HEAVY
CLIMATE CONSULTING

CARBON LITERACY FOR SUSTAINABLE AND LOW CARBON BUILDINGS

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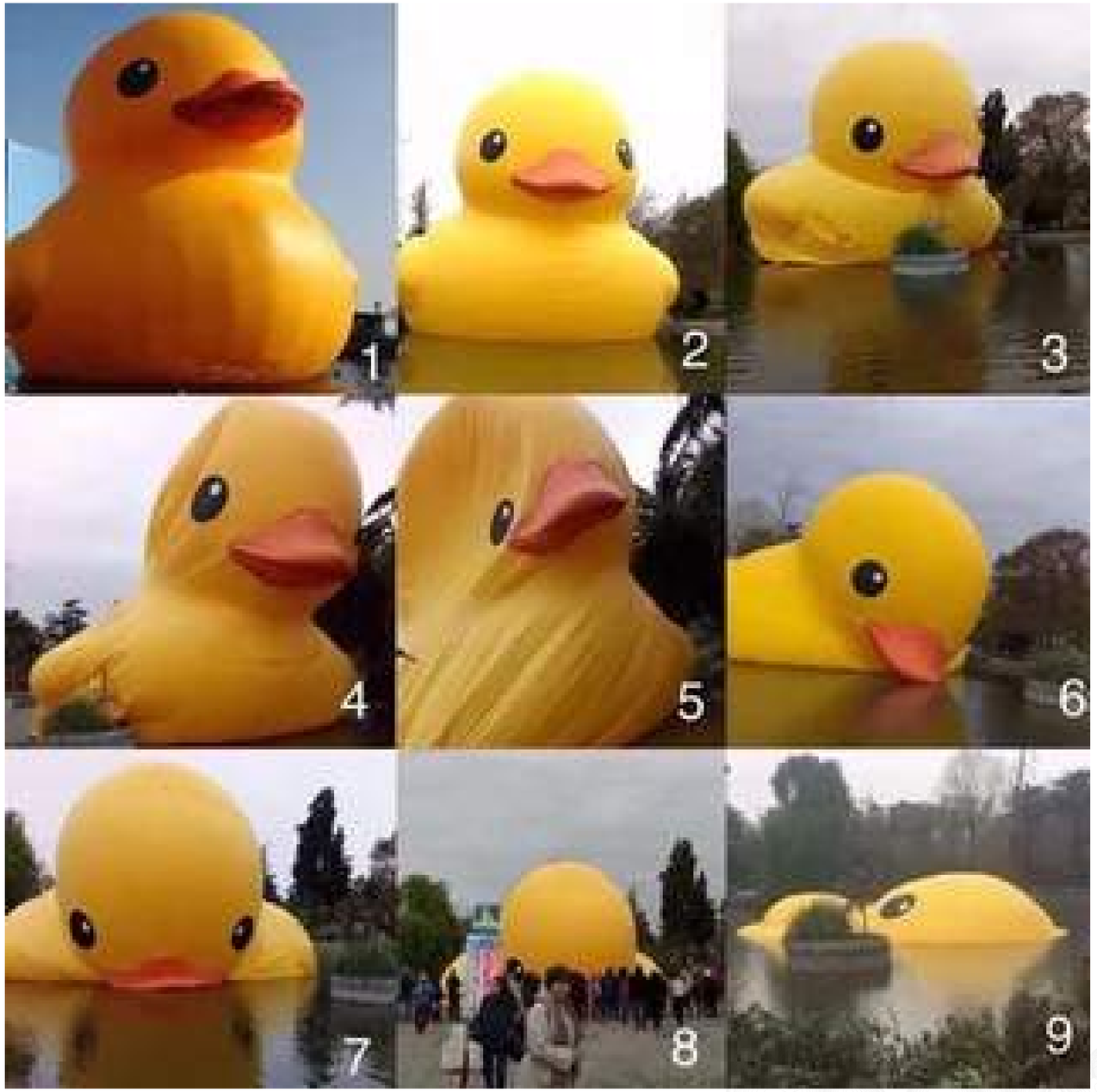
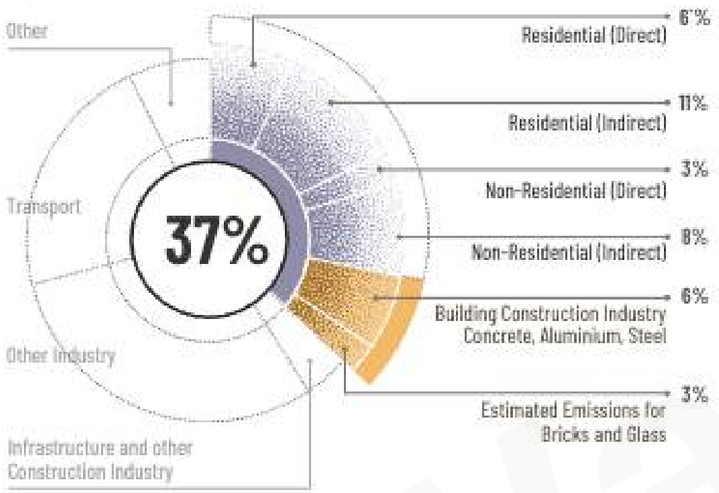
At Heavy Climate Consulting, we recognize that Ottawa is built on the unceded Anishinabe Algonquin territory, acknowledging the longstanding presence and connection of the Algonquin people to the land. The city, and many organizations within it, recognize the Algonquin as the traditional custodians and honor their historical and ongoing contributions.

DUCK-O-METER

How is everyone feeling today?



LEARNING OBJECTIVES



source: UNEP

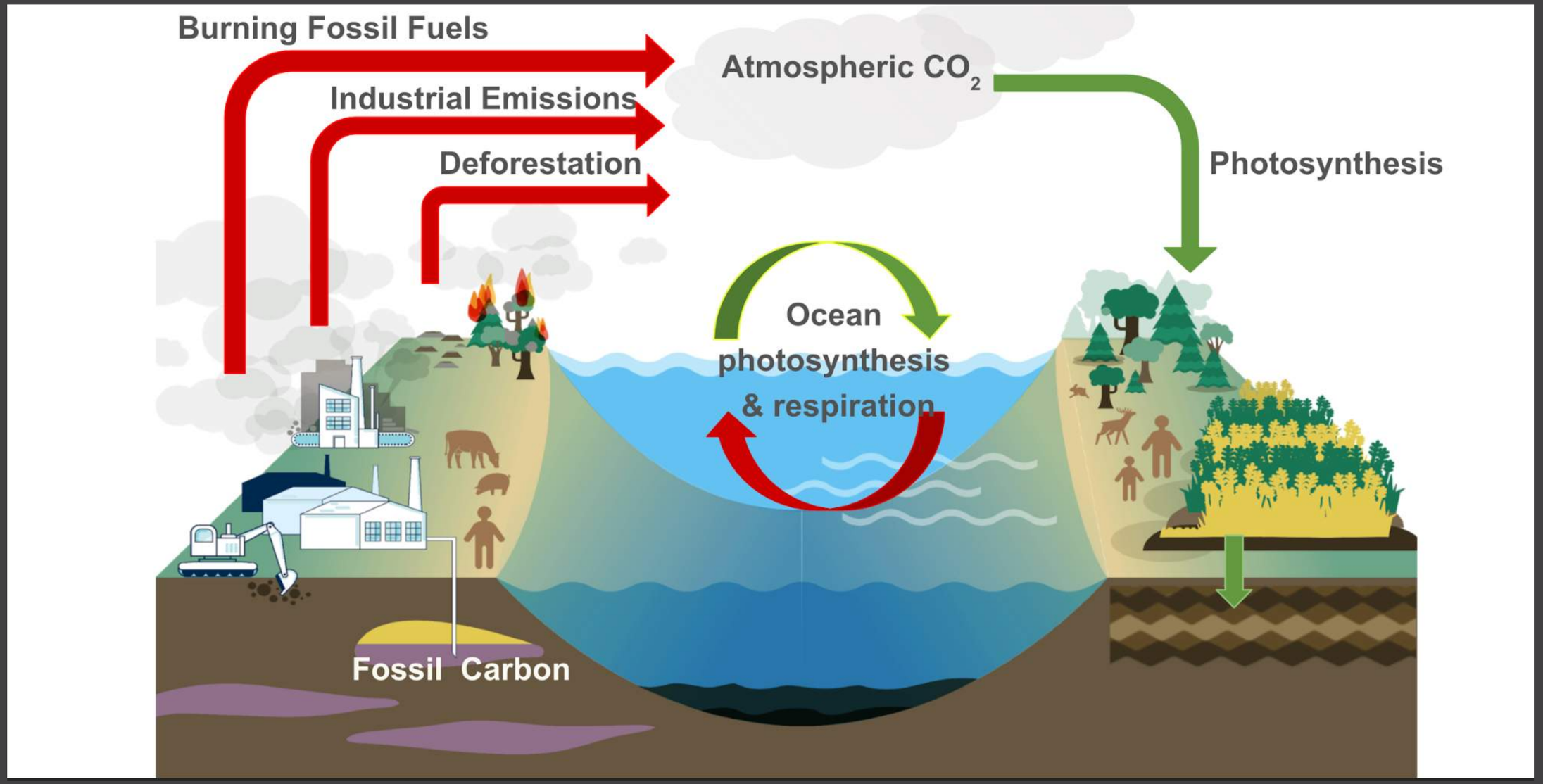
- Understand the basics of carbon
- Learn carbon management strategies
- Identify operational and embodied carbon reduction strategies
- Discover the benefits of early adoption of low-carbon design

