Today's agenda

- **Introduction to Nordic Harmonization of LCA** – Maria Tiainen, Finnish Ministry of the Environment
- **Introduction to webinar and project overview**– Morten Ryberg, Sweco DK
- **Findings and recommendations**
  - **LCA practice and regulations on the Nordic countries** – Kai Kanafani, BUILD
  - **Key variables for setting limit values and recommendations on a process for setting and following limit values for buildings**– Maria Balouktsi, BUILD
  - **Recommendations for environmental building stock monitoring** – Nicolaj Langkjær, Sweco DK
- **Q&A and next steps** – Morten Ryberg, Sweco DK

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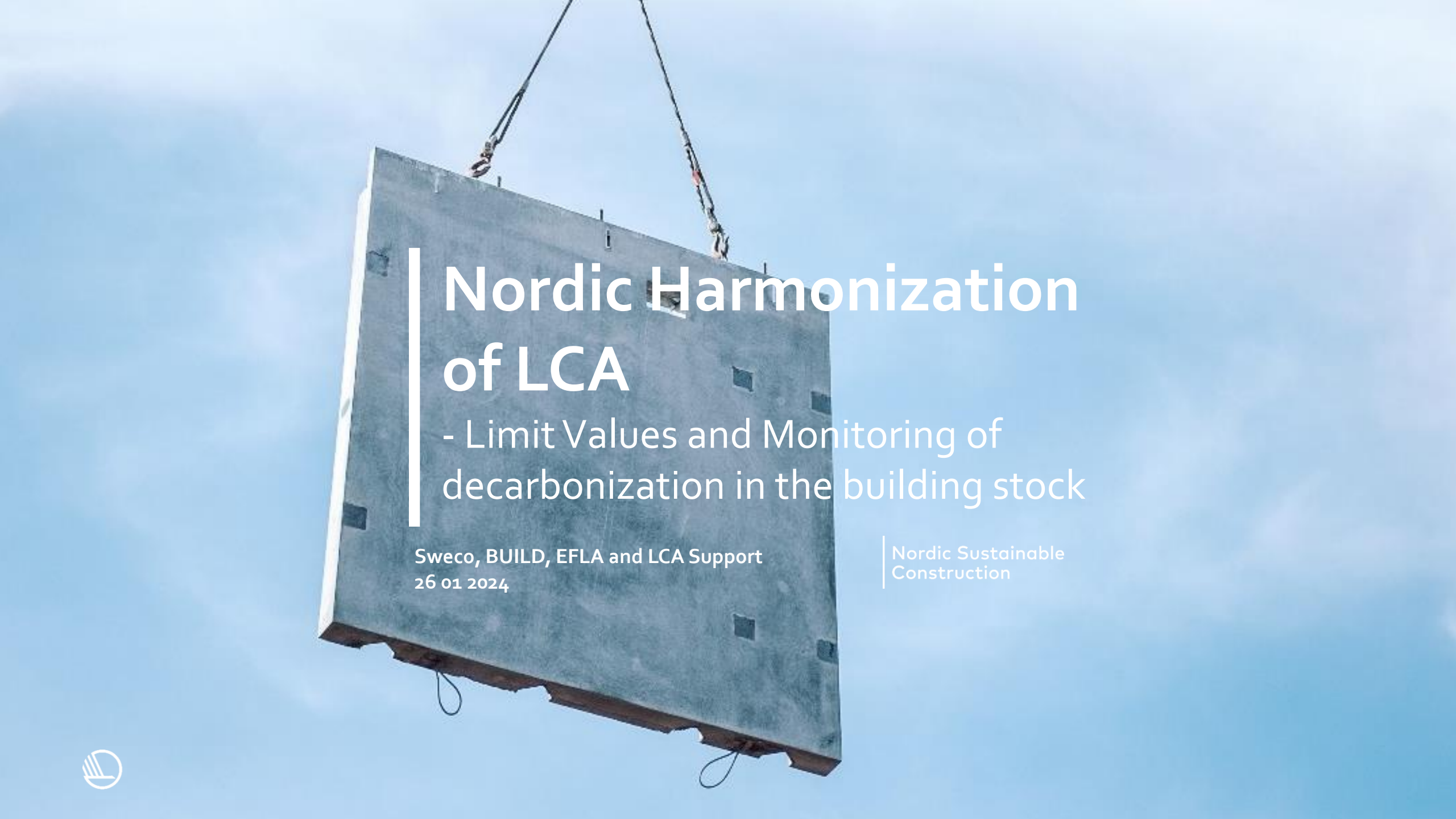

Nordic Harmonization of LCA

- Limit Values and Monitoring of decarbonization in the building stock

Sweco, BUILD, EFLA and LCA Support
26 01 2024

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Practicalities

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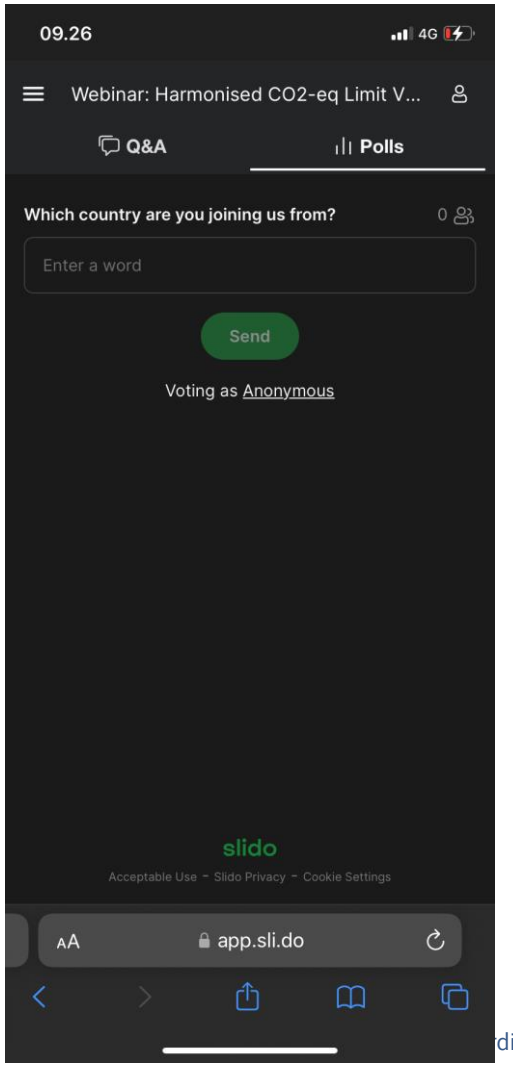

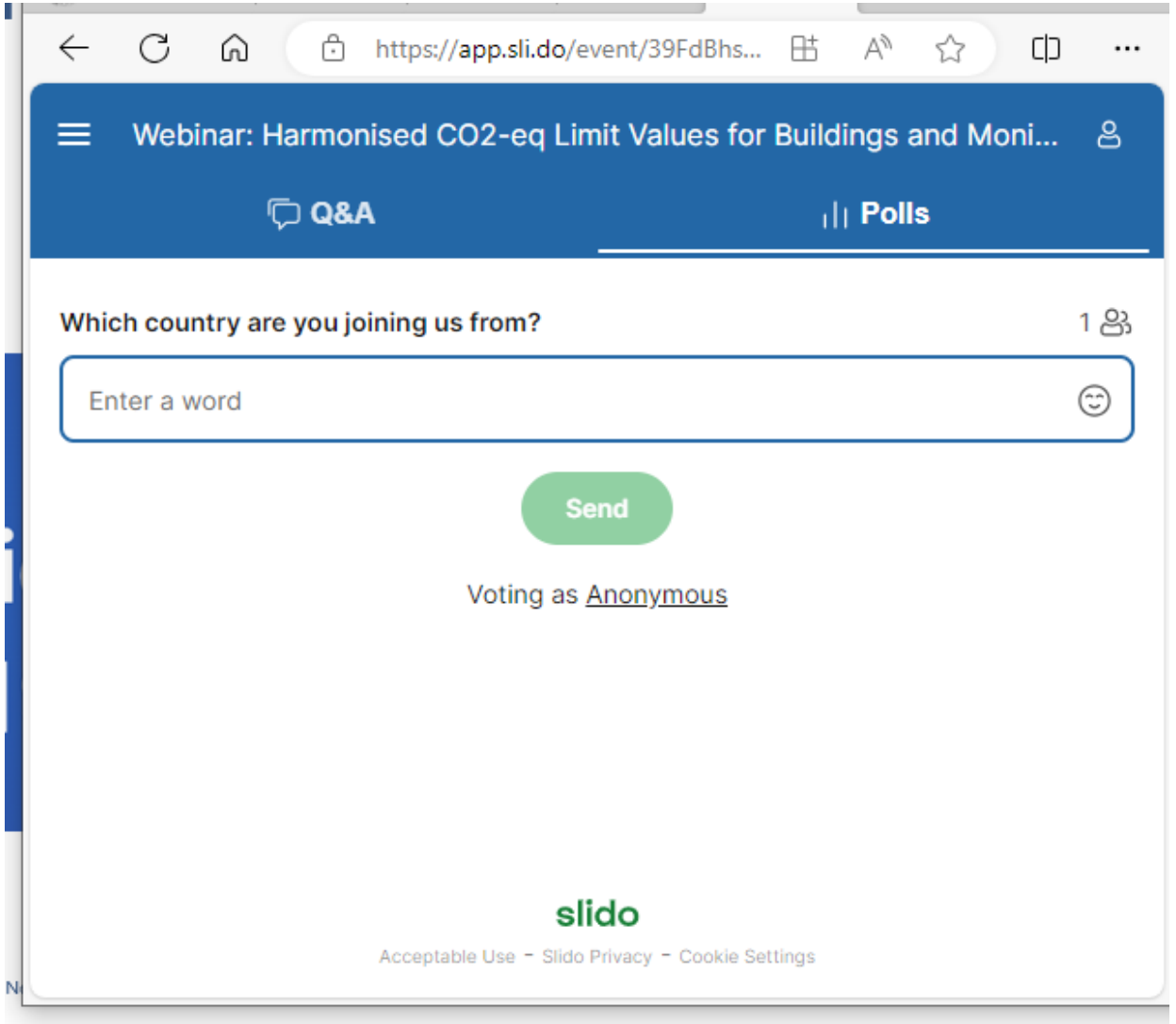

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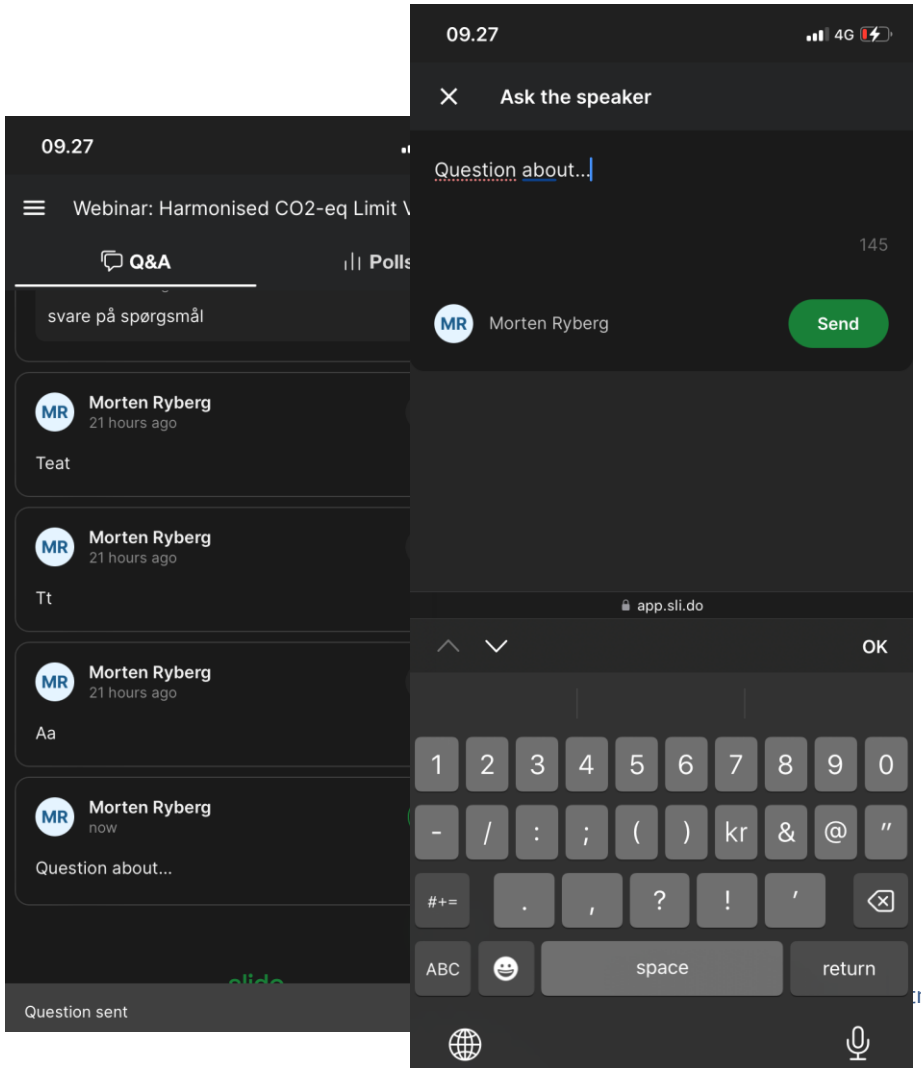

