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A Monetizing Cooperative Organization under the Paris Agreement Article 6

Methodological fundaments for constituency and operation

June 2025

.G Engineering and Carbon-Recycling Projects Ltd
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Carbon-Recycling ITMO$ and €CCO$: monetization of climate contributions within UNFCCC Paris Agreement Crediting Mechanisms

Introduction

Dear Friends,

Climate change mitigation is imperative to all. The Paris Agreement has created a basis for the common actions by all 196 parties that ratified it, by means of the Article 13 and the Enhanced Transparency Framework – ETF. The ETF is the ***Framework*** *that the UNFCCC, a* ***"Framework Convention"****, has been seeking since its creation in 1992. Each of our countries has now a Nationally Determined Contribution – NDC in place, which will become more and more ambitious until the complete cessation of global net emissions to be reached in 2050.* ***A race to zero has started****.*

Kyoto CDM and the Voluntary Carbon Markets have been very useful in testing the effectiveness of crediting mechanisms and market forces to drive the actions of the reporting countries and companies towards reducing emissions. One of us has been deeply involved as a "CDM-insider" for the last 25 years. Our conclusion may be expressed in the following sentence, firstly formulated at the www.carbon-recycling.eco creation manifest ***"Glaswegians in Maquiné"****, released just after the Glasgow Accords at COP 28 in 2021:*

"No, money cannot change climate, but there is a chance that climate may change money."

Almost five years have passed, and now, after Baku's COP, where Article 6 of Paris became operational, we may celebrate, finally:

"Yes, the climate currency is now in place, and we can use it worldwide".

What surprises us is that nobody seems to have noticed a new climate currency has been born. Did the politicians and decision makers really know what they were about to create when they agreed in the last COPs decisions? It doesn't matter, now.

The fact is: NDCs' Registry and A6.2/A6.4 crediting mechanisms are now operational. What we demonstrate in our explanatory boxes below a ***Central Bank for Mitigation Outcomes has been created****, under the* ***global UNFCCC governance,*** *enabling the accounting and exchange of credits by any* ***local actions****.*

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Global has met local, *to quantitatively account for our past and future individual responsibilities and contributions, applicable to people, governments, and businesses of all kinds. We, the people, can now bypass the borders we have artificially created to separate us into provinces and countries.*

www.carbon-recycling.eco initiative is very glad to release this "Methodological Fundamentals", describing the design of supply-side, demand-side, and policy-side methods for the generation and use of ***ITMO$ and €CCO$.***

Our approach is based on the ***Cooperative Organization*** *open to voluntary participation for individual persons, companies, public and private institutions. The contracts and agreements will be based on the generation and distribution of* ***ITMO$ and €CCO$*** *among the participants, based on transparent algorithms.*

There is hard work to be done, ahead of us. Not by the others, but by ourselves. Climate Mitigation is nothing else than homework, literally, and we cannot delegate it to others. But all work may be globally recognized, registered, and rewarded according to its outcomes. We may earn what we deserve.

Take a look and make your view and opinion. If any of you, and specially, if any of the very powerful incumbents conclude our approach doesn't fulfill its requirements for participation, and decide not to join our initiative, but instead propose to create on its own a "much better climate currency", go ahead!! There is no exclusivity, anybody can compete using the methodologies that will be publicly available after passing the scrutiny and approval by Paris A13 and A6.x governing bodies. We are at your disposal to collaborate according to the best of our capacity.

Vitória, Espírito Santo, Brazil,

On 05.06.2025.

Gilberto and Mailla

(cooperative members, idealizers)

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Explanatory Box 1

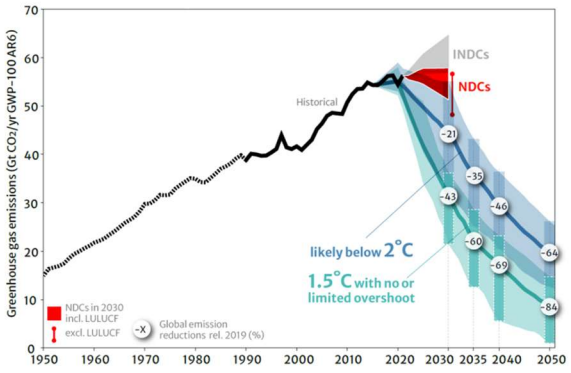
International Transfer of Mitigation Outcomes (ITMO$):
The climate currency created by Paris Crediting Mechanisms A6.2 and A6.4

UNFCCC COP29 in Baku, 2024, has operationalized Paris Agreement Article 6.2 and Article 6.4 market mechanisms, under the UNFCCC regulatory governance. The crediting mechanisms are based on the exchange of ***Internationally Transferred Mitigation Outcomes (ITMOs)*** among the countries that are parties to the Paris Agreement. We pledge to demonstrate here, that

ITMOs are, in fact, ITMO$: a new UN registered Climate Currency

The Paris Agreement has finally brought the UNFCCC into the condition of a Framework Convention, where each party to the convention has a commitment, namely, to achieve the long-term mitigation pathway by means of the Enhanced Transparency Framework – ETF (Article 13). The centralized registry and external/mutual auditing of the national inventories (**Biannual Transparency Reports - BTRs**) is centrally managed by the UNFCCC, performing the role of a **"Central Bank"** of the national emissions. The parties also submit and commit to achieve the 5-year-pace progressively more ambitious **Nationally Determined Contributions (NDCs)**.

Historical emissions from 1950, projected emissions in 2030 based on nationally determined contributions, and emission reductions required by the Sixth Assessment Report of the Intergovernmental Panel on Climate Change



		Reductions from 2019 emission levels (%)			
		2030	2035	2040	2050
Limit warming to1.5°C (>50%) with no or limited overshoot	GHG	43 [34-60]	60 [49-77]	69 [58-90]	84 [73-98]
	CO_2	48 [36-69]	65 [50-96]	80 [61-109]	99 [79-119]
Limit warming to 2°C (>67%)	GHG	21 [1-42]	35 [22-55]	46 [34-63]	64 [53-77]
	CO_2	22 [1-44]	37 [21-59]	51 [36-70]	73 [55-90]

Figure: NDCs implementation pathways. Source: UNFCCC Subsidiary Body, 59th Session, first Global Stocktake, 2023.

The above Figure shows the challenges ahead of us: we are enforced to reduce the global emissions to nearly zero up to 2050 to attend the 1.5°C Paris temperature goal.

Flexible market mechanisms can be implemented by either the bilateral/multilateral agreements (Article 6.2) or by the global crediting mechanism (Article 6.4) regulated by the UNFCCC Supervisory Body (SBM). The flexible mechanisms allow for the generation and use of **Internationally Transferred Mitigation Outcomes (ITMO$)**, if the host country in which boundary the emissions reductions take place authorizes the debt in its NDC, proceeding with the **corresponding adjustment.** The following Figure depicts the operation of flexible mechanisms.

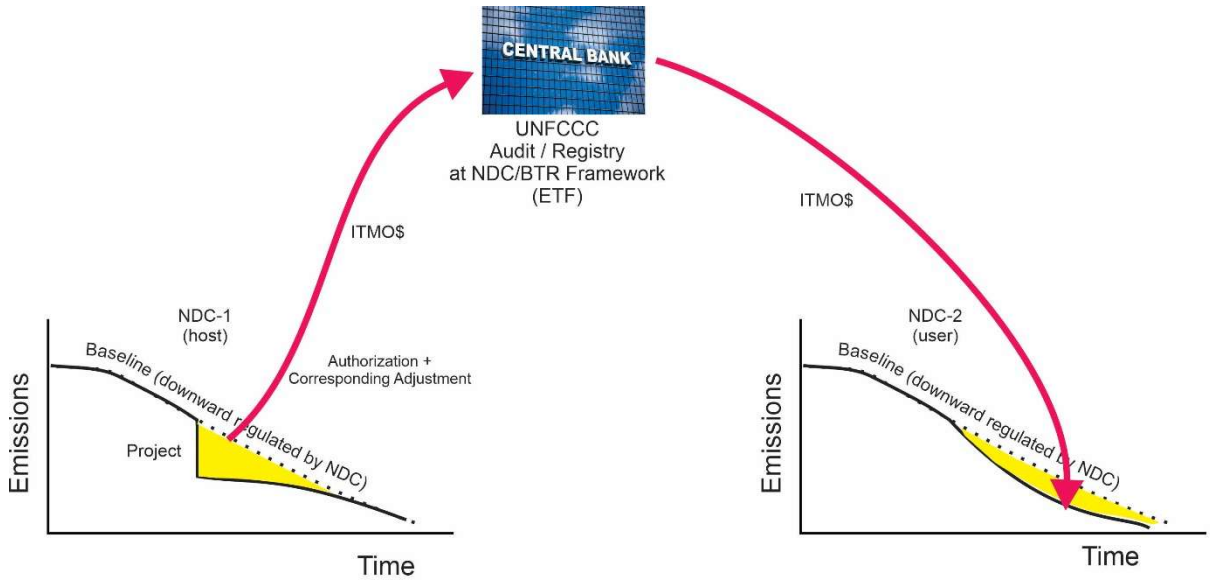


Figure: Article 6.2 Bilateral Agreements for the cooperative NDCs' implementation between two parties.

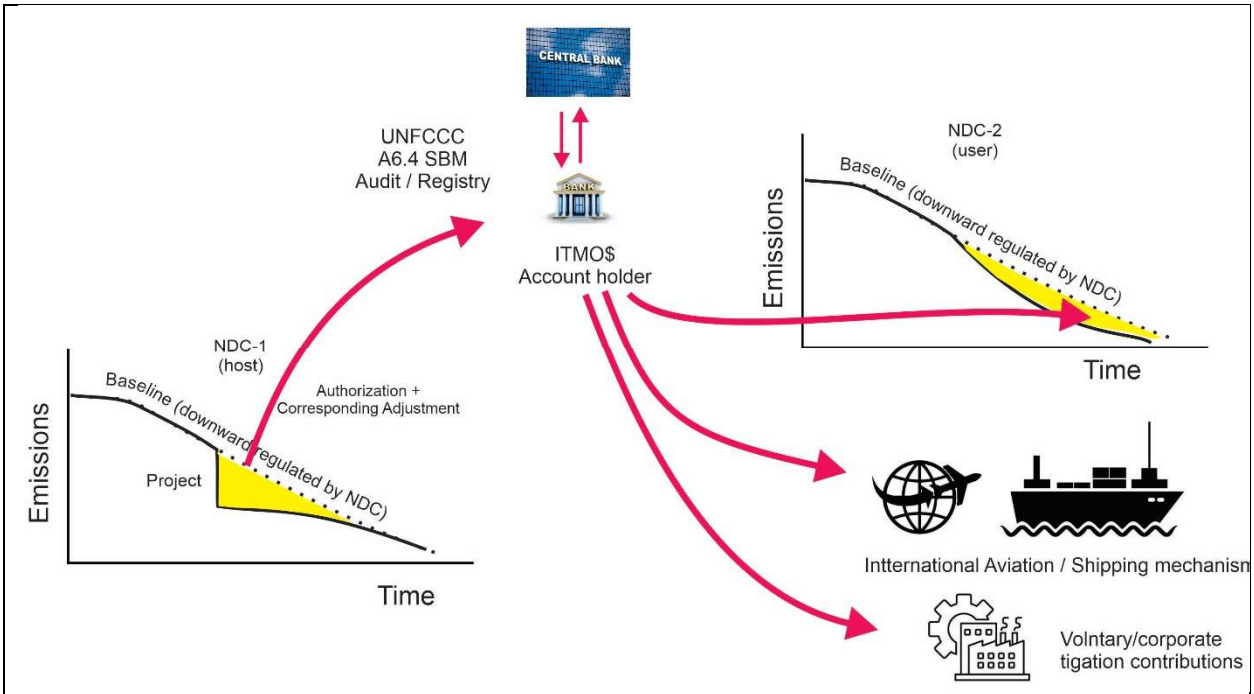


Figure: Article 6.4 crediting mechanism under the UNFCCC regulatory framework, and it's potential connection to the other NDCs (user) or voluntary carbon markets.

The **Glaswegian Rules, Modalities and Procedures – RMP** (COP26, 2021) require A6.2 and A6.4 methodologies to calculate **A6.2ERs and A6.4Ers (Emissions Reductions)**. The **A6.4Ers generate ITMO$** when the Designated National Authority – DNA of the host party authorizes the international transfer, by proceeding with the **corresponding adjustment of the host country NDC**. We may understand these requirements as follows:

Global emissions are limited to fixed allowances budgets up to neutrality in the middle of the century to attend the 1.5°C limit.

In other words, any **ITMO$** transferred from a host party to another is to be recovered in the future as an additional effort to achieve the neutrality within the agreed deadline, which is the **long-term low-emission development strategy – LT-LEDS**. The corresponding adjustment of an NDC to export ITMO$ will require a corresponding adjustment to compensate for the exportation by assuming a liability to replace the exported outcome by a domestic effort, or by importation from other parties before the neutrality deadline set by the LT-LEDS.

As indicated, **ITMO$** authorized by the host parties may be used by either other NDC(s) or for international purposes according to the authorization conditions. The host country proceeds with a corresponding adjustment in its NDC. It shall thus be highlighted the following

regulatory policy conditions that the host countries assume when joining the A6.2 and A6.4 mechanisms, which are rather different than the Kyoto CDM:

- The host country assumes regulatory **liabilities** with the authorized activities that become part of its own NDC. Once the activity reaches its end (in up to 15 years for emissions reductions, or 45 years for the removals) the host country would have a more ambitious NDC and will continue its operation to cope with its own targets. **There will not be a scenario of activities being abandoned or interrupted, during or after their crediting period, causing the increased emissions, like happened in Kyoto CDM, if the corresponding adjustments are properly managed by the parts, and the UNFCCC has a consistent enforcement on the global stocktakes**. The agreements between the Designated National Authorities – DNAs for the A6.2 cooperative approaches, or between the DNAs and the A6.4 activity participants and financing institutions/users of the ITMO$ shall reflect this condition: both hosting NDC1 and user NDC2 (or other user mitigation purpose, e.g. international aviation or maritime transportation), shall agree on clauses about the occurrence of reversals and the removals credits have been used by the NDC2.
- The corresponding adjustment of the NDCs that "exports" ITMOs will be engraved as a debt the host country is assuming to cover in the future. Since each party will need to fix its LT-LEDS at some point of time, the length of this period for achieving the net zero target, and the degree of enforcement of its attendance will be obviously be more or less stringent, depending on how much of ITMO$ the host country has "exported" by means of A6.2 or A6.4. If the host country exports more than reasonable according to its position in the global stocktakes, it may later be forced to compensate the "over exportation" when the NDC is at a more advanced stage, by means of either a "import/purchase" of ITMO$, or by an acceleration of the ambitiousness levels of the domestic contributions. In that sense, the **ITMO$ are not generated free of costs for the host countries**: they are in fact an anticipation of the future contributions and will be compensated by an enhanced speed of the domestic contribution or by changing the market position of the country from "exporter" to "importer" when the overall level of stringency is increased to all parties.
- These last conditions shall be very carefully considered by all parties (buyers and sellers, exporters and importers, hosts and users), including intermediating and financial institutions and interest holders, because now, when these mechanisms are just starting their operation, the generation and "market prices" of the credits are in their lowest level. As we describe in another section (see here) the generation and face values for the certificates will increase sharply over the transition, and the correction of wrong movements eventually incurred at the starting phase will be harder and more costly to correct for all parties involved. Nobody involved in the implementation of any activity will be able to escape from a liability beneath its own national judicial system (within its own country, no matter in which part of the equation the country is involved in the activity), because all parties have the same commitment to attend to the LT-LEDS. Any excessive usage of the emissions allowances at any year "y" for the NDC attendance

may generate in the future year "y+n" a demand to replace or rebuy corresponding allowances at a price that will be much higher then than now. Therefore, even if the UNFCCC does not implement a formal requirement to ensure the safeguarding and/or insurance for the ITMO$ issuance and usage authorizations by NDC, this condition is implicitly involved in the mechanisms, and the participants shall make their own options on how to share and resolve any consequence of their current decisions, when designing and getting involved in the activity implementation. **Unlike Kyoto, Paris has not "commitment periods", it is enforceable for the entire duration of the necessary transition to achieve the global temperature goals (1.5 to 2.0°C). Mitigation is now based on the overall global emissions allowance by the countries altogether, from the present level up to the neutrality in 2050. The "cap-and-trade" mechanisms of the A6.2/A6.4 are based on jointly and mutually enforcing command-and-control of the progressively more ambitious NDCs/BTRs under the UNFCCC registry and by means of the ETF, until the final goal.**

Listen to the AI generated Podcast about the Paris Agreement Article 6 Mechanisms

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Explanatory Box 2

Market Opportunities and Methodological Constraints for ITMO$ generation

Unlike Kyoto, there is no void regulatory space or unregulated boundary in the Paris mechanisms. Any technology, measure, or policy that intends to demonstrate and generate ITMO$ must be compatible and shall be accounted centrally by UNFCCC in the national inventories (BTRs) that are the basis for the NDC implementation progress. Both are based on the ***"2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories"***. In other words:

The freedom to develop and apply baseline and monitoring methodologies do not exist anymore. Mitigation outcomes measured as tCO2e only becomes ITMO$ if in compliance with the BTRs/NDCs methods: the ETF is a superimposed mechanism above A6.2 and A6.4.

The Kyoto CDM and the voluntary market methodologies were developed and applied to host countries in which there were no regulations in place to reduce their national emissions. Therefore, the methodologies could assume that in absence of the project, the emissions within any "project boundary" could proceed according to the "Business as Usual – BaU" scenario, whereby the host country has not any commitment to abate the emissions. This is gone.

The concept and the term "Business as Usual – BaU" must be abolished permanently starting 1.1.25 (the start date of the ETF and A6.2/A6.4 accounting system) and replaced by a kind of **"Business as Unusual – BaUu"** concept. The ongoing climate transition is thus not a voluntary "race to zero" by the conventional market players, it is in fact an enforced **"break to zero"**, that will displace existing players and create or induce the creation of new ones. The driving force is not the use of capital stocks accumulated in the previous 200 years by the conventional technologies, without having created provisions to cover the costs for the climate liability, rather a command-and-control regulatory enforcement of the progressively stringent NDCs inducing the substitution of the higher emitting technology, or to allow its continued operation only under the condition of a counteractive operation of removal activities within the crediting mechanism, neutralizing the residual emissions, 'whatever it costs'. The fundamental assumption is that there is no alternative to mitigation, except for adaptation, and this is unpayable for global warming beyond the level of 1.5 to 2°C.

A6.2 and A6.4 methodologies shall meet the mitigation targets requirements. The A6.4 Supervisory Body (SBM) and its Methodology Expert Panel (A6.4 MEP) will need to change their way of developing and applying methodologies, even eventually against their own will or

perception today, or against the pressure from the lobbies and legitimate and/or vested interests that have always driven the CDM process. We highlight some of the key features that must be considered in the A6.4 methodological framework.

