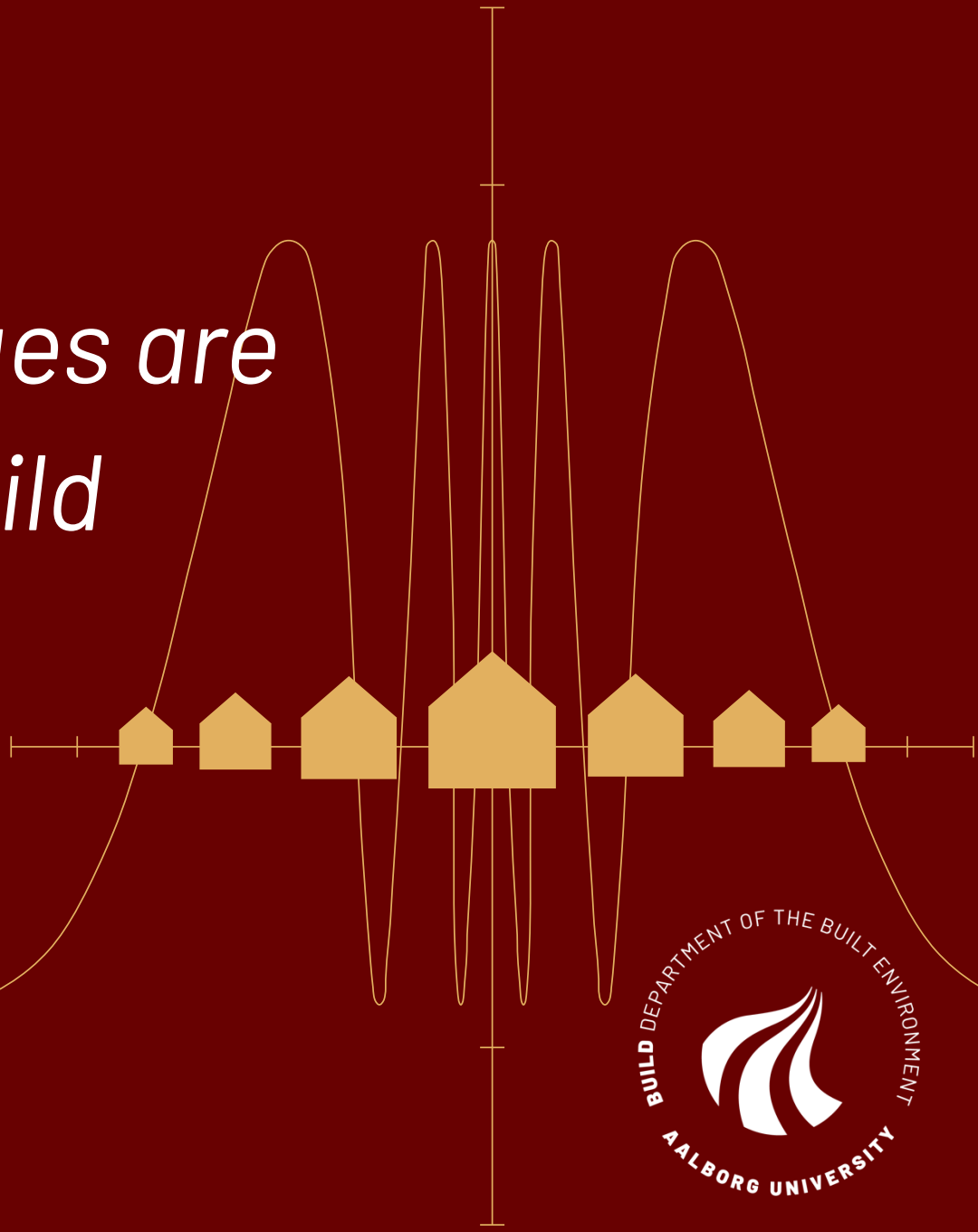
Why ambitious limit values are important for the build environment

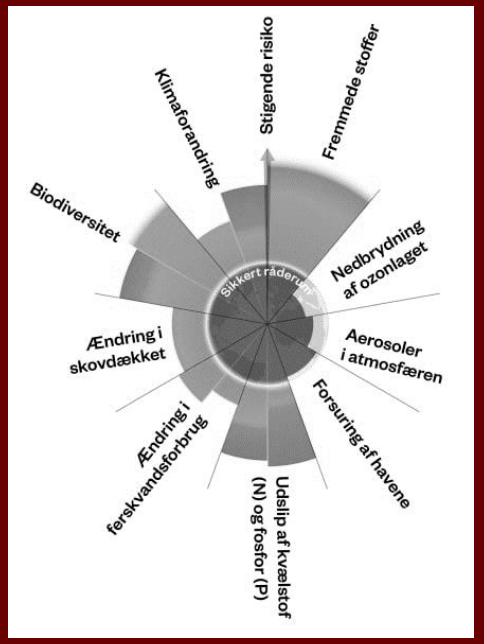
Professor Harpa Birgisdóttir



BUILD DEPARTMENT OF THE BUILT ENVIRONMENT
AALBORG UNIVERSITY

January 9th 2025

Urgent environmental challenge:



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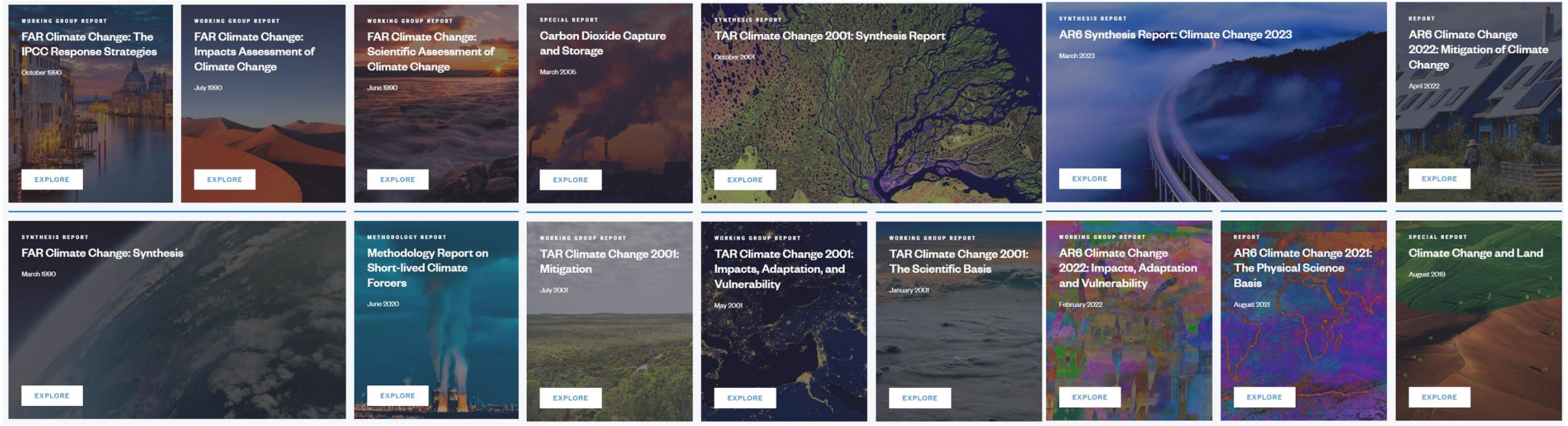
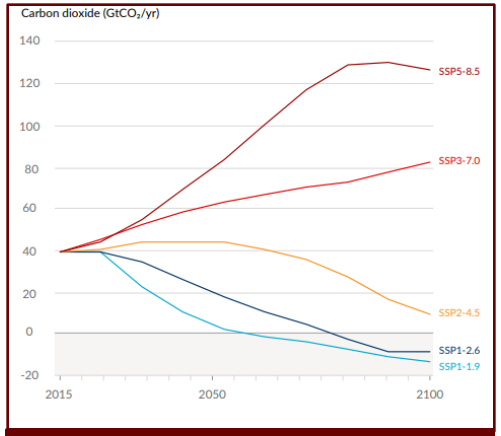
RESOURCES

IPCC – Urgent climate challenge

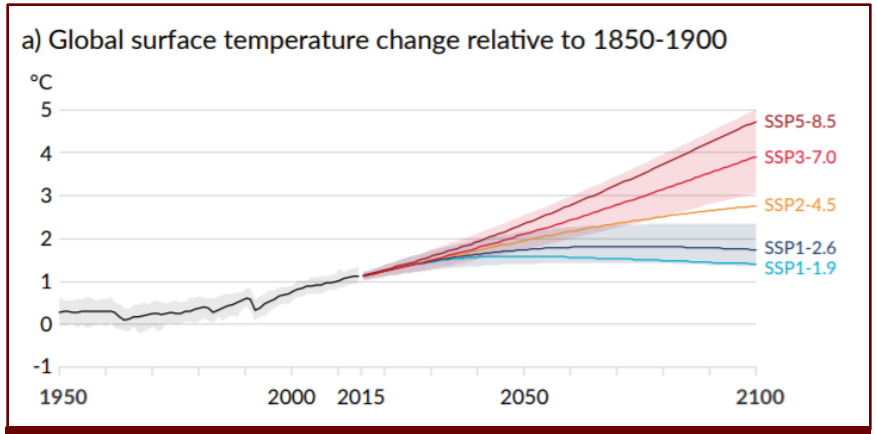
Since the IPCC was founded in 1988, 6 of the major Synthesisis Reports have been published:
1990, 1995, 2001, 2007, 2014 and 2023
In addition, many other related reports and journal articles from climate scientists



