Decarb Lunch Series

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Avoiding Common Pitfalls of Green Material Specification

Concrete, Steel, and Mass Timber

Wed Nov 20, 2024
12 - 1pm PST
Free Webinar
zebx.org

North Family FOUNDATION

CITY OF VANCOUVER

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Building to Electrification

CLF Carbon Leadership Forum British Columbia

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BC Retrofit ACCELERATOR

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5th BIRTHDAY

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CITY OF VANCOUVER

edge consultants

GSGN GLOTMAN | SIMPSON 60TH ANNIVERSARY

North Family Foundation

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VEMA DECONSTRUCTION

ZGF

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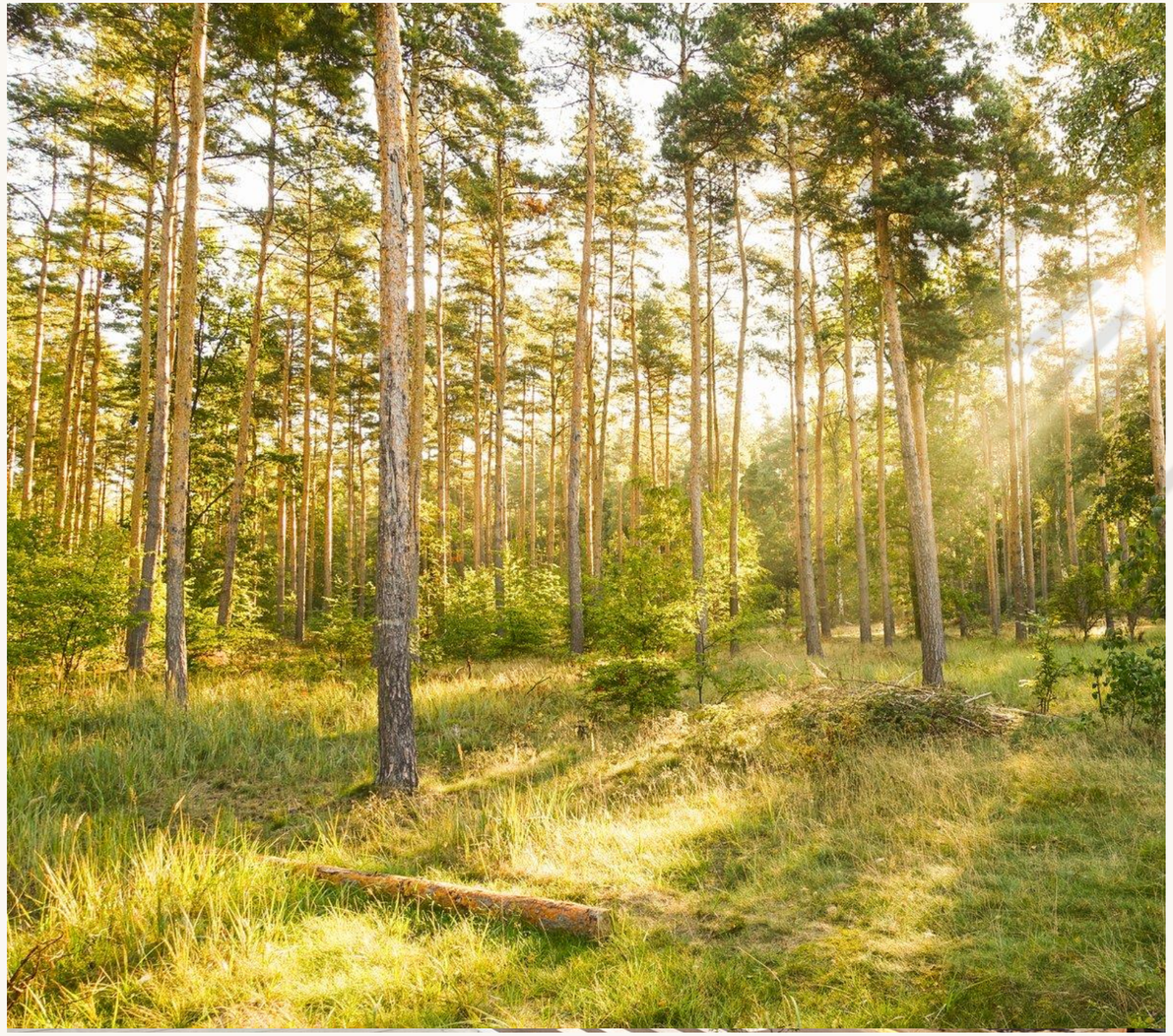
EQUILIBRIUM



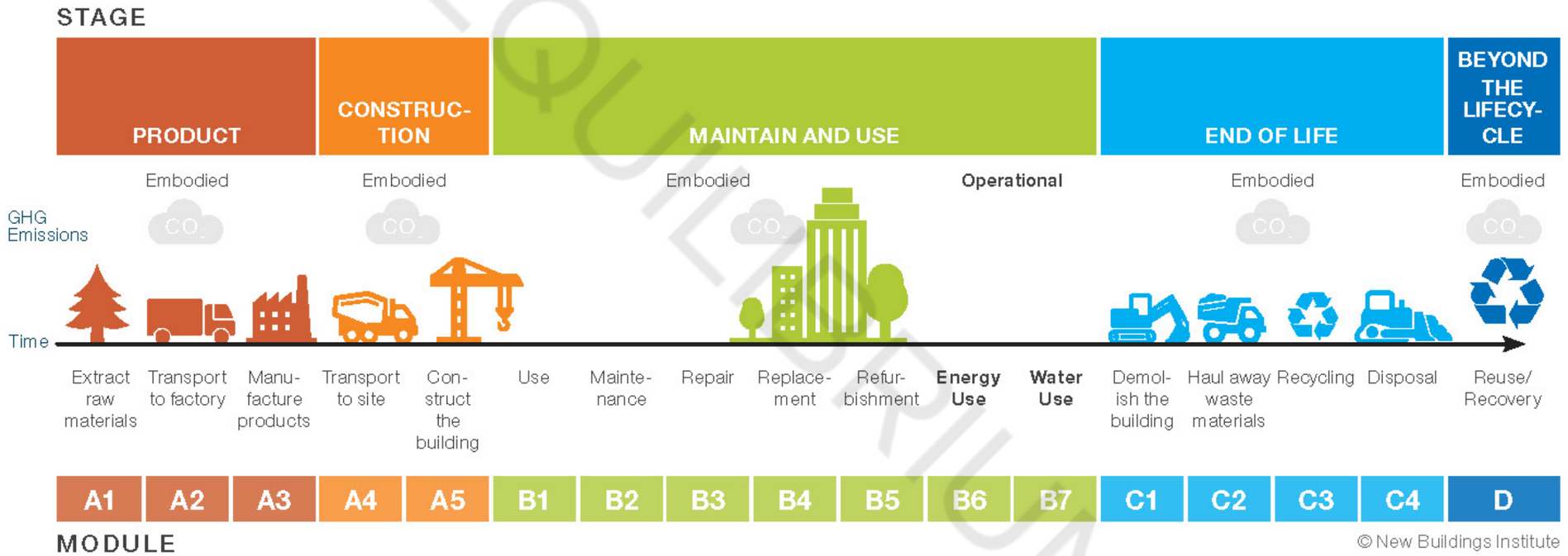
November 2024

The Embodied Carbon of Materials

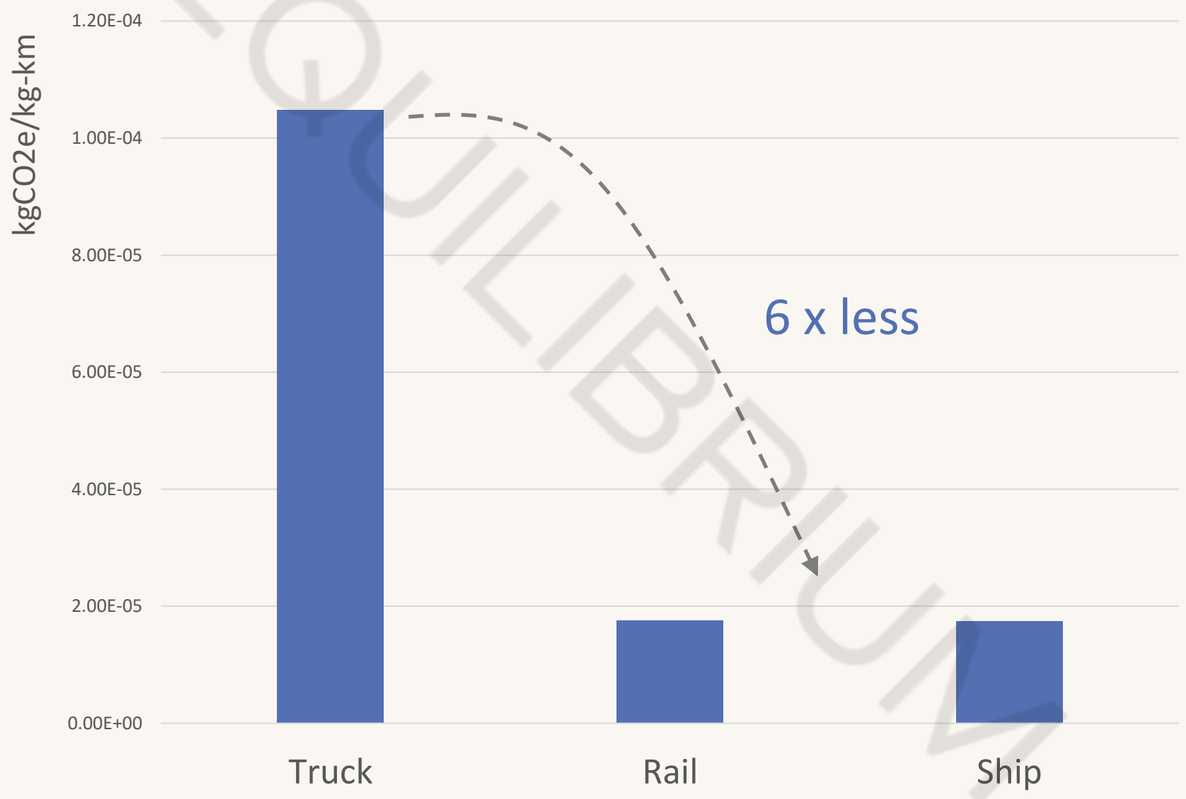
Avoiding Common Pitfalls of Green Material Specification

