PHN PRESENTS

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How to Retrofit Buildings in a Climate Emergency: Stepwise EnerPHit

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Lytton, B.C., on July 9, 2021.
Photo by Darryl Dyck, The Canadian Press.

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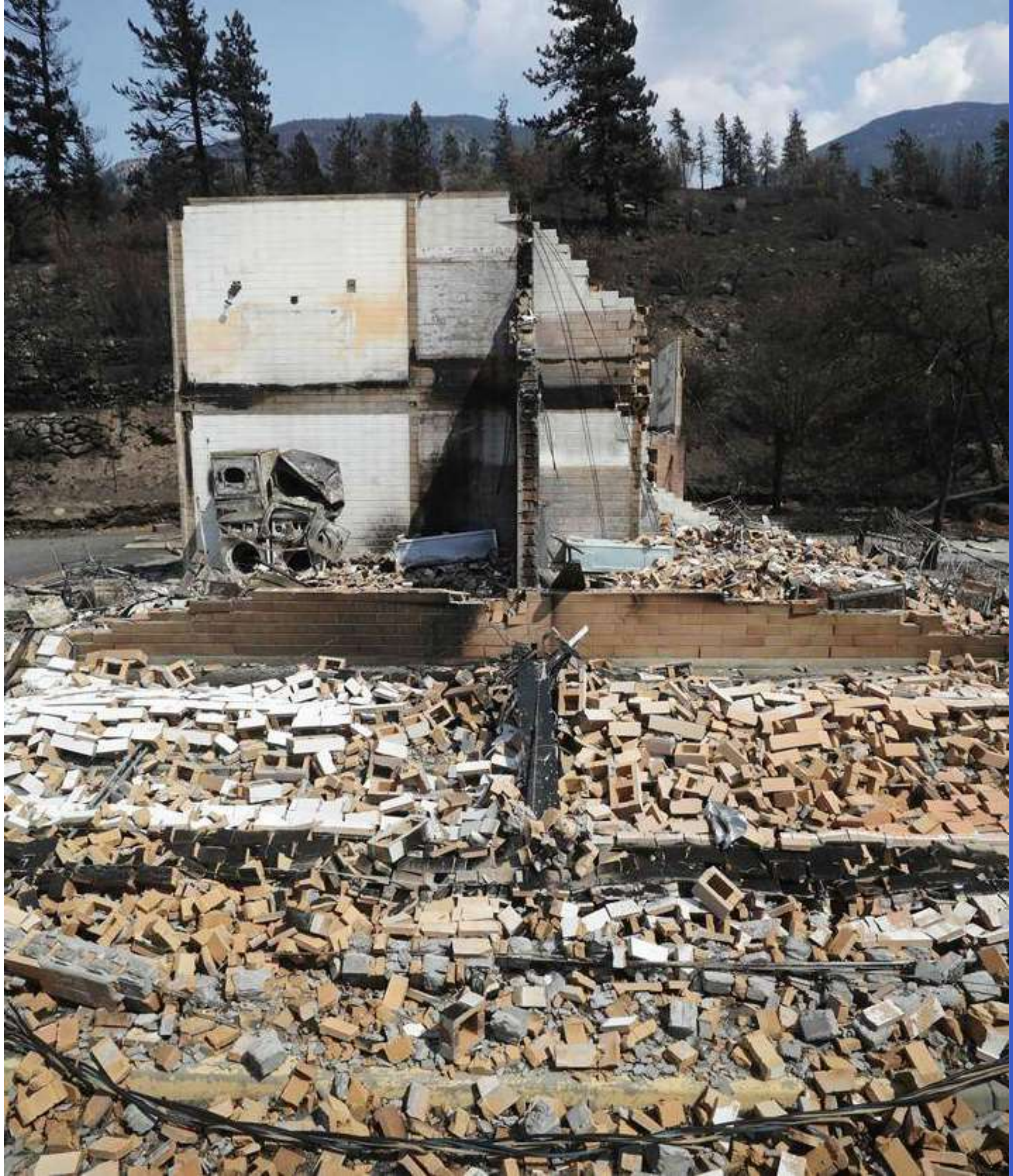
How to Retrofit Buildings in a Climate Emergency

- → There is no new normal.
- → Things will get much worse.
- → Every building needs a plan.
- → Stepwise EnerPHit is a template.
- → Keep Hope Alive.



Lytton, B.C., on July 9, 2021.
Photo by Darryl Dyck, The Canadian Press.

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There is no new normal.

At only 1.2˚C of warming, cascade effects are accelerating.

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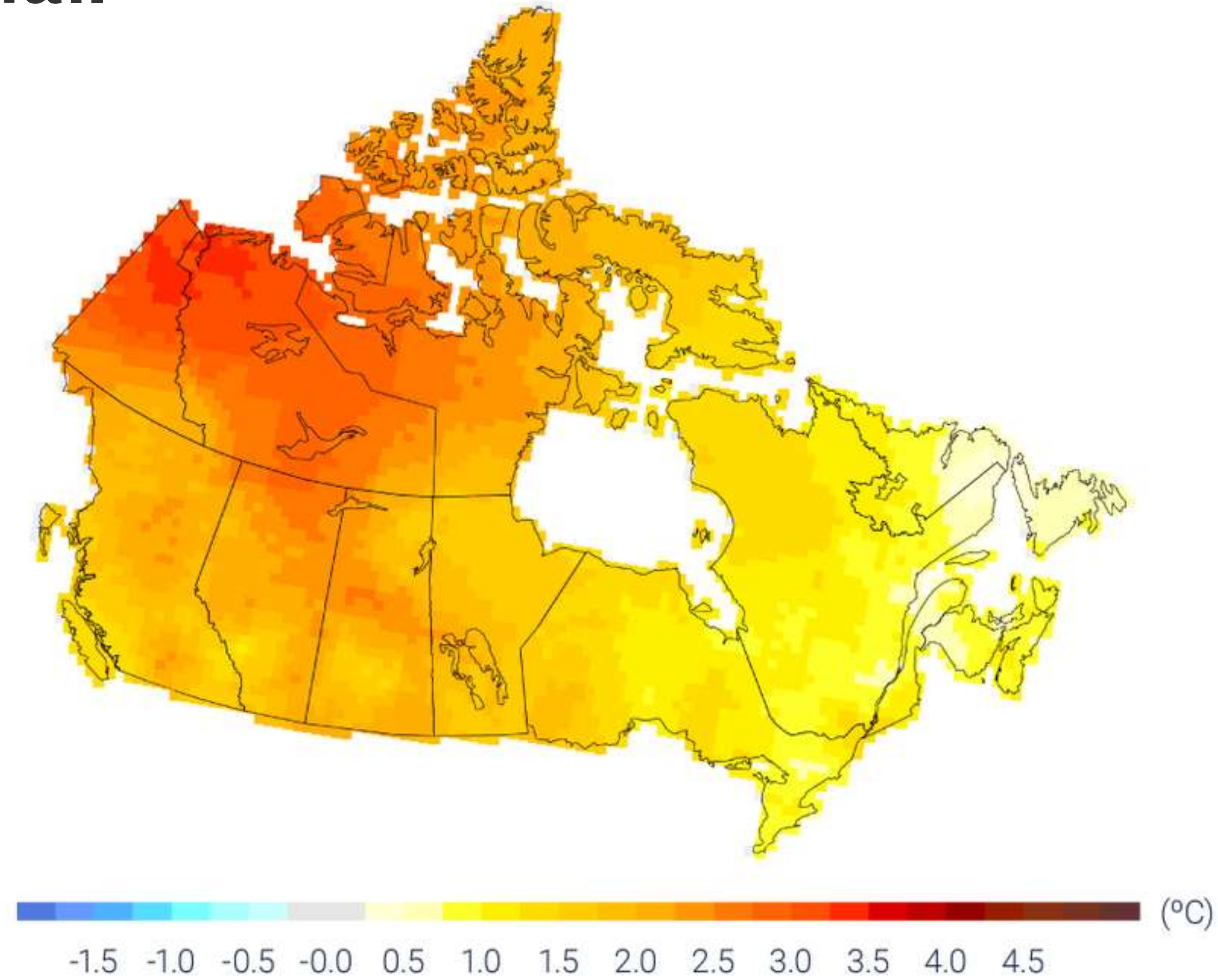
There is no new normal.

- → **The Earth has warmed 1.2°C**
- → **Land has warmed 1.8°C**
- → **Northwest Canada warming faster than North America**



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Source: Environment Canada

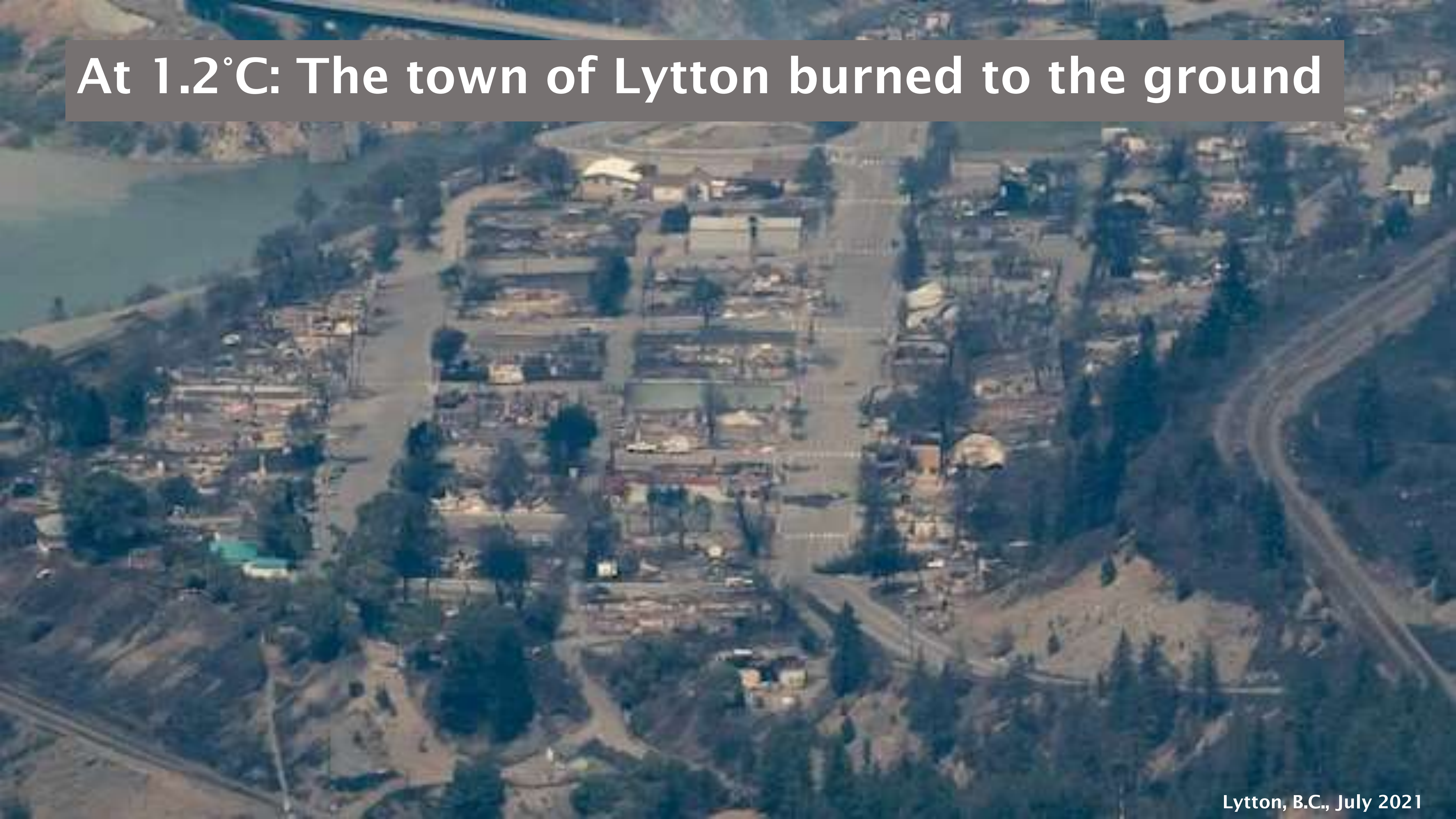
At 0.6˚C: Pine Beetles began surviving winter

Mountain Pine Beetle, image via NRCan.

By 0.8˚C: Every region of B.C. interior infected

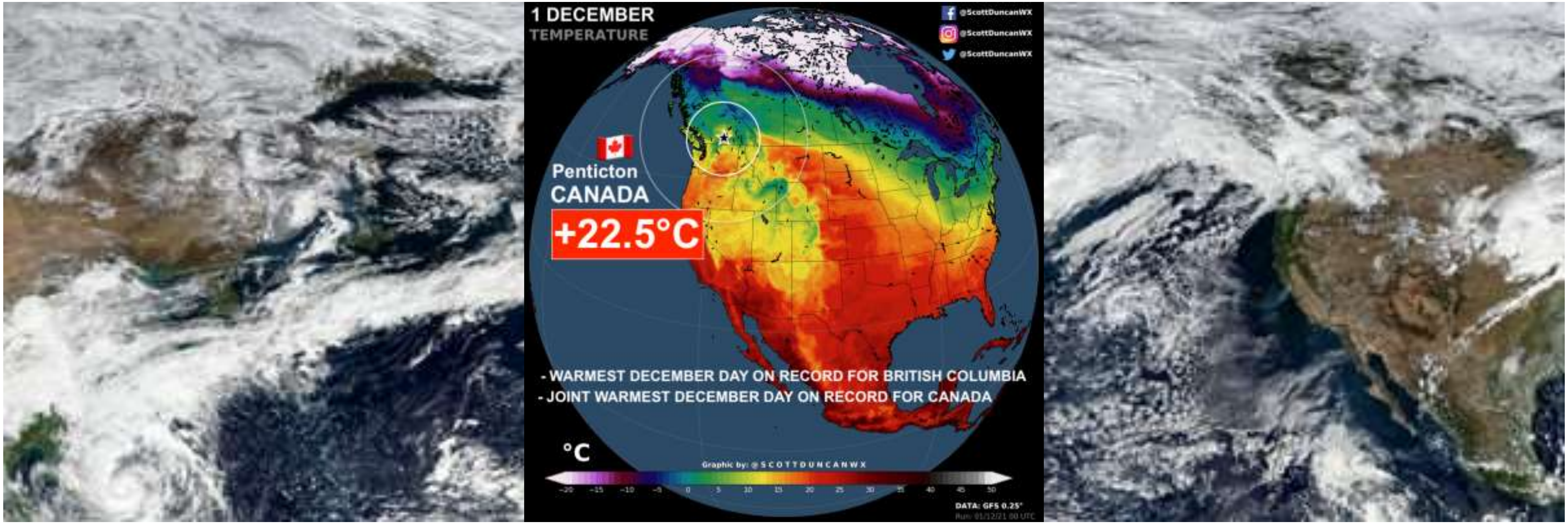
By 1.0˚C: Big wildfires part of every summer

At 1.2˚C: The town of Lytton burned to the ground



Lytton, B.C., July 2021

At 1.2˚C: Atmospheric rivers carried 2x water



A given volume of air at 20˚C (68˚F) can hold twice the amount of water vapor than at 10˚C (50˚F).

At 1.2˚C: Heavy rain turned clear-cut forests to mud

At 1.2˚C: Highways & railways cut in 20+ places

At 1.2°C: Vancouver cut off from Canada by road

At 1.2˚C: Fraser Valley flooded 3x in three weeks

At 1.2˚C: More than 640,000 farm animals died

What one “believes” doesn’t matter.

There is no new normal. Not in our lifetimes.

Cascade effects are the hallmark of runaway climate change.

What are the cascade effects that will hit your region?

