Table of Content for Presentation

4th Meeting of the Carbon Removals Expert Group

15 - 17 April 2024

Housekeeping Rules

1. IN-PERSON PARTICIPANTS: WEAR YOUR BADGE + SIGN THE ATTENDANCE LIST

Keep your badge (V-Pass) visible.

2. ONLINE PARTICIPANTS: TURN ON YOUR VIDEO & MUTE YOURSELF

We encourage you to turn on your video. Please leave your microphone on mute, unless you take the floor.

3. ASK QUESTIONS & INTERACT (in the room + Webex & Slido)

We want to hear from you! Please ask questions & share comments! We will try to take at least one question from each Webex and Slido in the Q&A.

4. CONSENT FOR THE WEBSTREAM RECORDING & PICTURES

Be informed that the meeting will be web-streamed, recorded and pictures will be taken.

5. SOCIAL MEDIA: #EUCarbonRemovals

Your posts and comments can help others learn more about the topic and connect with like-minded professionals in the industry.

Join via Webex

European Commission

AGENDA

Day 3: Permanent carbon removals and carbon storage in products

9:00	Welcome and structure of the day
9:15	*Discussion session*: BECCS & DACC
12:30	Lunch break
13:30	*Discussion session*: Biochar
14:15	Coffee break
15:00	*Discussion session*: Carbon Storage in products
16:30	Round-up and next steps

Permanent carbon removals

17 April 2024

Defining permanent carbon removals in the CRCF

*'**permanent carbon removal**' means any practice or process that, under normal circumstances and using appropriate management practices, captures and stores atmospheric or biogenic carbon for several centuries, including permanently chemically bound carbon in products, and which is not combined with Enhanced Hydrocarbon Recovery;*

*'**permanent carbon removal unit**' means one metric tonne CO2 equivalent of certified permanent net carbon removal benefit generated by a permanent carbon removal activity and registered by a certification scheme in its certification registry or, as appropriate, in the Union registry referred to in Article 12*

What does the CRCF say on permanent removals?

Quantification	• **Permanent Net Carbon Removal Benefit** • **LCA approach**
Additionality	• **Additionality tests in case of activity-specific baseline**
Storage and Liability	• **Consistent with CCS Directive and EU ETS Directive**
Sustainability	• **Consistent with ‘do no significant harm’ principle** • **Promote the sustainability of biomass in accordance with RED**

Process and outputs so far

September 2023 Expert Group meeting

- Public call for evidence and interviews
- Technical Scoping Paper

April 2024 Expert Group meeting

- Technical Assessment Paper

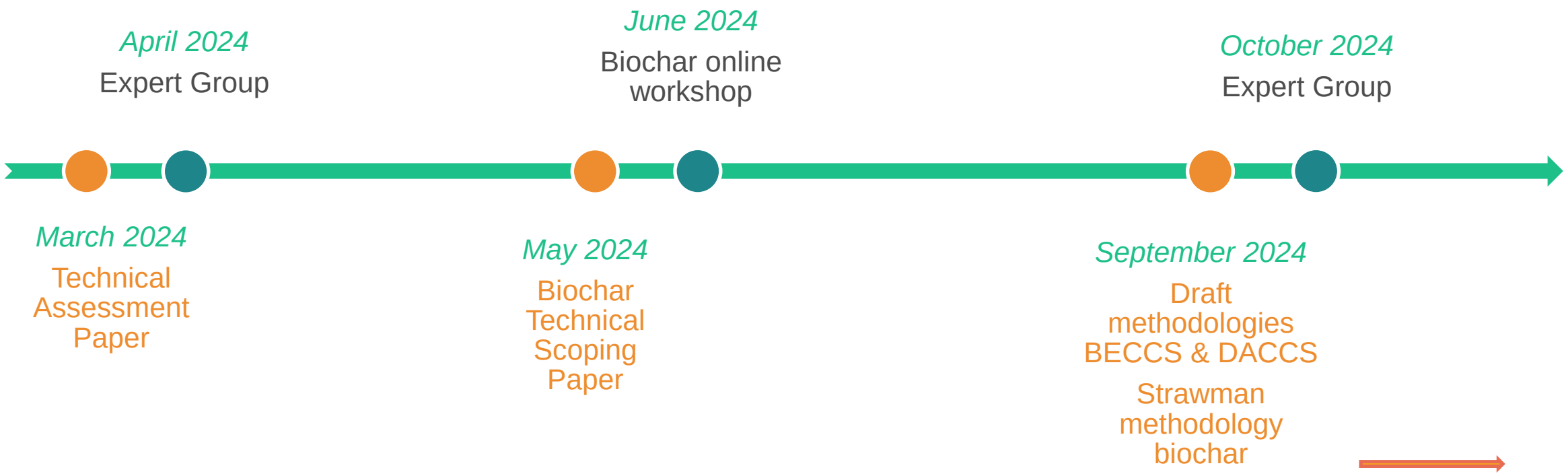
Today’s objectives

1. Discussion of preliminary findings of the Technical Assessment Paper for DACCS and BECCS

2. Identification of agreements or potential differences on the direction of travel

3. Initial discussion of key issues around biochar methodology development

Planned next steps



European Commission

BECCS & DACCS

By ICF

Support to the development of methodologies for the certification of industrial carbon removals with permanent storage – Technical Assessment Paper, DACCS and Bio-CCS

17 April 2024

Expert group on carbon removals, 25-26 October 2023

ICF in collaboration with Cerulogy and Fraunhofer ISI

Permanent carbon removals

- The Technical Assessment Paper (TAP) **identifies a number of issues** to be considered in the development of EU certification methodologies for permanent carbon removals, and **confirms that the development of certification methodologies** for DACCS and Bio-CCS is a priority for this year.