Tom Place

FIGURE 1: LIFECYCLE STAGES
Data source: BS EN 15978:2011

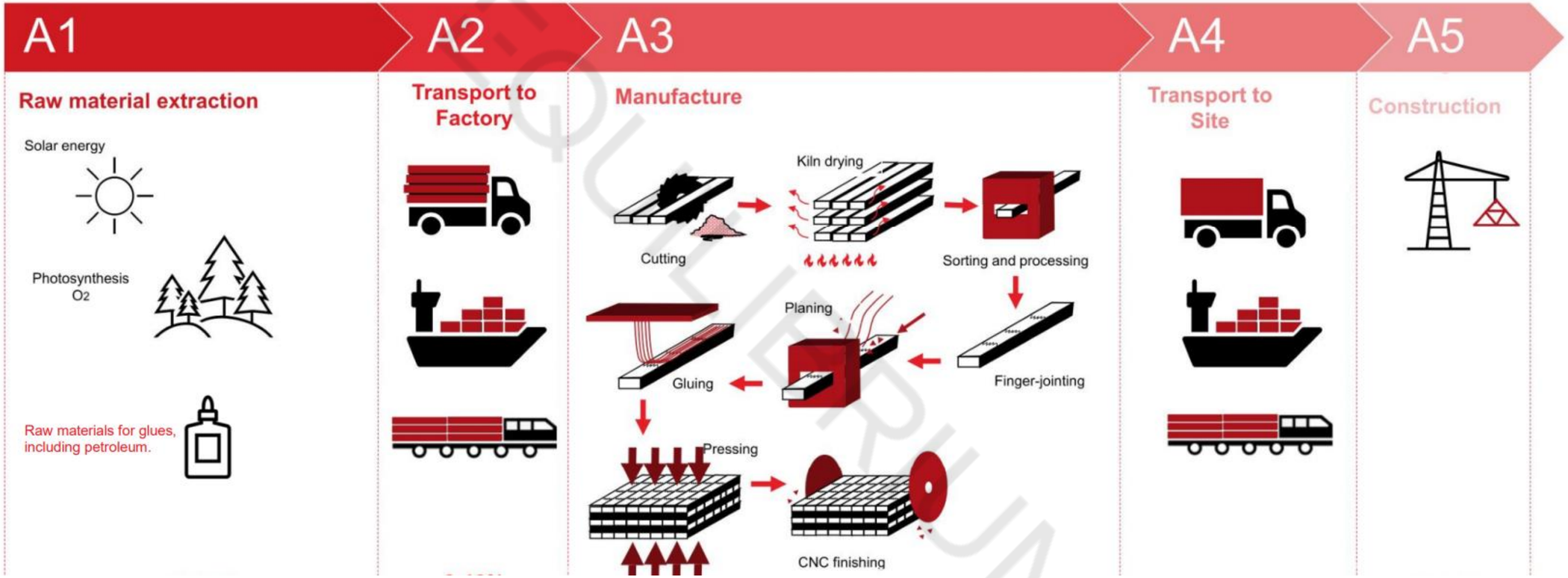


Embodied Carbon of Transport

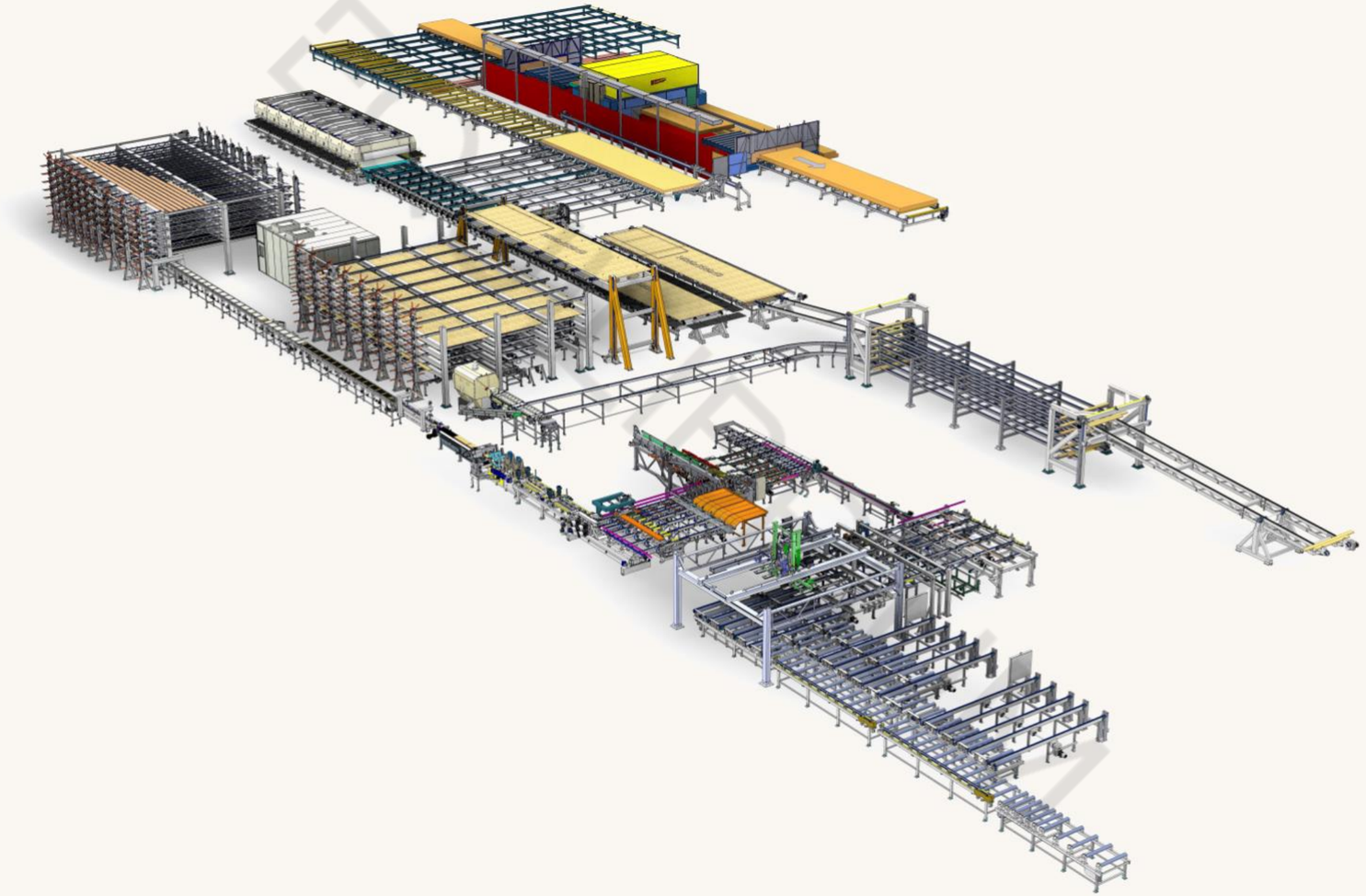


Average impact US EPA, CN, UK GOV

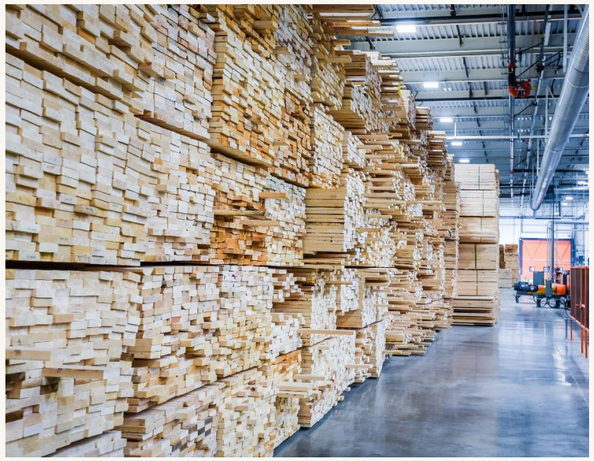
Mass Timber

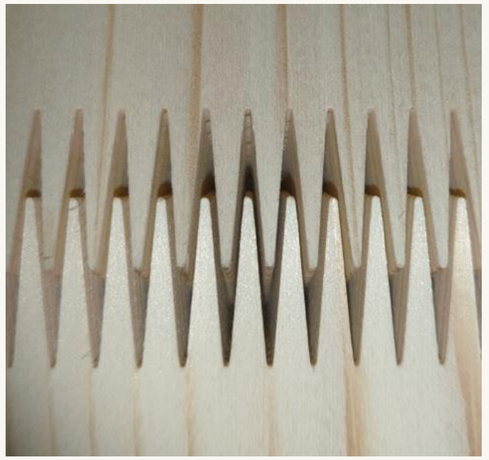


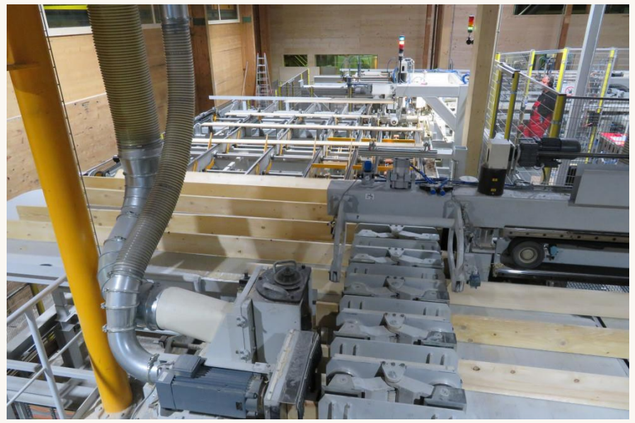
Source: Arup

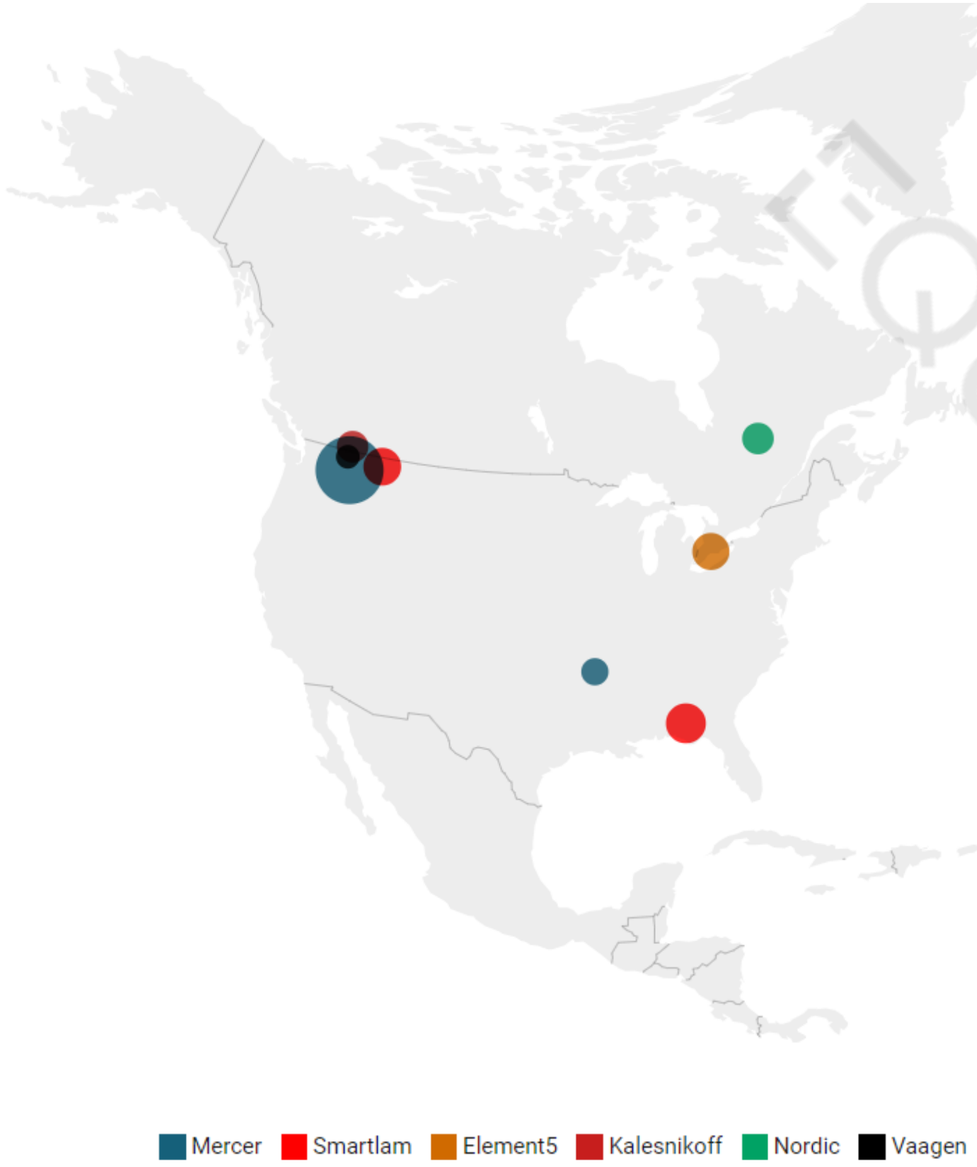


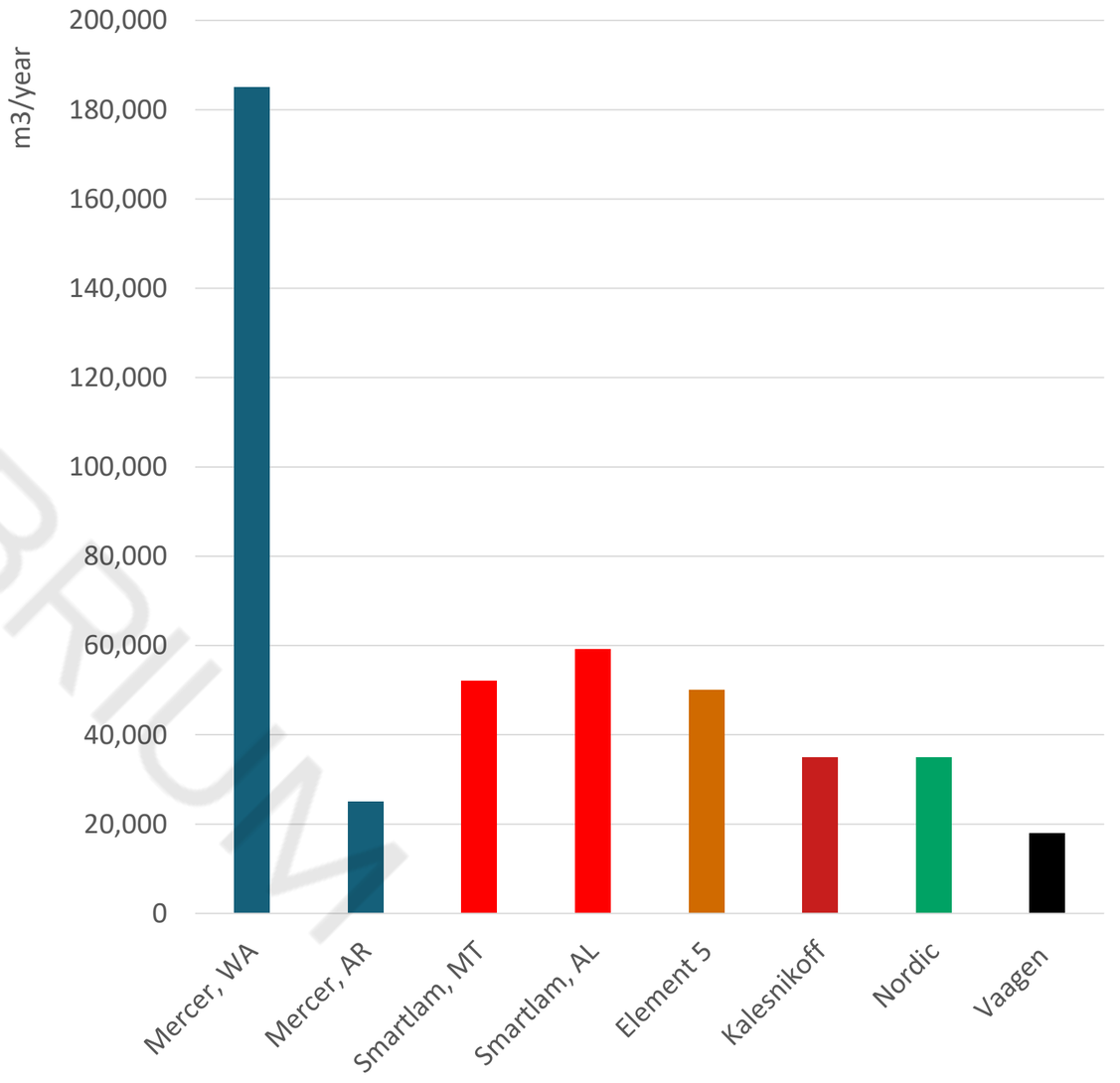
Source: Ledinek

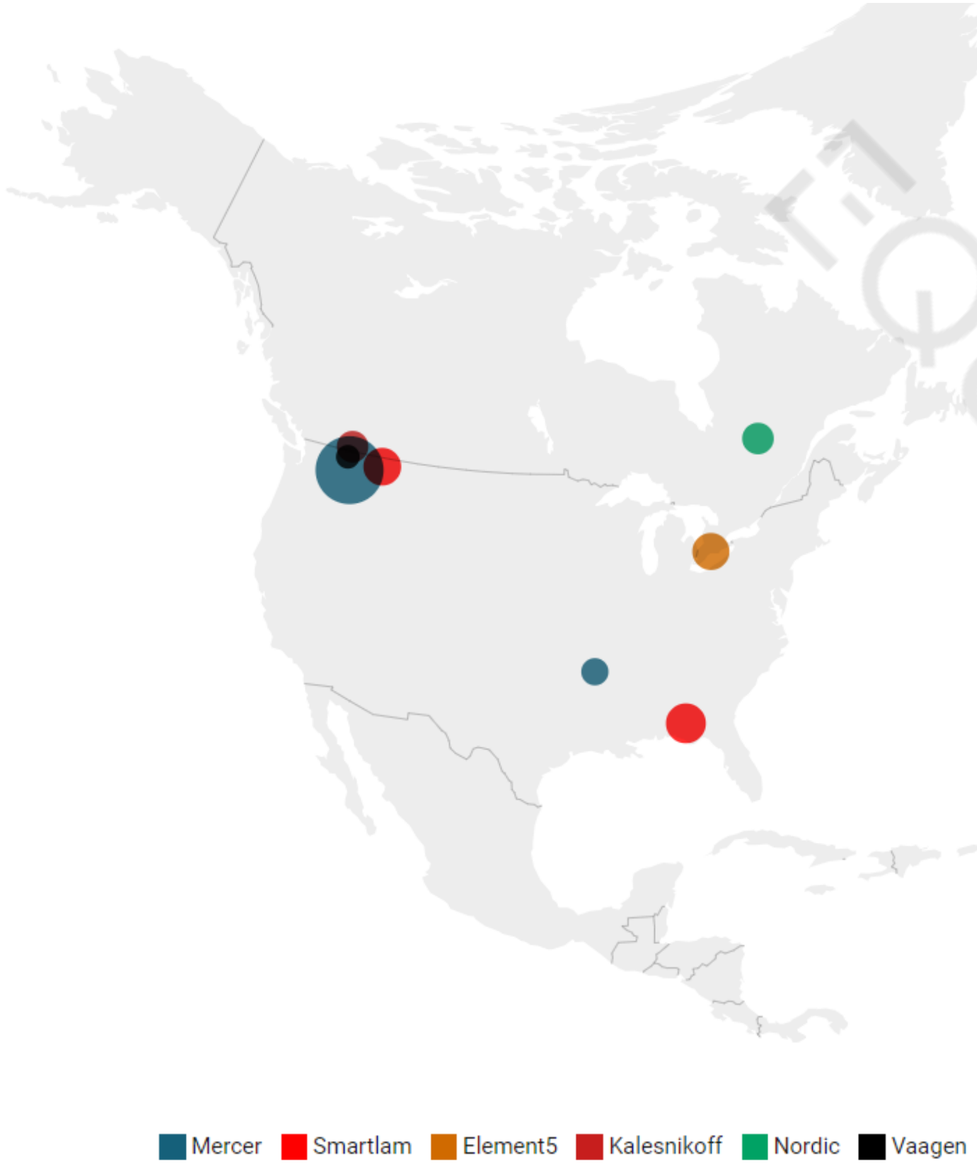


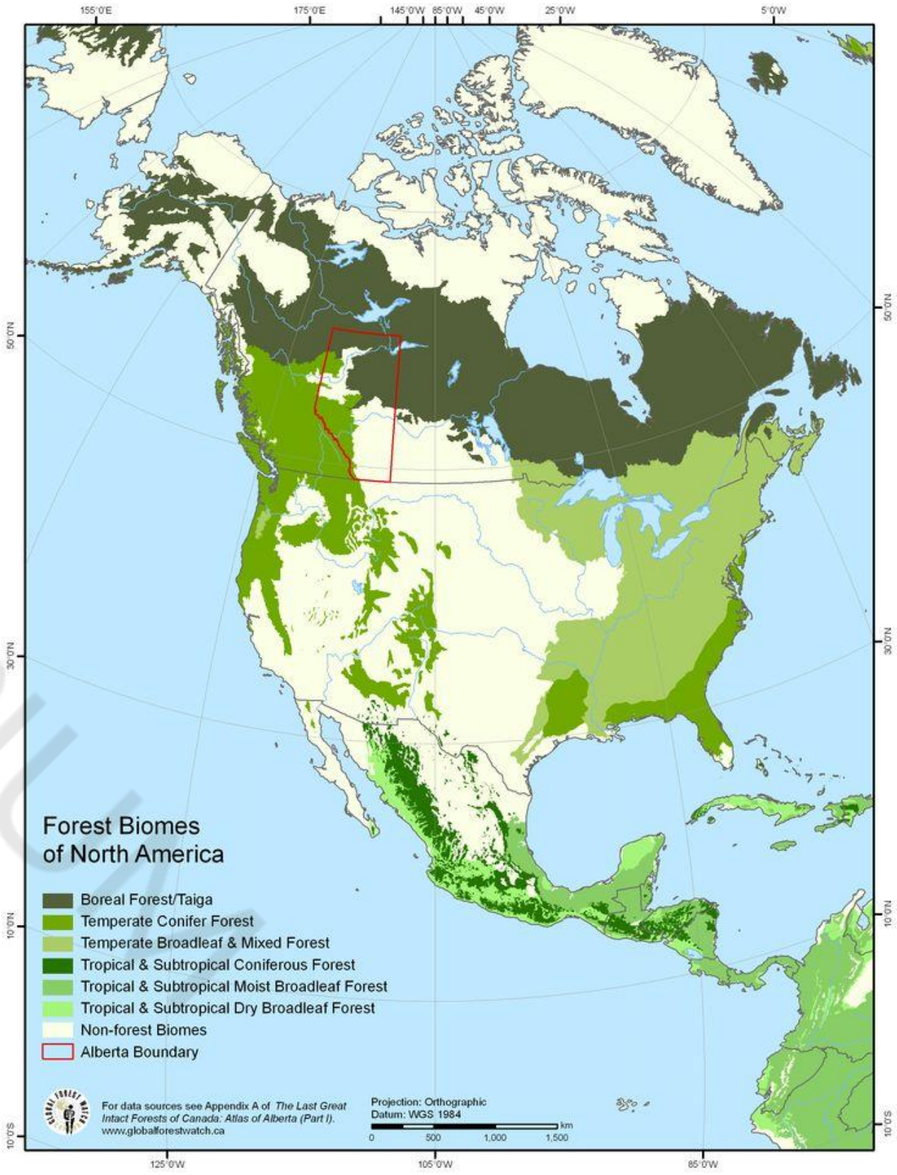


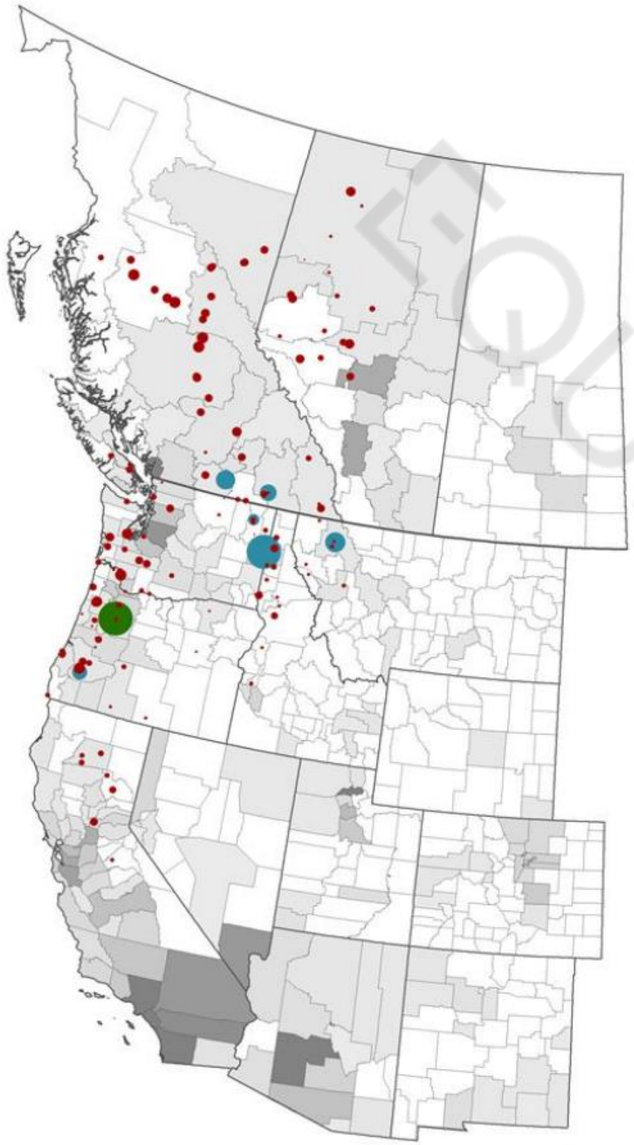












Lumber Mills

Mass Timber Facilities

CLT MPP

Mass Timber Panel Demand

Demand
(m^3/yr)

<500
50,000
100,000
200,000
>350,000

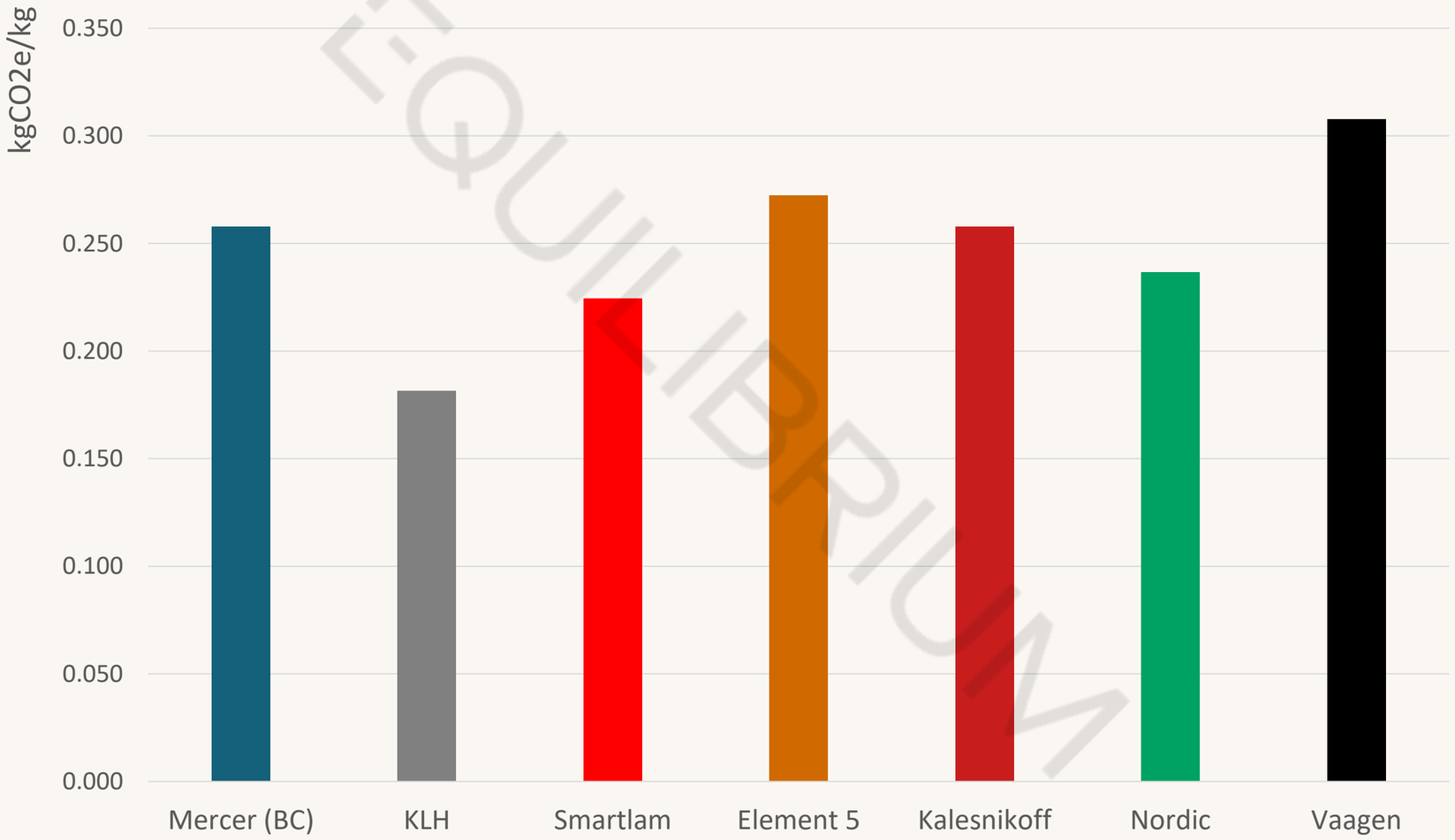
0 100 200 400 600 800 1,000 Kilometers

N

Locations: Supply ≠ Demand