Watermark

TABLE OF CONTENTS

PART 1: UNDERSTANDING CARBON

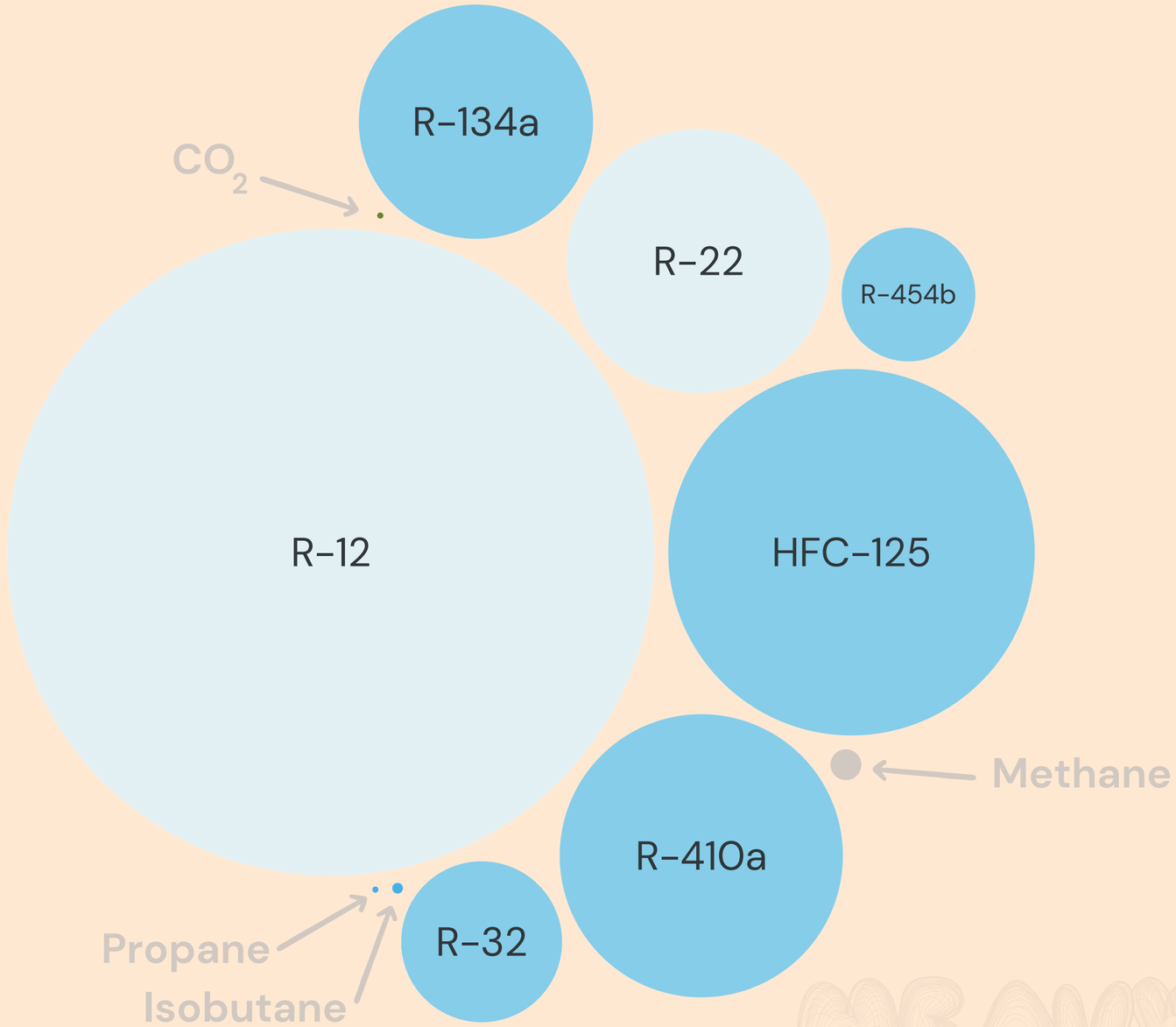

CARBON AND CLIMATE CHANGE
CO_2
source: edward burtynsky

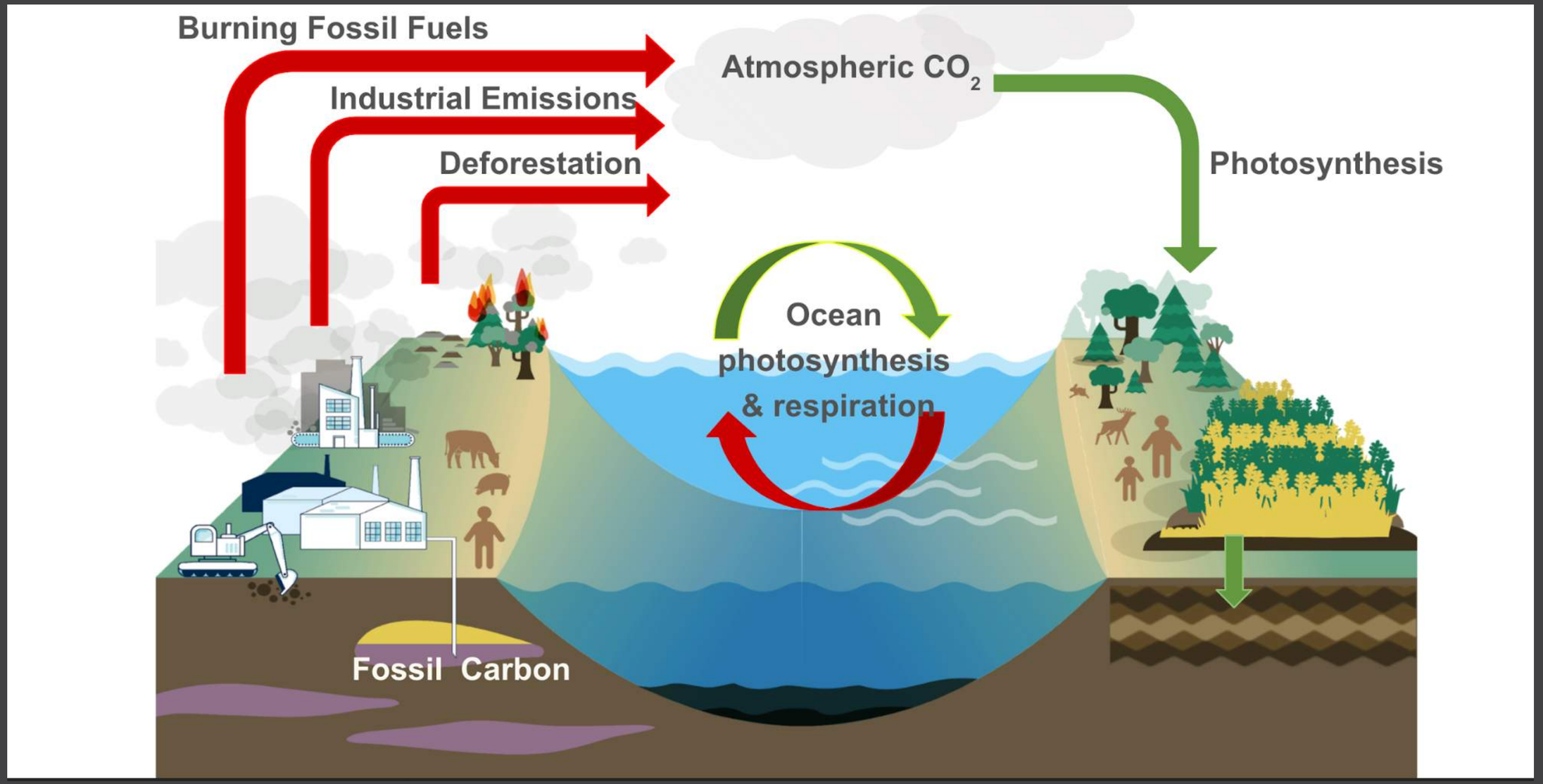


source: adapted from depositsmag.com

CO_2e =

Carbon Dioxide equivalent





source: adapted from depositsmag.com

UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

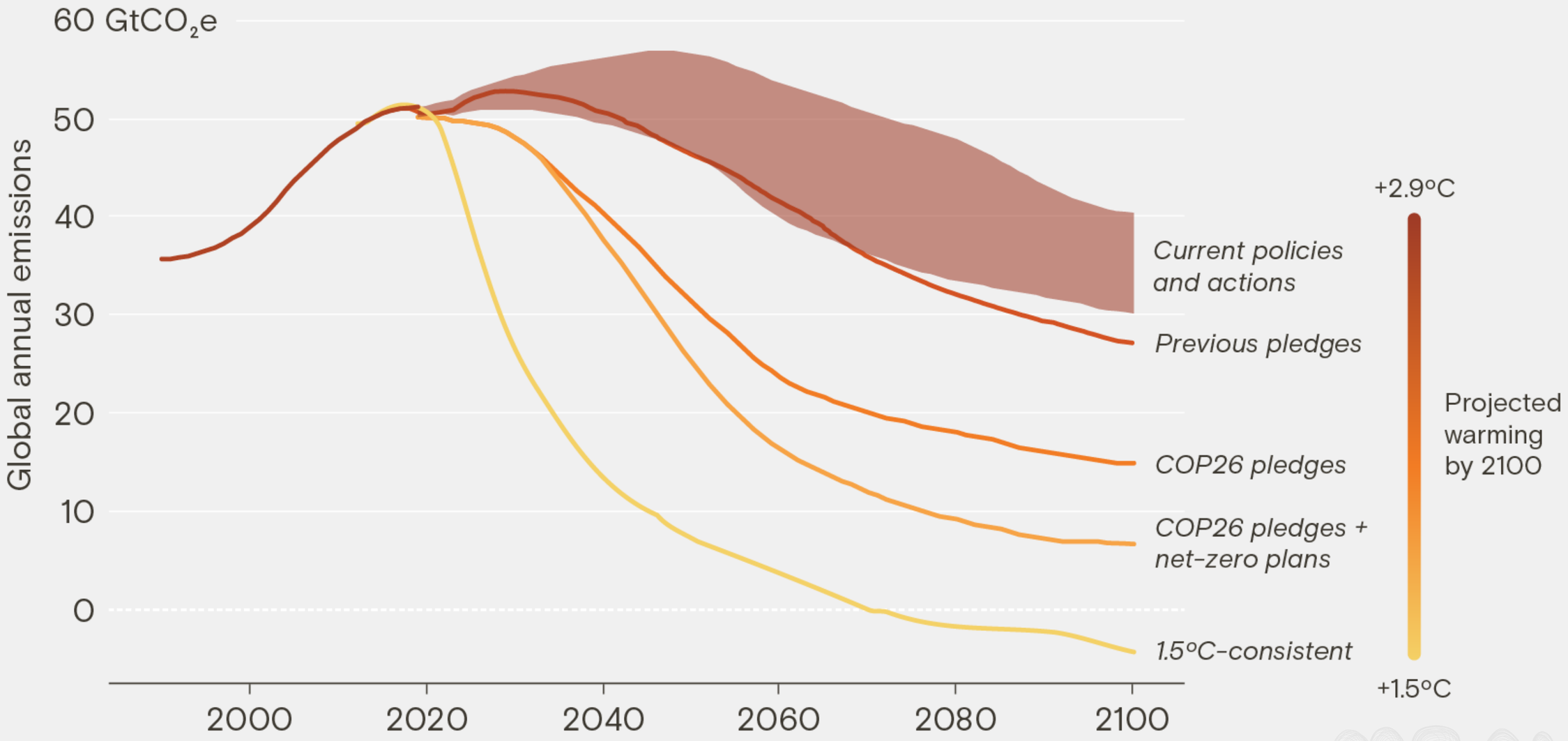
source: United Nations Department of Economic and Social Affairs

We stand at a pivotal point in history – the halfway mark for achieving the 2030 Agenda for Sustainable Development. With only 15% of the Sustainable Development Goals (SDGs) on track, we are down at half-time and far from meeting global climate goals. The most recent ***Sustainable Development Goals Report 2022*** highlights the increasing impacts of climate change and extreme weather events, along with other interlinking global challenges, which are setting back development gains and threatening the full achievement of the SDGs by 2030.