- **Consistency with the NDC**: the methodologies will need to be developed in such a way as to determine their impact on the **national inventories** of the countries involved. **The activity boundary is a parcel of the national boundary**. The methodologies shall thus make use of tools able to decompose the BTR/NDC into subnational units, in either the **geographic decomposition** (the jurisdictional decomposition, e.g. into states and/or municipalities) or in the **sectoral decomposition** (into the five sectors for LULUCF, Energy, AFOLU, IPPU and Wastes, and within each sector the institutional or individual entities/businesses/livelihoods at demand or supply-side) that are regulated by the DNA and collectively reported in the BTR/NDC.
- **Temporal and materials effects:** Differently from Kyoto, the liability of the activity participants does not cease at the end of the crediting period: what happens in that moment is that the activity ceases its phase of generating mitigation units to be transferred as ITMO$, and starts to account their mitigation effects at the NDC level, thus, contributing to the decrease/increase of national emissions. Consequently, the entire lifetime of individual appliance matters: (i) the displacement/decommissioning of previously existing technologies, (ii) the continued operation during lifetime, which may be shorter or longer than the crediting period; (iii) at the decommissioning of the technology and its eventual replacement by another one of the same or different kind.
    - Therefore, a **lifecycle evaluation** shall be part of any first-of-its-kind admission of new technologies/methodologies into the A6.4 mechanism, employing the concept of **circular economy**. The consumption of natural resources for virgin mineral extraction and the end-of-life recycling/disposals are accounted. Emissions regarding the energy consumption for the recycling (e.g. reverse logistic and energy for separation/segregation/reprocessing the wastes), may be eventually disregarded, assuming that renewable energy fluxes may be elastically augmented during the NDC implementation process to attend these needs, but not the requirements for virgin material consumption and depletion of disposal sites volumetric capacities.
    - The lifecycle evaluation is bound to the fact that Paris has no “commitment periods”, but a “temperature target bound to progressively more stringent NDC periods”: any net emissions that a technology imposes into the future, e.g. for its decommissioning and/or scrapping or recycling, or for its controlled accumulation (e.g. radioactive wastes) is a **lock-in effect** taking place in a future point in time where the emissions allowances and carbon prices are at much higher levels.
    - If the lifecycle evaluation concludes the technology is not compatible with the net carbon neutral scenario (it is a low-emissions device, but not a zero-emissions device), its displacement later by other substitute technology may be

necessary. These will be labeled as **transitional technologies**, attending the NDC process up to a certain point in the future. This may include, for example, the operation of existing natural gas networks (without increased extraction of natural gas reserves) to substitute higher emitting fuels.

- **Methods within any domain the demand-supply chain:** Since all activities boundaries at any country is under a NDC regulatory control, any boundary is principally eligible to demonstrate its contribution to enhanced emissions reductions or removals, either by changing its operative condition, or by changing its indirect effect by means of the **(i) avoidance and/or shifting demand for larger emitting goods or energy, or (ii) avoidance and/or shifting the supply of goods, energy or wastes/effluents to larger emitting destinations.** This opens the opportunity for the monetization of contributions for any level of the demand supply chain, namely: **primary producers, intermediates, and final consumers affecting the NDCs and global stocktakes at the sectors: (1) Energy, (2) IPPU (Industrial Production and Product Use), (3) AFOLU (Agriculture, Forestry and Land Use), (4) Land-Use, Land-Use Change and Forestry – LULUCF and (5) Wastes**. The two requirements for the methods are that they (i) transparently monitor and report in an auditable manner the changed behavior of the activity participants, individually and collectively; (ii) transparently and conservatively determine the emissions factor for the input/output.

The following Figure shows the interconnection among the sectors regulated by the BTRs and NDCs under the Paris Agreement Enhanced Transparency Framework (ETF), highlighting the importance of the **wastes sector as the proxy for the GHG estimations at any activity boundary.**

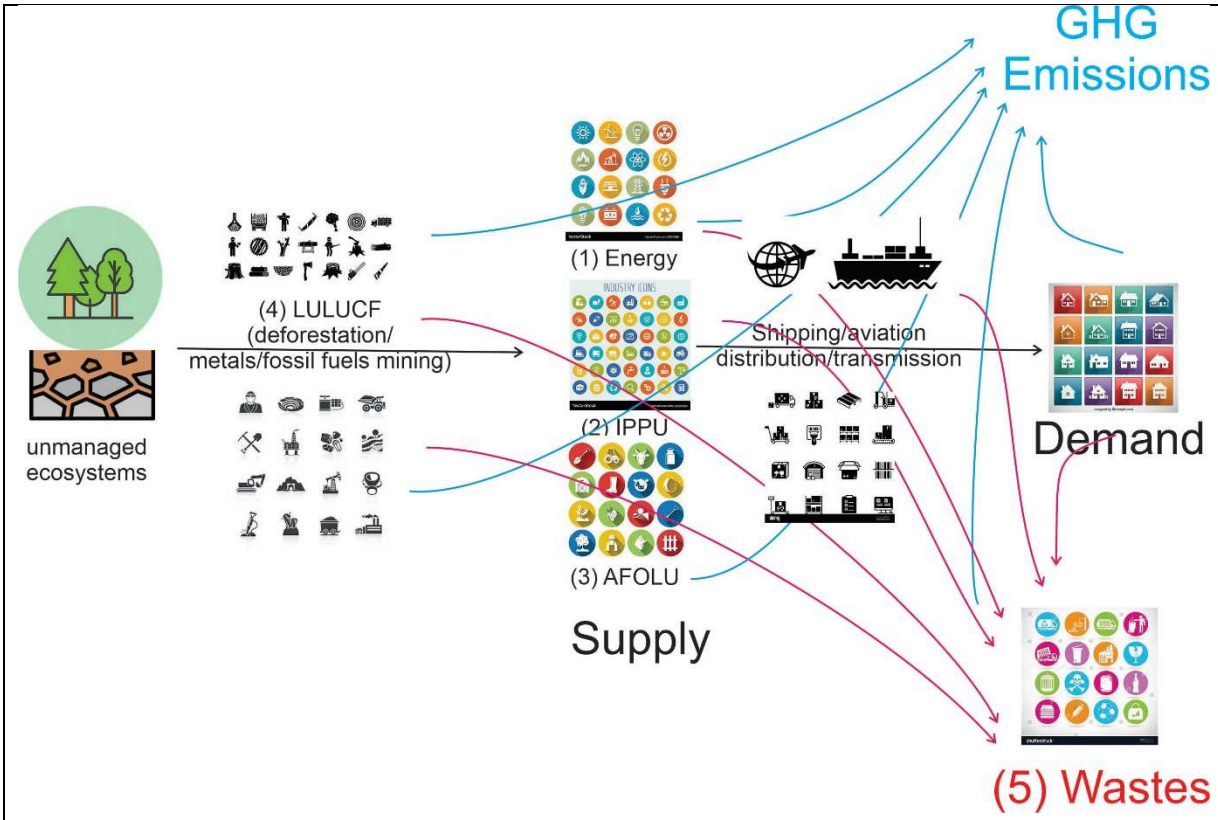

Figure: The sectoral interconnection in the typical arrangement of the historically prevailing linear economy fluxes. Emissions/removals at the sector (4) LULUCF (Land Use, Land Use Change and Forests) are impacted by the extraction of fossil fuels and primary minerals, that are raw materials for the supply-sectors related to (1) Energy, (2) IPPU (Industrial Processes and Product Use) and (3) AFOLU (Agriculture, Forestry and Land Use), to attend demand by the final consumers. All sectors generate GHG emissions and (5) Wastes, which are also treated and disposed of generating emissions. The www.carbon-recycling.eco cooperative approach uses the waste stream as the proxy for the GHG accounting at any activity boundary, to determine their contribution to climate mitigation during the NDC implementation process.

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Explanatory Box 3

Waste Sector as "proxy/monitoring parameter" for emissions reductions/removals

Carbon-recycling approach will be described in another section (see here) for emissions reductions or removals methodologies, based on the use of the **solid wastes / final residues, including pyrocarbon and biocarbon,** as key monitoring parameters indicating the implementation of: (i) the NDC implementation process of a host party within the ETF; (ii) the development of a registered A6.2 and A6.4 activity delivering **A6.4ERs and ITMO$** and (iii) any extraordinary contribution by an individual person/entity to achieve the national mitigation targets, registered nationally as a kind of **"Extraordinary Climate Contribution Outcomes - €CCO$"** within the national regulated market, or within a voluntary registry of mitigation outcomes, when such are in place.

The waste sector is by long not the most significative share of the overall anthropogenic GHG emissions, accounting for only 4% as the following figure indicates.

Figure ES.1 Total GHG emissions in 2023

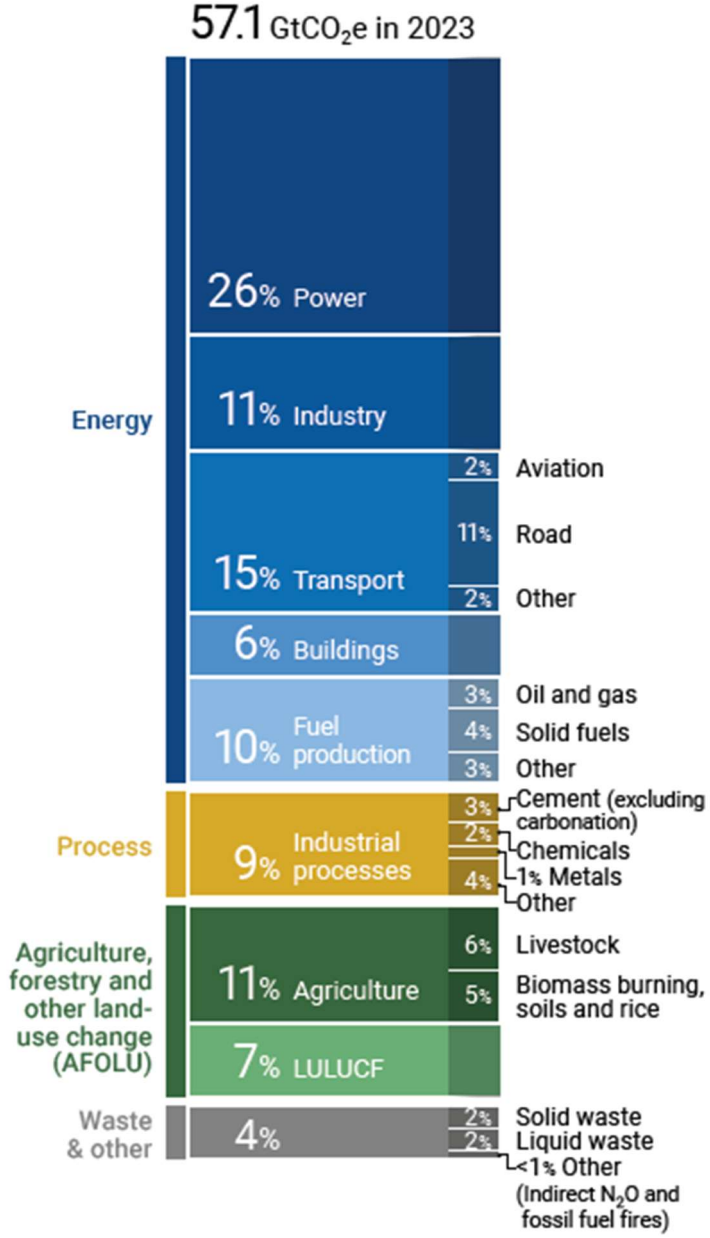

Figure: 2023 Global Anthropogenic GHG Emissions by sectors. Source: *United Nations Environment Programme (2024). Emissions Gap Report 2024: No more hot air … please! With a massive gap between rhetoric and reality, countries draft new climate commitments.* Nairobi. https://doi.org/10.59117/20.500.11822/46404

However, the waste sector emissions are strategically associated with all other sectorial GHG emissions, since both wastes and GHG emissions are in fact **geological records/footprints** of

externalities imposed by human activities into the environment. In fact, any one of us is leaving as an heritage to the next generations both (i) the daily leftovers and decommissioned devices we discharge to treatment/disposal sites, plus the solid wastes that corporative activities have generated to produce the goods we daily consume, at one side, and (ii) our GHG emitted to the atmosphere directly by daily utilization of appliances (cars, cooking/heating equipment, etc.) plus the GHG indirectly generated by the corporative activities delivering the energy and goods we consume, at the other side. Both are intrinsically related to each other, and…

solid wastes amount and composition are key indicators of the amount and composition of the GHG emissions for any activity.

This is the fundamental assumption used by the www.carbon-recycling.eco climate mitigation approach.

Unfortunately, this recognition has not been acknowledged by the UNFCCC and its scientific bodies. For example, the **IPCC Special Report: Global Warming of 1.5 ºC** has ignored the waste sector and did not cover this sector at all, in the chapters on mitigation pathways. Notwithstanding, we are convinced the correlation waste/GHG emissions may be used for both tracking the NDC implementation pathway (Article 13) as well as for monitoring activities registered within the Paris Agreement A6.4 crediting mechanism (PACM), to monitor and calculate their **A6.4ERs and ITMO$**.

SWDS as the Pivotal A6.4 Methodology: Since the wastes generation by any entity (public or private) and by any person (at households or at any location) is the fundamental marker of its contribution to the GHG emissions, a pivotal methodology shall be adopted by the A6.4 SBM and/or by all Designated National Authorities – DNAs, to identify and monitor every and each **Solid Wastes Disposal Sites – SWDS** around the world. These sites consist of a network of physical records of all the daily human activities in the past and present day (today) and are thus the key to following the forthcoming transition from our yearly ~57 Gt/CO2e atmospheric emissions in 2023 up to the Paris goal of emissions neutrality in the middle of the century.

Under a framework consultancy agreement with the UNFCCC, one of the members of the www.carbon-recycling.eco has drafted a zero-order conceptual methodology for the SWDS under the A6.4 mechanism. This draft has been evaluated by the **A6.4 Methodology Expert Panel - MEP** at its 2nd meeting on 24-28 June 2024 (webcast: https://www.youtube.com/playlist?list=PLBcZ22cUY9RKR_7zBikj7XMHaZaym9aBy) but not accepted or even revealed or disclosed for public comments. Given the confidentiality clauses of the consultancy agreement, we are not allowed to disclose here the proposed draft, interested people/institutions may eventually request it to the UNFCCC secretariat.

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Explanatory Box 4

Outlines for Supply-Side A6.4 Methodologies

The **NDC accounting and the ETF exchange of ITMO$** among the parties to the Paris Agreement is based on the **National Inventories**, where the yearly emissions are calculated for the sectors: **(1) Energy, (2) IPPU (Industrial Production and Product Use), (3) AFOLU (Agriculture, Forestry and Land Use), (4) Land-Use, Land-Use Change and Forestry (4) and (5) Wastes**. The national inventories are calculated based on the overall level of activity in the country that determine the total emissions for the entire sector, using one of the methods or "tiers", according to the level of confidence expected for reporting the estimates, each country has its key-categories according to the major economic activities. The A6.4 and A6.2 methods are based on **"activity boundaries"**, where the emissions at a certain site under the control of the "activity participants" are situated, and where a proposed change will be implemented to reduce the emissions below the baseline. The interconnection and cross-accountability between the "activity boundary" and "NDC boundary" is thus a necessary consistency requirement, if the A6.2 and A6.4 "emissions reductions" are to be transferred from one NDC to another NDC, or to a regulated mechanism (CORSIA and international maritime transportation). The overall requirement is that the NDC inventory may be based on a simplified tiering method, but the activity measurements shall be based on direct monitoring of the observed modifications of the emissions within the activity boundary and conservatively estimating its expected effect in the national inventory. This will allow for the issuance of ITMO$ authorizations to be subtracted from the user NDC (NDC2 in the pictures) and estimating the necessary Corresponding Adjustments (CA) to be added to the host NDC (NDC1 in the pictures).

Three kinds of methodologies are conceivable for the A6.4 and A6.2 mechanisms: the **(1) supply-side methodologies**, where the activity boundary and emissions reductions are accounted at the supplier side under the control of participants that deliver an energy, AFOLU or IPPU product to the final consumers; the **(2) demand-side methodologies**, where the consumers change their behavior in a cooperative/collective way, and **(3) Policy-side methodologies**, where the public entities enact changes in regulatory constraints, enforcing the emissions reductions at their jurisdictional boundary. We will cover the three kinds separately.

Further, the technology/measure leading to the emissions reductions may be classified in three types, as suggested by Table 5.1 of the IPCC WG-III AR6 Report: **(A) Avoid; (S) Shift; or (I) Improve - "ASI"** mitigation scopes.

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(I) **Supply-side baseline setting:** The first step is to determine a baseline emissions scenario for any activity boundary. The Glaswegian A6.4 RMP requires that baselines are downwards adjusted, but do not provide the way to make this adjustment. We consider the most rational way to determine the downwards adjustment is to relate it to the progression of the NDC targets. The activity boundary shall attend to the regulatory constraints and emissions allowances set by the national authority (DNA). The figure below shows the most common case of the activity being a supplier/producer of an industrial or agroforest good (IPPU and AFOLU) to the final consumers.

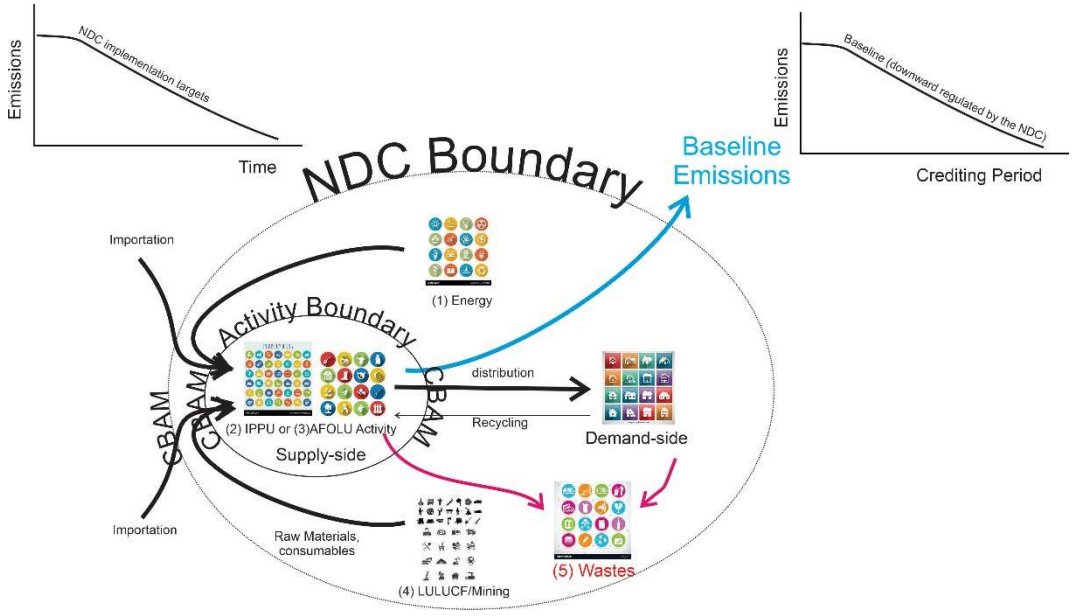

Figure: Outline of the baseline setting for a generic supply-side A6.4 activity belonging to the IPPU or AFOLU sectors regulated by a host NDC. The NDC targets will be reflected in the baseline as the downward adjustment set as an allowance prescribed by the national authority (DNA), when they are in place and directly affecting the activity boundary. The baseline emissions are the directly incurred by the activity and, according to the prescription by the methodology, may cover the consumption of energy, raw materials, consumables, etc. by the procedural tool "Carbon Border Adjusting Method – CBAM". The CBAM tool will take into consideration the baseline emissions for the production and delivery of the energy/material entering the activity boundary, downwards adjusted according to the national NDC, or by foreign NDCs, when the goods/energy are imported from abroad.