Source: https://bioresources.cnr.ncsu.edu/wp-content/uploads/2020/12/BioRes_16_1_862_Brandt_LCDBWW_Projected_CLT_Demand_Lumber_Supply_Analysis_17910.pdf

CLT A1-3 (kgCO2e/kg)

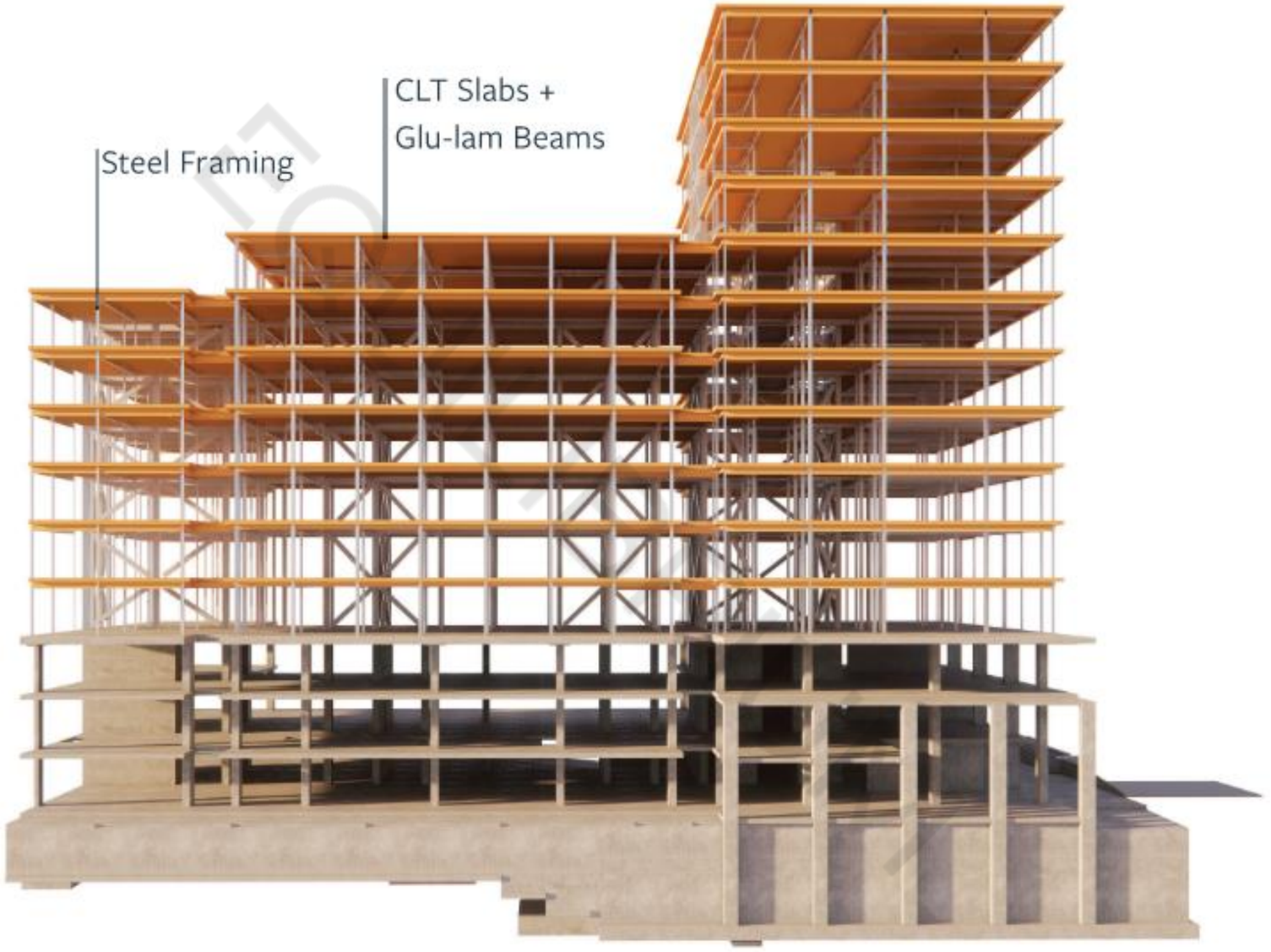


	A1-A3 (kgCO2e/kg)	Source	Distance (km)	A4 (kgCO2e/kg)	A1-A4 (kgCO2e/kg)
	0.25	PNW	670	0.10	**0.35**
		N-E	4180	0.60	**0.85**
		S-E	4600	0.67	**0.92**
	0.25	PNW	4150	0.60	**0.85**
		N-E	840	0.12	**0.37**
		S-E	1700	0.25	**0.50**
	0.25	PNW	1900	0.27	**0.52**
		N-E	3900	0.56	**0.81**
		S-E	3570	0.52	**0.77**

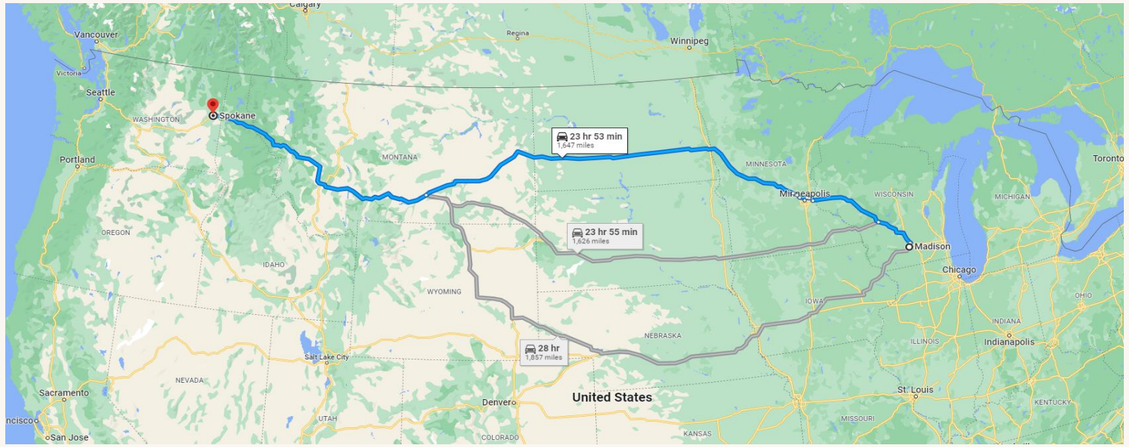
Getting it wrong = 3x worse

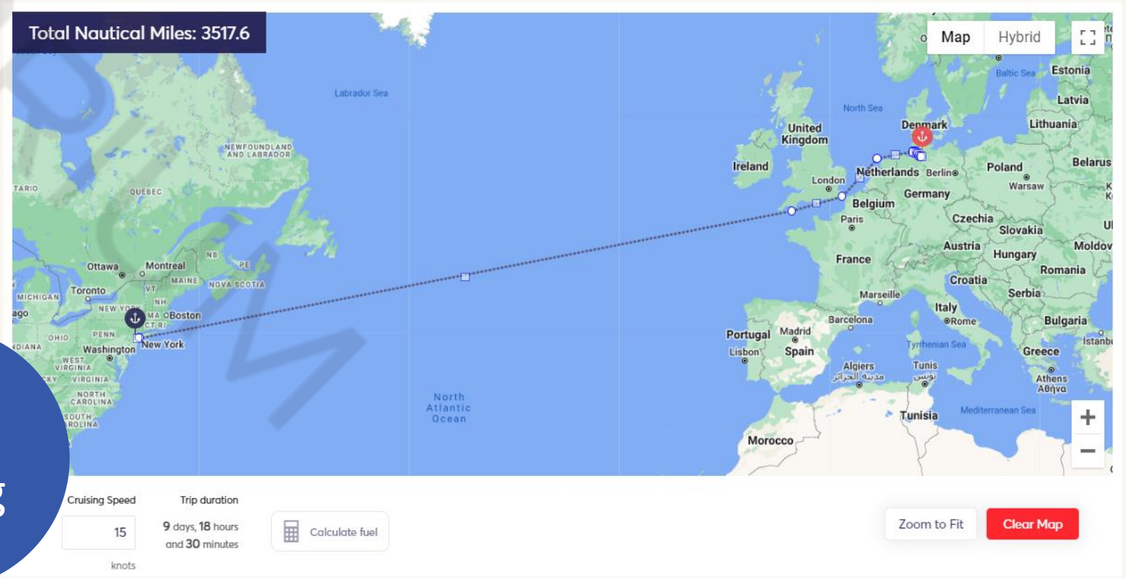

Bakers Place


GARDNER BAKI


CLT Slabs +
Glu-lam Beams
Steel Framing

	A1-A3 (kgCO2e/kg)	Mode	Distance (km)	A4 (kgCO2e/kg)	A1-A4 (kgCO2e/kg)
PNW Supply	0.26	Truck	2700	0.38	**0.64**
		Rail	0		
		Sea	0		
Europe Supply	0.18	Truck	390	0.28	**0.46**
		Rail	2600		
		Sea	6500		