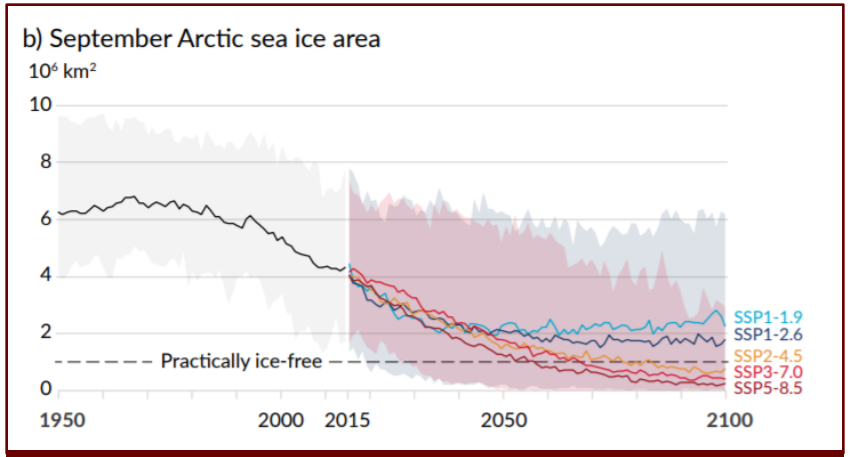
IPCC – Urgent climate challenge



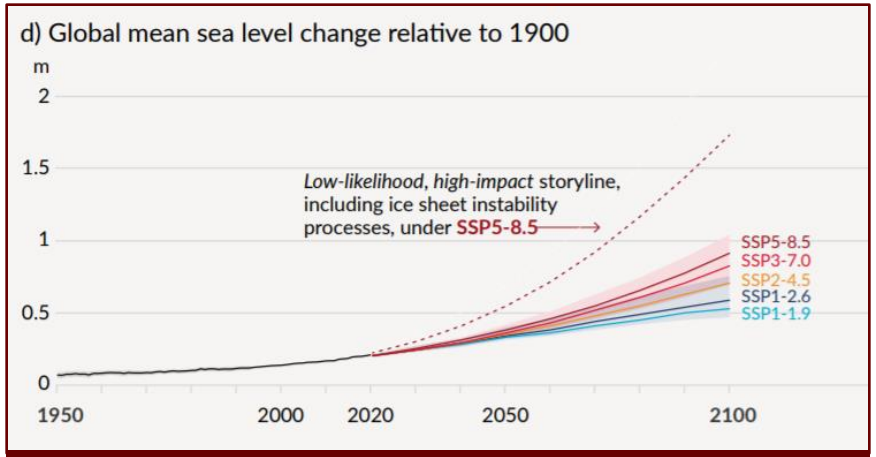
Five scenarios for emissions



What they mean for temperature rises



What they mean for Arctic ice



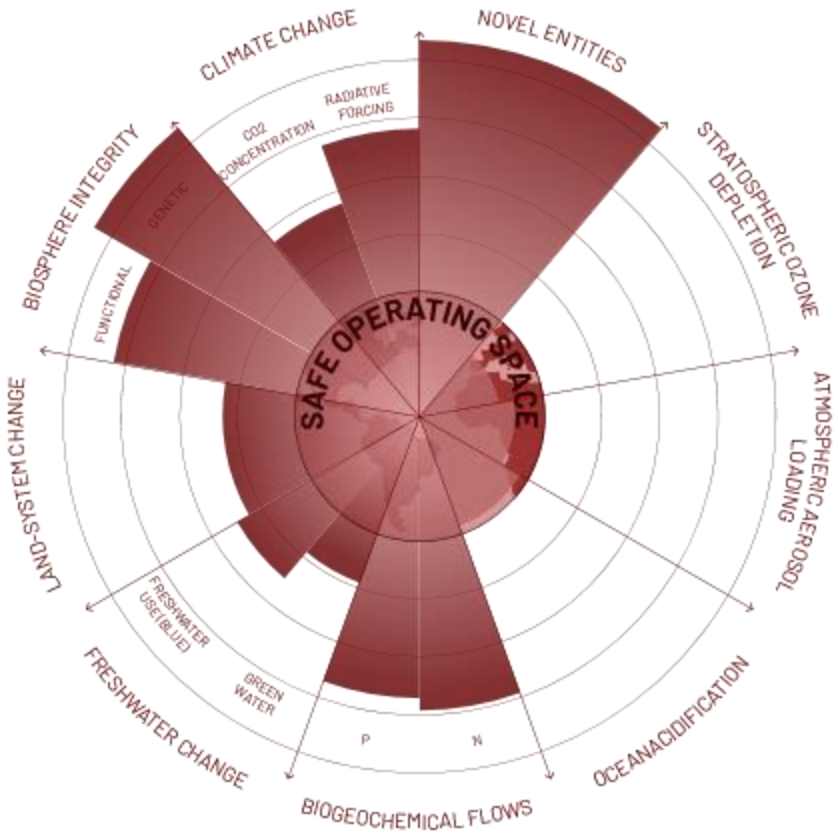
What they mean for sea level rise

Figures from the 2021 report

Planetary boundaries:
6 out of 9 have been exceeded

If human influences can be kept within the 'safe operating space', the planetary boundaries are not exceeded, however, 6 out of the 9 defined planetary boundaries have already been exceeded today, including the planetary limit for climate change, which is created by human emissions of greenhouse gases.

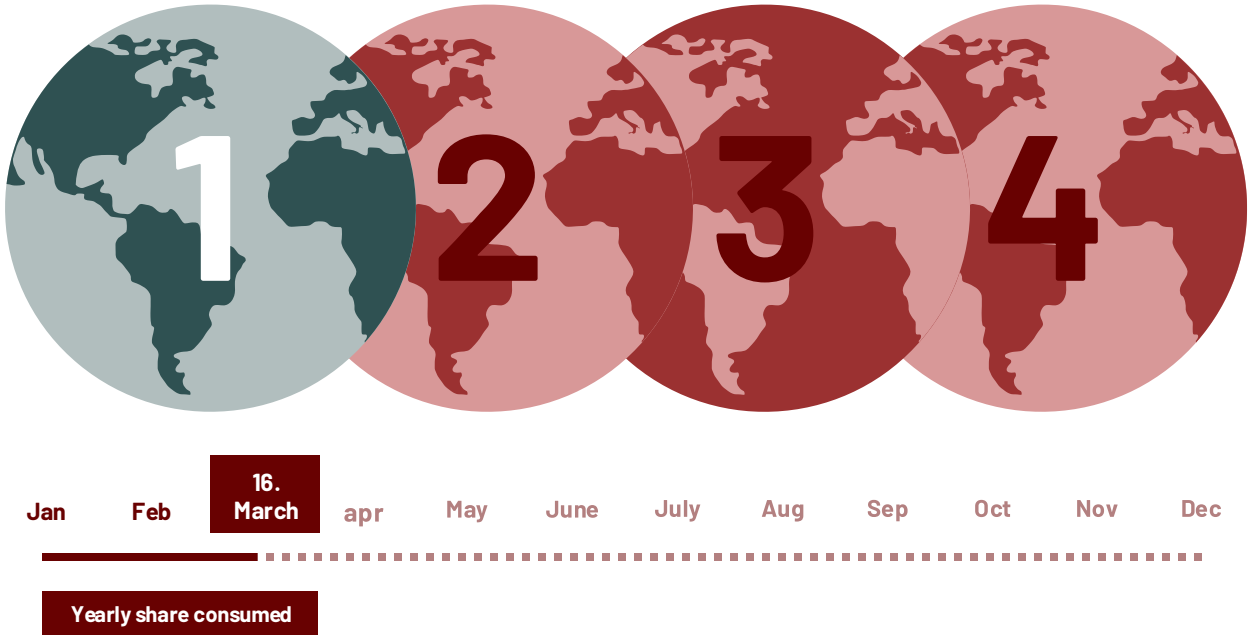
Climate change
Novel entities
Stratospheric ozone depletion
Atmospheric aerosol loading
Ocean acidification
Biochemical flows
Freshwater change
Land-system change
Biosphere integrity



Resources:

Earth overshoot day 2024:

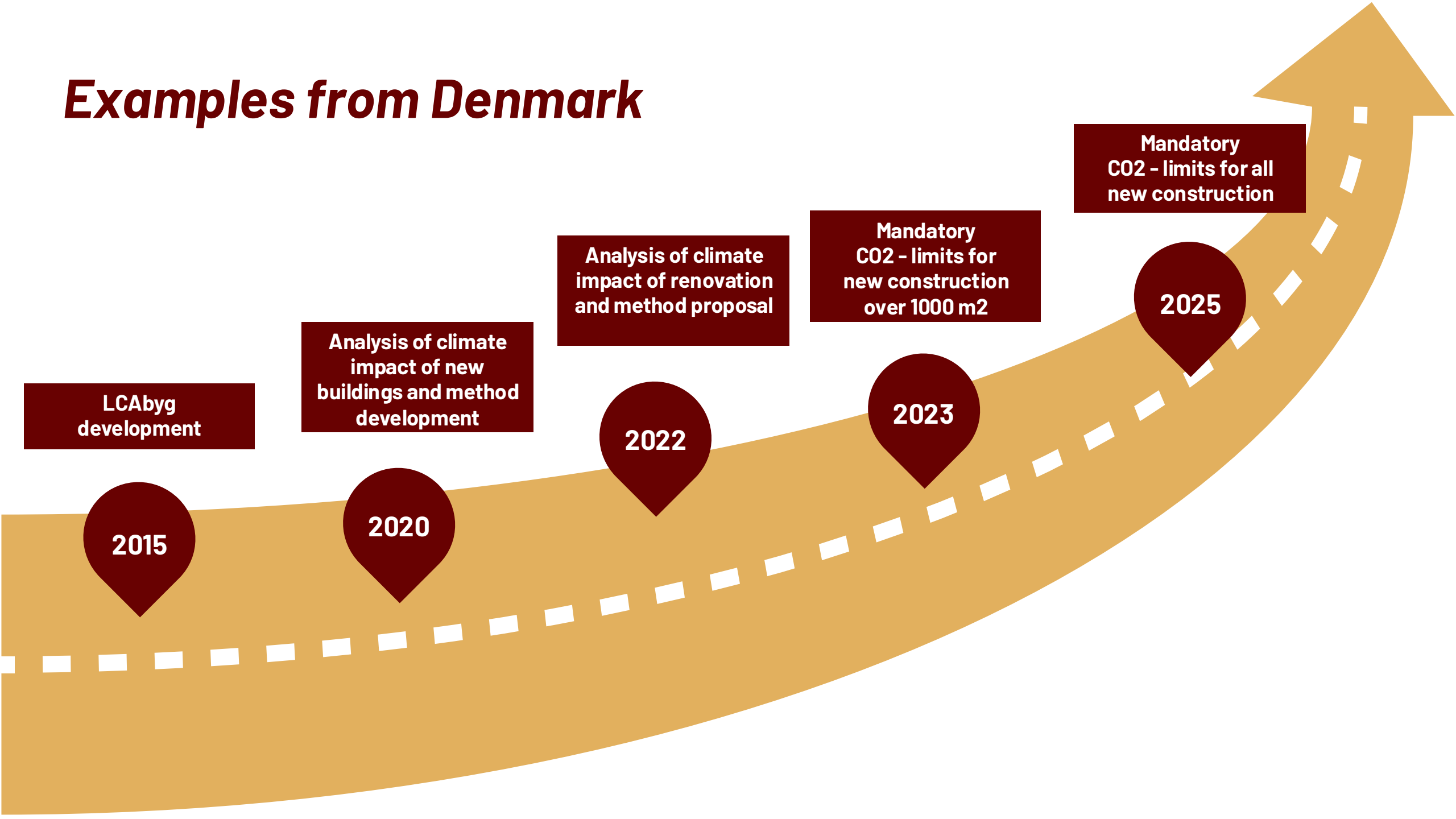
On March 16, we had used up our annual share of the planet's natural resources. This is 12 days earlier than last year.



Urgency

New buildings meeting the current Danish legislation on climate impacts of buildings exceeds the Greenhouse gas emission budget of the Paris agreement by up to **220%**

Examples from Denmark



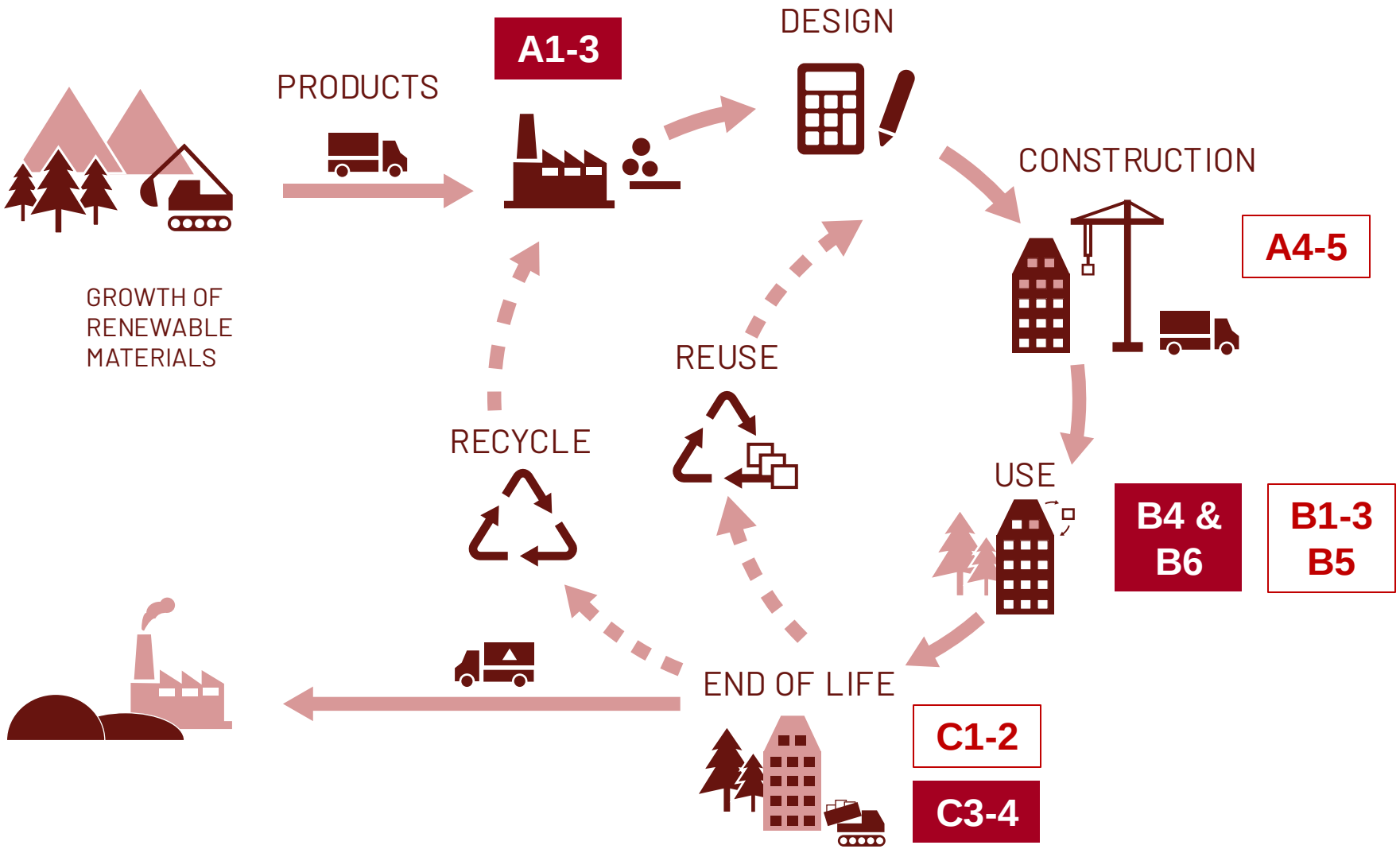
GATHERING KNOWLEDGE IN THE CLIMATE IMPACT OF BUILDINGS

NEW CONSTRUCTION (2020)
WHOLE LIFE CARBON ASSESSMENT OF 60 DANISH BUILDING CASES

PURPOSE

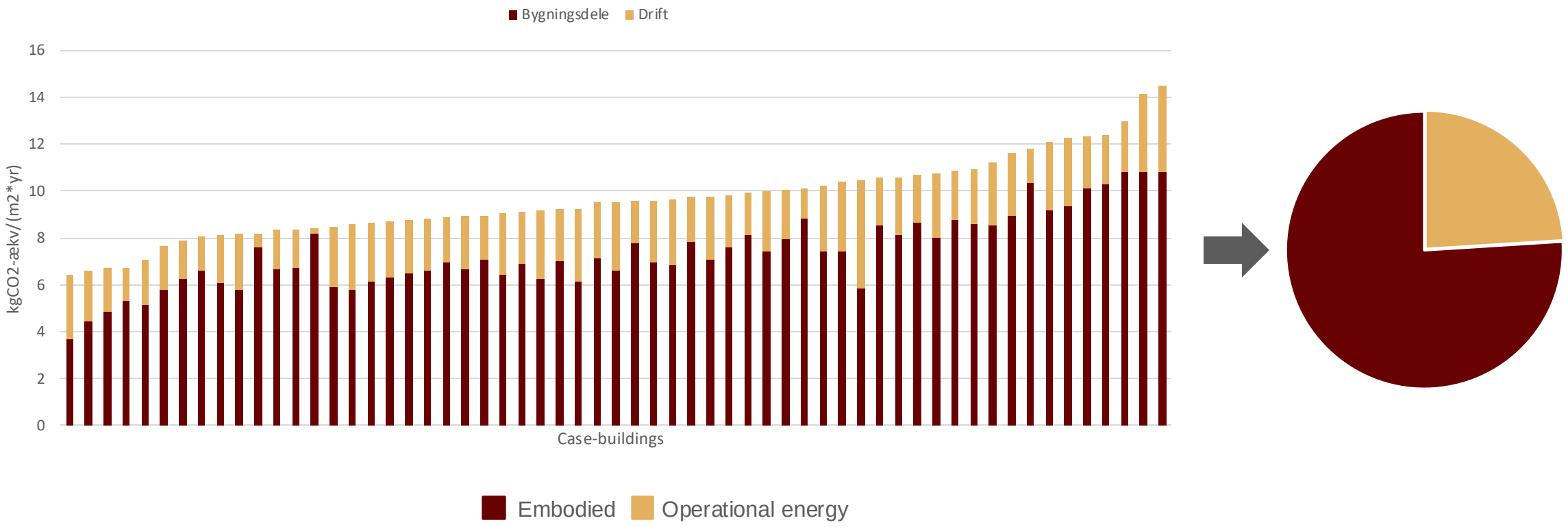
To establish sufficient data background on the climate impact of buildings in Denmark over their life cycle.

