

The background of the slide is an aerial photograph of a dense green forest. In the center, there is a large, irregularly shaped clearing that forms the silhouette of a house. The roof of the house is formed by a path or a small stream that winds through the trees. The walls of the house are also formed by the clearing, and there are two rectangular openings representing windows. The trees surrounding the clearing are a mix of dark green and light green, suggesting different species or stages of growth.

Centre for Worldwide Sustainable Construction (CWSC)

Anne Dekeukelaere,
EPFL
Switzerland

19.03.2025

Why is EPFL tackling the sustainable construction issue through 2 of its faculties?



The Institute of Materials (IMX) is ranked **#10**

**School of
Architecture,
Civil and
Environmental
Engineering
(ENAC)**

- Architecture
- Civil Engineering
- Environmental Sciences and Engineering

**School
of Engineering**

Limestone
Calcined
Clay
Cement



Electrical Engineering

Energy Science and Technology

Materials Science & Engineering

Mechanical Engineering

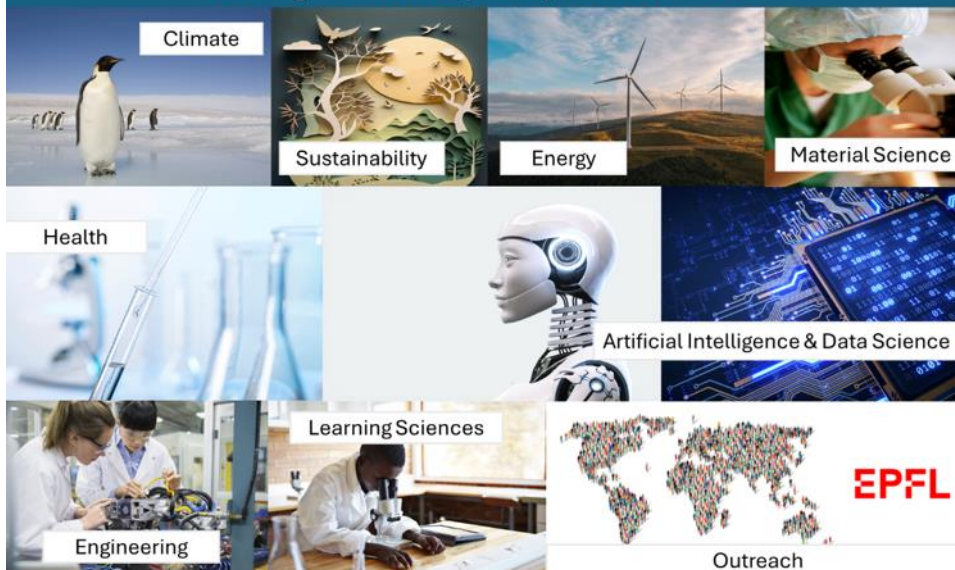
Microengineering

NeuroX

Quantum Science and Engineering

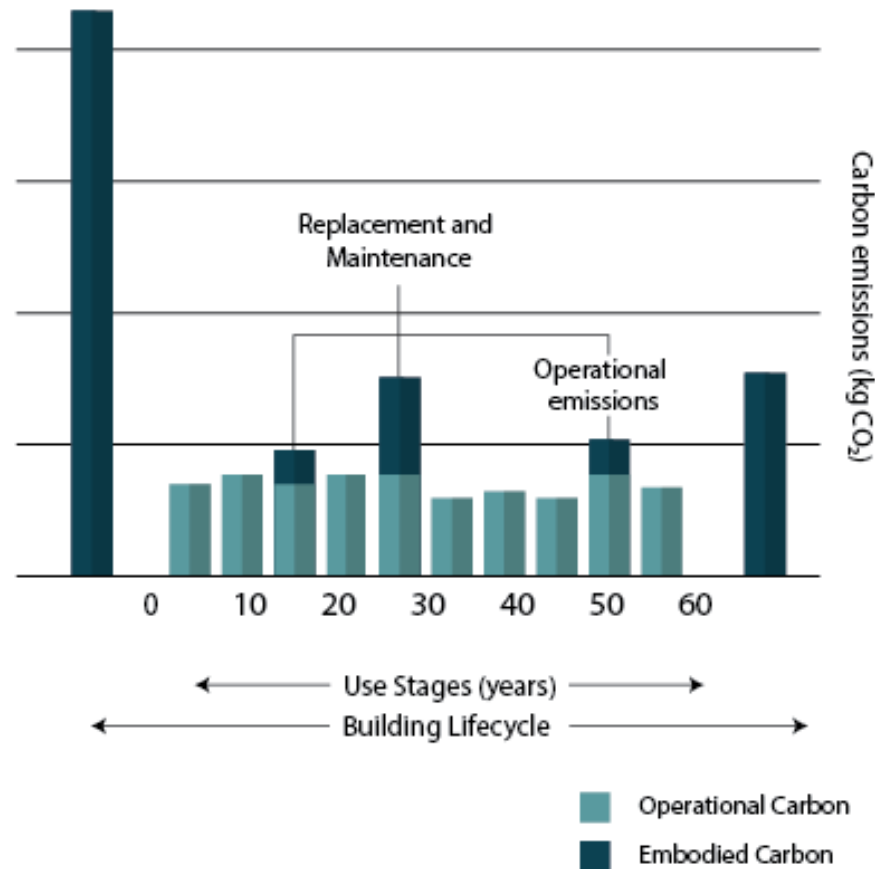
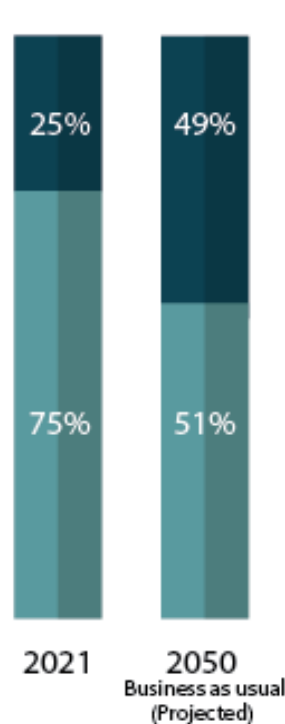
Robotics