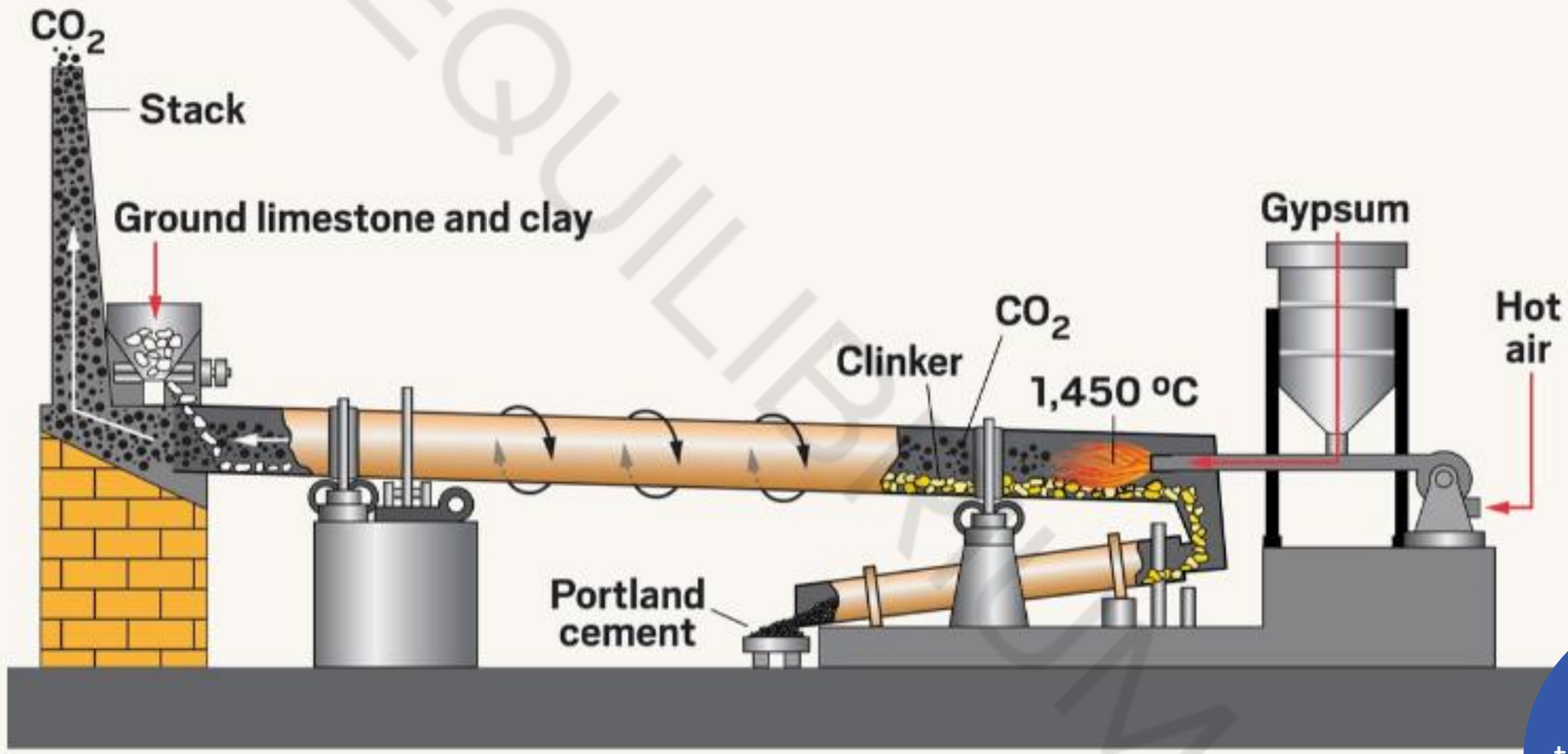
28% saving


KLH 13
USA


24762 KLH US

Concrete

Cement Production

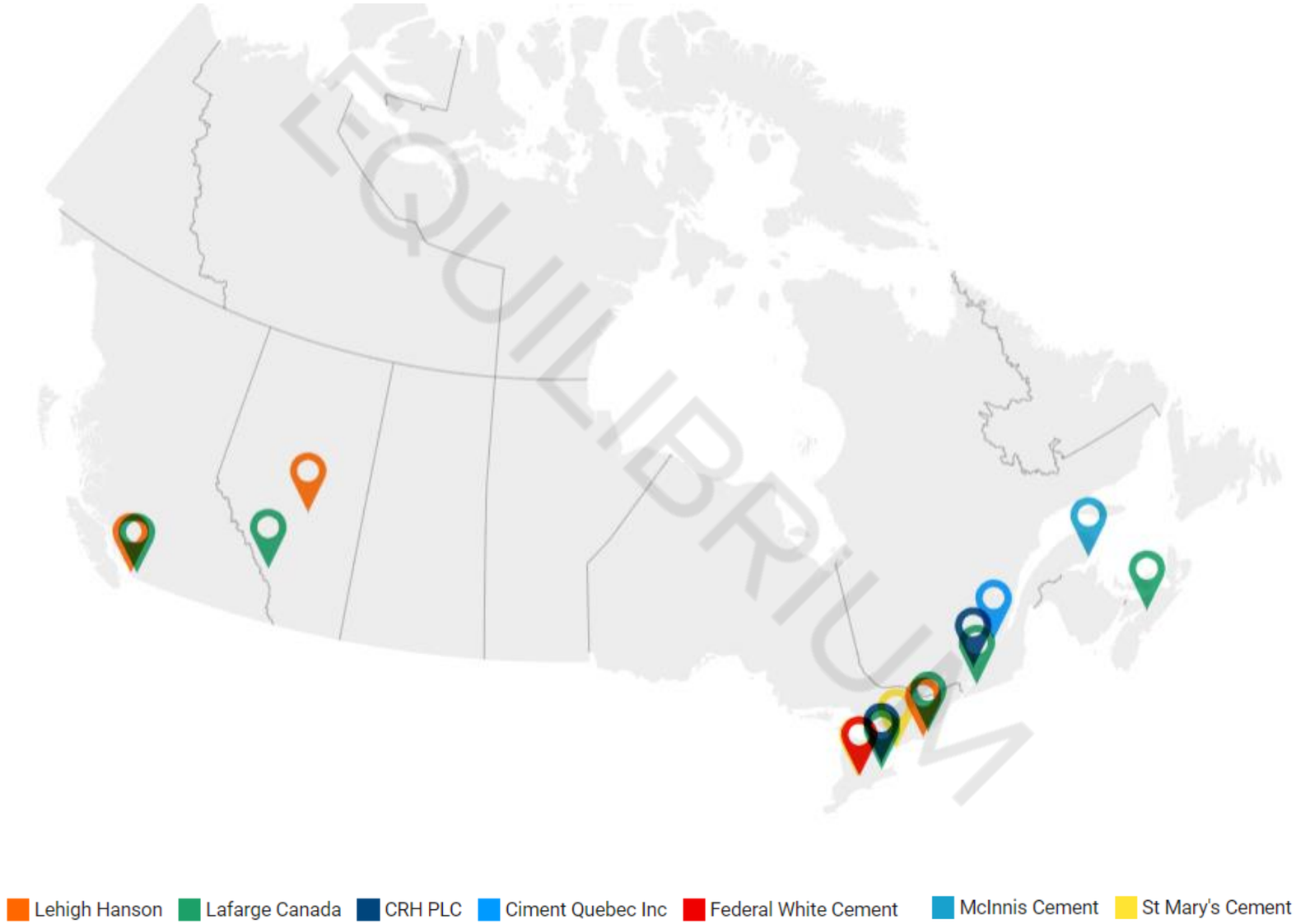


13 million tonnes per year in Canada

https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610000901

Cement Plants

2 cement plants = 120 batching plants in BC



41% Gravel or Crushed Stone (Coarse Aggregate)

26% Sand (Fine aggregate)

16% Water

11% Portland cement

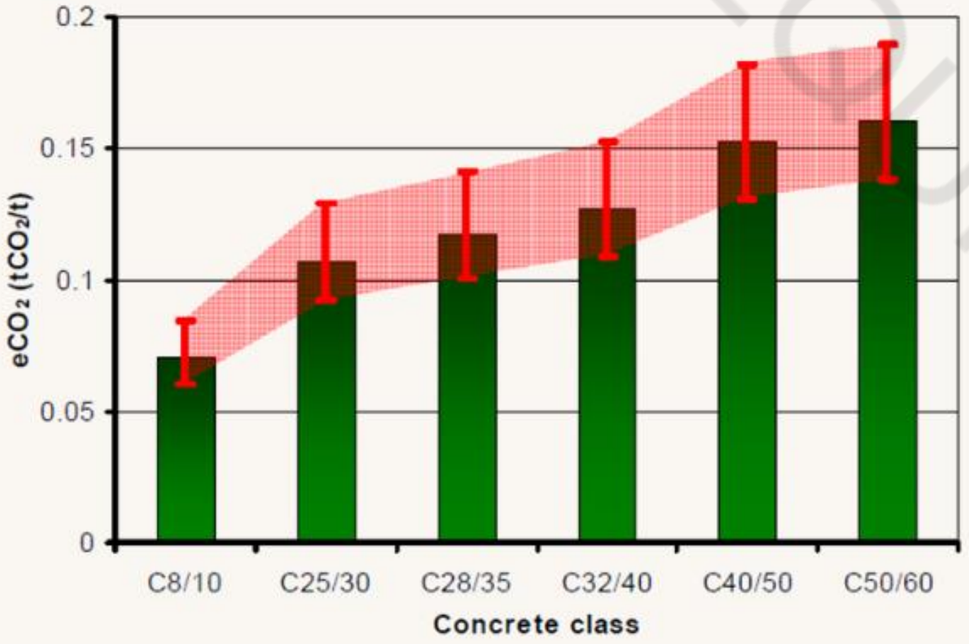
6% Air

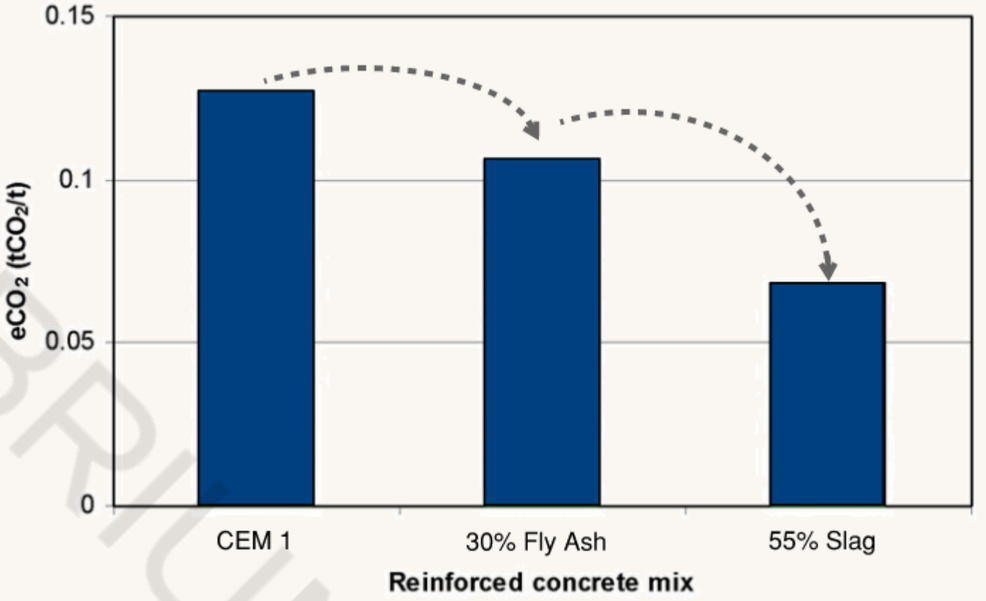
Typical Volumetric proportions of concrete basic ingredients (Godfellow, 2011).