As highlighted in the figure, the Tool "Carbon Border Adjusting Method – CBAM" is critical to all NDC boundaries (this kind of adjustment is already used by the EU regulation), to consider the carbon footprint and the attendance to the global allowances of emissions set by the NDCs and global stocktakes by any good or energy service. Similarly, when a domestic production

chain is delivering raw materials, consumables, and energy to the activity, the CBAM may be applied at the activity boundary to determine the baseline emissions for the goods/energy consumed by the activity during the crediting period (up to 15 years for emissions reductions activities). The CBAM tool shall be developed and approved/validated by the A6.4 SBM and host DNAs, using, for example, the **Standardized Baseline** approach, when multiple suppliers of the goods and consumables are in place.

(II) **Emissions Reductions.** The scopes for A6.4 Methodologies should follow, in our opinion, the approaches suggested by Table 5.1 of the IPCC WG-III AR6 Report, which consist of the three possible kind of activities: **Avoid/Shift/Improve – ASI** mitigation scopes.

At the supplier side, the most common cases will be the "Improve" or "Shift" situations, as described by the following figure, describing a generic situation of an activity implemented at any supplier site delivering an industrial (IPPU) or agroforest (AFOLU) product to the final consumers (demand).

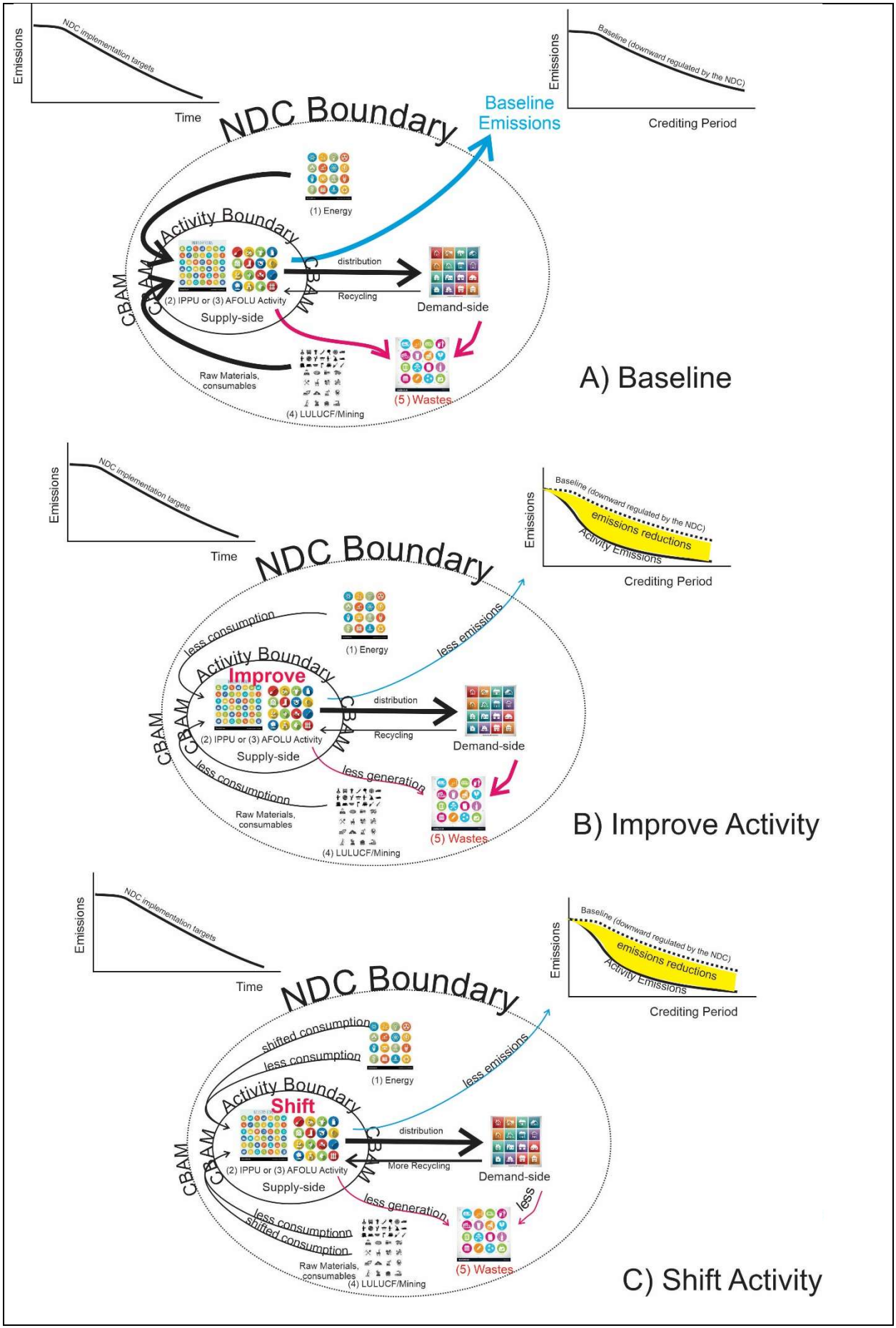
Emissions
NDC implementation targets
Time
NDC Boundary
Baseline Emissions
Emissions
Baseline (downward regulated by the NDC)
Crediting Period
(1) Energy
Activity Boundary
CBAM
distribution
Recycling
(2) IPPU or (3) AFOLU Activity
Supply-side
Demand-side
Raw Materials, consumables
(4) LULUCF/Mining
(5) Wastes
A) Baseline
Emissions
NDC implementation targets
Time
NDC Boundary
Baseline (downward regulated by the NDC)
emissions reductions
Activity Emissions
Emissions
Crediting Period
less consumption
(1) Energy
less emissions
Activity Boundary
Improve
CBAM
distribution
Recycling
(2) IPPU or (3) AFOLU Activity
Supply-side
Demand-side
less consumptionn
less generation
Raw Materials, consumables
(4) LULUCF/Mining
(5) Wastes
B) Improve Activity
Emissions
NDC implementation targets
Time
NDC Boundary
Baseline (downward regulated by the NDC)
emissions reductions
Activity Emissions
Emissions
Crediting Period
shifted consumption
less consumption
(1) Energy
less emissions
Activity Boundary
Shift
CBAM
distribution
More Recycling
(2) IPPU or (3) AFOLU Activity
Supply-side
Demand-side
less generation
less
less consumptionn
shifted consumption
Raw Materials, consumables
(4) LULUCF/Mining
(5) Wastes
C) Shift Activity

Figure: Outline of the methodology for determination of baseline and activities emissions, and calculation of Emissions Reductions (A6.4ERs) for a generic supply-side IPPU or AFOLU activity within a host NDC. The "Improve" type of activity is based on the changed technology or production/processing route to achieve a better efficiency in raw materials/energy utilization, thus, reducing the specific emissions (GHG emissions per unit output), beyond the baseline. The "Shift" situation is when the activity consists of changing the source of its baseline raw material/consumables or energy by a lower emitting input, the CBAM will be used to calculate the emissions reductions. Similarly, a "Shift" is also the increase of the rate of recycled versus virgin materials in the production process, the CBAM (including the emissions associated with the reverse logistics and processing of the recycled goods) will indicate the net Emissions Reductions effects.

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Explanatory Box 5

Outlines for Demand-Side A6.4 Methodologies

The fact that all countries now are responsible for their NDCs, and since all citizens of the countries are collectively responsible for the national climate governance, makes the **"individual contribution"** as one of the most interesting A6.4 methodological scopes. Of course, the registration of an individuum as an "activity proponent" is out of discussion, however, the **cooperative contribution** within a formal adhesion to a cooperative arrangement/agreement covering the registration, monitoring, reporting and distribution of the earned A6.4ERs among the participants is the way to go. This is one of the possibilities sought by our www.carbon-recycling.eco cooperative initiative.

The outlines for the demand-side methodologies are indicated in the following figure, where the two most promising scopes are the **"Avoid (A)" and "Shift (S)"** cases.

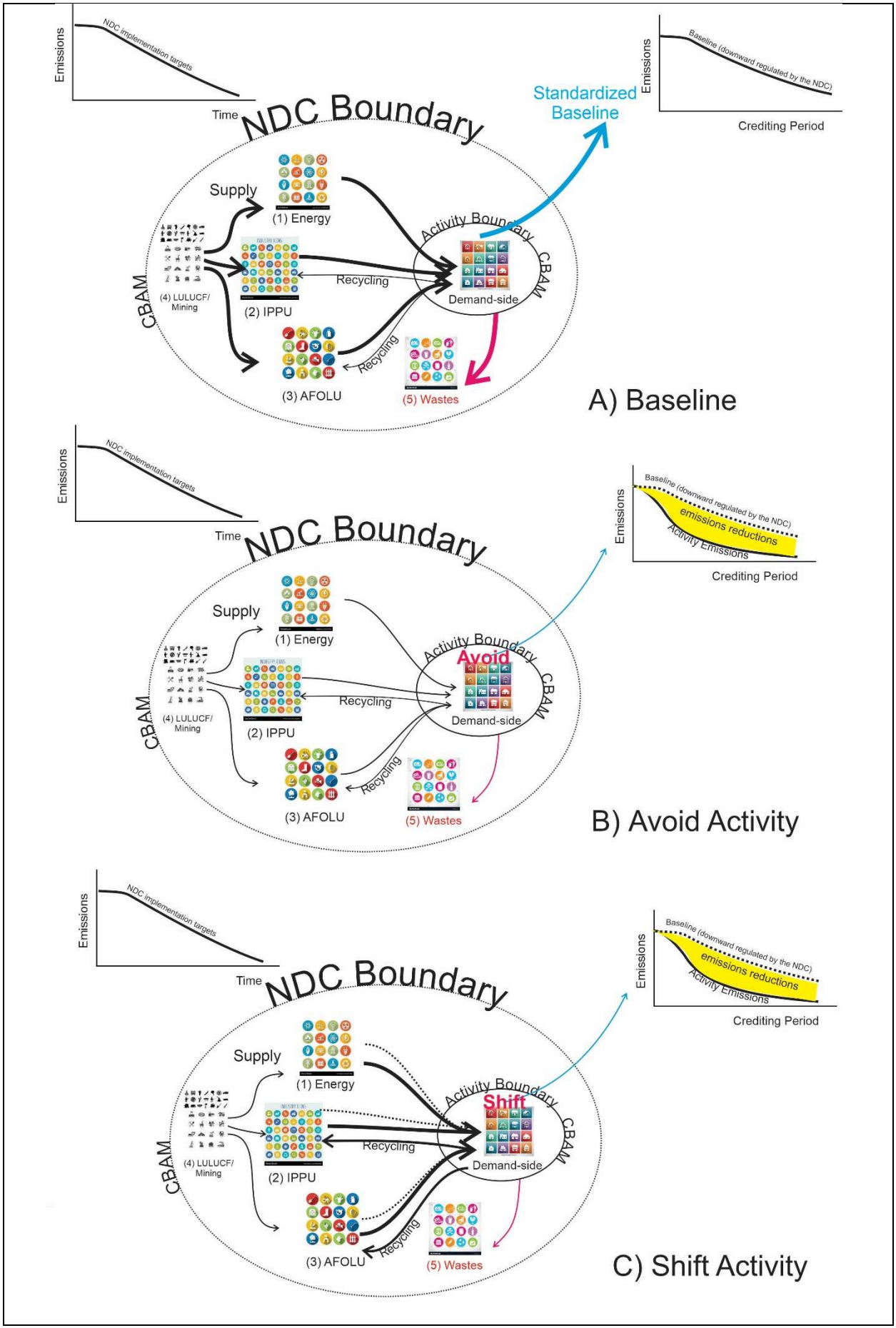
Emissions
NDC implementation targets
Time
NDC Boundary
Standardized Baseline
Emissions
Baseline (downward regulated by the NDC)
Crediting Period
Supply
(1) Energy
Activity Boundary
CBAM
Recycling
(4) LULUCF/ Mining
(2) IPPU
Demand-side
(3) AFOLU
(5) Wastes
A) Baseline
Emissions
NDC implementation targets
Time
NDC Boundary
Baseline (downward regulated by the NDC)
emissions reductions
Activity Emissions
Crediting Period
Supply
(1) Energy
Activity Boundary
Avoid
CBAM
Recycling
(4) LULUCF/ Mining
(2) IPPU
Demand-side
(3) AFOLU
(5) Wastes
B) Avoid Activity
Emissions
NDC implementation targets
Time
NDC Boundary
Baseline (downward regulated by the NDC)
emissions reductions
Activity Emissions
Crediting Period
Supply
(1) Energy
Activity Boundary
Shift
CBAM
Recycling
(4) LULUCF/ Mining
(2) IPPU
Demand-side
(3) AFOLU
(5) Wastes
C) Shift Activity

Figure: Outline of the methodology for determination of baseline and activities emissions, and calculation of Emissions Reductions (A6.4ERs) for a generic demand-side activity within a host NDC. The baseline is the continuation of the existing activities within the consumer side, supplied by the energy, industrial goods, and AFOLU products, and generating the wastes streams according to the proceeding NDC. The "standardized baseline" approach will be able to determine the downwards adjustments that the final consumers will acknowledge in their "activity boundary" by the NDC implementation during the crediting period. The NDCs will impose reduction of emissions among the suppliers of goods and services, reducing thus the emission factors to produce the individual goods and for the consumption of energy at the demand/households. The demand side activity scope is when the final consumers adhere to a cooperative approach, whereby a change of consumption habits involving "shift" or "avoid" is voluntarily implemented at the households, contributing to the climate mitigation in an extraordinary effort, that is registered and monitored during the crediting period.

"Avoid (A)" activity-type: They are based on the final consumers voluntarily adopting a monitorable reduction of consumption of any high emitting good or service. The net effect of the collectively cooperative action is **not necessarily** the overall reduction of the activity level of the economic activities delivering the non-zero-emitting good or service at the IPPU, AFOLU or Energy supplying sectors. As long as these suppliers attend the requirements of the NDC being enforced by the country DNA, these suppliers may continue to deliver their services or products to other consumers in the host country that did not adhere to the cooperative initiative, or to export the services or goods abroad, where the level of implementation of the NDC may be at a lower stage of stringency. Further, when the entire suppliers' sector has reached the provision of the service or good with net zero emissions, and this has been acknowledged by the host DNA in the national inventory, the Avoid-type activity loses its capability to generate Emissions Reductions, since the baseline becomes zero.

- **Examples of demand-side Avoid-Type activities (adapted from Table 5.1 IPCC WG-III AR-6):**
  - **Mobility: Smart logistic at purchases; Tele-working; Fewer long-haul flights; Local holidays**
  - **Shelter: Smaller decent dwellings; Shared common spaces; Multigenerational housing**
  - **Thermal comfort: Reduce m^2 (as above); Change temperature set-points; Change dressing-code; Change working times**
  - **Goods: Reduce consumption quantities; Long-lasting fabric; Appliances sharing economy; Changed cooking routines**
  - **Nutrition: Keep calories in line with daily needs and health guidelines; Reduce waste in supply chain and after purchase**
  - **Lighting: Occupancy sensors; Lighting controls**

"Shift (S)" activity-type: They are based on the final consumers voluntarily adopting a monitorable shift in the source or kind of consumption of any high emitting good or service, substituting them by a lower-emitting one. The same conditions as previously described for the Avoid-type applies, namely: The net effect is **not necessarily** the overall reduction of the activity level of the economic activities delivering the higher-emitting good or service at the IPPU, AFOLU or Energy supplying sectors. As long as these suppliers attend the requirements of the NDC being enforced by the country DNA, these suppliers may continue to deliver their services or products to other consumers in the host country that did not adhere to the cooperative initiative, or to export the services or goods abroad, where the level of implementation of the NDC may be at a lower stage of stringency. Further, when the entire suppliers' sector has reached the provision of the service or good with net zero emissions, and this has been acknowledged by the host DNA in the national inventory, the Shift-type activity also loses its capability to generate Emissions Reductions, since the baseline becomes zero.

- **Examples of demand-side Shift-Type activities (adapted from Table 5.1 IPCC WG-III AR-6):**
  - **Mobility: Modal shifts, from car to cycling, walking, or public transit; from air travel to high-speed rail**
  - **Shelter: Less material-intensive dwelling designs; Shift from single-family to multi-family dwellings**
  - **Thermal comfort: Architectural design (shading, natural ventilation, etc.); Shifting energy sources for heating/cooking/cooling.**
  - **Goods: Choose of materials or energy efficient products/appliances designs;**
  - **Nutrition: Dietary shifts from ruminant meat and dairy to other protein sources while maintaining nutritional quality**
  - **Lighting: Architectural designs with maximal daylighting; choose of more efficient appliances**

Monitoring Methodologies will be challenged for demand-side technologies/measures, many of the above-mentioned actions are innovative compared with the current Kyoto-CDM 'booklet' and voluntary market methods. The A6.4 SBM and its A6.4 Methodology Expert Panel – MEP should open their portfolio of eligible monitoring techniques to use new, groundbreaking methods, like **"Internet of things – IoT", "Artificial Intelligence – AI",** and the **"Things Social-Networking - TSN" (see here).**

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Explanatory Box 6

Outlines for Policy-Side A6.4 Methodologies

Climate mitigation is a national commitment for all parties to the Paris Agreement, and the NDCs shall include policies by the public administration resulting in emissions reductions, measured or not in GHG metrics (Please refer to Katowice's "Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement", decision 18.CMA.1, section III-B). Therefore, policies are also means to achieve emissions reductions to attend the NDC, or to go beyond the NDC targets, therefore, giving rise to the potential generation of **ITMO$**.

A6.4 methodologies may cover the implementation of national policies, although **A6.2** may be seen as the best approach when it is based on bilateral cooperations with **ITMO$** transfers, and **A6.8** when the policy is non-market oriented and belongs to financial or technical assistance between the parties.

Subnational, also named "Jurisdictional Mechanisms", formally adopted by a single or by a consortium of governments below the country level, e.g. at one federal state or at a group of cities, good opportunities for A6.4 methodologies covering policy initiatives by subnational regulatory bodies at state/province or city/county levels. Figure below indicates the potential implementation of jurisdictional policies, taking the USA as an example, since the climate mitigation governance in this country is collapsing.