Strategic Interdisciplinary Areas of Focus



Projected Contribution from Embodied and Operational Carbon within the building sector

% of Building Sector Carbon





LOW CARBON



LOW COST



LOW CAPITAL



HIGH PERFORMANCE

Tomorrow....



Three-quarters of the infrastructure that will exist in 2050 has yet to be built

- Antonio Guterres - UN SG



Up to 2060, the world is expected to add the equivalent of an entire New York City to the world, every month, for 40 years.

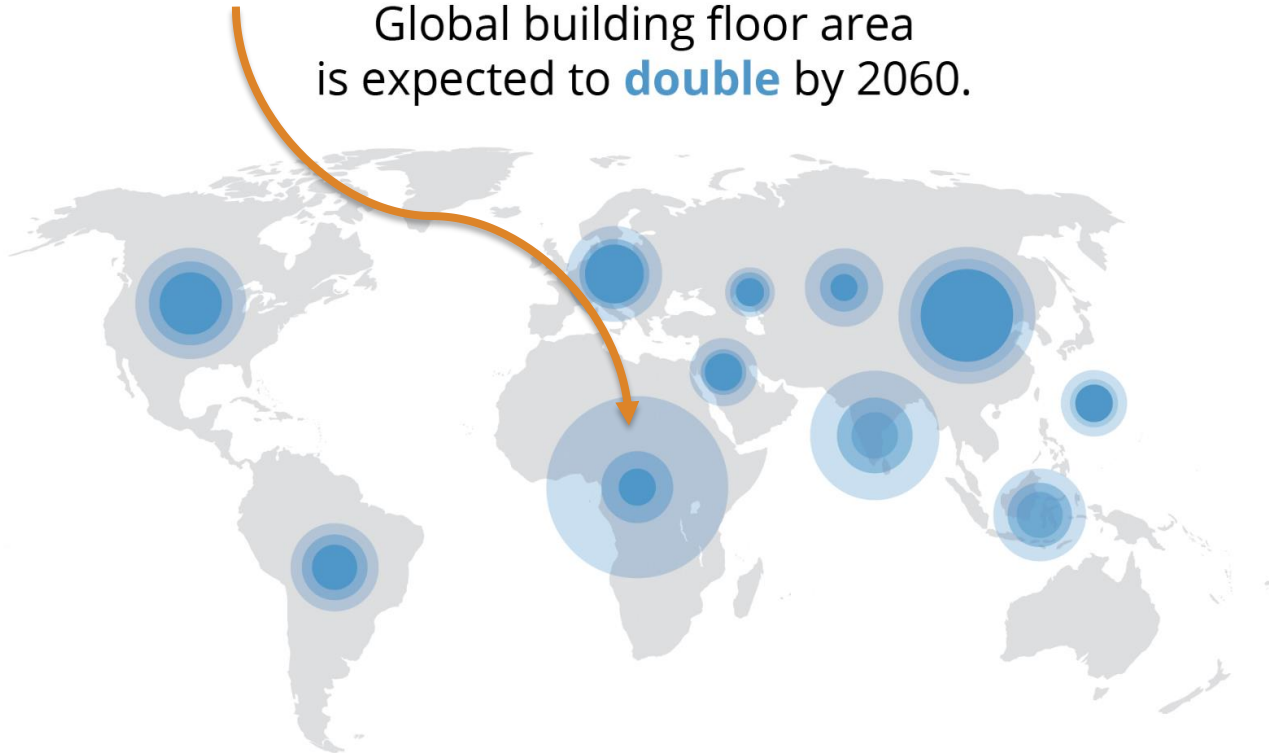
- Architecture2030.org



This will **NOT HAPPEN** in the Global North

It will happen HERE

Global building floor area
is expected to **double** by 2060.