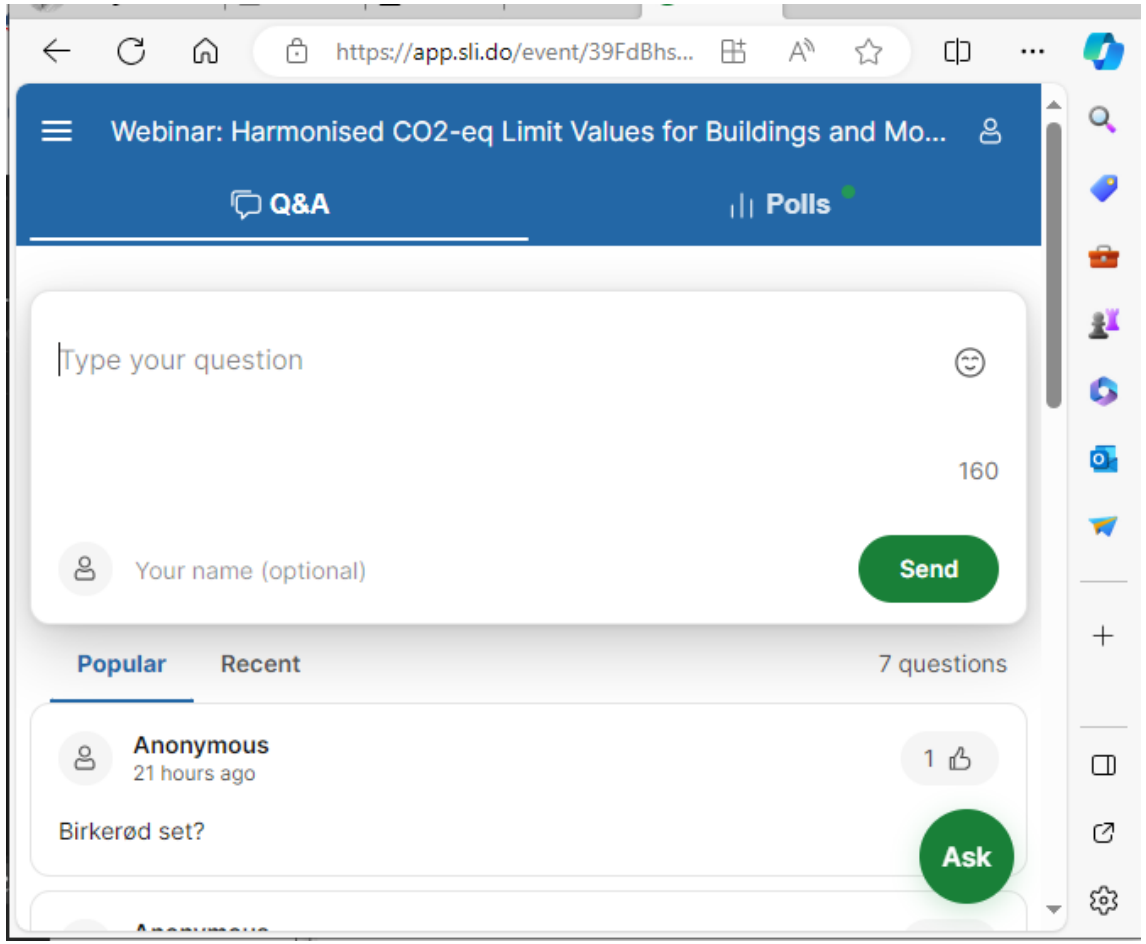

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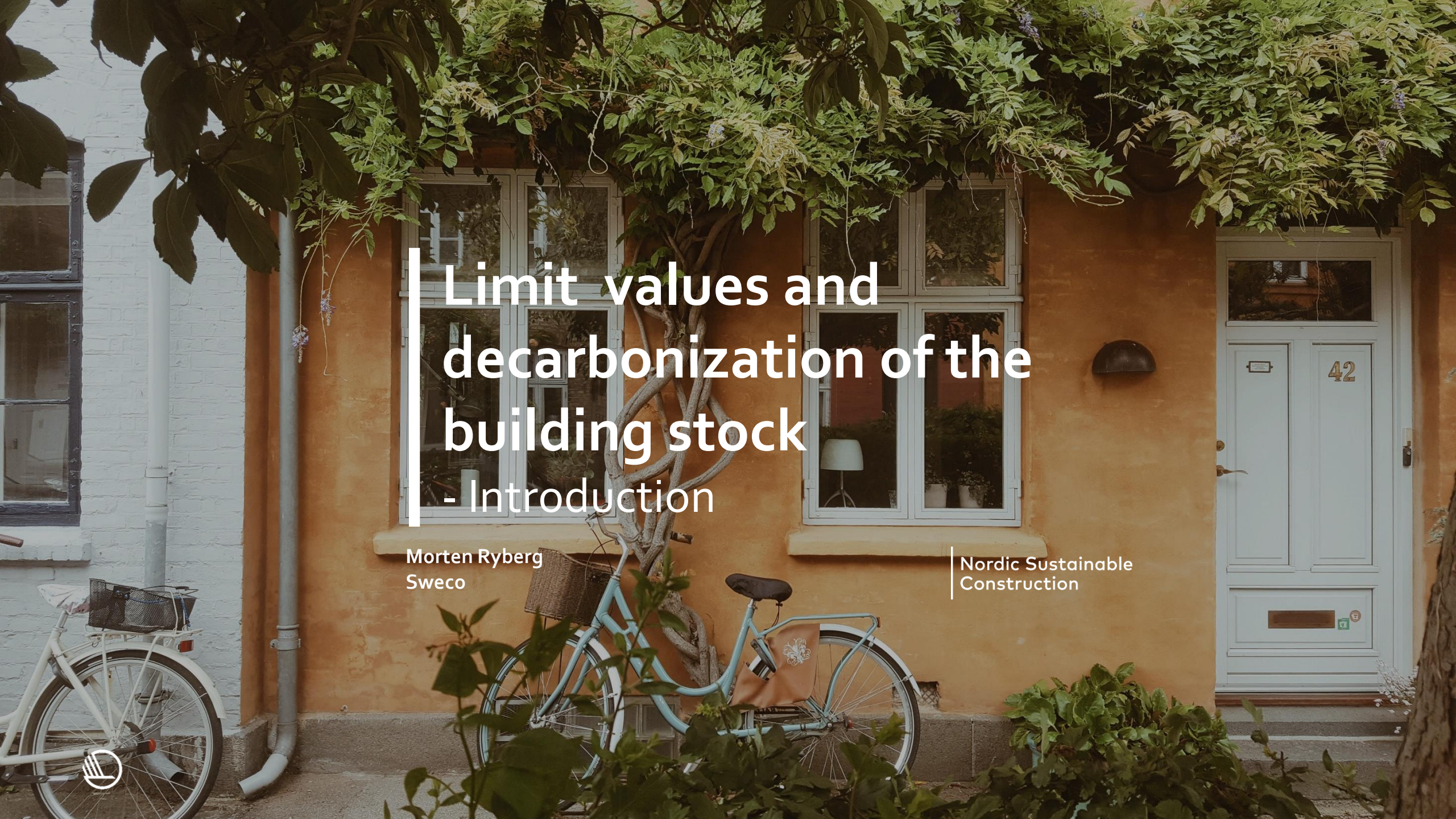

Limit values and decarbonization of the building stock

- Introduction

Morten Ryberg
Sweco

Nordic Sustainable Construction

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Nordic Harmonisation of LCA

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1

Analysis of Nordic LCA-practices

2

Data for LCA

3

BIM for LCA - calculating the climate impact of buildings through digitalization

4

GHG limit values and reporting of the decarbonization of the Nordic building stock

Task 4 Overview

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4.1

Setting and assessing limit values

Analysis of the different regulatory needs and LCA requirements

Analysis of variables that impact limit values

Recommendations for an optimal process for setting and following limit values for buildings

4.3

Report on monitoring decarbonization of the building stock

Approaches and recommendations for monitoring the decarbonization

Recommendations for setting limit values to incentivize decarbonization of properties

4.2

Process for monitoring the decarbonization of the building stock

Analysis of policies and methods for setting decarbonization goals

Utilization of statistics and data for monitoring building stock carbon emissions

Recommendations on process for monitoring decarbonization of the building stock

Overall Project Timeline

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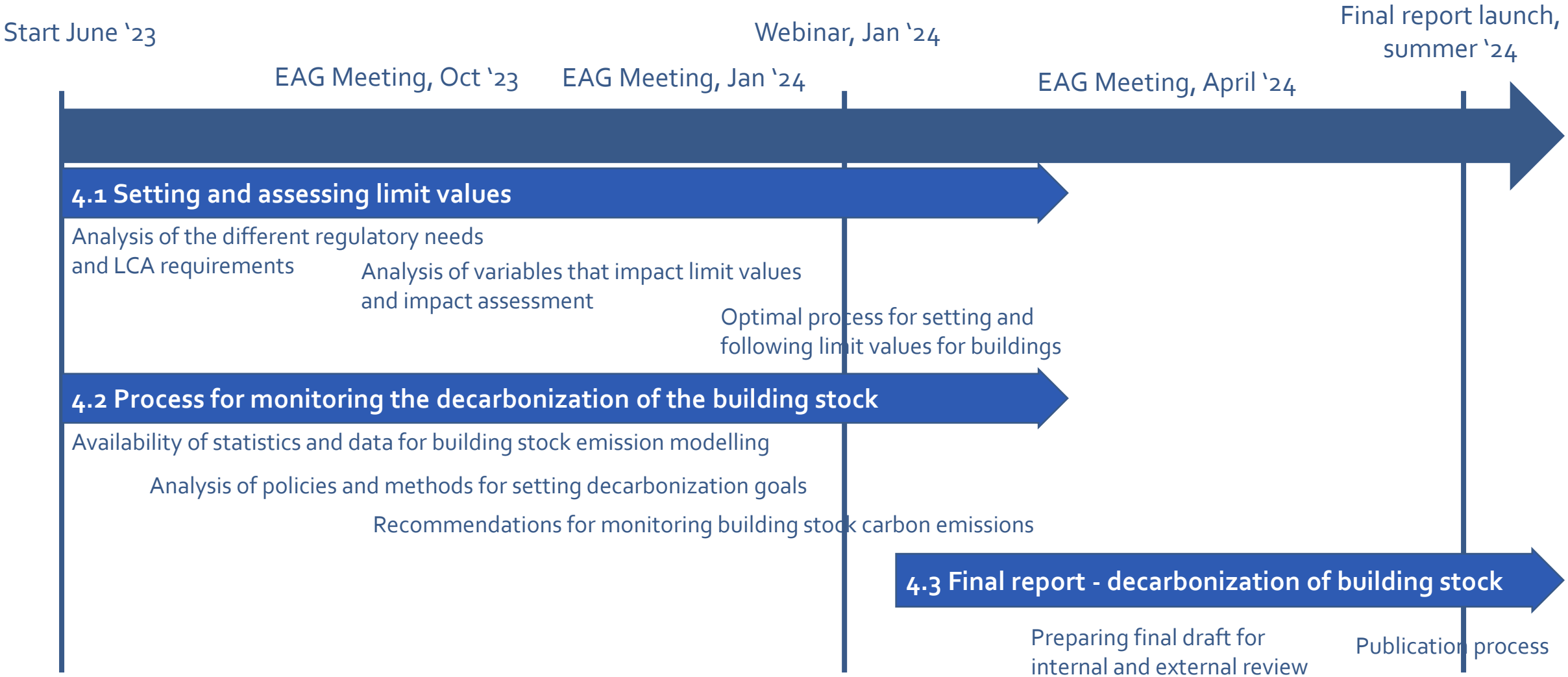

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TASK 4.1

- LCA methods and limit values

Kai Kanafani & Maria Balouktsi
BUILD AAU

Nordic Sustainable Construction

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WP1 WP2 WP3 WP4 WP5

Nordic Harmonization of Life Cycle Assessment

Task 1 Task 2 Task 3

Task 4

Limit Values And Reporting

Task 4.1 Task 4.2 Task 4.3

Setting And Assessing Limit Values

Task 4.1 A

Regulatory Needs

Task 4.1 B

Influential Variables

Task 4.1 C

Recommendations

Task 4.1 D

Impact Assessment

Task 4.1 A

Current approaches and harmonization potential

- Current status and roadmap for building carbon regulation
- National LCA definitions
- Preconditions for carbon regulation

Legislation schedule

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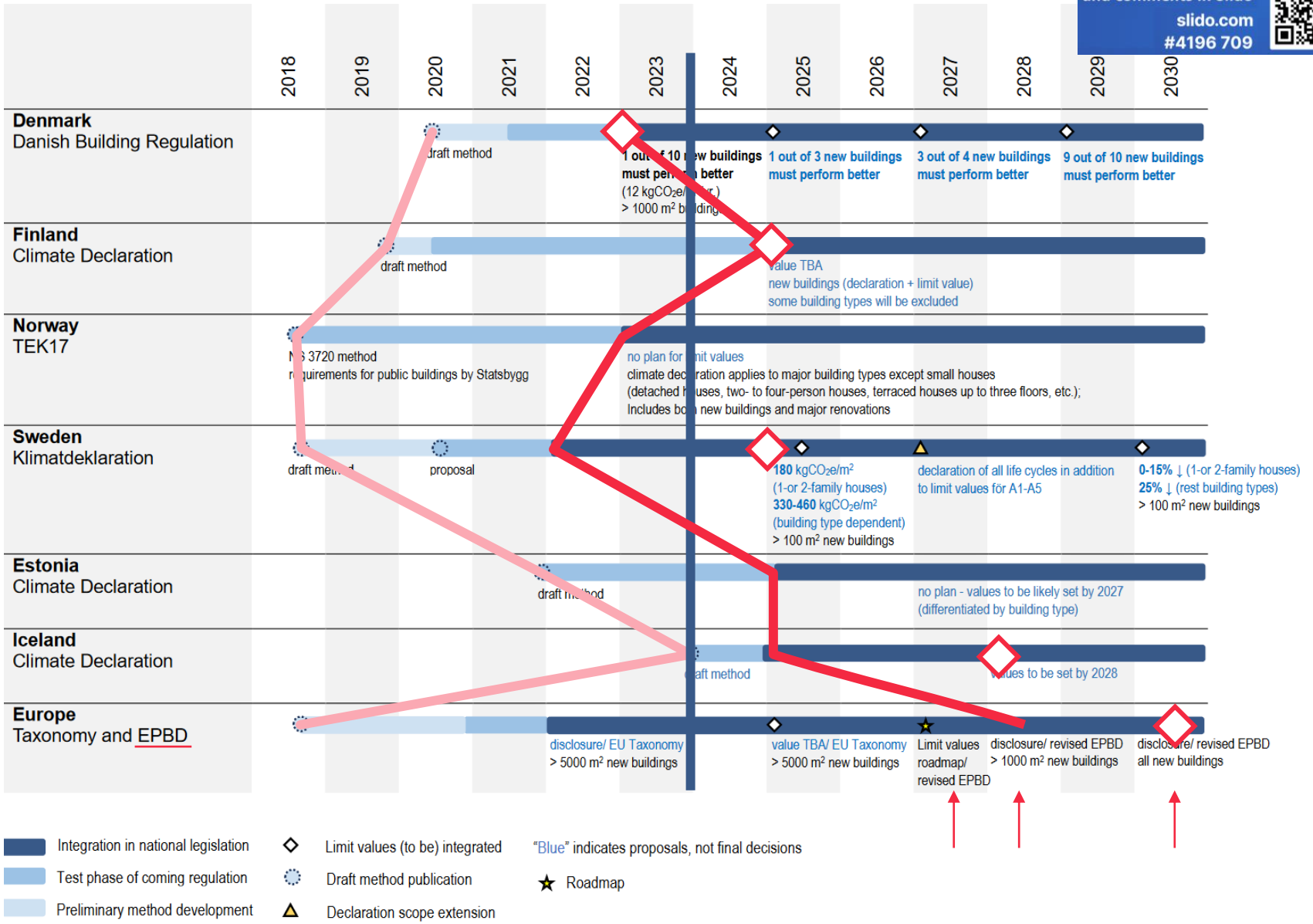


Buildings covered

BUILDING TYPE	DENMARK	ESTONIA	FINLAND	ICELAND	NORWAY	SWEDEN	
	BR18	Proposed climate declaration	Proposed climate declaration + limit value	Proposed climate declaration	TEK17	Proposed limit values 2025 (likely in line with climate declaration 2022)	Climate declaration 2027 (Boverket's proposal)
SINGLE-FAMILY HOME	✓ 4	-	-	✓	-	✓1	
OTHER RESIDENTIAL BUILDING	✓ 4	✓	✓	✓	✓	✓1	
OFFICE	✓ 4	✓	✓	✓	✓	✓1	
RETAIL AND RESTAURANT	✓ 4	✓	✓	✓	✓	✓1	
SCHOOL AND DAYCARE	✓ 4	✓	✓	✓	✓	✓1	
LABORATORY	✓ 4	✓	✓	✓	✓	✓1	
HOSPITAL AND HEALTH	✓ 4	✓	✓	✓	✓	✓1	
SPORTS FACILITIES	✓ 4	✓	✓	✓	✓	✓1	
CULTURAL AND OTHER PUBLIC	✓ 4	✓	✓	✓	✓	✓1 (some public authorities are exempted)	
RELIGIOUS	✓ 4	-	✓	✓	✓	✓1	
INDUSTRIAL	✓ 4	-	-	✓	✓	-	-
SUMMER COTTAGES	-	-	-	-	✓3	✓1	
OTHER	✓ 4	✓	-	✓	✓	✓1	
RENOVATION PROJECTS	-	-	-	✓2	✓	-	✓2
SIZE OF BUILDINGS	**2023-2025:** > 1000 m² **From 2025:** under political negotiation	unspecified	no size requirement, just building type	unspecified, buildings under scope classes 2 and 3 in BR	no size requirement, just building type	> 100 m²	-

LIMIT VALUE SCOPE
CLIMATE DECLARATION SCOPE
PROPOSED LIMIT VALUE SCOPE
PROPOSED CLIMATE DECLARATION SCOPE

✓= included

1) Exceptions apply
2) When building permit is needed (additional exemption rules for Sweden)
3) Included when in blocks
4) Only buildings subject to energy requirements

Compliance system

	DENMARK	ESTONIA (PROPOSED)	FINLAND (PROPOSED)	ICELAND (PROPOSED)	NORWAY	SWEDEN
TECHNICAL COMPLIANCE CONTROL	10% of cases checked	Not decided yet	Not decided yet	Not decided yet	Yes	10 % of cases checked
EXTERNAL VERIFICATION	No	Not decided yet	Not decided yet (possibly BIM file)	Not decided yet	No	No
REPORTING STAGE	As-built	Building permit	Building permit + As-built	Building permit + As-built	As-built	As-built
PUBLIC BUILDING LCA REGISTER	No	Not decided yet	Not decided yet	Not decided yet	No	Yes

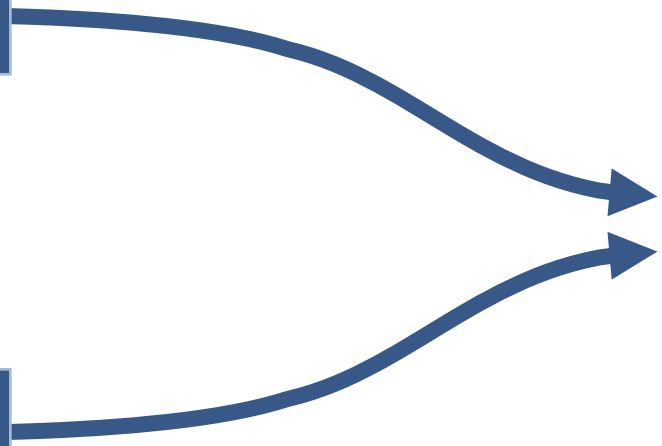
Carbon limit approach

Target approach (top-down)

Panetary boundary for Climate Change
National sector-specific carbon budgets

Empirical approach (bottom-up)

Observation of best practice (case sample / archetypes)
Trajectory based on observed distribution



Limit value trajectory

Examples of target-based initiatives:
Reduction Roadmap (DK)
DG Environment report (EU)

Selected technical variables

Reference unit

Varies considerably

Bound to existing building regulations

DK: Area correction for adjacent spaces

EU/Level(s) requires Usable Floor Area (UFA)

Scenario-based climate data

All countries propose to use future scenarios for module B6 (also required by Level(s))

No country proposes this for other modules (e.g. B4)

Energy exported to grid

Included in DK (module D), FIN (Handprint)

SWE: Declared separately, since B6 is lacking

EU/Level(s): Exported energy in module D

Readiness

How to enable the industry to perform compliant LCA?