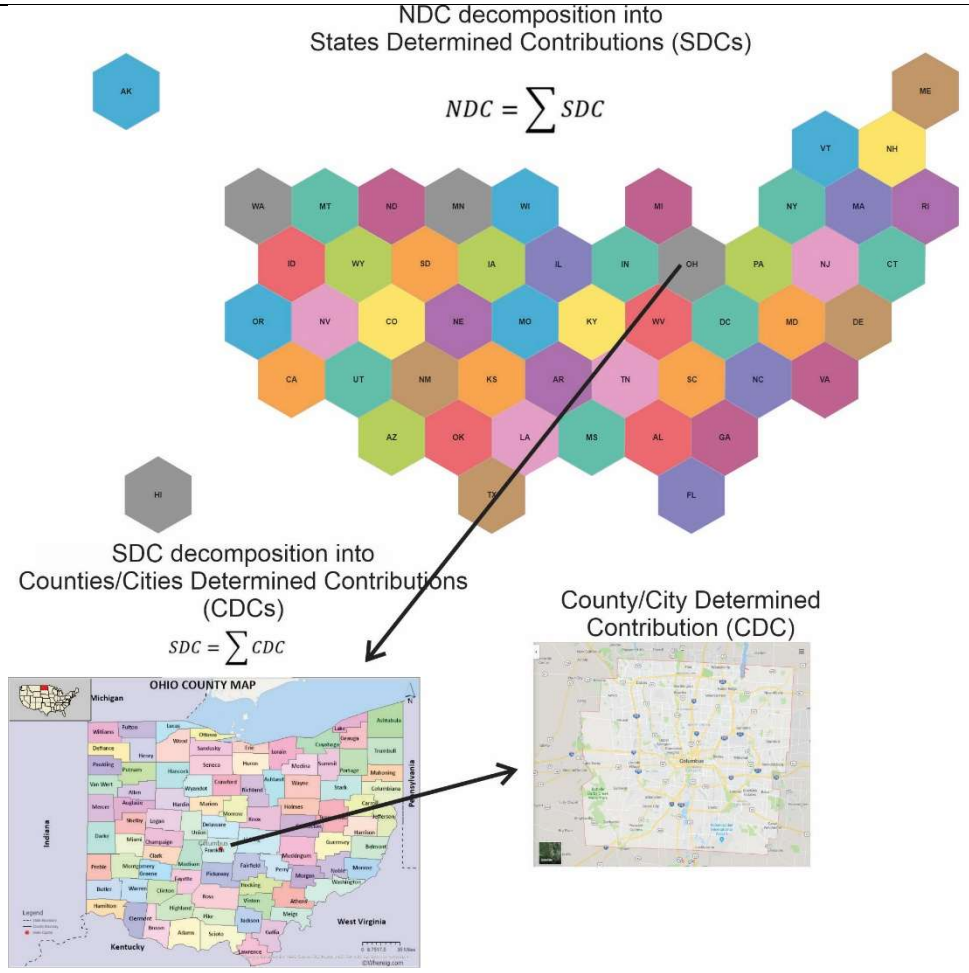

Figure: Jurisdictional decomposition of an NDC into subnational territorial units. The decomposition is not a trivial method, it may be guided/oriented by the A6.4 Supervisory Body – SBM within a Tool, e.g. making use of the supply-demand nexus, the Carbon Border Adjustment Method – CBAM, the national inventory sectoral composition (energy/LULUCF/IPPU/AFOLU/etc.) as rationale for the decomposition. However, the actual decomposition at any country will be a national prerogative by the DNA and the involved subnational governances, based on political circumstances, in the same manner as the Global Stocktakes contributions are subdivided into NDCs.

- **Examples of Policy-side activities for the three types Avoid (A), Shift (S) and Improve (I) (adapted from Table 5.1 IPCC WG-III AR-6):**
  - **Mobility: Integrate transport & land use planning (A); Smart logistics (A); Compact cities (A)**
  - **Shelter: Use wood as material (I); Use low-carbon production processes for building materials (I)**
  - **Thermal comfort: Improved insulation (I); Heat pumps (I); District heating (I)**

- **Goods: MSW and SWDS management (A, S and I), comment below.**
- **Nutrition: Urban greening and blueing policies with local food production (A, S and I)**
- **Lighting: Street lighting management policies (A, S and I)**

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Emissions Reductions and Removals (A6.4 ERs)
(The modified Fnrb approach)

The following definitions are set by CMA (Baku's decisions on Article 6 Mechanisms):

*"6. **Reductions in emissions, increases in removals,** as well as mitigation co-benefits of adaptation actions and/or economic diversification plans, are each and collectively referred to as" emission reductions or removals" (A6.4 ERs) in this document."*

*"8(a) **Anthropogenic removals** as the withdrawal of greenhouse gases (GHGs) from the atmosphere as a result of deliberate human activities. (IPCC AR6 WGIII report, glossary);"*

*"9(a) **Removals** are the outcomes of processes by which greenhouse gases are removed from the atmosphere as a result of deliberate human activities and are either destroyed or durably stored through anthropogenic activities;"*

Specifically for Carbon Dioxide (CO_2), we make reference to:

*"8(b) **Carbon dioxide removal (CO_2; CDR)** as anthropogenic activities removing CO_2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological, geochemical or chemical CO2 sinks, but excludes natural CO_2 uptake not directly caused by human activities. (IPCC AR-6 WG III report, technical summary)."*

References are made for the A6.4-STAN-METH-001, *"Standard: Application of the requirements of Chapter V.B (Methodologies) for the development and assessment of Article 6.4 mechanism methodologies"*, Version 01.1, and A6.4-STAN-METH-002, *"Standard: Requirements for activities involving removals under the Article 6.4 mechanism"*, Version 01.0. Baku's COP 29 Standards for Article 6 Mechanisms operation.

Removals vs Reversals and vintages paradox

The accounting of removals is set in Section 4.4 of the Standard A6.4-STAN-METH-002, based on **monitoring of carbon reservoirs within the activity boundary, during the monitoring period (e.g. for one year "y")**. We reproduce paragraph 30 of that standard:

"30. Removals eligible for crediting shall be determined as follows:
(a) The net change in greenhouse gas storage shall be calculated by subtracting the sum of the change in greenhouse gas stored in each applicable greenhouse gas reservoir in the baseline scenario from the sum of the change in greenhouse gas stored in each applicable greenhouse gas reservoir in the activity scenario, calculated from the start date of the period covered by a monitoring report to the end date of the same period;
(b) The net change in emissions, not including any greenhouse gas storage losses from the greenhouse gas reservoirs referred to in paragraph (a), shall be calculated by subtracting the total emissions in the baseline scenario from the total emissions in the activity scenario, calculated from the start date of the period covered by a monitoring report to the end date of the same period;
(c) If the net change in greenhouse gas storage is positive, then the number of A6.4ERs issued to the activity is calculated by combining the following terms (herein referred to as net removals):
(i) The net change in greenhouse gas storage, specified in paragraph (a);
(ii) Minus (-) the net change in emissions, specified in paragraph (b);
(iii) Minus (-) any applicable leakage effects;
(iv) Minus (-) any crediting deficit, specified in paragraph (d);
(d) If the calculation in paragraph (c) is negative, then no A6.4ERs shall be issued for the period covered by that monitoring report and the negative number shall be recorded as a ***crediting deficit*** *and included in future A6.4ER issuance calculations;*
(e) If the net change in greenhouse gas storage is negative, then there is a reversal of an equivalent quantity ***(herein referred to as reversals)****."*

These standard definitions have an apparent paradox concerning the "vintage" of the mitigation outcome in the ETF accounting system, when the ITMO$ are authorized by a NDC and the corresponding adjustments are set to it. As defined in the **Glasgow Article 6.2 Guidance and the clarification given by CMA in the "Sharm el-Sheikh Decision 6/CMA.4":**

"5. Clarifies that the vintage of an internationally transferred mitigation outcome is the calendar year in which the underlying mitigation occurred;"

The paradox becomes clear when we realize that **removals mitigation outcomes are monitored only ex-post after the commence of the A6.2 and A6.4 activity**, and any biomass stocks (carbon reservoirs) pre-existing and reported previously to the activity start cannot be claimed as a mitigation outcome.

Vintage paradox: **This definition of removals is apparently contradicting with the concept of renewable biomass: the biogenic constituents of any kind of wastes (urban, rural, industrial), the biofuels, the biomass collected or harvested during the mitigation activity, which have grown before the activity start, are not eligible as "removals", for their vintage years being previous to the crediting period, for their**

land-use generation sites being outside of the activity boundary. Therefore, none of these biogenic substrates are CO_2 emissions-free, like they have been considered in the Kyoto CDM.

This paradox raises a need for the SBM and its Methodology Panel – MEP to propose an accounting method or tool to determine the removals/reversals net effect of any biomass/biogenic substrate (Municipal Solid Wastes, biofuels, woody and non-woody biomass sources, etc.) to be used in any Emission Reduction Activity (e.g. biogas, composting, incineration, pyrolysis, etc.). If these substrates are used by the activity participants sourced from outside of the boundary and from vintage years before the activity starts, the net removals that were caused for the biogenic substrate generation, including emissions for the cultivation, fertilizers and irrigation emissions, etc., will need to be known for assessing the actual removal amounts. Moreover, when the substrate is produced during the crediting period (e.g. a BECCS activity using bagasse from a sugar-mill) the removal/reversals ratio shall be monitored in the sugar-crop cultivation, and the full effect on the carbon stocks of the activity boundary, including the direct emissions and leakage effects in the crop cultivation, shall be monitored and accounted for.

The modified Fnrb approach as possible solution

The Fraction of Non-Renewable Biomass (Fnrb) has been adopted in Kyoto-CDM to express the fraction of the CO_2 emissions by oxidation of any substrate that are counteracted by a removal activity (the renewable fraction, Frb which is CO_2 emissions-free) and the other fraction (Fnrb) is considered as non-renewable: any saving or avoidance of oxidation of a biomass substrate will thus receive a mitigation potential given by the fraction Fnrb. The methods and procedures to determine Frb and Fnrb are highly controversial in their origin, and tried to circumvent the estimation of "avoided deforestation" effects as a baseline for CDM activities, which were excluded by the Marrakech Accords.

Now, under the Paris Mechanisms, the **Fnrb needs to be revisited to reflect not only the fact that the removals are accounted simultaneously with the emissions reductions, but also to reflect the fact that the "vintage years" and emissions footprints of the compared baseline and activity substrates differ from each other**: any biomass we have at our disposal in this present year 2025 has been grown at vintage years before the present year. Therefore, a mismatch is unavoidable between the NDC and ITMOs calculation at the ETF, following the carbon-stocks changes measured in the LULUCF sector, compared with the emissions reductions incurred by the shift of fossil fuels or non-renewable biomass by renewable biomass from a removal activity. The removal activities, from now on, will monitor the actual renewable biomass generation (Fnrb = zero) from controlled activities of bioproduction of feedstocks, ex-post monitored and discounting all activities and leakages emissions.

Biomass from any other origin, not registered and not monitored under the A6.4 and A6.2 framework, are deemed as partly non-renewable, and must have a Fnrb that is not zero. This includes any component of MWS, bagasse, woody and non-woody biomass, biofuels, animal manure, etc.

We may somewhat rephrase the above as the following: "**any CO_2 emissions from combustion/oxidation of any fossil or non-fossil biogenic organic material is strictly a reversal emission**: the vintage year when the removal activity took place may be identified as being millions of years before today (fossil fuels) up to the CO2 uptake by a living vegetable in the yesterday afternoon…

The *"time-tunneling effect"* for the removal/reversal cross-comparison may be the basis for the *"Modified Fnrb Calculation Tool"*. Two parameters shall be known or estimated for a biogenic substrate: (i) the age distribution, where the mass fractions of the components are estimated for the median vintage year "y" when the removal took place in the past years/decades, when they were generated by photosynthesis. For example, yearly harvested crops from annual cultivation and annually collected fruits/biomass from perennial cultivations or natural ecosystems (e.g. fruits, nuts), garden wastes and litter collected in urban and rural areas, etc. will be ascertained to the year where they were mechanically collected. On the other hand, biomass from multiyear regrowth (e.g. trunks and woody branches from Afforestation/Reforestation and Sustainable Forest Management activities) are estimated for the age distribution of the forests ecosystem where they were extracted from; (ii) the type or kind of management practice at the LULUCF area where the bio-substrate was extracted (natural or managed land, rural and urban, etc.). This management practice factor will influence and determine conservatively the past emissions that were incurred historically in the production of the substrate and are used to discount for emissions and leakage effects that were incurred for the biomass production, adjusting the Fnrb accordingly.

A very useful reference value that may be introduced in the modified Fnrb calculation is the Keeling Curve ratio: the CO_2 level at the atmosphere in any past year starting 1850 (the pre-industrial era) up to the present value of the daily/yearly measured value may be used to correct and determine the net mitigation impact for a removal activity that has occurred in the past. For example, the trunk of a tree that is older than 50 to 100 years has a Fnrb that is closer to 1.0 (almost equivalent to a fossil fuel) whereas the present year cultivated vegetables have Fnrb that are close to zero, i.e. fully renewable, if the cultivation and leakage effects emissions are discounted. This Modified Fnrb factor will reflect more precisely the net mitigation effect of a removal, if it remains monitored and accounted for as per the removal Standard (paragraph 30 cited above). When, and if in the future any reversal occurs (see again para 30), the mitigation impact and Fnrb of the reversal's emissions will be calculated based on the age distribution of the reverted carbon stocks. The longer the permanence in time-tunnel effect, the larger the Fnrb.

A very desirable consequence of the adoption of the modified Fnrb is the driving force of market evaluation of biomass stocks according to their ages: older biomass, for example the wooden structures from demolishing houses or furniture, which are 100 or more years old in their extraction, will have Fnrb close to 1.0, and shall be preferably not used for any CO_2 emissions activity (e.g. combustion or energy), whereas the yearly cultivated crops or annually collected regrowth from decidual forests/trees management, will have the Fnrb close to zero, i.e., will have the largest emissions reductions potential if used to displace fossil fuels.

The proposed method for modified Fnrb shall be used not only for the removal/reversal accounting of living biomass and carbon stocks at nature-based solutions, but also for the CCS (fossil CO_2 with Fnrb=1.0 for geological storage) and BECCS (bioenergy-based CO_2 capture and storage).

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Policy-Side Methodologies at Sectors (4) LULUCF and (5) Wastes:
The Lifecycle's Framework Approach

We consider the sectors (4) Land-Use, Land-Use Change and Forestry (LULUCF) and (5) Wastes able to host mainly policy-side methodologies for Emissions Reductions and Removals. The combined and consistent application of accounting methods in LULUCF/Mining and Wastes/Disposal-Sites is strategic for both the ETF reporting process, based on NDCs and BTRs, and for capturing mitigation impacts of technological transition (avoid/shift/improve) using the A6.2/A6.4 crediting mechanisms.

The two sectors (i) LULUCF/Mining and (ii) Wastes/Disposal-Sites combined create a powerful control envelope for a secure and robust checking-point, using tangible mass balance methods, to determine the net effects of each newly proposed technology or technology-chain. They will allow for a technical recommendation about controversial options, e.g. electric mobility, green hydrogen, nuclear energy, biofuels, BECCS, biochar, etc., and to assess impacts for shifted final consumers demand (e.g. food habits, household appliances), to measure/monitor their real contribution towards carbon neutrality at the global stocktakes, NDCs and activity boundaries. They are key for the development of Carbon-Border-Adjustments-Metrics – CBAM, for appropriation of emissions reductions and removals transferred at any control point within the "cradle-to-grave" for a supply-demand framework with transparent identification and quantification of leakage effects.

The only required change in the LULUCF and Wastes sectors reporting and methodological use is the appropriate **inclusion of strategic biogeochemical markers (see Annex I – Lifecycle's Framework),** to measure the net impact of the shifting technology and or national/subnational inventories to cover cradle to grave transfer of matter in the production/commercial chains at the Energy, AFOLU and IPPU supply-demand framework, to assess the CBAM for the different kind of boundary and transboundary leakage effects.

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Municipal Solid Wastes – MSW and Solid Wastes Disposal Site – SWDS:
The first pivotal A6.4 methodology at local policy-level.

The www.carbon-recycling.eco initiative emphasizes that the wastes generation, collection and recycling/disposal is the pivotal methodology for the climate transition, for different reasons:

1) SWDS and MSW emissions mitigation is necessarily a **local policy:** the wastes services are worldwide executed directly or indirectly by the local municipalities, in the name of the local people.
2) Waste sector is the **physical and tangible link/connection between the supply-side and demand-side**. The wastes itself, and the emissions caused by the wastes belong to both the suppliers and consumers, and this joint responsibility cannot be disconnected. In the waste-hub, from the point of view of the circular economy, the role is inverted: consumers become suppliers, and suppliers become consumers/procurers. **Waste is the hub where both sides encounter each other and reveal their real contribution to the NDC implementation**.
3) **Wastes amount, composition, management and destination are the key parameters for most A6.4 methodologies to monitor and calculate the GHG emissions and ERs accruing to both the supply-side and demand-side**.
4) ***Zero-emissions production and delivery of any good, long- or short-lived appliances, consumables, energy or any services are only possible if they do not generate post-consumer or decommissioning waste, or if the post-consumer or decommissioning destination is also zero-emitting or negative emitting (removals).*** This is a fundamental axiom that can be easily demonstrated, and a key indicator of our advance towards the Paris' **Long-Term Low-Emission Development Strategy – LT-LEDS**.

Under a framework consultancy agreement with the UNFCCC, one of the members of the www.carbon-recycling.eco has drafted a zero-order conceptual methodology for the SWDS under the A6.4 mechanism. This draft has been evaluated by the **A6.4 Methodology Expert Panel - MEP** at its 2nd meeting on 24-28 June 2024 (webcast: https://www.youtube.com/playlist?list=PLBcZ22cUY9RKR_7zBikj7XMHaZaym9aBy) but not

accepted. Given the confidentiality clauses of the consultancy agreement, we are not allowed to disclose here the proposed draft, interested people/institutions may eventually request it to the UNFCCC secretariat.

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LULUCF Renewable Biomass Harvesting and Avoidance of CO_2 Reversal Emissions
The second pivotal A6.4 methodology at policy-level.

The www.carbon-recycling.eco initiative emphasizes that the renewable biomass generation, collection and processing by means of slow pyrolysis and carbon mineralization (biocarbon production) for controlled storage is also a pivotal methodology for the climate transition, for different reasons:

1) Land Use, Land Use Change and Forest (LULUCF) is the **NDC accounting and BTR reporting of the territory-atmosphere interaction, revealing the progressive increase/decrease of the country's carbon stocks of living biomass or harvested wood products resulting from the net yearly balance of CO_2-Removals (negative) and CO_2/CH_4-Reversal Emissions (positive).**
2) The land use categories cover all relevant carbon reservoirs that may increase or decrease during the NDC implementation period: **Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land**. The renewable biomass generation and **carbon-farming in all rural and urban areas** is therefore covered in the sector. It has a strong interaction with the **AFOLU and Energy** sectors, for being a source of **food and biofuel and firewood supply chains**.
3) The sector allows for methodologies covering the primary generation of renewable biomass for all households and institutional/corporative parcels of land, at the urban and rural areas, including the rural-green and rural-blue, the urban-green and the urban-blue territorial management.
4) Mitigation activities include the **Afforestation and Reforestation (A/R) and Agroforestry** with emphasis on nature conservation and/or productive management of the forests, under sustainable extractive production of long-living wood products and short living fibers, food, firewood, etc.
5) In land use, at any location of urban or rural areas, there is also the **physical and tangible link/connection between the supply-side and demand-side**. Consumers may become suppliers, and suppliers may become consumers/procurers. The emissions reductions will result from increased local production and decentralized supply, reducing the demand for the higher emitting long supply chains of food, bioenergy, and other land-based bioproducts.
6) **Renewable biomass generation in LULUCF, and its processing by means of slow pyrolysis and producing biocarbon for permanent storage is a preconized**

technology at the www.carbon-recycling.eco initiative. Please refer to our E-book at the annex. Biomass amount, composition, management and destination are the key parameters for developing the A6.4 methodologies.