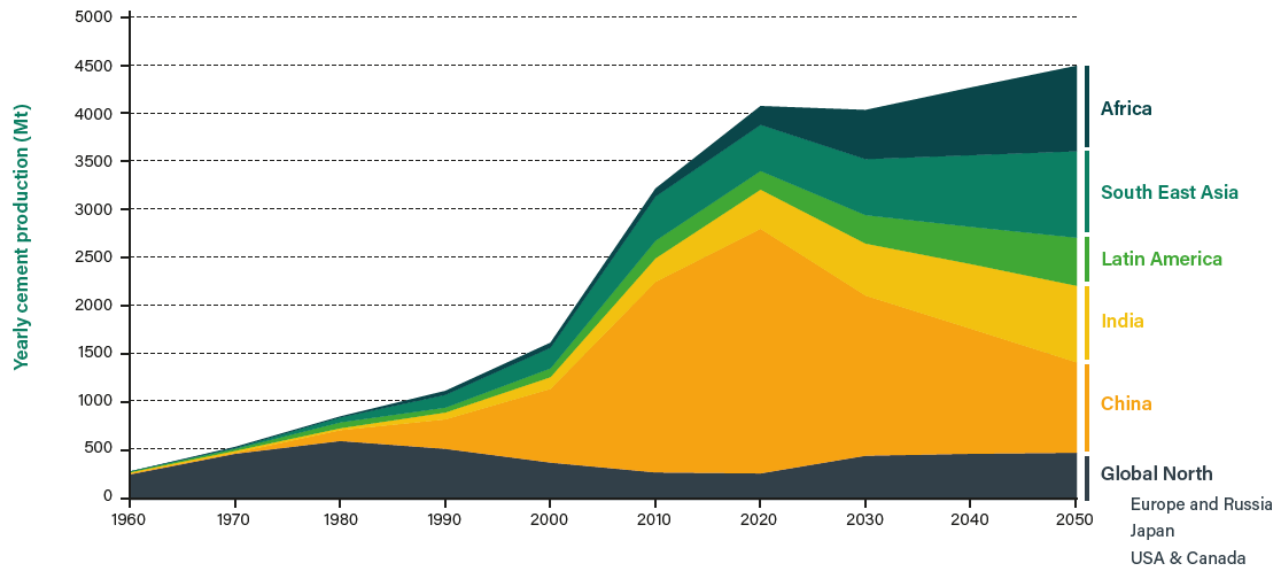


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Data Sources: Global ABC, Global Status Report 2017

Changing pattern of cement use:

Cement based materials are more than two thirds of all construction

Historical and forecast cement supply per region



We need solutions for people in developing countries

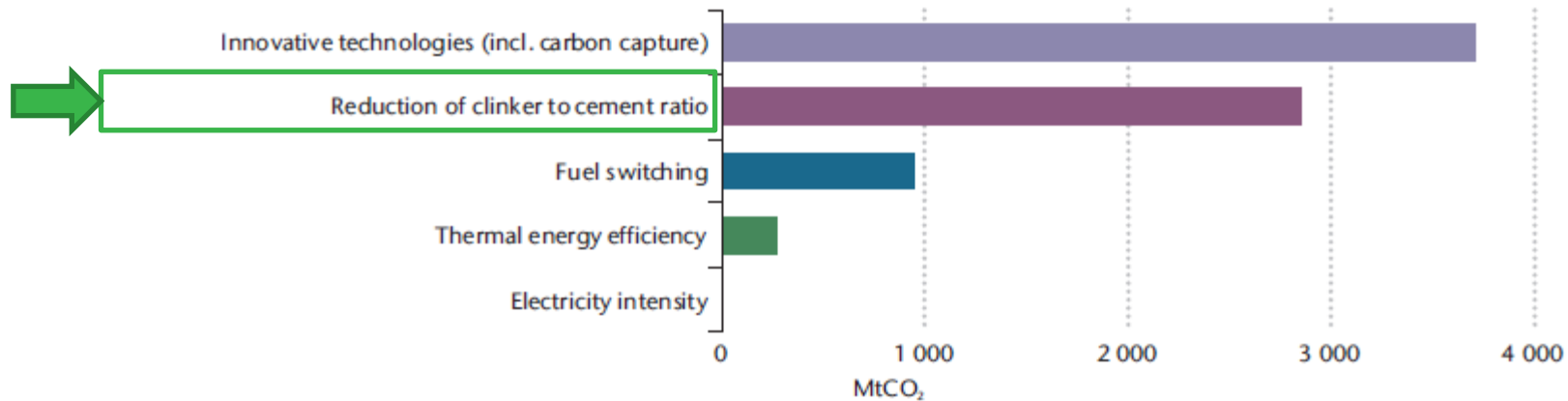




CO2 roadmap

The ambition is to reduce CO2 intensity of cement by 2050

Figure 7: Global cumulative CO₂ emissions reductions by applying the roadmap vision (2DS) compared to the RTS

