be updated in 2025 and every 3 years after that to account for changes in technological advancements.

The PUE of 1.3 is stringent enough for the current level of development of the sector in the Southeast Asia region. It is feasible that some centres in Singapore itself could comply with a PUE of 1.2, but the regional scope of the taxonomy makes 1.3 a more realistic short-term target. It provides alignment with the government-instated target and also establishes an ambitious threshold that is slightly more rigorous than the one proposed by the Climate Neutral Data Centre Pact, which unites the world's biggest data centre owners and operators (their target is PUE 1.4 by 2025 for countries in tropical climate and 1.3 for temperate and cold climates).

- **One of the two criteria must be met:**
    - **<u>If the activity in question is located in Singapore</u>: data centre must comply with Singapore Green Mark Scheme (SGMS) for new Data Centres Platinum Rating criteria**. The implementation of those practices is verified by an independent third-party and audited at least every three years.

  SGMS is a reliable Singaporean proxy that allows the measurement and improvement of a wide variety of parameters: design and architecture, cooling properties, energy efficiency (63% of all criteria relative "weight" within the labelling scheme), indoor environment quality and utilization of green innovative technologies. Platinum mark is the most stringent among the existing, it requires PUE of no more than 1.4-1.5; best-in-class energy management equipment; optimized water consumption; optimal air and light access for the building etc. It also allows us to utilize the requirements

provided by the Singaporean government thus making the system familiar to the local business community.

  - **<u>If the activity in question is located outside of Singapore</u>: WUE of the new data centres should be no more than 2.1 if the project starts before 2025, 2.0 if the project starts after 2025**

The water usage effectiveness is important taking into account limited water resources in Singapore and additional emission associated with their transportation from water-rich areas. The indicator of 2.1 is calculated using the "best in class" approach by subtracting 75% from the median indicator of 2.4 (with the lowest being 2.0).

- **Data centre operators must strive to power them with as much renewable or low-carbon energy (defined as the energy from the activities in the Energy sector of the taxonomy) as possible. After 2027, no less than 75% of the total energy consumption of the facility must come from renewable or low-carbon sources.**

Currently the Singaporean energy mix is dominated by oil and LNG that are responsible for more than 90% of generation. However, the national energy sector decarbonization strategy includes conversion of gas plants to hydrogen, creation of offshore solar and rooftop solar power stations (2 GW by 2030), import of green energy in various forms (30% of country's demand by 2035) and many other measures. The threshold of 75% is provided by the Climate Neutral Data Centre Pact, whose participants are among the biggest data centre owners in Singapore.

- **The GWP of refrigerants used in the data centre cooling system must not exceed 675**

In order to limit the GWP of refrigerants to a minimum, the threshold established for this activity by the European Taxonomy is proposed. 675 is the GWP of Difluoromethane, relatively low-emitting refrigerant popular across Asia and accessible on the market.

Amber threshold

The amber category is available only for retrofitting of the existing data centres and not for the new ones. Eligible activities thus include the retrofitting or maintenance/operation of facilities that are undergoing retrofitting that is compliant with the proposed thresholds.

- **PUE of the project is no higher than 1.6 if the retrofitting starts before 2025; no higher than 1.5 if retrofitting starts between 2025 and 2030**

This criterion is added to limit the upper boundary of the retrofittable facilities in order to avoid issuing amber label for a very old facilities. The target of 1.6 is calculated using "best-in-class" approach: average PUE for Asia-Pacific region is 1.75-1.77, and the subtraction of 10% amounts to roughly 1.6 (rounding up). A target of 1.5 is proposed after 2025 allows the taxonomy to keep up with the technological advancements.

- **Retrofit project must lead to aligning the existing data centre with a pathway of reaching PUE of 1.3 by 2030**

In order to be classified as amber, the retrofitting activity must be aimed at lowering the PUE of the facility to at least 1.3 by 2030.

- **One of the two criteria must be met**
    - **<u>If the activity in question is located in Singapore</u>: Data centre must comply with Singapore Green Mark Scheme for Data Centres Gold Rating Criteria**

    Gold rating is less stringent than the Platinum, but also rigorous enough to provide necessary level of climate efficiency to be classified as amber.

    - **<u>If the activity in question is located outside of Singapore</u>: WUE of the retrofitted data centres should be no more than 2.3 at the beginning of the retrofitting and retrofit project must lead to aligning the existing data centre with a pathway of achieving at least 2.0 by 2030**

    The starting indicator of 2.3 is calculated by subtracting 25% from the median indicator of 2.4 (with the lowest being 2.0).

- **The GWP of refrigerants used in the data centre cooling system must not exceed 675.**

This threshold stays as green due to low cost of complying with it and huge negative effect in case if it is relaxed.

Red threshold

Activities that are not compliant with either of the thresholds are designated as red.

Software

Green threshold

- **Data-driven solutions and software for GHG emission reductions**

These are considered to make a substantial contribution[10] to climate change mitigation because of the emissions reductions they enable through affecting various emission-sensitive indicators. Life-cycle GHG emissions and net emissions are calculated using ISO 14064-2:2019 or similar methodology. Quantified life-cycle GHG emission reductions are verified by an independent third party which transparently assesses how the standard criteria, including those for critical review, have been followed when the value was derived.

Amber threshold

- **Solutions and software that contribute substantially to reducing carbon footprint of the IT industry** through reengineering IT products and processes to improve their

[10] There is no common definition of "substantial contribution", so there are three options how this notion can be classified in the Taxonomy:

1. Define it numerically (causing a 15% better reduction\improvement of a target indicator than the best available on the market)
2. Leave it as it is, without a definition. Basically, it will mean that any GHG-emission software/solution can count as "making substantial contribution"
3. Define as "recognized as such by an independent third party"

energy efficiency, maximize their use, minimize their carbon footprint and meet compliance requirements.

Red threshold

Not available for this activity.

3.3. Compliance with other taxonomies

The Climate Bonds Taxonomy does not yet provide any criteria for ICT sector.

The EU Taxonomy provides criteria both for data centres and software, and in overwhelming majority of cases they are compatible with the ones in the draft Singapore Taxonomy. Data centres part refer to a variety of EU laws and regulations (*"European Code of Conduct on Data Centre Energy Efficiency, or in CEN-CENELEC document CLC TR50600-99-1 'Data centre facilities and infrastructures - Part 99-1: Recommended practices for energy management"*), but also contains a notion that it is possible to apply "*alternative best practices from the European Code of Conduct on Data Centre Energy Efficiency or other equivalent sources may be identified as direct replacements if they result in similar energy savings*".[11] As the criteria in the proposed Singaporean Taxonomy are more stringent than in the ones provided in the EU documents.

Concerning the software and solutions, the final decision on the compatibility can be made only after the final choice of "substantial contribution" definition is made. The EU Taxonomy solves this issue by stating that

"*where an alternative solution/technology is already available on the market, the ICT solution demonstrates substantial life-cycle GHG emission savings compared to the best performing alternative solution/technology.*

Life-cycle GHG emissions and net emissions are calculated using Recommendation 2013/179/EU or, alternatively, using ETSI ES 203 199, ISO 14067:2018 or ISO 14064-2:2019. Quantified life-cycle GHG emission reductions are verified by an independent third party which transparently assesses how the standard criteria, including those for critical review, have been followed when the value was derived[12]".

4. GFIT seeks feedback on the level of ambition for ICT criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

[11] 202 2 Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency (2022). https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/jrc128184_jrc128184_jrc128184_2022_best_practice_guidelines-1.pdf

[12] https://eur-lex.europa.eu/resource.html?uri=cellar:d84ec73c-c773-11eb-a925-01aa75ed71a1.0021.02/DOC_2&format=PDF

Detailed criteria and thresholds

Data processing, storage, transmission, and management

Sector	ICT	
Activity	Data processing, storage, transmission, and management	
ISIC code	6311	
ISIC description	Provision of infrastructure for hosting, data processing services and related activities, specialized hosting activities such as web hosting, streaming services, application hosting; application service provisioning; general time-share provision of mainframe facilities to clients; data processing activities such as complete processing of data supplied by clients or generation of specialized reports from data supplied by clients; provision of data entry services.	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practice / reference taxonomies
Green	• PUE of new facilities operating at full capacity must be no higher than 1.3. This number must be updated in 2025 and every 3 years after that. One of the two criteria must be met: ○ <u>If the activity in question is located in Singapore</u>: Data centre must comply with Singapore Green Mark Scheme (SGMS) for new Data Centres Platinum Rating criteria. The implementation of those practices is verified by an independent third-party and audited at least every three years. ○ <u>If the activity in question is located outside of Singapore</u>: WUE of the new data centres should be no more than 2.1 if the project starts before 2025, 2.0 if the project starts after 2025 • Data centre operators must strive to power them with as much renewable or low-carbon energy (defined as the energy from the activities in the Energy sector of the taxonomy) as possible. After 2027 no less than 75% of the total energy consumption of the facility must come from renewable or low-carbon sources • The GWP of refrigerants used in the data centre cooling system must not exceed 675 • If the project includes the construction of a new facility, the facility must be compliant with the relevant Green Building criteria from the present Taxonomy	Compatible with the EU Taxonomy in majority of cases. GWP threshold is adapted from the EU Taxonomy. Renewable energy Threshold is adapted from the Climate Neutral Data Centre Pact. Label and PUE target are adapted from the Singaporean regulations.
Amber	• Retrofitting only • PUE of the project is no higher than 1.6 if the retrofitting starts before 2025; no higher than 1.5 if retrofitting starts between 2025 and 2030 and • Retrofit project must lead to aligning the existing Data Centre with a pathway of reaching PUE of 1.3 by 2030 and	Amber thresholds are developed by Climate Bonds and modified throughout the discussions with the relevant experts during the consultation phase

	• The GWP of refrigerants used in the data centre cooling system must not exceed 675 and • One of the two criteria must be met: ○ If the activity in question is located in Singapore: Data centre must comply with Singapore Green Mark Scheme (SGMS) for Data Centres Gold Rating criteria. ○ If the activity in question is located outside of Singapore: WUE of the retrofitted data centres should be no more than 2.3 at the beginning of the retrofitting and retrofit project must lead to aligning the existing data centre with a pathway of achieving at least 2.0 by 2030	
Red	Not compatible with either of the thresholds	

GHG-related solutions and software

Sector	ICT	
Activity	GHG-related solutions and software	
ISIC code	6201; 6202	
ISIC description	This class includes the writing, modifying, testing and supporting of software; designing the structure and content of, and/or writing the computer code necessary to create and implement systems software (including updates and patches), software applications (including updates and patches), databases and web pages; customizing of software, i.e. modifying and configuring an existing application so that it is functional within the clients' information system environment; planning and designing computer systems that integrate computer hardware, software and communication technologies; provision of on-site management and operation of clients' computer systems and/or data processing facilities, as well as related support services	
Objective		
Traffic light	**Threshold**	**Alignment with international best practice / reference from other taxonomies or methodologies**
Green	• Data-driven solutions and software for GHG emission reductions are considered to make a substantial contribution to climate change mitigation because of the life-cycle emissions reductions they enable through affecting various emission-related processes • Life-cycle GHG emissions and net emissions are calculated using ISO 14064-2:2019 or similar methodology. • Quantified life-cycle GHG emission reductions are verified by an independent third party which transparently assesses how the standard criteria, including those for critical review, have been followed when the value was derived.	Compatible with the EU Taxonomy with the exception of definition about "substantial contribution"
Amber	Solutions and software that contribute substantially to reducing carbon footprint of the IT industry through reengineering IT products and processes to improve their energy efficiency,	Adopted based on suggestion from the consultations phase

	maximize their use, minimize their carbon footprint and meet compliance requirements.	
Red	N/A	

5. Waste

Sector overview

The Waste sector, and specifically solid waste management, has the potential to support other sectors of the economy in reducing greenhouse gas emissions through waste prevention, separate hazardous waste collection, waste reuse and recycling.