10-15% Aggregate

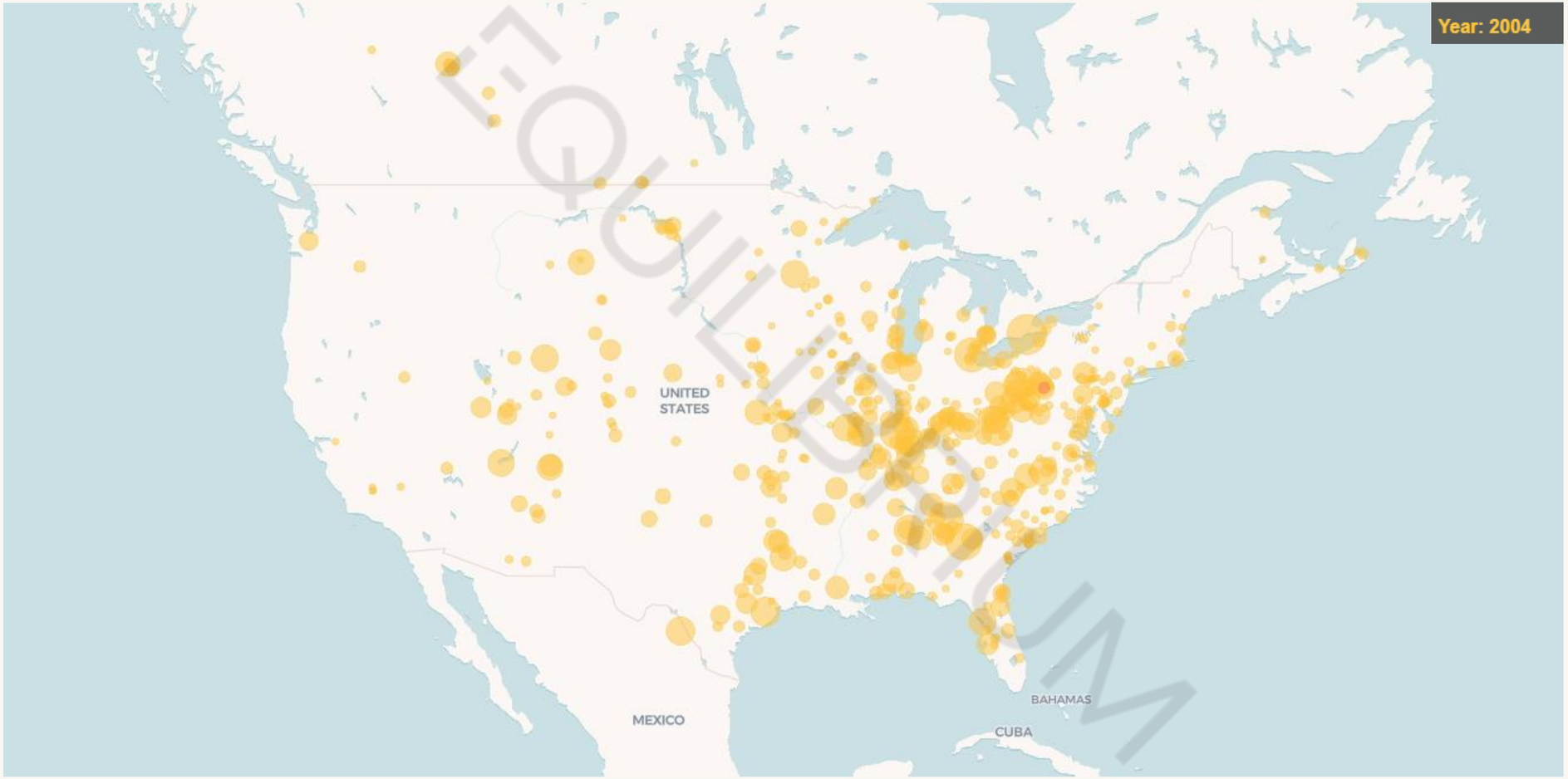
85-90% Portland cement

Typical GHG emissions proportions



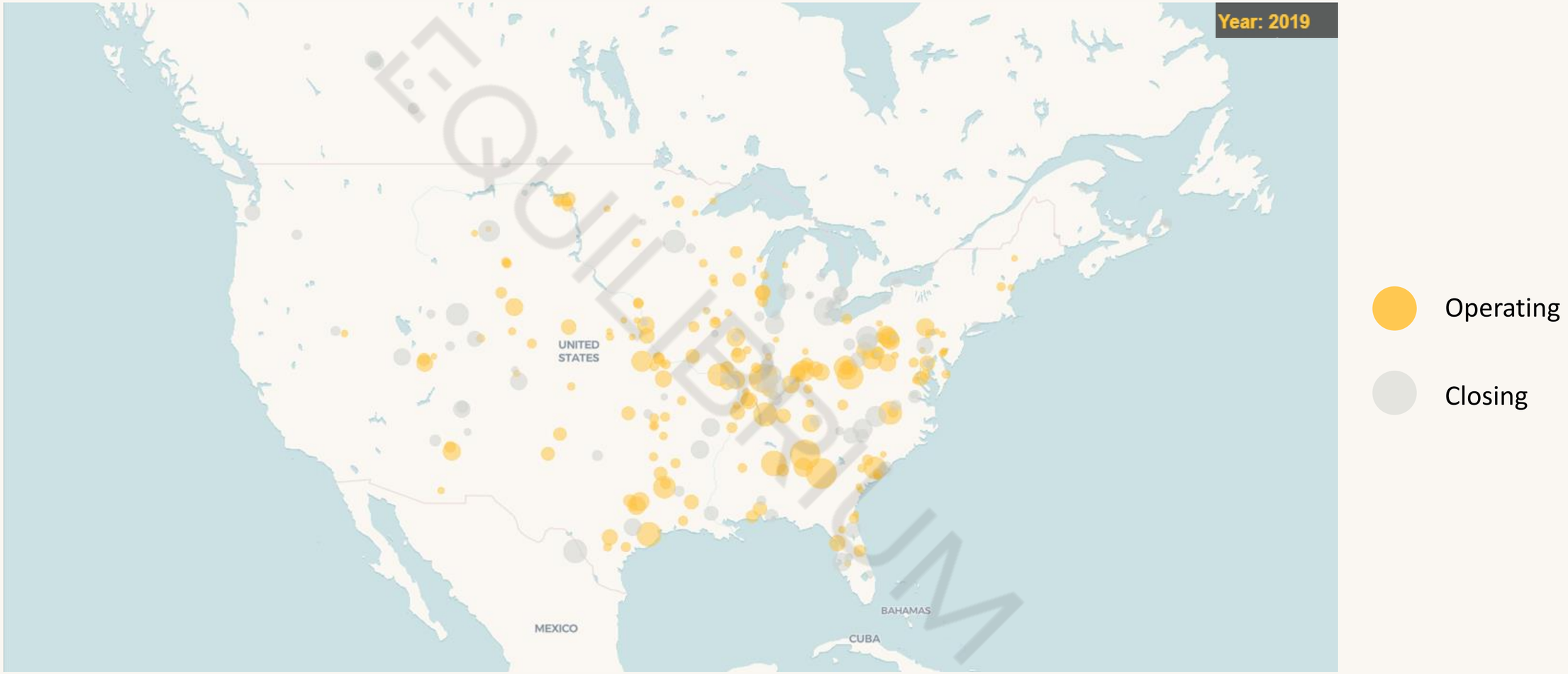


Fly Ash Sources – Coal Power



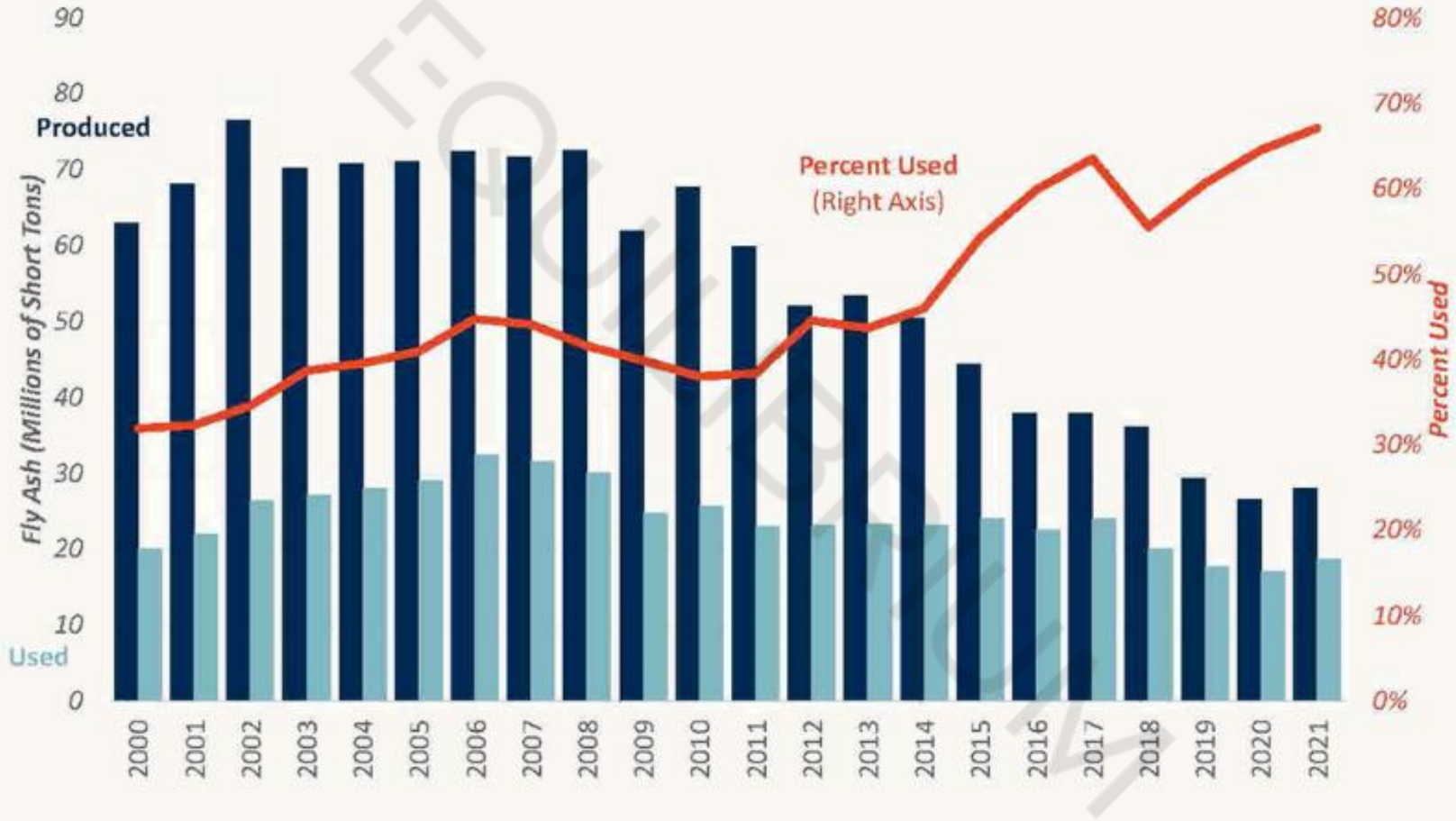
https://www.carbonbrief.org/mapped-worlds-coal-power-plants/

Fly Ash Sources – Coal Power



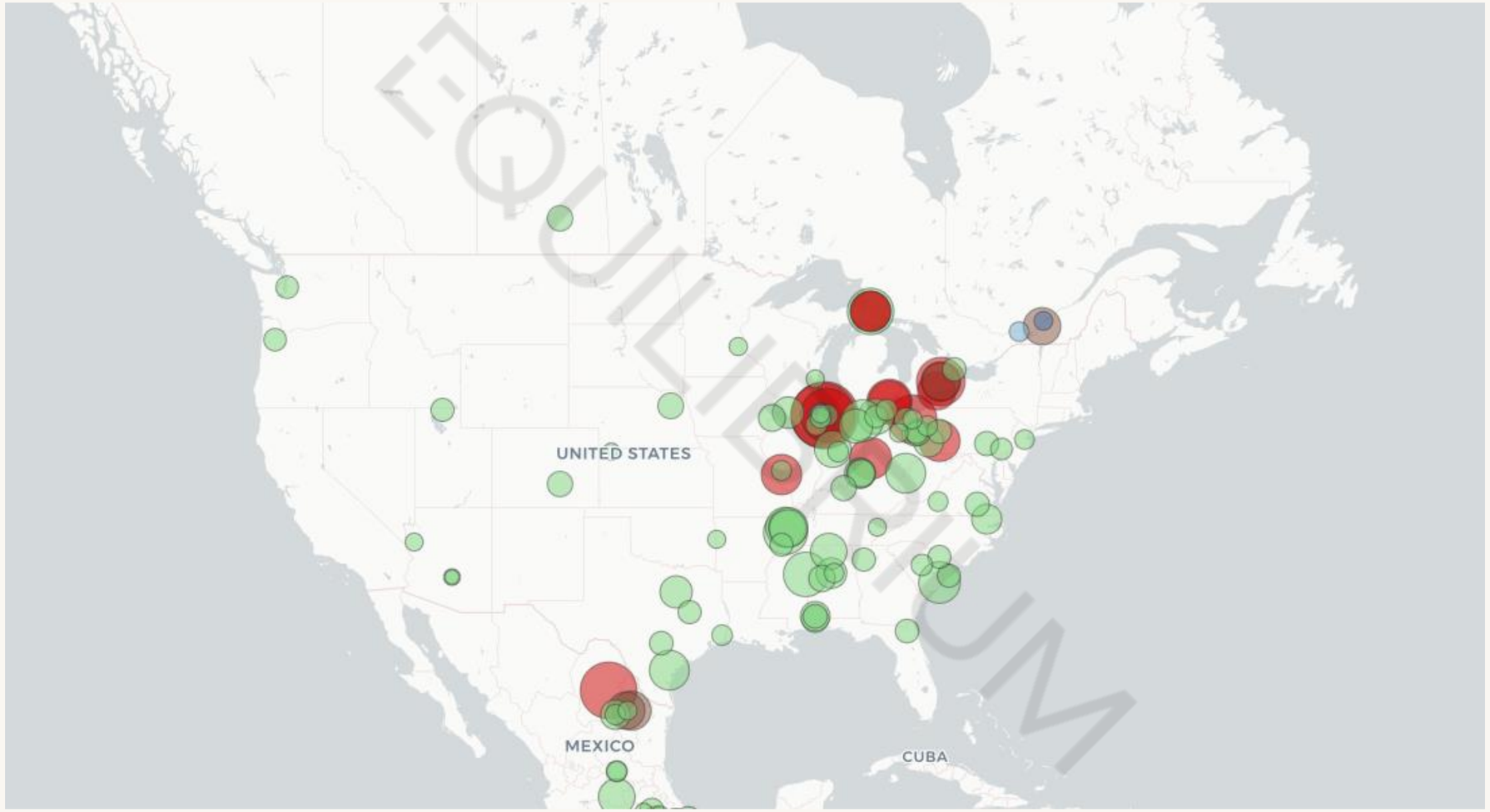
https://www.carbonbrief.org/mapped-worlds-coal-power-plants/

Fly Ash Use



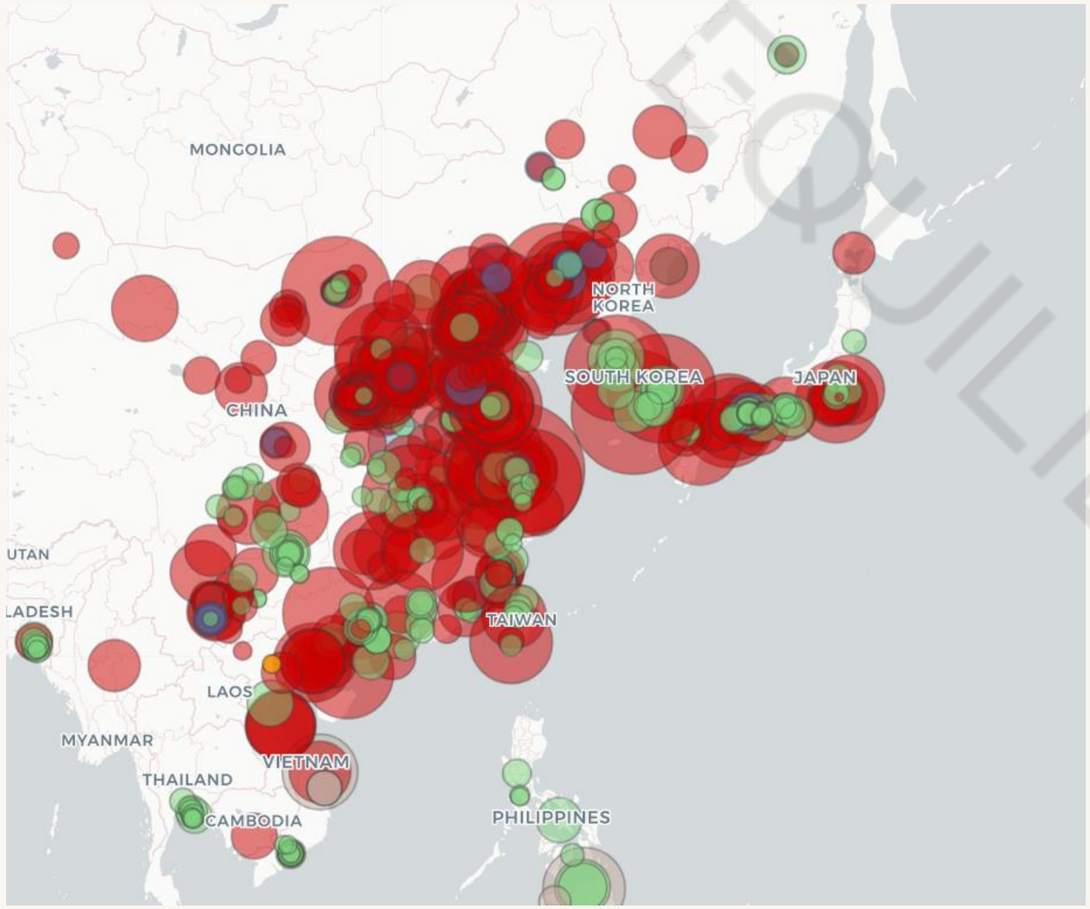
ACAA 2022 Production and Use Survey
https://concreteproducts.com/index.php/2022/12/12/survey-confirms-coal-ash-consumption-gains-in-cement-and-concrete/

Slag Sources – Steelmaking Plants



https://globalenergymonitor.org/projects/global-steel-plant-tracker/tracker-map/

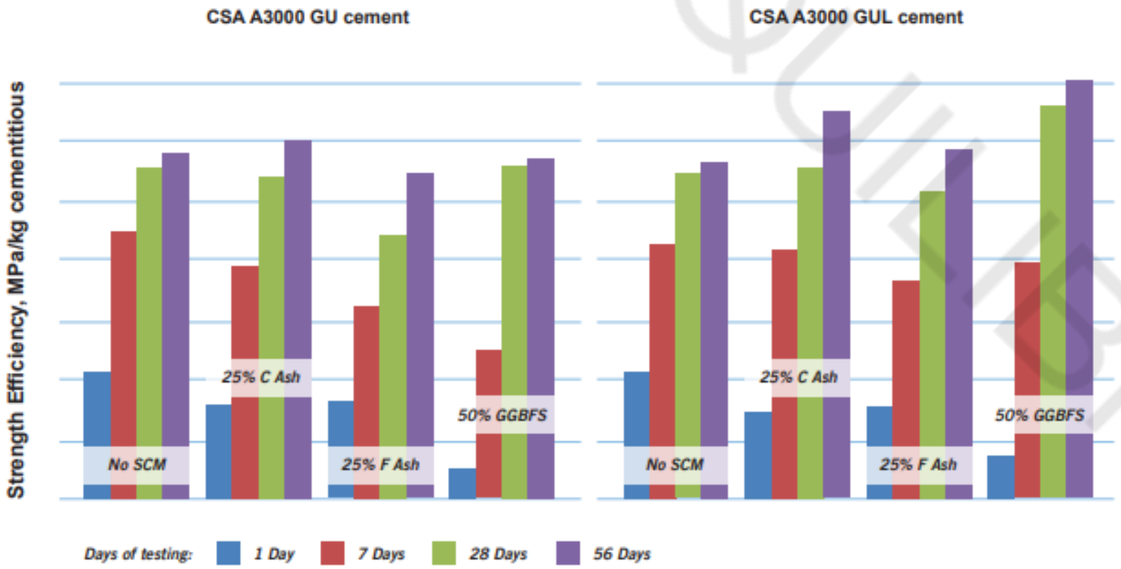
Slag Sources



0.6 million tonnes per year

https://www.projects.eao.gov.bc.ca/api/public/document/5d4e3d8f4cb2c7001b143901/download/Lehigh%20Hanson_Delta%20Grinding%20Facility%20Updated%20Project%20Description.pdf

GUL Cement



- Blended cement in which finely ground limestone (5 to 15%).