source: United in Science 2023

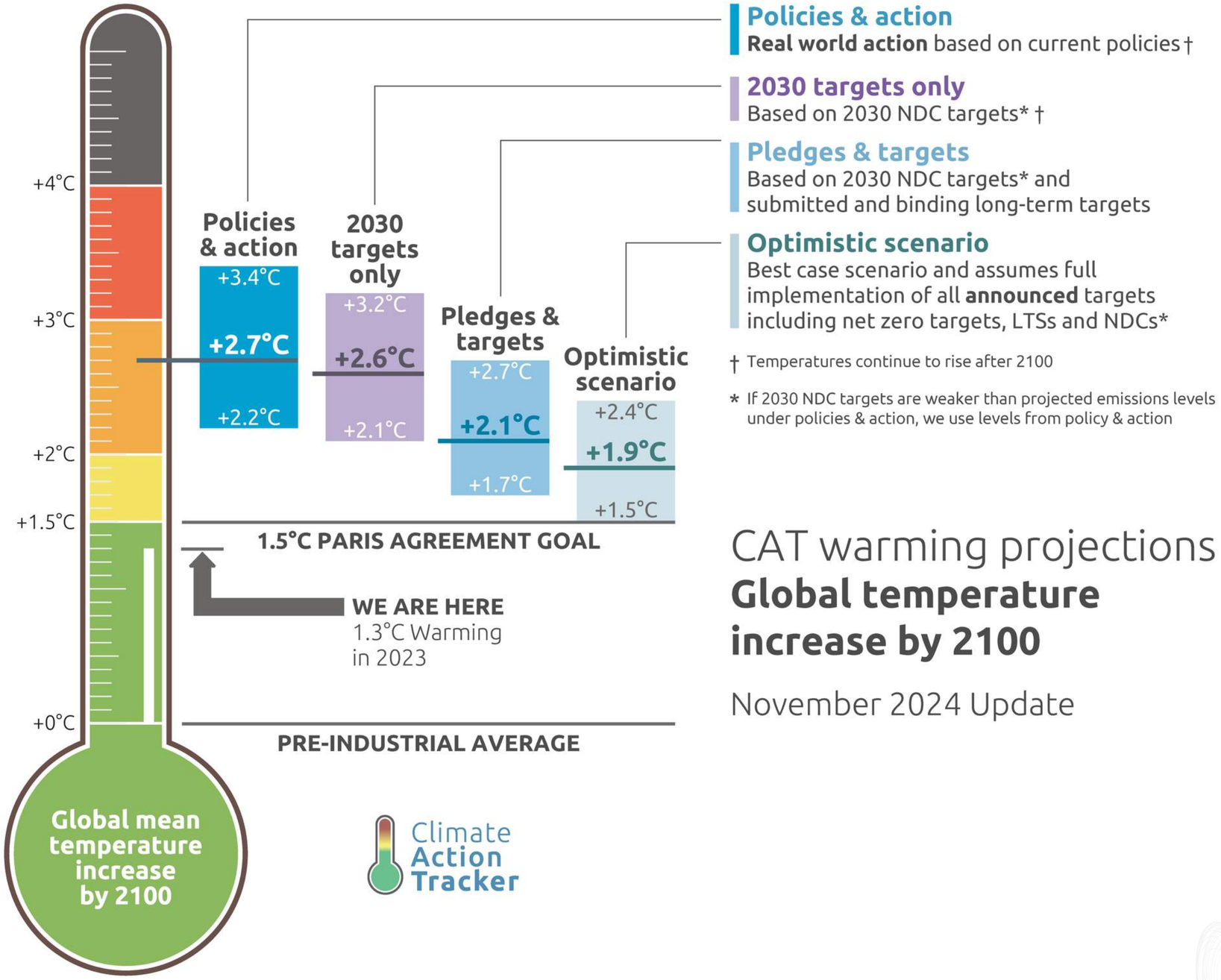
The emissions gap

Even if countries stick to COP26 pledges, we won't limit warming to 1.5°C



Data source: Climate Action Tracker

Grist



Policies & action
Real world action based on current policies†

2030 targets only
Based on 2030 NDC targets* †

Pledges & targets
Based on 2030 NDC targets* and submitted and binding long-term targets

Optimistic scenario
Best case scenario and assumes full implementation of all **announced** targets including net zero targets, LTSs and NDCs*

† Temperatures continue to rise after 2100

* If 2030 NDC targets are weaker than projected emissions levels under policies & action, we use levels from policy & action

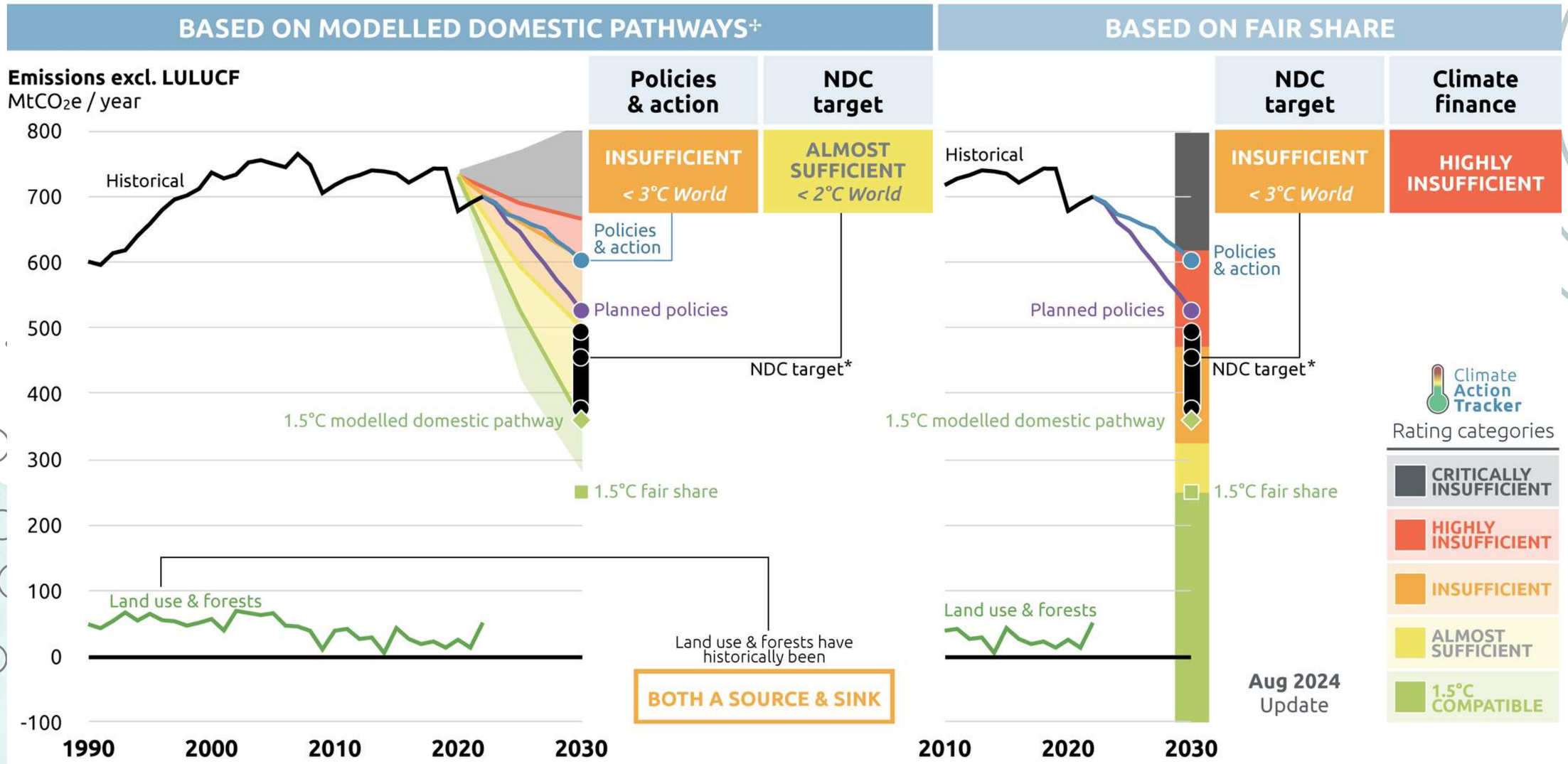
CAT warming projections **Global temperature increase by 2100**