1) Experience, competence, education
2) Precedence, voluntary schemes
3) Available data infrastructure

SCOPE

Life cycle

NO/SWE omit EoL stages

DK/FIN/IS include biogenic carbon

All lack some use-stage modules

EU/Level(s) require full scope

Building and processes

FIN/SWE omit site preparation and evt. deep foundations

SWE omits services in small buildings

FIN/SWE include fixed furniture

DATA INFRASTRUCTURE

Generic module impacts

Novel modules A4-5, C1-2 (FIN, EST, DK*)

Allowed for as-built reporting (all: Yes)

Generic inventory data

Material quantity and design (DK: informative)

Product service life (FIN, EST, DK)

Generic impact data

Construction products (FIN, EST, SWE, DK)

Building services (DK)

Transport processes (DK*, FIN, SWE)

A5 energy or waste (EST, FIN, NO, SWE, DK*)

Calculation tools

Pivotal role of tools in all countries

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Nordic Harmonization of Life Cycle Assessment

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Limit Values And Reporting

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Recommendations

Task 4.1 D

Impact Assessment

Task 4.1 B

Analysis of variables

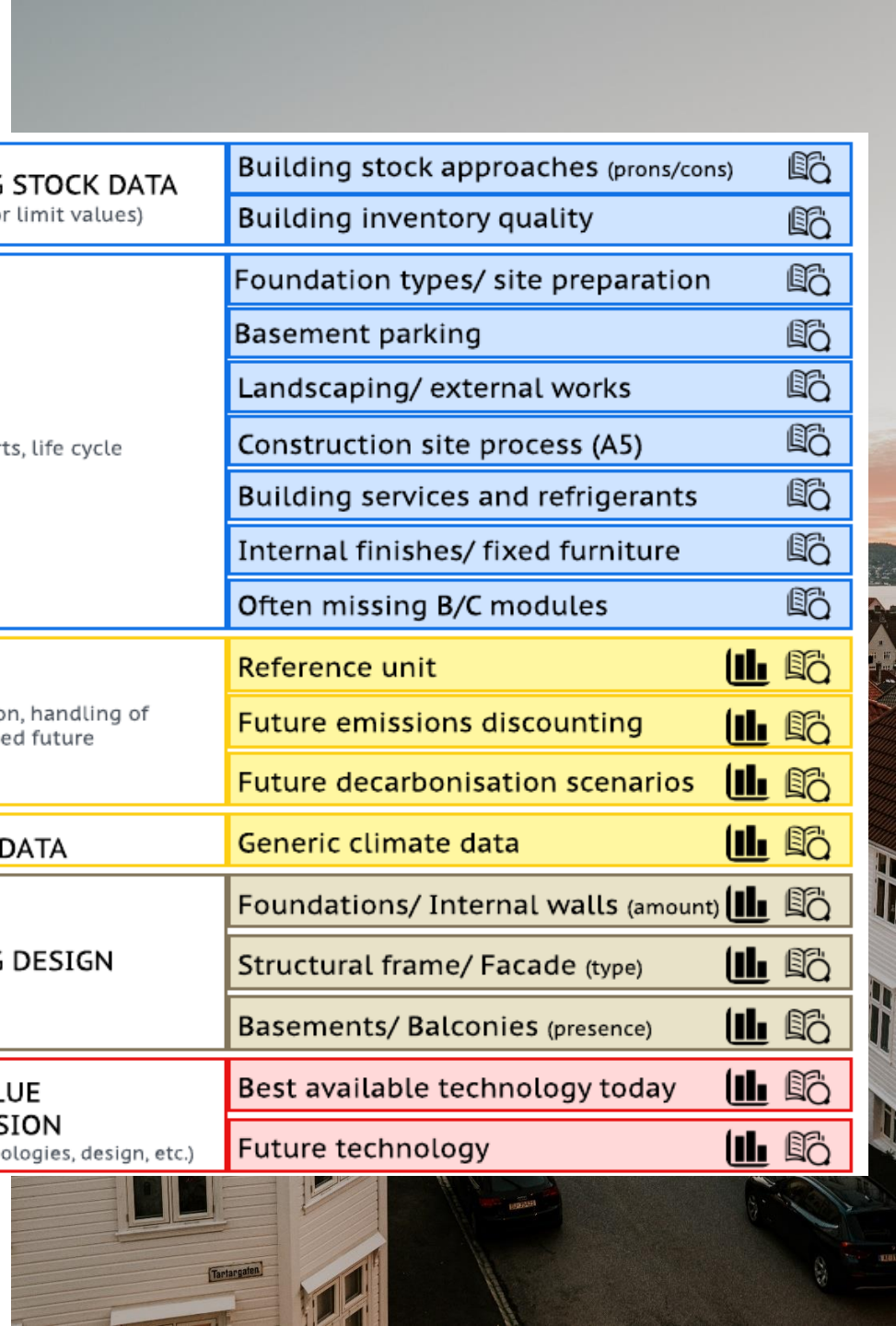
Literature study on existing limit value reports

Existing limit value reports from Nordic countries and some other European countries to collect the parameters/variables identified as having a notable influence in each context

Parameter analysis

performed with two generic case models, based on a typical apartment building and a detached home. Base: real cases, adjusted to represent more straightforward and simple models

BUILDING STOCK DATA (as a basis for limit values)	Building stock approaches (prons/cons)
	Building inventory quality
SCOPE (building parts, life cycle processes)	Foundation types/ site preparation
	Basement parking
	Landscaping/ external works
	Construction site process (A5)
	Building services and refrigerants
	Internal finishes/ fixed furniture
	Often missing B/C modules
METHOD (normalisation, handling of scenario-based future processes)	Reference unit
	Future emissions discounting
	Future decarbonisation scenarios
CLIMATE DATA	Generic climate data
BUILDING DESIGN	Foundations/ Internal walls (amount)
	Structural frame/ Facade (type)
	Basements/ Balconies (presence)
LIMIT VALUE PROGRESSION (future technologies, design, etc.)	Best available technology today
	Future technology



Building stock data for first generation limit value(s):

two broad approaches for creating a building data base

	Sampling/ Real buildings	Archetype
Cases sample needed	**Large**, necessary for validity	**Small**, only needed for verification
Systematic error probability	**Low**, due to specific case analysis	**High**, due to complex theoretical modelling
Parameter control	**Low-moderate**, large samples allow varying the emission data and the share of cases with certain properties (i.e. structural frame) depending on the depth of data available	**High**, building specifications can be changed at will, though requiring high technical expertise
Suitability for as-is analysis of the building stock	Without mandat. declarations: **Low-moderate**, representativity depends on case number and selection, related national statistics needed With mandat. declarations: **High**, due to a complete sample	**Low-moderate**, representativity depends on data input
Suitability for developing building stock scenarios or top-down target-based limit values	**Moderate**, depending on available best practice cases, however difficult to isolate cause/effect of parameters Optional: emission data and case selection (i.e. structural frame) allow scenarios	**High**, due to high parameter control, though requiring high technical expertise

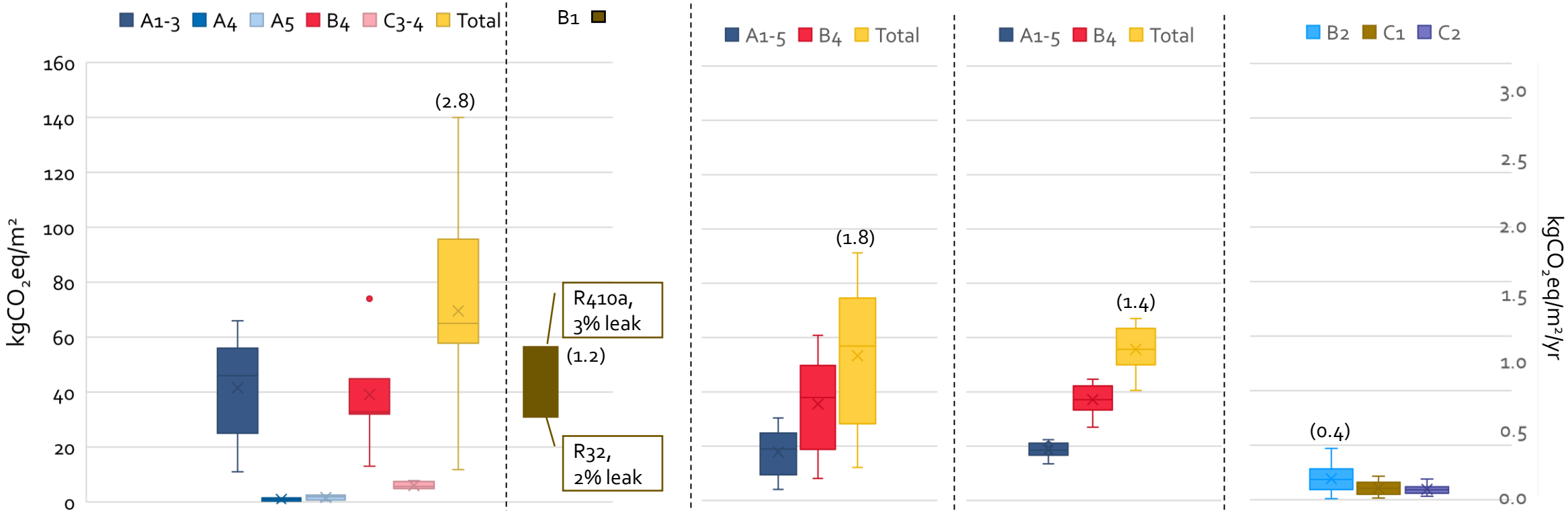
Scope context- and location-specific aspects

EXAMPLES OF MAXIMUM CONTRIBUTIONS INDICATED IN NATIONAL STUDIES (dependent on scope and building type)	Max contribution (%)	Max absolute impact ($kgCO_2e/m^2/yr.$)	Country (report)
1. Deep foundations/ Soil stabilisation *Should the limit value influence suitable construction locations / zoning?*	*up to* **30%**	**> 4**	FI (Bionova report, 2021)
2. Basement parking *Should the limit value affect available parking space?*	*up to* **17%**	**> 1.7**	DK (BUILD 2023:21)
3. External works/ Landscaping *Should the limit value affect landscaping and infrastructure?*	*up to* **28%**	**> 3**	NO (ZEN report, 2021)
4. Construction site (A5) *Should the limit value interfere with site conditions?*	*up to* **18%**	**> 1.7**	DK (BUILD 2023:14)

Significant influence on total GWP, but what aspects should the limit value affect?

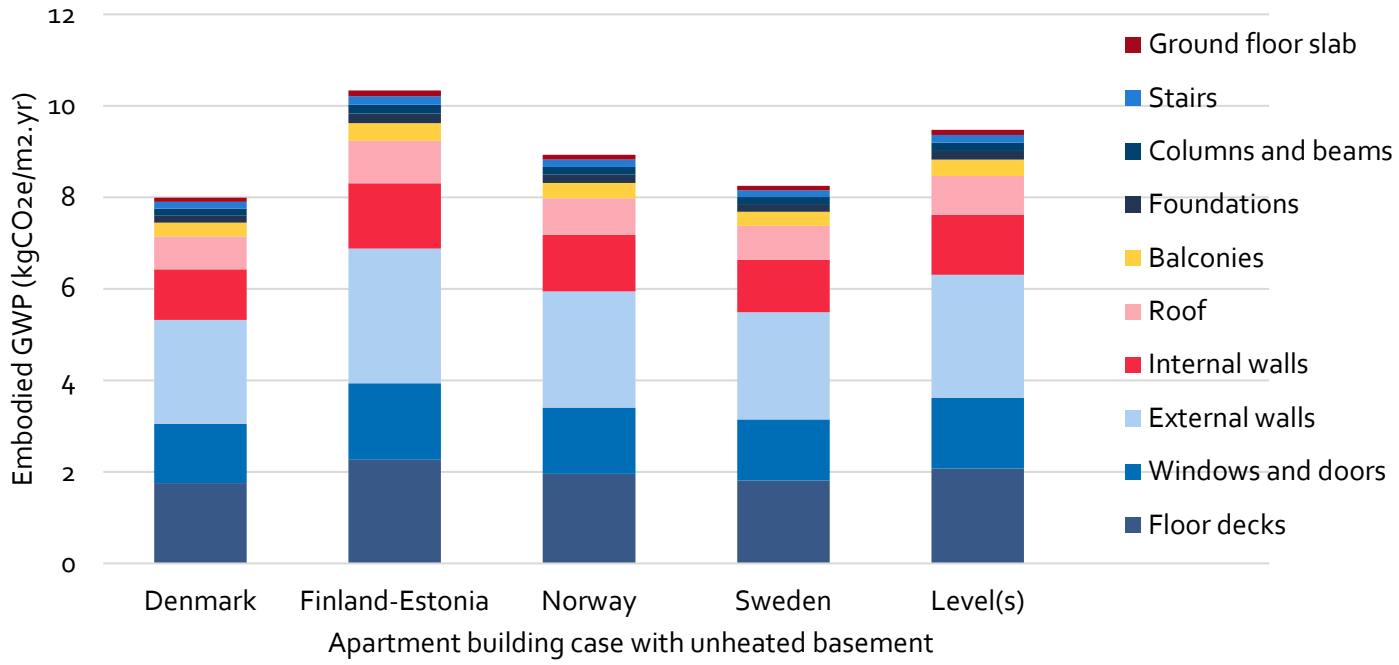
Scope Often missing building parts and B/C modules

- Excluding replacements (B4) in the scope undermines the relevance of certain building items
- Refrigerant leakage (B1) can significantly increase the contribution of building services to buildings' whole life impact



Method Reference area unit

- Big differences, implications for basements, balconies, etc.
- normalizing results per resident or building user could help account for how efficiently the space is used



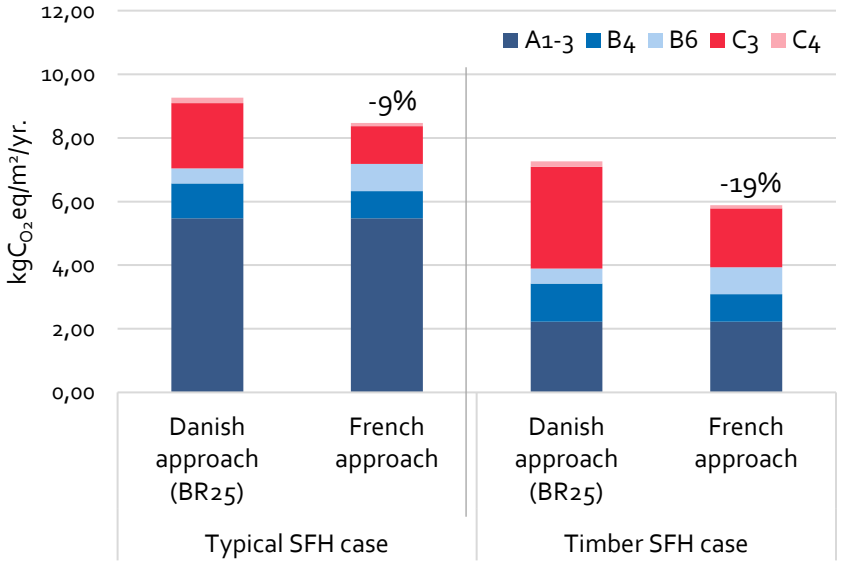
LCA results normalized (scope, data) using different reference area units; Nordic countries & LEVEL(s)