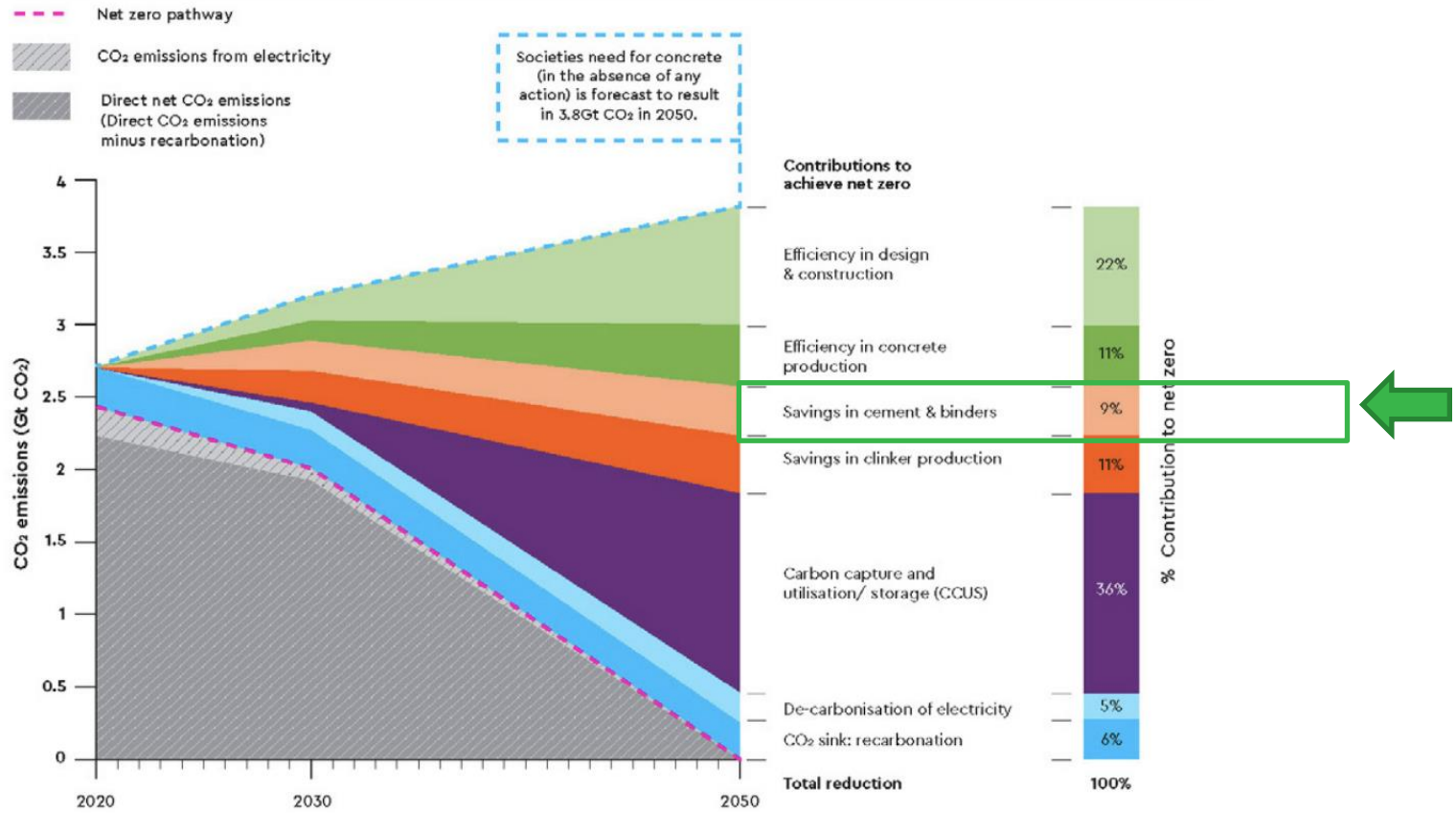


Note: Cumulative CO₂ emissions reductions refer to the period from 2020 to 2050 and are based on the low-variability case of the scenarios.

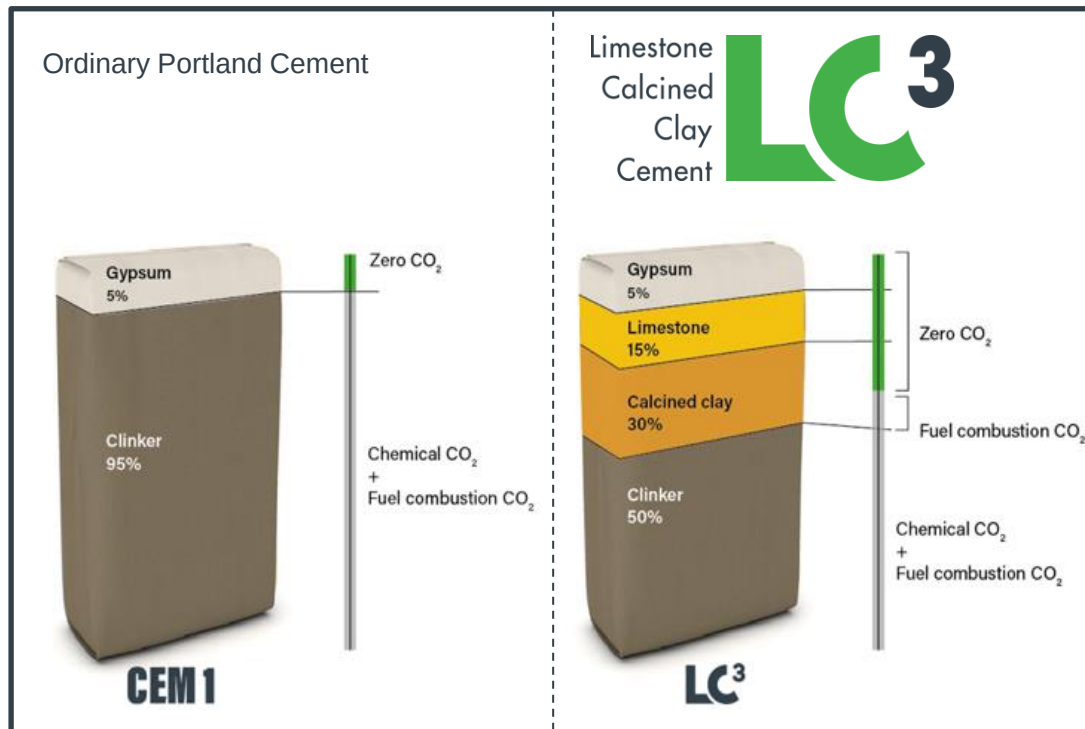
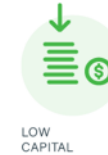
KEY MESSAGE: Innovative technologies including carbon capture (CO₂ emissions reduction of 48%) and reduction of the clinker to cement ratio (CO₂ emissions reduction of 37%) lead the way in cumulative CO₂ emissions reductions in cement making in the roadmap vision compared to the RTS by 2050.