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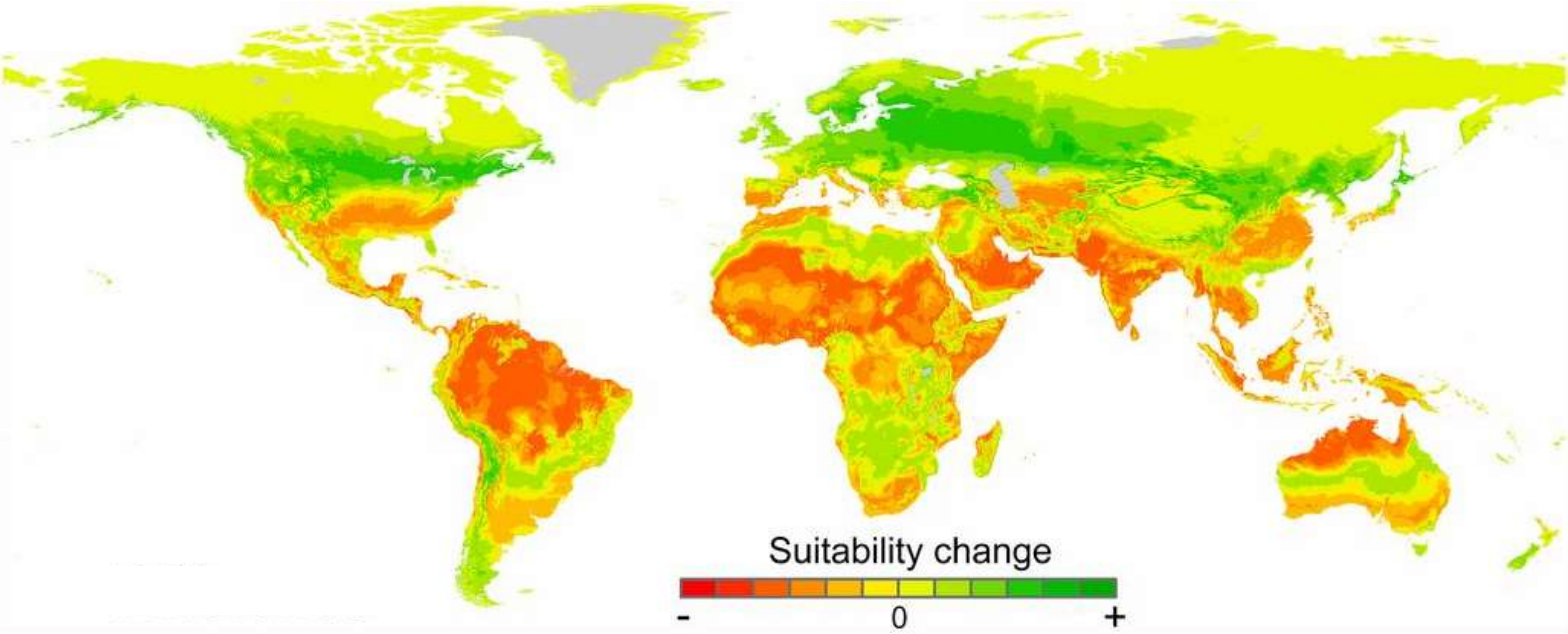
And remember: B.C. among safest places on Earth



Source: “Future of the human climate niche,” by Chi Xu, Timothy Kohler, et al. Proceedings of the National Academy of Sciences, May 4, 2020.

Roughly three billion will migrate by mid-century

Things will get much worse.

That’s what 1.2˚C looks like in British Columbia.
We are racing toward 2.6˚C of global heating.

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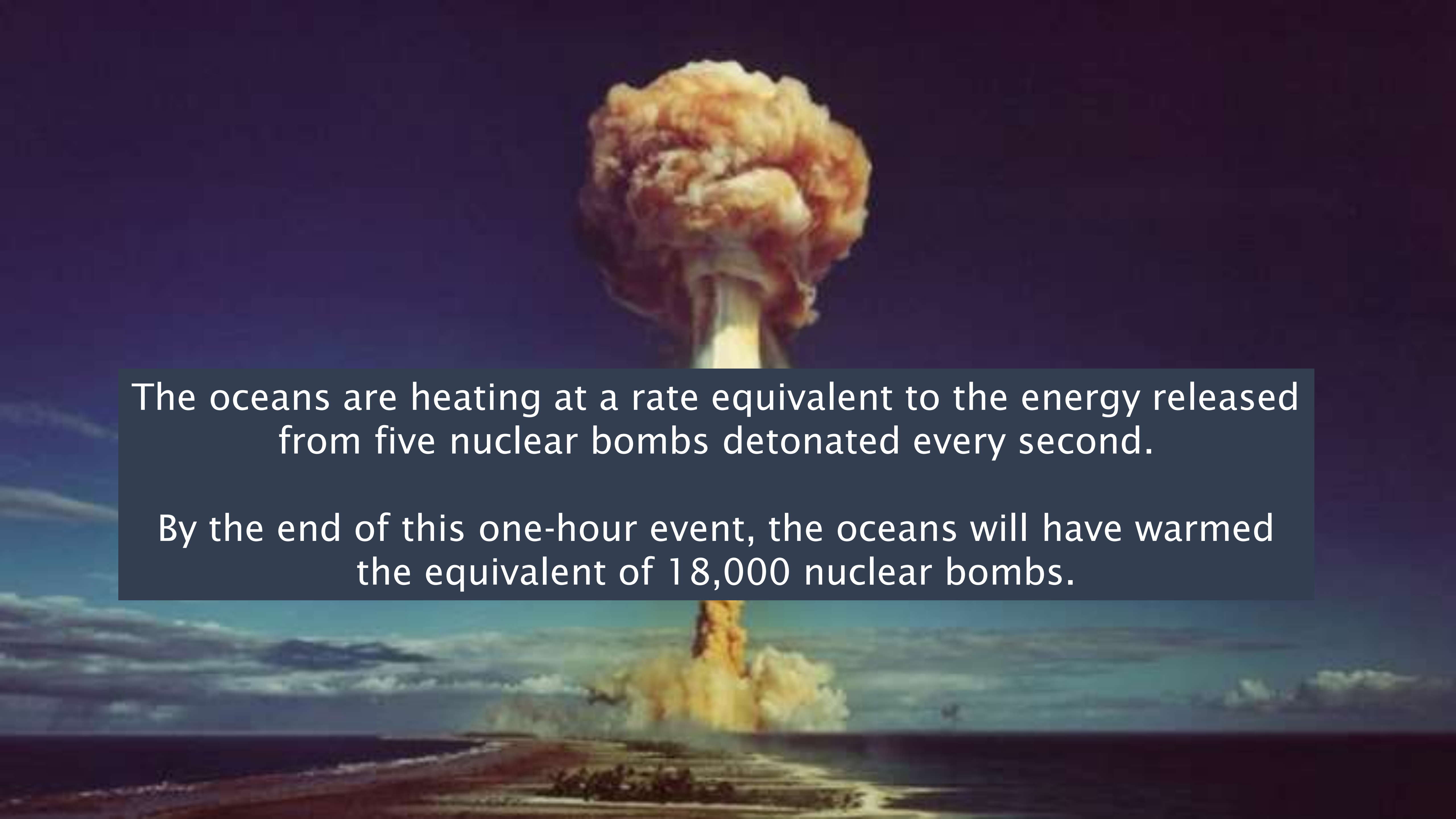
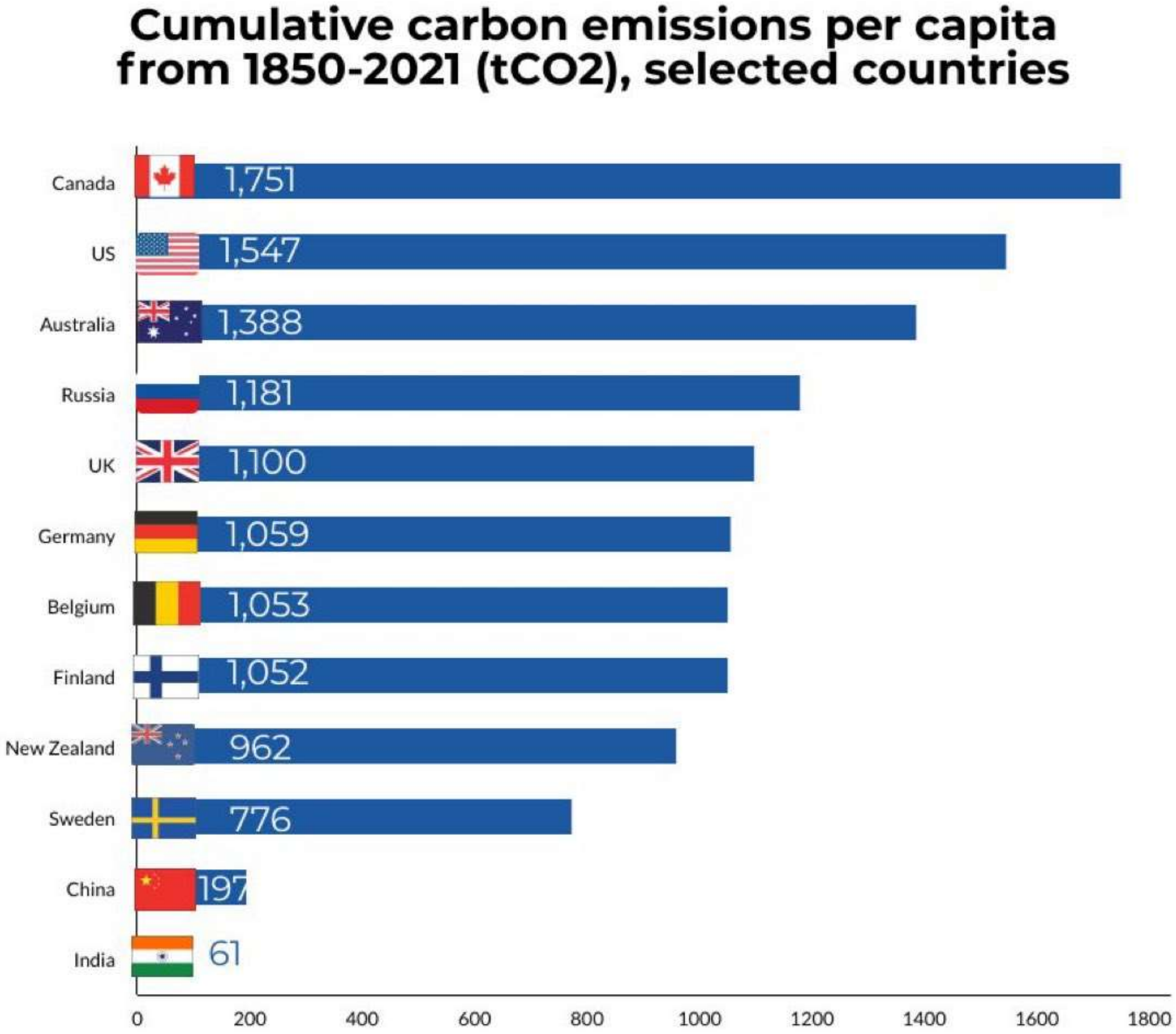


The oceans are heating at a rate equivalent to the energy released from five nuclear bombs detonated every second.

By the end of this one-hour event, the oceans will have warmed the equivalent of 18,000 nuclear bombs.

Canadians have emitted more cumulative C02 **per capita** than any other people.

Americans have been the second largest per-capita emitters.



Source: Carbon Brief

Two global GHG emissions targets

2030

~~40-45~~% below 2005

The entire global economy must reduce GHG emissions by 40-45%

2050

Net-Zero Everything

The entire global economy either emits no greenhouse gas emission or offsets its emissions. 120+ nations.

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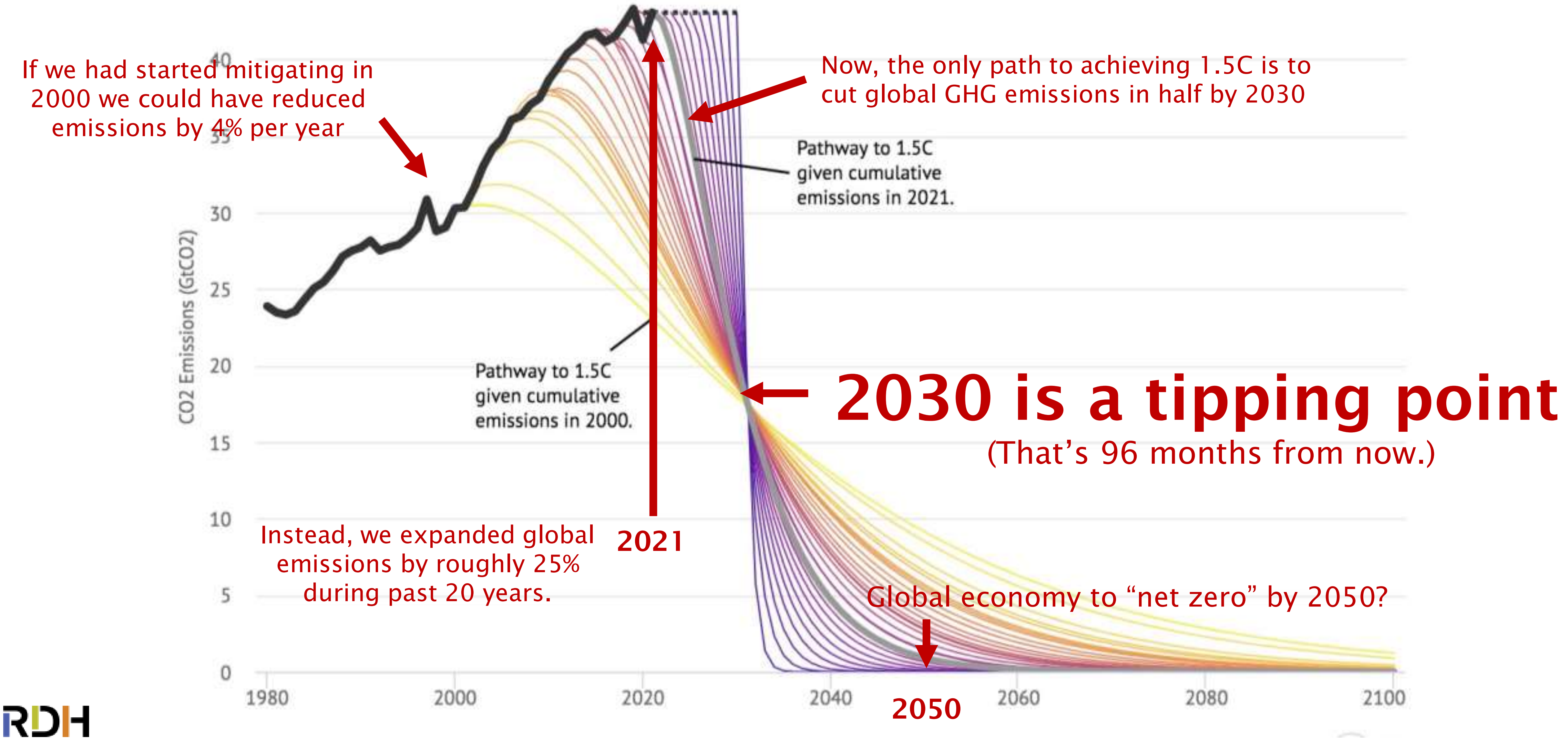
1.5˚C ‘safe’ threshold to be exceeded before 2030