Where:

- DACCS = capture of CO_2 from the air followed by storage in line with the CCS Directive
- Bio-CCS = capture of biogenic CO_2 followed by storage in line with the CCS Directive

- Purpose of this session is to **discuss**:
  - Key issues identified in the TAP ordered by the QUALITY criteria (i.e. quantification, additionality, long-term storage, sustainability) → we will present our current view and solicit views in agreement/contradiction
  - Some points not covered in the TAP that are specific to DACCS/Bio-CCS
  - Modularity and prioritisation for 2024

Quantification (1)

Issue	Key questions for discussion
Should $GHG_{associated}$ include emissions from capital goods (i.e. facility and equipment manufacture and construction)?	a) The TAP suggested inclusion subject to materiality screening b) We would currently be minded to exclude capital emissions as immaterial for Bio-CCS but require materiality screening for DACCS
How should emission factors be allocated to electricity consumed by a carbon removals project?	a) The TAP proposes to apply the rules from the RFNBO framework under RED II b) We expect this to be important for DACCS
What approach or approaches should be used for assessing and reporting uncertainty in net carbon removals?	a) The TAP proposes to require key uncertainties to be identified and quantified, with a narrative confirmation that the overall approach is unlikely to overestimate removals – but not to require full quantitative uncertainty propagation b) In the case of Bio-CCS/DACCS, we would expect measurement uncertainty to be limited, and manageable through requiring measurements at several stages
Scope for the initial certification methodology for Bio-CCS	a) Should all capture of biogenic CO_2 be in-scope, or only biogenic CO_2 from specified energy-generating installations?
For BECCS, there is a question of displacement of existing energy capacity (use of heat/power to run carbon capture unit)	a) The agreed text says that "displacement effects due to competing demand for energy or waste heat" should be accounted for b) Should reductions in energy output after installation of carbon capture equipment be accounted as indirect emissions?

Quantification (2)

Issue	Key questions for discussion
How should the breakdown of emissions in the $GHG_{associated}$ term be implemented in reporting?	a) The TAP suggests breaking down emissions by lifecycle category and b) including an indication of whether they were ETS-regulated and which corporate reporting scope (1, 2, 3) they fall under
For Bio-CCS, what is the scope for assessing $GHG_{associated}$ / how should emissions be allocated between the produced energy and captured carbon?	a) This is not addressed in the TAP. We are minded to include only the additional carbon capture unit and associated energy use within the system boundary for the project.
How many times should projects be permitted to renew the activity period?	a) The TAP states that we see no reason to limit renewals in the certification methodologies for DACCS/Bio-CCS
How should baselines be set?	a) The TAP suggests that a zero baseline could be set where carbon removal units are the only revenue stream – this would apply to DACCS b) In the case of Bio-CCS there is also revenue from energy sales, but if the carbon removal project is understood as consisting solely of addition of carbon capture to an operational bioenergy facility (cf. Recital 18a*) then a zero baseline might also be appropriate

Additionality

Issue	Key questions for discussion
What requirements should be set on financial additionality testing [when using an activity specific baseline]?	a) The TAP suggests basing requirements on the CDM investment analysis tool

Long-term storage

Issue	Key questions for discussion
Identifying storage as long-term	a) The TAP discusses the minimum timeframe for carbon removals to be treated as permanent. In the case of CCS-based removals, we suggest that the requirements of the CCS Directive should be adopted
Should it be acceptable to issue net carbon removal units based on modelling approaches?	a) The TAP suggests that where modelling is the best available quantification approach it should be used
Timing of unit issuance	a) For both DACCS and Bio-CCS, the TAP suggests that removals units should be issued following demonstration that CO2 has been injected for storage (i.e. for Bio-CCS the issuance would be decoupled from any consideration of biomass regrowth)
What reversal risk assessment should be undertaken for project certification?	a) In the case of DACCS and Bio-CCS, reversal risk assessment is part of site selection under the CCS Directive and therefore we anticipate no additional requirement in the certification methodologies

Sustainability

Issue	Key questions for discussion
How can the scheme recognise co-benefits?	a) The TAP suggests certification-methodology-specific identification of potential sustainability co-benefits. b) We are interested in whether there are likely to be substantial relevant co-benefits for DACCS. c) For BECCS, given the presumption that carbon capture is not associated with increased energy generation we do not see energy output as a reportable co-benefit. d) We are interested in whether there are likely to be other substantial relevant co-benefits for Bio-CCS
For Bio-CCS, would sustainability rules beyond those set by RED II Article 29 be relevant?	a) The agreed CRCF text directly references RED II Article 29 b) Would it also be appropriate to integrate the do no significant harm criteria for bioenergy from the sustainable finance taxonomy?

Prioritisation

1. The TAP states that a modular approach will be adopting to developing certification methodologies
2. Priority modules:
   a) Direct air capture
   b) Biogenic CO_2 capture
   c) CO_2 transport (as per CCS Directive)
   d) Geological CO_2 storage (as per CCS Directive)
3. Other areas for work in the near-term:
   a) Mineralisation of CO_2 in construction material
   b) Biochar production and use
4. We are interested to hear the views of the expert group on these priorities and approach

Biochar

By ICF

The context of biochar

Recognising the long-term carbon storage in biochar

Process & next steps:

European Commission

Support to the development of methodologies for the certification of industrial carbon removals with permanent storage – Technical Scoping Paper, biochar

17 April 2024

Expert group on carbon removals, 25-26 October 2023

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Biochar as a permanent carbon removal

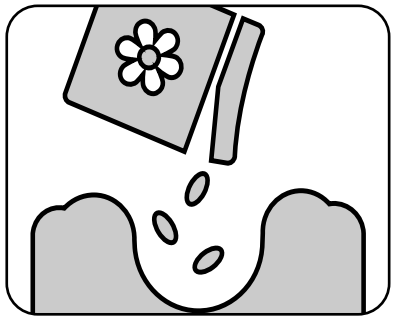
- The consortium has started looking at biochar production and use as a carbon removal activity
  - Informed by presentations from the last Expert Group meeting
- A Technical Scoping Paper on biochar certification will be circulated after this meeting
- Today, we would like to canvass views from the Expert Group in relation to three topics:
  - Assessing the permanence of carbon storage in biochar
  - Whether it is practical to monitor biochar in situ
  - Monitoring and reporting approaches