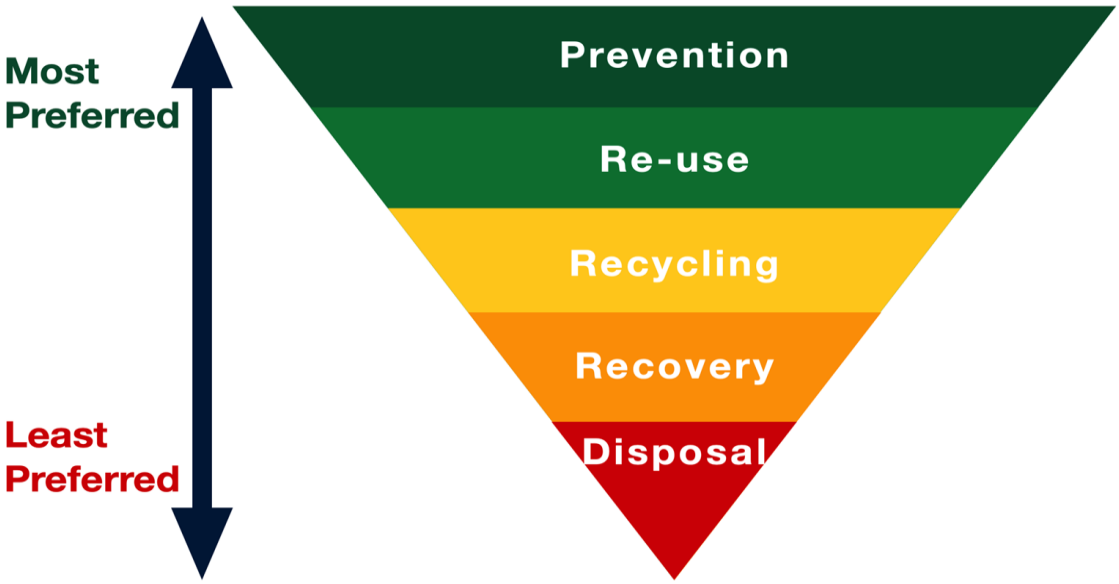
In Singapore, around 6.94 MTs of Municipal Solid Waste (MSW) was generated in 2021, with an overall recycling rate of 55%. Most of the waste is attributed to non-domestic sources (74%), and around 80% of total MSW is treated by Waste-to-Energy (WtE) plants (NEA, 2022). Currently, there are four WTE plants, a transfer station and one offshore landfill. Given Singapore's land constraints, there is limited space inland for additional MSW facilities. Nonetheless, Singapore aims to be a zero-waste nation by strengthening its climate, resource and economic resilience and adopt a circular economy approach to sustainable waste and resource management (NEA, 2022).

The Singapore Taxonomy for the Waste sector is developed for Singapore-based Financial Institutions (FIs) to guide business activities in Singapore and regionally. It includes key activities for the management of post-consumer MSW, etc., which have a substantial contribution to mitigating climate change and moving towards a circular economy. The following economic activities and assets were identified for this sector:

- Collection and transport of non-hazardous waste
- Biowaste treatment: composting of biowaste
- Biowaste treatment: anaerobic digestion
- Waste-to-Energy (WtE)
- Landfill gas capture and utilisation (not directly applicable to Singapore) Material recovery facilities

Waste hierarchy

The



waste hierarchy acts as a guide for developing criteria across the sector. The top level of these activities is highly encouraged with limited, or no criteria attached. Moving further down to recovery and disposal, these are the least preferred methods of eliminating waste but allowed in certain circumstances, with more stringent thresholds.

WtE activity is focused primarily based on incineration technology and was considered based on the relevance for Singapore. The metrics and thresholds for this activity ensure that recycling is still prioritised over incineration. Other waste-to-energy technologies such as pyrolysis, gasification that can produce alternate and sustainable fuels or chemicals are not covered currently in the taxonomy as these technologies are still under development. However, such technologies are covered under the R&D activities in the taxonomy. The activity of landfill gas capture and utilisation was included considering its relevance for ASEAN countries.

We note here that in Singapore's context, waste is first sent for incineration, and the incineration ash is subsequently landfilled together with non-incinerable waste. Landfilling of waste with methane capture has been included here as it provides guidance for such projects at the regional level.

Threshold overview and methodology

The criteria for the sector considers the waste management hierarchy to ensure adequate management of the MSW by prioritising recycling over energy recovery or landfilling. Separation at source or at an intermediate facility are promoted to ensure better and efficient recycling. Waste to Energy (WtE) has been included considering the local context, however, the thresholds are strict to ensure that only efficient plants are considered. Additionally, direct disposal of waste at WtE plants without pre-sorting of recyclables is not considered under green or amber categories.

The metrics chosen for activities related to collection and transportation and biological treatment of waste (composting and anaerobic digestion) are qualitative, as the climate mitigation effect is an inherent result of the economic activities. The mitigation of GHG emissions occur by the process of transformation of waste into by-products such as biogas or compost. The collection and transportation of waste to recycling facilities enables recycling and material recovery. However, the metrics include ensuring quality checks on the processes such as methane leakage monitoring, adequate use of by-products, ensuring sorting of waste, among others.

For Material Recovery Facilities, a minimum recovery efficiency was established to ensure that recycling is prioritised. For WtE, quantitative criteria related to energy efficiency and bottom ash recovery are established.

As in EU and Climate Bonds Taxonomy, the corresponding activities in Waste sector are primarily qualitative and incorporates criteria to ensure adequate process efficiencies (e.g., reducing methane leakage in composting plants). The green thresholds primarily support segregation of waste at source for effective recovery and recycling. The collection and transportation of non-hazardous waste for energy recovery directly without any material recovery for recycling has been defined as Amber as it is preferred to establish a waste value chain with intermediate sorting and processing to enhance recovery and recycling, as well as lower GHG emissions.

For WtE plants, the net thermal efficiency of the plants is expected to be above 25% and the bottom ash recovery of metal is expected to be at least 75% for Green classification, as this ensures net GHG emissions through enhanced energy recovery. Similarly, the green threshold for Material recovery facilities is expected be above 50%, so as to have significant material recovery that can foster a sustainable waste value chain, with economically feasible and environmentally supportive recycling sector. The 50% efficiency in intermediate sorting also prevents majority of waste entering the landfill and allows for net GHG emission reductions through high quality of waste recycling.

Note: Pre-sorting refers to a process where the input waste has undergone sorting of recyclables at an intermediate facility such as a Material Recovery Facility (MRF); Residual waste refers to non-recyclable fraction of the waste; Segregation refers to separating waste into different fractions such as biowaste, recyclables, etc**.**

5. GFIT seeks feedback on the level of ambition for Waste sector criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Collection and transport of non-hazardous waste

Sector	Waste	
Activity	**Collection and transport of non-hazardous waste**	
ISIC Code	E3811	
ISIC Description	Collection of Non-Hazardous Waste	
Objective	Net GHG emission reductions through reuse and high quality recycling of waste, which are enabled by the separate collection and transport of source-segregated non-hazardous waste fractions	
Traffic Light	**Threshold**	Alignment with international best practice/ taxonomies / methodologies
Green	• Collection and transportation of non-hazardous waste that is segregated at source or at an intermediate sorting facility that is intended for preparation for reuse or recycling operations. • Includes waste collection containers, transfer stations, transportation vehicles and other related infrastructure. • The criteria for vehicles are defined under the activities of Transportation sector.	Compatible with EU Taxonomy criteria
Amber	• Collection and transportation of non-hazardous waste for energy recovery directly without any material recovery for recycling. • Includes waste collection equipment and other related infrastructure. • The criteria for vehicles is defined under the activities of Transportation sector.	
Red	• Collection and transportation of non-hazardous waste directly for disposal to landfills. • Does not include adequate equipment for collections and transportation.	

Biowaste treatment: composting of biowaste

Sector	Waste	
Activity	**Biowaste treatment: composting of biowaste**	
ISIC Code	E3821	
ISIC Description	Treatment and Disposal of Non-Hazardous Waste	
Objective	Net GHG emission reduction through production and use of digestate as fertiliser/soil improver, displacing synthetic fertilisers and increasing carbon sequestration in soils.	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The bio-waste that is composted is source segregated and collected separately.	Compatible with EU Taxonomy criteria

	• Ensure efficient operations to avoid methane leakage (e.g., improper aeration or mixing). • The compost produced is used as fertiliser or soil improver.	
Amber	• Receiving unsegregated waste at site but sorting before composting the organic fraction. • Ensure efficient operations to avoid methane leakage (e.g., improper aeration or mixing). • The compost produced is used as fertiliser or soil improver.	
Red	• Waste is neither segregated at source nor pre-sorted. • Lack of proper aeration system. • Compost quality is poor and is not suitable for application to soil.	

Biowaste treatment: anaerobic digestion

Sector	Waste	
Activity	**Biowaste treatment: anaerobic digestion**	
ISIC Code	E3821	
ISIC Description	Treatment and Disposal of Non-Hazardous Waste	
Objective	Net GHG emission reduction through controlled production and utilization of biogas in various forms and applications, often displacing fossil fuels	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The bio-waste that is used for anaerobic digestion is source segregated and collected separately. • The produced biogas is used directly for the generation of electricity or heat or upgraded to bio-methane for injection in the natural gas grid or used as vehicle fuel or as feedstock in chemical industry. • The produced digestate is used as fertiliser or soil improver, either directly or after composting or any other treatment as permitted by the applicable regulations. • A monitoring and contingency plan is in place in order to minimise methane leakage at the facility. • Woody waste must be segregated before or after processing and sent to an eligible treatment plant (such as composting or biomass-based energy plants).	Aligned with EU Taxonomy criteria
Amber	• Waste is not source separated but pre-sorted at facility. • A monitoring and contingency plan is in place in order to minimise methane leakage at the facility. • The produced biogas is flared directly without use of energy. • The produced digestate is used as fertiliser or soil improver, either directly or after composting or any other treatment. • The rejects from pre-sorting facility are disposed at taxonomy-eligible facilities. • The sunset date for amber criteria is 2025[13].	
Red	• Waste is not source segregated or pre-sorted.	

[13] The aim is to avoid total flaring of biogas without energy recovery. Two year transition period is considered sufficient for implementing the retrofit.

	• No methane detection system installed. • The produced biogas is flared directly. • Digestate is not used as fertiliser or soil improver.	

Waste to Energy (Incineration)

Sector	Waste	
Activity	**Waste to Energy (Incineration)**	
ISIC Code	E3821, E3822	
ISIC Description	Treatment and Disposal of Non-Hazardous Waste Treatment and Disposal of Hazardous Waste	
Objective		
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• Residual or pre-sorted waste only • Net plant efficiency >= 25%; • Bottom ash recovery with at least 75% recovery of metal from ash • R&D relating to new and emerging technologies. These include but are not limited to pyrolysis, gasification that can produce alternate and sustainable fuels or chemicals	Aligned to Climate Bonds Taxonomy
Amber	• Unsegregated waste, but with pre-sorting at an intermediate facility to recover high quality recyclables before processing in the Waste-to-Energy plant. • Net plant efficiency less than 25%, till 2030. • Partial bottom ash recovery with some recovery of metal from ash (at least 50%).	
Red	• Waste directly used in waste to energy facilities without any pre-sorting. • Metal recovery in bottom ash is <50%. • Plant Efficiency less than 10%.	

Landfill gas capture and utilisation

Sector	Waste	
Activity	**Landfill gas capture and utilisation**	
ISIC Code	E3821, E3822	
ISIC Description	Treatment and Disposal of Non-Hazardous Waste Treatment and Disposal of Hazardous Waste	
Objective	Net GHG emission reduction through the capture and utilization of landfill gas in various forms and applications, often displacing fossil fuels.	
Traffic Light	**Threshold**	Alignment with best practice/ taxonomies or methodologies
Green	• The landfill cell where gas capture is implemented is permanently closed and will not receive waste. • The produced biogas is used directly for the generation of electricity or heat or upgraded to bio-methane for injection in the natural gas grid or used as vehicle fuel or as feedstock in chemical industry. • A monitoring and contingency plan is in place in order to minimise methane leakage at the facility.	Aligned to EU Taxonomy threshold

Amber	• The landfill cell where gas capture is implemented is permanently closed and will not receive waste. • Biogas is flared without use for generation of heat/electricity or biomethane production. • The sunset date for amber criteria is 2025.	
Red	• Operational landfill cells that are receiving unprocessed MSW. • Biogas is not captured or flared without use for generation of heat/electricity or biomethane production.	