7) **Land tenure and carbon credits ownership/liability are critical in the development and monitoring the ITMO$ and €CCO$ generated in LULUCF, therefore the policy-side and the contribution to sustainable development shall be ensured in every application of the methodologies.** The cooperative organization will be based on agreements and contracts to distribute the results among all involved participants, including the local communities and individual persons/households and livelihoods, using transparent algorithms for the calculation and automatic shares of the achieved outcomes belonging to all entities and persons involved in the registration, validation, implementation, monitoring, verification, financing and technical assistance, according to the agreed conditions.
8) In our convincement, the biocarbon harvesting and controlled accumulation is not an 'optional' mitigation, it will be recognized as a **necessary nature-based solution to prevent or minimize the occurrence of uncontrolled fires and other major disturbances (flooding, droughts, encroaching vegetation, aquatic ecosystems eutrophication, etc.), affecting all land uses categories**. For example, forest management (pruning, thinning, firebreak clearances, excess deadwood and litter removals) will become necessary for fire prevention. Fire extinguishing is impossible in unmanaged systems, which are becoming more exposed to this disturbance because of the accumulation of combustible biomass for fertilizer effects of enhanced temperature CO_2 and nitrogen availability and dry/wet oscillations.
9) **Using harvested biomass for energy is not the most appropriate mitigation strategy, it releases back the CO_2.** Although this is a valid strategy for shifting fossil fuel consumption, the net balance is not CO_2 removal, it is CO_2 stabilization. In other words: bioenergy is not a 1:1 replacement for fossil energy. **The fNRB factor must be revisited to correct this distortion of considering biomass equivalent to fossils, in the energy applications. We have provided a suggestion for its redefinition in a previous input to UNFCCC SBM (refer to a64-sb005-aa-a09)**
10) Removal pathways shall prefer the use of harvested wood products structurally, although each tree, when more than 50 to 100 years old, shall be treated as "non-renewable": planted trees will not grow in the next decades in the same condition as they grew in the past, climate has changed irreversibly. Anyway, at the end of the lifetime of all biomass products (long or short living), pyrolysis and biocarbon storage is necessary to avoid releasing CO_2 back to the atmosphere. **Biochar/biocarbon is a nature-based solution for "carbon preservation", storing it for future generations as biocarbon ("inertinites"), in tangible and auditable assets. It is the innovative "reverse mining" storage of the "carbon-coins" as described in our E-book in the Annex.**
11) The methodology shall be accounted as **"avoided CO_2 emissions" or "avoided reversals". It prevents aerobic decay (CO_2) and anaerobic decay (CH_4), preserving the "CO_2 removals" from the biomass growth/cultivation and**

sustainable forest management. Soil application is a valid destination that will consume only part of the biochar produced in sustainable land use management, the controlled storage of biocarbon shall be recognized as a further necessary step.

12) ***Zero-emissions scenarios for Paris' Long-Term Low-Emission Development Strategy – LT-LEDS will require the net negative emitting (removals) to compensate for the residual emissions that will not be abated throughout emissions reducing technologies.***

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The LULUCF at national inventories is based on the year-by-year carbon stocks changes for the categories Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land, as well as for the Harvested Wood Products. A very instructive discussion on the challenges associated with the LULUCF reporting is presented by Oeko Institut at https://www.oeko.de/blog/komplexe-datenlage-herausforderungen-bei-der-thg-bilanzierung-im-lulucf-sektor/. The Wastes reporting, on its term, is based on the SWDS and other management practices for post-consumers wastes, and the IPCCC Guidelines for National Inventories defines the higher tier method as based on the First-Order-Decay – FOD. ted in the following Table.

The registration of any A6.4 or A6.2 activities for monitoring of emissions reductions and removals in those areas, however, should be restricted to the cases where formal and informal land tenure by the activity participants is subject to public acceptance and recognition, if the local communities and indigenous people are directly involved and benefit from it, and if the activity contributes to sustainable development. Policy-side methodologies for LULUCF may include Afforestation and Reforestation – A/R, where the land-use is the basis for the removals activities based on increased carbon pools (forest conservation) and production carbon-pools (sustainable forest management, carbon farming concepts). Reduced Deforestation and Forest Degradation (REDD+) methodologies do not find an adequate basis at the Paris mechanisms, because baseline scenarios assuming inexistent or ineffective mitigation regulation by the national authorities will lose their applicability or justification for a very simple and clear reason: under Paris, all parties need to implement their NDCs and submit BTRs regularly, demonstrating it has control on the GHG emissions and will enforce the progressive reduction. For that reason, **from the point of view of constituency and operation of our monetizing cooperative initiative,** the LULUCF methodologies will be considered as being situated on the policy side, and not on the supply or demand sides. Similarly, the wastes management and disposal activities are also under the control of local governances, therefore, belong to the policy-side at municipalities or subnational governance levels.

The www.carbon-recycling.eco initiative highlights that one of its fields of actuation is the Removal methodologies, applied at both the LULUCF and Wastes sectors, where the slow pyrolysis and biocarbon production technology is used to stabilize/mineralize the renewable

biomass originated from these sectors, the net effect of which is the **"avoided CO_2 emissions" or "avoided reversals".** These are described in another sections (see here, and see here).

We also highlight that both sectors (4) LULUCF and (5) Wastes may be part of the leakage sections of emissions reductions methodologies in the sectors (1) Energy, (2) IPPU and (3) AFOLU: many of those methodologies will show negative leakage effects (emissions reductions) in the wastes and LULUCF sectors, by reducing the amount of wastes generated (e.g. when recycling is involved) or by reducing the drivers for land-use changes related to agriculture/pasture, etc.. Further, if we consider that emissions increase in LULUCF is also influenced by the extractive mining, the primary production of minerals and fossil fuels to attend to the demands of the other sectors, we may also conclude that benefic leakage effects will be reported from activities that reduce demand for primary raw materials, as indicated elsewhere (see here);

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Explanatory Box 7

Progressive Scarcity driving ITMO$ and €CCO$ Appreciation
Comparison of Emissions Reductions and Removals Certificates

Let's start with a proposed definition of the two monetary units for climate mitigation crediting:

- **€CCO$ is the net mitigation effect of an "Extraordinary Climate Contribution Outcome", measured in tons of CO2eq., resulting from the activity implemented by an activity proponent or by a cooperative of activity proponents, that is voluntary and additional to the climate contribution attributed to the activity participants by a National Determined Contribution – NDC, after it is registered, monitored and verified by the Designated National Authority – DNA of the host country, or by a voluntary market registry system.**
- **ITMO$ is the "Internationally Transferred Mitigation Outcome – ITMO" following the Decision 2/CMA.3, Glasgow, 2021 "Guidance on cooperative approaches referred to in Article 6, paragraph 2, of the Paris Agreement".**

It is thus indicated that **ITMO$** is mitigation outcomes formally transferred under the Paris Agreement flexible mechanisms (A6.2 and A6.4), while **€CCO$** is the nationally extraordinary contribution acknowledged by the NDC crediting mechanism (if in place) or by a voluntary market crediting mechanism.

Progressive Scarcity, Times Series, and Validity

Market prices of **ITMO$ and €CCO$** will be boosted by their progressive scarcity levels, since the NDCs implementation process towards the Paris' Long-Term Low-Emission Development Strategy – LT-LEDS will progressively raise the demand and close the low-cost technological opportunities for their generation. However, the attractiveness of financial investments in the carbon markets depends on diverse factors, we discuss some of them briefly:

- **Confidence in the UNFCCC and NDCs Mitigation Governance**: This is a major threat to any person and entity to invest in the form of working time and money in the Paris Agreement carbon markets, as we have been doing in the last five years without any income. There are many arguments in favor of or against trusting the UN adequate governance, in which the decision process is politically addressed by the consensual agreement of 196 national governments, showing different capability to legitimate represent the local communities, and subject to influences and lobbies by the incumbents and financial or geopolitical interests. There is however a clear reason for

hope: the climate system has its own convincing capacity, since adaptation is the only other option to mitigation, and the costs for damage and losses remediation are unpayable. We may expect that the planetary response to human predatory behavior will solve the situation, one way or the other. Please refer to first explanatory Box, and listen to the AI generated Podcast about the Paris Agreement Article 6 Mechanisms.

- **ITMO$ issuances bound to NDC Corresponding Adjustments, avoiding double counting:** The Paris target 1.5°C temperature increase is bound, according to the IPCC, to a limited budget of global emissions up to the point of complete cessation of the net emissions (neutrality) to be achieved in the middle of the century. This implies that each single ton of CO_2 emitted from 2025 onwards, after the ETF is in place, will be uniquely reported at the NDCs and their BTRs, and each ITMO$ issued by a party implies in an extra outcome to be demonstrated, since the authorizing party will have to arrive at its agreed LT-LEDS neutrality, irrespective of the ITMO$ extractions. Any agreement to allow a developed or developing country to postpone its LT-LEDS targets, or to relax its NDC contribution during the implementation period, shall be counteracted by the other parties enhancing their contributions, or using any still available non-utilized ITMO$ (saved assets). The stock of unutilized ITMO$ is therefore the only debt payment available to the NDC implementation demonstration at each closure of the 5-years long implementation periods and closure of the "bills payment" at global stocktakes (2023, 2028, 2033, 2038, … etc.).
- **ITMO$ issuances bound to fees, taxes, shares, by the host parties.** The cost of arriving at any ITMO$ is composed of the technological investment costs (the regular investment analysis), plus the transaction costs for the registration and monitoring (MRV), plus any fee, tax or share that the host country intends to charge for the activity participation and ITMO$ issuance on their own and souverain initiative, bound or not to raising funds for the implementation of its own NDC. However, any income the host party may have will not refrain from implementing the NDC in its full capacity and replacing the authorized ITMO$ with other achieved mitigation outcome, in the form of an emission reduction or a removal certificate, in the due course. This enhances the liability for the generation and use of the ITMO$, and its recognition as a market asset belonging to their holders, who freely negotiate the certificates according to own interests, while following the conditions authorized by the host party at its issuance.
- **"Legal, technical and financial implications of providing functionality for the treatment of financial security interests in the A6.4ERs within the mechanism registry":** this is a point to be addressed by the PACM, vide paragraph 46 of the 15th Meeting of A6.4 SBM. The UN registry will be open to account holders from the private sectors (we seek to be one of them), but the financial guarantees are bound to the contractual conditions between the account holders and the host countries. A6.4 activities may last for long periods (15 years for emissions reductions and 45 years for removals), under progressively changing NDCs implementation conditions. Securing financial interests for such long periods ensuring political and regulatory stability at the

host country's governance, as well as in the CMA Decisions, IPCC Guidelines, SBM A6.4 procedures and standards, etc. deserves some minimum level of safeguarding the private interests.

- **Time series, vintages, and validity of crediting certificates.** The PACM is based on the authorizations from host countries for **ITMO$ first transfer** for use by another NDC or by another international purpose, after proceeding with the corresponding adjustments to its own NDC. The interchangeability and validity of the ITMO$ vintage (the year when it was verified and issued at the host country) with the year where it is used by another NDC is a matter not fully clarified by the CMA decisions. At least in the first round of the market operations (from 2025 up to 2030), there is an implicit assumption that the vintages for ITMO$ extraction (authorizations) and use may be interchangeable: for example, the 2029 NDC of the user party may use the ITMO$ issued by the host parties in the year 2027. However, a transfer of non-used ITMO$ for the next period (2030 to 2035) is presumable non-acceptable under the prevailing rules. It is expected that once we get closer to net neutrality, e.g. after the year 2035, the closure of NDCs shall be kept in the time series under more strict conditions: either on a year-by-year basis (a kind of 'zipper-closure' in a year-by-year balance) or even in a shorter interval (month-to-month). In the period close to the neutrality (2040 onwards) it is expected that the crediting reaches the "on-line real time" compensation scheme: each net emission needs to be automatically compensated by an equivalent removal at the same time. It is worth to note that when the neutrality has been reached by all parties, there will be no "baseline emissions", therefore, the PACM will have no longer "Emissions Reductions" activities, only "Removals" that will generate the certificates to abate any residual emissions that cannot be abated. Those activities with residual emissions will only continue to be viable, if the amount of "removals" activities within or outside the NDC is running *pari passu* to it, generating the neutralization effect necessary to keep the neutrality. For example, if we dispose of wastes today in a landfill anywhere, and this landfill will be producing methane in the year 2050 or beyond because of our waste that is decaying there, this methane emission will have to be fully abated by any methane destruction technology or compensated by a CO_2 removal activity. The A6.4 SBM and its MEP should thus take care that the methodologies for determination of emissions reductions and removals are able to evolve accordingly, determining the point in time when the ERs and removals are considered as 'verified', using time intervals for yearly/monthly crediting or shorter.

Differentiating A6.4 Emissions Reductions and Removals Certificates: "checking account" vs "savings accounts"

A6.4 Emissions Reductions and A6.4 Removals certificates are not necessarily equivalent in their value and utilization. Both are used in the NDC reporting system for the demonstration of annual emissions/removals budget to be achieved and reported by the BTR and are interchangeable in metrics of ton CO2eq. However, we need to consider they **follow different patterns for vintage years reporting and validity/expiration**. This difference is not clearly

indicated in the prevailing CMA and SBM decisions, but we may draw some conclusions based on the following facts:

- **Emissions reductions achieved at two different vintage years are intrinsically different, and cannot cancel each other fully, because they have been achieved at different stages of the NDC implementation, facing different barriers or market opportunities, for the progressively more ambitious and challenging requirements set by the NDC.** Since, by definition, the baselines for A6.4 methodologies are dynamic and downwards adjusted over the crediting period, we may demonstrate that the A6.4ERs become scarcer over time. If an A6.4ER measured as 1 ton of CO_2,eq in the year "y" of the crediting period is transferred as ITMO$ from the host country to use by another NDC, the use of ITMO$ vintage "y" for closing BTRs of any subsequent years "y+n" is not pacific and will be disputed, since these ITMO$ were achieved at a different baseline/activity scenario in the year "y" as the NDCs are facing in the year "y+n". This is an issue that will need to be solved and clarified by A6.4 SBM or CMA. From the point of view of NDC implementation process, the A6.4ERs for **emissions reductions are thus a "checking account" for the current balances of credits/debts calculated for a certain point in time/year vintage and cannot be indefinitely accumulated or saved for future utilization**.
- **A6.4 certificates generated by removal activities are exposed to risks about their permanence and any reversals emissions shall be avoided or discounted.** If removals ITMO$ are used by another NDC or any mitigation purpose, and the reversals occur, the CMA and A6.4SBM will oversee the adjustments to the NDCs involved. We don't want to discuss all the details of the removal technologies and their differences; in separate sections we describe the www.carbon-recycling.eco approach (see here). In any case, we may draw the following conclusion: unused A6.4ERs certificates (for both removals and emissions reductions) are bound to tangible and auditable assets of global CO_2 emissions allowances for the global stocktakes until the net zero at the middle of the century. The difference about Emissions Reductions and Removals is that the ERs are fixed to the vintage year where they have been generated, while the removals may keep their integrity and be used for the NDC offset at any year in the future, if the risk for its permanence from that usage year onwards is addressed. **Removals are thus fit to play the role of savings accounts of indefinitely valid ITMO$ and €CCO$.** This statement has not been clearly pronounced by CMA and A6.4SBM decisions but will be easily recognized: there is no reason to impose any expiry date for a removal certificate bound to the existence of a living (forest) or preserved asset (biocarbon/carbon-coins, or gaseous CO_2 geologically stored, etc.), that remains tangible and auditable any time into the future. Additionally, the following remarks may be drawn from the intrinsic nature of the biobased removals activities and certificates:
    - A/R removals activities are limited to the saturation of the forest stands, up to the decreased/ceased CO_2 capture capacity of the forests in their mature status. However, once this saturation is achieved, still the A/R activity may

transit from the "removals" to the "avoided reversals", if the sustainable forest management is introduced for harvesting forest products, including biocarbon and carbon-coins, as explained in other section (see here).

- The accumulated biocarbon stocks tangibly demonstrated in the future, if the ITMO$ have not yet been used and remain in savings accounts, may be used for offsetting current emissions at any year "y+n" in the NDCs implementation period. Alternatively, accumulated biocarbon stocks without their ITMO$ having been used by NDC, may still be used for energy generation as zero-emitting biofuels, therefore allowing for offsetting emissions by shifting non-renewable sources. Or, even more interesting: if in the future the Bioenergy with CO_2 Capture and Storage – BECCS becomes an economically attractive technology for removals, the accumulated biocarbon stocks with unused ITMO$ may be used as feedstocks for BECCS and keep the removal ITMO$ status unchanged for offsetting any residual emissions in subsequent years. Or finally: if the biocarbon is stored and its ITMO$ has been used for NDC accounting purposes offsetting emissions, it still may be used as feedstock in BECCS activities, as zero emitting energy source, therefore offsetting equivalent residual emissions in that future year.

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Addressing Suppressed Demand Scenarios

For all three kinds of methodologies, on supply-side, demand-side, and policy-side, there is a need to consider the **situations where the currently employed technologies do not meet the minimum needs of the population living in the activity boundary.** This is the "suppressed demand" scenario, widely treated by the Kyoto CDM methodologies, especially applied for the context of **Least Developed Countries – LDCs and in the and underdeveloped zones of developing countries**.

In Kyoto-CDM this situation was relatively easy to be solved by the application of an **"hypothetical, counterfactual baseline approach",** in a project-by-project case, or in a meth-by-meth case. Since the host country had no mitigation commitment, it was easy to assume an inflated level of emissions in the project boundary, whereby another technology was supposed to be in place and being operated with attendance to the minimum level of services, instead of the pre-existing de facto situation.

However, now, in the A6.4 context, the situation needs to be addressed slightly differently, to reflect the fact that when the hypothetical baseline scenario is assumed, the implications of this assumption need to be considered in the context of the overall national inventory, BTR and NDC implementation for the host country. This condition is important to capturing the real emissions reductions the activity can deliver, beyond the levels reasonable required by the ongoing NDC period and at any year "y", allowing for the calculation of achieved A6.4

Emissions Reductions and their issuance and authorizations for international transfer as ITMO$, and proceeding with the corresponding adjustment as per the Glaswegian Accords.

The consideration of suppressed demand will require the development of a methodological tool, in our view, for a stepwise approach, and some hints may be given by the following pathway:

Step 1 – For each methodology the potential occurrence of suppressed demand scenarios shall be evaluated by the SBM, based on the manifestation of host countries DNAs claiming they may need to apply the **counterfactual baselines**, for being encountered in the country some or many situations where a minimum service level is not met, and the pre-existing situation shall be replaced by the formulation of the hypothetical scenario.

Step 2 – In order to define the counterfactual scenario, the host country DNA and activity participants or project design shall propose to SBM and formally introduce into the NDC the definition of the **"Decent Living Standards (DLS)", as a minimum level of service the host country population should have access, considering, for example, the dimensions of nutrition, shelter, living condition, clothing, health care, education, mobility, etc. (see IPCC WG-III AR-6).** The counterfactual baseline scenario and baseline emissions factor for a certain methodology (e.g. for clean cooking, goods consumption, wastes generation and management/disposal, etc.), would then be applied not based on the current or pre-existing level of activity in the activity boundary, but under the hypothetical scenario of the DLS being met by a deemed plausible technology. Some options for this baseline setting may be based on the consideration of (i) the "business as usual" scenario found in other regions or situations within the same country where the suppressed demand is not prevailing; (ii) "benchmark proxy country" approach, where data and situation of other country (developing or developed) is used as the proxy for selecting what are the baseline technologies and emissions in the activity boundary. The rest of the methodology, including activity emissions, leakage, etc. would be applicable without any major change.