November 2024 Update

source: Climate Action Tracker

CANADA OVERALL RATING

INSUFFICIENT

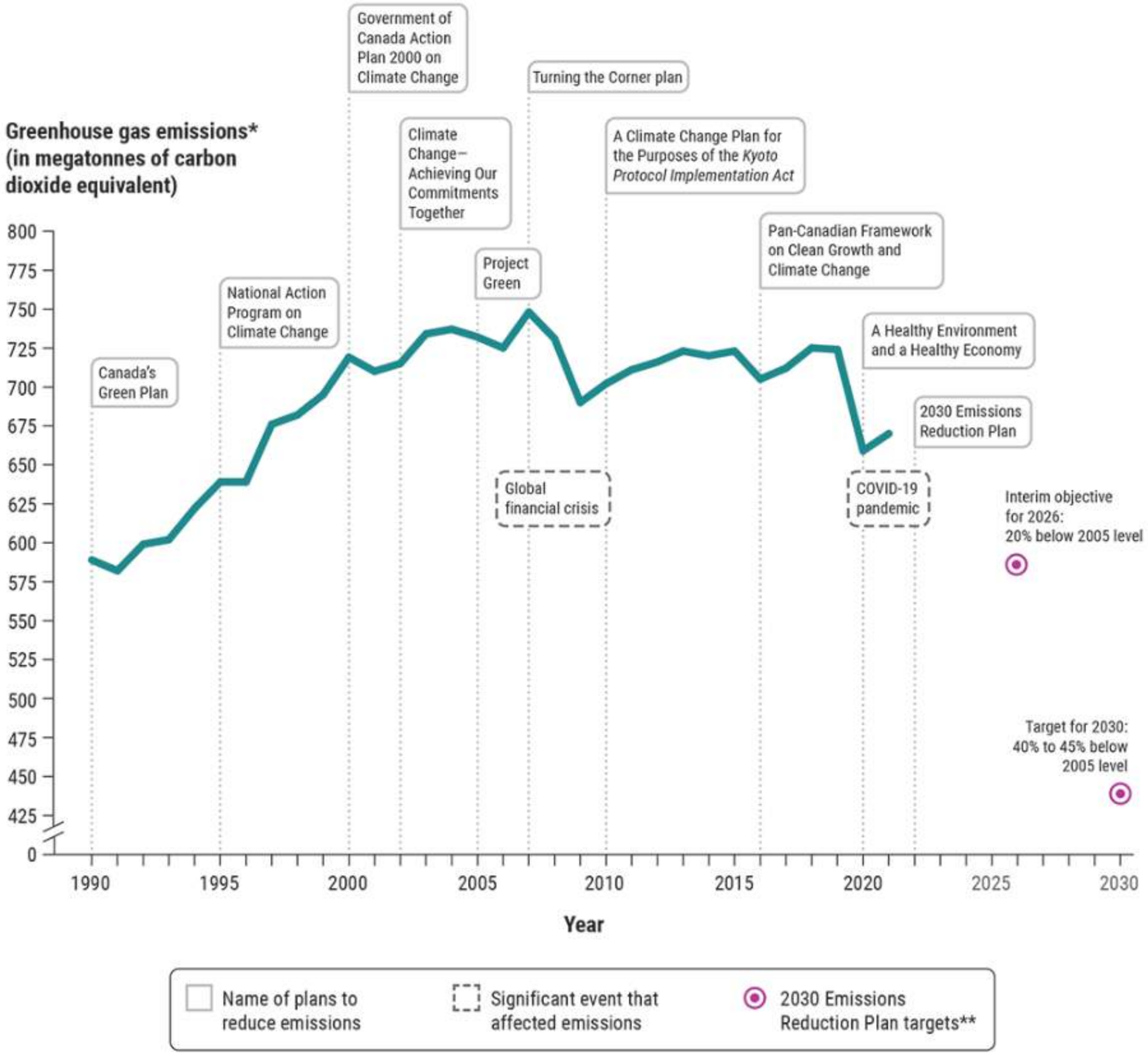


✢ Modelled domestic pathways reflects a global economic efficiency perspective with pathways for different temperature ranges derived from global least-cost models

* Due to the uncertainty surrounding LULUCF, the 2030 target is rated from the average of the range around the 40% target, rather than the top of the 40–45% target range

source: Climate Action Tracker


Gardiner Expwy
WEST
Richmond St.
Downtown



source: reports of the commissioner of the environment and sustainable development

MUNICIPAL LEGISLATION

- Toronto Green Standard
- TransformTO
- Building Emission Performance Standards
- NCC's 2024 Climate Adaptation Plan
- Ottawa's High Performance Development Standard
- Waterloo Region's Green Building Policy
- City of Hamilton

KEY CONCEPTS IN CARBON LITERACY

Carbon Footprint

Decarbonization

Carbon Sequestration

What are Scope 1, 2 and 3 carbon emissions?

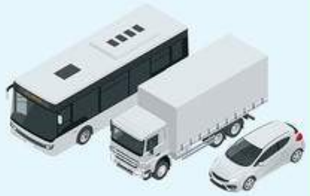
The three scopes are a way of categorising the different types of greenhouse gas emissions created by a company, its suppliers and its customers.

Scope 1
Direct emissions

Direct emissions that are owned or controlled by a company.

Emissions from sources that an organisation owns or controls directly.

Example
From burning fuel in the company's fleet of vehicles (if they're not electrically powered).



Scope 2
Indirect emissions

Indirect emissions that are a consequence of a company's activities but occur from sources not owned or controlled by it.

Emissions a company causes indirectly that come from where the energy it purchases and uses is produced.

Example
The emissions caused by the generation of electricity that's used in the company's buildings.