Material recovery facilities

Sector	Waste	
Activity	**Material recovery facilities**	
ISIC Code	E3830	
ISIC Description	Material Recovery	
Objective	The activity supports separation of recyclable components in the waste stream, thus displacing the use of primary raw materials in production processes.	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The activity results in a sorting efficiency of at least 50%, in terms of weight of the waste input. The sorted waste may then be used as secondary raw materials that are suitable for the substitution of virgin materials in production processes. After 2030, these facilities must achieve a sorting efficiency of at least 80%. • All facilities and equipment such as conveyor belts, compactors, pelletizers, air classifiers, magnetic belts, and other infrastructure required for material recovery are eligible.	The threshold of 50% is compatible with EU Taxonomy criteria
Amber	• The activity converts at least 40%, in terms of weight, of the sorted or separately collected non-hazardous waste into secondary raw materials that are suitable for the substitution of virgin materials in production processes. • Allowed till 2025[14] after which the facilities must meet the green criteria.	
Red	• Recovery efficiency of the Material Recovery Facility is less than 40%.	

[14] 2025 is chosen as the sunset given that the 40% threshold is low and less stringent than other taxonomies globally.

6. Water

Sector overview

The water sector is intrinsically integrated and interrelated with other sectors, and across every Sustainable Development Goal (SDG). Investment in water sector is pivotal to building climate resilience across sectors and strengthening international peace and security. The World Bank estimates that sustained negative growth will occur in some regions due to water related losses in agriculture, health, income and property (World Bank, 2016).

Water and energy use are also highly correlated meaning reducing leakages and increasing energy efficiency are also important to meeting climate mitigation goals. This is particularly for areas requiring desalination which is energy intensive or where water is transported over great distances. For example, in California, the water system uses approximately 20% of the state's electricity and 30% of its natural gas to pump, convey, treat, and heat water[15].

At the same time, poor access to safe drinking water and sanitation can lead to innumerable premature deaths and negatively affect a region's economy. The activities within the water sector for a sustainable finance Taxonomy shall primarily involve processes for efficient design of water collection, treatment, supply and wastewater treatment, with specific focus on increasing energy efficiency and reducing leakage losses.

In Singapore, water demand is currently about 430mgd, with more than half of the water demand accounted for by the non-domestic sector. Singapore's total water demand is expected to almost double by 2060, with the non-domestic sector accounting for 70%. The increase in water demand would be met by the installation, upgrading and effective operation of NEWater, desalination plants and distribution network (PUB, 2022) In Singapore, rainwater and used water are collected and conveyed through separate systems, ensuring that our waterways are free of pollution. Rainwater collected in local catchment areas is stored in 17 reservoirs and treated at our local waterworks to produce potable water. It is then distributed through a 5800km transmission network to both households and industries.

Used water is collected via 3600km of public sewers and deep tunnel sewerage systems and is sent to the four water reclamation plants for treatment (PUB, 2022). The treated used water, effluent, is further purified using advanced membrane technologies and ultra-violet disinfection to produce NEWater at NEWater plants. Singapore also has desalination plants which produces potable water.

The activities in water sector for Singapore have been defined as follows:

- **Plants:** Construction, extension and operation of new water collection and treatment systems
- **Plants:** Renewal of water collection and treatment systems

[15] https://www.ppic.org/publication/water-and-energy-in-california/

- **Distribution network:** Construction, extension and operation of new water collection and treatment systems
- **Distribution network:** Renewal of water collection and treatment systems (distribution networks)
- **Plant:** Construction, extension and operation of wastewater collection and treatment
- **Collection network:** Renewal of wastewater collection and treatment
- **Plants:** Desalination systems

The activities align with ISIC - Section E: Water supply, Sewerage, Waste Management and Remediation Activities. The Water collection, treatment and supply related activities align with E3600 and Wastewater sewerage related activities align with E 3700.

Choice of metrics

The metrics chosen for the water sector consider improvements in efficiencies of systems based on energy efficiency or net energy consumption or through reduction of leakages. The efficiencies are measured based on population equivalent or m^3 of water produced or treated. The metrics for distribution networks are based on leakage indices.

For desalination systems, the metrics are based on net GHG emissions measured per m^3 of potable water produced. Net energy consumption may take into account measures decreasing energy consumption, such as source control (pollutant load inputs), and, as appropriate, renewable energy generation (such as hydraulic, solar and wind energy). The plant can also purchase renewable energy to reduce the net GHG emissions.

Threshold overview and methodology

For new water collection and treatment systems, the threshold is based on net energy consumption per m3 of water produced for supply. The renewal of existing collection and treatment systems must demonstrate at least 20% improvement in energy efficiency over existing systems (measured over a period of 3 years). The net energy reduction can also be achieved using measures to decrease energy consumption, such as source control (pollutant load inputs), and, as appropriate, renewable energy generation (such as hydraulic, solar and wind energy)

Similarly, for construction of new wastewater systems, the thresholds are based on energy consumption per population equivalent or m^3 of wastewater treated. For renewal of wastewater systems, the thresholds establish a minimum improvement of at least 20% in terms of net energy consumption compared to the baseline (measured over a period of 3 years).

The green thresholds defined for wastewater collection and treatment are based on plant capacity and are detailed in Table 10. These thresholds are aligned with the EU Taxonomy limits. The amber thresholds are developed considering data from the wastewater plants in Singapore.

Table 10. Thresholds defined for wastewater collection and treatment for green category

Wate water treatment Plant Capacity (population equivalent – p.e.)	**Net energy consumption of wastewater treatment plant (KWh per p.e. per annum)**
Less than 10,000	35
Greater than 10,000 and lesser than 100,000	25
Greater than 100,000	20

The thresholds for distribution networks are based on reducing leakages in the systems for the segment of the network that is renewed.

The threshold for desalination systems is aligned to Climate Bonds and EU criteria, wherein average carbon intensity of energy used to power the plant must be at or below 100g CO_2e/kWh over the remaining lifetime of the asset. Alternately, the thresholds also incorporate carbon intensity (CO_2e/m^3 treated water) which is based on both carbon intensity of the energy sector (350g CO_2/kWh until 2025, 250g CO_2/kWh between 2025-2030 and 150 gCO_2/kWh between 2030-2035) and the plant efficiency of 3.5 kWh/m3. Desalination plants can meet the thresholds through reduction in carbon intensity of energy source and/or through improvements in energy efficiency.

6. GFIT seeks feedback on the level of ambition for Water sector criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Construction, extension and operation of new water collection and treatment systems

Sector	Water	
Activity	**Construction, extension and operation of new water collection and treatment systems**	
ISIC Code	E3600	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Water collection, treatment, and supply**	
Objective	Substantial contribution to GHG emissions savings through low specific energy consumption in the water collection, treatment and supply system	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The **net average energy consumption f**or **abstraction and treatment** equals to or is lower than **0.5 kWh per cubic meter** of water produced for supply. • Net energy consumption may consider measures decreasing energy consumption, such as source control (pollutant load inputs), and, as appropriate, energy generation (such as hydraulic, solar and wind energy).	Aligned with EU Taxonomy threshold and European benchmarking
Amber	• The net average energy consumption for abstraction and treatment equals to or is lower than **0.7 kWh per cubic meter** produced water supply. • Net energy consumption may take into account measures decreasing energy consumption, such as source control (pollutant load inputs), and, as appropriate, energy generation (such as hydraulic, solar and wind energy).	
Red	• Doesn't meet green or amber thresholds	

Renewal of water collection, treatment and supply systems

Sector	Water	
Activity	**Renewal of water collection, treatment and supply systems**	
ISIC Code	E3600	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Water collection, treatment and supply**	
Objective	Substantial contribution to GHG emissions savings through low specific energy consumption in the water collection, treatment and supply system	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• For renewal systems that meet the green thresholds established in the activity "*Construction, extension and operation of new water collection and treatment systems*", no additional requirements apply.	
Amber	• The difference in the **net average energy consumption of the system must be reduced by at least 20%** compared to own baseline performance averaged for previous three years, including abstraction and treatment, measured in kWh per cubic meter produced water supply and that established in the green	Aligned with EU Taxonomy threshold

	threshold category for *Construction, extension and operation of new water collection and treatment systems".* • The efficiency must be achieved after the completion of commissioning and optimization phase.	
Red	• Doesn't meet green or amber thresholds	

Construction, extension and operation of water collection, treatment and supply systems (distribution networks)

Sector	Water	
Activity	**Construction, extension and operation of water collection, treatment and supply systems (distribution networks)**	
ISIC Code	E3600	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Water collection, treatment and supply**	
Objective	Substantial contribution to GHG emissions savings through low specific energy consumption in the water collection, treatment and supply system	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The distribution loss (%) is less than 5% for the segment of the network	
Amber	• The distribution loss (%) is less than 20% for the segment of the network	
Red	• Doesn't meet green or amber thresholds	

Note: Distribution losses (%) = % AFW (real losses) + % UFW (unaccounted losses)

Renewal of water collection, treatment and supply systems (distribution networks)

Sector	Water	
Activity	**Renewal of water collection, treatment, and supply systems (distribution networks)**	
ISIC Code	E3600	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Water collection, treatment and supply**	
Objective	Substantial contribution to GHG emissions savings through low specific energy consumption in the water collection, treatment and supply system	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• For renewal systems that meet the green thresholds established in the activity "Construction, extension and operation of new water collection and treatment systems (distribution networks), no additional requirements apply.	
Amber	• For distribution systems, the leakage levels **must be reduced by at least 20% for the segment of the network** compared to own baseline performance averaged for previous three years, and that established in the green threshold category for *Construction, extension and operation of new water collection, treatment, and supply systems".*	Aligned with EU Taxonomy threshold

	• The efficiency must be achieved after the completion of commissioning and optimization phase.	
Red	• Doesn't meet green or amber thresholds	

Desalination Systems

Sector	Water	
Activity	**Desalination Systems**	
ISIC Code	E3600	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Water collection, treatment, and supply**	
Objective	Substantial contribution to GHG emissions savings through low specific energy consumption in the water collection, treatment and supply system	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• The average carbon intensity of energy used to power the plant must be at or below 350 gCO_2/m3 of potable water produced, or • the energy used for the desalination plant must have carbon intensity less than 100g CO_2/kWh over the remaining lifetime of the asset. • The carbon intensity threshold is based on the trajectory established in the energy sector.	Aligned with EU Taxonomy and Climate Bonds Taxonomy threshold
Amber	• The average carbon intensity of desalination plant must be less than 1225 gCO_2/m3 of potable water produced until 2025; less than 875 gCO_2/m3 of potable water produced between 2025 – 2030 and less than 525 gCO_2/m3 of potable water produced between 2030 – 2035. • Beyond 2035, desalination plants must meet the green criteria.	
Red	• Doesn't meet green or amber thresholds	

Note: *The carbon intensity for amber is established considering the carbon intensity of the energy sector (350 gCO_2/kWh until 2025, 250 gCO_2/kWh between 2025-2030 and 150 gCO_2/kWh between 2030-2035) and the plant efficiency of 3.5 kWh/m3. Desalination plants can meet the thresholds through reduction in carbon intensity of energy source and/or through improvements in energy efficiency.*

Construction, extension and operation of wastewater collection and treatment

Sector	Water	
Activity	**Construction, extension and operation of wastewater collection and treatment**	
ISIC Code	E3700	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Sewerage**	
Objective	Net GHG emission reduction through optimization of wastewater treatment thus substituting sanitation systems with higher GHG emissions.	
Traffic Light	**Threshold**	Alignment with international best

		practice/ reference/ taxonomies
Green	• The net energy consumption of the wastewater treatment plant equals to or is **lower than: 35 kWh per population equivalent** (p.e.) per annum for treatment plant capacity below 10,000 p.e.; **25 kWh per population equivalent** (p.e.) per annum for treatment plant capacity between 10,000 and 100,000 p.e.; **20 kWh per population equivalent (p.e.)** per annum for treatment plant capacity above 100,000 p.e. Net energy consumption of the operation of the waste water treatment plant may take into account measures decreasing energy consumption relating to source control (reduction of storm water or pollutant load inputs), and, as appropriate, renewable energy generation. • For the construction and extension of a waste water treatment plant or a waste water treatment plant with a collection system, which are substituting more GHG-intensive treatment systems (such as septic tanks, anaerobic lagoons), an assessment of the direct GHG emissions is performed to establish that the new systems is more efficient.	Aligned with EU Taxonomy threshold
Amber	• The net energy consumption of the wastewater treatment plant equals to or is **lower than: 63.5 kWh per population equivalent** (p.e.) per annum for treatment plant capacity below 10,000 p.e.; **46.5 kWh per population equivalent** (p.e.) per annum for treatment plant capacity between 10,000 and 100,000 p.e.; **37 kWh per population equivalent** (p.e.) per annum for treatment plant capacity above 100,000 p.e. Net energy consumption of the operation of the waste water treatment plant may take into account measures decreasing energy consumption relating to source control (reduction of storm water or pollutant load inputs), and, as appropriate, renewable energy generation.	
Red	• Doesn't meet green or amber thresholds	

Note: *Awaiting confirmation on the thresholds (for >100,000 PE, the limit is 20kWH per annum); p.e. to m3 data if available*

Renewal of wastewater collection and treatment

Sector	Water	
Activity	**Renewal of wastewater collection and treatment**	
ISIC Code	E3700	
ISIC Description	Water supply, Sewerage, Waste Management and Remediation Activities: **Sewerage**	
Objective	Net GHG emission reduction through optimization of wastewater treatment thus substituting sanitation systems with higher GHG emissions.	
Traffic Light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• For renewal systems that meet the green thresholds established in the activity "*Construction, extension and operation of wastewater collection and treatment*", no additional requirements apply.	