Assessing the permanence of carbon storage in biochar: Approaches

- We have identified two underlying approaches for soils:
  - Use of a decay function for carbon permanence parameterised by time, soil temperature and some biochar characteristic(s) such as H/C_{org} ratio
    - Calculated based on meta-analysis of incubation experiments
    - Examples of such approaches are available in the 2019 IPCC provisional method* for biochar in national inventories, Woolf et al. (2021)† and Azzi et al. (2024)‡, and are used in existing certification schemes
  - Identification by laboratory analysis of an inert fraction in biochar and treatment of that fraction as permanent
    - E.g. Inertinite benchmark approach presented by Prof Sanei at the October meeting
- Lower H/C_{org} ratio is associated with greater permanence. Several standards set a threshold of < 0.7; should the carbon removal framework set a lower requirement (e.g. < 0.4, < 0.2)?
- The forthcoming TSP will provide a more detailed background review of this research
- We are interested to hear views on permanence in non-soil applications

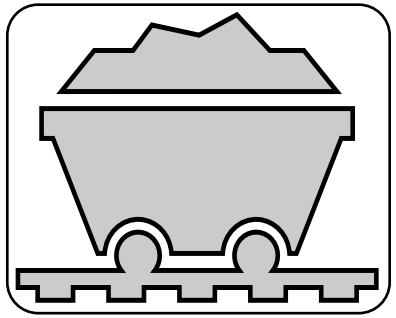
*https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch02_Ap4_Biochar.pdf
†https://pubs.acs.org/doi/full/10.1021/acs.est.1c02425
‡https://www.sciencedirect.com/science/article/pii/S001670612300438X?via%3Dihub

Post-application monitoring



In soils:

- After application to soils, biochar is subject to transport
  - Up and down the soil column
  - Laterally on the field
  - Out of the field by wind/water erosion
- It is our understanding that it is not practically possible to monitor biochar in situ in soils as the losses due to transport are likely to mask any information about losses due to degradation
  - If carbon reversals cannot be identified it is not possible to impose liability for such reversals on project operators
  - Reversal risk would instead need to be minimised through good practice and conservative permanence assessment
- It is our understanding that biochar incorporated in soils is largely protected from reversal due to fire
  - Should the certification methodology exclude surface application of biochar?



In materials:

- If incorporated in materials, biochar is not subject to transport
- If final use of materials is recorded, those materials could in principle be monitored
  - Potential to sample materials in situ (potentially problematic for structural material)
  - Identify whether reversals occur at end of use
- Is such monitoring practical and proportionate?

ICF Cerulogy Fraunhofer ISI

Monitoring and reporting of biochar production and use

- The European Biochar Certificate requires sampling and testing for:
  - C_{tot}, C_{org}, H, N, O, S, ash, H/C_{org} ratio
  - Various physical characteristics
  - Thermogravimetric analysis (to identify VOCs)
  - Nutrients (N, P, K, Mg, Ca, Fe)
  - Heavy metals
  - Organic contaminants
- Sample testing is required on at least an annual basis (where there is no reported change in production parameters)
  - Samples are also required to be taken daily (aggregated monthly) and retained for two years
- Existing standards differ regarding whether monitoring extends to the point of biochar use
  - Should monitoring extend to the point of biochar incorporation in soil

Assessing the permanence of carbon storage in biochar: Key questions/challenges

- Choice of decay function:
  - Functional form (e.g. exponential or power model)
  - Data source (e.g. Woolf et al. 2021, Azzi et al. 2024, other research, forthcoming research)
- There is a question about long-term behaviour
  - If a fraction of relevant biochar is inert on timescales of millions of years, an exponential decay model may not be a good long-term description
- Descriptive characteristic (H/C_{org} ratio or some other biochar propert[y/ies])
- Is there consensus on inertinites:
  - That inertinites in biochar can be identified with R_O reflectance testing?
  - That there is no decay pathway for inertinite macerals in biochar on centurial timescales?
  - Is the cost of regular testing of inertinite fraction reasonable?

Key takeaways from the permanent removals session

Adopting a modular approach to developing certification methodologies

Adopting a lifecycle assessment approach

Carbon storage in buildings

- Carbon Storage in Products: Methodology concept overview and objectives of the discussions
- Recommendations of the technical assessment paper: Carbon Storage in Products

CARBON STORAGE IN PRODUCTS

Methodology concept overview & objectives of the discussions

Defining carbon storage in products in the CRCF

carbon storage in products

‘carbon storage in products’ *means any practice or process that captures and stores atmospheric or biogenic carbon for at least 35 years in long-lasting products and which allows on-site monitoring of the carbon stored and certified throughout the monitoring period;*

carbon storage in product units

‘carbon storage in product units’ should be subject to an expiry date matching with the end of the relevant monitoring period, which should cover at least 35 years for carbon storage in products. Thereafter, the carbon captured and stored should be assumed to be released into the atmosphere, unless the operator or group of operators commits to prolonging the monitoring period.