Scope 3
Indirect emissions

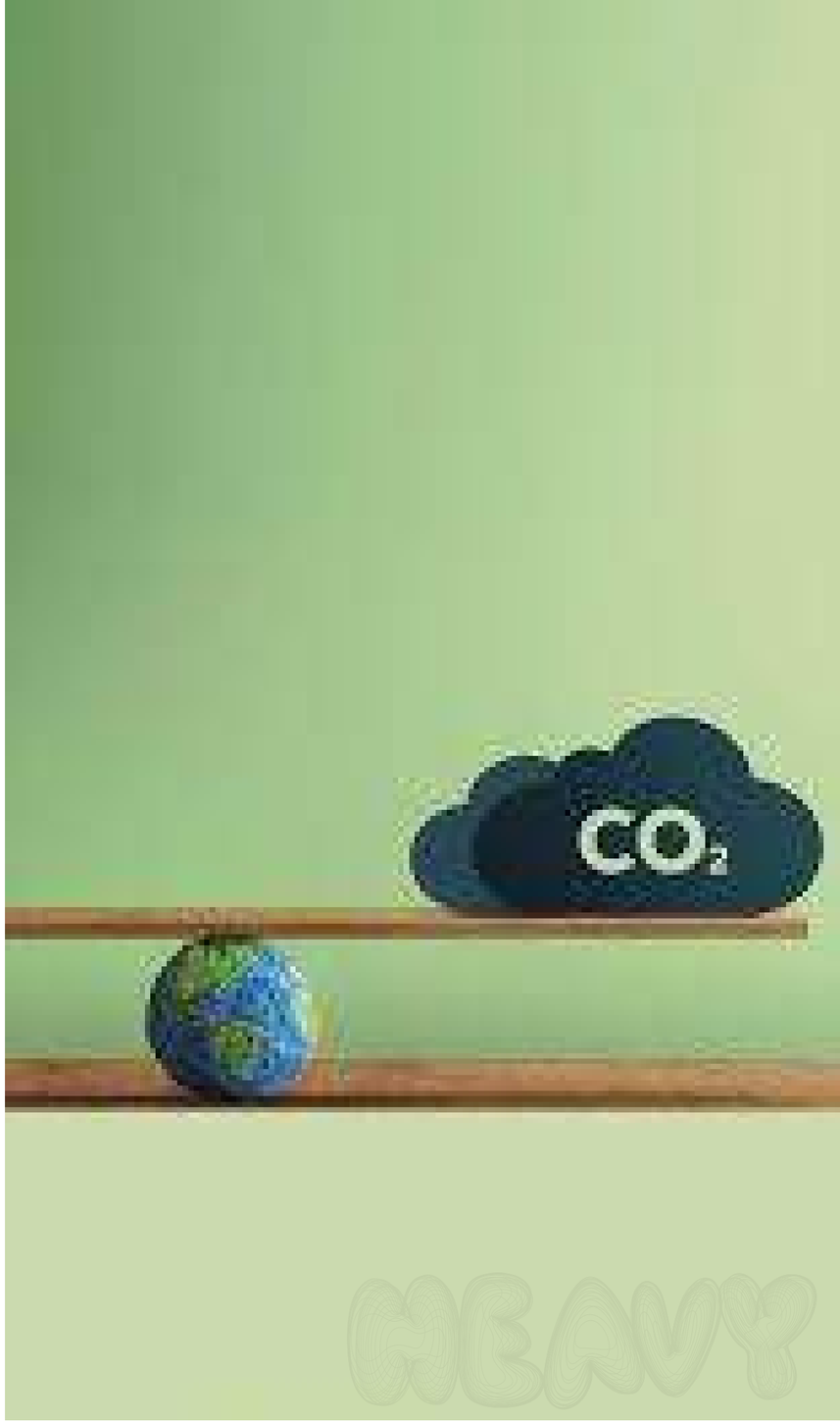
All emissions not covered in scope 1 or 2, created by a company's value chain.

Example
When the company buys, uses and disposes of products from suppliers.

nationalgrid

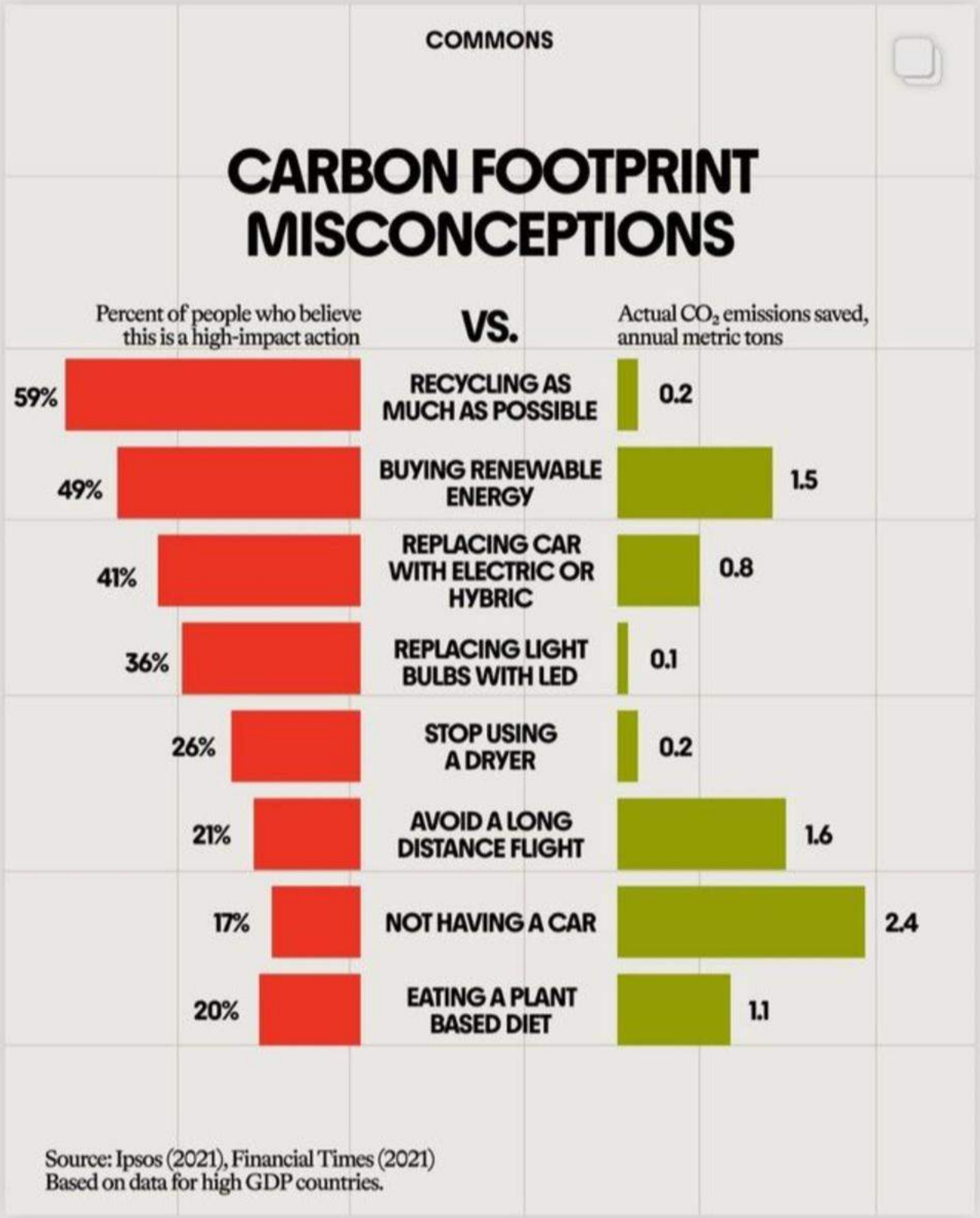
CARBON MANAGEMENT STRATEGIES


C O2
TAX
The Carbon Tax is Gone – Now What?
As of April 1st, 2025, Canada has effectively abolished its federal carbon tax system. While this move seems to have broad support, the medium- and long-term effects of canceling the program have...
Mantle Developments · Apr 30


CO2


Hydrogen H2
H2 HYDROGEN POWER
CLEAN ENERGY OF THE FUTURE

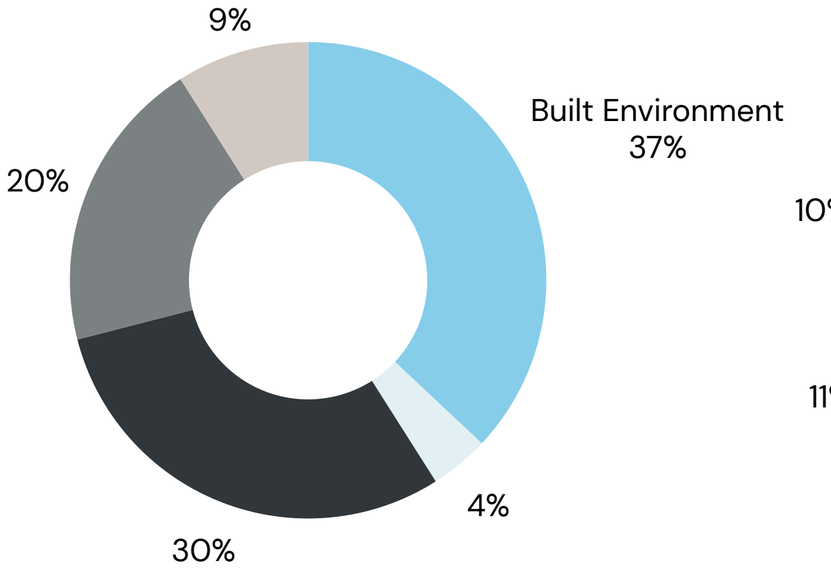

Qnergy
WEBER COUNTY
VeriCarbon
LANDFILL METHANE ABATEMENT
PILOT PROGRAM
A WEBER COUNTY RENEWABLE ENERGY PARTNERSHIP WITH
QNERGY AND VERICARBON
FOR MORE INFORMATION VISIT: WEBERCOUTYUTAH.COM
Qnergy


COMMONS
CARBON FOOTPRINT MISCONCEPTIONS
Percent of people who believe this is a high-impact action
VS.
Actual CO_2 emissions saved, annual metric tons
59%
RECYCLING AS MUCH AS POSSIBLE
0.2
49%
BUYING RENEWABLE ENERGY
1.5
41%
REPLACING CAR WITH ELECTRIC OR HYBRIC
0.8
36%
REPLACING LIGHT BULBS WITH LED
0.1
26%
STOP USING A DRYER
0.2
21%
AVOID A LONG DISTANCE FLIGHT
1.6
17%
NOT HAVING A CAR
2.4
20%
EATING A PLANT BASED DIET
1.1
Source: Ipsos (2021), Financial Times (2021)
Based on data for high GDP countries.