Amber	• The difference in the **net average energy consumption of the system must be reduced by at least 20%** compared to own baseline performance averaged for previous three years, including abstraction and treatment, measured in kWh per cubic meter produced water supply and that established in the green threshold category for "*Construction, extension and operation of wastewater collection and treatment".* • The net energy consumption is estimated in terms of kWh per population equivalent (p.e.)	Aligns with EU Taxonomy threshold
Red	• Doesn't meet green or amber thresholds	

7. Agriculture

Sector overview

Agriculture accounts for an estimated 34% of all anthropogenic GHG emissions worldwide (Crippa et al., 2021). In 2019, emissions within the farm gate (crop and livestock production, including on-farm energy use) accounted for 7.2 Gt CO_2 eq. yr−1, while emissions from land-use change accounted for 3.5 Gt CO_2 eq. yr−1. In brief, 65% of all emissions within the agri-food sector are related to primary food production (Tubiello et al., 2022). In addition to the high carbon footprint, traditional agricultural practices are drivers of biodiversity loss and water/soil degradation (Benton et al., 2021; Hunke et al., 2014). At the same time, agriculture is one of the sectors most vulnerable to the impacts of climate change (Tao et al., 2011). Recent extreme events have demonstrated how food production systems can be affected by shifting global climate; heat waves in southern Asia have destroying wheat crops and severe drought in southern Brazil has severely damaged the soybean crop.

Meanwhile, by 2050, it is projected that the global population will increase to 10 billion resulting in a 50% increase in food demand, with global grain demand projected to double. Income growth in low- and middle-income countries are driving changes in diets towards more emissions-intensive animal-based products, much of it grain fed. While the need to increase crop yields is clear, how this will be achieved is less obvious given the likely negative impacts of climate change and the evidence that yields of major crops have been levelling off in large parts of the major producing countries (Ray et al., 2012).

To reduce the impact of food production on the environment, the sector must shift to a more sustainable footing. Generally, ‘sustainable’ activities are understood as those that are capable of meeting the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland report; 1987). However, a standard narrative on what constitutes sustainable agriculture is yet to emerge due to the complexity of the sector. Production systems are often referred to as "sustainable", but the absence of agreed definitions mean that the risk of incremental changes to business-as-usual and of greenwashing is substantial. The goal of this document is to provide a common understanding on Low carbon agricultural operations for the Singapore context as a guide for the financial sector.

Levers for reducing emissions from the agriculture sector

For the following agriculture criteria, the focus is on reducing the GHG emissions relating to agriculture. There are a number of levers available to reduce emissions from agriculture which we are trying to target through these criteria. These include, but not only:

- Less emission intensive crop and animal production
- Reduced use of chemicals
- Increased use of bio solution
- Use of organic fertilizers

- Use of low carbon equipment
- Better monitoring of environmental conditions
- Plant breeding dedicated to achieve better yields and resilience

There are, of course, other environmental goals that are important when referring to agriculture – such as reduced leaching of chemicals etc. Where these are aligned with climate goals, they are also tackled here but they are not the focus on this phase of work.

Singapore context

Food security is an existential issue for Singapore. To safeguard Singapore's food security, the Singapore Food Agency (SFA) adopts a multi-pronged approach which includes diversifying food import sources, increasing local production and growing food overseas. SFA also takes a risk-based approach to food safety which is guided by science and consistent with international standards. SFA has in place an integrated farm-to-fork food safety system to ensure that food is safe for consumption.

More than 90% of Singapore's food supply is imported, with only about 1% of Singapore's land set aside for agricultural use. Given Singapore's heavy reliance on imports, a key strategy to enhance its food security is import source diversification. In additional, local farms play an important role in the nation's food security as local production serves as a buffer by reducing dependence on imports during supply disruptions. The local agri-food sector is predominantly made up of farms, producing hen shell eggs, vegetables, and seafood.

Choice of metrics

Due to the diverse characteristics of agricultural operations, the approach to identifying green agricultural practices and activities does easily lend itself to quantitative metrics and/or thresholds.

Instead, it classifies activities and sub-activities according to the "traffic light" methodology where green are activities that are encouraged, amber are activities that should either be phased out or changed over a period of time and red are harmful activities. This approach is similar to the one used for the construction of the Colombian Taxonomy.

Categorisation of activities

The agriculture sector is diverse containing a wide variety of activities and a huge range of crops and animals that can be raised or grown. Despite this diversity, many activities exhibit similar characteristics, making it possible to group them together for simplicity of the taxonomy.

The activities here have been mapped and grouped using ISIC as a guide as follows:

- **Crops (perennial and non-perennial, ISIC codes A011 and A012):** Palm (oil), coffee, cocoa, tea, rubber trees, nuts, fruits, rice, wheat, soybeans, corn, cassava, sugar cane, sugar beet, tobacco, vegetables.
- **Animal production (ISIC A014):** bovine cattle and poultry (meat and eggs).

How to use these criteria

The criteria have been designed to be applicable to granular green activities as well as to the wider level (production unit). For example, some of the criteria are suitable for green use of proceeds finance, such as green bonds, where a bond is raised for a specific project or asset (e.g. machinery) while others (e.g. the proxy certification standards) are applicable at the crop level or famer level and could be used as part of corporate disclosure to classify green revenues.

Note that for a listed activity to be effectively considered as green, it should be in line with the relevant related guidelines in one or more of the listed credible certification schemes - e.g. if the criteria requires low carbon soy production then it must meet the requirements of low carbon soy production under the appropriate scheme(s).

7. GFIT seeks feedback on the level of ambition for Agriculture sector criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Sector	Agriculture	
Activity	Perennial crops (Palm (oil), coffee, cocoa, tea, rubber trees, nuts, fruits); Non-perennial crops (rice, wheat, soybeans, corn, cassava, sugar cane, sugar beet, tobacco, vegetables) – includes conventional, protected and hydroponic systems	
ISIC code	A 0111, A 0112, A 0113	
ISIC description	Perennial and non-perennial crops	
Objective	Identify green, amber and red operations dedicated to the production of perennial and non-perennial crops.	
Traffic light	Criteria	Alignment with international best practice / taxonomies or methodologies
Green	• Agricultural equipment powered by renewable energy or • Agriculture equipment that appears amongst the most energy efficient in the country – including irrigation – as certified by local energy efficiency standards; or • Low carbon crop management: regenerative agriculture, organic farming, precision agriculture, agroforestry, controlled environments, as certified by eligible schemes (see list aside**us management of protected and hydroponic agriculture facilities (refer to Climate Bonds Criteria for Protected Agriculture and Water Infrastructure for best practices); • Use of organic and biofertilizers; • Use of physical and biocontrol of pathogens, pests and weeds; • Nurseries related to low carbon crop management; • Adoption and maintenance of monitoring and tracking technology (with the goal of enhancing predictability and precision in agricultural operation, and thus being a resilience and adaptation measure) • Plant breeding (conventional breeding and genetic engineering with focus on productivity and resilience).	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach. Eligible certification schemes**: • Roundtable of Sustainable Palm Oil (RSPO) • Indonesian Sustainable Palm Oil (ISPO) • Malaysia Sustainable Palm Oil (MSPO) • Palm Oil Innovation Group (POIG) • UTZ Certified and Rainforest Alliance • International Sustainability and Carbon Certification (ISCC) • Singapore Good Agricultural Practice (SG GAP); • Specification for clean and green urban farms – Agriculture (SS 661); • IFOAM Standard • Cocoa Certification – Conservation Alliance • Bonsucro • Global GAP • Roundtable on Responsible Soy (RTSR) • Proterra Foundation • Sustainable Rice Platform (SRP) • Climate-Friendly Rice Certification (AgriCapture) • RSB Standard • Smartcane BMP • Climate Bonds Protected Agriculture (Mexico) and Water Infrastructure Criteria[16]
Amber	• Nutrient management plan based solely on chemical fertilizers for soil-based cultivation is eligible if there is a plan to phase out chemical fertilizers over time	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach;

[16] Note: that there is currently very limited guidance on protected agriculture around the world, criteria may be used as a proxy until additional guidance becomes available.

	• By 2030, no nutrient management plan based solely on chemical fertilisers for soil-based cultivation will be eligible – and should shift to integrated approach[17]. • Phytosanitary management plan based solely on chemicals (Phase-out by 2030 and shift to integrated approach[18]).	
Red	• Use of chemicals listed in the Stockholm Convention 1a or 1b in the WHO classification of pesticides by hazard or not in compliance with the Rotterdam Convention[19]; • Operations on land that has been converted from high carbon stock (HCS[20]) after Jan 1, 2010.	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach;

[17] Integrated Farm Management (IFM) is a site-specific farm business approach that uses the best of modern technology and traditional methods (as defined by IFMA).
[18] Ibid.
[19] As defined by High Carbon Stock Approach - https://highcarbonstock.org/
[20] Ibid.

Sector	Agriculture
Activity	Animal production (bovine cattle and poultry)
ISIC code	A 0121 A 0122 A 0140
ISIC description	Animal production
Objective	Identify green, amber and red operations dedicated to animal production.

Traffic light	Criteria	Alignment with international best practice / reference from other taxonomies or methodologies
Green	• Agricultural equipment powered by renewable energy or • Agriculture equipment that appears amongst the most energy efficient in the country as certified by local energy efficiency standards; • Low carbon livestock management: regenerative agriculture, organic farming, precision agriculture, agroforestry, controlled environments, as certified by eligible schemes (see list aside); • Use of organic and biofertilizers (pastures); • Use of physical and biocontrol of pathogens, pests and weeds (pastures); • Food additives with the aim of reducing methanogenesis from enteric fermentation (e.g. 3-NOP and seaweed) • Adoption and maintenance of monitoring and tracking technology (with the goal of enhancing predictability and precision in agricultural operation, and thus being a resilience and adaptation measure); • Bio-digesters (Bio-septic tank); • Pasture and animal breeding (with focus on productivity and resilience).	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach. Eligible certification schemes: • The Global Roundtable for Sustainable Beef (GRSB) • Sustainable Poultry Network (SPN – USA) • PoutryCARE
Amber	• Nutrient management plan (grazing crops) based solely on chemical fertilizers (Phase-out by 2030 and shift to integrated approach[21]); • Phytosanitary management (grazing crops) plan based solely on chemicals (Phase-out by 2030 and shift to integrated approach[22]).	Climate Bonds Taxonomy; Colombian Taxonomy applies a similar approach.
Red	• Use of chemicals listed in the Stockholm Convention 1a or 1b in the WHO classification of pesticides by hazard or not in compliance with the Rotterdam Convention[23]; • Operations on land that has been converted from high carbon stock (HCS[24]) after Jan 1, 2010; • Use of feed that is related to non-eligible operations under the perennial and non-perennial crops standards (previous slides).	Climate Bonds Taxonomy; Colombian Taxonomy applies a similar approach;

[21] Integrated Farm Management (IFM) is a site-specific farm business approach that uses the best of modern technology and traditional methods (as defined by IFMA).
[22] Ibid.
[23] As defined by HCSA
[24] Ibid.