Context

Supply: Bio-based products

- Market share of biobased construction materials: 3%
- Create incentives for long-term use of biomass without increasing harvesting rates
- Greater material efficiency + circularity: recycling and reuse

Demand side: Buildings

EPBD

- WLC approach (embodied carbon matters)
- Carbon removals as **mandatory** indicator in national building renovation plans
- Carbon storage **voluntary** indicator in Energy Performance Certificate of Buildings

RENOVATION:

- ~75% of the EU building stock require large scale renovation
- 85-95% of EU buildings that exist today will still be standing in 2050

Certification methodology as **incentive for long-term use of (innovative) bio-based products & proof of carbon storage capacity of building.**

Biobased materials go beyond wood

Bio-based insulation

Cork based

Cross Laminated Timber (CLT)

Timber/ hard wood

OSB

Hemp based

sugarcrete

Eucalyptus wood

Flax based

Bamboo panels

Particle board

mycelium, the root structure of fungi

Agro-waste

- Rice Husk Ash (RHA)
- Sugarcane Bagasse Ash (SCBA)
- Bamboo Leaves Ash (BLA)
- Groundnut shell (GNS)
- Sawdust (SDA)
- Oil palm shell (OPS)
- Cork waste ash (CPA)
- Coconut shell (CNS)

miscanthus based

More info about agro-waste based construction products: [Can agro-waste serve as construction material? – Planet Rescue 101 (design.blog)]

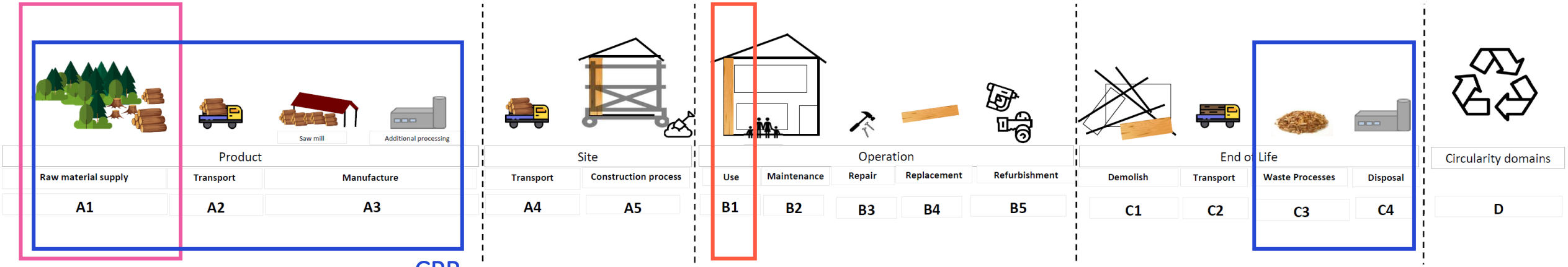
Certification of biogenic carbon storage in buildings - concept

Beneficiaries	building owners (who can carry the liability)
Voluntary	if a building owner wants to declare the carbon storage indicator in the Energy Performance Certificate (EPBD), certification will serve as proof (e.g. to show in their Cooperate Sustainability Reporting) • Modular ad-on to existing building carbon assessment to have a credible proof of the carbon storage content • Certification and verification processes docked into existing building check-up routine (our own processes certification bodies etc)
Scope (methodologies)	structural elements Insulation materials New build + renovation Bio-based materials

Along the quality criteria: sneak peak

Quantification	• Building on existing EN standards
Additionality	• Standardised baseline (distinguished between region/ country & building archtype)
Storage and Liability	• Timely limited certificates (min 35 years) • Possibility to recertify
Sustainability	• Sourcing perspective: Sustainability criteria from RED3 • User perspective: ensure sustainable buildings, e.g. with specific energy label, EPBD • Promote circularity through co-benefits

Related regulations



RED 3

Sustainability criteria for sustainable harvesting

CPR

GHG_fossil,GHG_biogenic, GHG_luluc per life cycle stage per product on DoPs

EPBD [+WLC]

Taxonomy

European Commission

Planned next steps

April 2024
Expert Group

September 2024
Public webinar

March 2024
Technical Assessment Paper

October 2024
Expert Group
Draft methodology

Public webinar
Carbon storage in buildings: How does it practically look like?
User cases, monetisation options, practicality of certification methodology

Further methodologies planning

CARBON STORAGE IN PRODUCTS

Recommendations of the technical assessment paper

By CRETA project

Long-term biogenic carbon storage in buildings

Recommendations and main open questions

Content

1. Presentation main recommendations *20 minutes*
2. Presentation main open questions *5 minutes*
3. Discussion
    1. Questions and reactions *30 minutes*
    2. Discussion of open questions *50 minutes*

The process

Thank you for your input and help so far

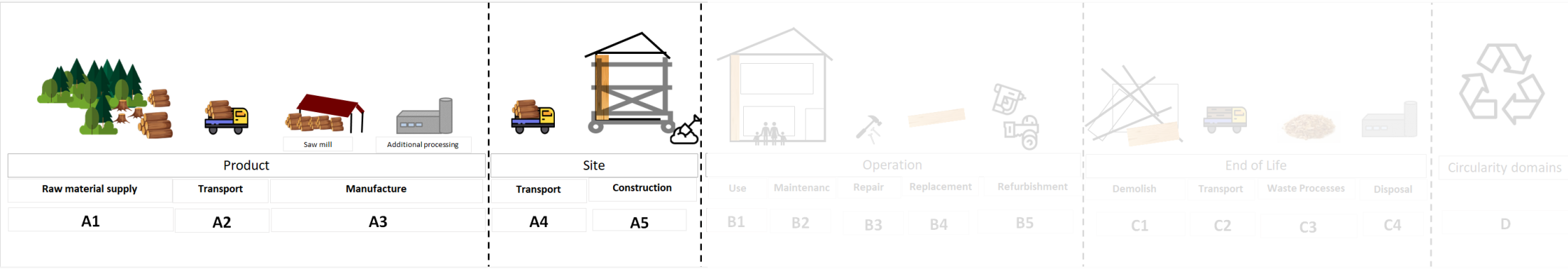
- Open call for input on existing methodologies
- Draft analysis of existing methodologies
- Discussion in 3rd Expert Group meeting
- Feedback on draft analysis
- Analysis of existing methodologies
- Feedback and discussion online
- Technical assessment paper

Quantification

Temporary net carbon removal benefit = $CR_{baseline} - CR_{total} - GHG_{associated} > 0$

Quantification - Scope

Include the A1-A5 stages.