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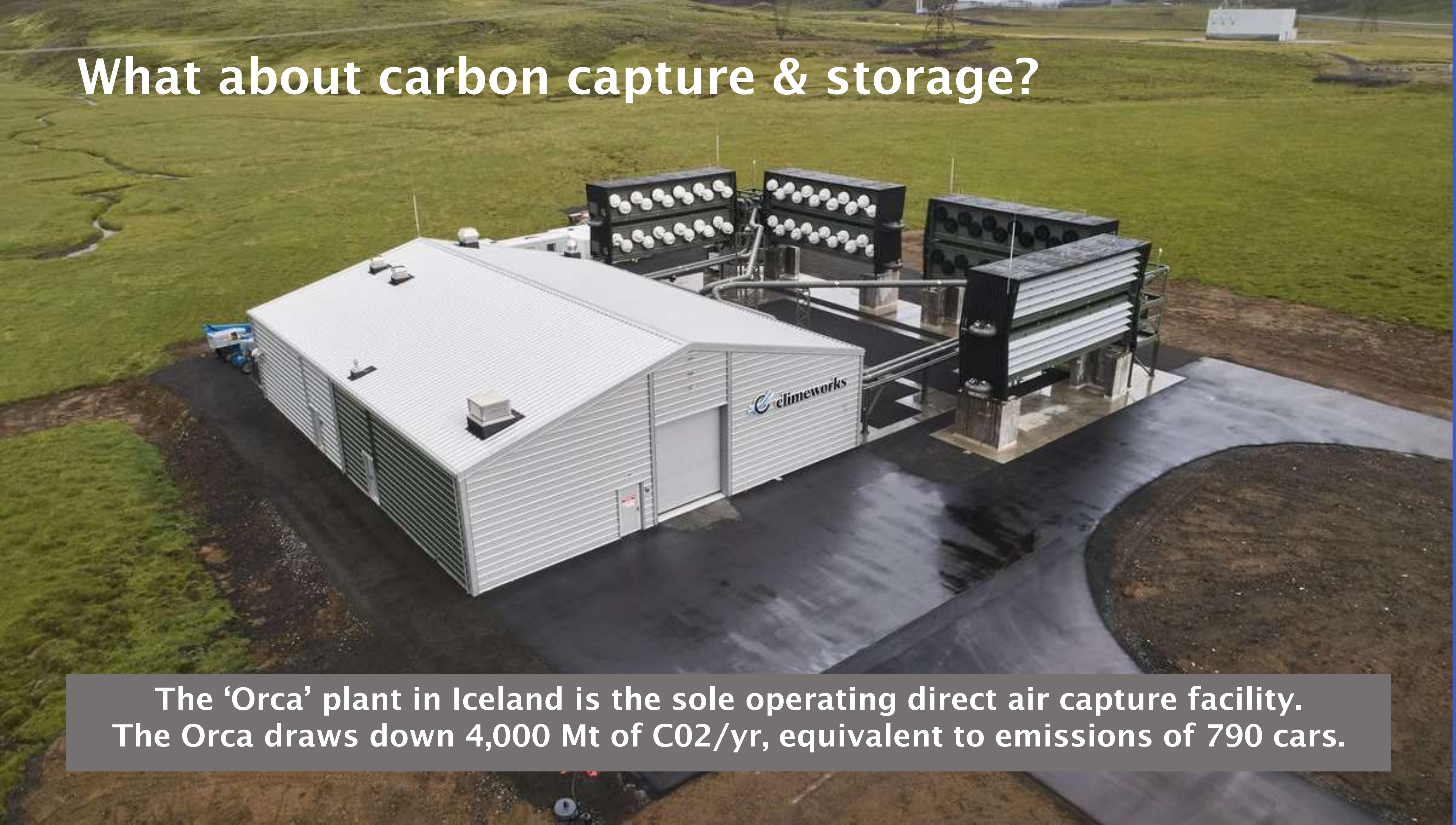
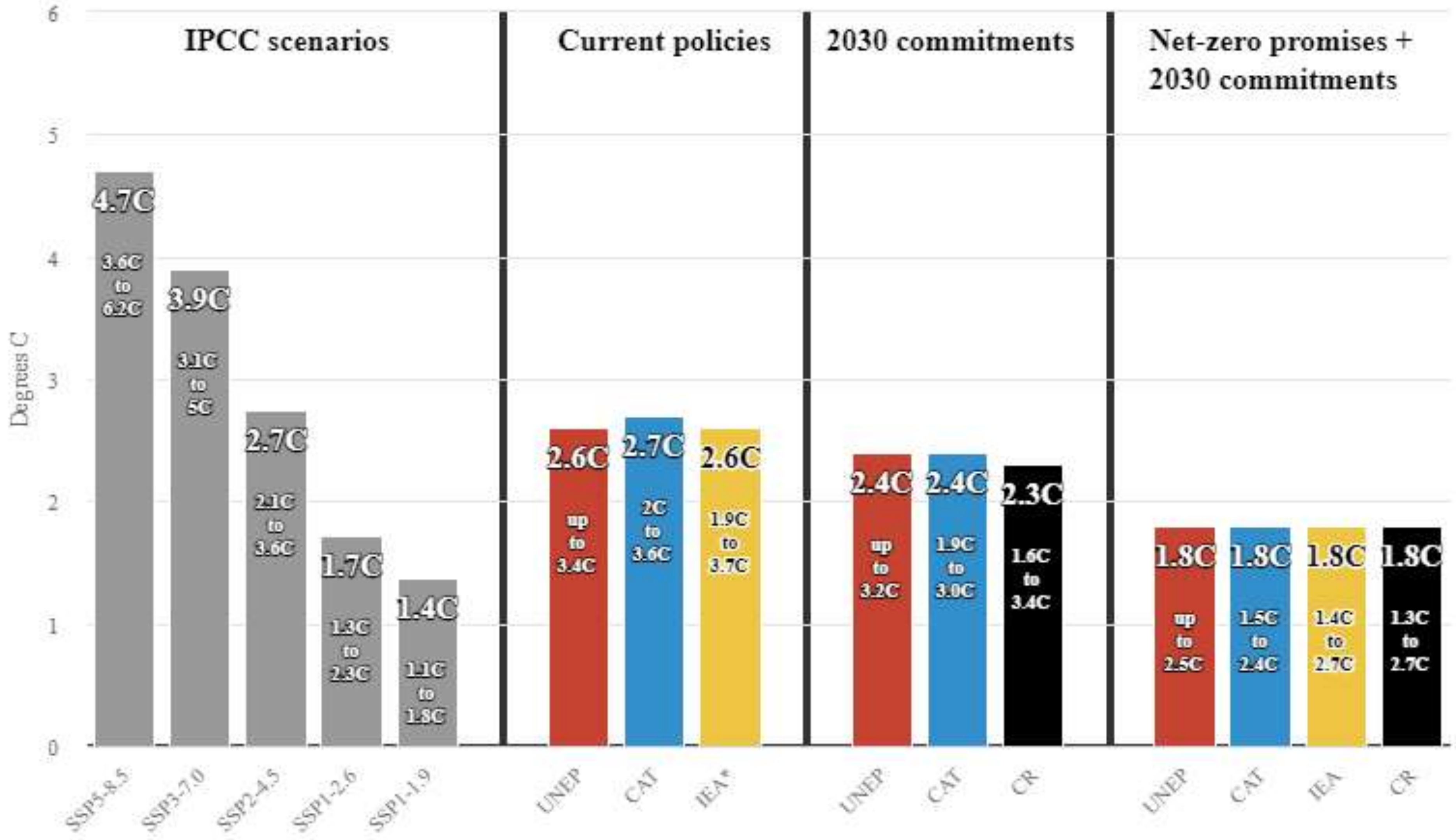
Source: Carbon Brief

What about carbon capture & storage?



The ‘Orca’ plant in Iceland is the sole operating direct air capture facility.
The Orca draws down 4,000 Mt of C02/yr, equivalent to emissions of 790 cars.

Experts now predict 2.6˚C heating this century



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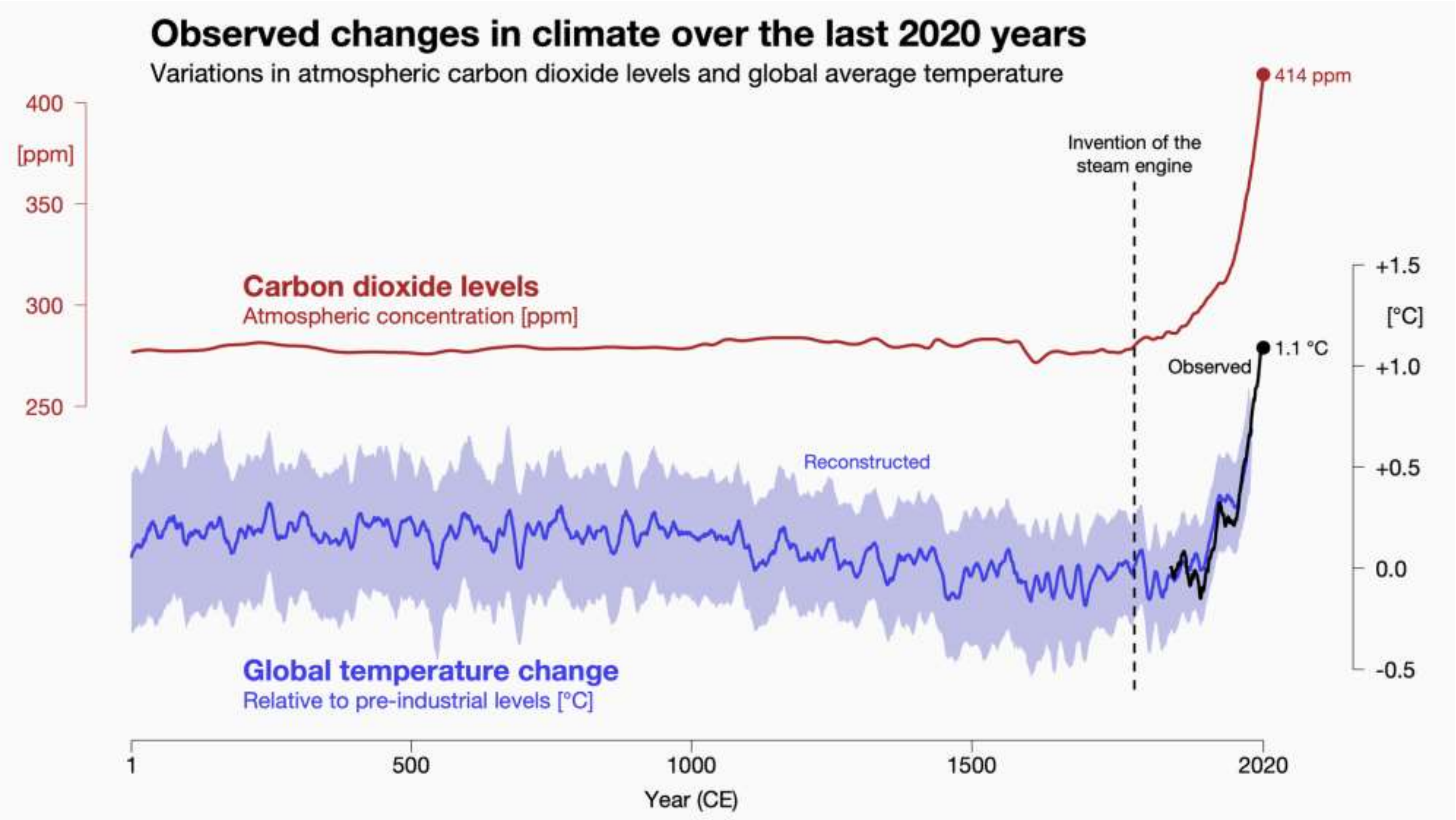
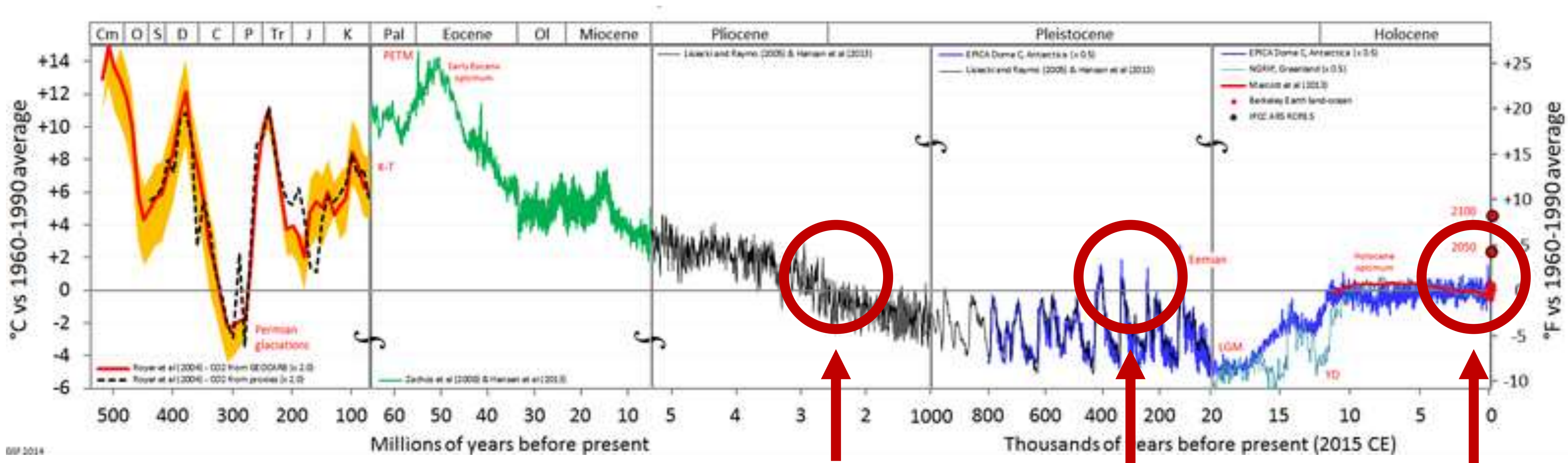
Source: Carbon Brief

Looking back 2,000 years…



Climate change is a new geologic epoch



Ape-like ancestors: Early stone tools.

Modern DNA: Language, farming art & music.

Common Era: Civilization as we know it.

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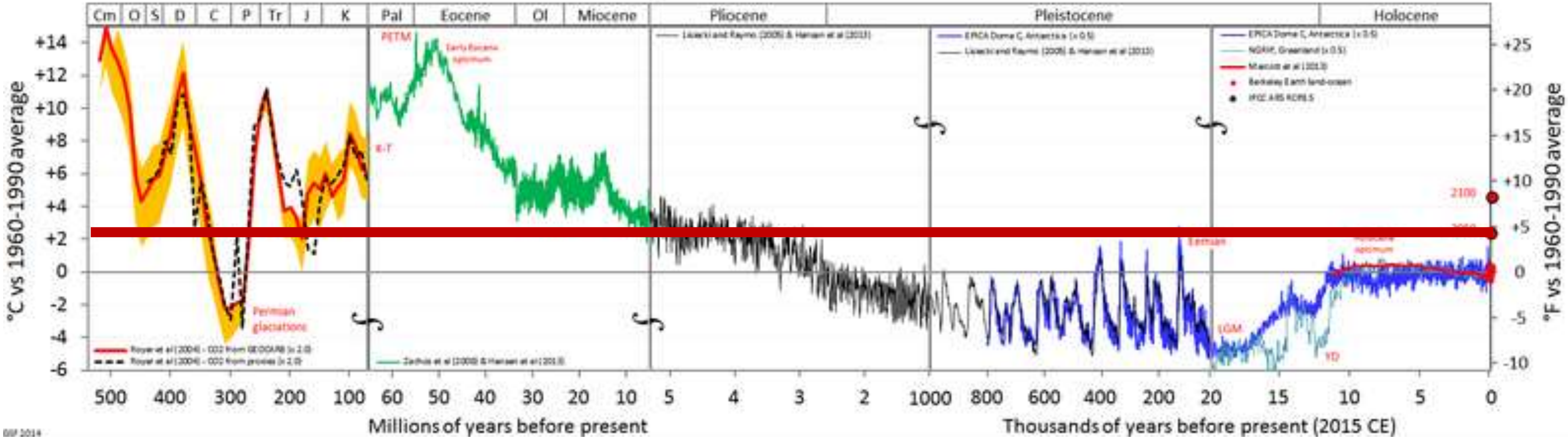
No human has ever lived on a 2.6˚C hotter planet



Where will we live? How will we survive?