8. Forestry

Sector overview

The forestry sector has an immense potential to provide environmental services that are extremely important in the fight against climate change. Forests can not only sequester and mitigate emissions of GHG, but also they play an important role in maintaining biodiversity assets intact. In addition, forestry can also be important to the local economy, through sustainable and regenerative systems.

Afforestation, reforestation, and forest management to maximize carbon sequestration are recognized as key strategies for climate mitigation by the Paris agreement because they are expected to slow global warming by removing CO_2 from the atmosphere. However, the actual mitigation effect of forestry activities will be influenced by many factors such as location, scale, and management effectiveness. In Europe for example, 250 years of land use change has increased forested areas by 10% and put over 85% of forests under management, yet this has not resulted in net CO_2 removal from the atmosphere because wood extraction released carbon stored in biomass, litter, dead wood, and soil carbon pools. In addition, converting deciduous forests into coniferous forests has resulted in changes in albedo, canopy roughness, and evapotranspiration from the land surface, which contributed to warming rather than climate change mitigation. Peat fires are a major contributor to GHG emissions in Indonesia (40% of the total in 2005 and, in 2015, rivalling daily emissions in the U.S.) and could add an estimated 1 billion tons to the country's carbon footprint.

Climate mitigation in the forestry sector is also strongly linked to avoiding deforestation and land use change. The total carbon content of forests has been estimated at 638 Gt for 2005, which is more than the amount of carbon in the entire atmosphere. According to the IPCC in its Fourth Assessment Report, reducing and/or preventing deforestation is the mitigation option with the largest and most immediate carbon stock impact in the short term.

Choice of metrics

Due to the diversity embedded in the forestry sector, the approach to identifying green agricultural practices and activities does not consider quantitative metrics and/or thresholds.

Instead, it classifies activities and sub-activities according to the “traffic light” methodology where green are activities that are encouraged, amber are activities that should either be phased out or changed over a period of time and red are harmful activities. This approach is similar to the one used for the construction of the Colombian Taxonomy.

Categorisation of activities

For the forestry sector, it is possible to group activities in three big groups, defined by the objectives and outputs of each operation in the sector.

The activities here have been mapped and grouped as follows:

- **Sustainable forest management** – a system that ensures that forests supply goods and services meet both present-day and future needs and contribute to the sustainable development of communities;
- **Forestry Plantation** - type of managed forest in which the trees are planted (as opposed to naturally regenerated), of the same age and generally of the same species, and are intended to maximize the production of wood fibre;
- **Conservation, restoration and maintenance** – actions needed to protect and assure that environmental services are provided by natural/pristine forests.

How to use these criteria

The criteria have been designed to be applicable to granular green activities as well as to the wider level. For example, some of the criteria are suitable for green use of proceeds finance, such as green bonds, where a bond is raised for a specific project or asset (e.g. nurseries) while others (e.g. the proxy certification standards) are applicable at the forestry project level and could be used as part of corporate disclosure to classify green revenues. Note that for an activity to be effectively considered as green, it should be in line with the relevant related guidelines in one or more of the listed credible certification schemes.

8. GFIT seeks feedback on the level of ambition for Forestry sector criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Sector	Forestry	
Activity	Sustainable forest management	
ISIC code	A 0200	
ISIC description	Forestry	
Objective	Identify green, amber and red assets, projects and related activities related to sustainable forest management.	
Traffic light	Threshold	Alignment with international best practice/ reference/ taxonomies
Green	• Land acquisition/refinancing if sustainable forest management practices are being carried out or being implemented as certified by credible international schemes (see list aside‡); OR • Equipment and costs incurred by the activities - pre and post extraction, including primary processing that is either powered by renewable energy or appear amongst the most energy efficient in the country - as certified by local energy efficiency standards); OR • Conservation, restoration and maintenance; OR • Nurseries[25] - required for the adoption of Integrated Farm Management (IFM[26] – find definition aside) practices - organic and biofertilizers/biocontrol – and that seeds and seedlings are sourced in sustainably managed areas; OR • Adoption and maintenance of monitoring technology that enables the tracking of the forest extracts and its conservation status.	Aligned to Climate Bonds Taxonomy; Colombian Taxonomy applies a similar approach; ‡Credible green certification schemes for sustainable forest management: • Forest Stewardship Council (FSC); • Programme for the Endorsement of Forest Certification (PEFC);
Amber	• Land acquisition with the purpose of adopting sustainable forest management practices as defined and certified by credible national schemes (see list aside); OR • Extraction of timber products that would be used as biomass or feedstock for heat generation and biofuels (Phase-out by 2030).	Amber certification schemes: • National certifications in ASEAN (to be considered AMBER until national schemes are assessed).
Red	• Exploitation of timber and non-timber products from endangered species.	

[25] Nurseries are defined any facility designated to produce tree seedlings grown under favourable conditions until they are ready for planting.

[26] Integrated Farm Management (IFM) is a site-specific farm business approach that uses the best of modern technology and traditional methods (as defined by IFMA).

Sector	Forestry	
Activity	Forestry Plantation	
ISIC code	A 0200	
ISIC description	Forestry	
Objective	Identify green, amber, and red assets, projects and related activities related to forestry plantation.	
Traffic light	Threshold	Alignment with international best practice / reference from other taxonomies or methodologies
Green	• Equipment and costs incurred by the activities (equipment must be powered by renewable energy or appear amongst the most energy efficient in the country - as certified by local energy efficiency standards); OR • Use of organic and biofertilizers; OR • Use of physical and biocontrol of pathogens, pests and weeds; • Conservation, restoration and maintenance; • Nurseries[27] - required the adoption of Integrated Farm Management (IFM – find definition below) practices - organic and biofertilizers/biocontrol – and that seeds and seedlings are sourced in sustainably managed areas; • Adoption and maintenance of monitoring technology that enables the tracking of the forest extracts.	Aligned to Climate Bonds Taxonomy; Colombian Taxonomy applies a similar approach; Credible certification schemes: • Forest Stewardship Council (FSC); • Programme for the Endorsement of Forest Certification (PEFC); • National certifications in ASEAN (to be considered AMBER until national schemes are properly assessed).
Amber	• Plantation of forests with the goal of extracting timber products that would be used as biomass or feedstock for heat generation and biofuels (Phase-out by 2030); • Nutrient management plan based solely on chemical fertilizers (Phase-out by 2030 and shift to integrated approach[28]); • Phytosanitary management plan based solely on chemicals (Phase-out by 2030 and shift to integrated approach[29]).	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach;
Red	• Use of chemicals listed in the Stockholm Convention 1a or 1b in the WHO classification of pesticides by hazard or not in compliance with the Rotterdam Convention[30]; • Operations on land that has been converted from high carbon stock (HCS31) after Jan 1, 2010.	Aligned to Climate Bonds Taxonomy; EU Taxonomy does not include agriculture; Colombian Taxonomy applies a similar approach;

[27] Nurseries are defined as: any facility designated to produce tree seedlings grown under favourable conditions until they are ready for planting.
[28] Integrated Farm Management (IFM) is a site-specific farm business approach that uses the best of modern technology and traditional methods (as defined by IFMA).
[29] Ibid.
[30] As defined by HCSA
[31] Ibid

Sector	Forestry
Activity	Conservation, restoration, and maintenance of natural/pristine forests
ISIC code	A 0200
ISIC description	Forestry
Objective	Identify green, amber and red assets, projects and related activities related to conservation, restoration and maintenance of forests extracts.

Traffic light	Threshold	Alignment with international best practice / reference from other taxonomies or methodologies
Green	• Land acquisition with the purpose of conservation, restoration and maintenance; • Equipment and costs incurred by the activities (equipment must be powered by renewable energy or appear amongst the most energy efficient in the country - as certified by local energy efficiency standards); • Use of organic and biofertilizers (only relevant for restoration/ replanting of natural forest); • Use of physical and biocontrol of pathogens, pests and weeds; • Nurseries[32] - required the adoption of Integrated Farm Management (IFM – find definition below[33]) practices - organic and biofertilizers/biocontrol – and that seeds and seedlings are sourced from native species in sustainably managed areas; • Adoption and maintenance of monitoring technology that enables the tracking of the forest extracts and its conservation status.	Aligned to Climate Bonds Taxonomy; Colombian Taxonomy applies a similar approach;
Amber	• None	
Red	• None	

[32] Any facility designated to produce tree seedlings grown under favourable conditions until they are ready for planting.
[33] Integrated Farm Management (IFM) is a site-specific farm business approach that uses the best of modern technology and traditional methods (as defined by IFMA).

9. Carbon capture and storage

Sector overview

Carbon capture and storage/sequestration (CCS) is the process of capturing carbon dioxide (CO_2) before it enters the atmosphere, transporting it and storing it in underground geological formations. CCS includes a range of different process and technology options to capture and store CO_2. According to IEA, CCS is an important decarbonisation pathway for hard-to-abate sectors and will contribute to achieving global climate goals. Carbon capture may happen in two main ways:

a) Point source capture: CO_2 capture from large point sources such as power plants or industrial facilities, or

b) Direct air capture where CO_2 is absorbed directly from the atmosphere.

Singapore is studying emerging low-carbon technologies such as Carbon Capture Utilisation and Storage (CCUS) This includes the study "*Carbon Capture, Storage, and Utilisation: Decarbonisation Pathways for Singapore's Energy and Chemicals Sectors*"[34] which was commissioned by the government and concluded in June 2021.

Singapore does not have any known suitable reservoirs for the permanent storage of CO_2 in its subsurface, but analysis of the geological storage potential in neighbouring countries indicates an estimated regional storage potential of 84.8 Giga tons[35] (Singapore's annual emissions are approximately 0.5Gig tons.

Currently, Singapore is targeting at least 2 million tons of carbon capture by 2030 and more than 6 million tons/year by 2050, as it transforms its Jurong Island downstream oil hub into an energy and chemicals park that operates sustainably.

CCS is a developed technology that is, however, rapidly developing due to the increasing demand. There is no universally adopted classification of CCS activities and no ISIC codes for them, but based on the examples of other taxonomies (Climate Bonds, EU and South Africa) activities can be classified the following way:

- **Point-source capture of CO_2** is the process of capturing CO_2 from a large emissions source – e.g. an industrial facility. Most CCS projects utilize point source capture given the higher concentrations of CO_2 make the capture process more efficient. Point-source capture is listed here for completeness of the process but it cannot be viewed as a standalone activity because it is never carried out separately from a certain industrial or power generation activity. Its main goal is to decrease the emissions of the activity it is linked to. Point-source capture is not a separate activity in other

[34] https://file.go.gov.sg/carbon-capture-utilisation-and-storage-decarbonisation-pathway-for-singapore-energy-and-chemical-sectors-pdf.pdf
[35] Ibid.

taxonomies and is mostly mentioned in this taxonomy as a part of industrial activities criteria.

- **Direct air capture (DAC) of CO_2.** DAC is the process of capturing dispersed CO_2 from the atmosphere that are not linked to a point source. DAC has the potential to make a substantial contribution to global decarbonisation but the technology is still at an early stage of practical application. The costs of DAC are much higher as higher energy demand is required to capture low concentration CO_2 streams.
- **Transportation** of captured CO_2 can be done by various means, including pipelines, ships, railroad cisterns or trucks.
- **Permanent sequestration of captured CO_2** includes injecting of CO_2, removed by point- or direct air capture of CO2 within an underground geological formation for an indefinite period of time.
- **Research, development and innovation for CCS-related technologies**. Research activities that are related to CCS are included in the Taxonomy to underline the importance of the development of this field.