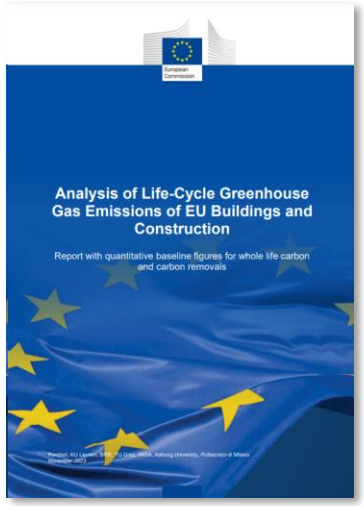


- Adheres to existing standards.
- Hold project developer responsible for transport and construction emissions.
- EoL excluded because would lead to 0 kg CO_2 eq. of stored carbon.
- Prediction of ultimate EoL fate is hard and decreases reliability.
- Good EoL practice can be directed and incentivised through minimum sustainability requirements and co-benefits.

Quantification - $CR_{baseline}$

Use a standardised baseline.

- Creates consistent, comparable, and transparent calculations.
- Low administrative burden for operators and auditors.
- Can be based on Ramboll study with baseline figures for embodied and stored carbon.
  - And periodically updated with methodology in development.
- No additionality checks.

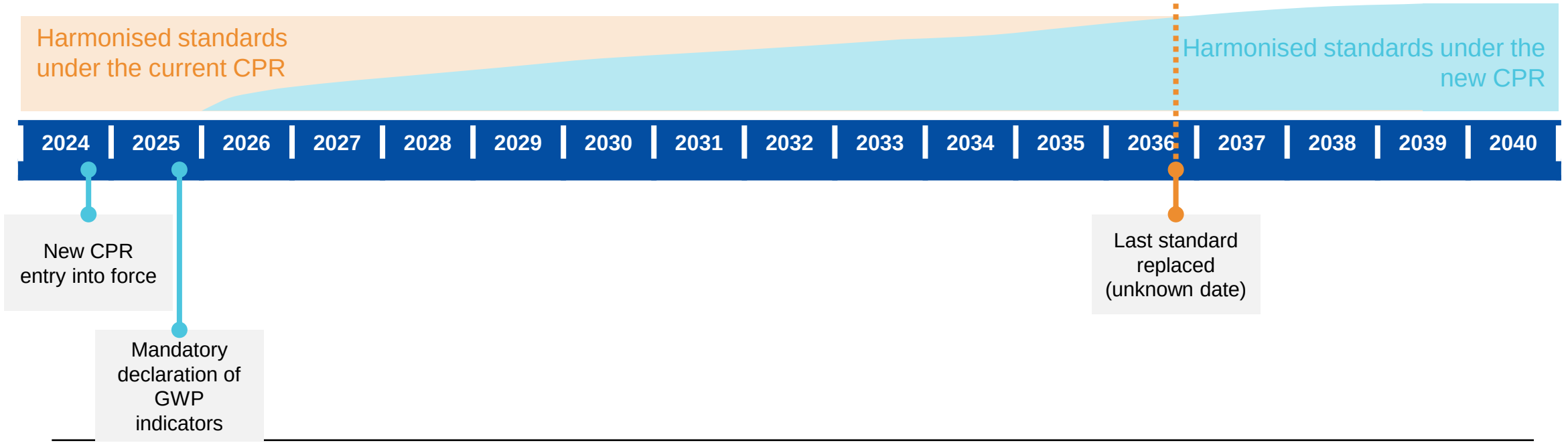


Rambol (2023) *Analysis of Life-Cycle Greenhouse Gas Emissions of EU Buildings and Construction.*

Quantification - CR_{total}

Use GWP-biogenic values in stages A1-A3 from EPDs adhering to EN15804+A2.

- Benefits of standardised assessment and reporting and 3rd party review
- CPR will eventually required this data for all construction products covered by harmonised standards.
- Emissions from transport (A4) and construction (A5) losses are covered under $GHG_{associated}$



Example

Potential environmental impact per m^2 of Hemp Fibre Insulation with 100 mm thickness

Parameter describing environmental impacts	PRODUCT STAGE				
	Raw material supply (A1)	Transport (A2)	Manufacturing (A3)	Sum of A1-A3	Transport to site (A4)
Global warming potential – fossil (GWP) [kg CO_2 eq.]	1.34E+00	3.85E-01	4.51E-01	2.18E+00	4.05E-03
Global warming potential – biogenic (GWP biogenic) [kg CO_2 eq.]	-4,4E+00	0	0	-4,4E+00	+4,4E+00*
Depletion potential of the stratospheric ozone layer (ODP) [kg CFC-11 eq.]	5.67E-10	5.18E-17	2.88E-10	8.55E-10	5.43E-19
Acidification potential (AP) [kg SO_2 eq.]	3.44E-03	3.24E-04	3.89E-04	4.15E-03	6.22E-06
Eutrophication potential (EP) [kg $(PO_4)^{3-}$ eq.]	3.81E-03	4.68E-05	3.86E-05	3.90E-03	1.20E-06
Formation potential of tropospheric ozone (POCP) [kg C_2H_4 eq.]	1.89E-04	-1.03E-05	3.75E-05	2.16E-04	1.14E-07

Quantification - $GHG_{associated}$

Requires further discussion

$GHG_{associated} = GHG_{total} - GHG_{baseline}$

\+ Fits requirements of regulation and in line with calculation of CR_{total}.

\- High administrative burden for all parties involved.

? If the biomass is sustainably harvested (according to Art 29 from RED), should the A1 phase not be zero-rated to be in line with the ETS and RED?