Step 3 – Consistent application of the baseline downwards adjustments. If the suppressed demand scenario is selected for a mitigation activity, the downwards adjustment of the baseline shall be based also on the "counterfactual situation" of the NDC being in a more developed stage, compatible with the technology that was deemed as the baseline. For example, if air conditioning is not available in the pre-existing scenario (scenario "A"), the DLS may be the introduction and operation of air conditioning using grid electricity and the emissions associated with this system is the hypothetical scenario "B". If the low emissions activity consists of onsite renewable energy generation (solar, wind) for air conditioning (scenario "C"), the emissions reductions will be calculated based on the difference between "C – B" and not "C – A". However, the baseline downwards adjustment for the years "y+n" will be based on the consideration that the hypothetical technology "B" is in place, and the

baseline is adjusted according to the projected scenario for the grid electricity emissions factor over the crediting period.

Step 4 – Evaluating impacts on ETF: Since the counterfactual scenario will be used at some or multiple locations in the host country where the A6.2 and A6.4 activities may be introduced to generate ITMO$, their implication on the NDC and BTRs reporting during the crediting period shall be accounted and disclosed to the Technical Expert Review – TER process. The natural consequence is that the NDC and its BTRs will also be split twofold: (a) the **"actual, real data NDC/BTR reporting"**, where national emissions inventory are showing the on-the-ground situation where the suppressed demand lowers national emissions for the lack of attendance of DLS. This NDC and BTR reporting will show the real evolution of the country's contributions to the global stocktakes at all sectors (Energy, AFOLU, IPPU, etc.), but will not be used for setting the baseline downwards adjustment factors, on the contrary: it will disclose a kind of "baseline inflation rate". (b) The **counterfactual NDC/BTR reporting** where the country "hypothetical emissions levels" are reported based on the attendance of the DLS for the relevant sectors, and which are taken for the determination of baseline downwards adjustments. It is thus emphasized that the country reports the "counterfactual NDC and BTRs" covering all geographical situations (cities, populations, communities, businesses or statistically tiered up sources of emissions) where the DLS are not attended, irrespective whether they are boundaries of registered A6.2 or A6.4 activities or not. In the "real BTR scenario" the impact crediting activities will be noticed as a less pronounced reduction (or even as less intense increase) of the emissions from the pre-existing scenario (historical situation, with lower emissions because of the DLS not being met). On the other hand, the "counterfactual BTR" will report over the years the impact of the ongoing A6.2 and A6.4 activities on the hypothetical baselines, assumed to be the potential emissions levels for the geographic areas from where the suppressed demand situation prevails.

Two important consequences arise because of this: first, the host country where the suppressed demand scenarios are identified shall not only report and disclose transparently in its BTR and NDC their occurrence, the **whole ETF, including crediting mechanisms (like 6.2 and 6.4) need to be coupled with non-market (e.g. A6.8) and/or technical and financial assistance mechanisms (Paris Article 9 and 10), to include addressing suppressed demands as one of the targets of the climate transition**. In fact, such distinct system for NDCs is already in place: the ETF allows parties to submit and follow two different NDCs targets: the **conditional vs non-conditional NDC targets**. The proposal here is that conditional NDCs reveal the suppressed demand scenarios, triggering measures towards addressing them, reporting in the BTRs the counterfactuals baselines and ITMO$ transferred due to their achievements, in transparent manner.

Secondly, that the selection of the activity boundaries for the design and implementation of A6.2 and A6.4 activities within the host country shall be managed by the DNA and involved participants transparently in order to target the **attendance of the DLS in the country as**

a whole during the NDC implementation periods up to the LT-LEDS, without positive or negative discrimination of the communities that are participant to the A6.2 and A6.4 in regard to the other populations, that are not selected for hosting such activities. This may include, for example, the generation of incomes to the public sector at the host country from the ITMO$ generation, in the form of taxes, shares, or fees, and the financial benefits from the carbon crediting would be used to implement domestic policies to overcome the suppressed demand scenarios in other regions or communities that have not been selected to host the ITMO$ generating activities.

Demand over-suppressing avoidance

This is a totally new issue that needs to be discussed and addressed in Paris Article 6, that was never an issue in Kyoto context. As we have described in another section of this framework (see here), the A6.4 and A6.2 open opportunities for **demand-side methodologies to generate €CCO$ and ITMO$,** in the Shift (S) or Avoidance (A) of consumption of higher emitting goods/services. As it will be easily recognized by the market forces, such methodologies and activities will be mostly implemented in developed countries, or in higher income regions of the developing countries, where the participants are final consumers and families that find in the mitigation an opportunity for domestic income generation given the high appreciation of the achieved certificates, as we may expect from the progressive scarcity described elsewhere (see here).

Given the gradual increase of the financial attractivity for carbon credits certificates, and the appeals for implementation of demand-side emissions reductions, there might occur the situation where some of the community members participating in such activities will change their behavior for **avoiding (A) or shifting (S) consumption of goods, energy, services, etc., in exaggerated manner**, in order to generate more ERs. The potential situation to be avoided, here, is that those 'freak' participants start violating their own basic needs and come to a lifestyle that is found to be below a "Decent Living Standards – DLS", sacrificing themselves.

This situation will not be connected to prevent "overestimation of baselines", like the case for suppressed demand, but to the **"activity emissions overachievers" or "over-suppressing the demand" at the activity scenario**. Although the emissions reductions would be real and verified by the activity monitoring, they should not be accepted for violating the minimum needs of the participant populations, causing unacceptable social costs for individuals exposed to living conditions below certain thresholds. The aim is not only to protect individual members of the community, but also to avoid social costs to the public system, for a kind of **"leakage effect"**: the over-suppressed demand may rise negative effects in the public health, security, and wellbeing at the participant communities to unacceptable levels.

To avoid this occurrence, there will a need for the DNAs of host countries and by the SBM, when developing the avoid (A) and shift (S) categories for demand-side methodologies, to define the **"minimum demand threshold"** to be monitored and verified at the activity scenario, and capping ERs generation amounts up to the saturation level, which is the difference of the baseline emissions (high consumption of high emitting goods), and the activity scenario emissions, but which cannot be lower than the minimum threshold.

In conclusion, the distinction shall be made for both developed and developing countries about the two rather different situations: **(a) the "suppressed demand" lowest threshold, representing the minimum level of living standard expected to be attended in the "baseline scenario" and (b) the "lowest threshold for demand suppressing" applicable to the "activity scenario", a minimum standard to be followed by the participant population during the activity.** They do not need to match each other and are adopted mainly in two different contexts: the suppressed demand at the lower income countries/regions, and the demand suppressing at higher income countries or regions. The suppressed demand is an involuntary exposition of populations to unacceptable living standards, where the demand over-suppressing is the voluntary self-exposition to unacceptable living standards. When the suppressed demand situation is observed in any country, it must be formally declared, triggering the formulation of DSL for the respective methodologies, allowing the use of "counterfactual baselines" at the activity boundary and at the NDC reporting. This declaration must deflagrate countrywide measures to overcome the situation, involving not only the crediting mechanisms, but also other financial and technical mechanisms, on a market or non-market basis. The demand over-suppressing does not require any adjustment in public policies, it is more of a nature of avoiding the exacerbation of personal behavior beyond the limits of rationality, most probably related to psychosocial susceptibility of individuals that overreact in their response to the climate crisis and emergency.

As indicated previously for methodologies related to demand side (see here), the standardized baselines approach and the Carbon Bord Adjustment Method – CBAM may be employed to determine the baseline consumption of goods, services, etc. in the "per capita" or "per household" levels at the host country. In this case, eventually, if the host countries intend to host activities using those methodologies, they may indicate the **range of variation of the level of consumption of those goods and services that the DNA consider as appropriate to the current level of the NDC implementation period, and projections about the evolution of these indicators up to the LT-LEDS situation.** This will facilitate activity participants, when designing and recruiting demand-side participants to join the initiative in the host country, to disclose the **potential generation of ERs certificates, by changed behavior towards the achievement of "extraordinary climate contribution outcomes" (the €CCO$).** As described in other section (see here), the demand-side activities may consist of avoiding "luxuries" or proactively refraining from legitimate satisfaction of final consumers desires, by collecting "carbon credits" instead, to be used in a future situation when such desire satisfaction will face higher limitations

because of the proceeding NDC process. For example, if annual long-haul air travel abroad for vacations is a legitimate "baseline" in one country, the participant may opt to skip this travel in the year "y", generating the ER certificate, and this certificate may be used to satisfy the same travel at the year "y+n" in the future, when, due to the enhanced NDC implementation process, the restrictions accruing to the more stringent NDC will impose higher costs or penalties to satisfy this same desire.

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Explanatory Box 8

Cooperative initiative based on carbon-recycling with ITMO$ and €CCO$ carbon-banking

The initiative www.carbon-recycling.eco will seek its registration under the A6.4 UNFCCC Mechanism. It will use its own capability and the resources mobilized by joining stakeholders/investors, to develop and apply monitoring methodologies under the A6.4 process. The methodologies will allow for the monitoring, reporting, and verification (MRV) of the contributions achieved by each individually contributing entities (persons, households, firms, private and public institutions) during the lifetime of the registered activities.

A transparent algorithm will be used by cooperative arrangement to generate and distribute the annual outcomes among the participants, based on quantitative key indicators related to the individual efforts and their achieved **Mitigation Contribution Units (MCUs)**. The contribution units will be apportioned into their baseline downwards adjusted national components (contribution to the NDC as required by its enforcement) and the extraordinary contributions (beyond the NDC), which will be issued as **Extraordinary Climate Contributions Outcomes - €CCO$** to the member account. Once the host country DNA authorizes the international transfers of the €CCO$, by proceeding with the corresponding adjustment to the NDC, they become **ITMO$** and may be used for international purposes: (i) for use by another NDC; (ii) for user at voluntary market offsets; (iii) as an **ITMO$ asset/savings** for the future.

The NDCs being progressively more ambitious will increase the demand for **ITMO$/€CCO$** and at the same time reduce the potential of generating new certificates. Therefore, the investments to generate and to spare the stocks of certificates are attractive and rentable, the liquidity guaranteed by the increased demand by the NDCs and the international aviation and shipping carbon offsets. As discussed in previous section (see here), the **ITMO$/€CCO$** relating to **Removals Certificates** can keep their validity indefinitely in the

future, and constitute **savings account** for the accumulation of climate mitigation currency/assets.

Www.carbon-recycling.eco intends to promote all types of A6.4 methodologies and activities:

- **Emissions reductions and removals methodologies at supply-side**: using the methods based on Carbon Border Adjusting Methods – CBAM (Standardized Baselines - SBs) for the types **Improve (I) and Shift (S),** as described before (see here) for at all relevant sectors: **(1) Energy, (2) IPPU (Industrial Production and Product Use), (3) AFOLU (Agriculture, Forestry and Land Use)**.
- **Emissions reductions and removals methodologies at demand-side**: using the methods based on Carbon Border Adjusting Methods – CBAM (Standardized Baselines - SBs) for the types **Avoid (A), Shift (S), and Improve (I)** as described before (see here).
- **Emissions reductions and removals methodologies at policy-side**: The pivotal methodologies for the carbon-recycling cooperative are the **Avoid (A), Shift (S), and Improve (I) at the sectors (4) LULUCF (Land-Use, Land-Use Change and Forestry) and (5) Wastes, including the biocarbon and pyrocarbon technology for Removals.**

The technicalities of the Biocarbon and Pyrocarbon approaches for processing renewable biomass (from LULUCF and other sectors) and bulk waste streams (including MSW) is described in Annex – I (see here).

The www.carbon-recycling.eco Cooperative intends to have among its members the private sector carbon-banking responsible companies (see here the proposed conditions for management/organization), taking care that the removed biocarbon and pyrocarbon stocks are safely and in audit-able manner stored for the future. Thus, the asset owners of the corresponding **€CCO$/ ITMO$** certificates will be able to freely trade the assets as savings-account, and once used by an NDC or any other purpose they will be engraved accordingly, while keeping the integrity until any point in time in the future when the utilization as carbon-neutral energy stocks is authorized as described in other section (see here).

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Explanatory Box 9

Methodologies Outlines

The www.carbon-recycling.eco initiative intends to develop throughout bottom-up and top-down interactions with the A6.4-SBM and A6.4MEP the methodologies for the cooperative initiative for emissions reductions and removals. The same methodologies will also be applied, under slightly adaptations, for national and subnational regulatory market mechanisms (NDC accounting) and voluntary carbon market (VCM) registry systems. Some outlines for the concept of methodologies are:

- **Compatibility with the long-term low-emission development strategy – LT-LEDS**: each methodology shall be checked against this criterion. If the methodology is of the type **"Improve (I)"** and involves a **"First of its kind (Foik)"** application of a technology/measure, the compatibility of the technology with the LT-LEDs is checked by a Tool on "temporal and material boundary evaluation", checking:
    - **Definitive technologies**: the impacts on sectors Energy (1) LULUCF-mining (4) and Waste (5) are addressed in the methodologies adequate measures, and the technology is thus considered as compatible with the LT/LEDS and can be operated indefinitely during the crediting period and beyond it.
    - **Transitionary technologies:** if it is found that the technology can generate emissions reductions but still do not attend the LT-LEDS for its impact in the Waste or LULUCF sectors, the methodology shall specify the conditions for the transitional use of the technology, e.g.: (i) the activity may be used in combination with other components at LULUCF and Wastes to achieve additional emissions reductions or removals to address non-abated GHG emissions; (ii) the methodology shall specify the conditions for addressing emissions that will be incurred after the crediting period, when the technology is decommissioned and replaced by another, compatible with the LT-LEDS; etc..
- **Transitions from UN regulated A6.4 (ITMO$) to National or voluntary market regulated activities (€CCO$ and MCUs).** Contrary to Kyoto CDM, the climate mitigation activities under the Paris Agreement cannot finish or be interrupted/abandoned without continuation, during or after the termination of the crediting period. An important point in any A6.4 Methodology, therefore, is the transition of the activity to the national governance when it leaves the UN registration. The A6.4 methodology shall not contain obligatory measures in this regard, because the national regulations are self-governing, but recommendations of "best practices and examples" on how the activity will transit from the UN-ITMO$ generation, in a kind of 'weaning' process. If the national NDC has a system in place for crediting, and the activity is still able to generate emissions reductions in comparison with the baseline,

the transition to national mechanisms to generate "Ecco$" at NDC regulated mechanism should be used. Alternatively, the methodologies under voluntary carbon market registries (VCM) may be used. Even if the activity no longer generates ERs, it must transit to the national governance and attend the gradual downwards adjustment of the emissions in line with the LT-LEDS: the activity will be reported in the BTRs as generating the regular NDC's **Mitigation Contribution Units (MCUs)**.

- **Additionality based on regular viability studies**: Additionality was a major issue in Kyoto's CDM, and it continues to be under the Pariser mechanisms. Additionality is demonstrated when the activity can only occur with the financial incentives from the crediting mechanisms. Under Paris, there will be several regulated and voluntary mechanisms in place, but all of them will be bound to some extent to the NDCs and their progressively more ambitious targets. Therefore, both the "baseline scenario setting" and the "additionality checking" will be under general rules, but the application of these rules are locally sensitive: the same activity may be additional in one host country, but not in another country. This depends obviously, primary, on the current ambitious level of the host NDC at any moment, since the parties proceed with different paces towards the LT-LEDS. Secondly, this depends on the economic instruments used by the host DNA to enforce the NDCs limits/baseline emissions allowances on the activity boundary. If the host party has a market-based mechanism in place, the baseline and additionality shall be checked as the first step against the requisites set by local carbon markets. If the activity is found to be additional (not financially attractive) under the economic instruments set by the local DNA (carbon cap-and-trade mechanisms, carbon taxes, etc.) it is also additional regarding the A6.4 mechanism, and the ITMO$ may be issued and transferred, making the corresponding adjustments at the host NDC. It will thus be a matter of choice if the local DNA authorizes the ITMO$ "exportation" by this activity, replacing them by other domestic mitigation contribution units, or not. The consistent implementation of the NDC will be reported by the BTR and the national inventory and submitted to audit by the technical expert review as per the ETF modalities and procedures. If, however, the NDC does not have a system in place to check for additionality, the ITMO$ generation shall be checked for their impact in the financial viability of the activity, using the regular methods: the activity implemented without the ITMO$ generation shall be checked against the same scenario, but with the ITMO$ generation: if the ITMO$ generation is able to turn the activity from financially non-attractive to attractive, the additionality is demonstrated. To apply the additionality tool, the expected evolution of the monetary values of ITMO$ during the crediting period based on publicly available estimations shall be presented by the activity proponents. The projected prices for ITMO$ will vary according to the offer and demand for it during the 5 (five) years lasting periods between the consecutive global stocktakes, and of the projected technological development and degree of maturity/learning curves of the competing technologies delivering emissions reductions and removals. Projections for the expected prices increase will be publicly available by different official and non-official sources of macroeconomic data analysis, including central banks and governments. This

prospective carbon-price evolution shall be used by activity proponents at conventional microeconomic financial viability methods, to demonstrate the additionality of the activity. This approach is consistent with the progressive marginal cost: technologies that are more efficient and compatible with the LT-LEDS but having higher investment and operational costs to achieve each mitigation unit, will only become viable in later stages of the NDCs implementation, as compared with the less expensive technologies. This tends to minimize the overall cost for the transition from the present situation up to the LT-LEDS.

- **Participants identification and double-counting avoidance based on physical connection to SWDS and Things Social Network – TSN tool:** as described elsewhere in this document, the primary monitoring of the activity's implementation will be the solid wastes and liquid effluents (which, throughout treatment plants, are also contributing to monitorable solid wastes/sludge generation). Therefore, the physical "thing" used to indicate the source of emissions and amount of emissions reductions is the wastes stream, and the unequivocally identification of the Solid Waste Disposal Sites – SWDS where the individual activities and their participants are physically and juridically/regulatorily bounded is the key identification of the activity participants and their role as "account holders". This precludes the occurrence of double counting, since each individual participant (private or public entity, individual person, or households/livelihoods) are identified by means of the things under their ownership or, from the climate perspective, under their tutorial management, see explanation for the Things Social Networking – TSN in the next box.

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Explanatory Box 10

Things Social Networking – TSN:
A Tool for Monitoring Emissions Reductions and Removals

The www.carbon-recycling.eco intends to develop and apply a methodological monitoring tool **"Things Social Networking – TSN"** for use in its A6.2 and A6.4 activities. We outline here just the principles for the tool use and operation.

The cooperative members will be individual people or private/public entities, that **voluntarily** participate at emissions reductions or removal activities within the supply-side, demand-side, or policy-side methodologies. The activities should be registered in crediting mechanisms, at national or subnational regulatory system, or at voluntary market registry systems, or Paris Agreement A6.2 and A6.4 mechanisms. The activity is a supply-side regulated by the host country NDC, pertaining to Energy (1), IPPU (2) or AFOLU (3), or demand-side activities, that are final consumers of goods/services provided by the suppliers. The activity participation is also eligible for the sector LULUCF (4), including management of natural ecosystems and forestry and mining of minerals or extraction of fossil fuels, and for the sector Wastes (5), including the final disposition of solid wastes (SWDS). However, our view is that these two last activities (waste and LULUCF) should be always treated as belonging to the policy-side activities and having the public sector as one of the activity participants, as explained before (see here).