Utilisation of CO_2

Captured CO_2 may either be transported and stored or used on-site by industrial processes that require a source of carbon. Huge quantities of CO_2 are currently used each year, mainly in in the fertiliser industry and for enhanced oil recovery while new utilisation pathways in the production of CO_2-based synthetic fuels, chemicals and building aggregates are gaining momentum.

Utilization is not included in this first version of the taxonomy for a number of reasons including the nascent stage of the technologies, as well as the fact that the use of CO_2 does not always result in emissions reductions and are therefore not compatible with a low carbon future. There also remains a lack of guidance in this area to leverage for this phase of work.

For these reasons, the precautionary principle was applied, and utilization is not eligible within this taxonomy. This may well change in the future as clearer guidelines become available.

Choice of metrics

- **Point-source capture of CO_2.**

Here the only plausible metric is compatibility of the targeted industrial or power generation activity with the corresponding green threshold.

- **Direct air capture of CO_2**

The main metric that measures the efficiency of direct air capture is **carbon removal efficiency**. To effectively remove CO_2 using DAC deployment, low-carbon energy sources are required. On a life cycle basis, the total emissions from DAC construction, commissioning, operation and decommissioning need to be lower than the CO_2 emissions captured and removed from the atmosphere. When in operation, DAC consumes large amounts of

electricity and heat, and thus the carbon intensity of these inputs will directly impact emissions savings. If carbon removal efficiency is low and the sources of heat is high-emitting, direct air capture of CO_2 may produce marginal emissions savings at best, and at worst, additional emissions. The Table 11 is provided below:

Table 11. Matrix of DAC carbon removal efficiency per source of heat and energy

Source of heart	Source of electricity	Carbon removal efficiency
Direct heat (natural gas)	Grid	60-90%
The heat pump (power-to-heat)	Solar photovoltaic	79-89%
The heat pump (power-to-heat)	Wind	95%
The heat pump (power-to-heat)	Grid	9-95%
Waste heat	Solar photovoltaic	85-92%
Waste heat	Wind	96%
Waste heat	Grid	48-97%

Source: *Direct Air Capture: A Key Technology for Net Zero*[36] *(IEA 2022)*

- **Captured CO_2 transportation**.

The main metric associated with CO_2 is the **rate of leakages**. Proper construction properties of the vessel and leakage detection system can prevent captured CO_2 from leaking back into the atmosphere.

- **Permanent sequestration of captured CO_2**.

Proper arrangement of the geological formation for CO_2 storage, the establishment of reliable surveillance systems and prevention of leakage are key metrics in assessing the efficiency of sequestration.

- **Research, development, and innovation for CCS-related technologies**.

Research and development activities have a metric of **technology readiness level (TRL)** which employs a scale from 1 to 10 to indicate how far the technology stands from being utilized commercially.

[36] https://iea.blob.core.windows.net/assets/78633715-15c0-44e1-81df-41123c556d57/DirectAirCapture_Akeytechnologyfornetzero.pdf

Criteria and thresholds

Green threshold

Point-source capture of CO_2

- Point-source capture of CO_2 is eligible only as a supplementary activity for the activities in the present taxonomy.

It can't be certified as a separate activity.

- Point-source capture of CO_2 is eligible as green if it makes the target activity compatible with the green threshold for a specific activity – e.g. is eligible for cement if its addition means that cement meets the green criteria for cement (as defined within this Taxonomy) Applicability of this option to each individual sector can be found in a specific activity article (for example, in the Industry section).

Direct air capture of CO_2

- Overall life cycle carbon removal efficiency of the DAC installation should be no less than 80% (Scopes 1 and 2 included)

A threshold of 80% reduction efficiency leaves only renewables and low-carbon gases to be used for heating and electricity supply for the DAC facility. The threshold comes from the South African Taxonomy, the only one having a separate DAC article.

Captured CO_2 transportation

- The CO_2 transported from the installation where it is captured to the injection point does not lead to CO_2 leakages above 0.5 % of the mass of CO_2 transported.

This criterion is defined by an established EU normative and added for compliance with the EU Taxonomy.

- The CO_2 is delivered to a permanent CO_2 storage site that meets the criteria for underground geological storage of CO_2 set out in Section «Permanent sequestration of captured CO_2»
- Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party.
- The activity may include the installation of assets that increase flexibility and improve the management of an existing network.

Permanent sequestration of captured CO2

- Operation of a permanent CO_2 storage facility is eligible if the facility complies with ISO 27914:2017 for geological storage of CO_2.

This criterion is adopted from the EU Taxonomy which lists mentioned ISO standard as legitimate and based on best practices in the field.

Research, development, and innovation for CCS-related technologies

- The activity researches, develops or provides innovation for technologies, products or other solutions that are dedicated to carbon capture, transportation and storage
- The implementation of the technologies, products or other solutions being researched for carbon capture, transportation and storage has the potential to result in overall net GHG emissions reductions once commercialized.
- Where the researched, developed or innovated technology, product or other solution is at TRL 1 to 7, lifecycle GHG emissions are evaluated in simplified form by the entity carrying out the research. The entity demonstrates one of the following, where applicable:
    - **(a)** a patent not older than 10 years associated with the technology, product or other solution, where information on its potential has been provided;
    - **(b)** a permit obtained from a competent authority for operating the demonstration site associated with the innovative technology, product or other solution for the duration of the demonstration project, where information on its potential has been provided.
- Where the researched, developed or innovated technology, product or other solution is at TRL 8 or higher, lifecycle GHG emissions are calculated using ISO 14067:2018 or ISO 14064-1:2018 and are verified by an independent third party.

Amber threshold

Point-source capture of CO_2

- Point-source capture of CO_2 is eligible only as a supplementary activity for the activities in the present taxonomy.
- Point-source capture of CO_2 is eligible as amber if it makes the target activity compatible with the amber criteria for this specific activity. Applicability of this option to each individual sector can be found in a specific activity article (for example, in the Industry section).

Direct air capture of CO_2

- No amber threshold is provided for this type of activity as retrofitting is not possible for this kind of technology at this stage of its development.

Captured CO_2 transportation

- The CO_2 transported from the installation where it is captured to the injection point does not lead to CO_2 leakages above 10 % of the mass of CO_2 transported.

10% is calculated as the average value of leakages for CCS defined as such by the International Council on Clean Transportation based on the research of the existing facilities[37].

[37] https://theicct.org/sites/default/files/publications/lca-biomethane-hydrogen-eu-oct21.pdf p. 15

- The CO_2 is delivered to a permanent CO_2 storage site that meets the criteria for underground geological storage of CO_2 set out in Section «Permanent sequestration of captured CO_2»
- Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party.
- The activity may include the installation of assets that increase flexibility and improve the management of an existing network.

Permanent sequestration of captured CO_2

- Retrofitting of the existing geological storage formation that leads to its compliance with ISO 27914:2017 for geological storage of CO_2.

Research, development, and innovation for CCS-related technologies

- No amber criteria are available for research and development activities.

Red threshold

Point-source capture of CO_2

- No red criteria are available for point source capture as this is an enabling technology that can't harm the objective of climate change mitigation.

Direct air capture of CO_2

- DAC installations with low carbon removal efficiency (less than 80%) are designated as red

Installations with this kind of carbon removal efficiency most probably operate on some sort of natural gas or other non-renewable sources of energy and must be excluded.

Captured CO_2 transportation

- Transportation or retrofitting of transportation systems that do not comply with relevant green and amber criteria are designated as red.

Permanent sequestration of captured CO_2

- Construction of new facilities that fail to comply with ISO 27914:2017 is designated as red.

Research, development, and innovation for CCS-related technologies

- No red criteria are available for research and development activities.

9. GFIT seeks feedback on the level of ambition for CCS sector criteria, whether TSC are clear, usable, or any other alternative metrics, policies and documents should be used as reference?

Detailed criteria and thresholds

Point-source capture of CO_2

Sector	Carbon capture and storage	
Activity	Point-source capture of CO_2	
ISIC code	No code	
Description	The capture of CO_2 from a point source in an industrial or power generation facility	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practice/ reference/ taxonomies
Green	• Point-source capture of CO_2 is eligible only as a supplementary activity for the activities in the present taxonomy (for example, in the industry section). • Point-source capture of CO_2 is eligible as green if it makes the target activity compatible with the green threshold for a specific activity. Applicability of this option to each individual sector can be found in a specific activity article (relevant for sections related to the production of cement, iron and steel, hydrogen, basic chemicals).	Not present in any other taxonomy. Added for clarity as cross-reference article as per request of the consultation group
Amber	• Point-source capture of CO_2 is eligible only as a supplementary activity for the activities in the present taxonomy (for example, in the Industry section). • Point-source capture of CO_2 is eligible as amber if it makes the target activity compatible with the green criteria for a specific activity. Applicability of this option to each individual sector can be found in a specific activity article (relevant for sections related to the production of cement, iron and steel, hydrogen, basic chemicals, as well as energy generation from gas).	
Red	N/A	

Direct Air Capture of CO_2

Sector	Carbon capture and storage	
Activity	Direct air capture of CO_2	
ISIC code	No Code	
Description	Construction and operation of DAC facilities	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practices/reference /methodologies
Green	• Overall life cycle carbon removal efficiency of the DAC installation should be no less than 80% (Scope 1 and 2 included)	Aligned with the South African Taxonomy
Amber	N/A	
Red	• DAC installations with low carbon removal efficiency (less than 80%) are designated as red	

Transportation of captured CO_2

Sector	Carbon capture and storage	
Activity	Transportation of captured CO_2	
ISIC code	No code	
Description	Captured CO_2 transportation via pipelines, ships, railroad cisterns or trucks.	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practices/reference /methodologies
Green	• The CO_2 transported from the installation where it is captured to the injection point does not lead to total CO_2 leakages above 0.5 % of the mass of CO_2 transported. • The CO_2 is delivered to a permanent CO_2 storage site that meets the criteria for underground geological storage of CO_2 set out in Section «Permanent sequestration of captured CO_2» • Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party. • The activity may include the installation of assets that increase flexibility and improve the management of an existing network.	Adopted from the EU Taxonomy
Amber	• Retrofitting of the existing CO_2 transportation systems in order to bring down the leakage rate from the current rate is eligible as amber. • The starting leakage rate may not be above 10 % of the mass of CO_2 transported. • The CO_2 is delivered to a permanent CO_2 storage site that meets the criteria for underground geological storage of CO2 set out in Section «Permanent sequestration of captured CO2» • Appropriate leak detection systems are applied and a monitoring plan is in place, with the report verified by an independent third party. • The activity may include the installation of assets that increase flexibility and improve the management of an existing network.	Based on the Climate Bonds research as per request of consultations group
Red	• Transportation or retrofitting of transportation systems that do not comply with relevant green and amber criteria are designated as red	

Permanent sequestration of captured CO_2

Sector	Carbon capture and storage	
Activity	Permanent sequestration of captured CO_2	
ISIC code	No code	
Description	Permanent storage of captured CO_2 in appropriate underground geological formations	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practices/reference /methodologies

Green	Operation of a permanent CO_2 storage facility is eligible if the facility complies with requirements and recommendations of ISO 27914:2017 for geological storage of CO_2.	Adopted from the EU Taxonomy
Amber	N/A[38]	
Red	Construction of new facilities that fail to comply with ISO 27914:2017 is designated as red.	

Research, development, and innovation for CCS-related technologies

Sector	Carbon capture and storage	
Activity	Research, development, and innovation for CCS-related technologies	
ISIC code	No code	
Description	The research applied research and experimental development of solutions, processes, technologies, and business models and other products dedicated to carbon capture, transportation and storage	
Objective	Climate change mitigation	
Traffic light	**Threshold**	Alignment with international best practices/reference/methodologies
Green	• The activity researches, develops or provides innovation for technologies, products or other solutions that are dedicated to carbon capture, transportation and storage • The implementation of the technologies, products or other solutions being researched for carbon capture, transportation and storage has the potential to result in overall net GHG emissions reductions once commercialized. • Where the researched, developed or innovated technology, product or other solution is at Technology Readiness Level (TRL) 1 to 7, lifecycle GHG emissions are evaluated in simplified form by the entity carrying out the research. The entity demonstrates one of the following, where applicable: **(a)** a patent not older than 10 years associated with the technology, product or other solution, where information on its potential has been provided; **(b)** a permit obtained from a competent authority for operating the demonstration site associated with the innovative technology, product or other solution for the duration of the demonstration project, where information on its potential has been provided. • Where the researched, developed or innovated technology, product or other solution is at TRL 8 or higher, lifecycle GHG emissions are calculated using ISO 14067:2018 or ISO 14064-1:2018 and are verified by an independent third party.	Adapted from the EU Taxonomy, but expanded in scope (EU Taxonomy only contains research for DAC technology, not for the whole spectrum of CCS)
Amber	N/A	
Red	R&D activities that do not meet green criteria are not eligible for finance.	