? How to reliably account for phase A4 and A5 if not included in EPDs?

Example

Environmental impact parameters - Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	4,26E+02	2,74E+00	6,08E+00	4,35E+02	1,50E+01	4,50E+01	8,07E-01	2,05E+00	-2,04E+01
GWP-biogenic	kg CO_2 eq.	-3,83E+01	2,36E-03	3,84E-01	-3,79E+01	2,63E-03	2,42E-02	3,06E+01	8,16E+00	4,27E+00
GWP-luluc	kg CO_2 eq.	6,78E-01	1,09E-03	1,15E-03	6,80E-01	4,90E-04	1,87E-02	1,06E-03	1,88E-03	-3,56E-03
GWP-total	kg CO_2 eq.	3,89E+02	2,75E+00	6,46E+00	3,98E+02	1,50E+01	4,50E+01	3,14E+01	1,02E+01	-1,62E+01

Quantification

Temporary net carbon removal benefit = $CR_{baseline} - CR_{total} - GHG_{associated} > 0$

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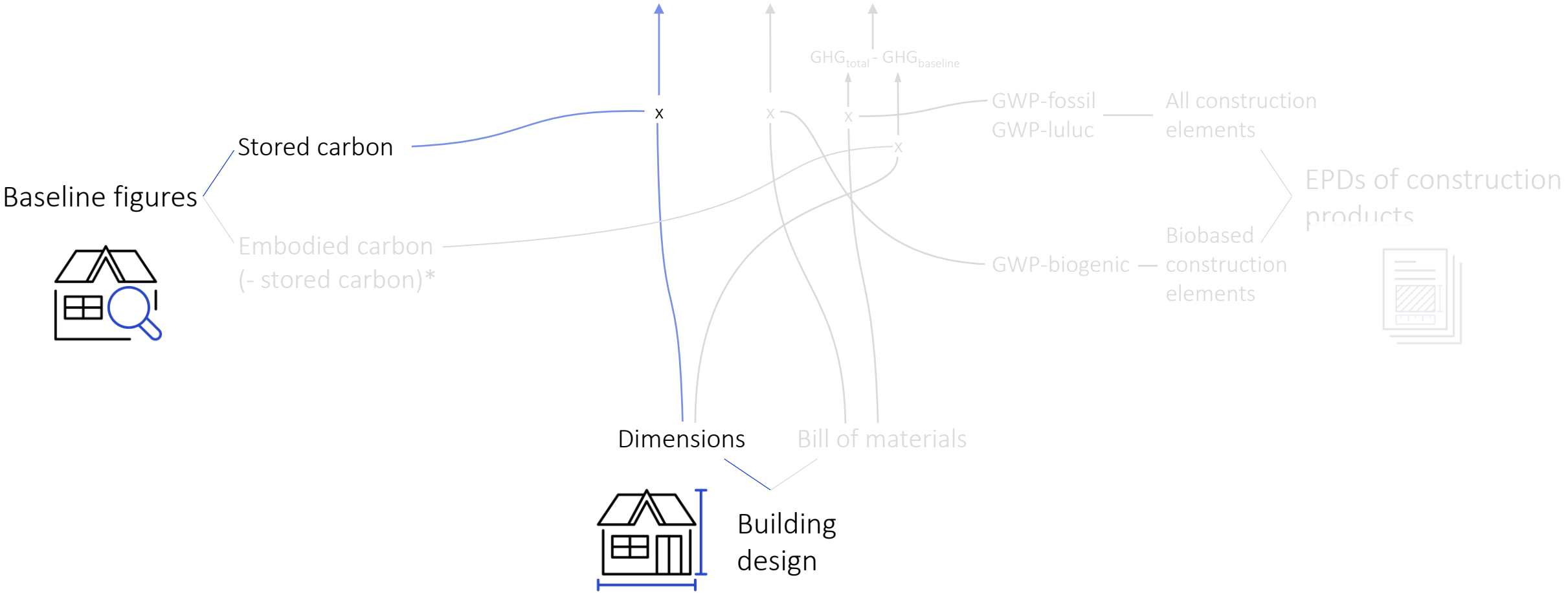

*Embodied carbon here refers to the total GHGs- the stored carbon

Quantification

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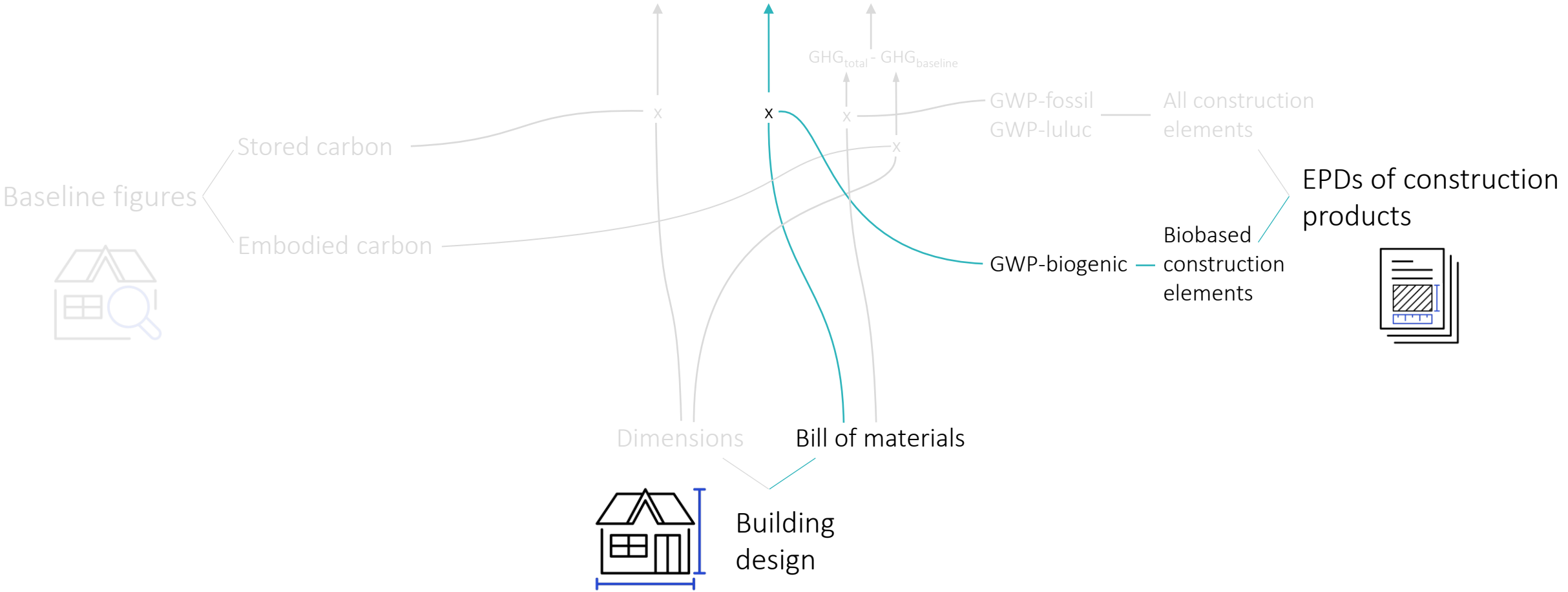