The GCCA roadmap to net zero

The net zero pathway



LC³ – Limestone Calcined Clay Cement



- LC³ is a **low-carbon** blended cement type
- **Reduces CO₂ emissions in cement by 40%**

Supplementary cementitious materials



Limestone



Fly ash



Slag



Natural
pozzolan



Calcined clay



Non calcined limestone does not provide additional strenght



Fly ash generated in coal fired furnaces. Coal fired power plants are set to decrease in the future. High variable quality & max 35%



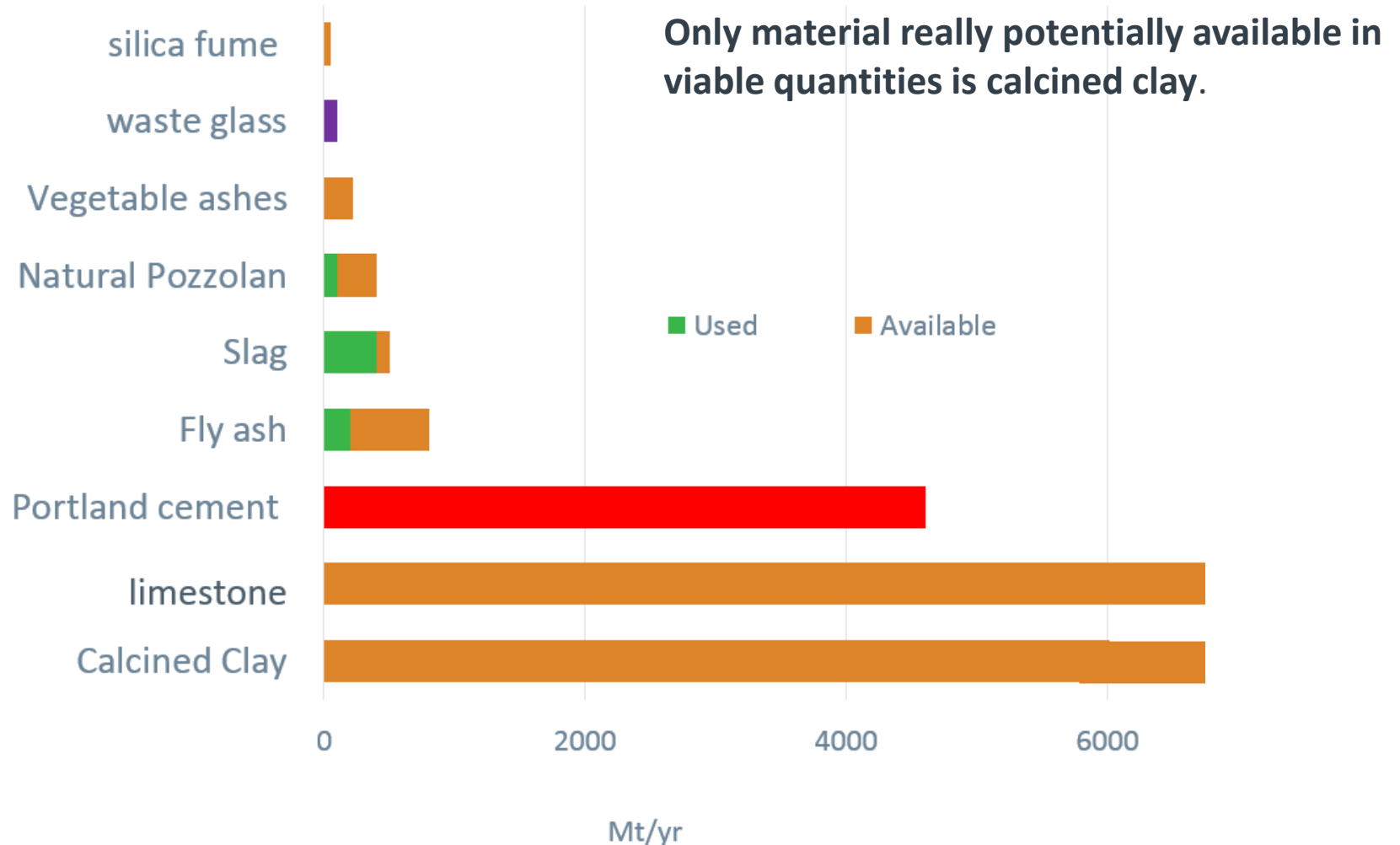
Slag will decrease as the sector will shift from blast furnace to more energy efficient scrap based electric arc furnace.