Coca-Cola
life

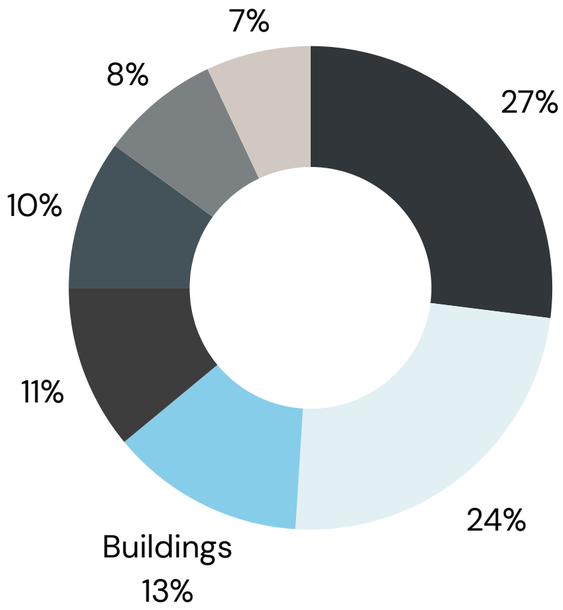

Bill C-59

PART 2: CARBON IN THE BUILT ENVIRONMENT



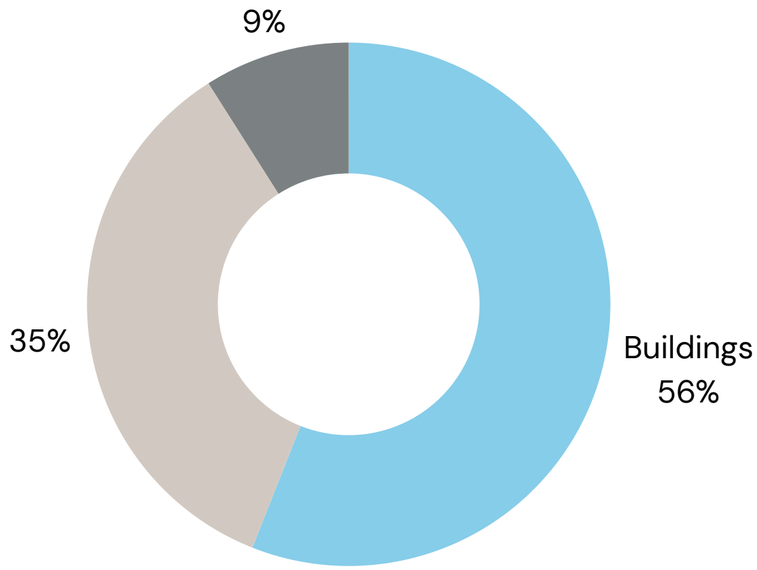
Global Greenhouse Gas Emissions *(2022)*

source: UNEP Building Materials and the Climate: Constructing a New Future



Canada’s Greenhouse Gas Emissions *(2020)*

source: Emission Reductions Through Greenhouse Gas Regulations—Environment and Climate Change Canada



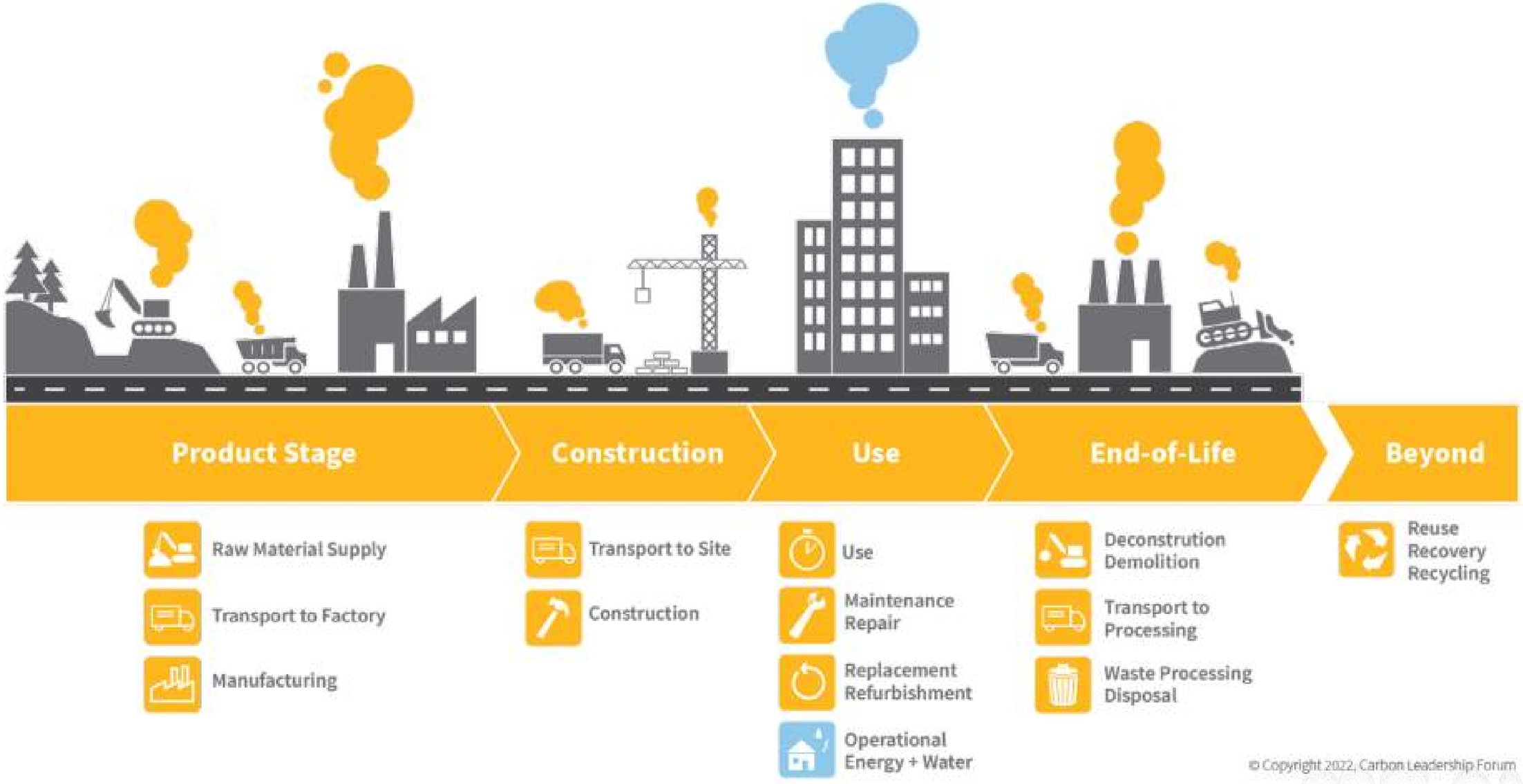
Toronto’s Greenhouse Gas Emissions by Sector *(2022)*

source: City of Toronto Sector-Based Emissions Inventory

postwar bungalow

$$ - medium renovation

Total Unit Count = 4 **Units**
Total Occupancy = 8 Beds
Ground Floor Area = 117.9m2
Basement Floor Area = 117.1m2
Garden Suite Floor Area = 104.8m2
Total Floor Area = 339.8m2



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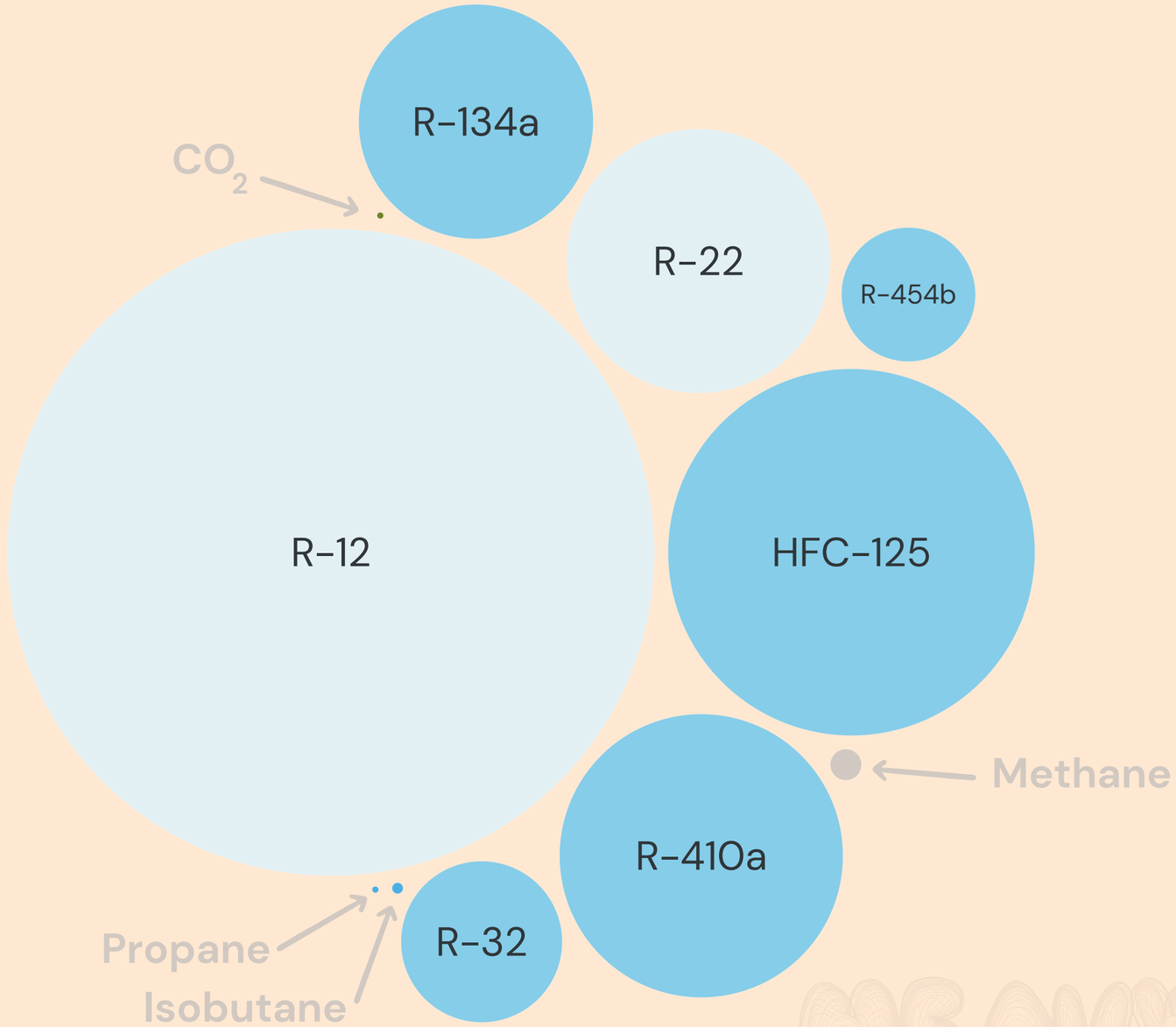
CO_2e =