On the basis of this, possible reference values are calculated and suggested

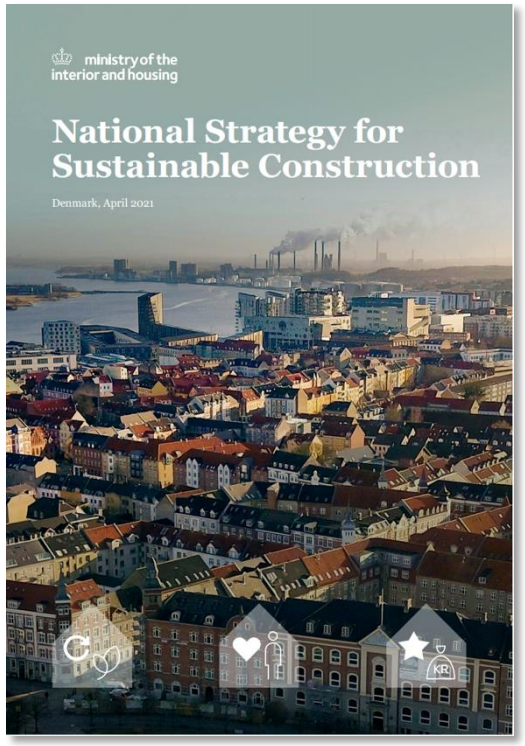


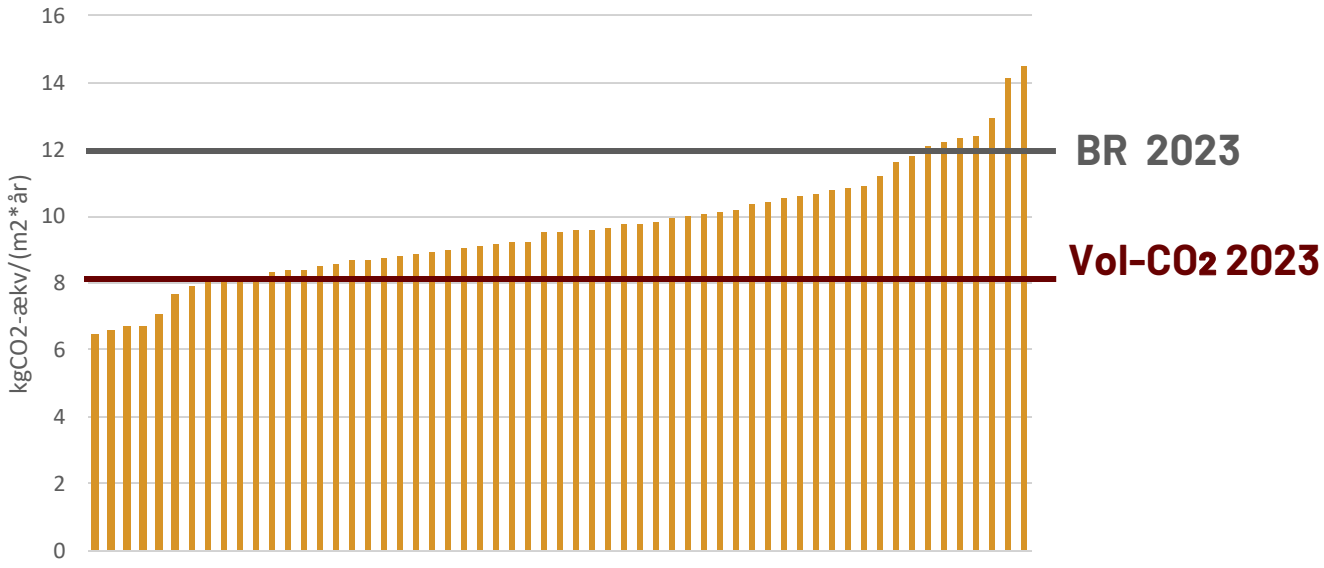
(50 years reference study period)

Results: Whole life carbon of new buildings

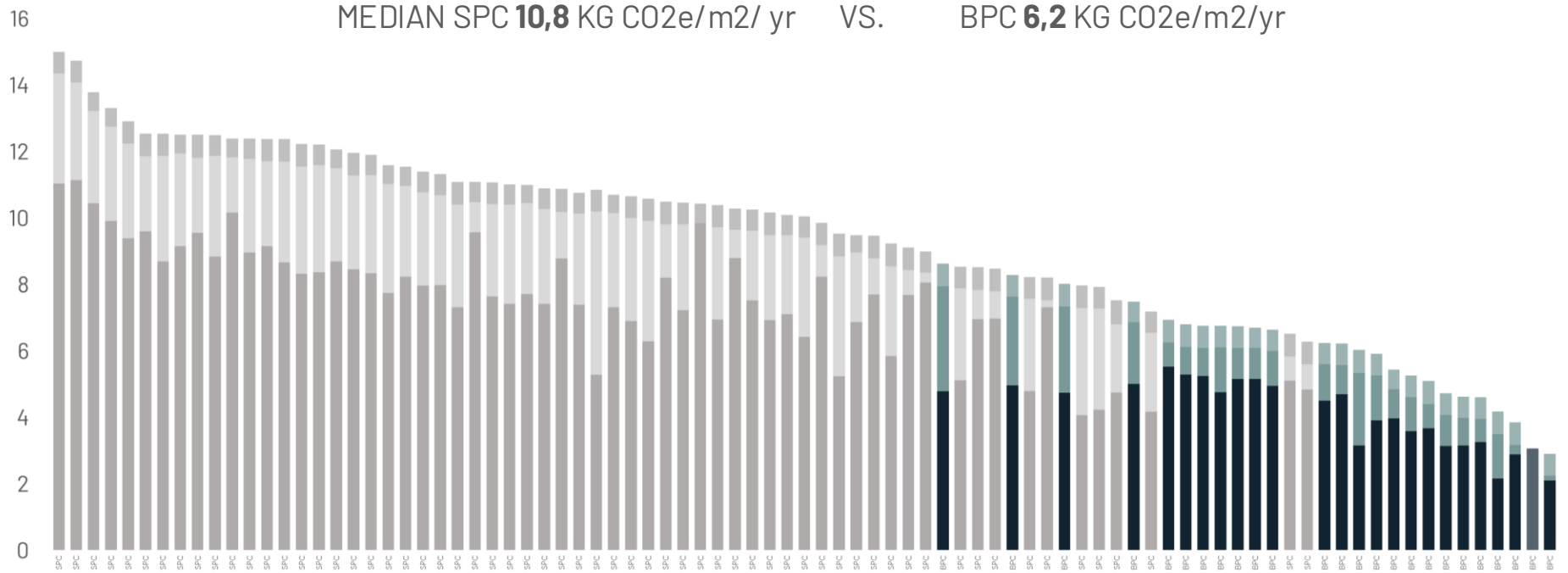


LCA REQUIREMENTS IN BUILDING CODE WITH LIMIT VALUES





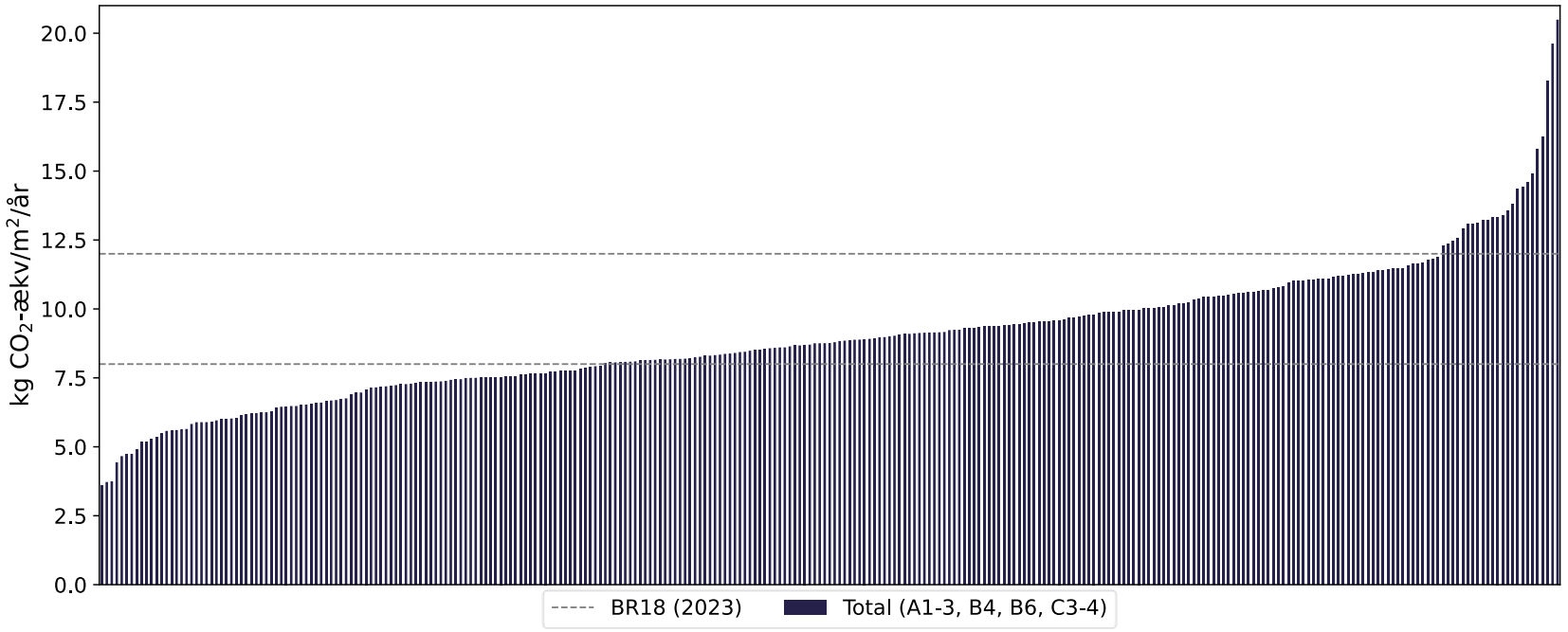
Conventional vs. best practice – how can we change?