Method Approach to future scenarios (B and C modules)

A shift towards more dynamic considerations are discussed in some countries…

A. Future emissions with simplified discounting :

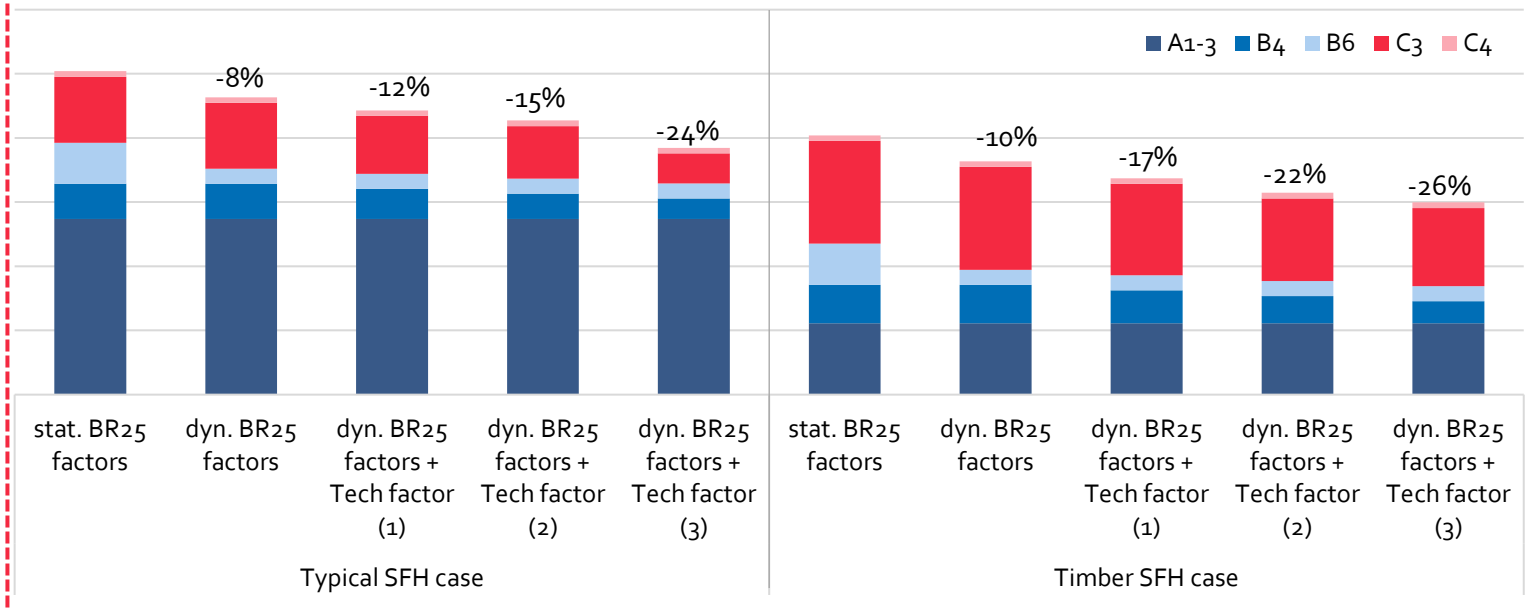
- ~10-20% lower LCA result when simplified discount factors are applied
- promotes use of wood as C3 impacts (+1) are also discounted



Application of the French simplified discount factors as an example

B. Future emissions with material type specific decarb. scenarios :

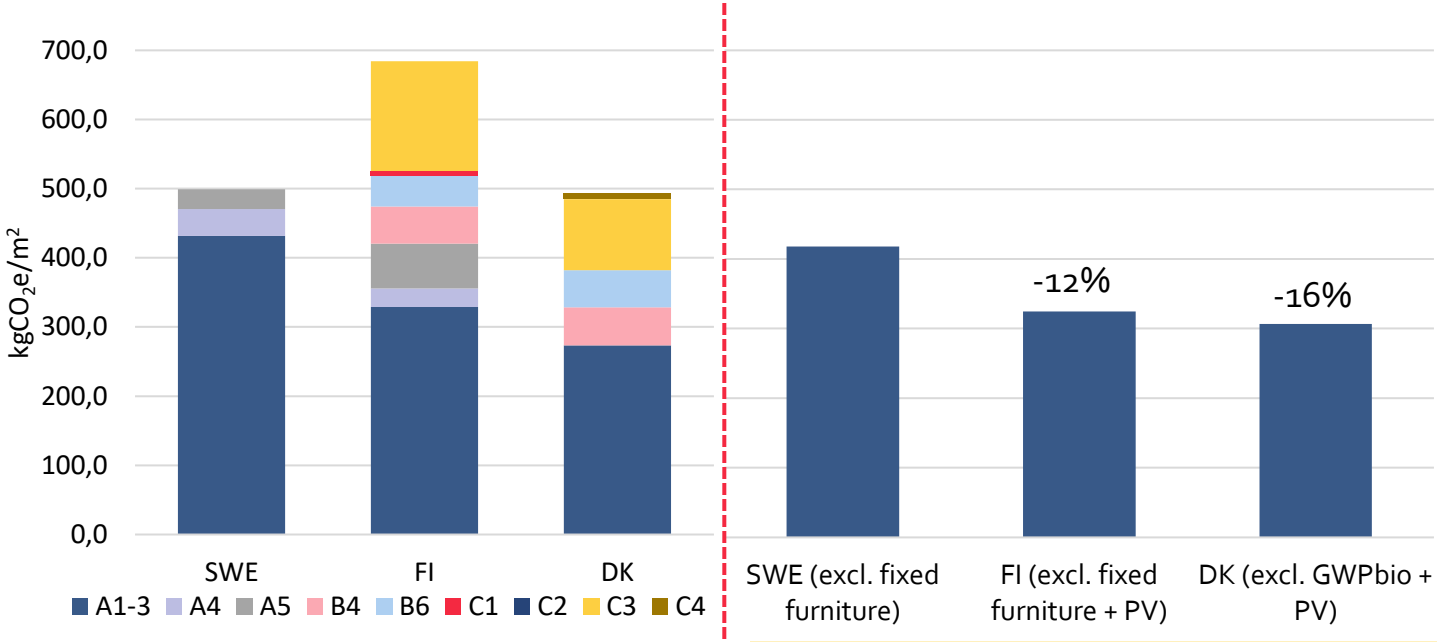
- Up to ~ 25% lower LCA result when considering the most ambitious future decarb. for both operational and embodied part (B4, C3 of non-wood products)
- more product-neutral method ,-1/+1 method for wood is preserved



Application of technological factors (from literature) per broad product category

Climate Data

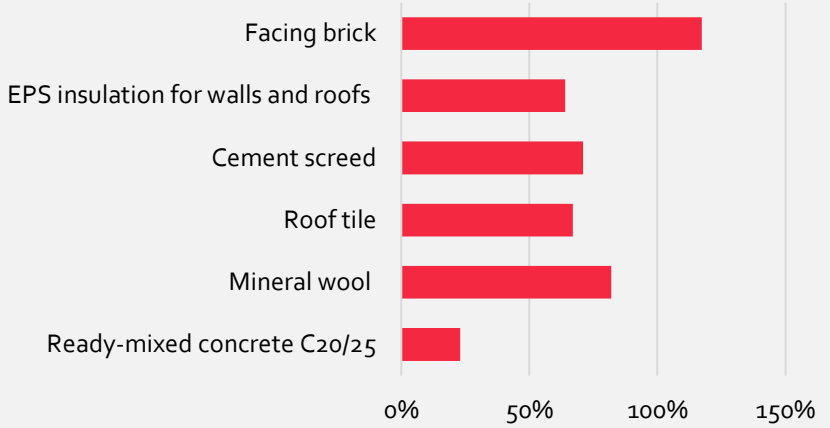
- Even if Nordic countries were using the same assessment scope and method, **comparability is still hindered by differences in data**
- **Great variations in some values used for similar products in national gen. databases** – reflect differences in conservative factors, background data, or actual differences in the products



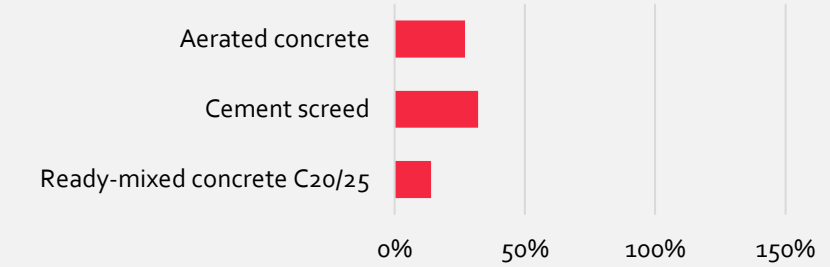
National scope/Typical SFH case
(adj.: same reference unit)

A1-3 scope/Typical SFH case
(adj.: same building parts, same indicator)

Examples of notable differences between SWE and DK (new) gen. product impact data

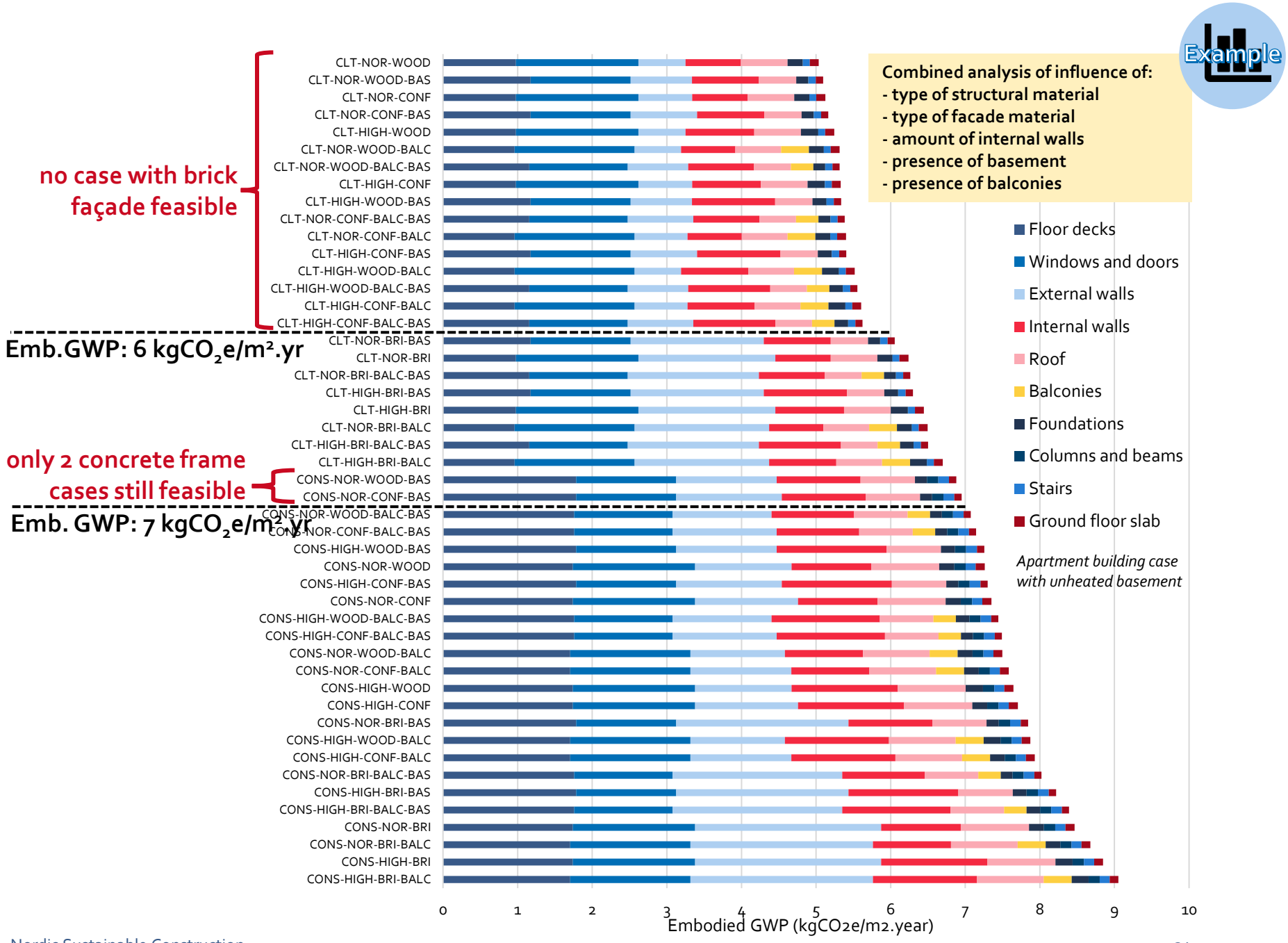


Examples of notable differences between SWE and FI gen. product impact data



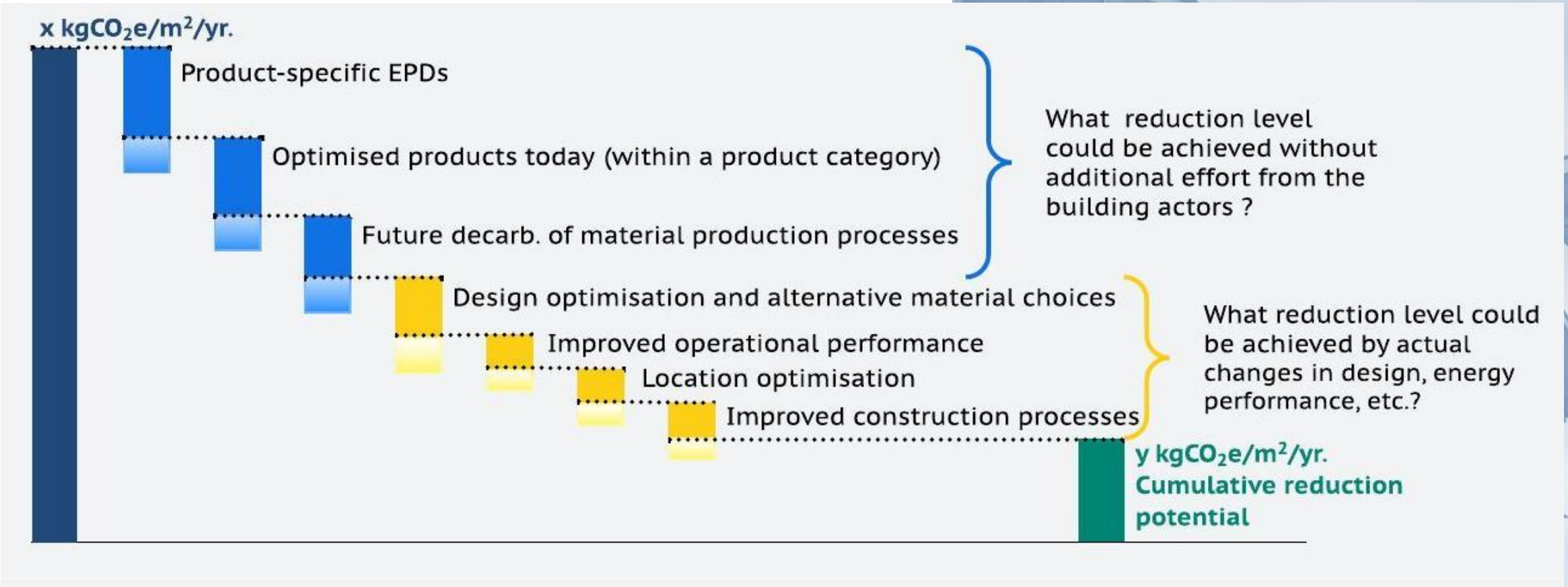
Building Design

- **presence of a basement leads to lower emissions per m² in cases with high emissions,** *and slightly higher emissions per m² in cases with low emissions.*
- **Structural frame and façade choices become constrained with tight limit values,** *not considering future material decarbonization opportunities*