[38] Note: No amber criteria are available for storage of CO2 as the criteria are binary – either it meets the ISO standard or it does not, If it does not, it is presumed not to be investible and therefore red.

10. Appendices

Industry

Appendix 1: Overview of high to abate sectors – decarbonization pathways

Table 12: Decarbonization pathways for selected sectors

Sector:	Decarbonisation pathway	
Manufacture of iron and steel	IEA Net-Zero Emissions (IEA NZE) pathway adjusted in line with the Climate-Aligned Finance Framework for Steel approach: The IEA NZE Benchmark utilized by the Sustainable STEEL Principles is a modified version on the "Net Zero by 2050" scenario published by the International Energy Agency (IEA) in 2021, with the following modifications: Yearly emissions and scrap utilization data was interpolated using the decadal emissions and scrap utilization data published by the IEA in the "Net Zero by 2050" report; Scope 1 emissions were taken directly from the IEA's "Net Zero by 2050" report, while scope 2 emissions were estimated using the technology shares of total production included in the report paired with the corresponding emissions factors included in the Mission Possible Partnership model.	
Manufacture of basic chemicals	Hydrogen	There are numerous end-to-end hydrogen production pathways, however they are tailored to energy source, conversion technology, transport method selected. Thus, is preferable to develop pathway agnostic carbon emission benchmarks. Climate Bonds has presented the projection of decreasing threshold values performed to ensure that assets and activities are aligned to a transition pathway that contributes to the 1.5°C target. These benchmarks have 2030, 2040, and 2050 targets that get stricter over time to offer guidance to investors and industry on how emissions should reduce in upcoming decades. Hydrogen production carbon intensity benchmarks can be met by different energy sources and technology options, as has been verified using carbon intensity values estimated by MIT Energy Initiative's SESAME platform.
	Chlorine	2030 threshold was established based on an updated value proposed in a European Union study[39] 2040 and 2050 – thresholds have been designed as qualitative requirements to ensure the process delivers low carbon chlorine by using renewable power, given that the main source of emissions in the Chlorine process come from indirect emissions due to the electricity usage
	Other basic chemicals	The determination of the carbon emission thresholds in these criteria was done based on the alignment to a 1.5C decarbonisation pathway for the entire chemical sector recently published by Teske et al. (2022)[40] With the reduction rates from Teske et al.'s pathway and taking as basis the thresholds for 2022, the thresholds were extrapolated to 2019 first using the 4.7% annual reduction to have the 2019 base value, afterwards, the aforementioned reduction rates were applied to calculate the 2030, 2040 and 2050 threshold.
Manufacture of cement	The SBTi Cement sector guidance[41] was chosen as the most suitable for cement company pathways. It is 1.5oC-aligned, being based on a Sectoral Decarbonisation Approach (SDA) reflecting robust International Energy Agency (IEA) modelling of sector-specific carbon budgets, taking into consideration the cost of decarbonising each sector	
Manufacture of hydrogen	There are numerous end-to-end hydrogen production pathways, however they are tailored to energy source, conversion technology, transport method selected. Thus, is preferable to develop pathway agnostic carbon emission benchmarks. Climate Bonds has presented the projection of	

[39] EU (2021). Support study for the preparation of energy efficiency benchmarks in the context of the Revised ETS State Aid Guidelines. https://ec.europa.eu/competition-policy/system/files/2021-11/kd0121322enn_ETS_efficiency_benchmarks.pdf
[40] Teske, S., Niklas, S., Talwar, S. et al. 1.5°C pathways for the Global Industry Classification (GICS) sectors chemicals, aluminium, and steel. SN Appl. Sci. 4, 125 (2022). https://doi.org/10.1007/s42452-022-05004-0
[41] https://sciencebasedtargets.org/resources/files/Cement-guidance-public-consultation.pdf

	decreasing threshold values performed to ensure that assets and activities are aligned to a transition pathway that contributes to the 1.5oC target. These benchmarks have 2030, 2040, and 2050 targets that get stricter over time to offer guidance to investors and industry on how emissions should reduce in upcoming decades. Hydrogen production carbon intensity benchmarks can be met by different energy sources and technology options, as has been verified using carbon intensity values estimated by MIT Energy Initiative's SESAME platform.

Appendix 2: Specific measures for chemical production

Table 13: **Criteria for eligible decarbonisation measures or retrofitting activities**		
Area	**Eligible measure (note that measures are eligible on their own)**	**Mitigation criteria**
Various		
Energy efficiency measures	Revamps, modifications or acquisition of equipment (boilers, furnaces, reactors, heat exchanger, distillation columns and other separation units, etc.)	At least a 30 % improvement in energy efficiency.
Switching to low carbon process technologies	Revamps, modification and acquisition of equipment and other infrastructure needed for the implementation and operation of low carbon process technologies.	The alternative processes technology does not release direct process CO_2 emissions, e.g., methane pyrolysis, catalytic partial oxidation of methane to methanol.
Carbon Capture and Storage	Infrastructure related to CO_2 capture of emissions from the basic chemicals production, transportation and storage	• The minimum capture rate from process and energy emission streams should be 90% or emissions reduction at the facility level have to be at least of 50%. • The CO2 will be transported and stored in line with the Taxonomy criteria (green category)
Relating to feedstock used		
Switch to hydrogen as a feedstock	Infrastructure for production of basic chemicals using hydrogen or Refurbishment and retrofitting of facilities to use hydrogen or Acquisition of equipment to produce basic chemicals using hydrogen	Starting from 2030, the hydrogen to be used meets the Taxonomy criteria for hydrogen production (green category)
Using biomass as a feedstock	Biomass used complies with the criteria applicable for biomass sourcing set out in the Taxonomy Bio-energy criteria (green category) Infrastructure for production using biomass or Refurbishment and retrofitting of facilities to use biomass or Acquisition of equipment to produce basic chemicals using biomass	
Using CO_2 as a feedstock	Infrastructure for production using CO_2 as a feedstock or	1. The source of CO_2 sources is either: ● Direct emissions from chemical production; OR

	Refurbishment and retrofitting of facilities to use CO_2 as a feedstock or Acquisition of equipment to produce basic chemicals using CO_2 as a feedstock	● Direct emissions from other industrial activities 2. The basic chemical produced is used for the manufacture of durable products (e.g. construction materials stored in buildings, or recyclable products e.g. PET). 3. If the basic chemical produced is used for products that release the CO_2 immediately when the products are used (such as in urea, carbonated beverages, or fuels), the capital investment is not eligible. 4. CO_2 is not used for enhanced oil recovery, and the production of other forms of fossil energy sources. 5. This measure may involve the need for electricity when electrochemical processes are used, and also the need for hydrogen as a feedstock. If so, that hydrogen must comply with the Taxonomy criteria (green category)
Use of recycled material as feedstock (e.g. using olefins recovered from plastics chemical recycling processes)	Infrastructure for the production using recycled feedstock or Refurbishment and retrofitting of facilities using recycled feedstock or Acquisition of equipment to produce basic chemicals using recycled feedstock	Recycled material should: ● represent at least 20% of the feedstock in regions without local recycling regulations or with lower recycled content requirements. ● represent more than 20% of the feedstock in regions with local recycling regulations. If the region has a higher recycled content percentage, it should prevail. ● have lower cradle-to-gate emissions than the virgin material
Relating to energy used		
Electrification of the processes	Revamps, modifications and acquisition of equipment (furnaces, reactors, separators, etc.) and other infrastructure necessary for electrification of the processes	Electricity must be low-carbon and comply with the most up to date Taxonomy criteria for electricity grids (green category)
Heat supplied from geothermal, solar thermal or waste heat recovery systems	New heat exchange equipment, such as evaporators, furnaces, boilers, etc., or Revamps or modifications to heating related equipment in existing process	Heat supply complies with the most up to date Taxonomy criteria for the relevant source of energy (green category)
Using hydrogen as an energy source	Revamps or modifications to equipment (boilers, furnaces, burners, etc.) in existing utilities system required for the use of hydrogen as fuel or Infrastructure for the production of a basic chemical in scope using hydrogen as an energy source	Starting from 2030, the hydrogen to be used meets the Taxonomy criteria for hydrogen production (green category)

Using biomass as an energy source	Revamps or modifications to equipment (boilers, furnaces, burners, etc.) in existing utilities system required for the use of biomass as fuel or Infrastructure for the production of a basic chemical in scope using biomass as an energy source	The bio-energy complies with the Taxonomy Bio-energy criteria (green category) Only secondary organic streams are eligible. Wood and other dedicated crops are not eligible.

Appendix 3: Cement additional methodology and tables

The facility is eligible if its emissions intensity, adjusted using the relevant correction factor (Table 15), is lower than the relevant facility-level emissions intensity threshold (Table 14)

Table 14: Threshold values forming the emissions pathway for all cement production facilities

Year	Carbon intensity (t CO_2/ t cementitious product)	Year	Carbon intensity (t CO_2/ t cementitious product)	Year	Carbon intensity (t CO_2/ t cementitious product)	Year	Carbon intensity (t CO_2/ t cementitious product)
2022	0.448	2029	0.374	2036	0.253	2043	0.125
2023	0.437	2030	0.363	2037	0.234	2044	0.107
2024	0.427	2031	0.345	2038	0.216	2045	0.089
2025	0.416	2032	0.326	2039	0.197	2046	0.071
2026	0.406	2033	0.308	2040	0.179	2047	0.054
2027	0.395	2034	0.289	2041	0.161	2048	0.036
2028	0.384	2035	0.271	2042	0.143	2049	0.018
						2050	0

Table 15: Correction factors to determine the carbon intensity of the production

Cement class	Expected emissions (tCO2eq/t cementitious product)	Correction factor
32.5	0.550	1.18
42.5	0.649	1.00
52.5	0.748	0.87

Worked example 1 – one single cement grade produced on site

• A single facility produces cement of strength class 32.5 (correction factor of 1.18 per Table A3.2).

• The facility's emissions intensity is 0.416 t CO2/ t cementitious product.

• The corrected emissions intensity is 0.491 t CO2/t cementitious product (0.416 x 1.18). This is the number compared to the pathway thresholds

Worked example 2 – multiple cement grades produced on site

• A single facility produces several cement products of varying strength grades. In an example year, it produces 4000 tonnes of 42.5 cement, and 6000 tonnes of 52.5 cement.

• The weighted average grade is: ((42.5 x 4000) + (52.5 x 6000)) / (4000 + 10000) = 48.5 48.5 is of course not an industry standard grade but is simply for the purposes of working out the expected emissions using the above linear relationship between cement class and emissions.

• This linear relationship above assumes that for every increase in cement grade (megapascals) by 1, emissions increase by 0.099 t CO2/ t cementitious product.

• The expected emissions of a 48.5 cement is: (48.5-42.5) x 9.9 = 0.708t CO2/ t cementitious product.

• The conversion factor is 0.649 / 0.708 = 0.92

• The facility's emissions intensity is 0.416t CO2/ t cementitious product.