The TSN starts with the **identification of the cooperative member,** his/her/its **regulatory border**, and the relevant **tutored things**. The **SWDS connecting-hub** is used for the purpose of members identification and monitoring. The following Figure indicates the operation of the system. **Hubs for Monitoring, Report, Verification (MRV)** are defined and used according to the methodologies. Only relevant tutored things, inputs, outputs, and their relevant parameters will be under the MRV vigilance, to assess and calculate: (i) baseline emissions; (ii) activity emissions, (iii) removals, and (iv) leakage effects. The individual members data is remotely accessed and centrally aggregated at the **Cooperative Coordinating Entity - CCE**, to determine the individual and overall contributions to the NDCs/global stocktakes, and to issue **individual shares on ITMO$ and €CCO$**, monetizing the individual contributions according to the agreed algorithm. For internal and external audits/certifications the participants allow and ensure access to the auditing agents for verifications, measurements or any measure specified by the methodology to determine the consistency of the reported mitigation outcomes. And, most important, as we may conclude from the present situation of the existing web-based social networks: the voluntary participation of the members do not exclude the internal governance of the platform to ensure the data protection and privacy to all members, according to the local regulations at all countries it operates, and in the lack of this, to a

minimum set of guarantees by the internal governance and contractual conditions, worldwide enforceable.

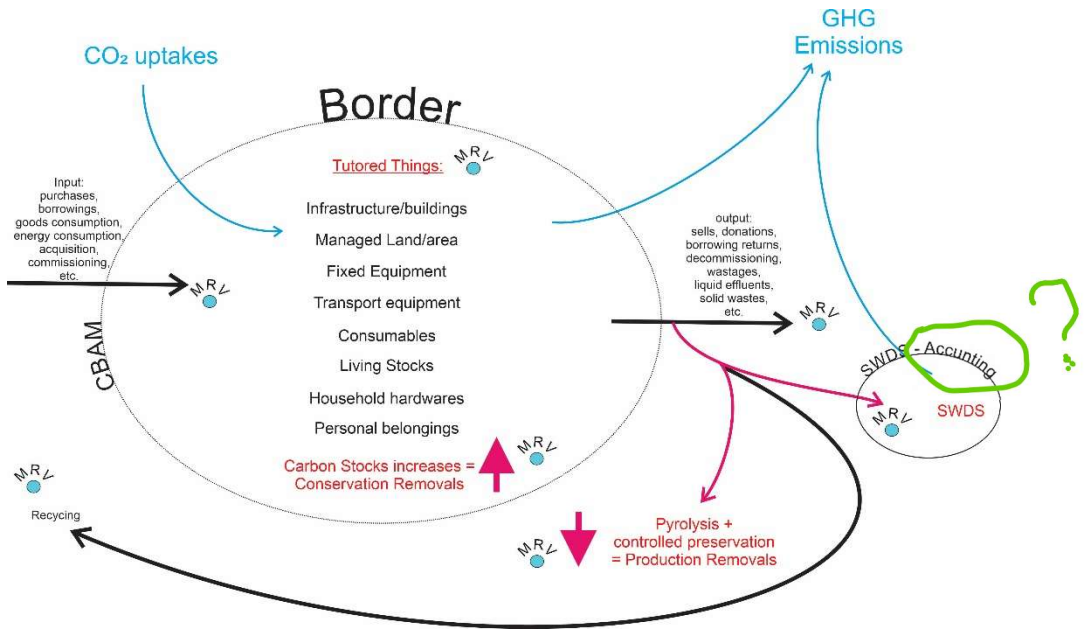

Figure: Things Social Network – TSN monitoring system. Cooperative members borders, the border crossing flows of inputs, outputs, disposals, and preservations are monitored. Member identification and accounting based on the connection to the local SWDS, constituting a hub within a worldwide network of SWDSs, by means of which any individual person or company/entity may uniquely identified, and tracked/monitored. The methodological requirements for Monitoring, Reporting and Verification – MRV at the strategical hubs will be remotely and physically accessed by the Cooperative Coordinating Entity – CCE to determine the achieved mitigation outcomes, and to provide the monetization to the participants according to the agreed algorithm for ITMO$ and €CCO$ distribution.

It is worth to note that, as also described in another section (see here), the emissions factors and accounting for the tutored things are not restricted to the time duration of the crediting period, but for their entire existence, from its commissioning, that may be pre-existing to the registration, until its decommissioning, which may occur after the crediting period.

The reason is that the Paris Agreement Crediting Mechanisms acknowledge the emissions reductions and the mitigation outcomes at the hosting boundary as an **anticipation** of the emission reduction that the activity participant would have to achieve anyway in a future point in time, by the progressive NDC implementation towards the LT-LEDS neutrality, and each ITMO first transfer is bound to the corresponding adjustment at the host NDC. Therefore, any Mitigation Contribution Unit – MCU issued as €CCO$ or ITMO$, registered or not as an A6.4ER or A6.2ER, is an anticipation of the contribution the host would deliver in the future years. If

the host country authorizes the first transfer of ITMO$ for use by other parties, these other NDCs or users may utilize the certificates for attending their mitigation outcomes beneath the UNFCCC-ETF accounting system, if the credit remains valid for that use according to the rules for global stocktakes. The certificates issued for removals, on the other hand, if not yet used, may be valid indefinitely in the future, if the tangible assets of carbon stocks preserved by the activity continue to exist and are demonstrated at the time of the use. The removals certificates, therefore, may be seen as a kind of "savings account", the occurrence of reversals emissions shall be addressed anyway for both the unused and used credits. This is also described in another section (see here)

The activity participants will be entitled to the emissions reductions according to the difference between the activity emissions and baseline emissions that are enforced by NDC during the crediting period and downwards adjusted. However, the activity emissions (and the baseline) shall be measured in their absolute values as compared with the "zero emissions scenario", which is to be achieved in the LT-LEDS. If an activity consists of an improved-type technology substituting the pre-existing one, the emissions comparison shall be based on the complete life-cycle analysis of the "tutored things", including the "cradle to border" and "border to grave" emissions (when SWDS or controlled preservation is the output), or "border to cradle" (when recycling is the output scenario) for both the baseline and activity. If the activity can generate emissions reductions but is not compatible with the "net zero emissions", it is a transitory technology. In this case, participants are advised to use ITMO$ and €CCO$ for allocating funds to replace again the technology in the future, when the next-gen cleaner but more expensive technology becomes available to attend the same need in the progressive transition. If the technology is compatible with the net zero scenario, the ITMO$ and €CCO$ may still be generated until the baseline at all NDCs arrives to zero (LT-LEDS). These earnings are legitimate incomes/incentives to the deployment and expansion of the technology use, shifting the remaining stocks of the larger emitting technologies.

Similarly, for demand-side activity participants, when the activity is of the "shift" or "avoid" types, the emissions reductions shall not be viewed as a kind of "hot-air", i.e. a reduction in the level of activity that is overcompensated by the monetary gains for selling the certificates when the crediting period finishes. In fact, the **ITMO$ and €CCO$** shall be viewed as an incentive to enhance the ambition level by the consumers beyond what is required by the NDC in the current years, in anticipation of the emissions reductions that will be anyway required in the future. While collecting certificates during the crediting period, the consumers are advised to allocate them into savings accounts to achieve funds in a manner to realize the avoided or shifted activities in the future, when such activities will only be achievable at higher costs because of the progressive ambition of the NDC.

No matter the economic reason for the use of the Things Social Network – TSN tool, we would also include the **Ethics on Things – EoT Principle**: humans shall responsibly tutor all things under their ownership, which, from the geological perspective, are the physical register of our own individual life. Under the TSN system, the participant persons and entities/companies

beneath the cooperative will disclose and report to the global climate authority – UNFCCC all things under their individual tutorship that interact or may interact with the climate system. Moreover, they voluntarily assume the commitment to contribute to the mitigation outcome, sharing, according to the common but differentiated responsibility principles, within the supply-demand framework, the burdens to overcome the environmental and climate impacts imposed.

Recycling is not an option, it is a requirement for all materials at the LT-LEDS emissions neutrality, because any virgin non-renewable natural resource extraction, and any wastes disposals, will be bound to emissions at LULUCF or other residual emissions sources, to be abated. However, the reverse logistics may turn recycling not technically or financially feasible in the present days, or in the short and middle terms. Therefore, **controlled (p)reservation is an eligible form of enhancing recyclability**. If the post-consumer end-of-life 'things' cannot be returned and reprocessed by "IPPU or AFOLU" sectors immediately, the controlled storage of the 'things' in an inert state is way to generate "reserves" of spent materials, gaining scales for turning the reverse logistic and the recycling economically feasible in the medium to long terms. This is the logic of using Pyrolysis and storage of bulk waste streams (e.g. MSW) under the concept of "pyrocarbon" route as proposed by this cooperative initiative.

Carbon-coins and carbon-banking are a form of CO_2 and CH_4 avoidance and (p)reservation, thus, a feasible route for emissions abatement and carbon-recycling. This is surely the major pledge of www.carbon-recycling.eco to the UNFCCC and its governing bodies and scientific advising panels, namely the IPCC, the Subsidiary Body - SB, the A6.4 SBM and its A6.4 MEP. It is already widely accepted by these bodies that the biochar route with application of the biochar to the agricultural soils is a "removal" technology. Therefore, there is no fundamental reason to reject the controlled storage of biocarbon or pyrocarbon (pyrolyzed bulk wastes) under tangible and auditable conditions for accumulation of carbon stocks to the preservation and or eventually for the use by future generations, when the climate conditions allow for that utilization. The technical explanation about the pledged approach is found in the Annex to this document (see here).

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Biochar song: https://suno.com/song/acfbaeb7-bb70-48dc-b592-41d8eddd7576

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Annex I: Lifecycle's Framework

Each row in the table below describes the lifecycle framework for climate mitigation in its accounting and balance and consistency-check for the strategic minerals/materials in their supply-demand nexus. The pivotal policy-side methodologies will be developed for each framework, covering the sectors *"(4) Land-Use, Land-Use Change and Forestry – LULUCF/Mining"* and *"(5) Wastes/SWDS"*. The frameworks make use of Life-Cycle-Approaches (LCAs) for tracking emissions/removals footprints in the "cradle-to-grave" and "cradle-to-cradle" (cycling and recycling chains). A6.4 and A6.2 crediting methodologies may be developed covering the sectors *"(1) Energy", "(2) Industrial Production and Product Use (IPPU)", and "(3) Agriculture, Forestry and Land Use (AFOLU)"* at any step of the supply-demand nexus, under the categories Avoid (A), Shift (S) and Improve (I). Using the Standardized Baselines (SBs) procedures, the baseline emissions factors (BEFs), activity emissions factors (AEFs) and leakage emissions factors (LEFs) may be dynamically followed, and Carbon-Border-Adjustment-Metrics (CBAMs) consistently applied at any boundary, any year 'y' of the transition. The Enhanced Transparency Framework (ETF) with the progressive implementation of Nationally Determined Contributions (NDCs) and their Biannual Transparency Reports (BTRs) constitute the basis for the accounting system at any regulatory level, from local to global, during the transition up to the Long-Term Low-Emission Development Strategy – LT-LEDS. The table is not final and exhaustive, frameworks descriptions may be updated and new frameworks added, according to the transition pathway and technologies development and learning-curves.

Sector 4 – LULUCF/Mining (Primary Sources – "Cradles")	Carbon-Border Adjustment Metrics – CBAMs (at boundaries)	Sector 5 – Wastes and SWDS/Recycling (Final Graves/Secondary Cradles)
Group I – Alkaline-Earth Metals Carbonates		
I(a) - Cement framework		
Limestones and dolomites constitute the highest entrapped and mineralized CO_2, removed from the atmosphere in the early evolution of planet biogeological history. The	The framework for A6.4/A6.2 methodologies where cement and lime consumption are relevant or indicative of the emissions intensity are used to monitor the mitigation	From the construction and commissioning dates which may extend retroactively in the past (for existing infrastructure), up to end of lifetime, which may lay further into the future

framework starts with the ETF transparently reporting the national reserves and yearly amounts mined are used as tracker for cement and lime industry emissions footprint up to the final consumers, reporting impacts on LULUCF at the mining sites and associated infrastructure.	outcomes for technologies involving avoid (A), shift (S) and improve (I). These may include the IPPU (cement production), up to buildings, urban infrastructure, civil construction. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading ("grid"), allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	are used to calculate the potential emissions reductions per unit service delivered by the A/S/I technology up to the LT-LEDs and beyond, for each ton of cement/lime used and the associated emissions. Expected decommissioning and stranded assets from demolition/rebuilding and civil construction wastes generation and disposal are estimated and discounted as leakage by the relevant methodologies. If the technology framework recycles these wastes into a new production chain (cradle-to-cradle) the additional positive effects may be accounted for.
I(b) – Soil/water alkalinity framework		
Limestones ($CaCO_3$) and dolomites ($CaCO_3$/ $MgCO_3$) reserves and yearly amounts primarily mined are used as trackers for their use at soil pH correction and alkalinity management up to the final consumers/utilizers and the post-consumer impacts on the soil/water/atmosphere mass exchange. The ETF/NDC implementation process covers the progressive regulatory shifts and their impact on BTRs.	The framework for A6.4/A6.2 methodologies where limestones and dolomites are used for soil amendment and alkalinity management (AFOLU/IPPU/Energy-BECCS, etc.) monitor mitigation outcomes based on unit consumption of this input, following the supply-demand nexus, and the A/S/I approaches. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading ("grid"), allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating	The final impact of limestone and dolomites mobilization includes the release of embedded CO_2 in those minerals, irrespective of calcination: when applied to soil/water bodies for alkalinity increase, or for the industrial use as neutralizers/gas absorbers. The potential recycling route for the replenishing exhaust reserves is the **coral cultivation on shallow waters on seas**. This is a very desirable activity with the removal methodology built in connection with the Afforestation and Reforestation – A/R, to be promoted, credited, and largely practiced for

	emissions reductions and ITMO$ authorizations at any year "y".	restauration of mineral reserves of earth alkaline minerals, preventing irreversible losses of CO_2 to the deep oceans.
Group II – Fossil Hydrocarbons		
II(a) – Energy Framework		
The framework starts with the ETF transparently reporting the national reserves and yearly amounts of hydrocarbons (natural gas, oil, coal, bitumen, etc.) extracted for energy purposes. Emissions footprints may include the retroactively incurred since the reserve's estimations, extraction investments (wells, mining equipment), and impacts on LULUCF, in a per unit mass/energy estimate of the GHG emissions for the primary mineral sold, including the fugitive emissions at the production sites/fields.	The framework for A6.4/A6.2 methodologies where fossil fuels are relevant or indicative of the emissions intensity are used to monitor the mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). These may include the sectors Energy (e.g. refining, distribution) up to the final consumers and final services provided: grid- and captive-electricity, heating/cooling, mobility, etc. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the fuels and for the energy efficiency of appliances, allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	CO_2 is the final "waste gas" at any fossil hydrocarbon energy application, therefore, in principle, this currently not subject to any waste disposal or recycling, except when the combustion process is connected to the CCS (geological CO_2 storage), when it becomes at carbon-neutral to a certain extent. However, we reemphasize the www.carbon-recycling.eco pledge that the renewable biomass route based on pyrolysis and biocarbon/pyrocarbon storage constitute a legitimate recycling approach. Please refer to our E-Book at the Annex. In all cases, the emissions factors for the baselines, activities, and leakage effects for the energy infrastructure include the past, current, and end-of-life decommissioning and disposal/recycling of the infrastructure involved in the supply-demand chain, to make the adequate comparison with the other alternatives.
II(b) – Thermochemical Framework		

The application of coal/coke as the thermos-reducing agent for the metallurgical process is a framework, starting with the primary extraction of the minerals to be used in the supply-demand chain. The ETF reports the national reserves and yearly amounts extracted for that purpose. Emissions footprints may include the retroactively incurred since the reserve's estimations, extraction investments (wells, mining equipment), and impacts on LULUCF, in a per unit mass/energy estimate of the GHG emissions for the primary mineral sold, including the fugitive emissions at the production sites/fields.	The framework for A6.4/A6.2 methodologies where thermochemical agents are relevant or indicative of the emissions intensity are used to monitor the mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). These are mainly at sector IPPU (iron and steel, copper, silicium, etc.). Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the thermochemical agents, allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	CO_2 is the final "waste gas" at thermochemical applications, therefore, in principle, this framework is currently not subject to any waste disposal or recycling. However, we reemphasize the www.carbon-recycling.eco pledge that the renewable biomass route based on pyrolysis and biocarbon/pyrocarbon storage constitute a legitimate recycling approach. Further, the Shift (S) category methodologies at this framework shall include the use of **biocarbon from renewable sources** as substitutes for the thermochemical process. Please refer to our E-Book at the Annex.
II(c) – Plastic Polymers Framework		
The framework starts with the ETF transparently reporting the national reserves and yearly amounts of fossil oil extracted and used, totally or in part, for the plastic monomers and associated petrochemical processes. The reporting is apportioned with the above group II(a) when the oil is used for energy and petrochemical processes. Emissions footprints may include the retroactively incurred since the reserve's	The framework for A6.4/A6.2 methodologies involving plastic polymers supply-demand chains are used to monitor the mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). These are mainly at sector IPPU petrochemical processes and demand-side final consumers and wastes. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and	**The CO_2 emissions from environmentally dispersed plastic wastes proceed in biogeochemical weathering process, the decay rates are in the order of magnitudes of decades to centuries but are not zero**. Paris Crediting Mechanisms are bound to the non-temporal limit of tolerated temperature increase. Therefore, **under Paris the plastic wastes cease their condition of being "GHG emissions-free", when left in nature**. In

estimations, extraction investments (wells, mining equipment), and impacts on LULUCF, in a per unit mass/energy estimate of the GHG emissions for the primary mineral sold, including the fugitive emissions at the production sites/fields.	international trading of the polymers, allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	fact, the decay of plastic polymers is slow, even for the purpose of the LT-LEDS scenario, but is not null. CO_2 emissions for decomposition shall be used to calculate the **temporal leakage effects of plastic dispersion, within and beyond the LT-LEDS, calculated as an emission factor that estimates the CO_2 emissions and global warming effects in the long term.** For example, after the LT-LEDS, the overall amounts of plastic wastes that continue decaying worldwide in SWDS, or dispersed in soil/rivers/oceans (including the currently already dispersed, and added to the non-properly managed wastes from now onwards), will represent a lock-in effect of annual residual GHG emissions that require the counteractive neutralization by an equivalent amount of removals. However, plastic decay rates may be reduced to zero if the surface area exposed to the atmosphere/soil/water weathering agents are minimized or reduced to zero. **Plastic wastes crediting mechanism mechanisms shall reflect this, the only potentially net-zero technologies are the industrial recycling purely based on renewable energy, and/or**

		controlled accumulation/preservation technologies, resulting in the "avoided dispersion" of active plastic surface areas. These last technologies include the "dry storage" of clean plastic wastes and "pyrocarbon" SWDS (see our www.carbon-recycling.eco E-book in the annex).
Group III – Biogenic Carbon		
III(a) – Food Framework		
The framework starts with the ETF transparently reporting the LULUCF carbon stocks and its interaction with the AFOLU sector, with the yearly changes in the land-use categories and carbon stocks, and the annual production of relevant food supply-demand indicators, which may be, according to key categories in a country-by-country basis: starch (maize, rice, wheat, etc.), vegetal protein (beans), edible oils, fruits & fresh vegetables, animal proteins, etc.. Emissions footprints are set per unit mass/energy for the GHG emissions intensity for primary production and domestically or internationally traded.	The framework for A6.4/A6.2 methodologies where food processing and consumption are relevant or indicative of the emissions intensity are used to monitor the mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). These may include the sectors IPPU (e.g. industrial processing), distribution/logistic up to the final consumers. Urban, peri-urban, and rural "green" and "blue" agendas for decentralized food production, and sustainable extractive food collection (fishery, honey, fruits etc.) are also part of the framework. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the food products allowing for the CBAMs at any boundaries, consistent with the host	Wastes generation at each step in the supply-demand chain (from crop residues in the fields, passing through industrial and commercial facilities, up to the post-consumer wastes) are subject to the progressively more detailed assessment and the final wastes disposal sites and management systems (biogas, composting, etc.) are used to assess the mitigation outcomes at the food framework. Temporal leakage for the accumulation of wastes in the SWDS with potential residual GHG emissions up to the LT-LEDS and beyond are calculated and discounted to the corresponding methodologies. Again, we reemphasize the www.carbon-recycling.eco pledge that the recycling route based on pyrolysis and biocarbon/pyrocarbon storage constitute a

	countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	legitimate recycling approach. Please refer to our E-Book at the Annex.
III(b) –Structural Wood and Fibers Framework		
This AFOLU based primary source of raw materials from biogenic cultivars or forest management includes the lignocellulose structural wood products, cellulose (paper and cardboard), textiles (cotton, wool, leather). The framework starts with the ETF transparently reporting the LULUCF carbon stocks and its interaction with the AFOLU sector, with the yearly changes in the land-use categories and carbon stocks, and the annual production of relevant raw materials. Emissions footprints are set per unit mass/energy/surface area/volume for the GHG emissions intensity for primary production and domestically or internationally traded.	The framework for A6.4/A6.2 methodologies cover mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). These may include the sectors IPPU (e.g. industrial processing), civil construction, commerce, final consumers products use (clothes, packing materials) and post-consumers destination and circular economy, comparing this framework with other fossil based with plastic polymers or cement-based alternatives. Urban, peri-urban, and rural infrastructure redesign agendas are also part of the framework, with the side-effects measured at the energy, AFOLU and IPPU sectors. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the intermediate and final products allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	The biogenic end-of-life products are either disposed of with additional future generation and release of GHG (CO_2/CH_4) or subject to recycling, biogas generation, composting. Again, as pledge from our cooperative www.carbon-recycling.eco the pyrocarbon route for carbon preservation as a removal activity ("avoided reversals technology") is also an eligible technology (see our E-book).