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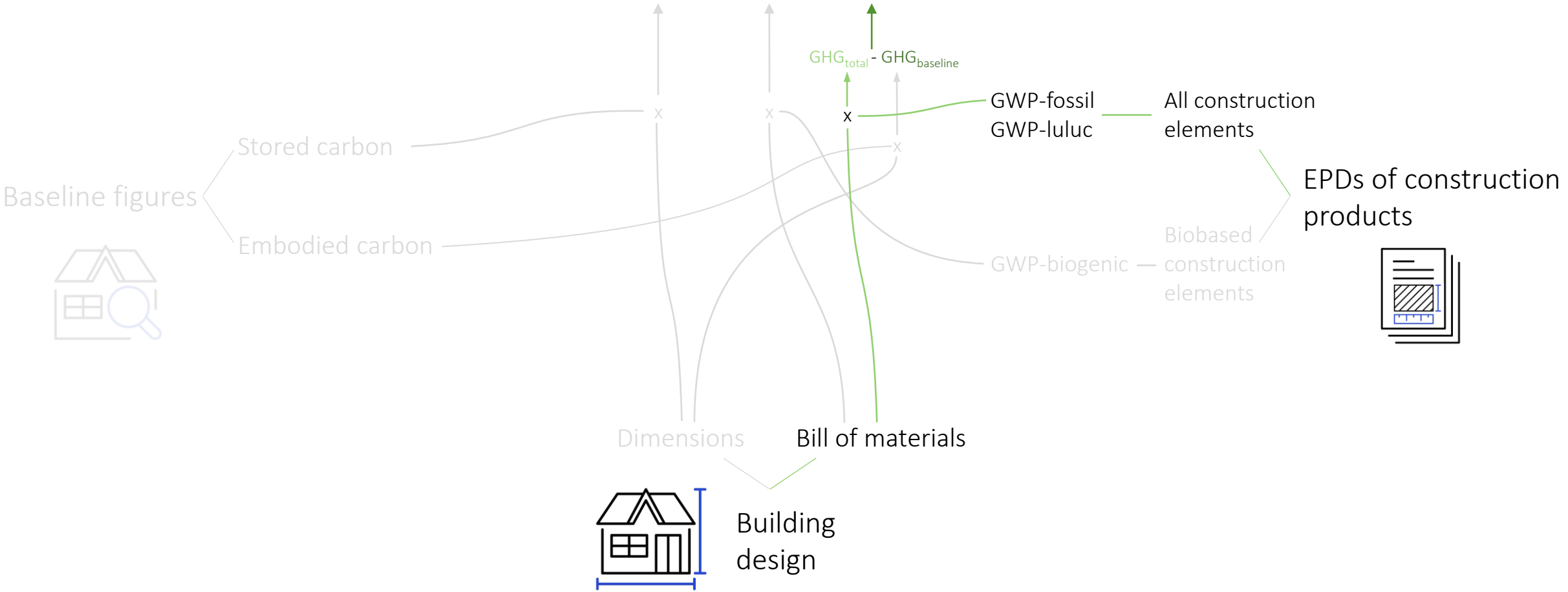
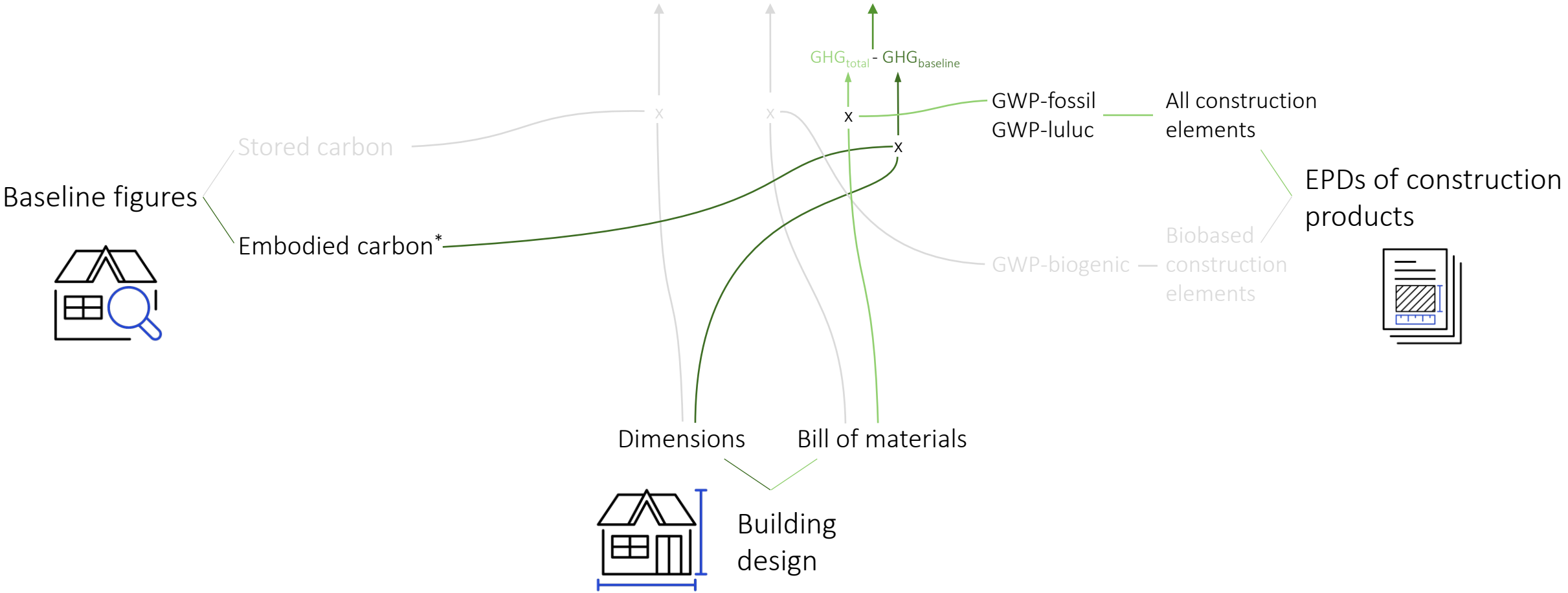