• The corrected emissions intensity is 0.383t CO2/t cement (0.416 * 0.92)

Appendix 4: Cross-cutting criteria for iron and steel

Table 16: Cross-cutting criteria

Eligible Assets	Facility specific mitigation criteria
Fossil gas	Using fossil gas both as reducing agent and for energy generation, is only eligible for existing facilities prior to 2030. To qualify after 2030 such facilities would have to use fossil gas combined with CCUS measures that meet the Taxonomy criteria for CCS and: • Utilisation of direct CO2 emissions from steel production is used for the manufacture of durable products and does not lead to enhanced oil recovery and the production of other forms of fossil energy sources. • Projects using fossil gas (even if) combined with CCUS should demonstrate that on-site activities: MRV (monitoring, reporting and verification), and mitigation measures for methane leaks as per the best practice recommended[42]. Any venting or burning within the limits of the steel plant shall be avoided, except in emergency situations, in such case it shall be reported and accounted in the GHG assessment. • Projects using fossil gas (even if) combined with CCUS should demonstrate that upstream activities: provide evidence of having in place MRV (monitoring, reporting and verification), and mitigation measures for methane leaks as per the best practice recommended[43].
Coal	Using coal both as reducing agent and fuel in the steelmaking process, is only eligible for existing facilities prior to 2030. After 2030, facilities would have to use coal combined with CCUS measures that meet the Taxonomy criteria for CCS and utilisation of direct CO2 emissions from steel production is used for the manufacture of durable products and does not lead to enhanced oil recovery and the production of other forms of fossil energy sources. Projects using coal should demonstrate: • Upstream activities: provide evidence of having in place MRV (monitoring, reporting and verification), and mitigation measures for methane leaks as per the best practice recommended[44].
Biomass	Facilities using biomass as a reducing agent are only eligible if they use the following sources of biomass (NB dedicated crops are not eligible): • Agricultural residues: feedstocks need to be certified under approved best practice standards.[45] • Plantation wood: the wood plantation shall demonstrate to meet the requirements set out for "plantation forestry" of the Climate Bonds Forestry Criteria.[46] And

[42] Best practice can be found in the report: Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector. Monitoring, Reporting and Verification (MRV) and Mitigation. United Nations Economic Commission for Europe. 2019
https://unece.org/fileadmin/DAM/energy/images/CMM/CMM_CE/Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector__Monitoring__Reporting_and_Verification__MRV__and_Mitigation-_FINAL__with_covers_.pdf

[43] ibid

[44] ibid

[45] Feedstocks used are certified under one of the following, pre-approved best practice standards: RSB; RTRS; FSC; ISCC Plus; Climate Bonds Agriculture Criteria. Alternatively, please see Climate Bonds Bioenergy criteria 3.3.2. Requirement 2: Feedstocks certified under approved best practice standards, Option B
https://www.climatebonds.net/files/files/Bioenergy%20Criteria%20Document%20Aug%202022.pdf

[46] https://www.climatebonds.net/files/files/standards/Forestry/Crit%20Forestry%20Criteria%20document_July%202020.pdf

	Facilities using biomass as fuel are only eligible if they use secondary organic streams. Wood and other dedicated crops are not eligible. The production of the biofuel must be demonstrated to meet the Taxonomy criteria for biofuels.
CCS/CCUS	Facilities using CCUS are only eligible if the CCS meets Taxonomy criteria for CCS and utilisation of direct CO2 emissions from steel production is used for the manufacture of durable products (e.g. construction materials stored in buildings, or recyclable products e.g. PET). CO2 should not be used for products that release the CO2 immediately when these are used (such as in urea, carbonated beverages, or fuels), nor for enhanced oil recovery, and the production of other forms of fossil energy sources.

Appendix 5: Hydrogen additional information

Methodological notes for Life Cycle Assessment (LCA)

a) The life cycle assessment should follow the latest releases of ISO std[47] (ISO 14040, ISO 14044 for life-cycle assessment, and ISO 14067 for product carbon footprint). The Recommendation 2013/179/EU will be acceptable for assets located in the EU. Results should be verified by an independent third party.

b) GHG emissions must be estimated for a purity of 99.9% vol, and a gauge pressure of at least 3 MPa using correction factors. For pressures higher than 3 MPa, additional energy compression emissions must be included as well.

c) The methodology factor in a Global Warming Potential for a period of 100 years (GWP100) for methane should be 30[48].

d) GHG emissions accounting:

$$Etotal = E1 + E2 + E3 + E4 + E5 - E6 + E7 + E8$$

E total: Total emissions

E1: Upstream feedstock related emissions (including sourcing[49], processing, transport and storage)

E2: Upstream energy related emissions (including sourcing, processing, transport and storage)

E3: Fugitive emissions (Including hydrogen emissions)

E4: Process emissions

E5: CCS emissions related to energy consumption and leakages

E6: Carbon emissions captured

E7: Compression and purification emission (Energy required to compress and purify hydrogen)

E8: Transportation emissions to the site where hydrogen will be used (energy and electricity related emissions, and fugitive emissions during transportation)[50]

[47] ISO standards available at: www.iso.org/standard/38498.html; www.iso.org/standard/37456.html

[48] Sixth Assessment Report — IPCC

[49] Depending on the feedstock, it can be extraction, cultivation, or collection

[50] Transportation infrastructure emissions are not included

Additional Guidance for different production pathways up to the point of production[51]:

The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) methodology working paper contains guidelines to a calculation method for GHG accounting for the following production pathways up to the point of production[52]:

- Steam Methane Reforming combined with CCS: **Appendix P1 of IPHE working document**
- Biomass as a feedstock combined with CCS: **Appendix P5 of IPHE working document**
- Manure-based production: **P5.4** Bio-digestion
- Land fill gas-based production: **P5.4** Bio-digestion
- Biomass from secondary sources: **P.5.5** Biomass gasification.
- The IPHE working document also has guidelines for emission sources and allocation for biomass-based production:
    - Emissions sources in Biomass-Based Hydrogen Routes/CCS: **Appendix P.5.6**
    - Allocation for the Biomass/CCS pathway: **Appendix P.5.7**

Table 17: Eligible measures for Hydrogen

Area	Activity	Mitigation criteria
Various		
Carbon Capture and Storage	Infrastructure related to CO2 capture of emissions from the hydrogen production, transportation, and storage	• The minimum capture rate from process and energy emission streams should be 90% or emissions reduction at the facility level have to be at least of 50%.[53] *(please note that capture rate is not equivalent to emissions reduction at the facility level given that the latter may depend on multiple emission sources)* • Issuers must present a quantitative performance report of the CCS operations, including the following information[54]: ○ Intended capture rate capacity, maximum capture rate capacity, annual capture of CO2, annual transport of CO2, annual storage of CO2.[55]

[51] The IPHE methodology will develop guidelines for transport emissions accounting in the coming months.

[52] www.iphe.net/_files/ugd/45185a_6159cefcd88f4d9283ab0e60f4802cb4.pdf

[53] A minimum capture rate must be demonstrated only for specific investments on CCS or CCU infrastructure. Entire facilities that have CCS embedded do need to meet this requirement if the facility meet the carbon intensity benchmark in **Table 8**

[54] CCS performance report must be verified by an independent party

[55] Zhang et al, 2021. https://pubs.acs.org/doi/pdf/10.1021/acs.estlett.2c00296

Area	Activity	Mitigation criteria
		• Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks on site and upstream.[56] • There is evidence[57] that demonstrates the CO2 will be suitably transported and stored in line with the Taxonomy criteria for CCS.
Carbon Capture and Utilisation	Infrastructure related to capture, transportation, and utilisation of CO2 emissions from the hydrogen production.	• The minimum capture rate from process and energy emission streams should be 90% or emissions reduction at the facility level have to be at least of 50%. [58] • Issuers must present a quantitative performance report of the CCS operations, including the following information[59]: ○ Intended capture rate capacity, maximum capture rate capacity, annual capture of CO2, annual transport of CO2, annual utilisation of CO2. • Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks on site and upstream[60]. • There is evidence[61] that demonstrates the CO2 will be suitably transported in line with the Taxonomy criteria for CCS. **Utilisation** • CO2 must be used for the manufacture of durable products (e.g. construction materials stored in buildings, or recyclable products that will not be incinerated as a final disposal alternative). • CO2 should not be used for products that release the CO2 immediately when the products are used (such as in urea, carbonated beverages, or fuels) • CO2 is not used for enhanced oil recovery, and the production of other forms of fossil energy sources.
Electrification of processes	Revamps, modifications and acquisition of equipment and other infrastructure necessary for	Automatically eligible

[56] Additional guidance can be found in the report Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector. Monitoring, Reporting and Verification (MRV) and Mitigation. United Nations Economic Commission for Europe. 2019 https://unece.org/fileadmin/DAM/energy/images/CMM/CMM_CE/Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector__Monitoring__Reporting_and_Verification__MRV__and_Mitigation-_FINAL__with_covers_.pdf

[57] Either directly from the facility or through contracts or agreements with a third party

[58] A minimum capture rate must be demonstrated only for specific investments on CCS or CCU infrastructure. Entire facilities that have CCS embedded do need to meet this requirement if the facility meet the carbon intensity benchmark in Table 4.1.

[59] CCS performance report must be verified by an independent party

[60] www.dnv.com/news/dnv-gl-launches-certification-framework-and-recommended-practice-for-carbon-capture-and-storage-ccs--108096 Monitoring alternatives include satellite-based or drone-based measurement. Additional guidance can be found in the report Best Practice Guidance for Effective Methane Management in the Oil and Gas Sector. Monitoring, Reporting and Verification (MRV) and Mitigation. United Nations Economic Commission for Europe. 2019 https://unece.org/fileadmin/DAM/energy/images/CMM/CMM_CE/Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector__Monitoring__Reporting_and_Verification__MRV__and_Mitigation-_FINAL__with_covers_.pdf

[61] Either directly from the facility or through contracts or agreements with a third party

Area	Activity	Mitigation criteria
	electrification of the processes	
Relating to feedstock used		
Using biomass as a feedstock	Infrastructure to produce hydrogen using biomass Refurbishment and retrofitting of facilities to use biomass Acquisition of equipment to produce hydrogen using biomass	The biomass used complies with the criteria applicable for biomass sourcing set out in the Taxonomy criteria for bioenergy. Only secondary organic streams are eligible. Wood and other dedicated crops are not eligible.
Using landfill gas as a feedstock	Infrastructure to produce hydrogen using landfill gas Refurbishment and retrofitting of facilities using landfill gas as a feedstock Acquisition of equipment to produce hydrogen using landfill as a feedstock	Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leakages on site and upstream[62]. Landfill gas complies with the Taxonomy criteria for waste management for landfill gas recovery.
Using manure-biomethane	Infrastructure to produce hydrogen using manure biomethane Refurbishment and retrofitting of facilities using manure biomethane Acquisition of equipment to produce hydrogen using manure biomethane	Issuers must demonstrate MRV (monitoring, reporting and verification), and mitigation measures for methane leaks. Manure biomethane complies with the Taxonomy criteria for waste management criteria for composting.
Relating to electricity source		
Using Wind, solar, hydro, geothermal energy-based electricity	Infrastructure to produce hydrogen using renewable energy sources Refurbishment and retrofitting of facilities using renewable energy sources Acquisition of equipment to produce	Renewable energy produced on site must comply with the most up to date Taxonomy criteria for the relevant source of energy. Issuers must demonstrate the use of only additional renewable electricity. To do that, issuers can implement the following options: a) Renewable-based[63] captive power generation, OR b) A power purchase agreement demonstrating a commercial link of the electrolyser with new renewable power capacity; OR c) Excess of renewable-based electricity that would have been otherwise curtailed.

[62] Monitoring alternatives include satellite-based or drone-based measurement. Additional guidance can be found in the report Best_Practice_Guidance_for_Effective_Methane_Management_in_the_Oil_and_Gas_Sector__Monitoring__Reporting_and_Verification__MRV__and_Mitigation-_FINAL__with_covers_.pdf (unece.org)

[63] Energy produced from renewable sources such as wind, solar, and small hydropower generation

Area	Activity	Mitigation criteria
	electrolytic hydrogen using renewable energy sources	Further, temporal and geographical correlation between the additional renewable electricity generation and the electrolyser electricity consumption must be demonstrated. • Temporal correlation: Issuers must demonstrate that the electricity is produced and used simultaneously, on a monthly basis, using telemetry measurement techniques. Renewable electricity that has been locally stored can be used as well. • Geographic correlation: Issuers must demonstrate physical capacity to transport the electricity from the renewable generation plant to the electricity consumption site. The electricity must not pass a zone of grid congestion.
Using low-carbon electricity	Infrastructure for the production of hydrogen using electricity from the grid.	The carbon intensity of the electricity grid must ensure that the production process is in compliance with the total carbon intensity benchmark in ***4.1***

11. Agriculture References

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