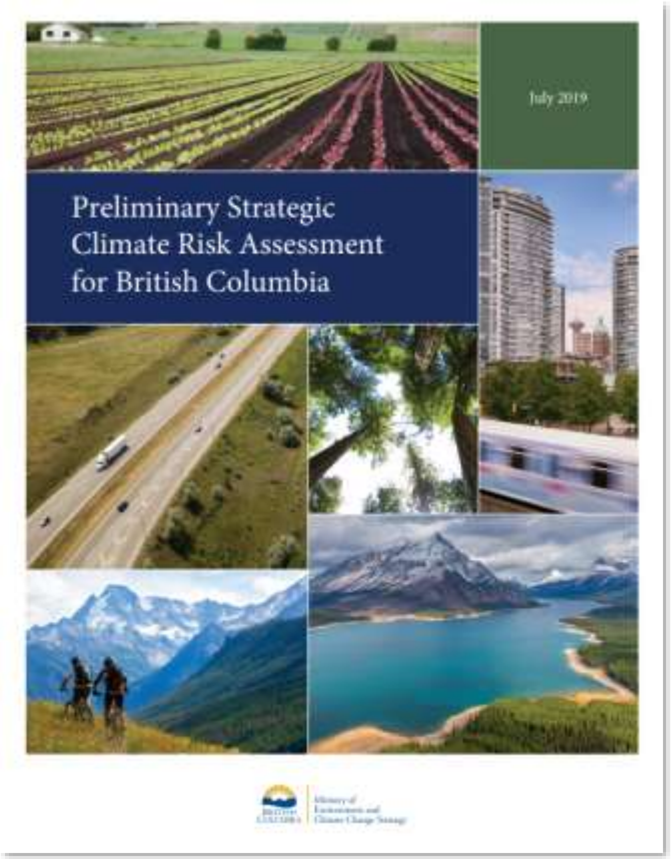
Every building needs a plan.

Adaptation: Buildings must shelter people on a +2.6˚C planet.
Mitigation: Buildings must emit noting to preserve a +2.6˚C planet.

Did we know this was going to happen?

"These are extraordinary events… Not measured before, not contemplated before..."

B.C. Premier John Horgan

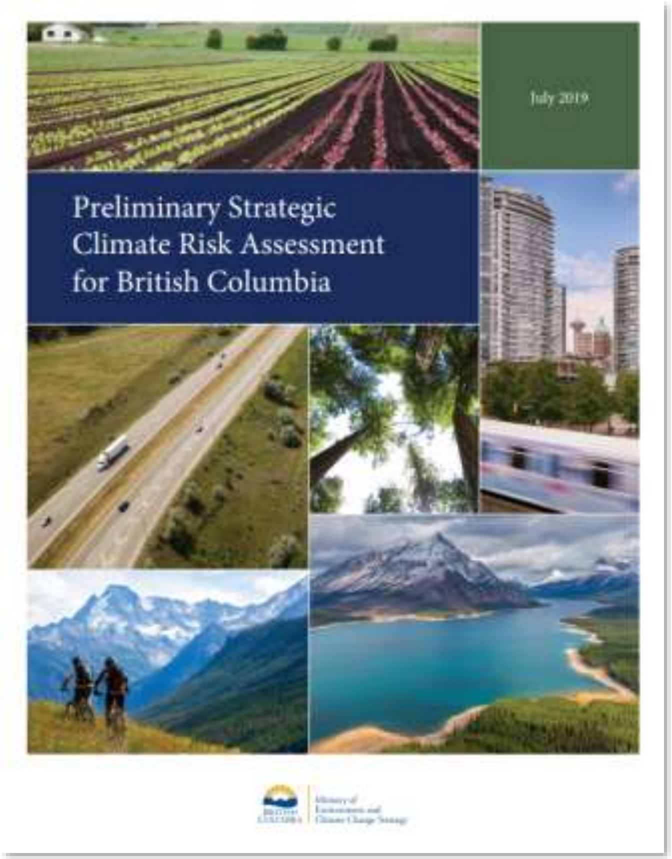


B.C.'s cascade effects were predicted in detail

This is precisely what climate scientists told us would happen.

For example, the "Preliminary Strategic Climate Risk Assessment for British Columbia" warned in 2019:

→ Wildfires & smoke
→ Extreme storms
→ Overland flooding
→ Sea level rise
→ Overheating



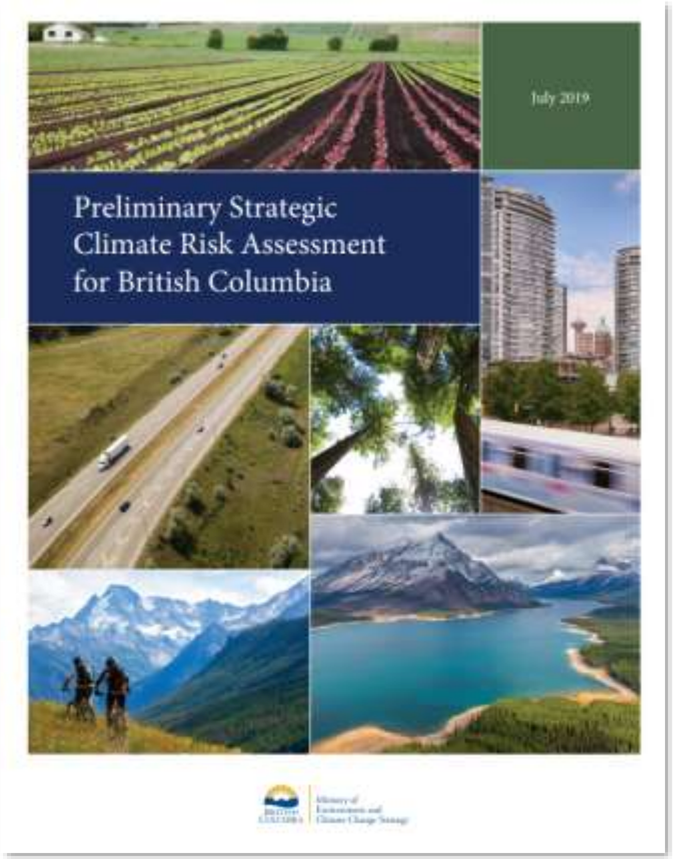
What are the cascade effects predicted for your region?

Architects and Engineers are legally responsible

"Professionals can only be accountable for establishing that their work addresses concerns that could reasonably be identified given the state of knowledge at the time they executed the work.

"In engineering practice we define reasonable in terms of the standard of care… Climate change imposes a new and evolving pressure on the standard of care."

~ Engineers Canada
National Guideline on Climate Change Adaptation



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“Registrants… are expected to consider the impact of their work on the climate”

Earth’s climate is changing at an unprecedented rate. Multiple lines of evidence show that emissions of greenhouse gases from human activities – in particular, carbon dioxide and methane – are the primary driver of this trend.[i] Climate change is not a future problem; action is needed now, and every passing day matters.

Professional engineers and professional geoscientists (Engineers and Geoscientists BC registrants) can play a key role in addressing the challenges and risks of climate change. In addition, many organizations and clients are setting climate change related objectives that may intersect with a registrant’s practice and need to be considered. The responsibilities for registrants to consider climate change in their practice

- registrants are expected to keep themselves informed about the changing climate and consider potential impacts on their professional activities;[ii] and,
- registrants have the potential to influence greenhouse gas emissions through their professional activities and are expected to consider the impact of their work on the climate.[iii]

This Climate Change Action Plan (the “Plan”) sets out a strategy for Engineers and Geoscientists BC to support registrants in fulfilling their professional responsibilities and meeting the requirements of clients and project owners to consider climate change. The Plan provides direction and commitment to key

updated in three years.

Politicians can pretend they didn’t know. We can’t.

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https://www.egbc.ca/getmedia/a39ff60e-80a1-4750-b6a5-9ddc1d75248a/APEGBC-Climate-Change-Position-Paper.pdf.aspx

Adaptation:
Six hundred people died inside buildings.

Heat Dome of 2020

→ Record high of 49.6˚C on June 29 in Lytton

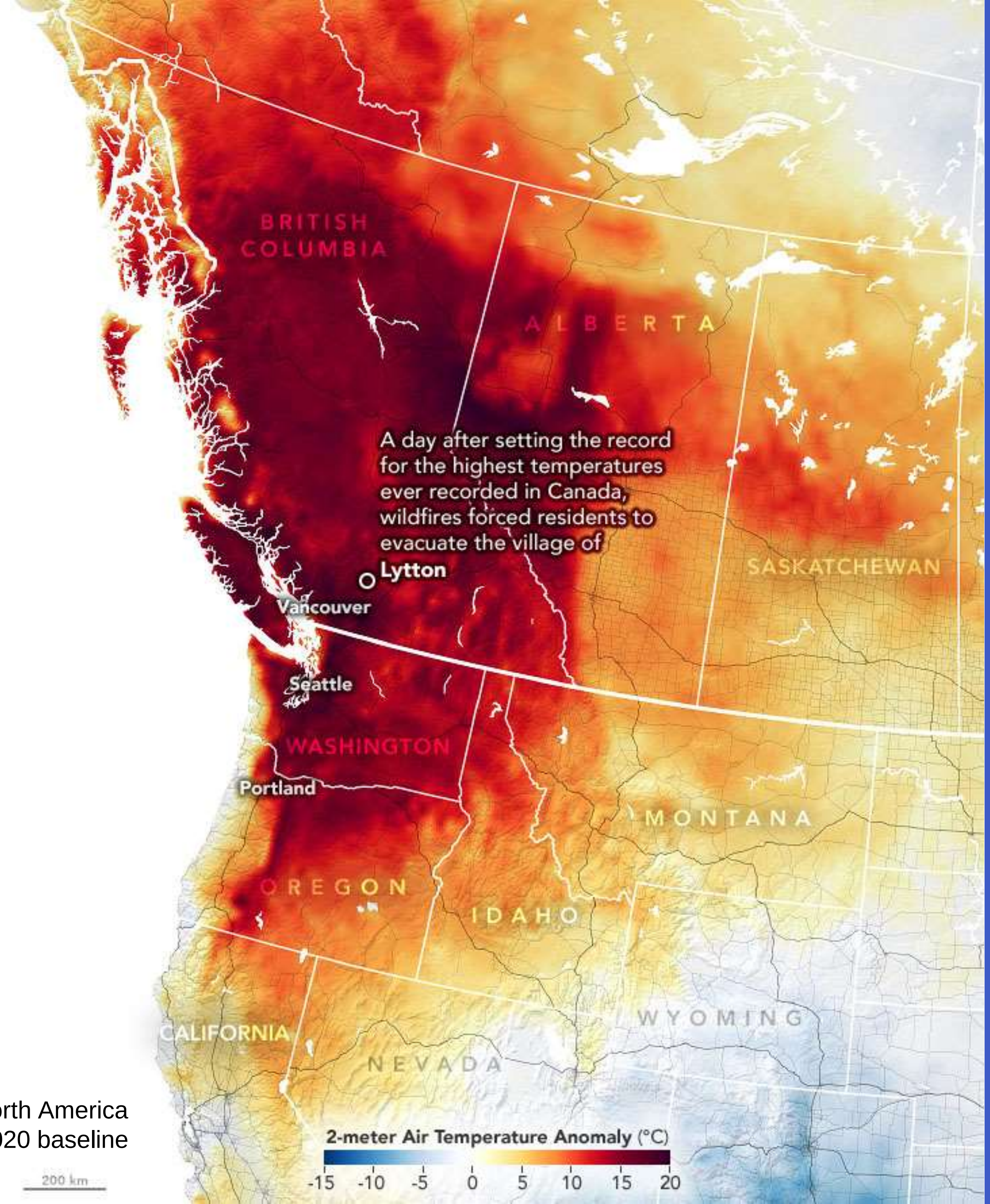
→ Record low of 29˚C on June 28 in Burnaby

Deaths attributed to the Heat Dome in B.C.

→ 595 people died from heat-related causes

→ Majority were seniors

→ 99% died in at home



Map: Air temperature anomalies across North America on June 29, 2021, compared to 2014–2020 baseline

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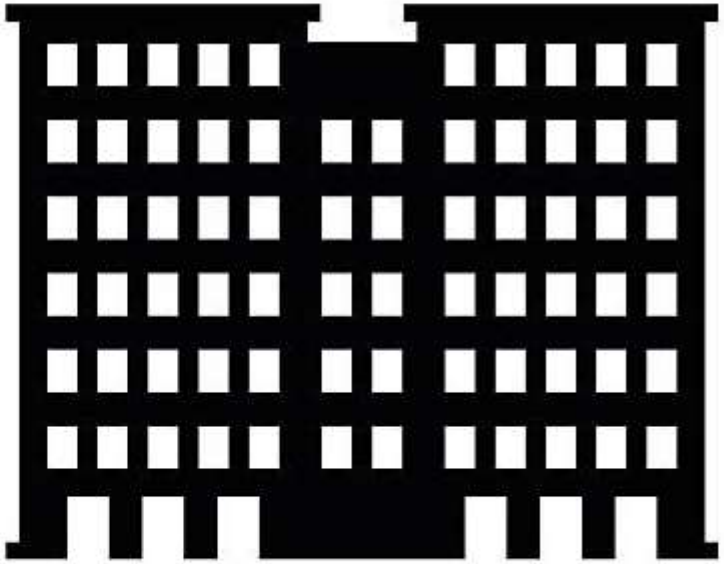
There are at least six factors that affect overheating

OUTSIDE *the* BUILDING

SOLAR GAIN
Shading, SHGC, glazing area.

TEMPERATURE
Model for 2050 & 2080, not 1985.

URBAN HEAT ISLAND
Most multiunit on infill sites.
Effects greater than climate change.



INSIDE *the* BUILDING

OCCUPANT DENSITY
Small units produce higher IHG/m2 than large units.

DHW HEAT LOSS
Don't put DHW in same room as HRV. Shorten DHW runs.

LIFESTYLE VARIATION
How residents live and play affects IHGs significantly.

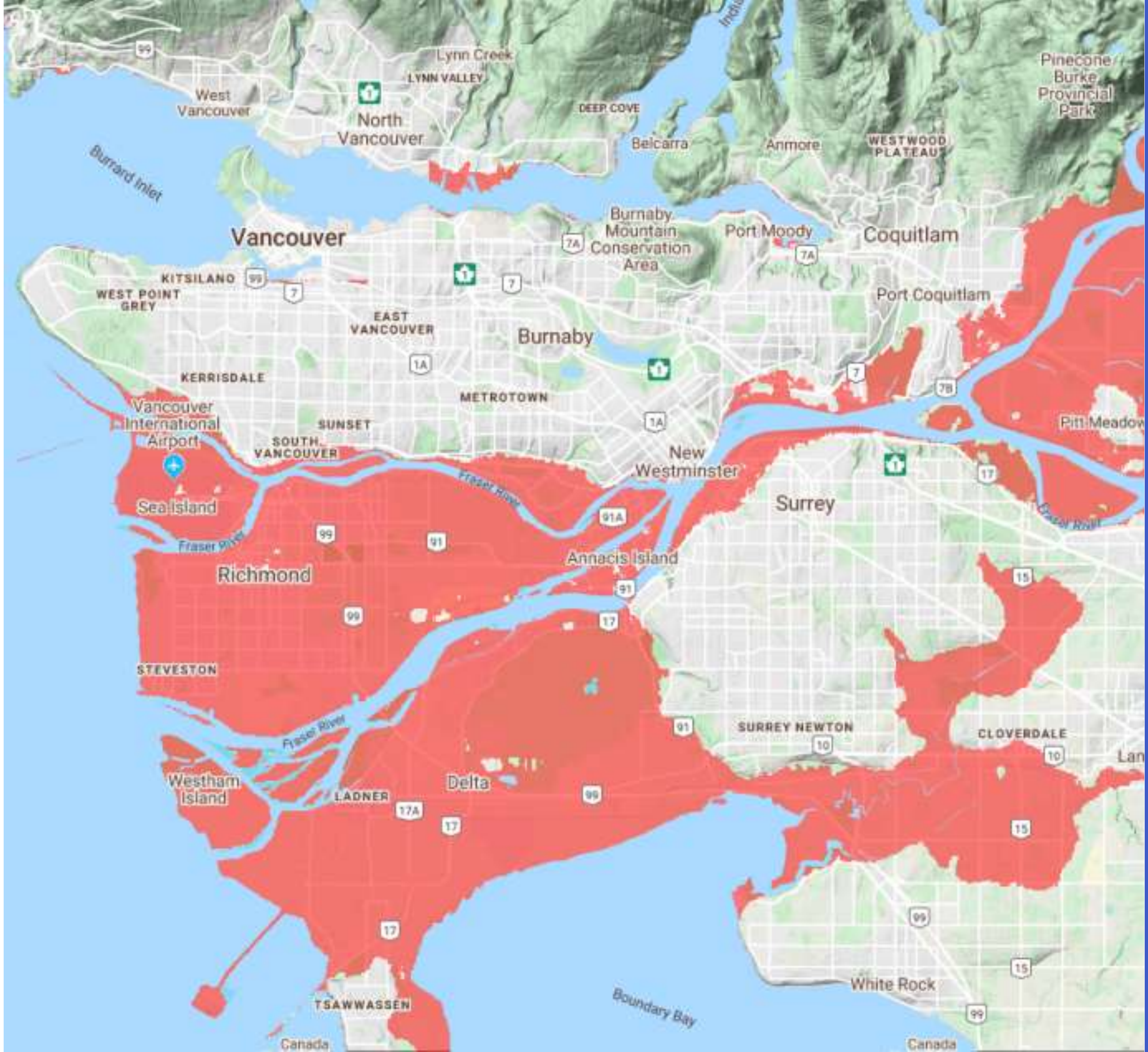
Adaptation: Wildfire smoke.