Best practice cases with up to 76 % reduction from standard practice housing

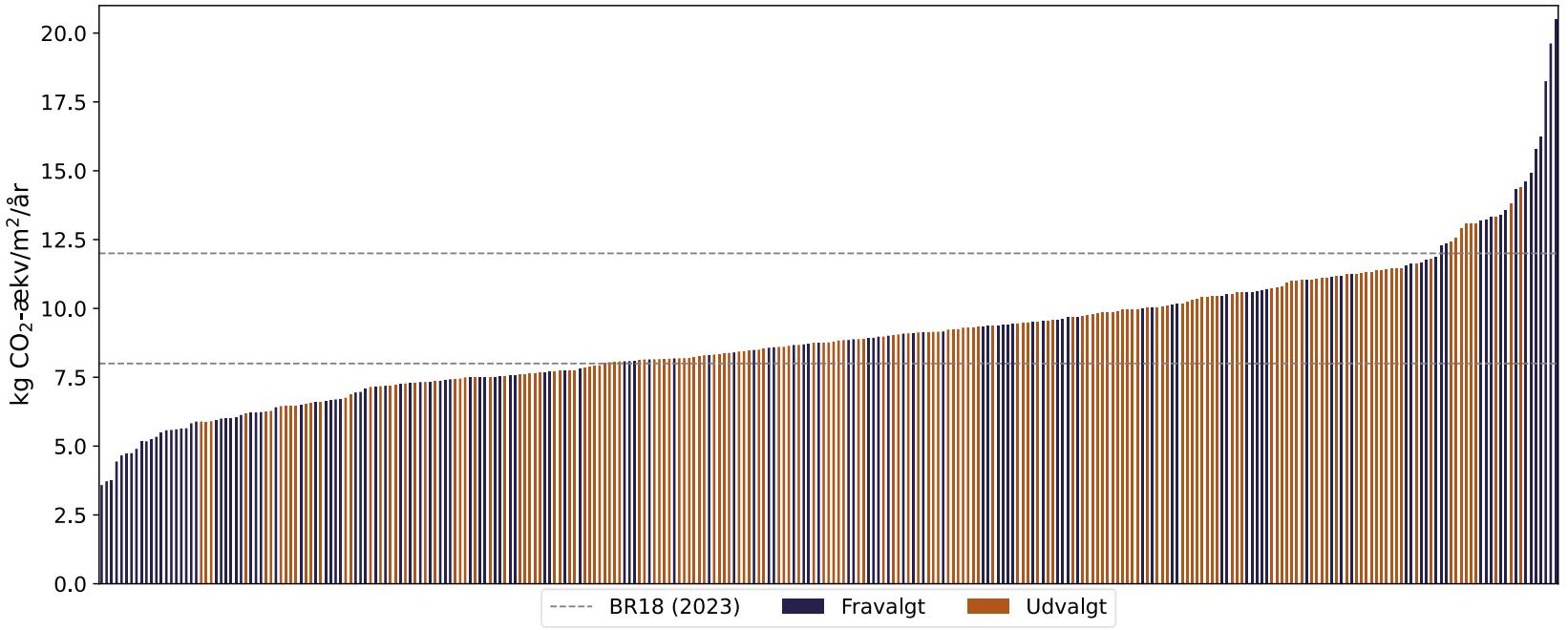
New construction (2023)
Climate impact from 292 buildings

292 cases



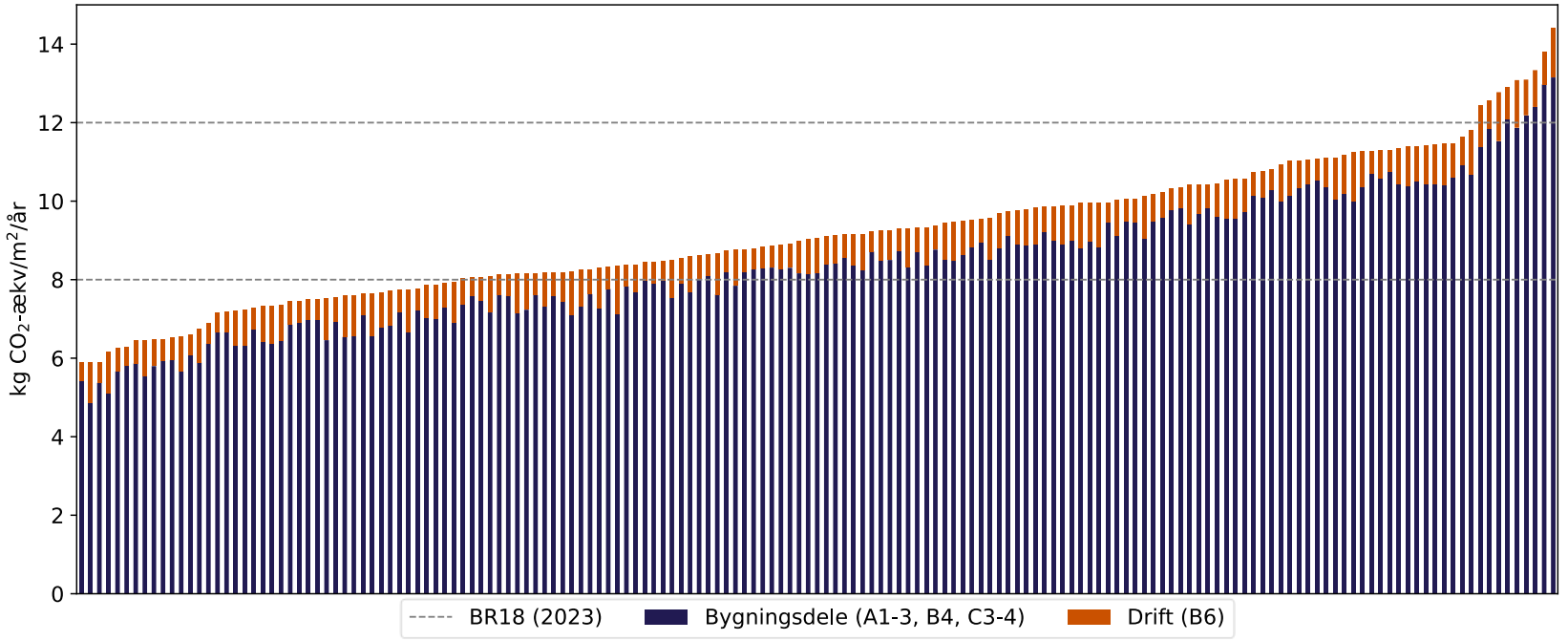
Climate impact from 292 buildings 2023

Selecting out of atypical new construction, where 292 cases are reduced to 163 representative cases