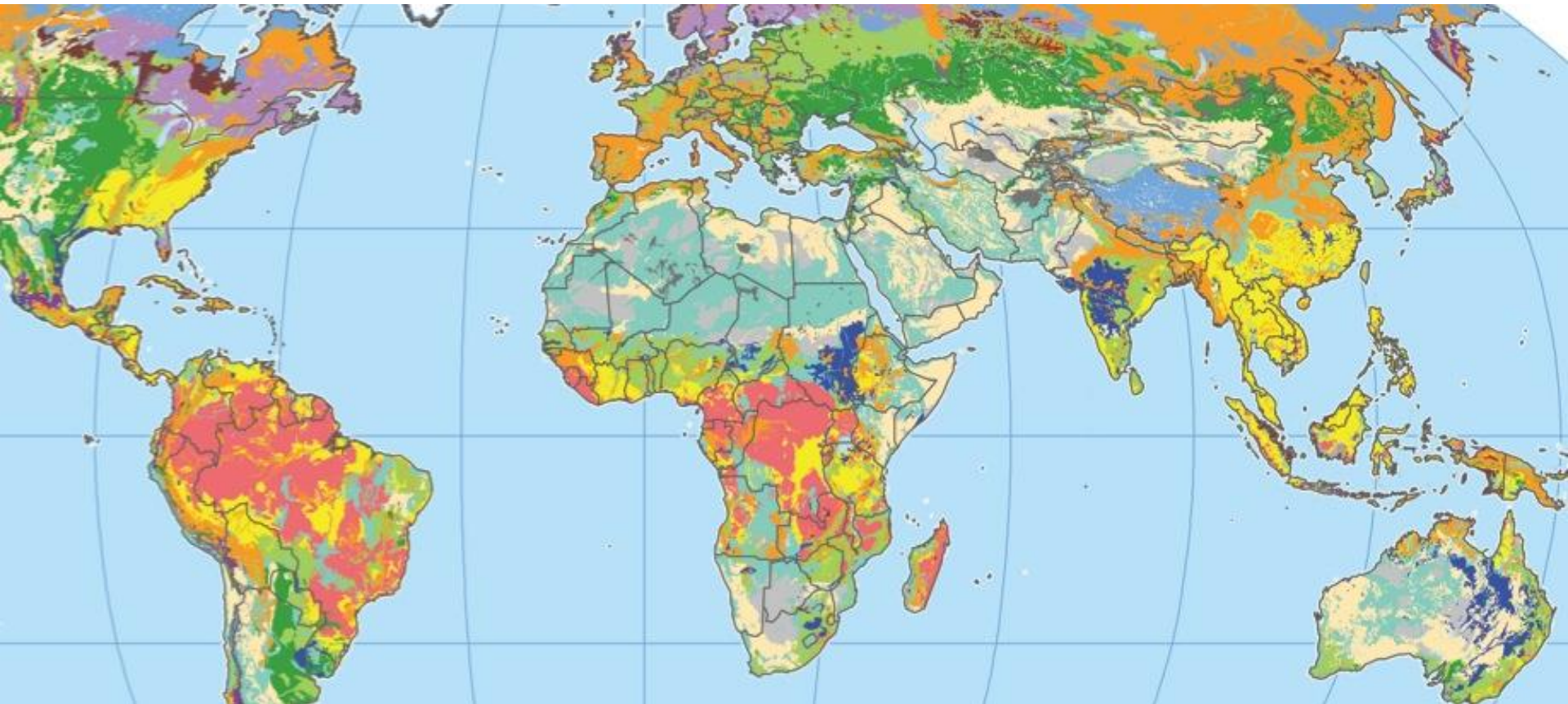
Natural pozzolan availability and reactivity varies widely from region