Adaptation: Sea level rise.

→ Storm surges by 2050

→ One meter rise by 2100

https://www.technologyreview.com/2019/09/25/132873/global-sea-levels-are-rising-even-faster-than-predicted-says-uns-climate-committee/



Adaptation: Sea level rise.

The seas along the U.S. East Coast are rising three to four times faster than the global average, according to the US Geological Survey.

Boston, New York City, Miami, Tampa and New Orleans are particularly vulnerable.

https://www.sciencenews.org/article/boston-adapting-rising-sea-level-coastal-flooding

Mitigation:

"By 2030, all new buildings will be zero carbon, and all new space and water heating equipment will meet the highest standards for efficiency."

~ Clean BC (p.16)

No new furnaces or boilers after 2030 in B.C.

Boilers & furnaces

Old: 60-80% efficient

New: 90% efficient

Electric resistance

100% efficient

Heat Pumps

Gas: 120% efficient

Electric: 250%+ efficient
Cooling + heating

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Large buildings: C02 heat pumps to replace boilers

Gas Boiler

c. 80% efficient

C02 (R744) Electric Heat Pump

COP of 4.11 = 411% efficient

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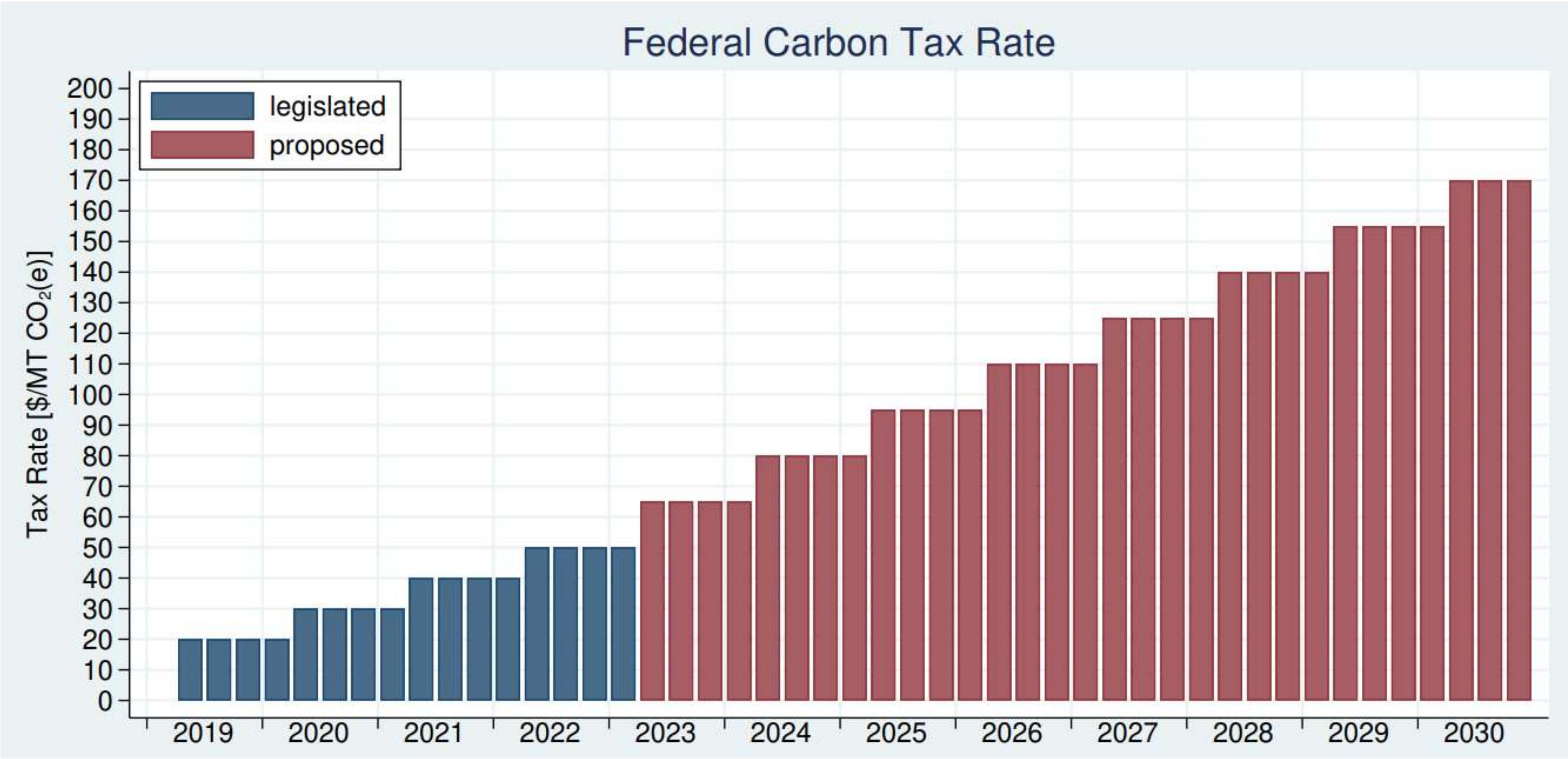
Canada's federal carbon tax: $9 GJ by 2030



Average Canadian house uses 92 GJ of fossil gas per year. That's $828/yr by 2030.

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B.C. is also about to launch new grants

Last program: Many furnace installations were of poor quality.
Last program: Windows were double-pane, often poorly installed.

How will building owners avoid “locking in” low performance?

Imagine being a building owner in 2022

New retrofit demands:
smoke, heat, IAQ.

Continuous
cascading
disasters.

Massive demand for
new housing

Continually changing
building technology.

Building owners & operators.

Continually changing
code requirements.

Bans on gas
connections or
appliances

Continually
escalating
costs.

Canadian carbon tax
rises to $170/t by 2030

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Every building needs a climate retrofit plan

Strategies for adaptation and mitigation may include:

→ Consider flooding scenarios: Lift building? Sell property?

→ Model overheating for current and future climate. Options?

→ Measure indoor air quality. Retrofit ventilation & filtration.

→ Mitigation: How to get to zero emissions by 2030?

→ Consider impacts of future code requirements.

→ Consider impacts of Canadian carbon tax rising to $170 a tonne.

→ How much capital is available, and when?

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The Lord Harley apartments in Victoria, BC

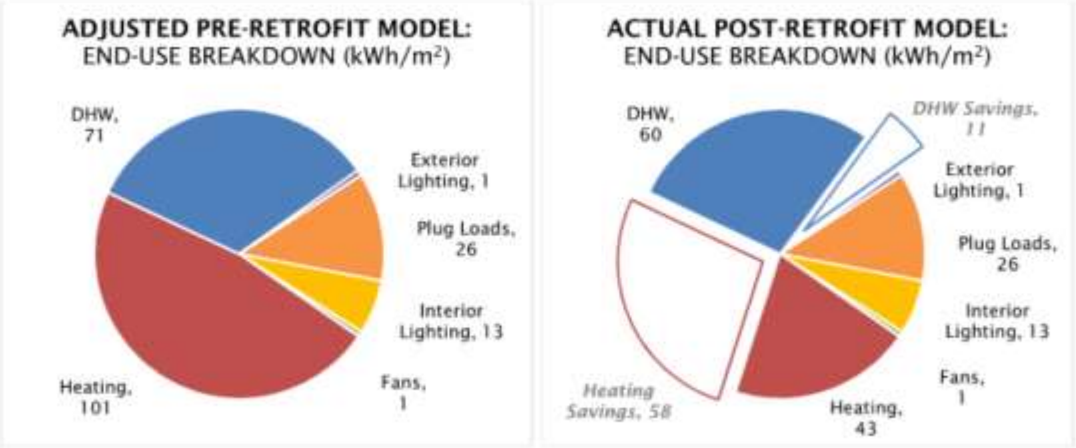

Figure 0.1 End-use breakdown of the adjusted pre-retrofit and actual post-retrofit model; savings are shown in outline. The analysis indicates that heating energy is reduced by 57% and DHW energy is reduced by 15% following the retrofit.

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Minto Properties in Ontario

Two MURBs as their first retrofit studies

Ottawa

- 26 stories
- 242 units
- 171,000 sq ft
- 1970s
- No major previous renos

Toronto

- 13 stories
- 227 units
- 203,400 sq ft
- 1970s
- No major previous renos

Stepwise EnerPHit

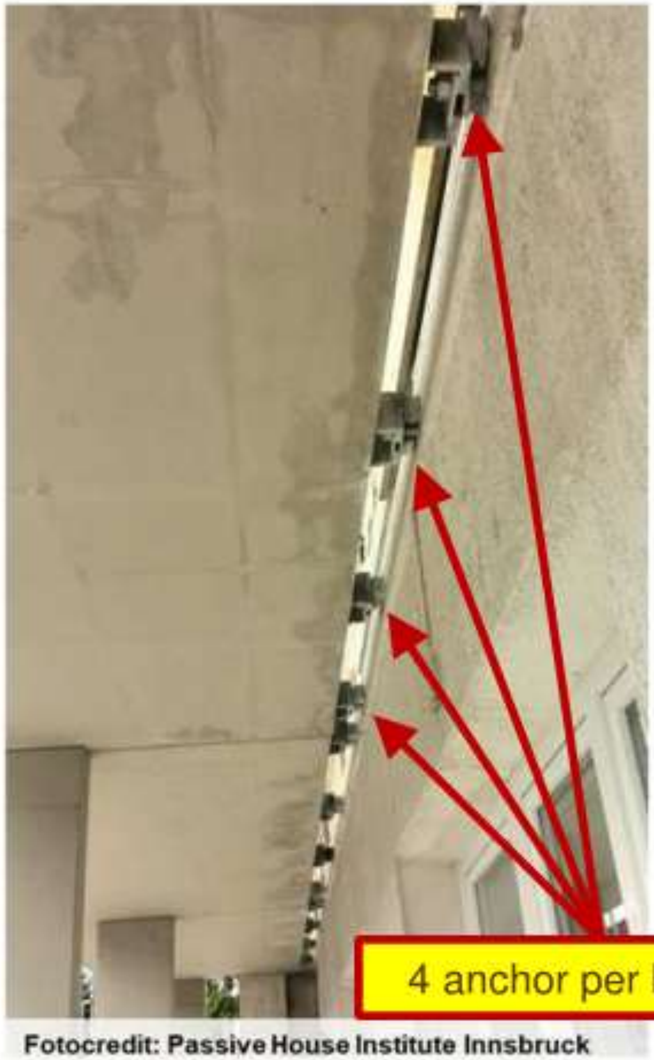
A tool to help building owners plan for adaptation & mitigation.

Some 5,000 buildings have been upgraded using the EnerPHit approach

Fotocredit: Passive House Institute Innsbruck

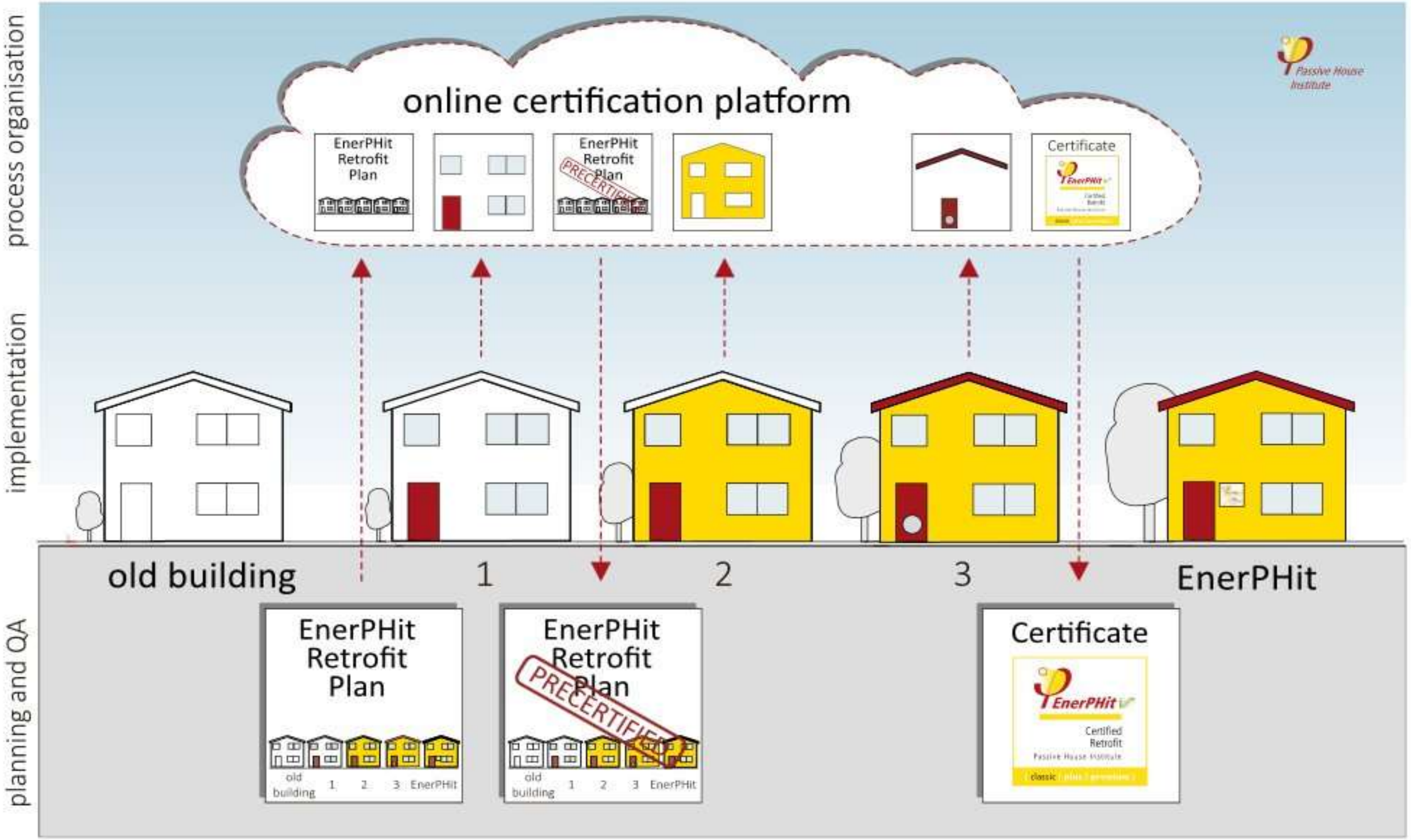
Picture: Balcony situation of the existing building. Source: Passive House Institute Innsbruck