- Same materials as GU cement with less clinker

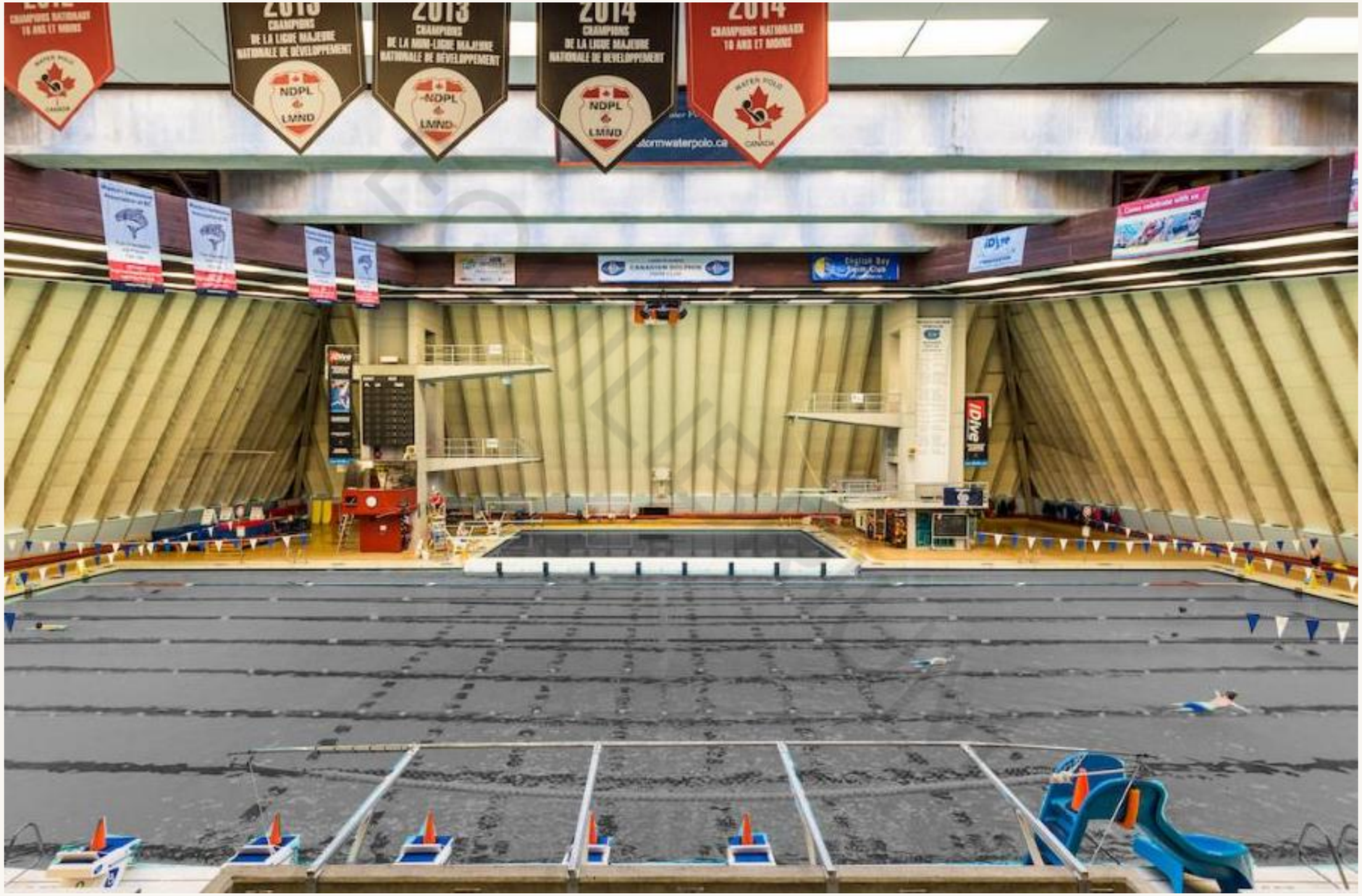
- GUL is the only cement produced in BC

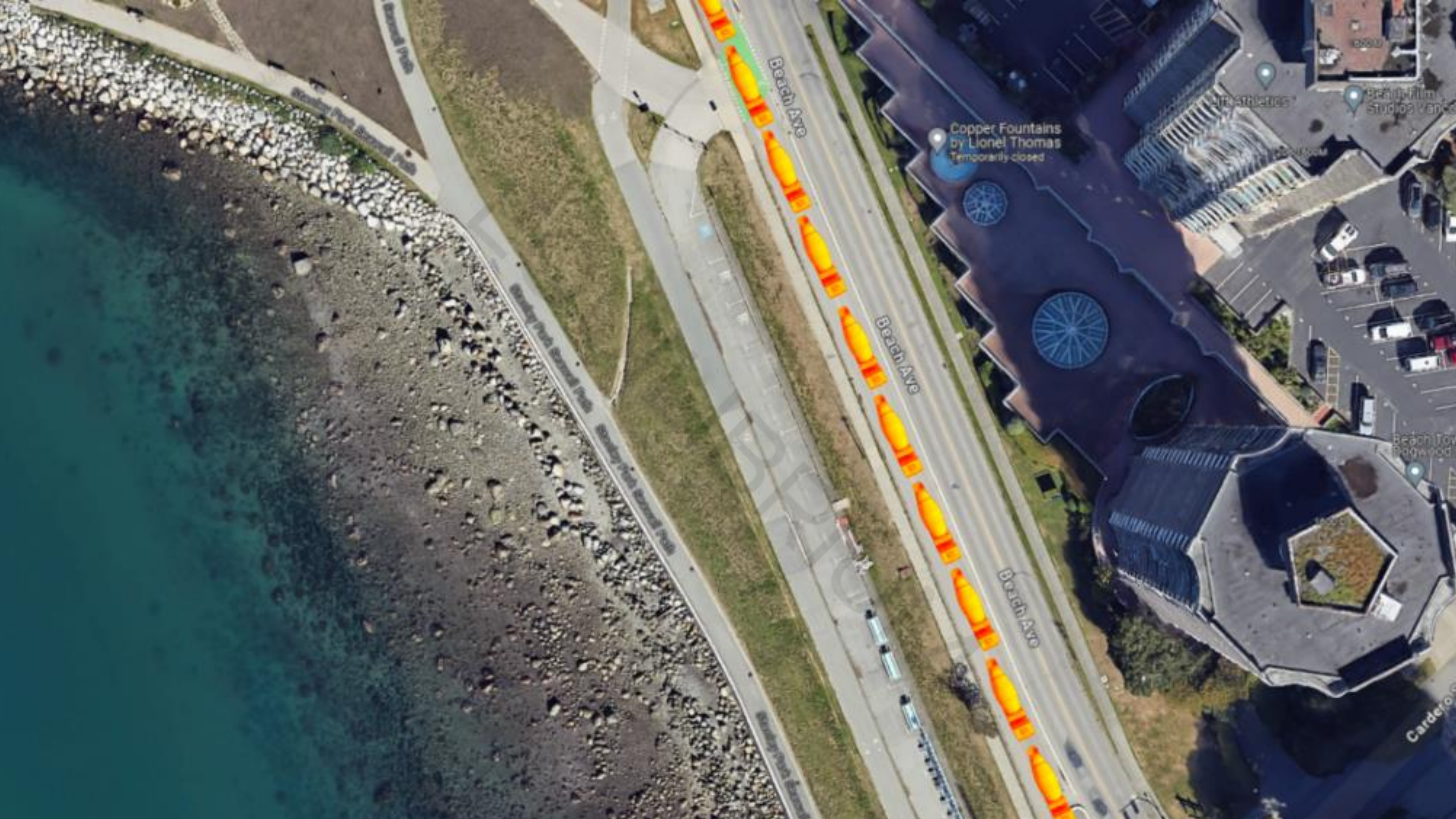
- Equivalent performance to GU

- Reduces CO2 emissions by 5-10%

https://www.lafarge.ca/sites/canada2/files/2023-08/lafarge_rebrand_onecem_sell_sheet_en.pdf


2013
CHAMPIONS
DE LA LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2013
CHAMPIONS
DE LA MINI-LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2014
CHAMPIONS
DE LA LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2014
CHAMPIONS NATIONAUX
16 ANS ET MOINS
WATER POLO
CANADA
stormwaterpolo.ca
IDive


2013
CHAMPIONS
DE LA LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2013
CHAMPIONS
DE LA MINI-LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2014
CHAMPIONS
DE LA LIGUE MAJEURE
NATIONALE DE DÉVELOPPEMENT
NDPL
LMND
2014
CHAMPIONS NATIONAUX
10 ANS ET MOINS
WATER POLO
CANADA



Copper Fountains
by Lionel Thomas
Temporarily closed
Beach Ave
Beach Ave
Beach Ave

Chicken World Canada | Vancouver Fried...
Fast Food
Alberta All Beef Hot Dog
Fast Food
Morton Park
Denman St
Martway
George Cunningham Memorial Sundial by
Three Greenhorns Memorial Sundial
Vonns Vancouver Smash Burgers and
Blue Ocean Wellness Spa
1780
1778
Davie St
Cactus Club Cafe English Bay
CRAFT Beer Market English Bay
Davie St
1734

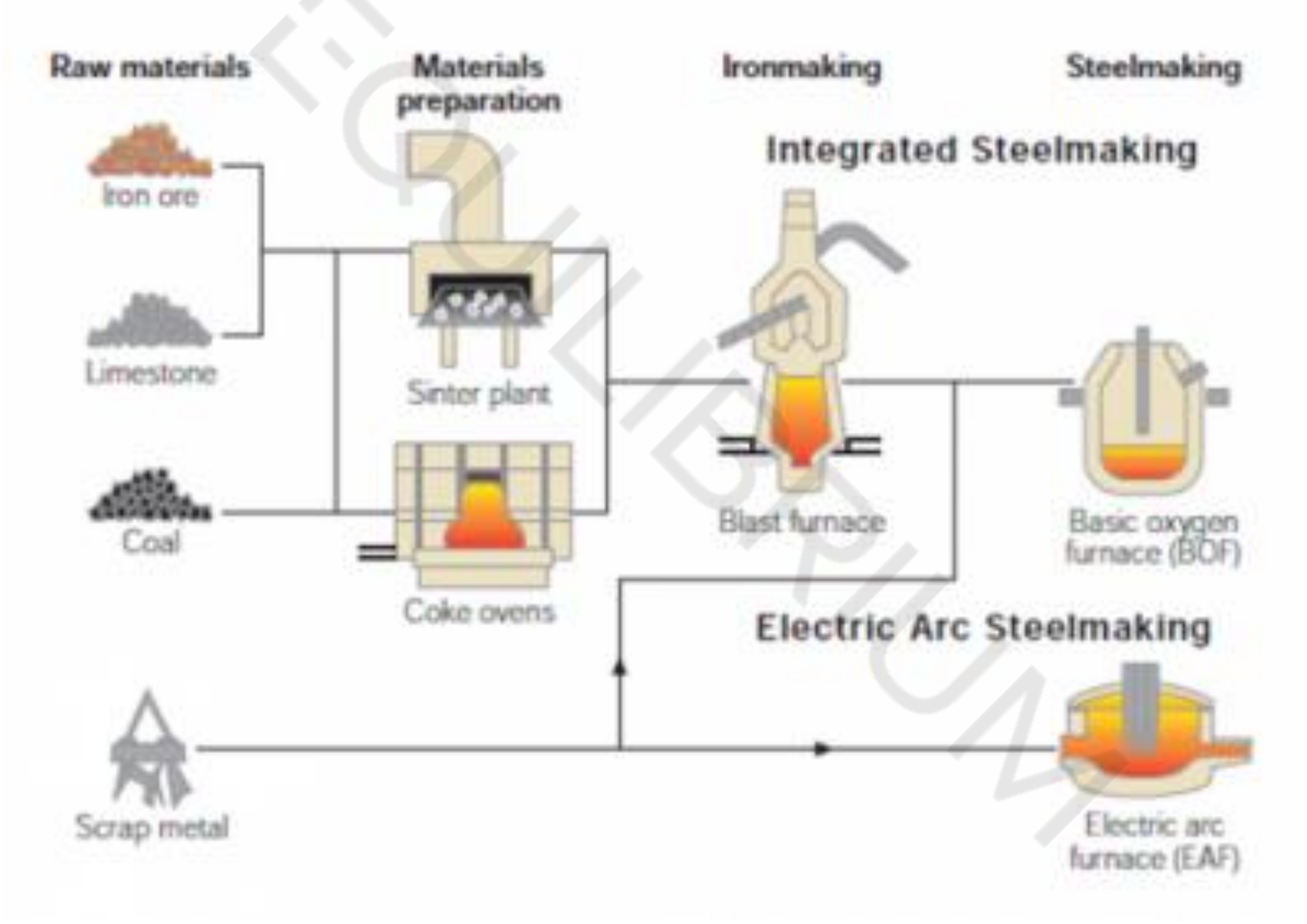

Air India Memorial
Washroom
Stanley Park Dr
Stanley Park Dr
Lagoon Dr
Lagoon Dr
Lagoon Dr
Stanley Park Pitch & Putt


Third Beach
Stanley Park
Vancouver Aquarium
Totem Poles
Vancouver Seawall
Vancouver Harbour
Second Beach
The Westin Bayshore, Vancouver
Vancouver Convention Centre
WEST END
A-maze-ing Laughter
Ready Mix Concrete Waterfront
English Bay
Best Ready Mix Concrete
GASTOWN
DOWNTOWN EASTSIDE
DOWNTOWN VANCOUVER
CHINATOWN
Exposed Aggregate Supply Vancouver
Costco Wholesale
Vancouver Maritime Museum
Museum of Vancouver
Kitsilano Beach
KITS POINT
YALETOWN
STRATHCONA
Kitsilano Pool
Temporarily closed
KITSILANO
Science World

Concrete Summary

- Annual cement production in BC = 2 million tonnes
- Approximately 15 million tonnes of concrete
- SCMs: Slag and Fly ash are both available – speak to suppliers early
- In BC, always specify GUL cement

Steel


Raw materials
Materials preparation
Ironmaking
Steelmaking
Integrated Steelmaking
Iron ore
Limestone
Coal
Sinter plant
Coke ovens
Blast furnace
Basic oxygen furnace (BOF)
Electric Arc Steelmaking
Scrap metal
Electric arc furnace (EAF)

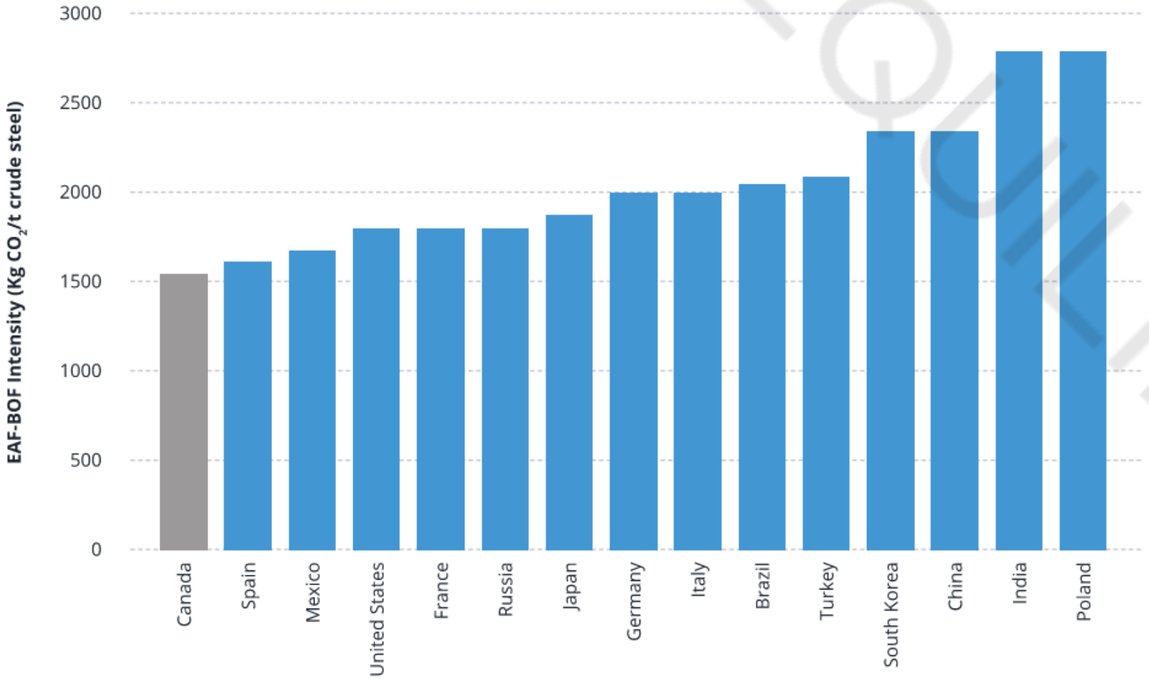


Figure 3: Carbon intensity of BF-BOF steel production (2016)