Carbon Dioxide equivalent



STRATEGIES FOR REDUCING CARBON

Operational Carbon

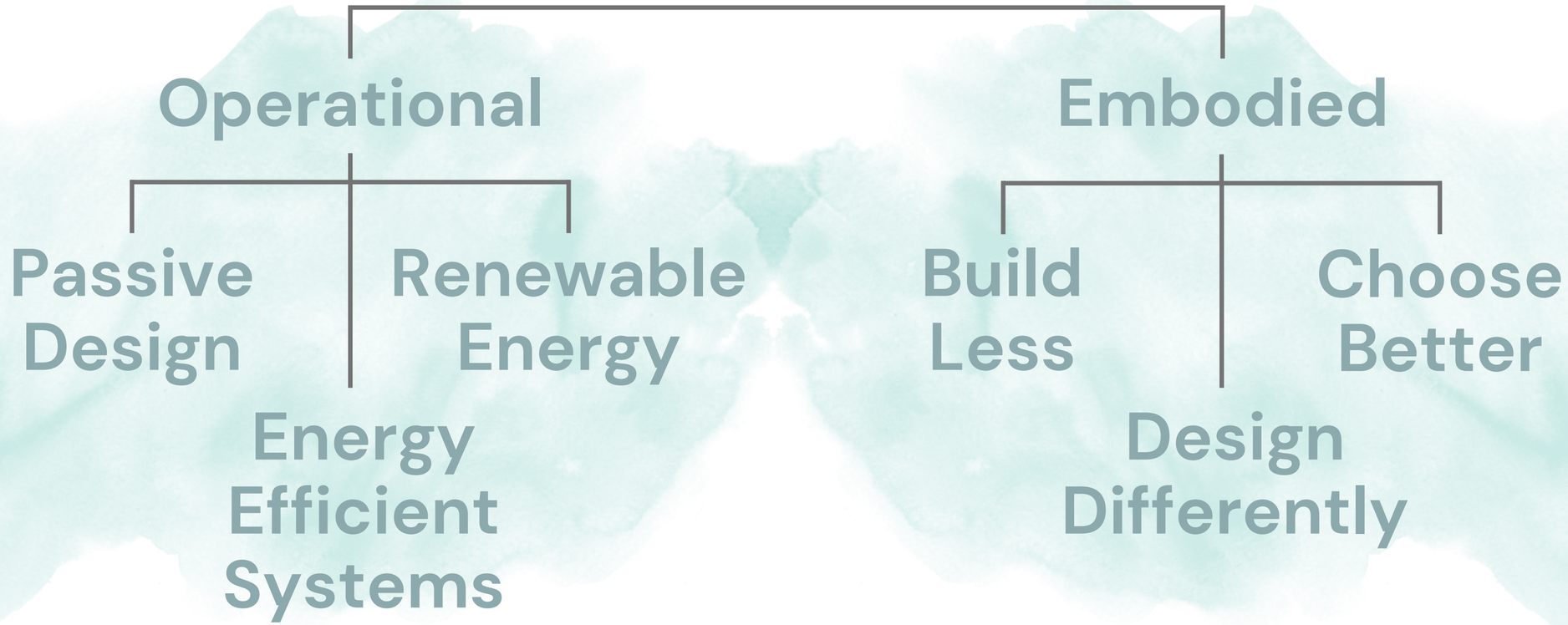
- Passive design
- Natural light and ventilation
- Energy efficient systems
- Renewables
- Commissioning and controls
- Grid awareness
- Load reduction

STRATEGIES FOR REDUCING CARBON

- Build Less
  - Reuse buildings and materials
  - Design for adaptability and disassembly
- Design Differently
  - Different structural materials
  - Structure, layout, floor plates, basements
- Choose Better
  - low carbon concrete, recycled steel, locally sourced, bio-based

Embodied Carbon

STRATEGIES FOR REDUCING CARBON



STRATEGIES FOR REDUCING CARBON

Operational

Energy modelling
Thermal Energy Demand Intensity (TEDI)
Energy Use Intensity (EUI)

OBJECTIVE
Passivhaus
ENERGY STAR Portfolio Manager
RETSCREEN

CaGBC Zero Carbon Workbook
Building Envelope Thermal Bridging Guide (BETBG)
Cove.Tool

Embodied

Environmental Product Declarations (EPDs)
Product Category Rules (PCRs)
Life Cycle Assessment (LCA)

RDH / TMU Building Enclosure Assembly Tool
One Click LCA
C.Scale

Athena Impact Estimator
BEAM
Tally / TallyCAT
EC3

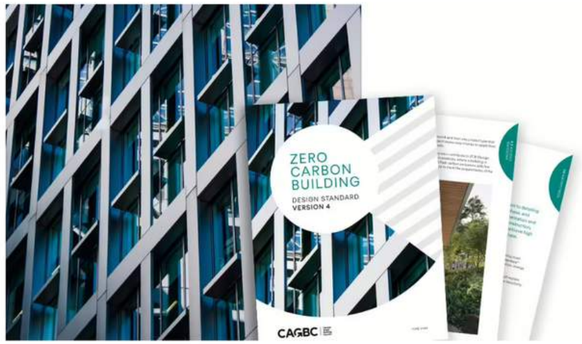
CAGBC | Canada Green Building Council

Two pathways for buildings

Zero Carbon Building – Performance Standard

The ZCB-Performance Standard™ is used to demonstrate that a building has achieved zero-carbon operations. It requires verification annually.

LEARN MORE



Zero Carbon Building – Design Standard

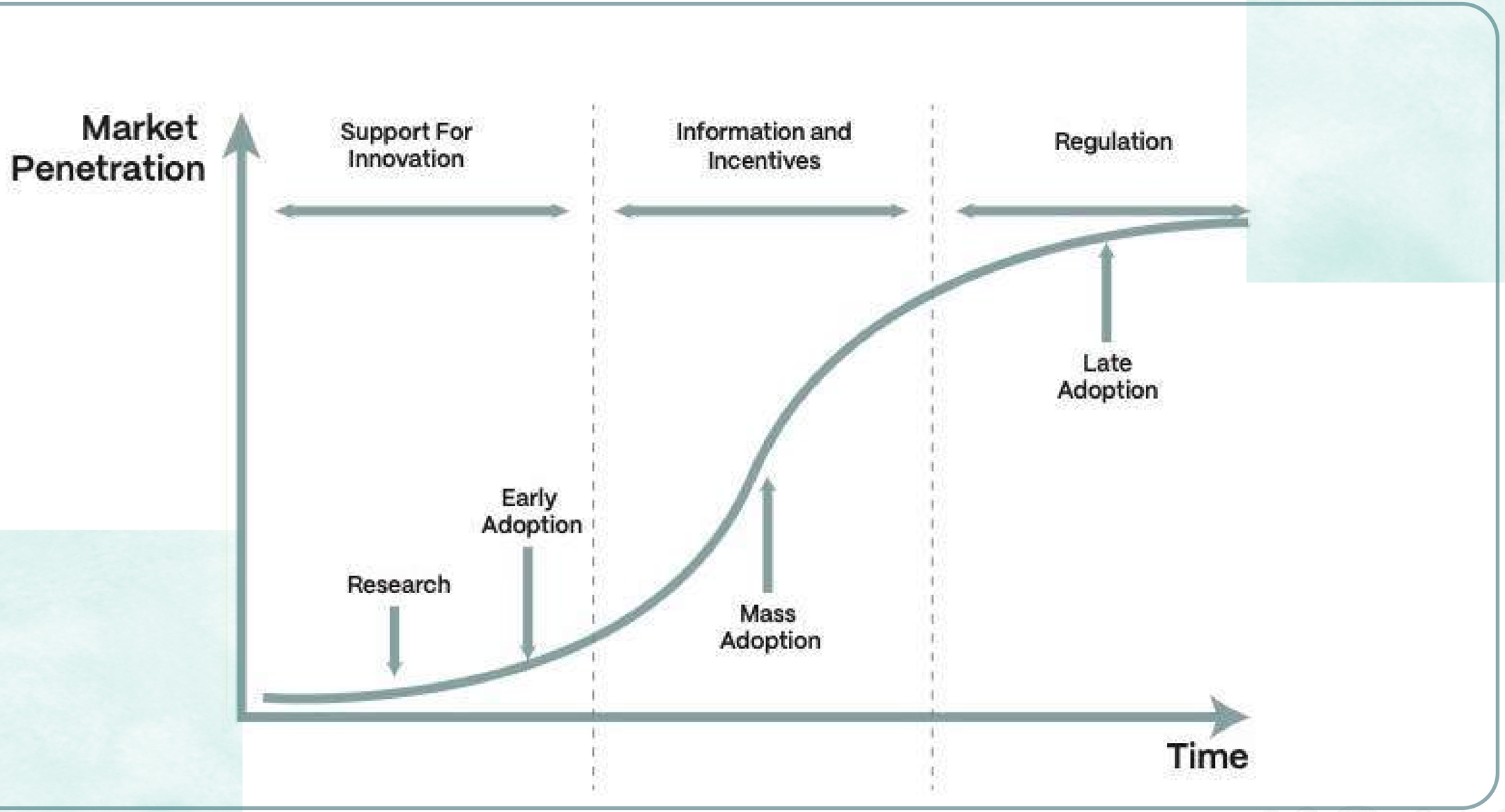
The ZCB-Design Standard™ guides the design of new buildings or retrofits of existing ones. It offers a pathway to ensure buildings can achieve zero-carbon once in operation.