SINFONIA projects



Picture left: New free-standing balcony construction only with few punctiform connections to the thermal envelope. Source: Passive House Institute Innsbruck
Picture right: Renovated building with new thermal bridge free balconies. Source: Passive House Institute Innsbruck

Stepwise Enerphit provides a template



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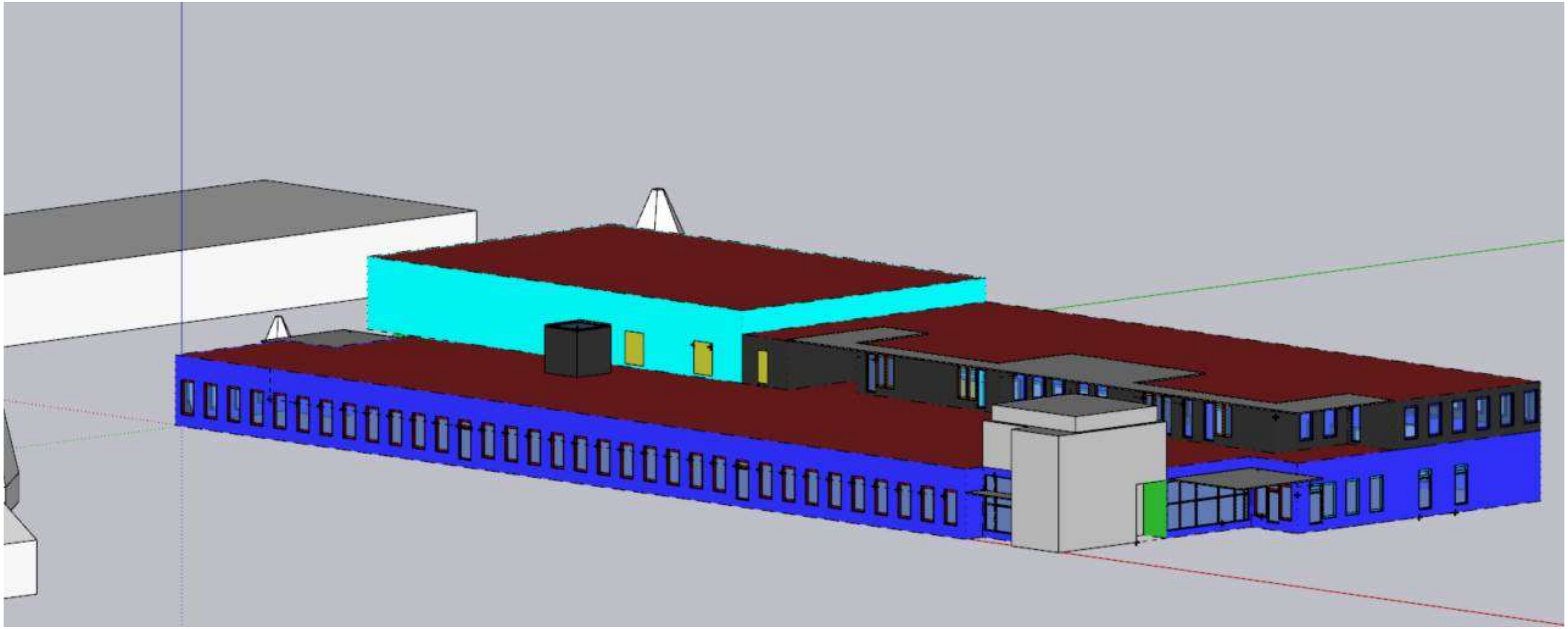
DesignPH: A 3-D energy modelling input tool



Two paths to EnerPHit: Component method

Table 2 EnerPHit criteria for the building component method

Climate zone according to PHPP	Opaque envelope[1] against... ...ground	...ambient air			Windows (including exterior doors) Overall[4]			Glazing[5]	Solar load[6]	Ventilation	
	Insulation	Exterior insulation	Interior insulation[2]	Exterior paint[3]	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat recovery rate[7]	Min. humidity recovery rate[8]
	Max. heat transfer coefficient (U-value)			Cool colours							
	[W/(m²K)]			-	[W/(m²K)]			-	[kWh/m²a]	%	
Arctic		0.09	0.25	-	0.45	0.50	0.60	$U_g - g*0.7 \leq 0$		80%	-
Cold	Determined in PHPP from project specific heating and cooling degree days against ground.	0.12	0.30	-	0.65	0.70	0.80	$U_g - g*1.0 \leq 0$		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	$U_g - g*1.6 \leq 0$		75%	-
Warm-temperate		0.30	0.50	-	1.05	1.10	1.20	$U_g - g*2.8 \leq -1$		75%	-
Warm		0.50	0.75	-	1.25	1.30	1.40	-	100	-	-
Hot		0.50	0.75	Yes	1.25	1.30	1.40	-		-	60 % (humid climate)
Very hot		0.25	0.45	Yes	1.05	1.10	1.20	-		-	60 % (humid climate)

Two paths to EnerPHit: Energy demand method

Table 3 EnerPHit criteria for the energy demand method (

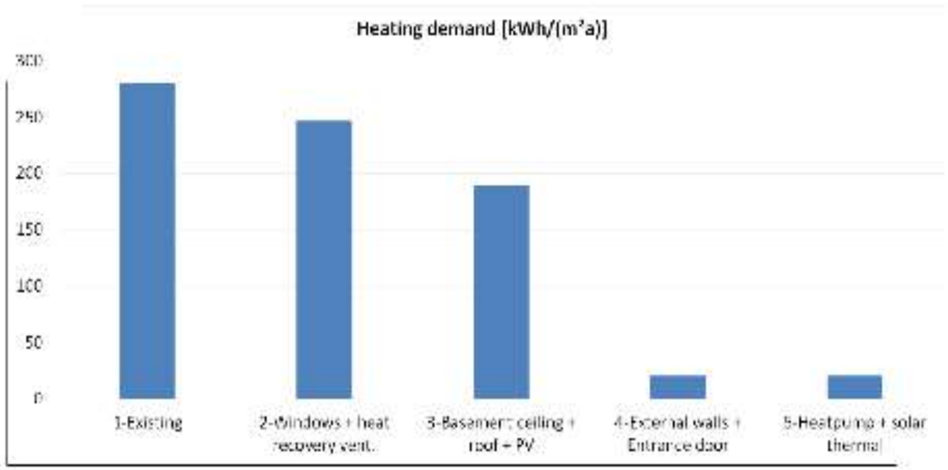
Climate zone according to PHPP	Heating	Cooling
	Max. heating demand	Max. cooling + dehumidification demand
	[kWh/(m²a)]	[kWh/(m²a)]
Arctic	35	equal to Passive House requirement
Cold	30	
Cool-temperate	25	
Warm-temperate	20	
Warm	15	
Hot	-	
Very hot	-	

BOTH METHODS ALSO REQUIRE

→ Airtightness equal to or less than 1.0 ACH @ 50 Pa

→ PER demand of 60 kWh/m2a

Stepwise Enerphit



Select the active variant here >>>>>>>		Active: 1-Existing	Existing	Windows + heat recovery vent.	Basement ceiling + roof + PV	External walls + Entrance door	Heatpump + solar thermal
	Units	1	1	2	3	4	5
Heating demand	kWh/(m²a)	246,7	279,7	246,7	189,0	20,6	20,6
Heating load	W/m²	100,0	129,2	100,0	79,8	15,6	15,6
Cooling & dehum. demand	kWh/(m²a)	2,3	6,2	2,3	1,1	0,3	0,1
Cooling load	W/m²	18,2	31,9	18,2	12,8	5,8	4,0
Frequency of overheating (> 25 °C)	%						
PER demand	kWh/(m²a)	770,4	855,8	770,4	624,9	203,0	36,7
EnerPHit Plus?	yes / no	no	no	no	no	no	yes

Overview of measures

Source file: 'EuroPHit_SBS_Windows_2_EnerPHit_PHPP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Retrofit step No.		1-Existing	2-Windows + heat recovery vent.	3-Basement ceiling + roof + PV	4-External walls + Entrance door	5-Heatpump + solar thermal		Criteria	Alternative criteria
Year		until 2016	2017	2022	ca 2027	ca 2037			
Measures									
Occasion ("anyway measure")	a		Window replacement	none	Exterior wall - new render	Boiler - replacement			
Energy-saving measure			Passive House windows	Basement ceiling: Insulation	Exterior wall - insulation	Heat pump			
Occasion ("anyway measure")	b		Extract air system	Roof - new covering	Ext. door - replacement	Hot water storage tank replacement			
Energy-saving measure			Heat recovery ventilation	Roof - insulation + PV system	Passive House door	Solar thermal system + stratified storage tank			
Component characteristics									
Wall to ambient air, ext. insulation (U-value)	[W/(m²K)]	1,87	1,87	1,87	0,15	0,15			
Roof (U-value)	[W/(m²K)]	1,27	1,27	0,13	0,14	0,14			
Building envelope to ambient (U value)	[W/(m²K)]	1,68	1,68	1,33	0,15	0,15		0,15	-
Basement ceiling / floor slab (U-value)	[W/(m²K)]	0,72	0,72	0,26	0,26	0,26			
Building envelope to ground (U-value)	[W/(m²K)]	0,72	0,72	0,26	0,26	0,26		0,29	-
Windows / doors ($U_{installed}$)	[W/(m²K)]	2,71	1,09	1,09	0,82	0,82		0,85	-
Glazing (g-value)	[]	0,75	0,55	0,55	0,52	0,52		0,39	-
Glazing/sun protection (max. solar load)	[kWh/(m²a)]	404	216	197	85	23		-	-
Ventilation (effective heat recovery efficiency)	[%]	0	77	77	77	77		75	-
Airchange at press. test n_{50}	[1/h]	5,0	1,0	1,0	1,0	1,0		1,0	-
Building characteristics									
Heating demand	[kWh/(m²a)]	280	247	189	21	21		-	-
Heating load	[W/m²]	129	100	80	16	16		-	-
Cooling + dehumidification demand	[kWh/(m²a)]	6	2	1	0	0		-	-
Cooling load	[kWh/(m²a)]	32	18	13	6	4		-	-
Non-renewable primary energy (PE demand)	[kWh/(m²a)]	451	408	337	132	65		-	-
Renewable primary energy (PER demand)	[kWh/(m²a)]	856	770	625	203	37		51	37
Renewable primary energy generation (reference to projected building footprint)	[kWh/(m²a)]	0	0	100	100	127		60	33
Criteria fulfilled for EnerPHit Plus?		no	no	no	no	yes			
Annual energy-related costs									
Energy-related invest. (interest+repayment)	[€/year]	0	310	502	976	1284			
Expected energy costs (total of all energy use in the building)	[€/year]	5900	5360	4440	1810	1060			
Total costs	**[€/year]**	**5900**	**5670**	**4942**	**2786**	**2344**			

Investment and maintenance costs

Source file: 'EuroPHit_SBS_Windows_2_EnerPHit_PHPP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

	Retrofit step No.	1-Existing	2-Windows + heat recovery vent.	3-Basement ceiling + roof + PV	4-External walls + Entrance door	5-Heatpump + solar thermal	
	Year	until 2016	2017	2022	ca 2027	ca 2037	
a	**Occasion ("anyway measure")**		**Window replacement**	**none**	**Exterior wall - new render**	**Boiler - replacement**	
	Investment costs		11.180 €	0 €	6.440 €	12.000 €	
	Maintenance costs		0 €	0 €	0 €	320 €	
	Energy-saving measure		**Passive House windows**	**Basement ceiling: Insulation**	**Exterior wall - insulation**	**Heat pump**	
	Investment costs		16.770 €	2.160 €	23.920 €	16.000 €	
	Financial support (present value)		2.000 €	400 €	3.000 €	2.000 €	
	Maintenance costs		0 €	0 €	0 €	100 €	
	Service life [years]		40	50	50	20	
	Annuity (energy related only)	0 €	131 €	56 €	459 €	-98 €	0 €
b	**Occasion ("anyway measure")**		**Extract air system**	**Roof - new covering**	**Ext. door - replacement**	**Hot water storage tank replacement**	
	Investment costs		4.680 €	5.810 €	1.000 €	1.000 €	
	Maintenance costs		50 €	0 €	0 €	0 €	
	Energy-saving measure		**Heat recovery ventilation**	**Roof - insulation + PV system**	**Passive House door**	**Solar thermal system + stratified storage tank**	
	Investment costs		8.580 €	11.620 €	1.600 €	7.500 €	
	Financial support (present value)		1.000 €	1.500 €	200 €	1.000 €	
	Maintenance costs		100 €	0 €	0 €	70 €	
	Service life [years]		30	50	40	20	
	Annuity (energy related only)	0 €	179 €	137 €	15 €	406 €	0 €
Total Invest. costs (annual interest+repayment) [€/a]							
Total (incl. previous steps)		0 €	976 €	1.352 €	2.066 €	3.487 €	3.487 €
Energy related (incl. previous steps)		0 €	310 €	502 €	976 €	1.284 €	1.284 €

dary conditions Interest rate and inflation: Nominal interest rate 3,0% Inflation 1,0% Real interest rate 2,0%

average energy price (during service life): Electricity 0,25 € Natural gas / Oil 0,09 € Wood 0,07 €

Scheduler

Source file: 'EuroPHit_SBS_Windows_2_EnerPHit_PHPP.xlsm' (PHPP version: 9.3)

EnerPHit Retrofit Plan: End-of-terrace Passive House, Example City, DE-Germany

Assemblies	Last renewal	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2016	2017	2020	2022	2025	2030	2032	2035	2037	2040	2045	2050
Retrofit steps:														1	2		3			4		5			
Render facade	1966																			X					
Facade decoration	1966																			X					
Balconies/Loggias	1966																			X					
Exterior door	1987																			X					
Pitched roof covering	1966																X								
Flat roof																									
Roof weatherings	1987																X								
Windows	1966														X										
Blinds / sun screens	1966														X										
Basement ceiling	2022																X								
Boiler	2015																					X			
Ventilation	2017														X										
Solar thermal system	2035																					X			
Airtightn. test: X, Leakage search: (X)															(X)		(X)		X						

Initial condition

X Retrofit dates

Main-tenance

Smaller Repairs

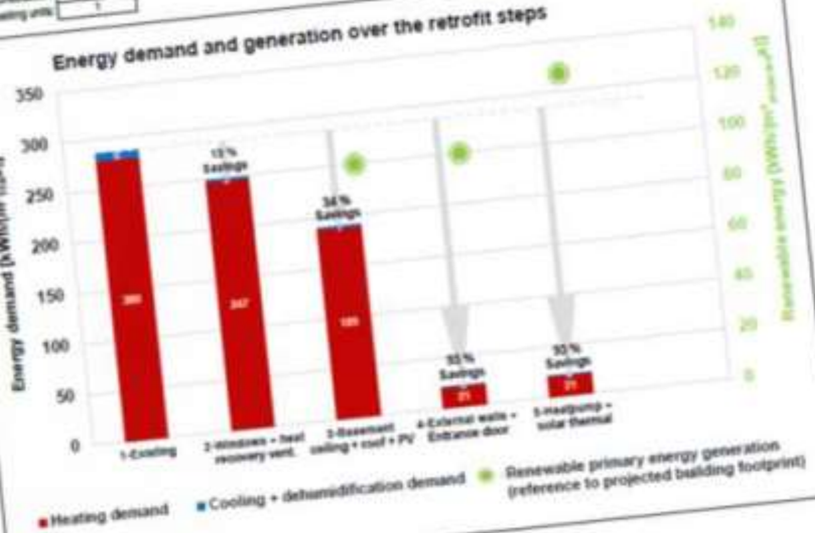
Extensive Repairs

Immediate replacement

Institute

EnerPHit Retrofit Plan

Target standard: EnerPHit Plus



Dear building owner,

31.6.2016

In the next few years you intend to modernise your building and to improve stepwise its level of thermal protection. This "EnerPHit Retrofit Plan" will help you to make the right decisions at each step.