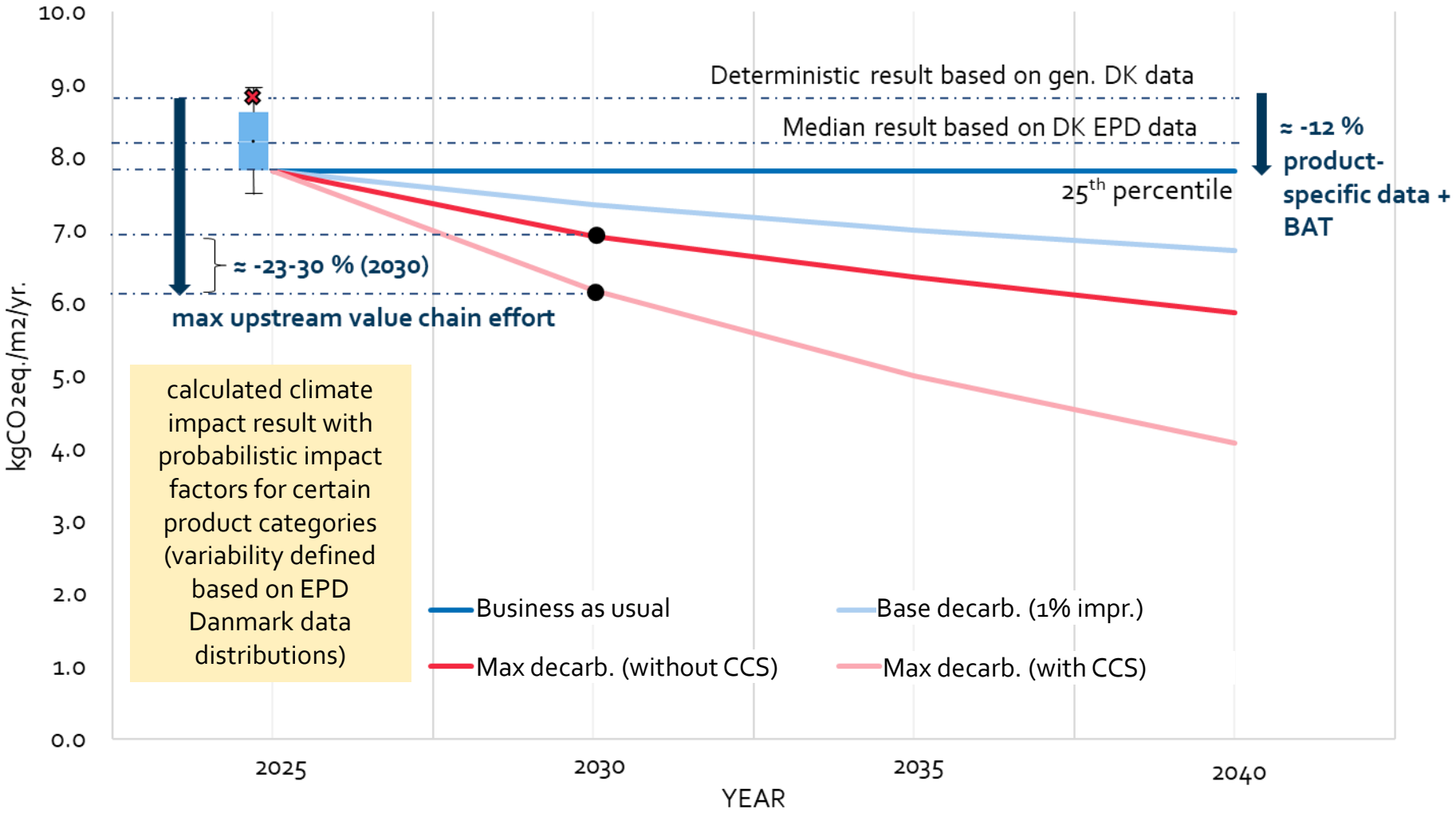


Carbon Limit Progression

How much can limit values be tightened?



Possible reduction with no great effort



Today's best available technology must be seen as the typical practice in the future construction – needs to be reflected in the limit value progression

Illustrative example: Progression of embodied GWP of a typical Danish single-family house case

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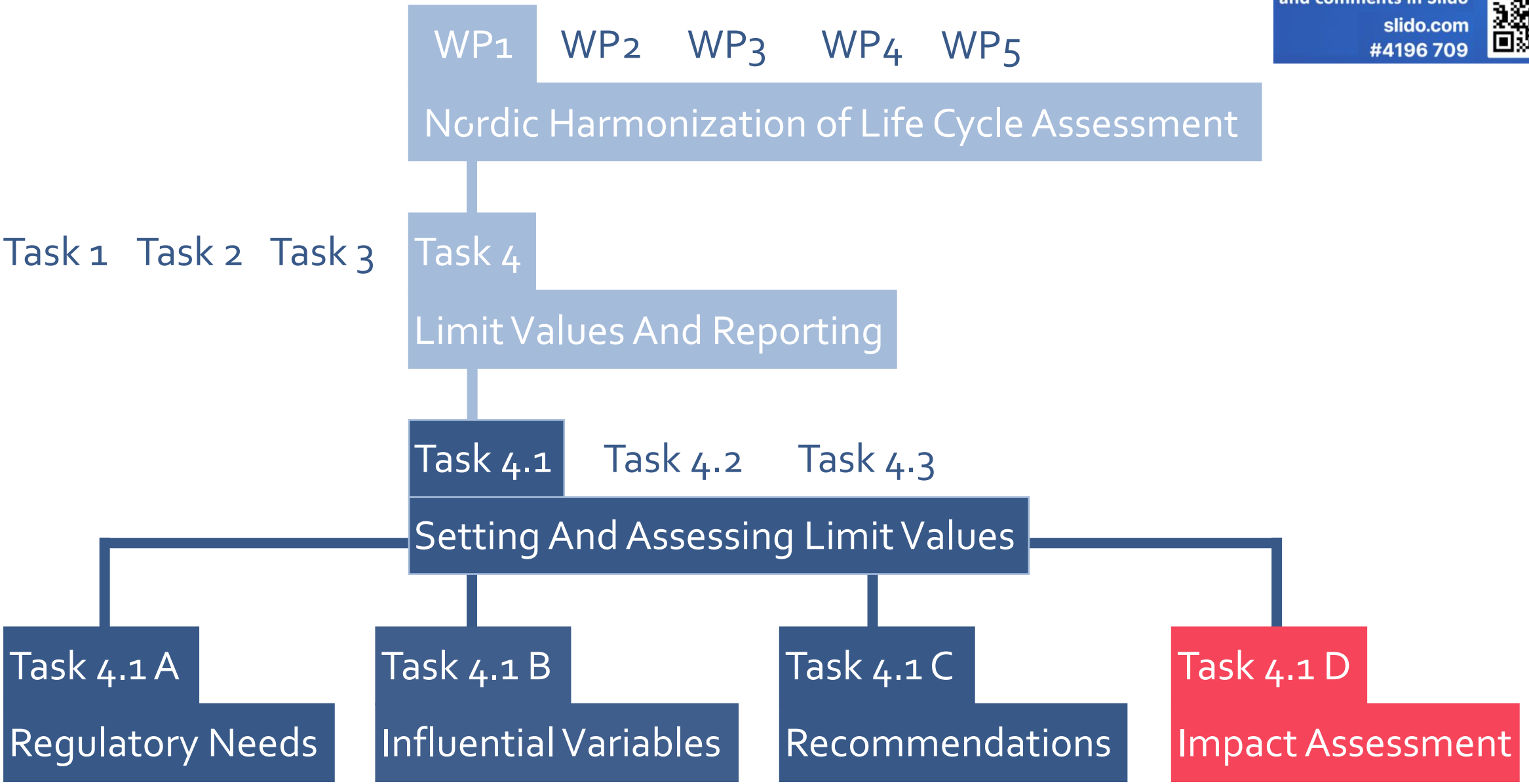
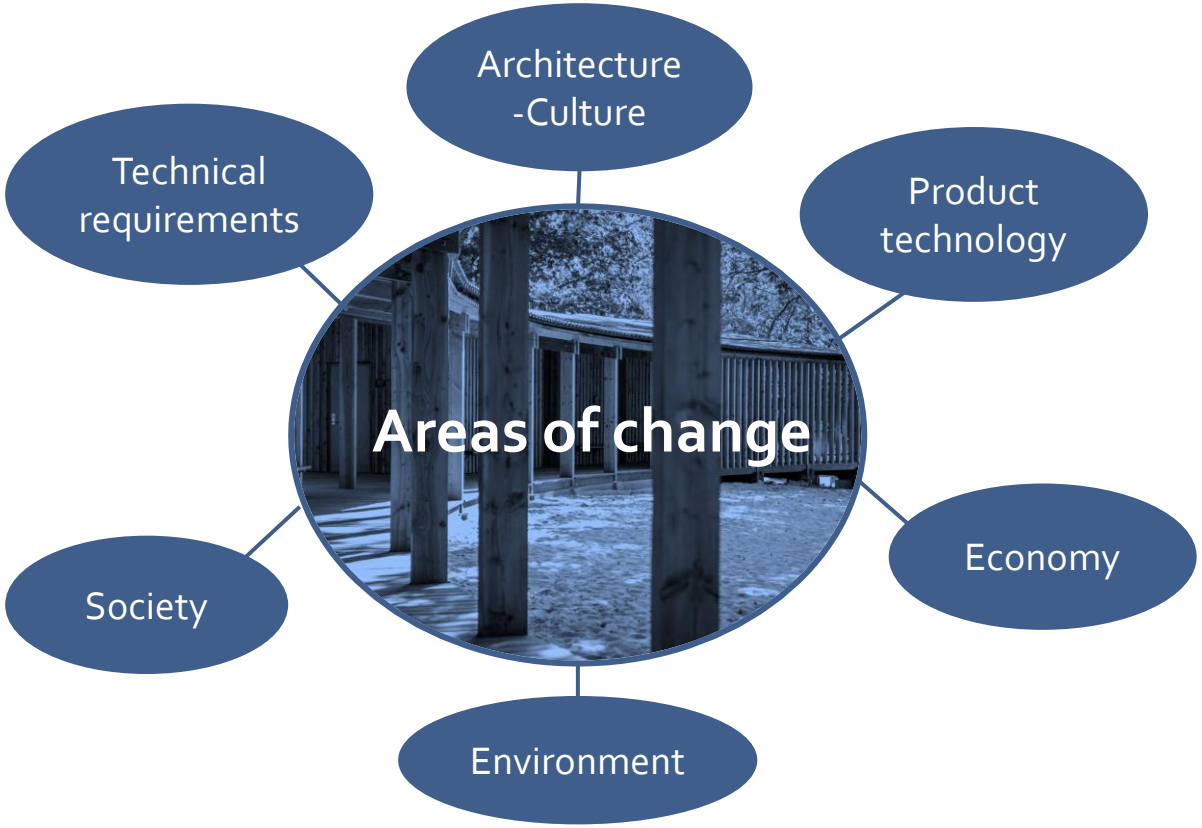


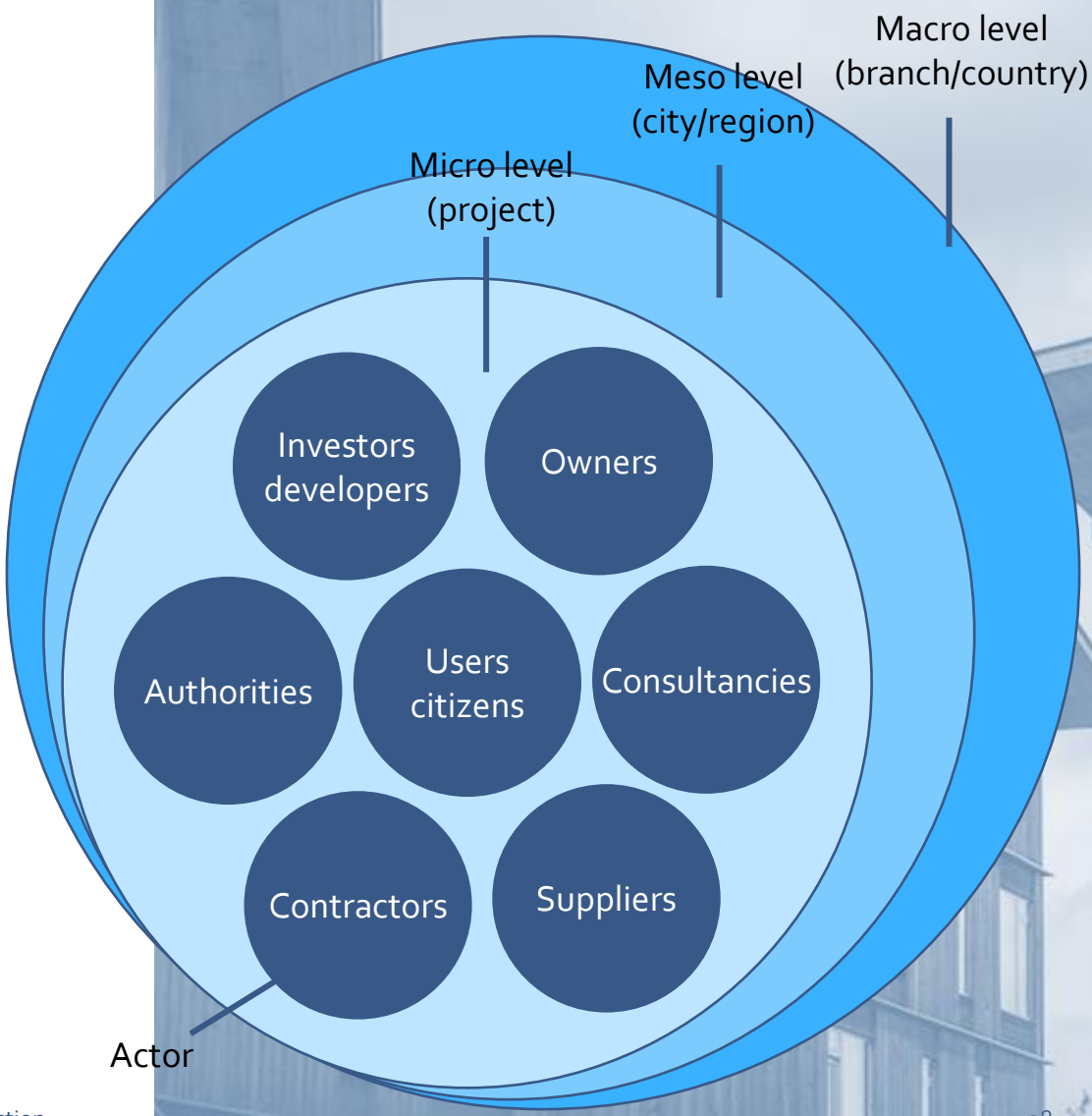
Task 4.1 D

Impact assessment



Analysis of expected changes different limit values scenarios are expected to cause or require

Actors and levels of change



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What variables are suited to be harmonized across regions?

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What location-sensitive variables should be out of scope for the initial limit values?