LEARN MORE

56
Current ZCB-Performance certifications

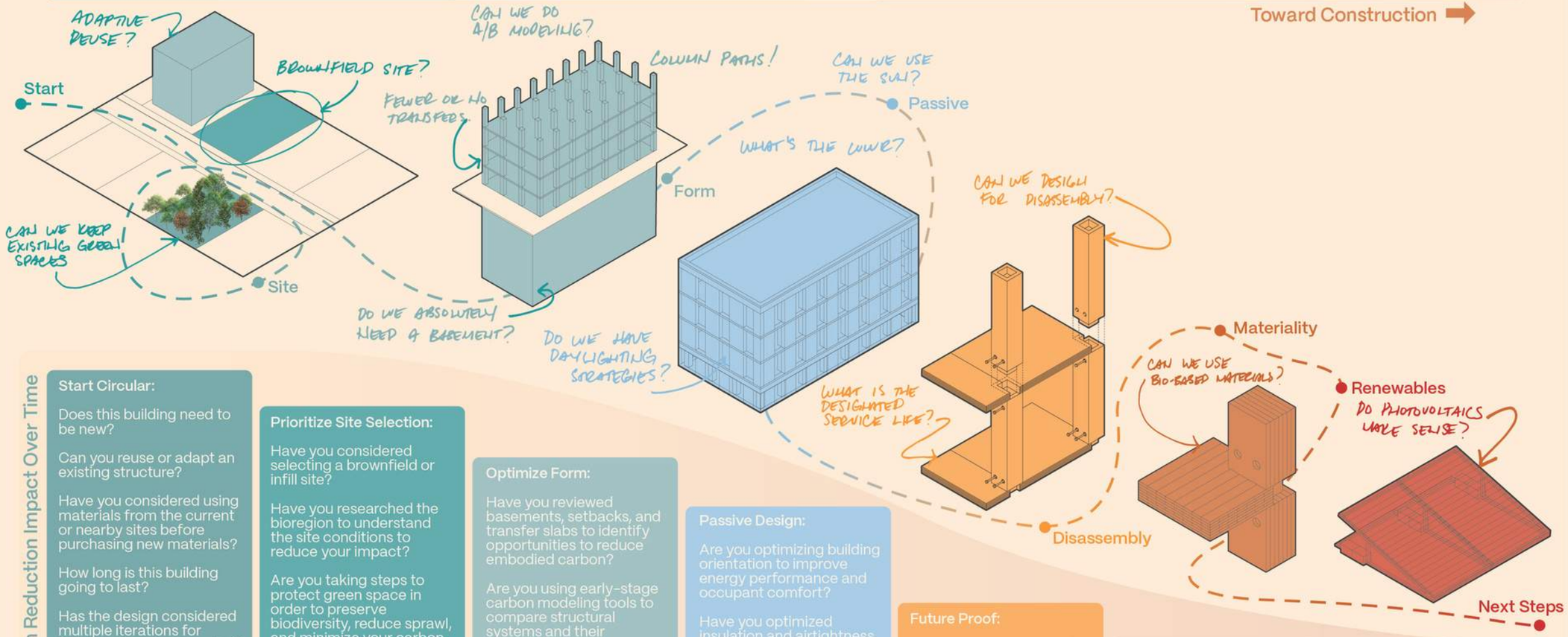
62
ZCB-Design certifications

3 in 4
ZCB-Design certifications are fully electrified


Market Penetration
Support For Innovation
Information and Incentives
Regulation
Late Adoption
Early Adoption
Research
Mass Adoption
Time

Seven Steps to Shape Your Project Carbon Curve

Predesign → Schematic Design → Design Development → Toward Construction



Carbon Reduction Impact Over Time

Start Circular:

Does this building need to be new?

Can you reuse or adapt an existing structure?

Have you considered using materials from the current or nearby sites before purchasing new materials?

How long is this building going to last?

Has the design considered multiple iterations for future use-case scenarios?

Does the design consider future climate conditions?

Prioritize Site Selection:

Have you considered selecting a brownfield or infill site?

Have you researched the bioregion to understand the site conditions to reduce your impact?

Are you taking steps to protect green space in order to preserve biodiversity, reduce sprawl, and minimize your carbon footprint?

Have we considered the source energy emission factors of the locale?

Optimize Form:

Have you reviewed basements, setbacks, and transfer slabs to identify opportunities to reduce embodied carbon?

Are you using early-stage carbon modeling tools to compare structural systems and their impacts?

Can you modify the form and structure of your building to reduce material use?

Passive Design:

Are you optimizing building orientation to improve energy performance and occupant comfort?

Have you optimized insulation and airtightness to reduce energy loss?

Are you using day-lighting and window placement to minimize artificial lighting?

What steps can you take to design for passive ventilation?

Future Proof:

Is the design optimized for disassembly?

What is the design service life of the building?

How does the durability of materials match the design service life?

Material Choices:

Are you prioritizing low-carbon materials?

Have you thought about materials available in your region?

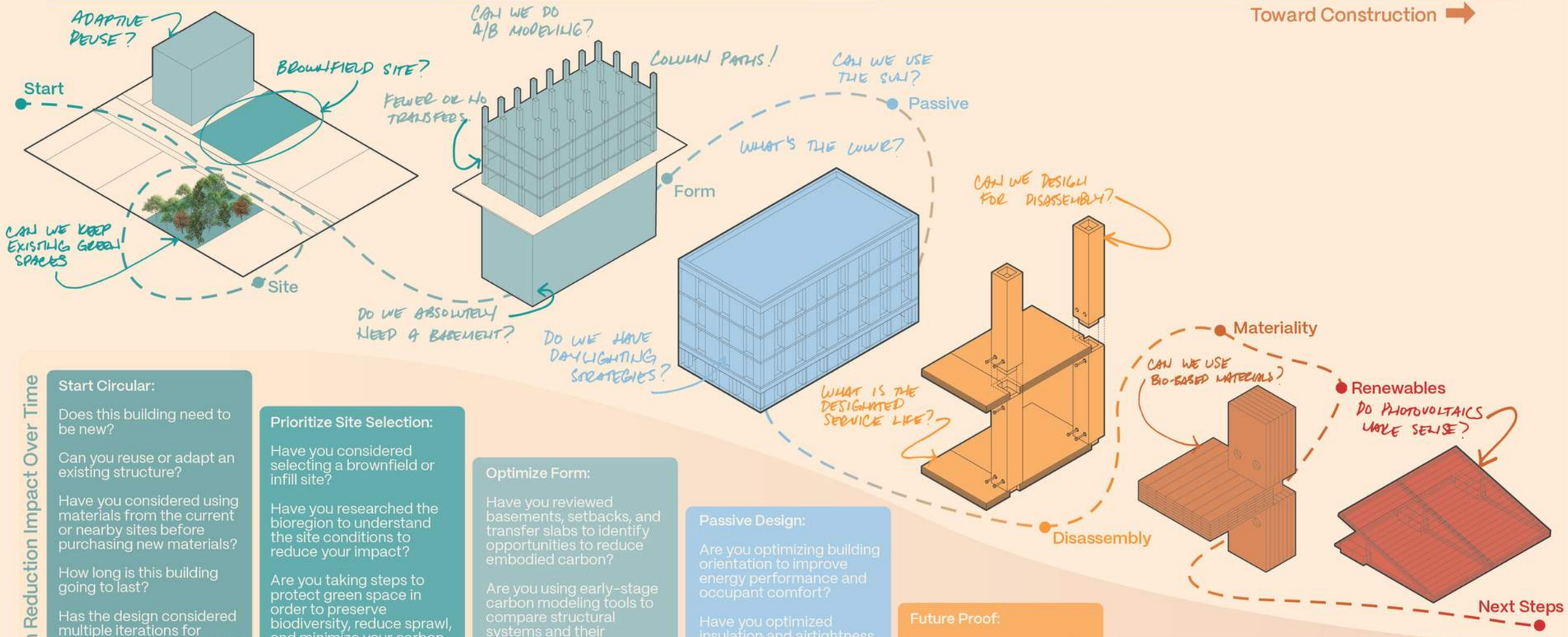
Renewables:

Are you exploring on-site renewable energy options to further reduce the project's carbon impact?

Seven Steps to Shape Your Project Carbon Curve

Predesign | Schematic Design | Design Development

Toward Construction



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