Availability of SCMs



Availability of suitable clays, yellow pink and light green regions, and others

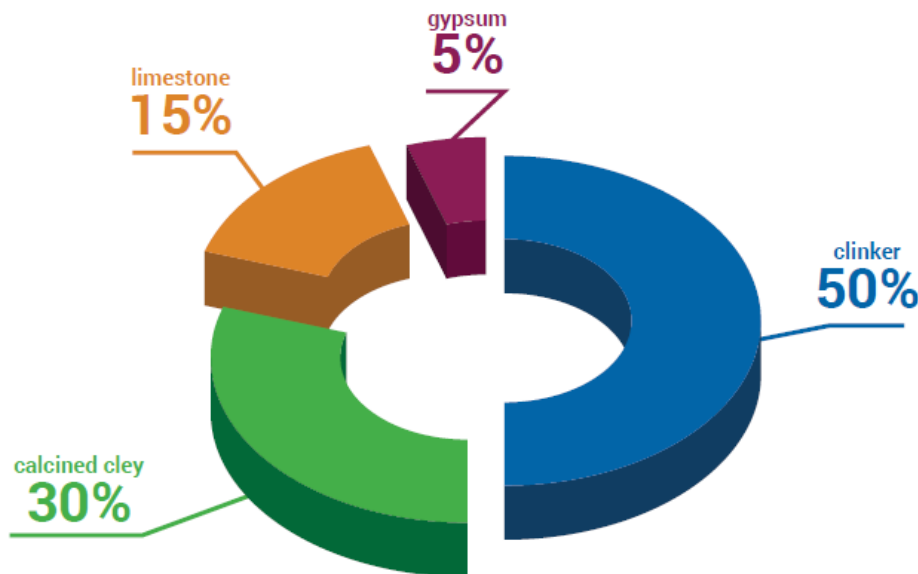


Suitable clays presently stockpiled as waste



What is LC³

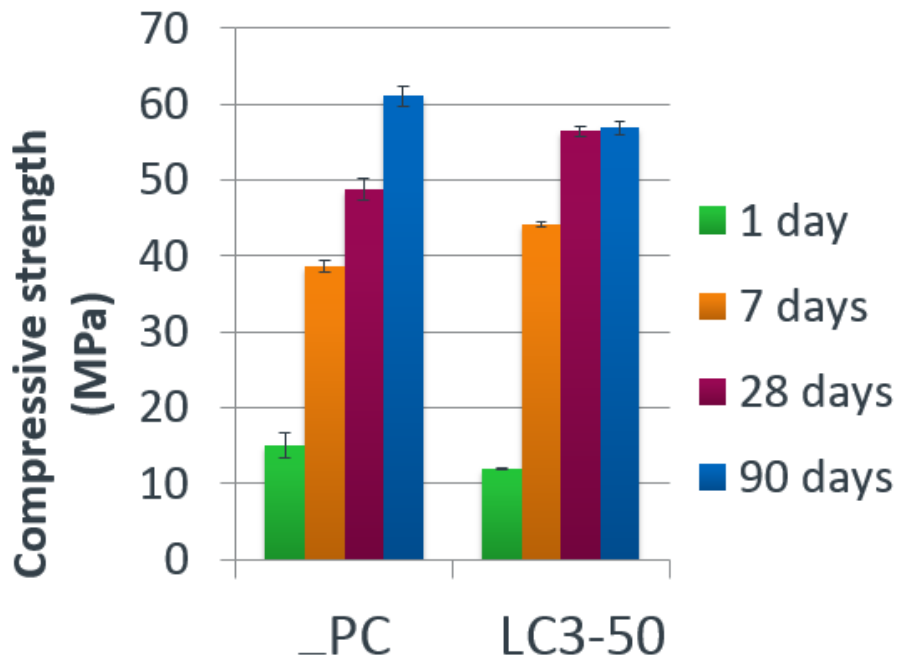
LC3 is not just a blended cement like the others



- 50% less clinker
- 40% less CO₂
- Similar strength as OPC
- Better chloride resistance
- Alkali Silica Resistant

Compressive strength of LC3 versus OPC

LC3 develops ultimate strengths comparable to OPCs



Why can we get such high replacement levels?
Calcined kaolinite (metakaolin) is much more reactive than glassy SCMs