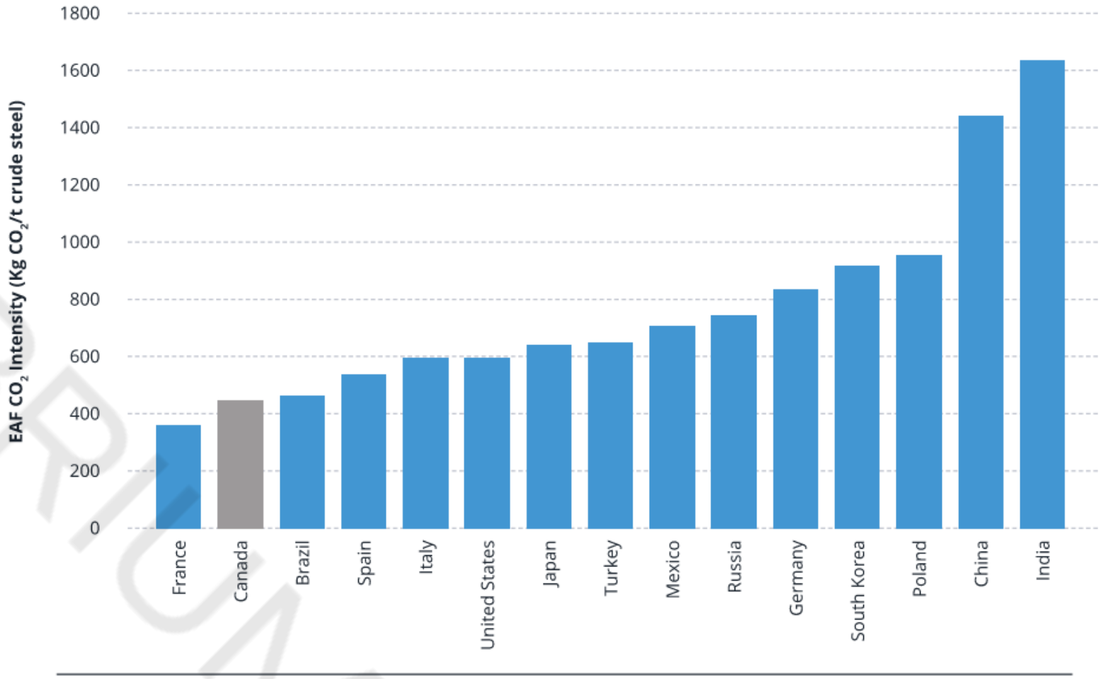
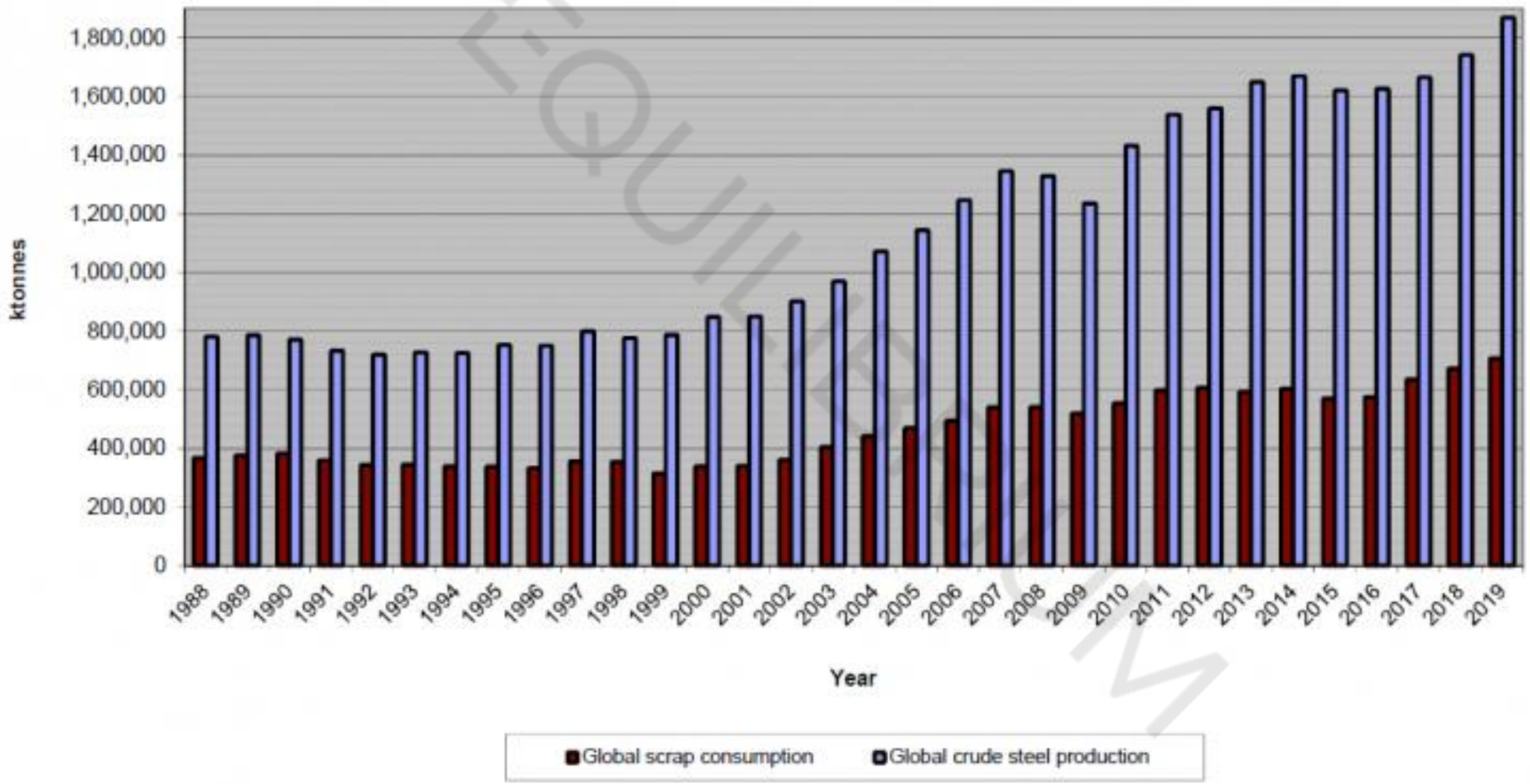


Figure 2: Carbon intensity of EAF steel production (2016)[36]



32% supply from scrap

https://www.steelconstruction.info/Recycling_and_reuse#Steel_production

ArcelorMittal About Climate action Smarter Future Industries Investors Sustainability Careers Media MT:NA ↗ €28.48

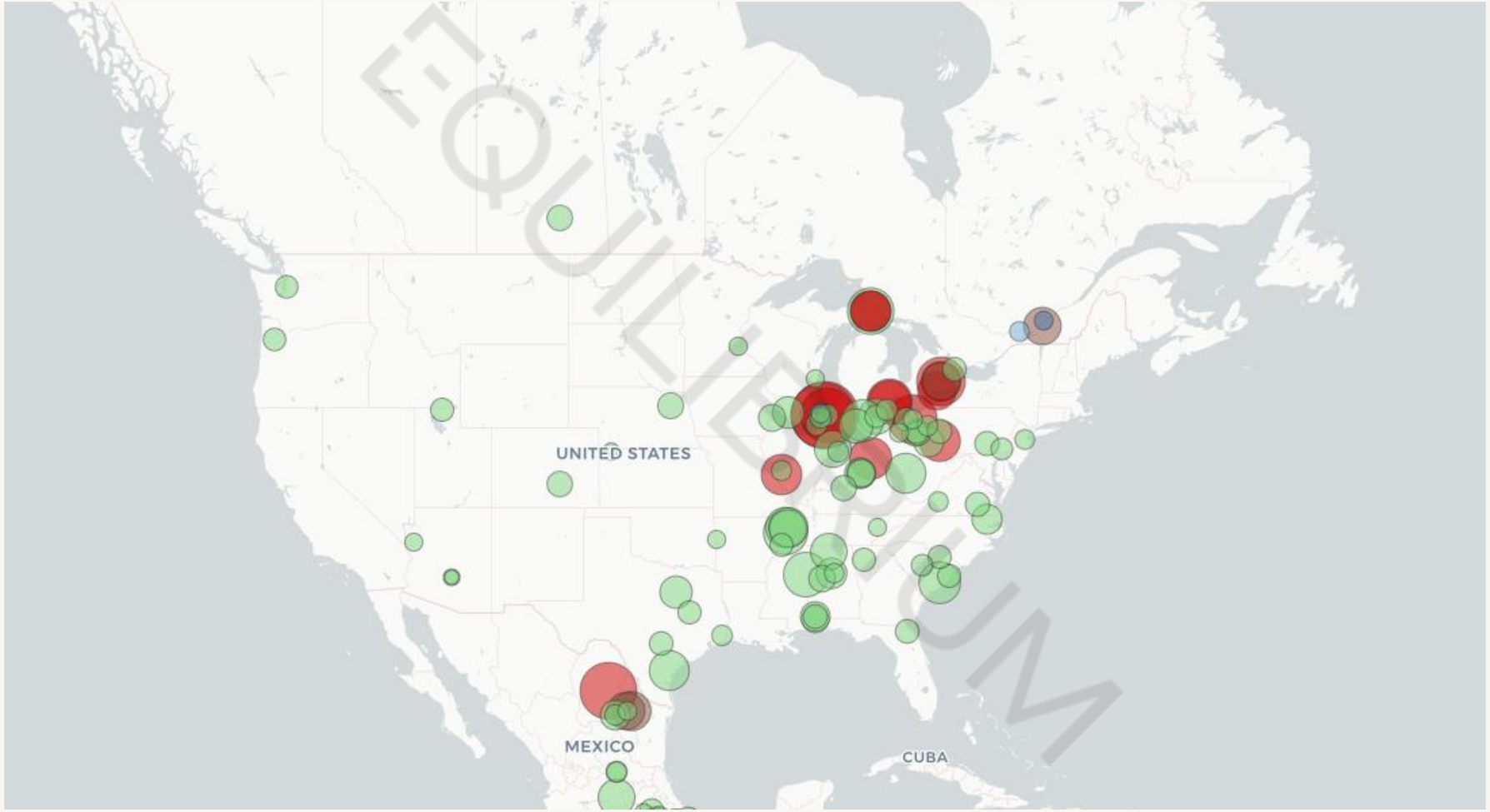
Scrap and recycling

Globally, the current production of steel is three times higher than the supplies of scrap available. Nearly all steel is recycled (87-90%), but even by 2050 scrap supplies will only make up around half of the projected demand for steel. Stakeholders sometimes expect us to reduce our carbon footprint by using more scrap, and yet since virtually all post-consumer scrap available globally is already being recycled, there is no global carbon benefit from encouraging steel producers to use more scrap. Only as more steel products become obsolete can the world produce more recycled steel.

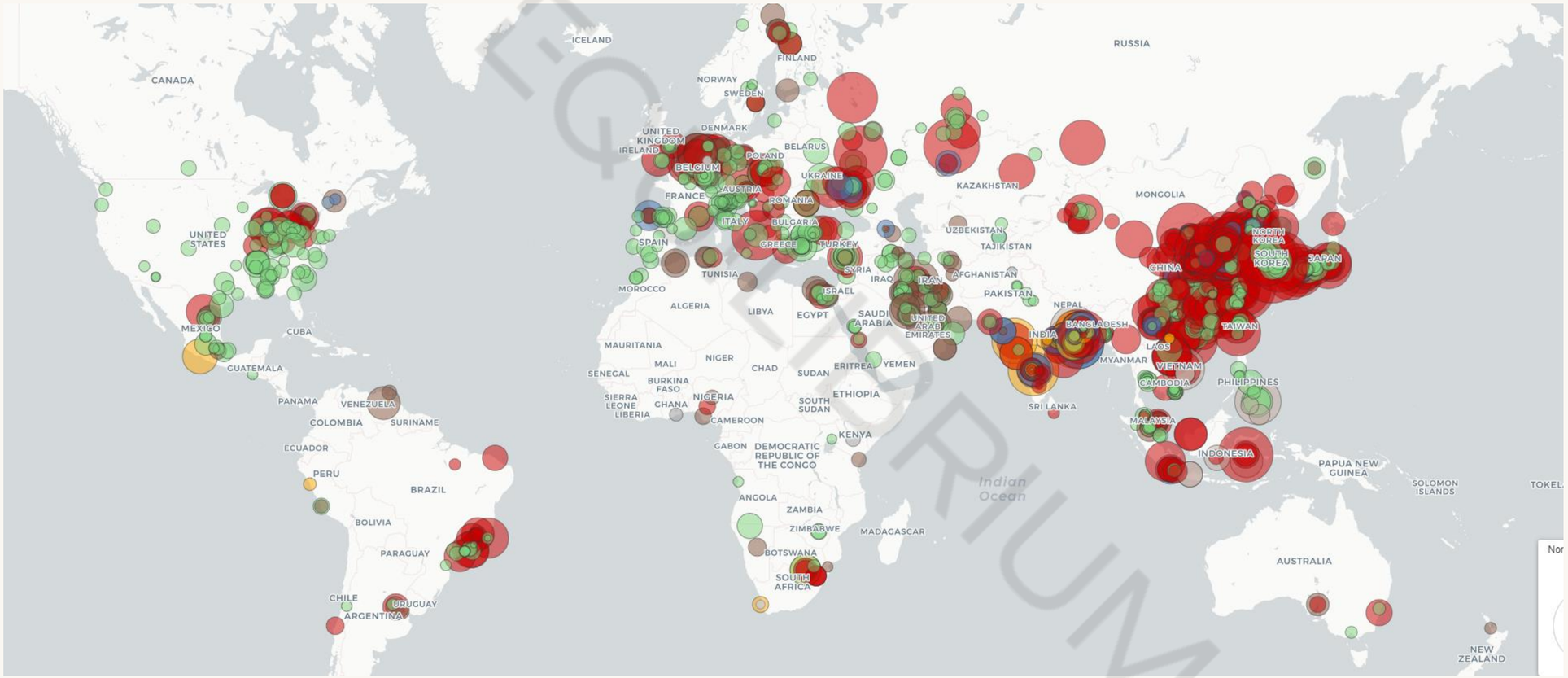
Blast furnace production of steel from primary iron resources will clearly remain vital to support society's demand for steel – and for the low-carbon transition - for many decades to come. In fact, it is necessary to produce more primary steel today in order to create the future stocks of scrap for a perfectly circular steel industry of the future.