EnerPHit Standard

In the case of refurbishments of existing buildings, it is not always possible to fully achieve the Passive House Standard with reasonable effort. The reasons for this lie e.g. in the unavoidable thermal bridges due to existing basement walls. For such buildings, the Passive House Institute has developed the EnerPHit Standard. With the use of Passive House components, EnerPHit retrofitted buildings offer almost all the advantages of a Passive House building with optimum cost-effectiveness at the same time:

- Comfortable living with uniformly warm walls, floors and windows
- Draughts, condensation and mould growth are no longer a problem
- Permanent supply of fresh air with a pleasant temperature
- Independence from energy price fluctuations
- Financial profits from the very first year on due to up to 90 % reduced heating costs
- Climate protection due to decreased CO2 emissions of the same scale

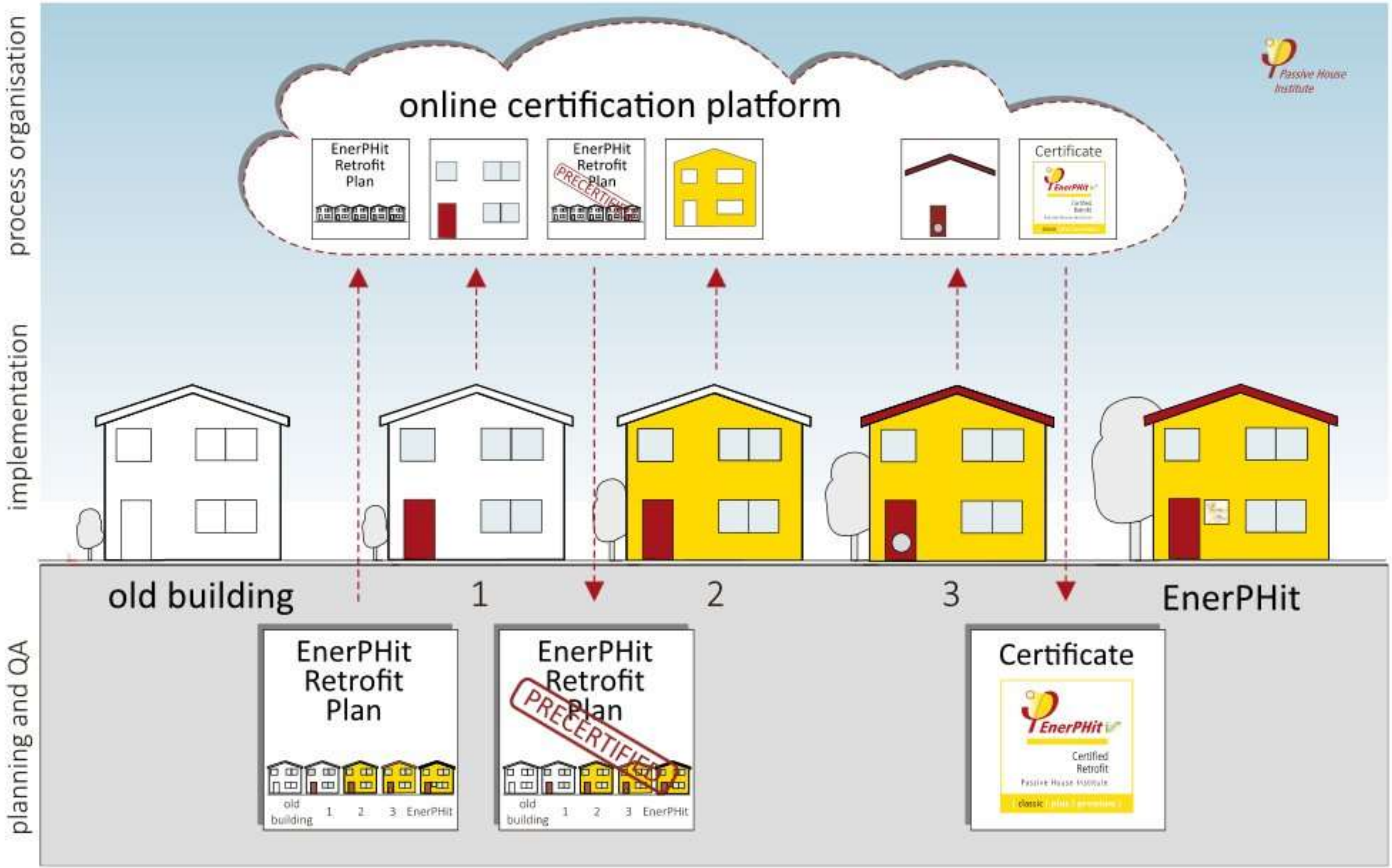
EnerPHit Retrofit Plan

Most buildings are modernised in a step-by-step way when the respective building component needs to be renewed. Advantage can be taken of such opportunities to carry out future-oriented improvements to the thermal protection of the building. For example, if the façade already needs to be renewed anyway, the extra effort for thermal protection of the exterior wall to the Passive House quality at the same time will be manageable. Nevertheless, many interdependencies exist between individual energy efficiency measures, so that a good standard of thermal protection can only be achieved cost-effectively if an overall concept is prepared for the entire building prior to the first modernisation step. With the modernisation route planner, such an overall concept will be worked out for you by your Passive House Designer or energy consultant. This offers you the following advantages:

- Preparing for future steps already with today's measures will save costs on the whole and will ensure an optimal final outcome.
- An excellent final outcome can only be achieved if each individual step is implemented with the appropriate quality (EnerPHit-Standard).
- Once the overall concept has been prepared, it is available for every further step and thus facilitates the planning process (you don't have to start from the beginning every time).
- The energy demand is stated for each step.
- The approximate time points for upcoming refurbishment measures are stated in the general plan. This serves as a valuable aid for personal finance planning.

Pre-certification

The modernisation route planner as well as other relevant documents can be checked by a PHI accredited certifier for additional quality assurance. If the examination shows that the EnerPHit Standard will be achieved with the implementation of all planned measures, then the first step can be carried out. After this a preliminary EnerPHit certificate can then be issued for the building. If quality assurance is continued accordingly for each step, then the full EnerPHit certificate will be issued for the building upon completion of the last step. A preliminary certificate increases the value of your building because its potential is clearly demonstrated. It also increases the credibility of the refurbishment concept in the context of talks with the bank e.g. because the achievable cost saving is available in a reliably calculated way. Apart from that, you can demonstrate to the outside world that you are committed to climate protection.


process organisation
implementation
planning and QA
online certification platform
Passive House Institute
EnerPHit Retrofit Plan
EnerPHit Retrofit Plan
PRECERTIFIED
Certificate
old building
1
2
3
EnerPHit
EnerPHit Retrofit Plan
old building
1
2
3
EnerPHit
EnerPHit Retrofit Plan
PRECERTIFIED
old building
1
2
3
EnerPHit
Certificate
EnerPHit
Certified Retrofit
Passive House Institute
classic

Key features of Stepwise EnerPHit

- PHPP model prepared in consult with building owner. The building's "final" outcome is determined.
  - Avoids "lock in" of low performance
  - Other Passive House features addressed: DHW, cooling, efficient appliances, comfort.
- Cost estimates and savings are built into the process
- Retrofits broken into three or more "steps" in consult with homeowner/contractors.
  - Steps based on: Future code, adaptation requirements, mitigation requirements, govt programs, funding options
- Detailed plan prepared by a CPHC or CPHD
- PHI-accredited Building Certifier approves the Stepwise Plan
- In-progress plaque issued once 25% of efficiency is achieved. Final plaque at 100%.

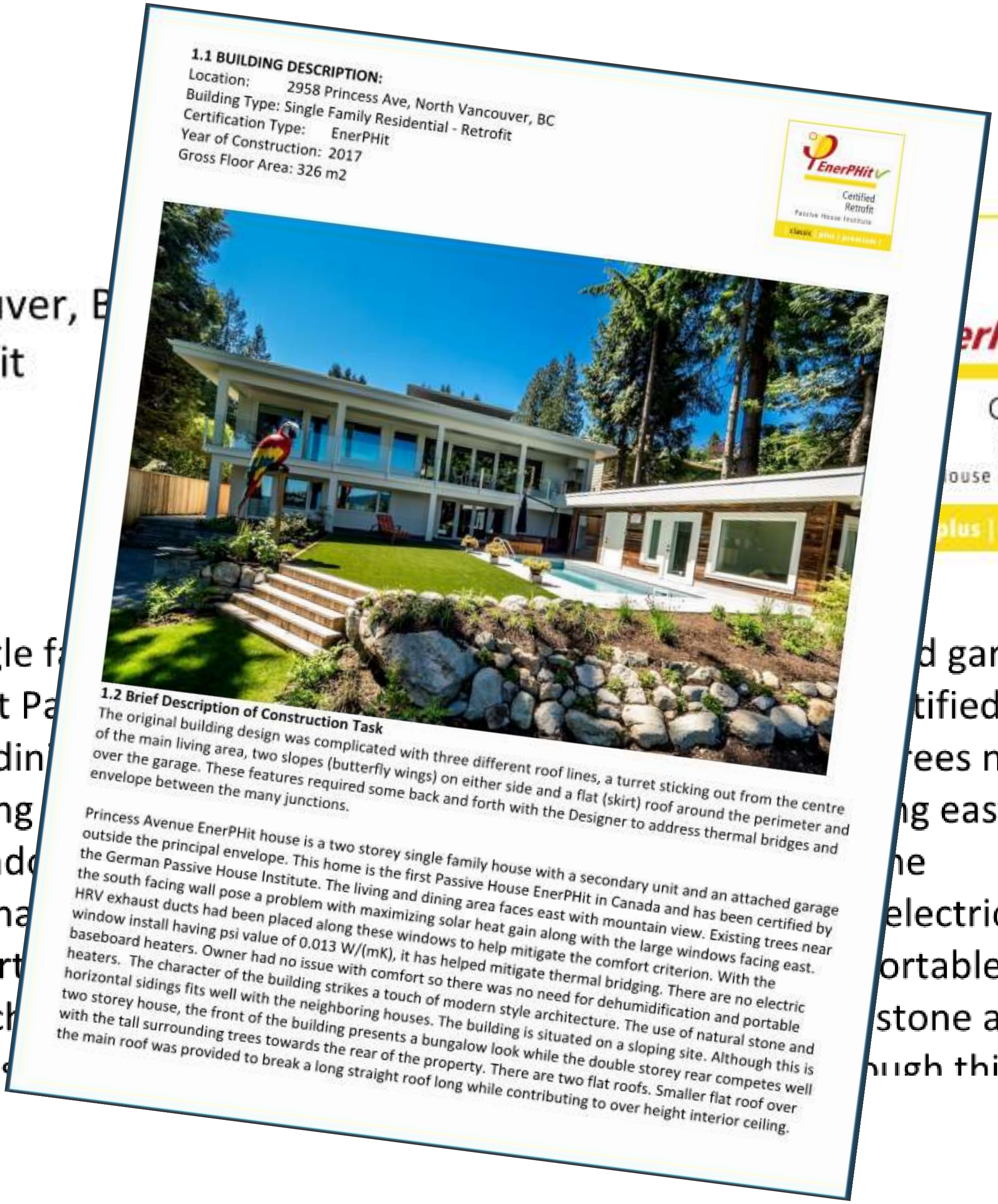
Princess, North Van: EnerPHit 2017 (ID 5158)

RDH

Princess, North Van

1.1 BUILDING DESCRIPTION:
Location: 2958 Princess Ave, North Vancouver, B
Building Type: Single Family Residential - Retrofit
Certification Type: EnerPHit
Year of Construction: 2017
Gross Floor Area: 326 m2

Princess Avenue EnerPHit house is a two storey single f ... d garage
outside the principal envelope. This home is the first Pa ... tified by
the German Passive House Institute. The living and din ... rees near
the south facing wall pose a problem with maximizing ... ng east.
HRV exhaust ducts had been placed along these windo ... he
window install having psi value of 0.013 W/(mK), it ha ... electric
baseboard heaters. Owner had no issue with comfort ... ortable
heaters. The character of the building strikes a touch ... stone and
horizontal sidings fits well with the neighboring hou ... ough this is


1.1 BUILDING DESCRIPTION:
Location: 2958 Princess Ave, North Vancouver, BC
Building Type: Single Family Residential - Retrofit
Certification Type: EnerPHit
Year of Construction: 2017
Gross Floor Area: 326 m2

1.2 Brief Description of Construction Task
The original building design was complicated with three different roof lines, a turret sticking out from the centre of the main living area, two slopes (butterfly wings) on either side and a flat (skirt) roof around the perimeter and over the garage. These features required some back and forth with the Designer to address thermal bridges and envelope between the many junctions.

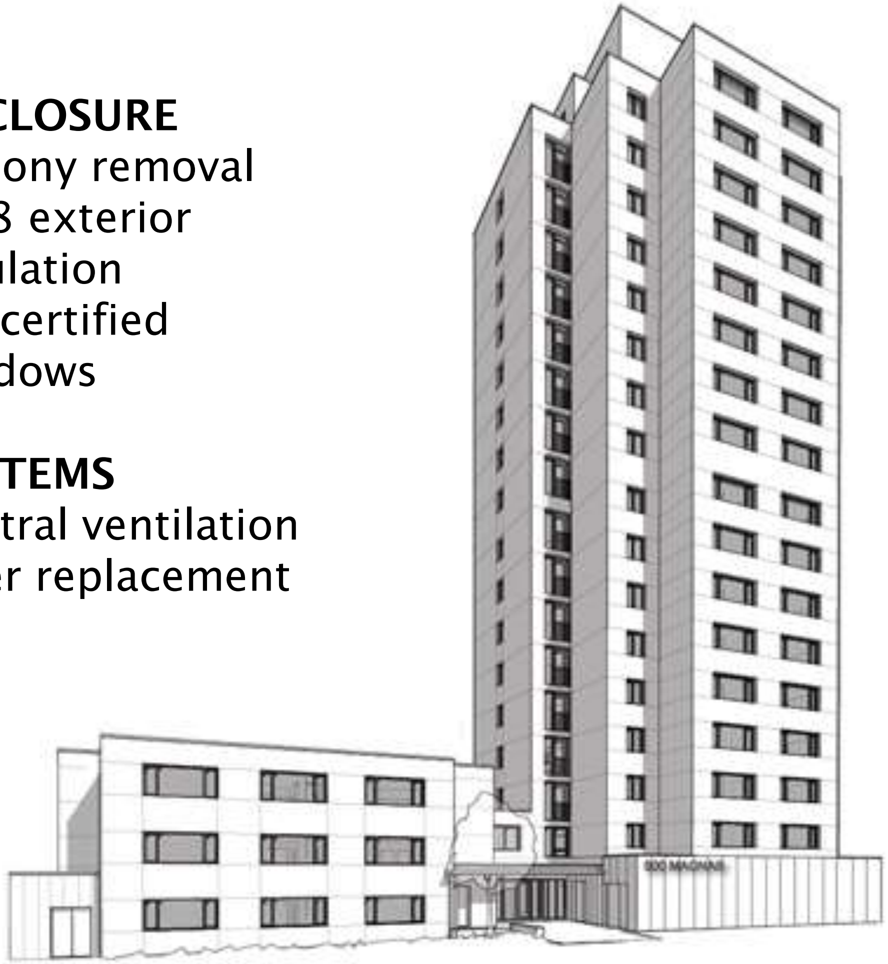
Princess Avenue EnerPHit house is a two storey single family house with a secondary unit and an attached garage outside the principal envelope. This home is the first Passive House EnerPHit in Canada and has been certified by the German Passive House Institute. The living and dining area faces east with mountain view. Existing trees near the south facing wall pose a problem with maximizing solar heat gain along with the large windows facing east. HRV exhaust ducts had been placed along these windows to help mitigate the comfort criterion. With the window install having psi value of 0.013 W/(mK), it has helped mitigate thermal bridging. There are no electric baseboard heaters. Owner had no issue with comfort so there was no need for dehumidification and portable heaters. The character of the building strikes a touch of modern style architecture. The use of natural stone and horizontal sidings fits well with the neighboring houses. The building is situated on a sloping site. Although this is two storey house, the front of the building presents a bungalow look while the double storey rear competes well with the tall surrounding trees towards the rear of the property. There are two flat roofs. Smaller flat roof over the main roof was provided to break a long straight roof long while contributing to over height interior ceiling.