Constructions with LC3 materials

2014 → 2024



Colombia



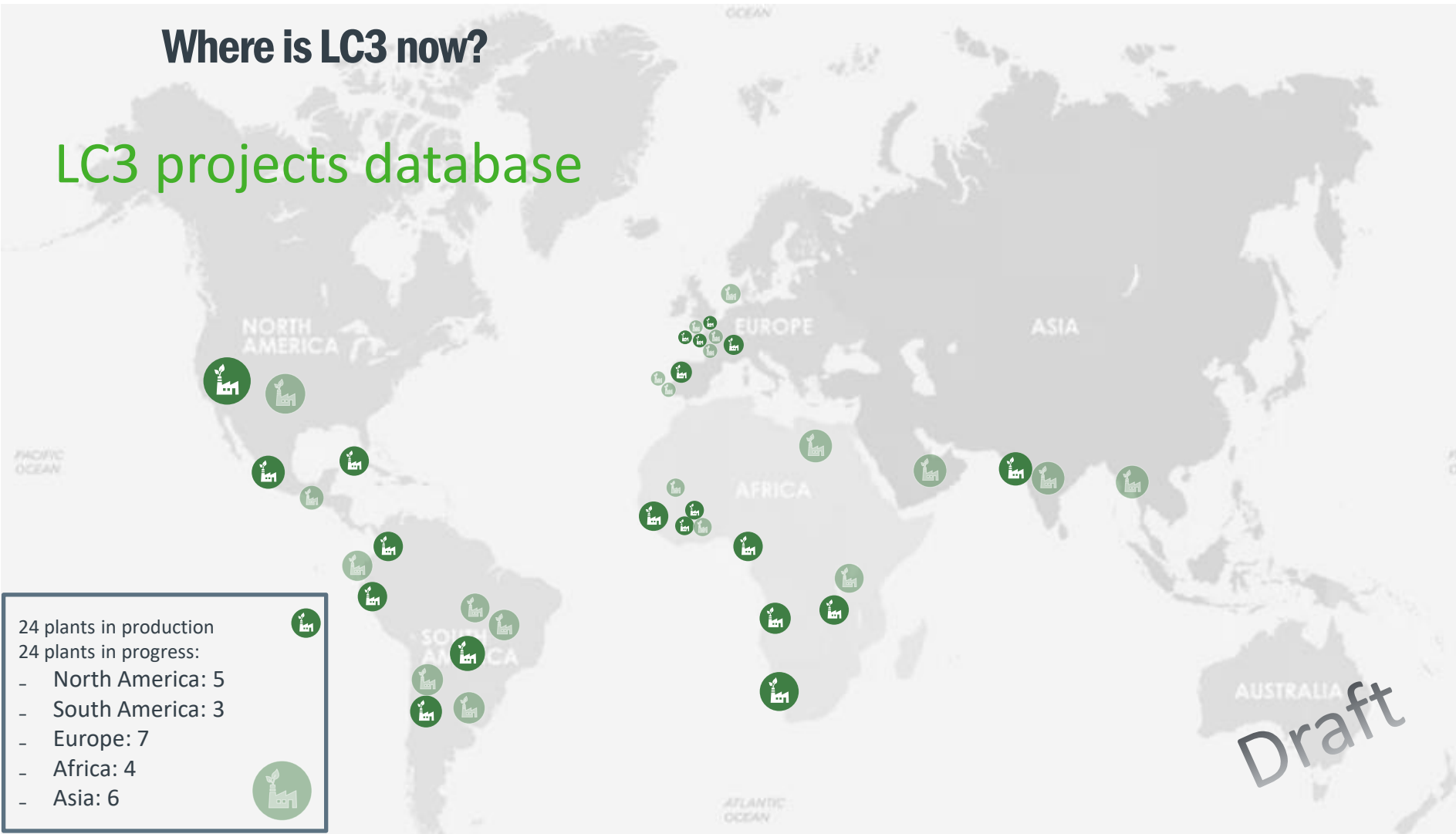
Switzerland



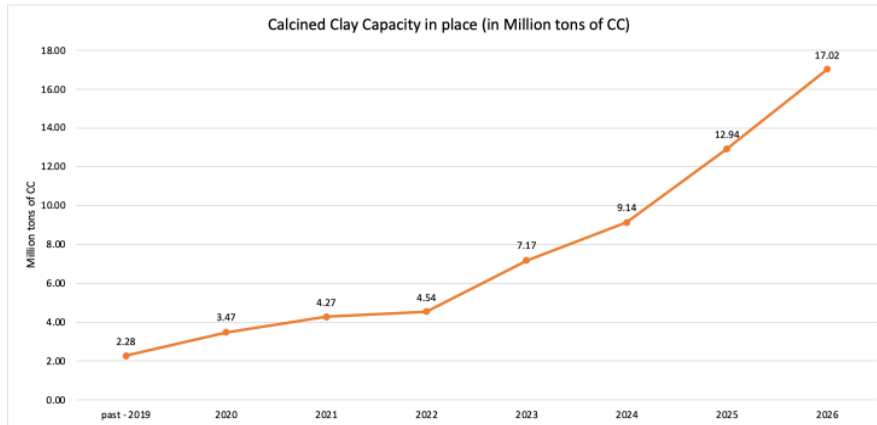
Rolex campus in planning

Where is LC3 now?

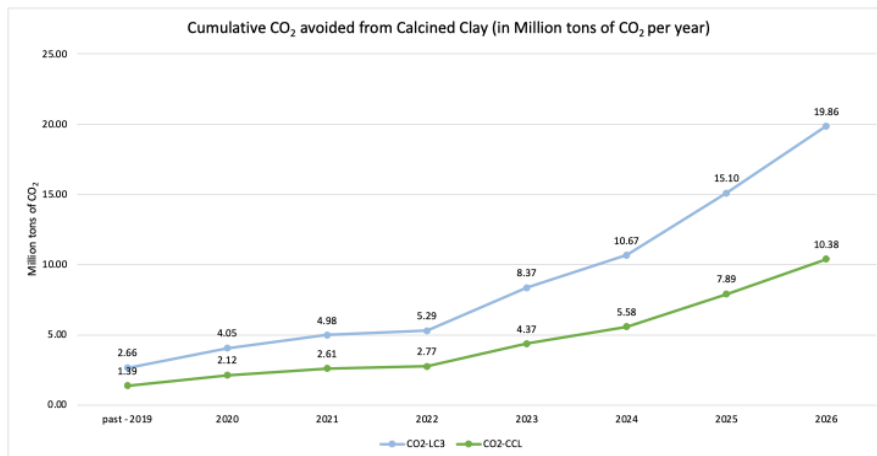
LC3 projects database



Quick LC3 update



13 milion tons of calcined clay capacity will be in place in 2025



This is 8 million tons of CO₂ reduced per year on the basis of each calcined clay will replace clinker (diff of 600 kg).
Or alternatively this is 15 million tons of CO₂ reduced per year on the basis of LC3 replacing OPC (clinker factor + limestone effect)

LC3 CO₂ reduction = 25% of Swiss emissions



Thank
You