50% EAF by 2050

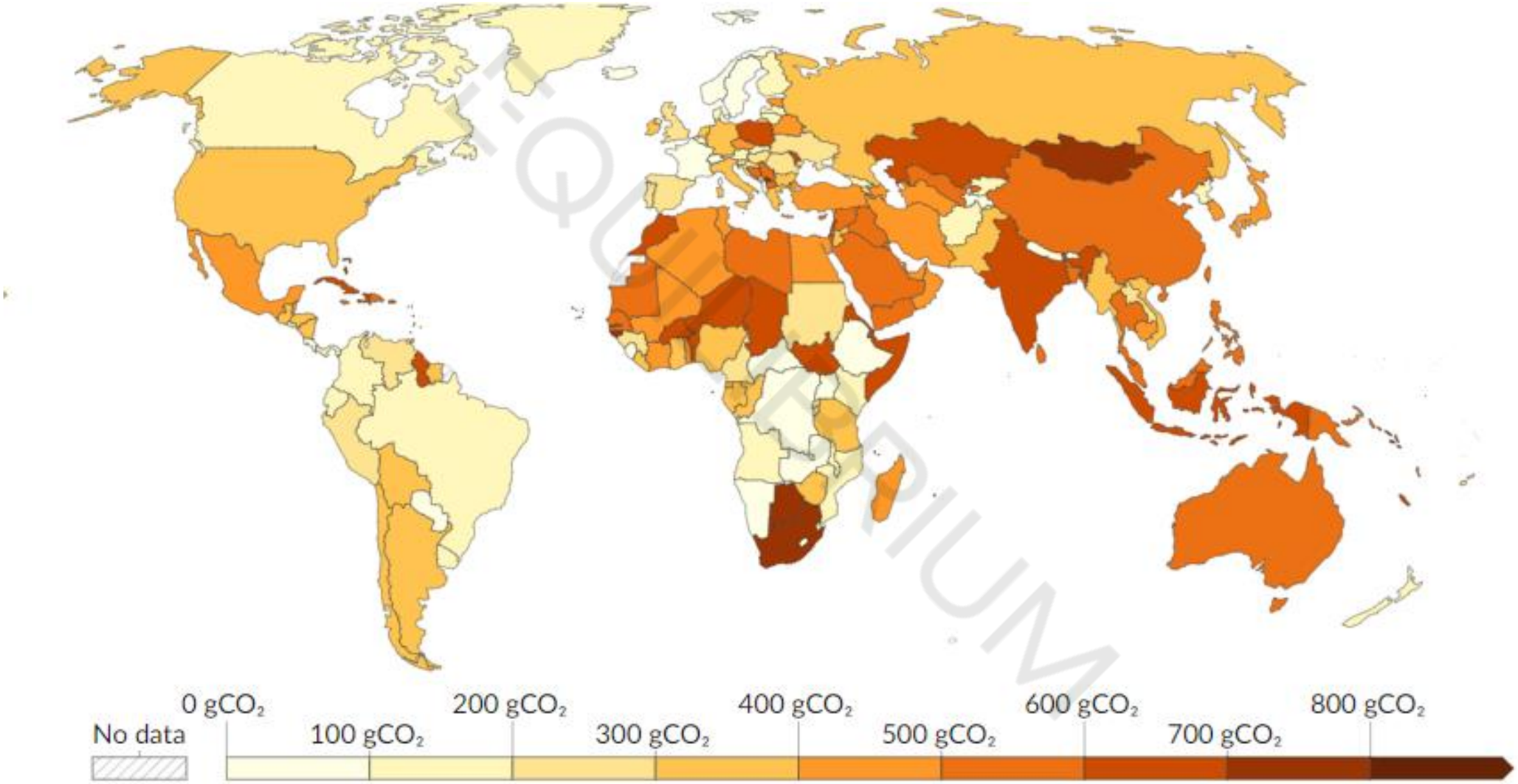
Steelmaking Plants



https://globalenergymonitor.org/projects/global-steel-plant-tracker/tracker-map/



https://globalenergymonitor.org/projects/global-steel-plant-tracker/tracker-map/



https://ourworldindata.org/electricity-mix

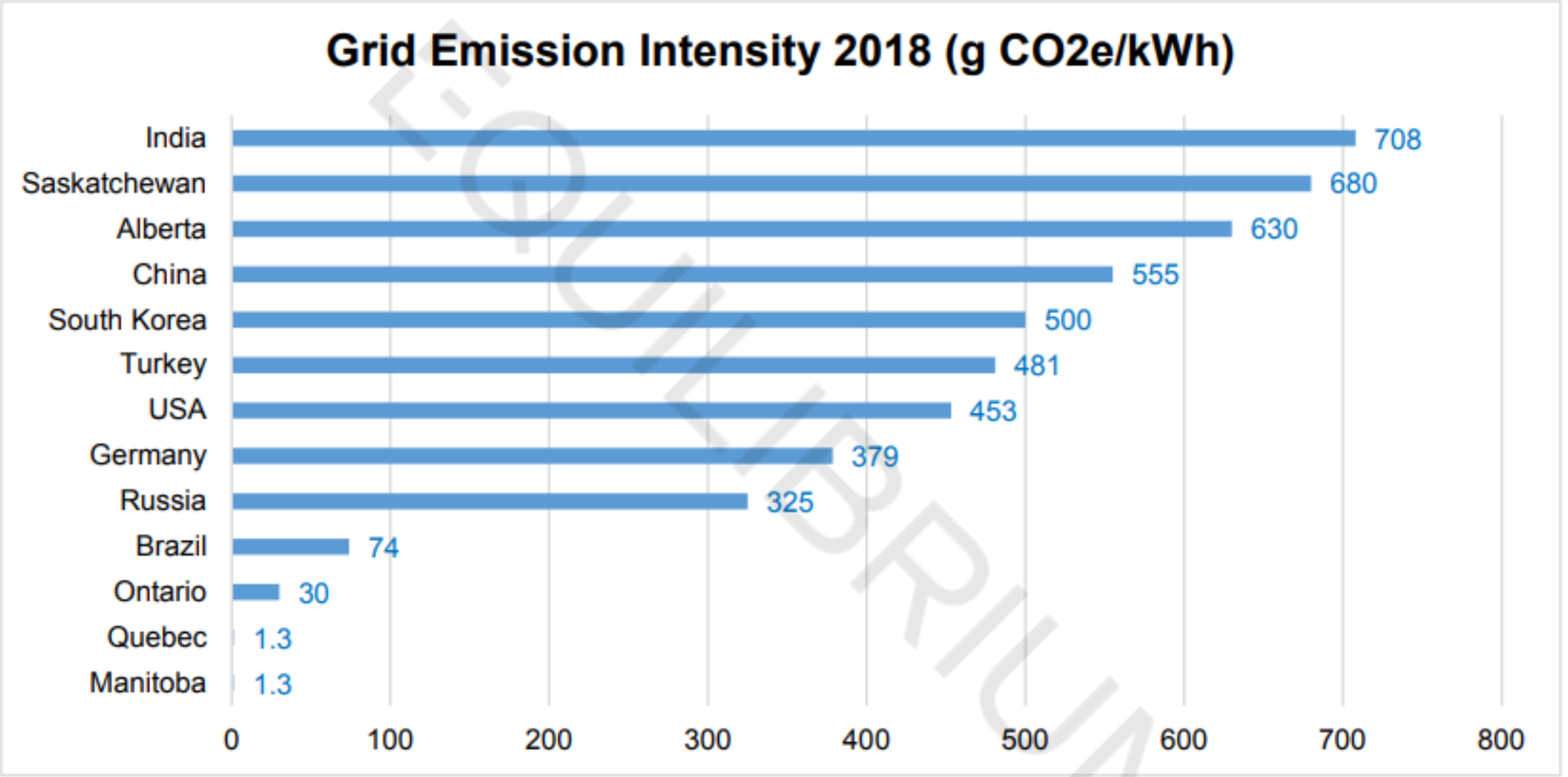
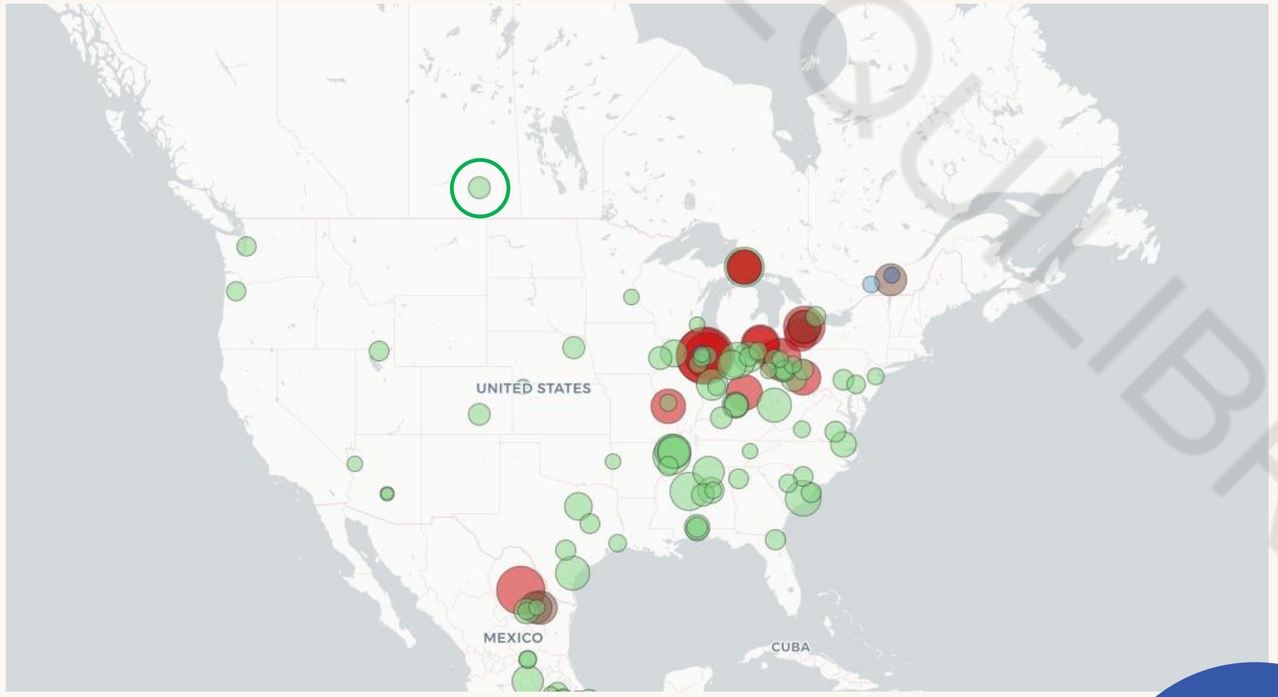


Figure 29: Comparison of Grid Emission Intensity of CSPA Identified Trading Partner Countries with Canadian Steel Producing Provinces

https://canadiansteel.ca/files/resources/Golder-Report-CSPA-NRCan.pdf



Environmental Product Declaration | EVRAZ North America | Steel Plate

Table 5. *Life Cycle Impact Assessment (LCIA) results for the EVRAZ NA Steel Plate. Results reported in MJ are calculated using lower heating values. All values are rounded to three significant digits.*

Impact Category	Life cycle stage			
	A1	A2	A3	Total (A1-A3)
IPCC AR5				
GWP (kg CO_2 eq)	719	0.00	236	955
	75%	0%	25%	100%
TRACI 2.1				
GWP (kg CO_2 eq)	714	0.00	235	949
	75%	0%	25%	100%

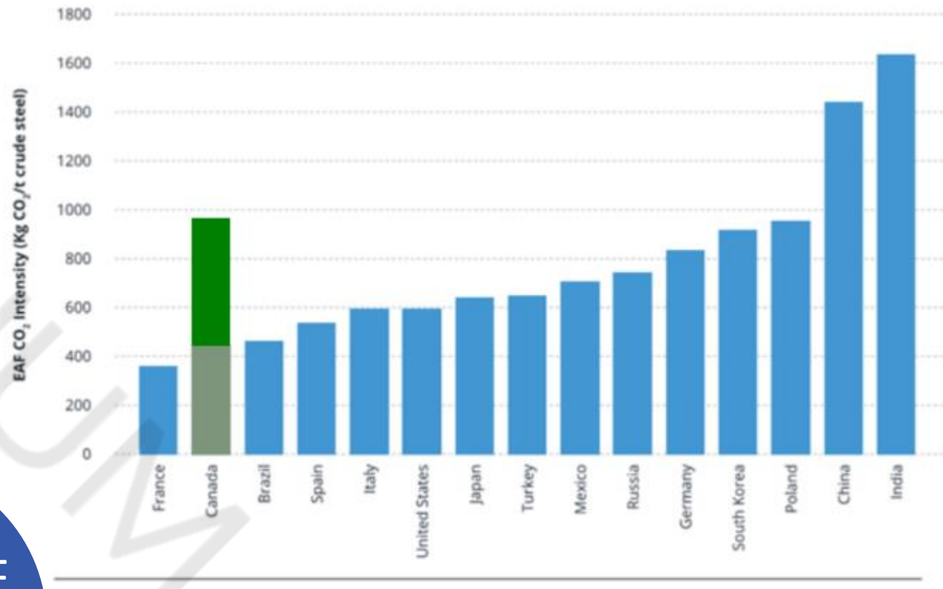


Figure 2: Carbon intensity of EAF steel production (2016)[xx]

Not all EAF steel is equal

https://canadiansteel.ca/files/resources/Golder-Report-CSPA-NRCan.pdf

https://c71b3c27-dc50-4762-9bcd-e7a96d28ca39.usrfiles.com/ugd/c71b3c_d2cd4fb4d4004e39818e547be056d644.pdf

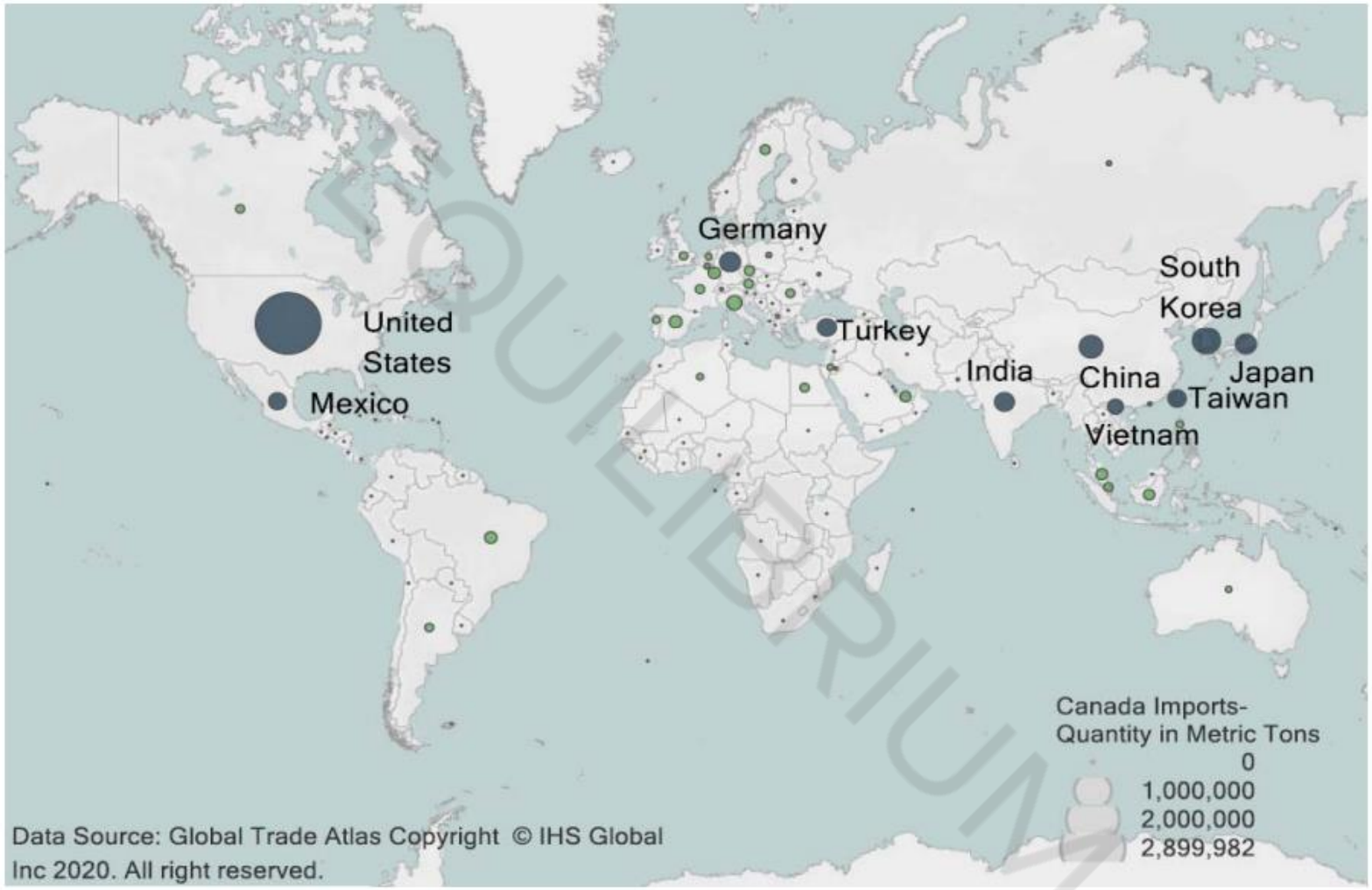


Figure 23: Canada's Imports of Steel Mill products 2019, Top 10 Countries in Blue

https://legacy.trade.gov/steel/countries/pdfs/imports-Canada.pdf

Steel Summary

- Annual steel production in Canada = 12.9 million tonnes
- 32% of steel demand can be met with recycled steel.
- Specify both EAF and BOF, but be smart.
- Focus on reducing global emissions over project emissions.

Conclusions

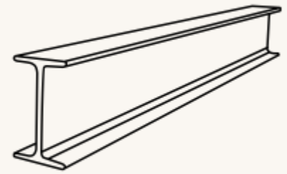
Mass Timber

- Supply not spread evenly across NA
- Transport a more significant part of the carbon story.
- Supply chain engagement key to reducing trucking kilometers and carbon.
- Local supply or rail & boat shipping to minimize total upfront carbon

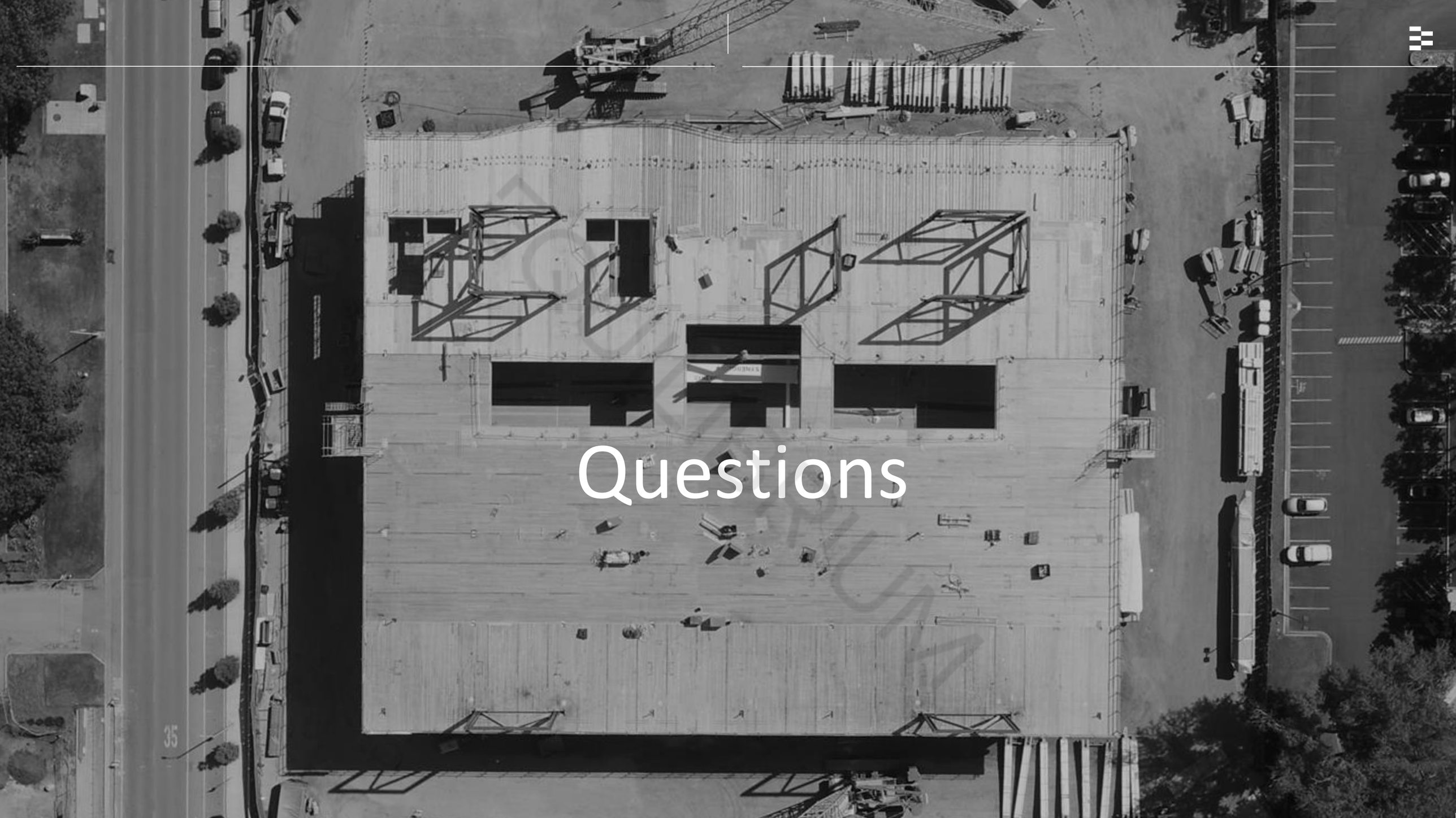
Concrete

- 2 cement plants supply BC
- GUL (limestone cement) default in BC
- SCM availability is supplier and geography dependent in NA
- Reducing concrete volumes is key to saving carbon industry-wide

Steel



- Recycled steel only covers 32% demand
- Specify both EAF and BOF but do so smartly
- Establish material supply routes and reduce shipping distances
- Focus on reducing global emissions over project emissions.



Questions

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