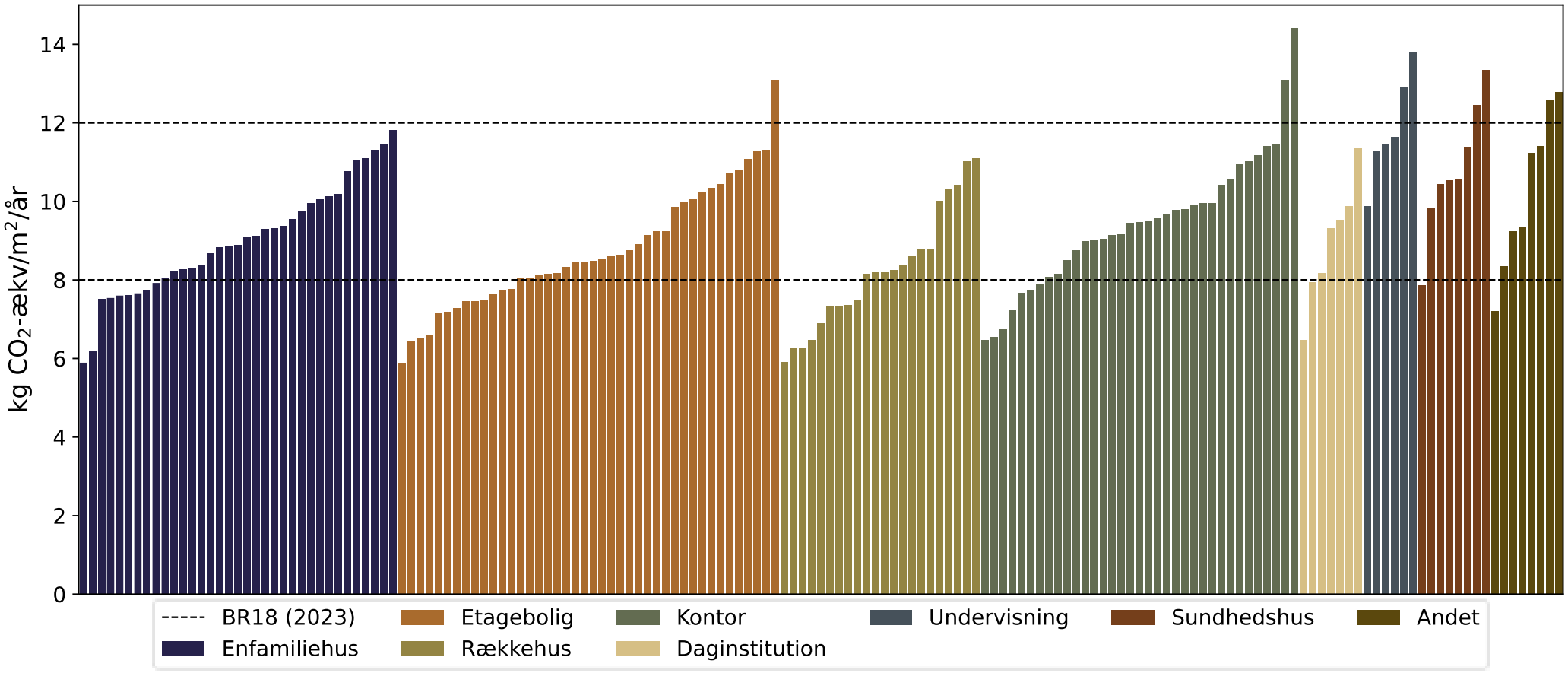


Climate impact from 292 buildings 2023

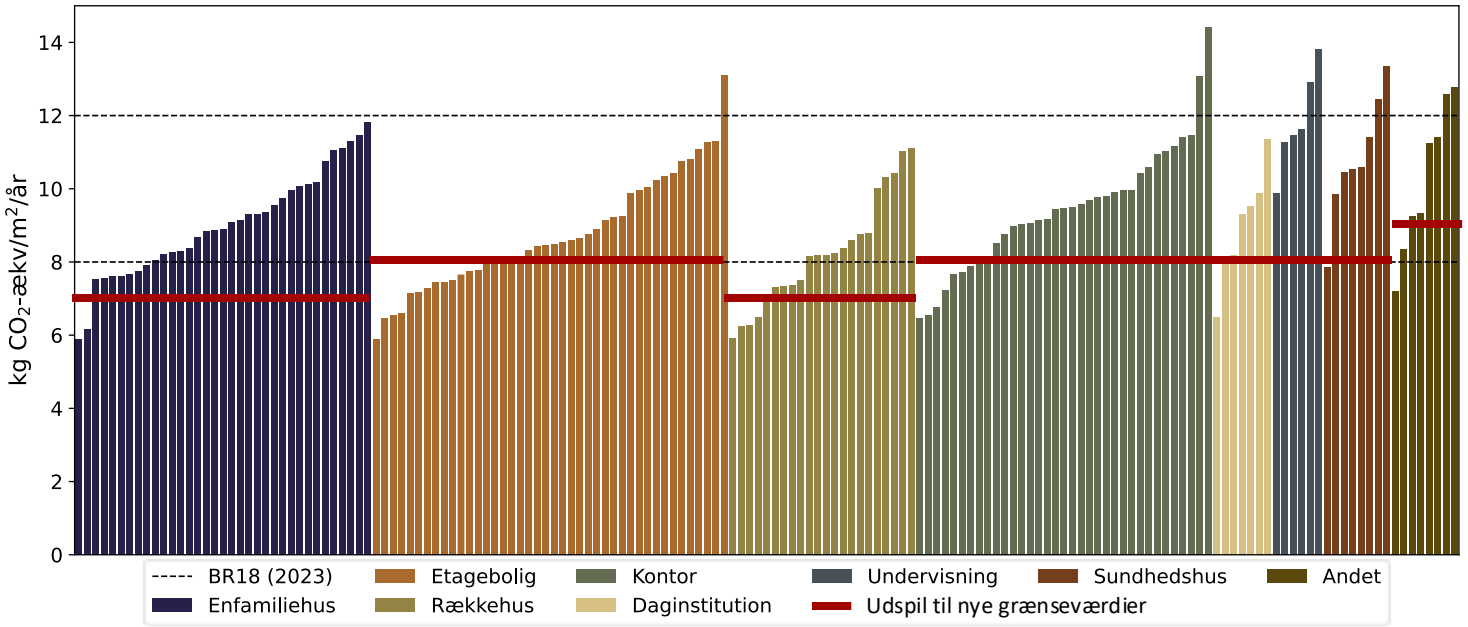
Climate impact from 163 representative cases for what is being built in Denmark



Different building types

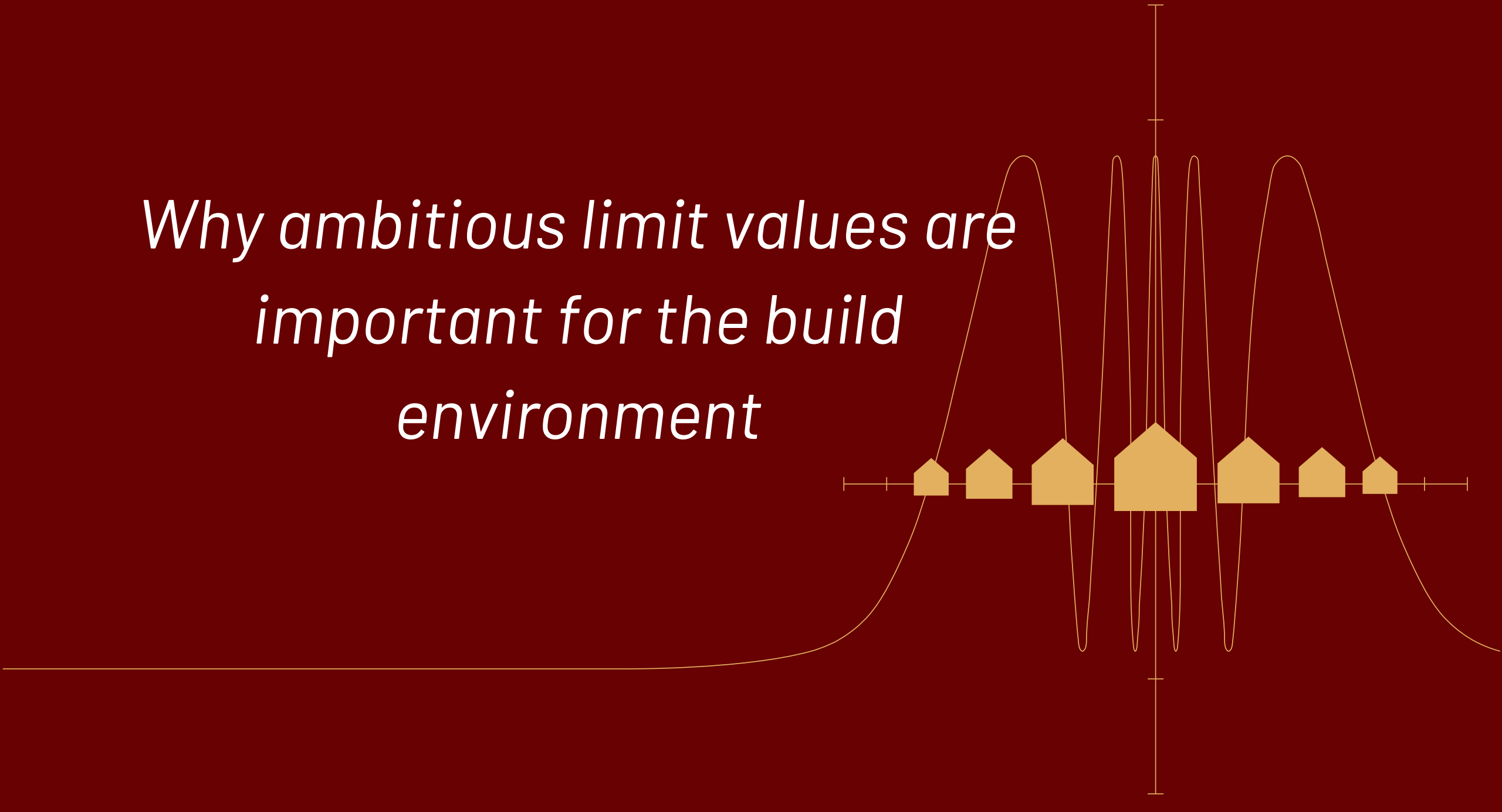


New limit values for 2025

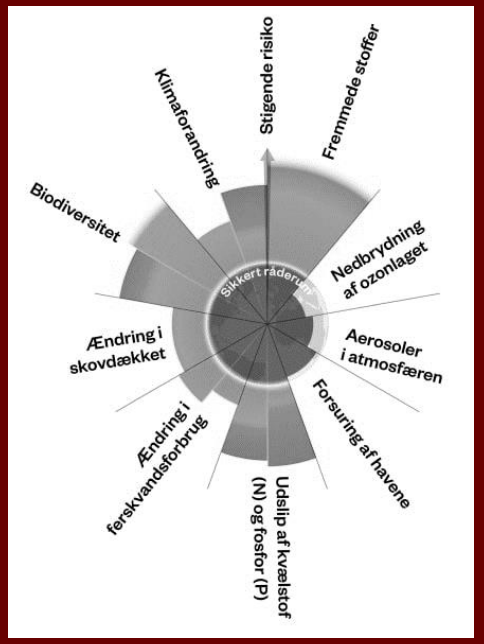


Climate requirements for buildings	**Limit value** kg C02-ækv. / m2 / year
Single-family houses and terraced houses	6,7
Multi-storey dwellingsr	7,5
Office buildings	7,5
Institutions	8,0
Other new construction, e.g. shops, warehouses and parking garages	8,0
Holiday homes and the like (not included in the calculation basis for the graph)	4,0

Why ambitious limit values are important for the build environment



Urgent environmental challenge:



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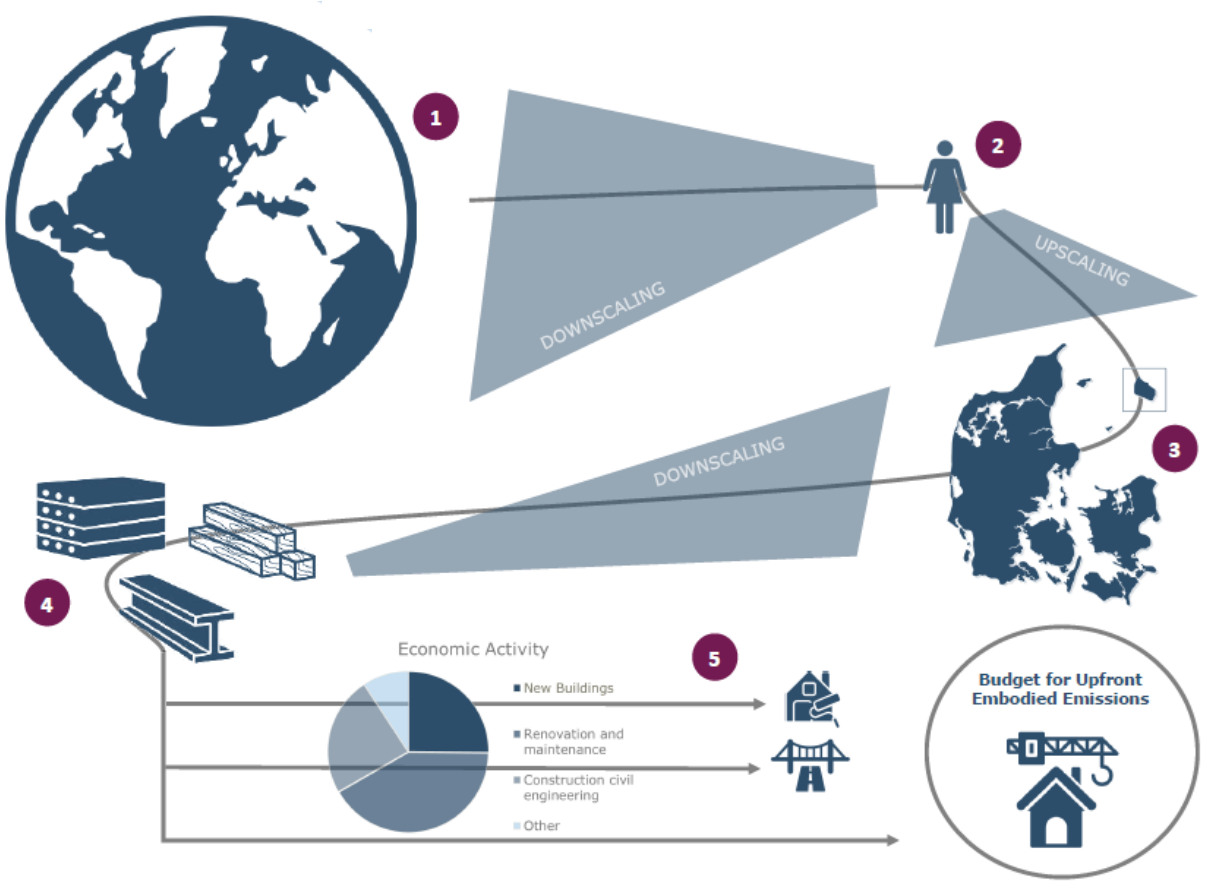
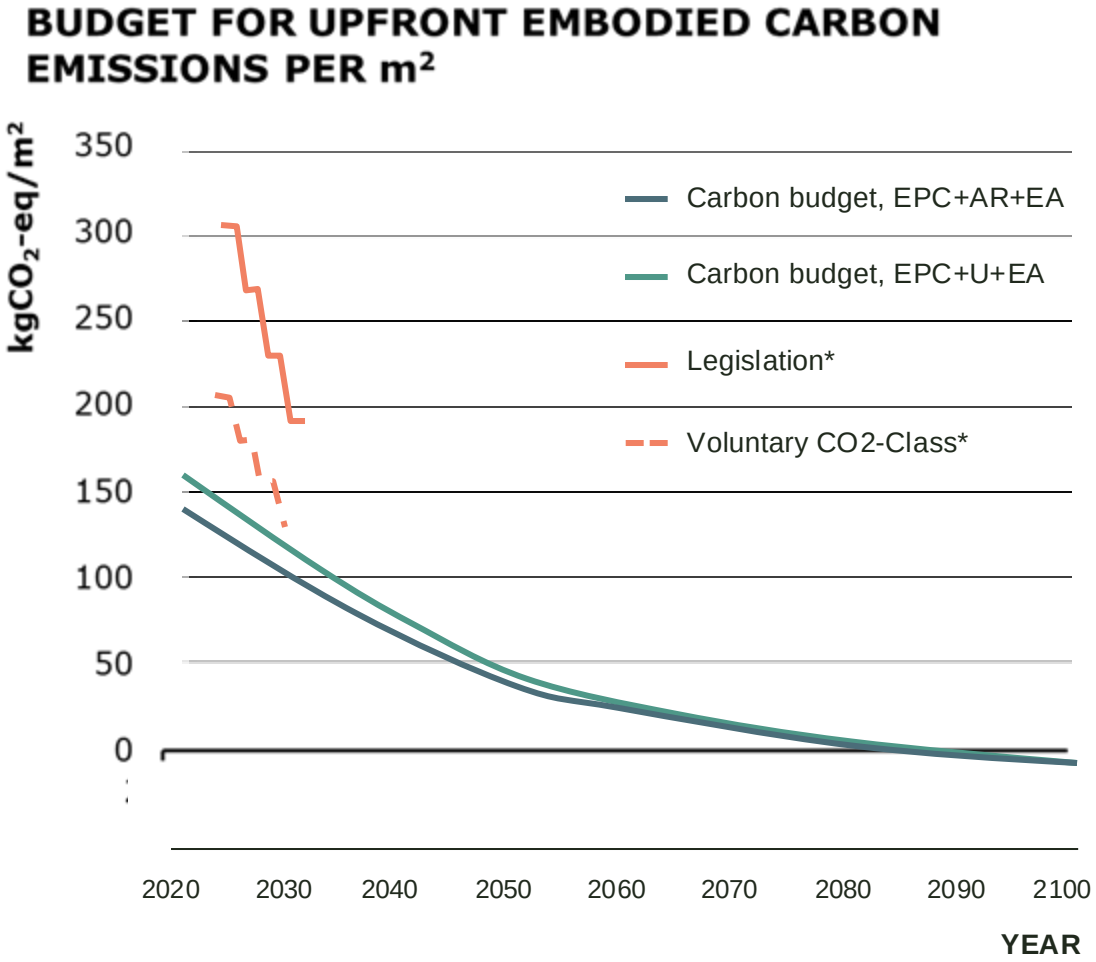
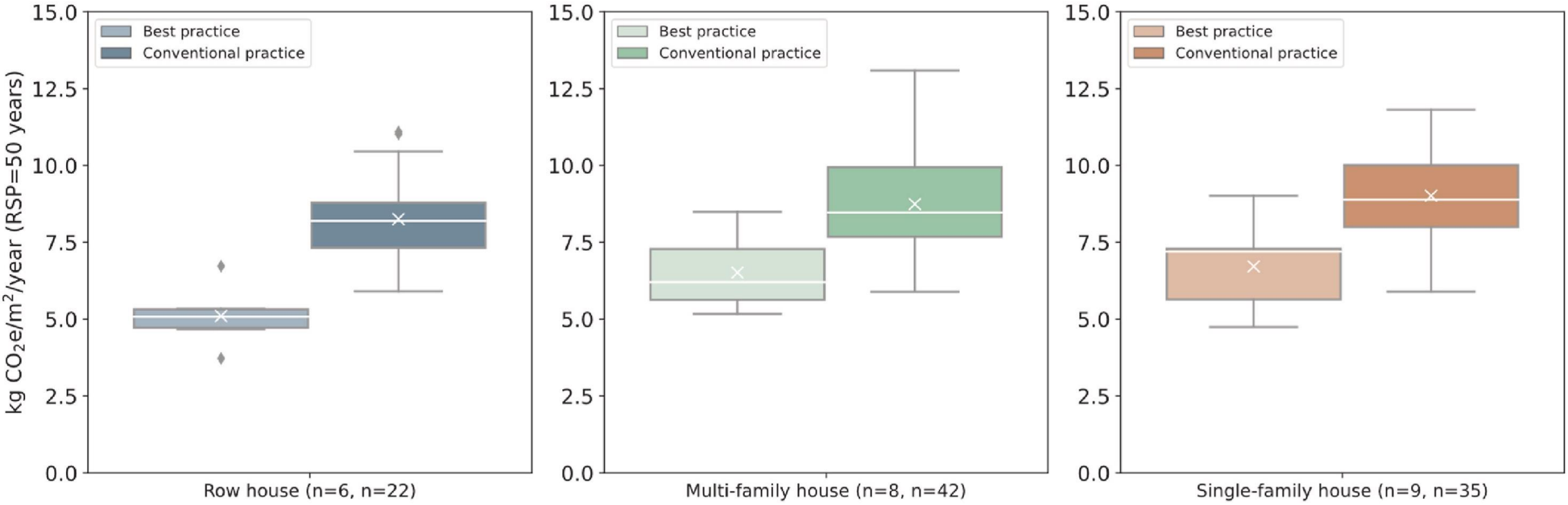
How far are the limit values in the building code from the CO2 budgets of the Paris agreement?