Icons created by Crf from Noun Project

Quantification

Temporary net carbon removal benefit = $CR_{baseline} - CR_{total} - GHG_{associated} > 0$



**Embodied carbon here refers to the total GHGs- the stored carbon*

Icons created by Crf from Noun Project

Uncertainty and long-term storage

Address uncertainty in data with deductions of certifiable carbon storage.

- Deductions = uncertainty in calculated amount of stored carbon.
- Deduct a percentage of the calculated amount to create a conservative estimate.
- ? How should this percentage be determined?

Use a buffer pool as collective insurance against unplanned releases.

- Buffer pool = uncertainty about long-term storage of the carbon.
- Set a percentage of the certified temporary storage units aside to indemnify creditors.
- ? Can insurance agencies be involved?

Sustainability

Align the minimum sustainability criteria with existing regulation and initiatives.

- Use Article 29 of RED III to as basis for the criterium ‘Protection and restoration of biodiversity and ecosystems’.
- The DNSH criteria from Taxonomy cover the same 6 environmental objectives.
- Level(s) covers 4 out of 6 objectives.

? How can requirements from Article 29 of RED III be translated to biomass for construction?

? How can thresholds and technical screening criteria of the DNSH criteria from the Taxonomy be used?

? Can indicators and assessment methodologies from Level(s) be used?

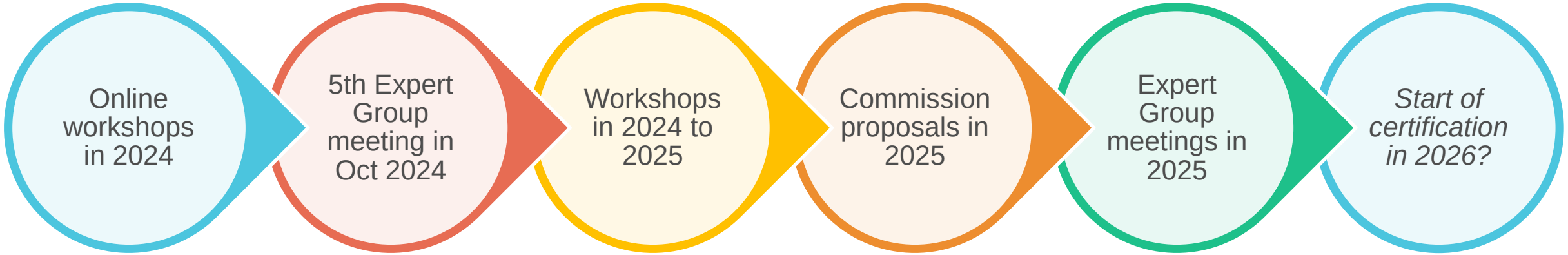
Main questions

1. Quantification: How can we balance practicality and completeness in calculation of $GHG_{associated}$?
2. Sustainability: How to incentivise circular design strategies and EoL practices?
3. Additionality: How to deal with uncertainty around additionality with standardised baselines?
4. Long-term: How to set the minimal lifespan for eligible construction elements?

Parting messages and conclusions

European Commission

Timeline



- First draft methodologies
- Drafts on verification and registry rules

- Workshops on novel removals
- Financing options for removals

- Delegated acts for first certification methodologies
- Implementing acts for verification and registry rules

- Development of further certification methodologies

European Commission

Events up to October

18 April	Commission publishes **call for proposals for Mission Soil** WP2024 (applications 8 May – 8 October); Infoday on 25 April
	Continuing discussion in **CREDIBLE** Focus Groups on carbon farming https://www.project-credible.eu/get-involved)
June	Online workshop for **Biochar**
19 June	Kick-off event on second study on ETS options for agrifood value chain
July	Online workshop for **peatlands**
September	Online workshop on **agriculture and forestry**
September	Online workshop on **bio-based buildings**
September	Stakeholders workshop on rules for **verification and registries**
First half October	Publish input papers for expert group meeting
Week of 21 October	**EXPERT GROUP MEETING**