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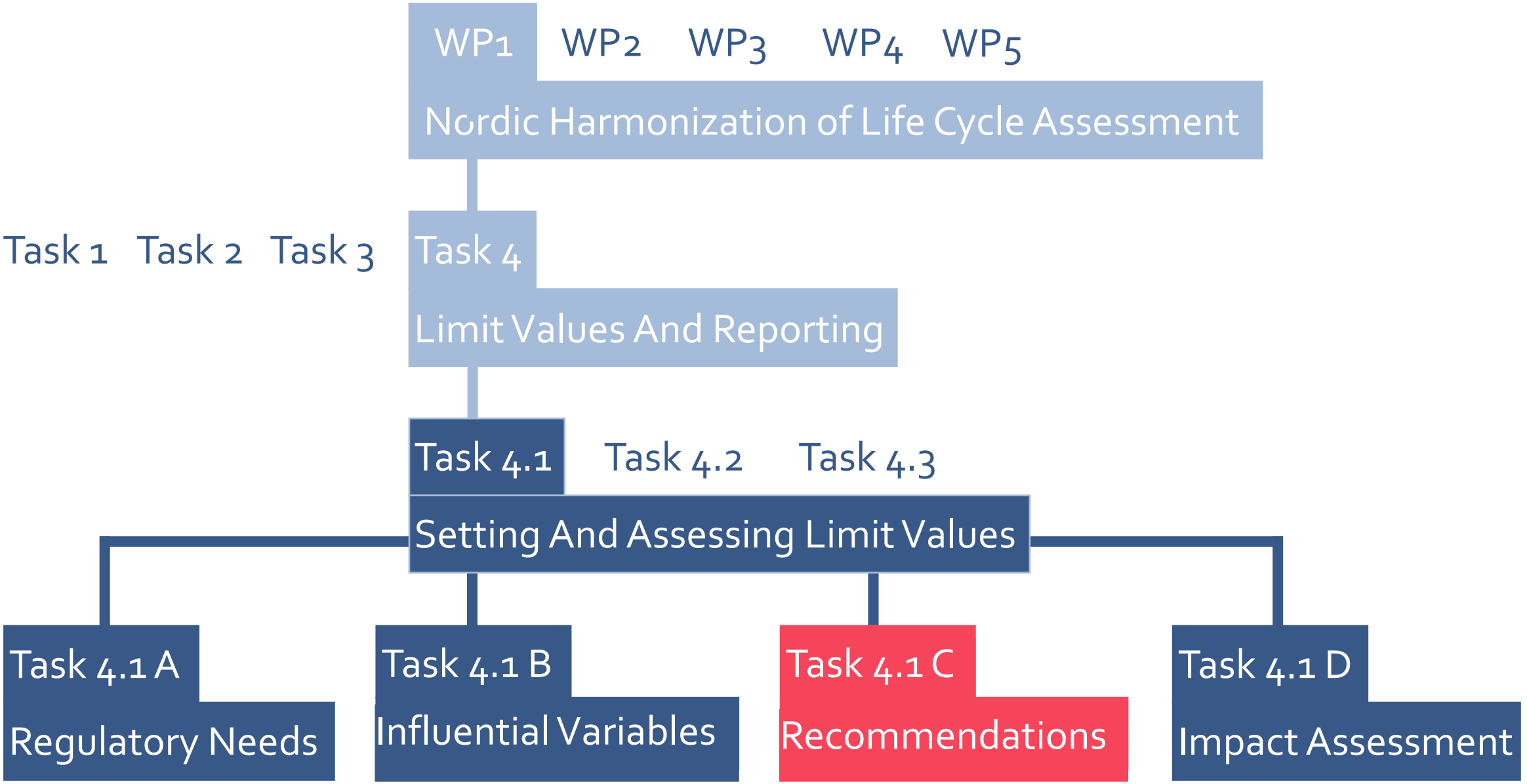
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Regulatory Needs
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Influential Variables
Task 4.1 C
Recommendations
Task 4.1 D
Impact Assessment

Recommendations

For developing and implementing limit values

VARIABLE	RECOMMENDATION	HARMONIZATION
Competence building	Voluntary declaration scheme Iterative stakeholder feedback Academic and professional education	***EU:*** *New learning material is being developed in ongoing EU-project*
Stakeholder involvement	Consultation groups for evaluating experiences and discussing key decisions	
Generic data	Generic impact data for products and processes close data gaps Generic service life secure harmonized assessments Generic process/module impact data and standard components and systems aid implementation	**Nordic:** structure and content of the national generic climate databases (e.g. product categories and variants, indicators, applied conservative factors), guidelines for EPD developers by the national program operators ***EU:*** *Construction Products Regulation and EcoDesign Directive will make environmental product data mandatory in the long term*
EPD availability & digitalization	EPD data shall be digitally accessible and exchangeable for improved feasibility	
Building model	Define structure and level of detail of building model Use classification standard and allow conversion	**Nordic:** Common platform with mapping tables for conversion ***EU:*** *Level(s) may define overall principles*

Recommendations

For developing and implementing limit values

VARIABLE	RECOMMENDATION	HARMONIZATION
Building database	Collect detailed building stock data Existing LCA from voluntary schemes might be useful Define sample and eventually archetypes representative for building stock Case analyse parameters may relate to limit value differentiation	**Nordic:** Possible Nordic case database with harmonized parameters and structure will boost learnings on low-carbon solutions and barriers
Carbon limit differenti-ation	Building sample analysis shall support the necessary differentiation after type, size or other building parameters The actual optimization potential might differ between buildings	**Nordic:** Common criteria for differentiating limit values ***EU:*** *EPBD requires limit value roadmaps to per building type and climate zone*
Trajectory towards full scope	Implementation of declarations/limit values may require a gradually expanding scope Alternatively, generic/standard data and definitions can fill gaps and speed up implementation	**EU/Nordic:** Trajectories depend much on the harmonization of life cycle scope and scenarios

Recommendations

For developing and implementing limit values

VARIABLE	RECOMMENDATION	HARMONIZATION
Building reference area	Also declare results per useful floor area (UFA) to get EPBD-ready Analyze adjacent spaces (basement, attic, external stairs/ramps and balconies) Optional: Consider occupancy-related units (e.g. impact per user) to reduce total area	***EU:*** *UFA required for mandatory declarations for >1,000 m² buildings by 2028*
Cost-effectiveness	Disclose roadmap for scope and limit values early on Monitor industry readiness Monitor building stock for calibrating feasible carbon levels	***EU:*** *EPBD requires national limit value roadmaps by 2027 – principles yet to be defined* **Nordic:** Different national decarbonization goals and pathways have to be respected
Carbon regulation of renovations	Develop carbon declaration method Test regulation on voluntary basis	**Nordic:** Align scope, method and data

TASK 4.2

- Monitoring the decarbonization of the building stock

Nicolaj Hostrup Langkjær
Sweco

Nordic Sustainable Construction

Please pose questions and comments in Slido
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Nordic Harmonization of Life Cycle Assessment

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Limit Values And Reporting

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Monitoring the decarbonization of the building stock

Task 4.1 A

Policies and strategies for decarbonization

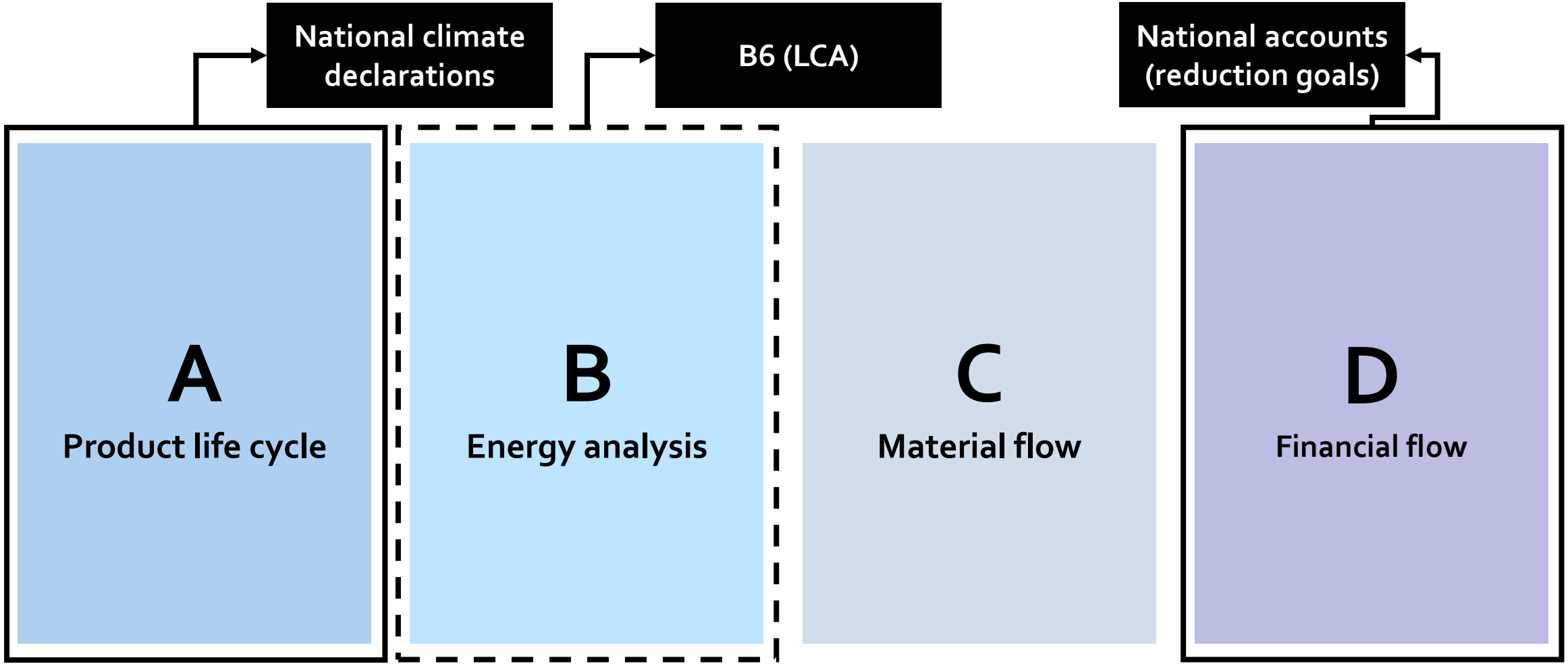
Task 4.1 B

Process for monitoring the decarbonization of the building stock

Task 4.1 C

forecasting and modelling of future scenarios

Environmental building stock modelling



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Which environmental building stock modeling approach do you see best fit for assessing decarbonization efforts?

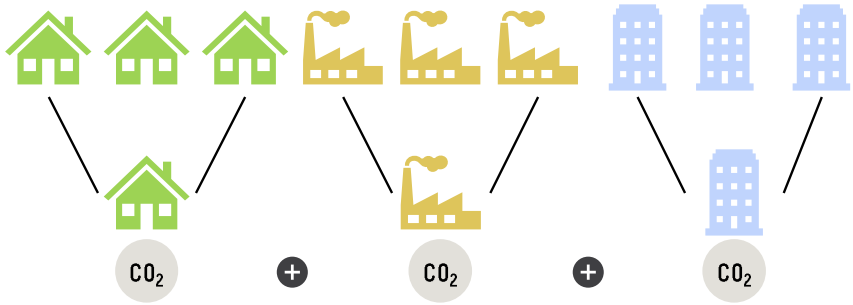
ⓘ Start presenting to display the poll results on this slide.

Building stock carbon monitoring

1

Archetype modeling with LCA/energy modelling *(Bottom up)*

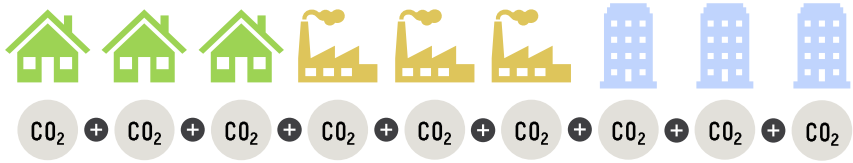
Archetypes with emissions factors are defined. Monitoring on building stock level is achieved by utilizing data on newly added m2 pr. archetype to the building stock



2

Sample LCA/Energy model*(Bottom up)*

Sampling carbon emission reporting (climate declaration). Monitoring is enabled with complete sample



3

Financial modeling (EIOA) *(Top down)*

Typically, environmental input-output analysis. Emission factors are accounted to financial flows. Monitoring is already established

Building stock carbon monitoring

1

Archetype modeling with LCA/energy modelling *(Bottom up)*

Archetypes with emissions factors are defined. Monitoring on building stock level is achieved by utilizing data on newly added m2 pr. archetype to the building stock

2

Sample LCA/Energy model *(Bottom up)*

Sampling carbon emission reporting (climate declaration). Monitoring is enabled with complete sample

3

Financial modeling (EIOA) *(Top down)*

Typically, environmental input-output analysis. Emission factors are accounted to financial flows. Monitoring is already established

Product LCA method

Financial flow method

Building stock carbon monitoring

1

Archetype modeling with LCA/energy modelling *(Bottom up)*
Archetypes with emissions factors are defined. Monitoring on building stock level is achieved by utilizing data on newly added m2 pr. archetype to the building stock

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Sample LCA/Energy model *(Bottom up)*
Sampling carbon emission reporting (climate declaration). Monitoring is enabled with complete sample

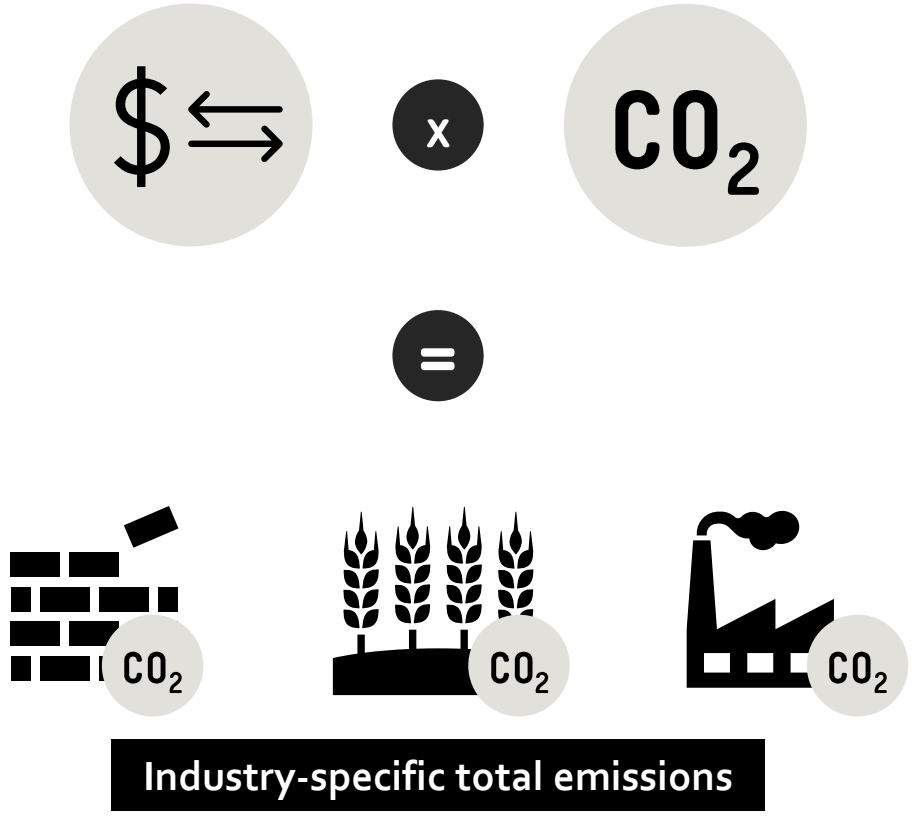
3

Financial modeling (EIOA) *(Top down)*
Typically, environmental input-output analysis. Emission factors are accounted to financial flows. Monitoring is already established

Possibility to investigate cause and effect on building level

Possibility to investigate effect on macro level

Financial flow modeling (EIOA)



- Comparable with strategic national Co2 reduction goals
- Reporting is already established (national accounts)

- Comparable with CO2 limit values in climate declarations
- Affordability bias
- Identification of solutions on building level
- Doesn't allow to research emission causes on micro level