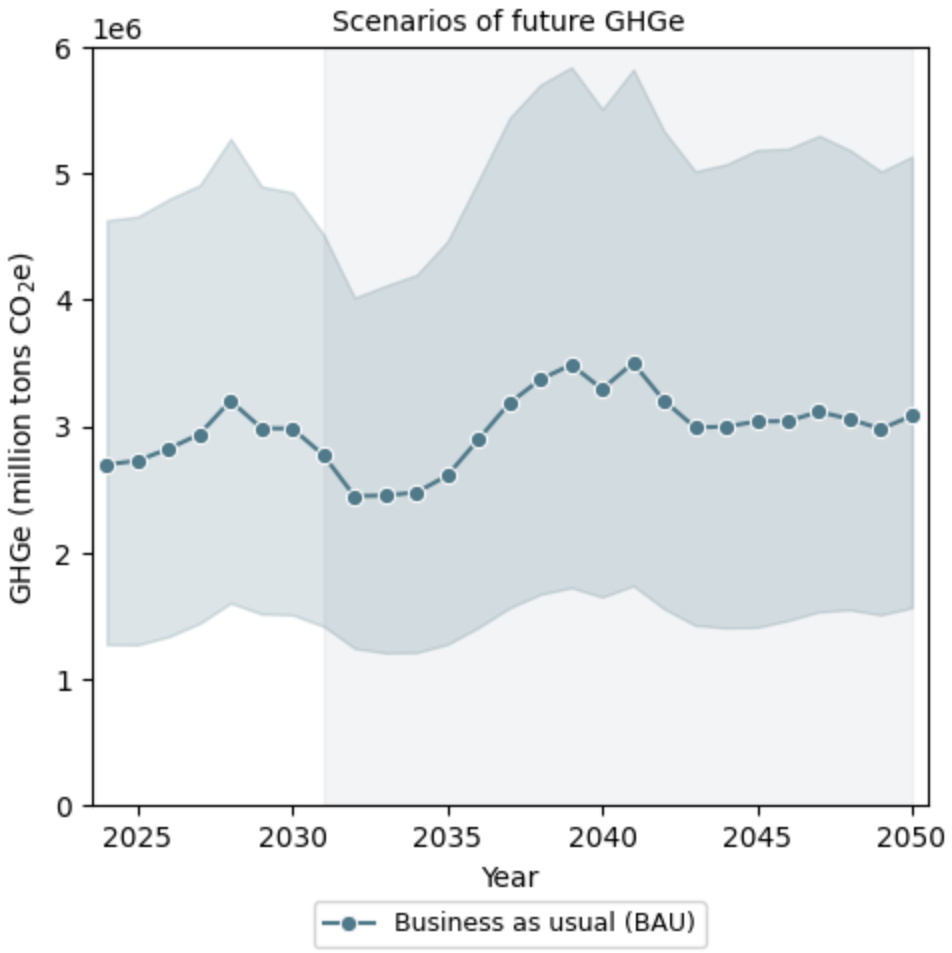
Industrial Phd project: **Lise Hvid Horup Sørensen**, Rambøll
Supervisors: Morten Ryberg, Michael Hauschild, Harpa Birgisdottir, Christian Thuesen, Andreas Qvist Secher and Gitte Gylling

Large variation between conventional and best practice



A novel approach to establishing bottom-up LCA-based limit values for new construction. Buket Tozan et al. 2024

The effects of limit values: The future GHGe (million tons CO2e) from new construction



- WLC from large share of New construction in Denmark
- Based on WLC data for building types
- Scenarios for future new build based on previous building activity

Resource consumption and GHGe of future new construction: Hotspots for mitigation efforts in Denmark. Buket Tozan et al. 2025

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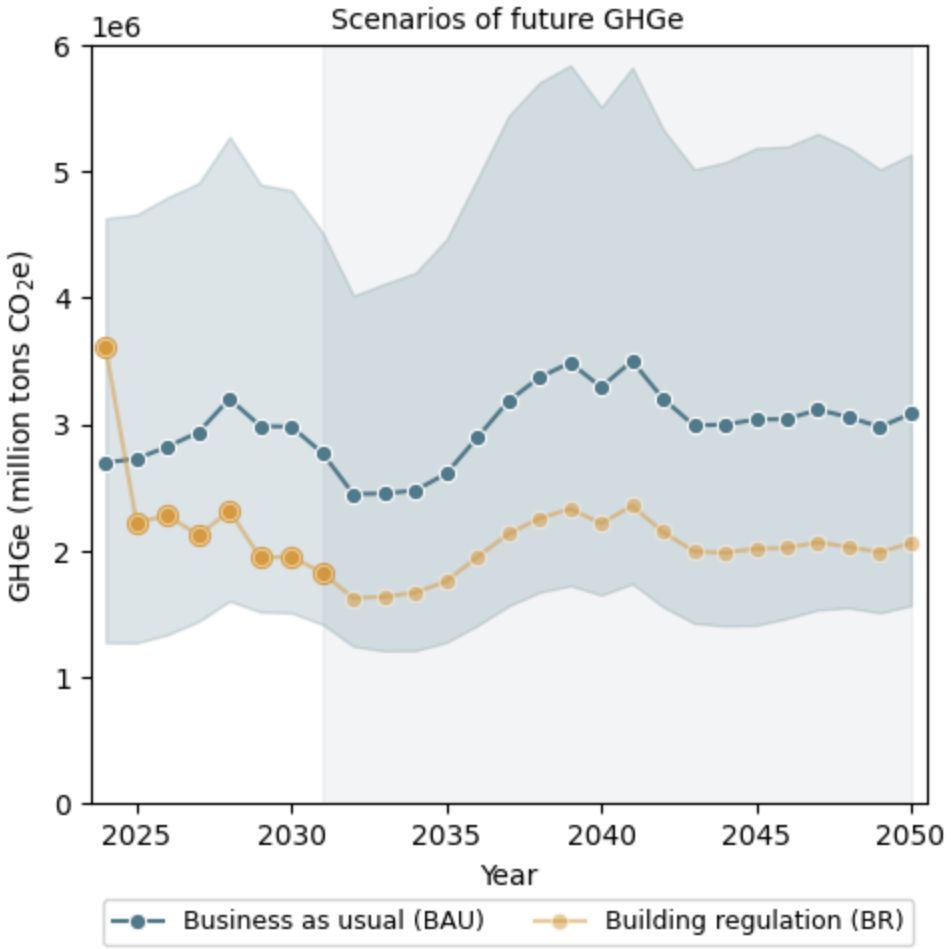

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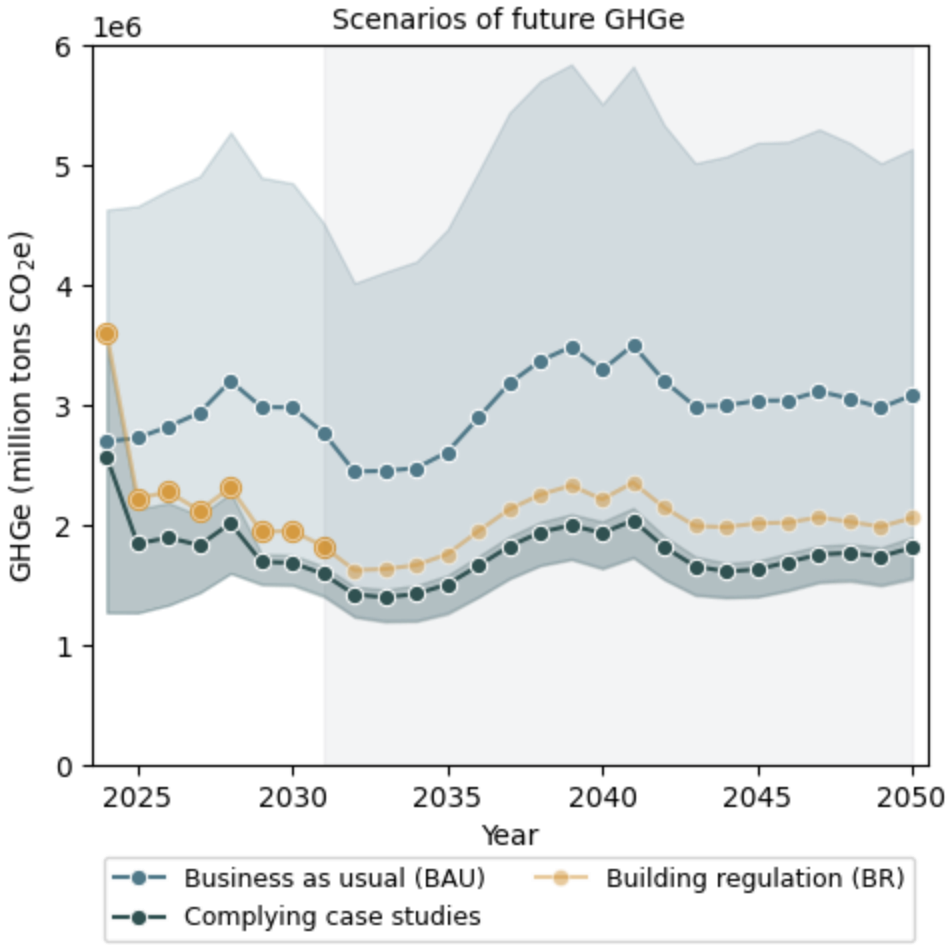

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- The emissions if buildings just fulfill the limit values (2023 - 2025 – 2027 – 2029)

- Scenarios for WLC emissions for new construction after limit values

Resource consumption and GHGe of future new construction: Hotspots for mitigation efforts in Denmark. Buket Tozan et al. 2025

Sufficiency and absolute targets

m2

We need to talk about our consumption of space

m2

Danes have the largest building area per person in the world.

Average:
54 m2 living space/person
22 m2 service area / person

The detached house has grown from the average of **122 m2** in 1963 to **213 m2** in 2022

m2

Large proportions of building area are unused

Danish families, for example, only use 37% of their living space regularly

Therefore, ambitious limit values can’t solve this alone

THANK YOU!