III(c) – Bioenergy Framework		
The framework includes the use of biomass and biofuels for energy generation and energy services output (heating, cooling, mobility, etc.). The framework starts with the ETF transparently reporting the LULUCF carbon stocks and its interaction with the AFOLU sector, where the bioenergy is generated as main or co-product when combined with other biobased frameworks. The yearly changes in the land-use categories and carbon stocks, and the annual production of relevant energy carriers are reported by the parties. Emissions footprints are set per unit mass/energy for the GHG emissions intensity for primary production and domestically or internationally traded.	The framework for A6.4/A6.2 methodologies cover mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I). The energy sector is the main correlation for reporting and crediting the outcomes. The bioenergy, depending on their source and production method, may approximate to the zero-emissions (carbon-neutral) and/or negative emissions (BECCS). The comparative baselines are for the similar services provided by fossil energy and/or other primary energy sources. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the intermediate and final products allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	CO_2 is the final "waste gas" at bioenergy applications, therefore, in principle, this framework is currently not subject to any waste disposal or recycling, except when the BECCS with CO_2 geological storage is introduced as a removal technology. However, we reemphasize the www.carbon-recycling.eco pledge that the renewable biomass route based on pyrolysis and biocarbon storage constitute also a legitimate recycling approach. Of course, the **slow pyrolysis** conversion of biomass does not generate larger amounts of energy, the main product of it is **biocarbon**. This biocarbon may be controlled accumulated and preserved (negative emissions), used as feedstock for energy generation (zero emissions) or for BECCS (negative emissions). **Biorefineries based on fast- and flash-pyrolysis** for production of gaseous and liquid fuels from biomass may also be sought. Please refer to our E-Book at the Annex. Please also refer to our biochar/biocarbon comparative route (see here).
Group IV – Organic Heteroatoms: Hydrogen, Nitrogen, Sulfur, Phosphorous		
IV(a) – Hydrogen Framework		

There are no relevant primary source/occurrence of elemental hydrogen in the earthen crust or atmosphere. This framework is purely based on secondary generation, based on the consumption of energy. Therefore, any LULUCF and mining effects of the hydrogen generation and use shall be accounted as a **methodological leakage effect**, due to its effects on IPPU and raw materials mobilizations for commissioning, using, and decommissioning the hydrogen related infrastructure. Notwithstanding, the ETF shall transparently report the LULUCF carbon stocks and its interaction with the IPPU and hydrogen infrastructure. The yearly changes in the land-use categories and carbon stocks, and the annual production of relevant primary minerals and their emissions shall be reported for determining the leakage effects.	Hydrogen is the second main atomic constituent of the Groups II (fossil hydrocarbons) and III (biogenic carbon) and has mainly been generated from the formers (fossil hydrocarbons/methane steam reforming, the "black hydrogen"). Historically, the main hydrogen application is exactly in the oil refining (hydrotreating, hydrocracking). However, since there is an increased push towards the large-scale hydrogen generation and use as an energy carrier, a "color palette" for hydrogen generating processes are being under different stages of research and development, the water electrolysis by consumption of renewable electricity being promoted as the "green" route. The framework for A6.4/A6.2 methodologies shall cover the direct effects on the Energy sector, by discounting the leakage effects on IPPU and civil/industrial infrastructure and final appliances. Comparative baselines are for the similar services provided by fossil energy and/or other primary energy sources, taking into consideration the temporal and material leakage effects for the compared frameworks, in same metrics/accounting including past, current and future built, commissioned and	Water vapor is the final "waste gas" at any hydrogen energy application (combustion/fuel cells), therefore, in principle, this framework does not affect direct waste effects. However, the emissions factors for the baselines, activities, and **leakage effects** for the energy infrastructure shall include the past, current, and end-of-life decommissioning and disposal/recycling of the infrastructure involved in the supply-demand chain, to make the adequate comparison with the other alternatives, in the context of Avoid (A), Shift (S) and Improve (I).

	end-of-life decommissioning in the supply-demand nexus, extended to the LT-LEDS and beyond.	
IV(b) – Nitrogen Framework		
There are no relevant nitrogen minerals in the earthen crust, although it is the major constituent of the atmosphere. This immense reservoir is almost non-available for direct use, except for the biogenic N_2 fixation by the rhizobia microorganisms in association with the Leguminosae, and for the ammonia synthesis, an energy intensive IPPU process. Therefore, any LULUCF and mining effects of nitrogen production and use are accounted as in the ETF as **methodological leakage effects**, due to its effects on IPPU and raw materials mobilizations for commissioning, using, and decommissioning the nitrogen related infrastructure. Notwithstanding, the ETF shall transparently report the LULUCF carbon stocks and its interaction with the IPPU and nitrogen infrastructure. The yearly changes in the land-use categories and carbon stocks, and the annual production of relevant primary minerals and their emissions shall be reported for determining the leakage effects.	The production of ammonia is the major initial step of the nitrogen framework, for both the main applications: as a fertilizer for agriculture, and for the use as explosives in pacific and military artifacts. More recently, connected with the push towards hydrogen generating processes, ammonia is being considered not only as an alternative energy carrier for being more convenient than hydrogen itself for long range logistics, but also as the fuel in combustion and fuel cells applications. Of course, this is a controversial framework, irrespective of the GHG emissions, for the great concerns related to the safety issues at large-scale "green ammonia" storage and management and use, given its high toxicity and explosivity. The framework for A6.4/A6.2 methodologies shall cover the direct effects of the framework in Energy and IPPU sectors, by discounting the leakage effects on LULUCF/mining, civil infrastructure, and final appliances producing, use and discharge. Comparative baselines	Same as with hydrogen, ammonia use as energy applications (combustion/fuel cells), does not affect direct waste for the consumables, but for the fixed infrastructure during and after their lifetime. Emissions factors for the baselines, activities, and **leakage effects** for the energy infrastructure shall include the past, current, and end-of-life decommissioning and disposal/recycling of the infrastructure involved in the supply-demand chain, to make the adequate comparison with the other alternatives, in the context of Avoid (A), Shift (S) and Improve (I). Similarly, the nitrogen applications in the fertilizers and explosives/defense sectors shall be considered in their respective context of generating N_2O emissions. The leakage effects may be considered in the supply-demand chains, from the cradle to grave for both primary nitrogen production in industrial conversion processes, as well as based on the nitrogen-rich disposal of waste and drainage water from agricultural fields and animal

	shall be set for the similar services provided by fossil energy and/or other energy carriers, taking into consideration the temporal and material leakage effects for the compared frameworks, in same metrics/accounting extended to the LT-LEDS and beyond. Other uses for nitrogen include fertilizer and nitrates as intermediate and final chemicals in weapons and in some textiles (adipic acid), where the higher GWP N_2O comes into play. Kyoto-CDM has collected experiences in this sector, and the lessons learnt over there are useful now to achieve integrity of A6.2 and A6.4 mechanisms.	husbandry, rural residues, urban and post-consumer wastes. The anoxic decay (composting) and anaerobic decay of biogenic wastes also incur to N_2O emissions. The enhanced nitrification of managed and non-managed terrestrial and aquatic ecosystems, up to oceans, are also contributing to the eutrophication of such ecosystems and biomes, the consequences of which may be considered as potential leakage effects. Nitrogen compounds are also relevant as local and regional atmospheric pollution from combustion sources (NO, NO_2, photooxidants and O_3) resulting from trace amounts of nitrogen in the fuels or from thermal oxidation of atmospheric nitrogen at high temperatures. They have an impact on air quality and on environmental acidification, which may interact with the CO_2 uptakes at managed and unmanaged conditions.
IV(c) – Sulfur and Phosphorus Framework		
Sulfidic minerals are widely explored because of their metal constituents (Iron Pyrites/associated with gold, copper, lead, zinc, mercury, antimony). In general, the oxidation route is the most widely practiced	Phosphorus is a macro-fertilizer widely used in agriculture, related to the eutrophication of managed and unmanaged terrestrial and aquatic ecosystems, including the oceans. The framework for A6.4/A6.2 methodologies	Phosphorus is relevant about leakage effects not related to its direct use, but the indirect effects for the eutrophication. In the combustion processes sulfur as contaminants to the fuels will result in atmospheric

for metal recovery, and sulfuric acid is a by-product in that ustulation processes. Sulfides are also removed from fossil fuels refining (oil, natural gas) or post combustion flue gases at coal combustion. Phosphates reserves are also limited, the major route for the phosphorus production as a fertilizer is based on the use of sulfuric acid in the apatite's chemical digestion. Therefore, the two frameworks may be considered together. The ETF shall report on the primary mineral's extraction, and their direct effect on LULUCF carbon stocks. Emissions footprints are set per unit mass for the GHG emissions intensity for primary production and domestically or internationally traded.	shall cover the direct effects of the framework in AFOLU and IPPU sectors, by discounting the leakage effects on LULUCF/mining (previous row), and wastes disposals and dispersion (next row). In the sulfur and sulfuric acid processes there aren't major relevant climate effects, except for the fact that sulfur in the surficial waters and lakes/wastewater receiving bodies will promote the acidification and in the anaerobic decays the nuisances from hydrogen sulfide as a strong odorous substance.	emissions of SOx, which are local and regional pollutants contributing to the acidification, affecting the atmosphere-water CO_2 equilibrium. There is also a discussion about possible direct intervention on the stratosphere, with intentional "sulfur explosions" or sulfur injections in that upper atmosphere layer to disseminate aerosols and reduce the solar radiation penetration. These "geoengineering" solar direct radiation management are highly disputable and shall not be implemented without a wide scientific consensus and regulatory approvals.
Group V – Structural metals (Iron and Steel, Chromium, Aluminum, Magnesium…) Frameworks		
We don't make the subdivision of the individual metal's frameworks, at least for now in this first public release, because although each one has a very distinct pathway in their supply-demand production and recycling chains, the generic description given here are applicable to all of them in the overall context of climate mitigation. All these metals are intensively extracted from their primary ores, mostly from open pits mining	Metallurgical process for the primary reduction and secondary, scrap-based recycling routes, are energy intensive and there are relevant non-energy GHG emissions for the thermo-reduction using fossil based or biobased carbon, as was mentioned in the above frameworks. A very long stepwise chain of shaping and mechanical processing may proceed up to the final products to be sold or used in the final consumers or infrastructure	As structural metals, these are mainly recovered at the end of life with only minor loss in their chemical composition integrity, the recycling route is thus the natural waste method to be credited. The corresponding positive impact of recycling on the primary non-renewable resources preservation (avoided mining) shall be part of the crediting scheme. The logistic arrangements at the post-consumer waste collection and disposal,

sites. ETF shall transparently account for these extraction sites worldwide and report the effects on LULUCF and reserves exploration and depletion rates. Emissions footprints are set per unit metal mass for the GHG emissions intensity for primary production and domestically or internationally traded.	(buildings, vehicles, domestic appliances, etc.). Framework for A6.4/A6.2 methodologies cover mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I) in each of these steps. The net mitigation may be accounted in the IPPU and Energy sectors, and when bioenergy is involved also the AFOLU and LULUCF, and the demand-side methodologies. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the intermediate and final products allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	the disassembling and separation of extraneous materials are the only major restrictions to be overcome, and when not practical or not financially attractive in a given year "y", the controlled disposal and wastes preservation approach can be used to credit the 'reverse mining' approach (see here the pledged crediting approach for wastes preservation by www.carbon-recycling.eco). With the progressive implementation of the ETF and NDCs, these preserved wastes controlled accumulated at the disposal sites become increasingly attractive to the recycling for the carbon prices being more valuable according to the closures of BTRs (see here the description of the progressive evaluation of the ITMO$ and €CCO$)
Group VI – Electro-electronic metals (Copper, Silicium, Lithium, Cobalt, Rare Earths) Frameworks		
We don't make the subdivision of the individual metal's frameworks, at least for now in this first public release, because although each one has a very distinct pathway in their supply-demand production and recycling chains, the generic description given here are applicable to all of them in the overall context of climate mitigation. All these metals are extracted from their primary ores,	Different metallurgical processes are in place for each metal, for primary virgin raw ores and secondary, scrap-based recycling routes. GHG emissions intensities vary up to the final products to be sold or used in the final consumers or infrastructure (e.g. wind energy generators, solar PV panels, vehicles and batteries, domestic appliances, etc.). Framework for A6.4/A6.2 methodologies	The end-of-life conditions of the post-consumer or at decommissioned infrastructure (e.g. wind and solar farms replacements) will generate variable amounts and quality and purity range of the spent metals. Recycling is not always the most attractive route, but it shall be considered as the preferred one, even in the early design of the technologies employing these metals. For

which are limited in geological occurrences and subject to increasingly scarcity if the reserves increase and financial/climate impacts for their exploration become to a barrier to cover the demand. ETF shall transparently account for these extraction sites worldwide and report the effects on LULUCF and reserves exploration and depletion rates. Emissions footprints are set per unit metal mass for the GHG emissions intensity for primary production and domestically or internationally traded.	cover mitigation outcomes for technologies involving avoid (A), shift (S) and improve (I) in each of these steps. The net mitigation may be accounted in the IPPU and Energy sectors, and when bioenergy is involved also the AFOLU and LULUCF, and the demand-side methodologies. Standardized baselines and their downwards adjustments at each country settle the emissions factors for domestic and international trading of the intermediate and final products allowing for the CBAMs at any boundaries, consistent with the host countries NDC statuses, for calculating emissions reductions and ITMO$ authorizations at any year "y".	that, the climate mitigation impact of their use shall include the cradle-to-grave and cradle-to-cradle analysis compared with the conventional technologies they intend to displace (e.g. electric vehicles vs internal combustion). When recycling is attractive enough at a certain NDC at its evolution stage in year "y", the leakage effects for energy sector impacts (reversal logistics requirements) and non-renewable natural resources preservation (avoided mining and LULUCF preservation) shall be part of the methodological mitigation monitoring. When not practical or not financially attractive in a given year "y" at any NDC, the controlled disposal and wastes preservation approach can be used to credit the 'reverse mining' approach (see here the pledged crediting approach for wastes preservation by www.carbon-recycling.eco). With the progressive implementation of the ETF and NDCs, these preserved wastes controlled accumulated at the disposal sites become increasingly attractive to the recycling for the carbon prices being more valuable according to the closures of BTRs (see here the

		description of the progressive evaluation of the ITMO$ and €CCO$)
Group VII – Uranium and Radioactive Isotopes Framework		
Nuclear energy is considered a potential candidate to supply firm electricity loads, because its GHG emissions intensity being not related to the operation condition of the generating units. This claim must be evaluated and decided in Paris/Glasgow Accords by means of the appropriate accounting of the emissions within the ETF and NDCs processes, within the LT-LEDS until 2050 and beyond, since the post-2050 GHG accounting and limitation will proceed. **The LCA for the "cradle-to-grave" management of this framework is the most developed, not because of climate, but for its connection to defense/military and radioactivity protection**. The LULUCF impact of primary mining is a fundamental cornerstone: all accounting of the GHG emissions shall be based on the primary exploration of uranium reserves, worldwide. **The ETF shall be closely implemented for its Technical Expert Reviews – TER in joint agreement with the IAEA and the control and oversees the overall impact of all**	All steps in the nuclear cycle for energy and other purposes, including military, are well known and managed. The corresponding emissions and CBAMs may be defined and the opportunities for Avoid (A) Shift (S) and Improve (I) in all steps of the supply-demand sides may be developed and implemented as A6.2 and A6.4 methods. **Risks related to reactors security and safety shall be treated similarly as the risk of reversal emissions for CO_2 removals: provisions shall be taken by the liability chain in the nuclear agreements and participant NDCs and private businesses about the incurred responsibilities when the sinister situation occurs, and the associated GHG emissions are needed to be compensated by the removals/emissions reductions credits to cover the gaps**.	Radioactive wastes managements are in place that cover adequately the "graves" where provisory and definitive storage of the contaminated wastes. In practice, as we have highlighted, this is the only framework where the "wastes preservation" is practiced, the only requirement is to develop an fix the liability in regard to the participant NDCs (the ETF modalities and procedures reporting) and the businesses (the A6.2 and A6.4 modalities and procedures reporting) for the period up to the 2050 (the LT-LEDS) and beyond. Of course, the post-2050 needs to be included in the bill-to-pay for the supply-demand chain users and participants of nuclear energy activities. The lock-in effects for the radioactive wastes emissions can be quantitatively estimated at the onset of any project: the required spaces/volumes and the associated measures to keep the wastes under protected and safe conditions, including the emissions for wastes disposal solutions, may be estimated**. A financial risk analysis and provisions based on the Net**

applications, including defense and military. Confidential information may be marked as confidential, but the Transparency in NDCs is not bound to any exclusion of all sectors for their GHG accounting and reporting in its full. This same statement shall apply *mutatis mutandis* to the nitrogen framework (Group IV(b) above) in its connection to the weapons and defense sectors and their emissions appropriation.		**Present Value evaluation method of post-2050 emissions trading and carbon costs shall be used**. The most reliable and rational method would be based on the expected pathway the UNFCCC intends to impose on the atmospheric CO_2 levels (the Keeling curve) up to the stabilization of the global temperature at the same or similar levels in the pre-industrial era (e.g. before 1850). This same statement shall apply *mutatis mutandis* to the plastic polymers framework (Group II(c) above), since plastic pollution and plastic dispersion has also emissions footprints beyond the 2050 scenarios.

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