Existing data landscape

Database information gathering

#	Database name	Brief description	Responsible organization	Link to organization	Link to database	Datatype	Relevant key data	Coverage area	Accessibility	Access cost	Format	Responsible for datainput	Update freequenzy	Integration	Legal c
1	BBR - Building and Housing Register	In BBR (Building and Housing Register), you can find information about all buildings and residences in Denmark. There is a lot of information available for each individual building, such as its location, its usage, size, and age	Ministry of Taxation (Skatteministeriet (Vurderingsstyrelsen))	https://vurdst.dk/	https://bbr.dk/forside	Building register	Area Facade material Roof material Type of heating Number of floors	Nationwide	Public	Free	Structured database	Building owner	Continuosly	No	
2	Protected and listed buildings	FBB is the register of Protected and listed buildings in Denmark maintained by the Danish Agency for Culture and Palaces. FBB contains information about approximately 7,100 protected buildings in the country and about 370,000 buildings whose preservation value has been assessed. Additionally, FBB includes basic information about over 4 million buildings in Denmark. This information is sourced from the Building and Housing Register (BBR) and is automatically updated.	Ministry of Culture (Kulturministeriet (Slots- og kulturstyrelsen))	https://slks.dk/	https://www.kulturarv.dk/fbb/index.htm	Register for preserved buildings	Area Facade material Roof material Type of heating Number of floors Material description	Nationwide	Public	Free	Structured database	Data comes from BBR and Ministry of Culture	Continuosly	No	
3	Waste data system (ADS)	The Waste Data System is a web-based database that collects information about waste streams in Denmark. According to the Waste Data System Order, companies responsible for waste treatment are required to report to the Waste Data System. During reporting, they need to specify the source of the waste, the type of waste, and how the waste should be treated. Companies reporting waste data have the ability to edit and retrieve their own waste data, while certain waste data is publicly accessible.	Ministry of Environment (Miljøministeriet (miljøstyrelsen))	https://mst.dk/	https://www.ads.mst.dk/Default.aspx	Waste register	Type of waste (sector) Type of waste (category) Amount of waste	Nationwide	Public	Free	Structured database	Companies responsible waste treatment	Minimum yearly. Also possible to update continuosly	No	
4	Energy label	Energy labeling makes the energy consumption of buildings visible and serves as a type of product declaration. The energy performance certificate also provides an overview of energy-related improvements	Ministry of Climate, Energy and Utilities (Klima-, Energi- og forsyningsministeriet (Energistyrelsen))	https://ens.dk/	https://old.sparenergi.dk/forbruger/vaerktoejer/find-dit-energimaerke	Energy label register	Calculated energy demand	Nationwide	Public	Free	Structured database	Energy labeling of buildings can only be carried out by companies that are certified to perform energy labeling. Certification requires a quality management system	Continuosly	No	

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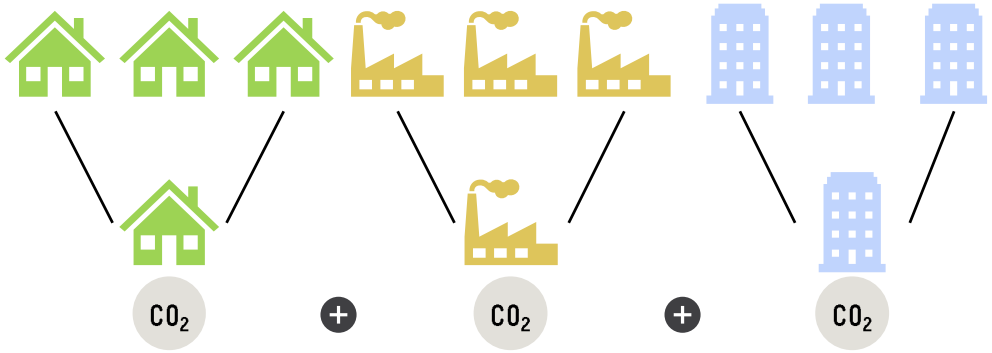
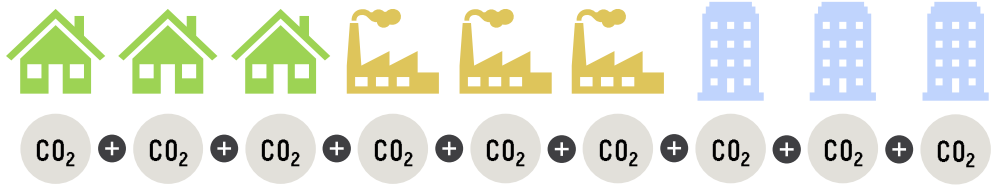
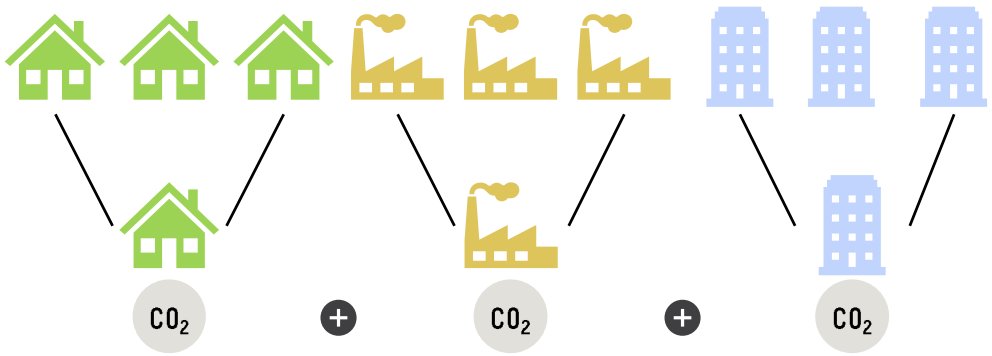
Archetype or sampling approach for monitoring





Recommendation 1

Archetype modeling

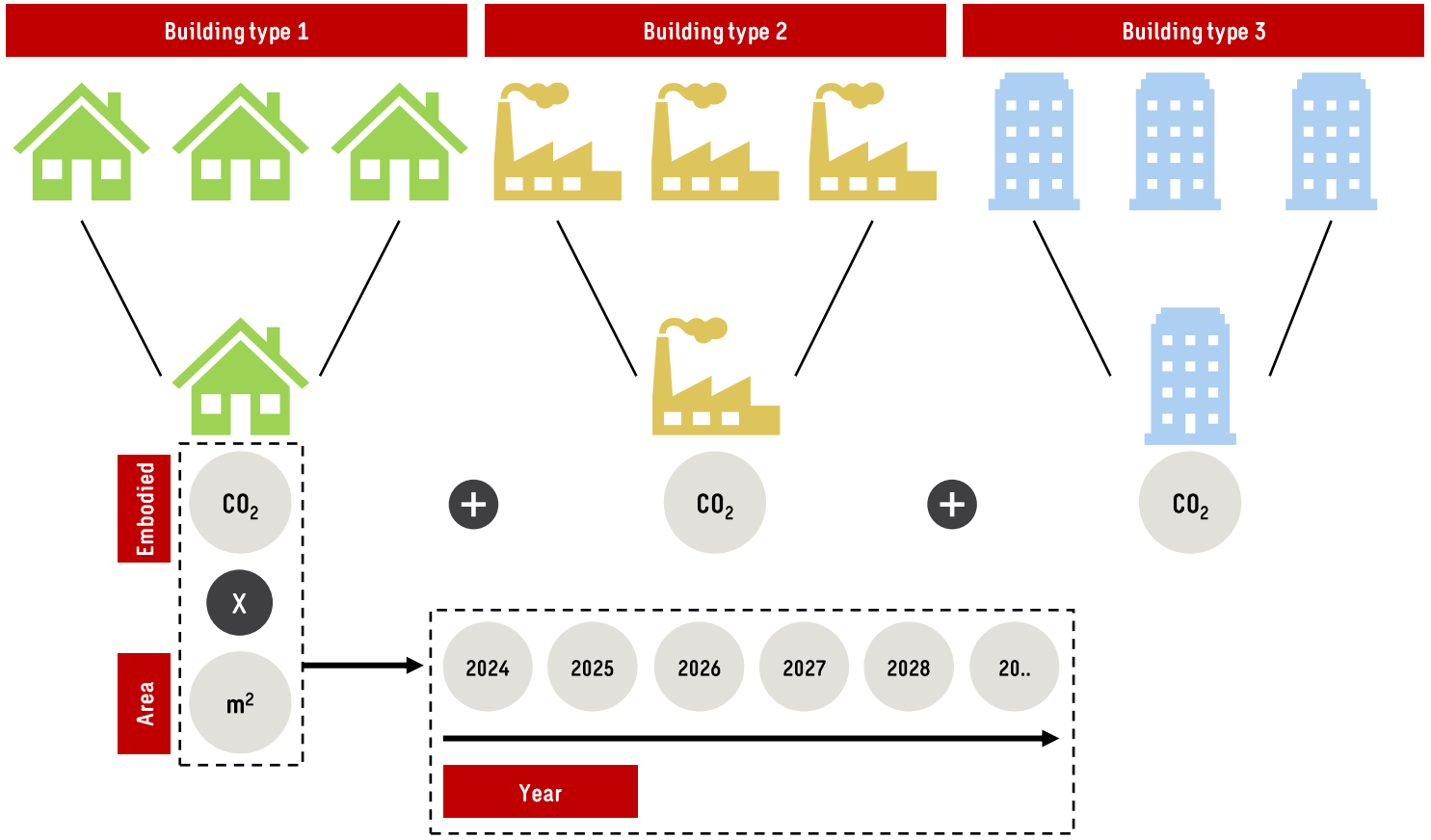


- Suitable for developing building stock scenarios or top-down target-based limit values
- Smaller representative samples can be used for monitoring the entire building stock

- Risk of systematic errors
- Representativity depends on data input
- Database infrastructure doesn't exist