RDH

Ken Soble Tower, Hamilton, Ontario

ENCLOSURE
Balcony removal
R-38 exterior insulation
PHI-certified windows

SYSTEMS
Central ventilation
Riser replacement



The Ken Soble Tower is the oldest high-rise apartment building in Hamilton, Ontario. Built in 1967, it has been in decline for several years.

The 18-story apartment tower is now on track to be one of the largest EnerPHit certified projects in North America.

The project will modernize 146 units of affordable seniors' housing with increased comfort and a greater ability to withstand a changing climate.

Ken Soble Tower, Hamilton, Ontario

Built in 1967

Balconies sawed off in fall 2019

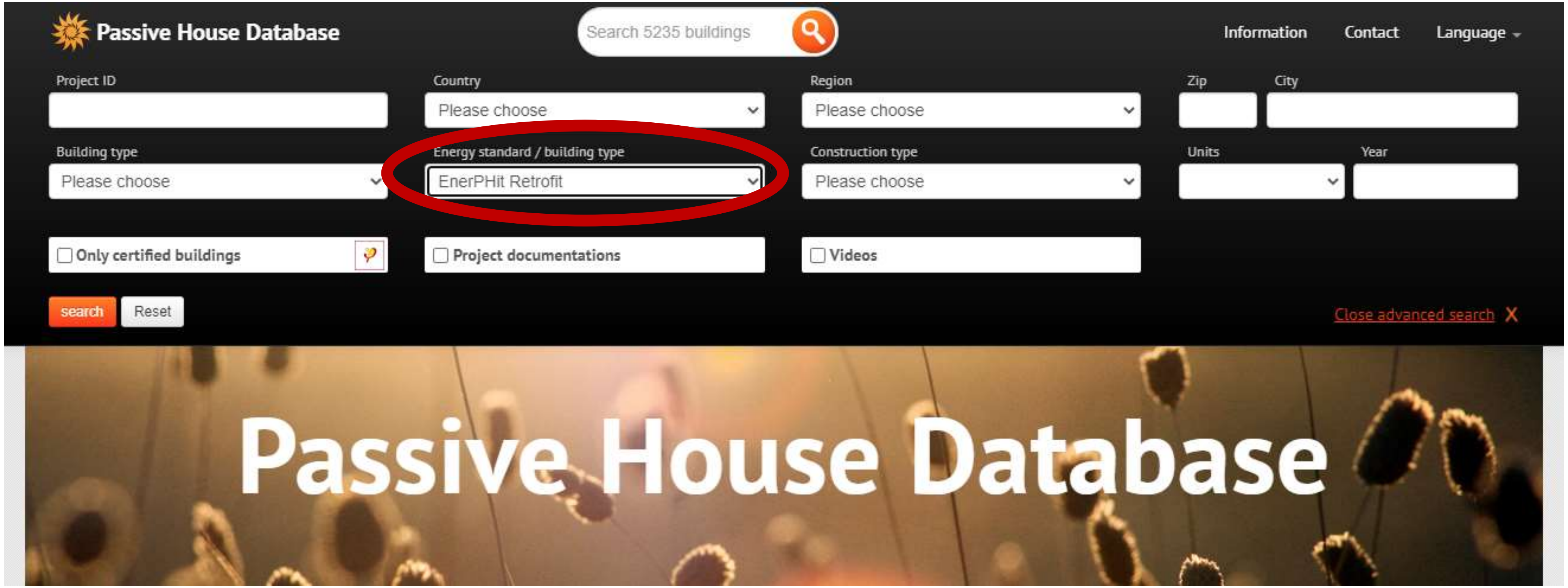
Masonry sealed, ready for insulation.

Pirelli Building: EnerPHit retrofit in New Haven

More about EnerPHit

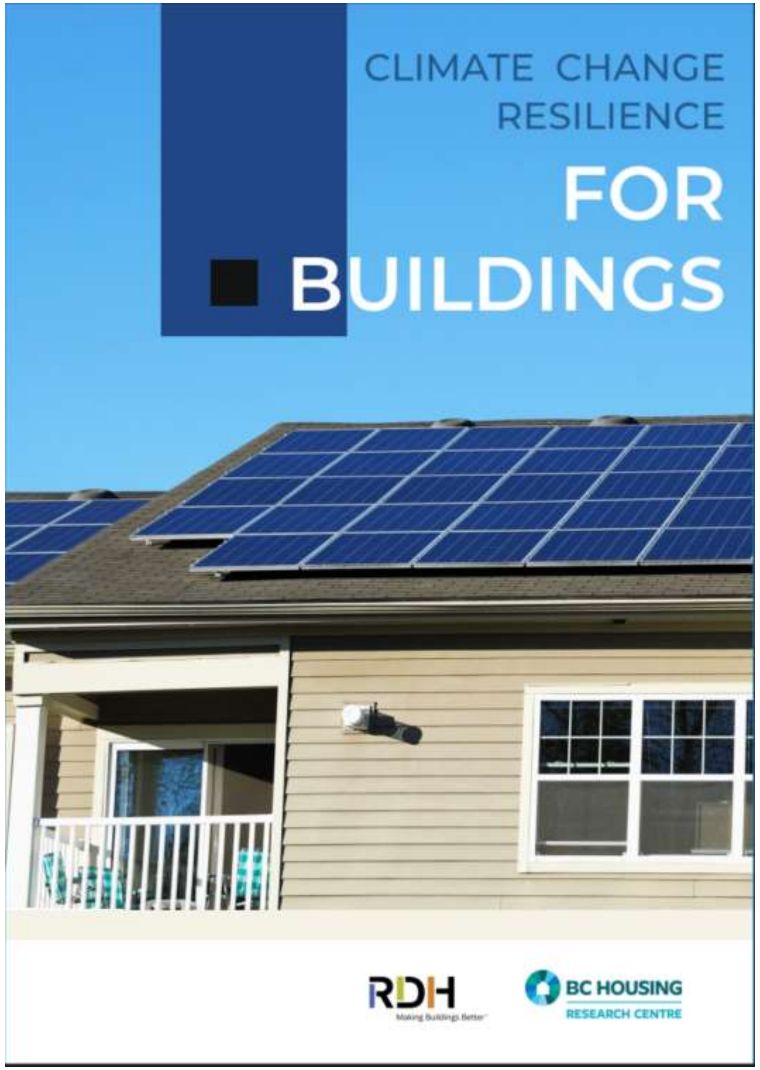
https://passipedia.org/certification/enerphit

https://passivehouse-database.org/index.php?lang=en



RDH

RDH Guides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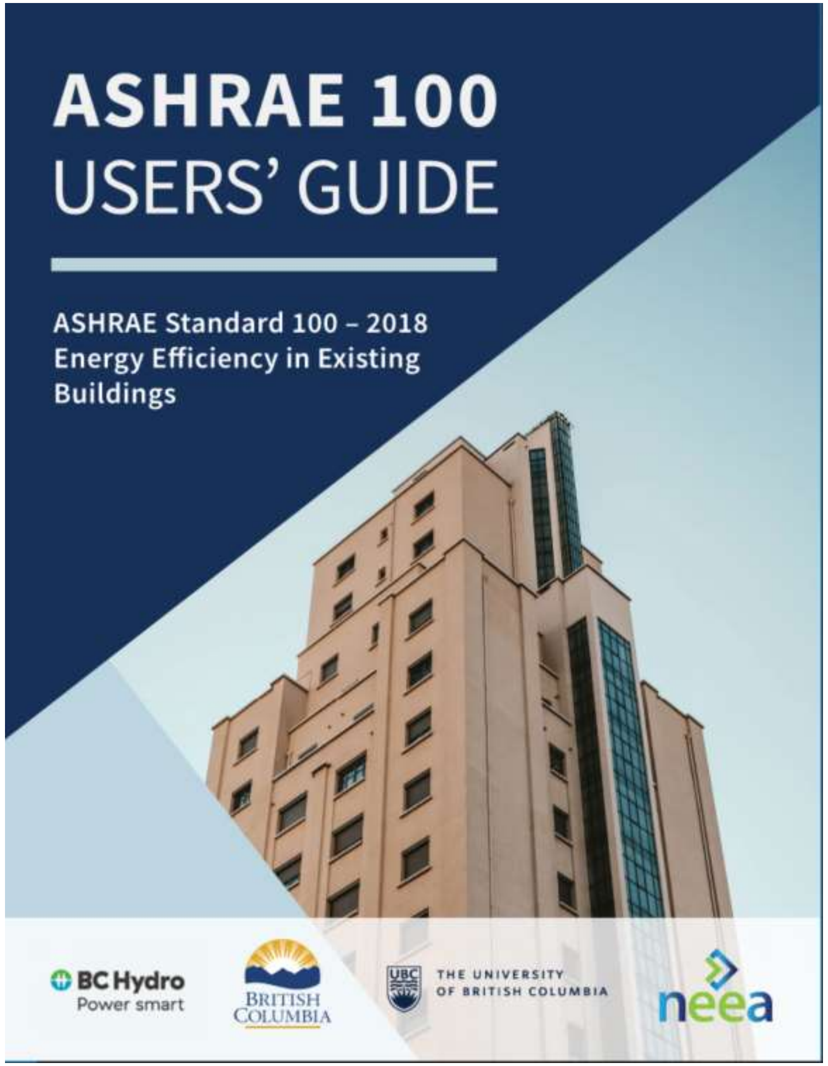
RESILIENCE
FOR
BUILDINGS
RDH
BC HOUSING
RESEARCH CENTRE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USERS' GUIDE
ASHRAE Standard 100 – 2018
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Power smart
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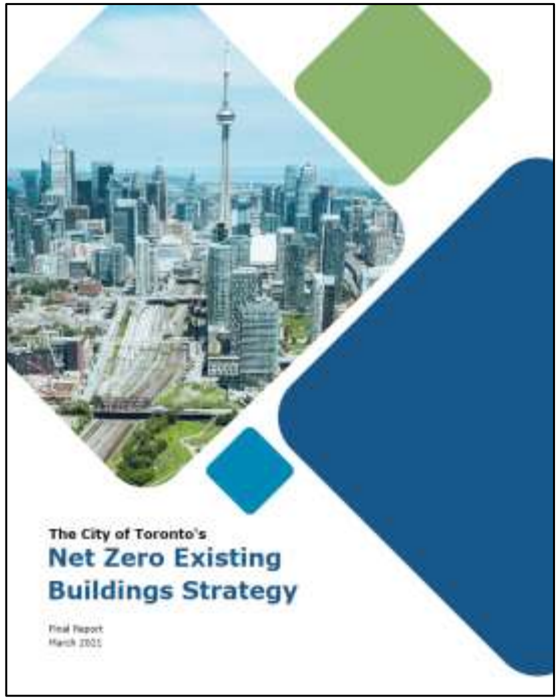
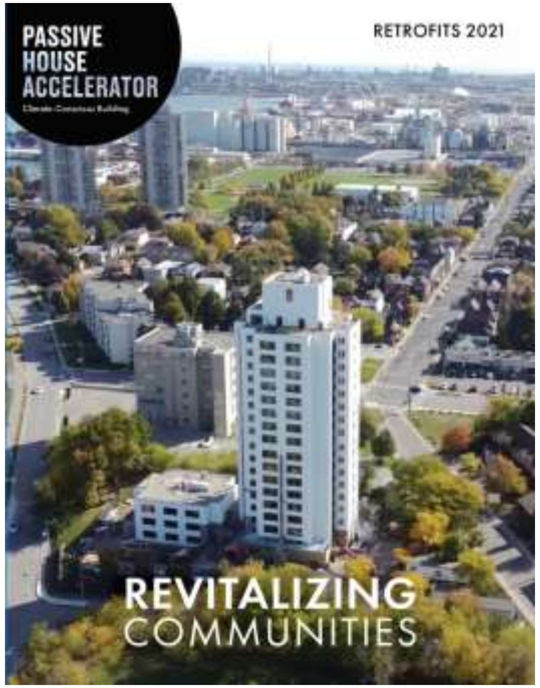
COLUMBIA
UBC
THE UNIVERSITY
OF BRITISH COLUMBIA
neea

Other guides





“Keep Hope Alive”

1983 was the zenith of the Reagan Presidency.
Many African Americans felt abandoned by Washington.

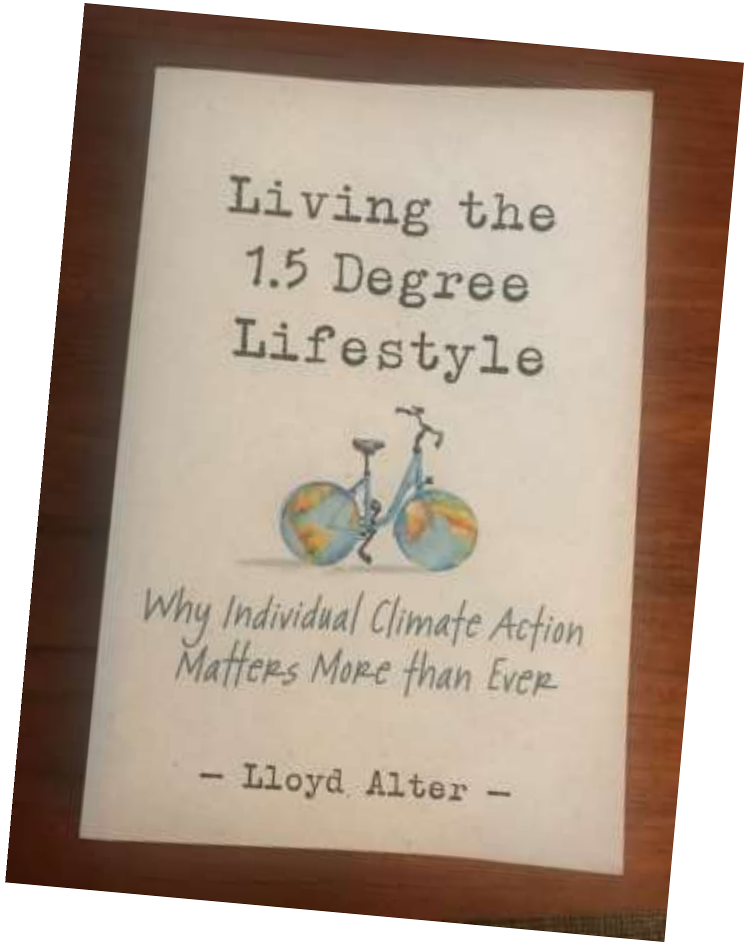
RDH

April 4, 1968, Memphis, Tennessee


“Keep
Hope
Alive”
Fall 1983

Despair: Americans emit 16.6 tonnes GHG/person. Hope: Two tonnes GHG/person by 2030.

- Set a personal target. Start monitoring yourself.
- Write a climate retrofit plan for your home.
- Get an e-bike. Drive less. (4.6 t/yr)
- Fly much less. (¼ t/hr)
- Eat less meat. (3 t/yr)
- Buy less of everything.
- Talk about 2030. Don’t do this alone.
- Support political action to end fossil fuel era.



PHN PRESENTS

DECEMBER 7, 2021

How to Retrofit Buildings in a Climate Emergency: Stepwise EnerPHit

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RDH Building Science
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