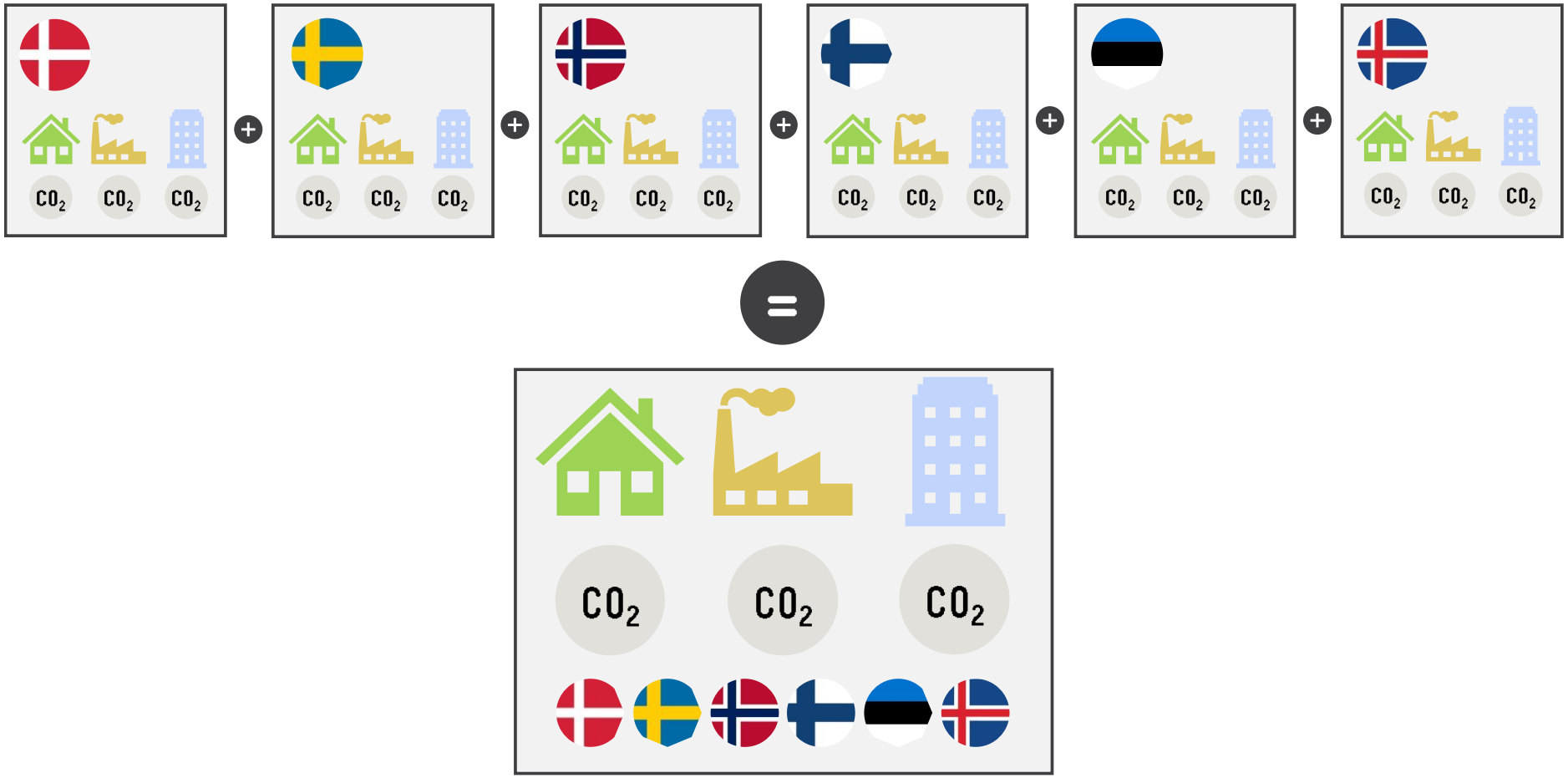
Archetype modeling

Available attributes from existing building information databases



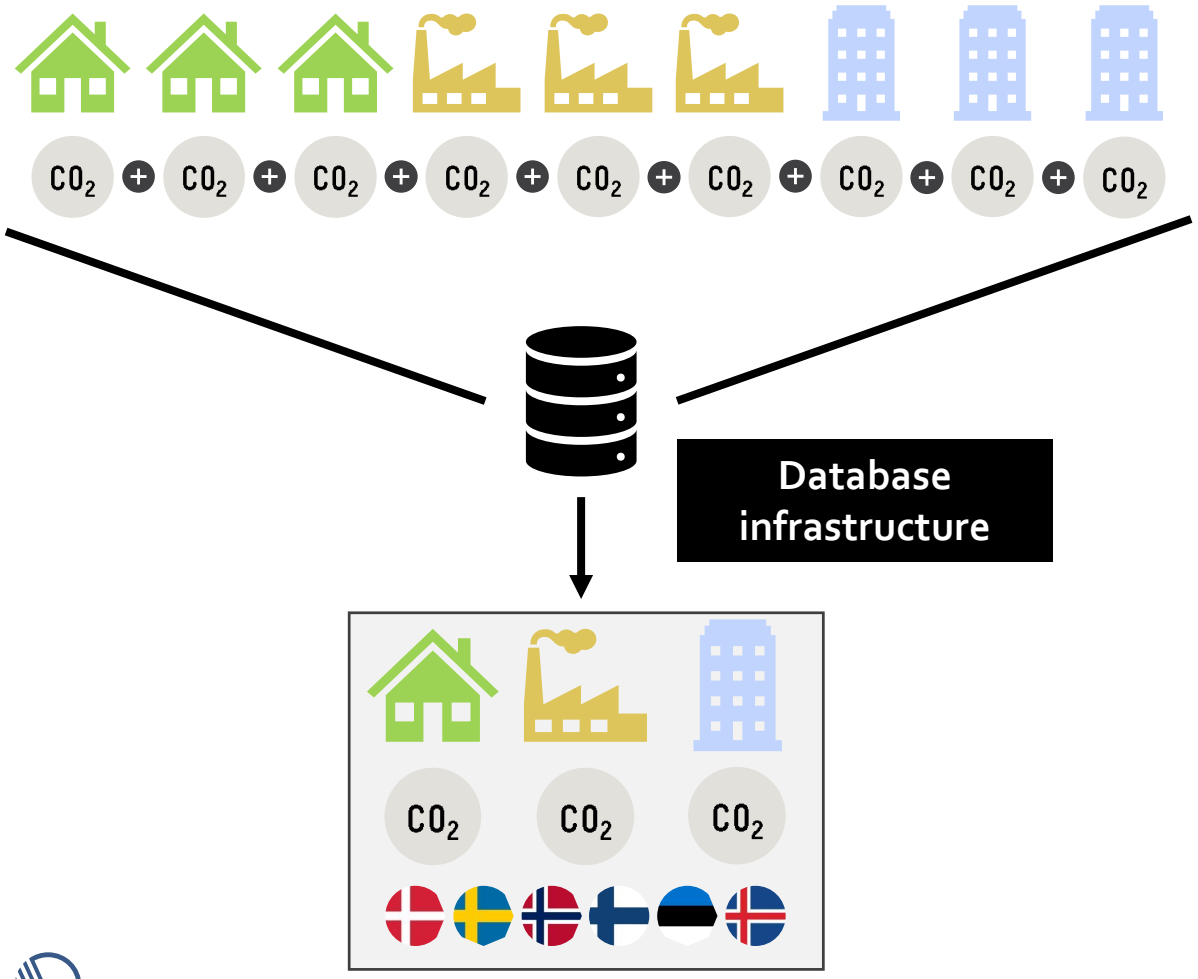
Archetype modeling

National emission factors



Climate declaration and EPBD

Enabling a complete sample approach

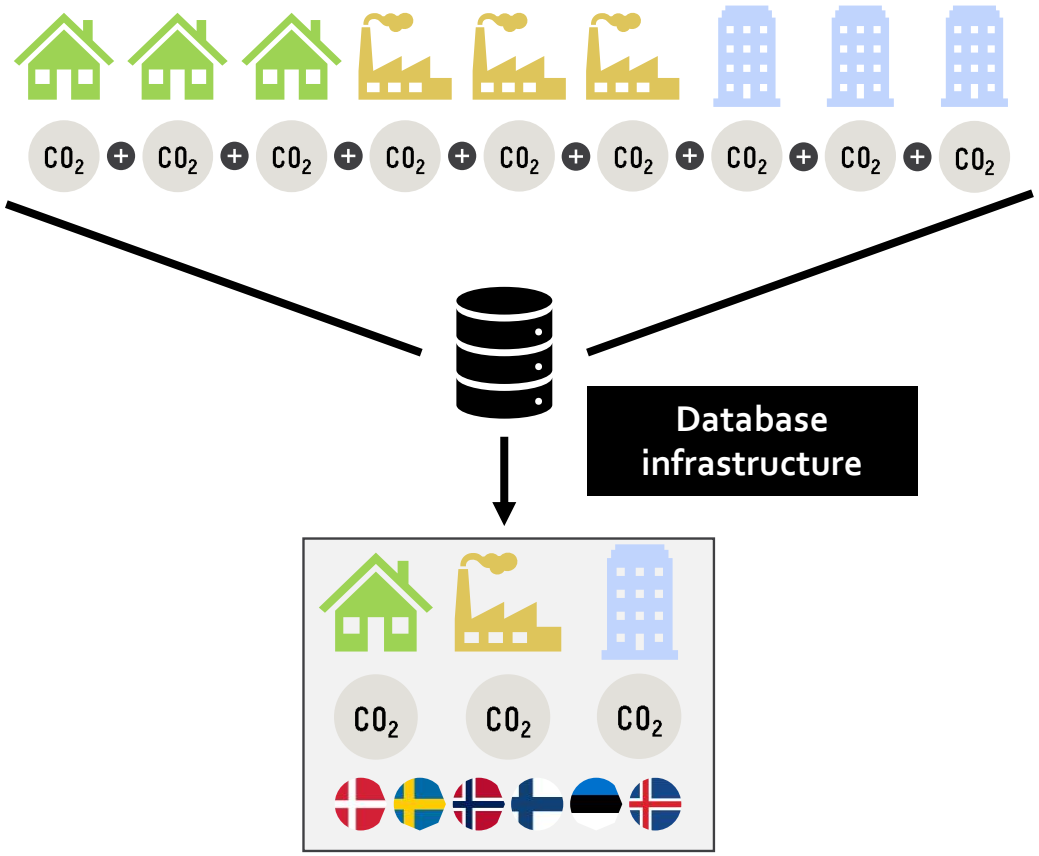


The introduction of climate declarations in the Nordic countries in the forthcoming years.

The EU Energy Performance of Building Directive Article 7 states that Member States shall ensure that the life-cycle Global Warming Potential (GWP) is calculated in accordance with Annex III and **disclosed through the energy performance certificate of the building**

Recommendations 2

Complete sample of climate declarations



- With mandatory climate declarations, the suitability for as-is analysis of the building stock is high
- With complete sample, the suitability for developing building stock scenarios or target-based limit values is high

- A large or complete sample of building stock is needed for validity
- Database infrastructure doesn't exist

Recommendations 2

Complete sample of climate declarations

ANBEFALING #1 FORTSAT

Stramning af CO2-krav til bygninger og styrkelse af LCA-metoden

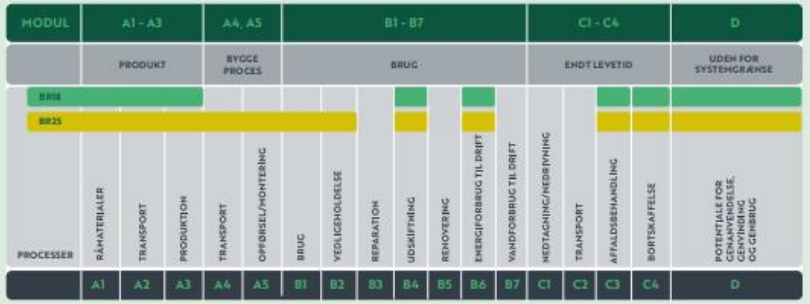
Fælles beregningskerne for LCA-beregninger skal sikre konsistens

En fælles beregningskerne for LCA-beregninger skal styrke tilliden til beregningerne. Forvaltningen af beregningskernen skal forankres hos en statslig styrelse med ansvar for at kvalificere LCA-beregningskernen gennem udbud af analyser. Private aktører og rådgivere skal kunne udvikle værktøjer, som kan refereres op imod beregningskernen.

Fælles, standardiseret rapporteringsmetode og database

For at sikre ensartethed i rapportering af LCA-resultater, skal der udvikles et fælles standardiseret rapporteringsformat. LCA-resultater skal også samles i en database for at sikre, at viden om bygningers CO2-aftryk let kan deles, analyseres og inspirere på tværs af sektoren.

Figur 24: Forslag til udvidelse af LCA

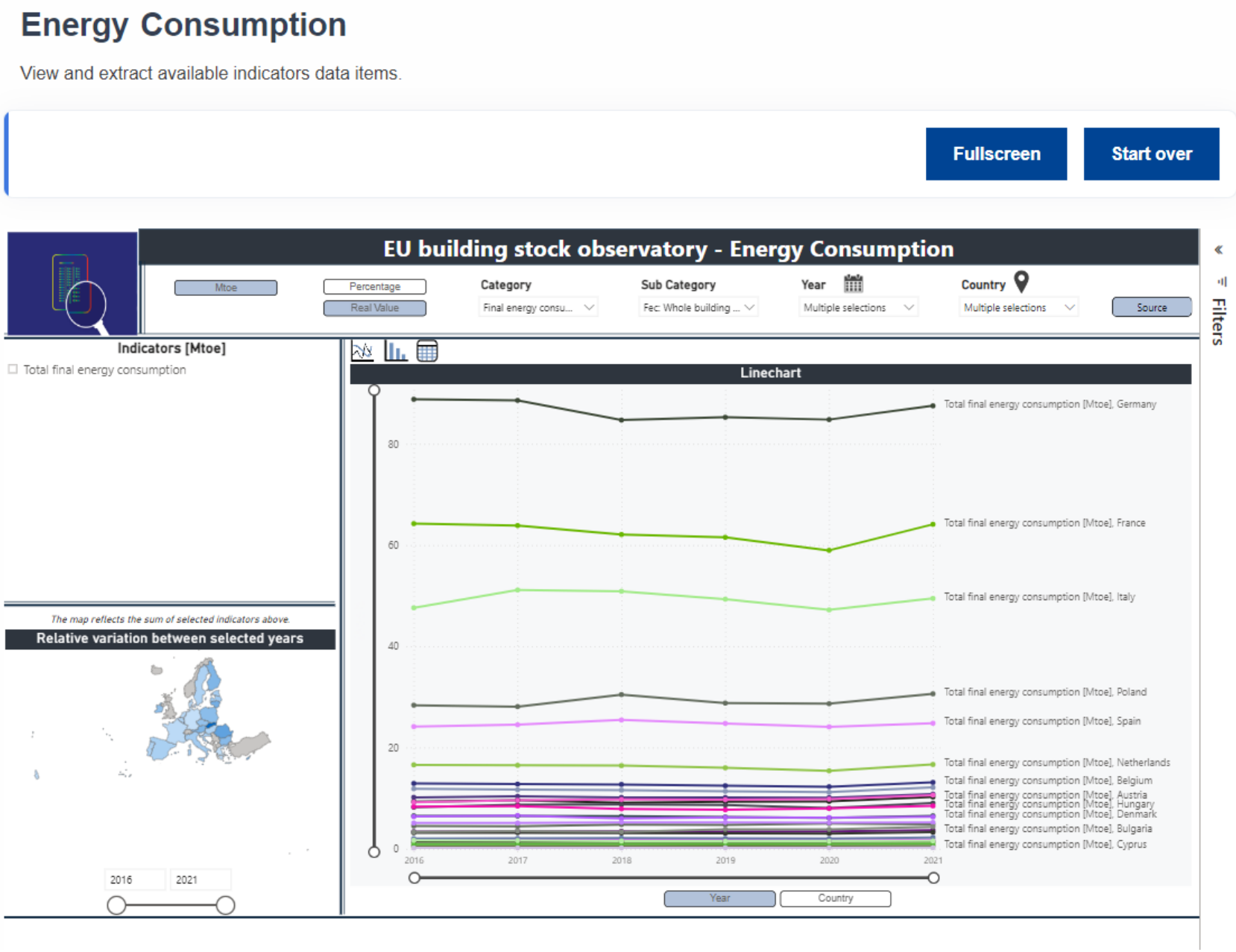


4. CO2

To ensure uniformity in the reporting of LCA results, a common standardized reporting format must be developed. **LCA results should also be collected in a database to ensure that knowledge of buildings' CO2 footprint can easily be shared, analyzed, and inspire across the sector.**

Energy

Data for building operations



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Monitoring the decarbonization of the building stock

Task 4.1 A

Policies and strategies for decarbonization

Task 4.1 B

Process for monitoring the decarbonization of the building stock

Task 4.1 C

forecasting and modelling of future scenarios

National and international policies and strategies for decarbonization

Task 4.2 A

	2030		2035	2040		2045	2050
Denmark	70%	55%					110%
Estonia		50%	70%				
Finland	60%	50%					
Iceland***	55%						
Norway		10 TWh**					*
Sweden	63%	50%***		75%	100%****		
Europe	40%	42,5%					

Renewable energy portion

National carbon neutrality goal

Carbon reduction compared to 1990-levels

* Norway aims to become a low-carbon society by 2050

** Norway aims to reduce energy consumption in buildings by 10 terawatt-hours by 2030

*** Sweden aims to improve energy efficiency by 50% in tearms of energy usage by the year 2030 compared to levels in 2005

**** The government of Sweden changed the term from "renewable" to "fossil-free" in the summer of 2023 to include nuclear power

***** Iceland aims to reduce the dependence of fossil fuels and promoting the use of renewable energy sources and climate-friendly fuels

Forecasting and modeling of futures scenarios

Task 4.2 C

- Review of 4 initiatives/research papers including different elements for forecasting and scenario modelling
- Elements are categorized:
  - Emission factor
  - Building stock
  - Building design
- Recommendations for forecasting and modelling of futures scenarios based on the analysis findings

	Building emissions factors	Building stock	Building design
Environmental modelling of building stocks – An integrated review of life cycle-based assessment models to support EU policy making	• Energy and material production efficiency • Change in heating, cooling and illumination • Recycling and reuse of materials. • Energy consumption and future electricity mix changes	• Building stock size and renovation plan • Building stock growth based on population • Building typology requirement change	• Dwelling size development • Building characteristics change due to climate • Rate of timber and low impact concrete typologies
Dynamic Environmental Sustainability Assessments of the Built Environment: Coupling MFA and LCA	• Energy decarbonization • Less carbon intensive materials (Materials within Europe & less waste) • Reduced energy from construction site • Reduced heat and electricity requirement in buildings	• Growth in building stock based on students and faculty • Model the lifetime of research and educational purposed buildings the same as residential	• Increase in area-to-user ratio • New construction with less carbon intensive material for the load bearing structure
IEAs pathway to 1.5-degre	• Energy decarbonization • Tripling renewable energy and other low emissions energy resources • Increase the amount of energy demand from the building sector		
UKGBC's Whole Life Carbon Roadmap	• Decrease the operational carbon emissions • Decrease in average energy usage • Reuse materials for a reduction in virgin material demand • Reduction in embodied emissions	• Increase in building stock based on population • Reduction in demand of office and residential buildings • Retrofit existing homes	• Reduction in material usage through design efficiency

Recommendations

Forecasting and future scenarios

Emission factors

- Energy decarbonization
- Reduced energy and heating demand
- Recycled materials
- Material production optimization

Building stock

- Building stock size
- Building stock typology
- Renovation rate (size)
- Population size and demographic development

Building design

- Building size (area requirements)
- Building characteristics (architecture)
- New “low carbon” materials
- Design effeciency

A draft report on **"Monitoring the decarbonization of the building stock" (Task 4.2)** will be published for commenting to webinar participant

Please comment before **15-02-2024**

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Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.

Next steps

Please pose questions and comments in Slido
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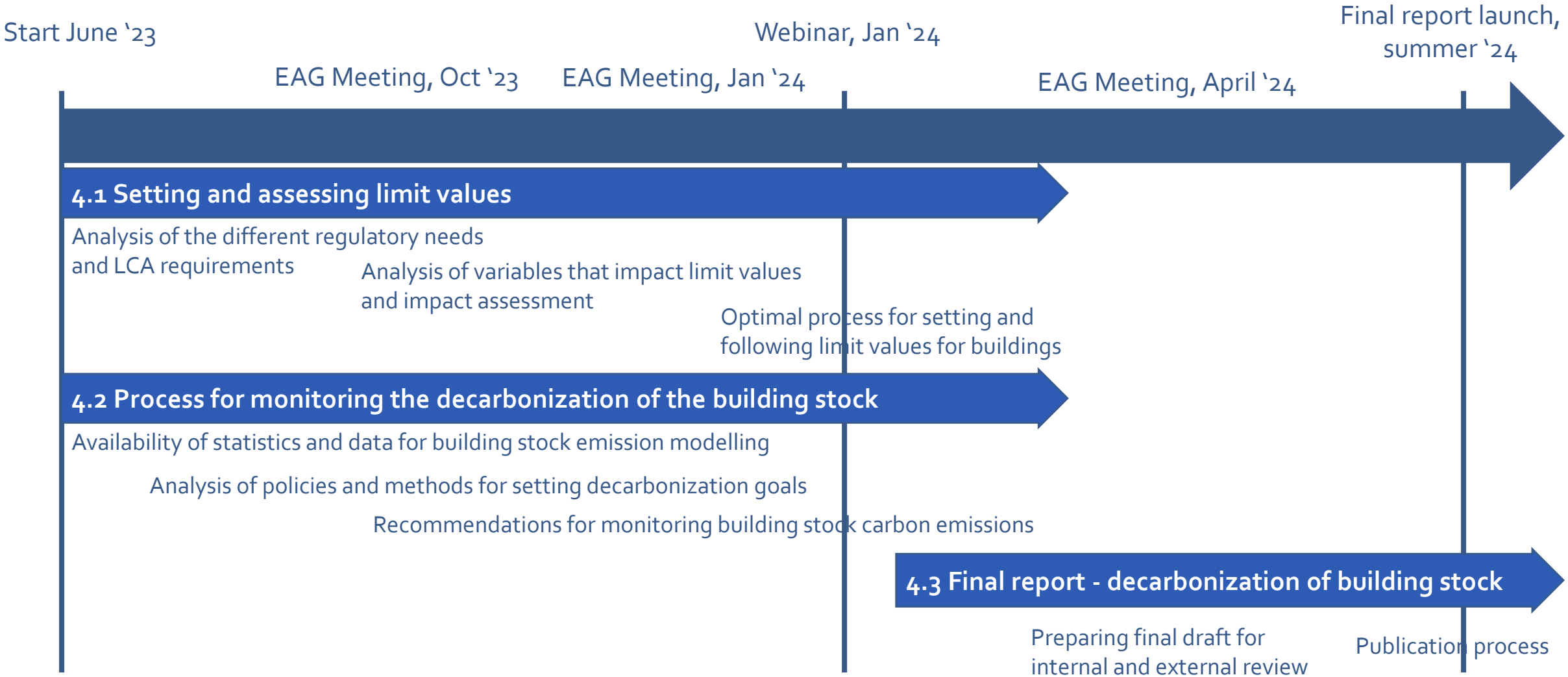

Inputs to project draft reports

- The 1st draft report on "Setting and Assessing Limit Values in Nordic Countries" has already been sent you.
- You can also find it via the webinar website
- We would greatly appreciate your inputs and comments by Feb. 2nd.
  - Please send these to sm-dk-lca-and-co2-limits@sweco.dk

- The 2nd draft report on "Monitoring decarbonization of the building stock " will be made available for commenting after the webinar.
- It will also be available via the webinar website
- We would appreciate your inputs and comments by Feb. 15th.
  - Please send these to sm-dk-building_stock_decarbonization@sweco.dk

Thank you for your time!

Nordic Sustainable Construction