ENERGY STEPCODE

BUILDING BEYOND THE STANDARD

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What is the BC Energy Step Code

- An “opt-in” energy performance standard that local governments and industry can adopt.
  - As base code
  - Incentive programs/Zoning & masterplans
- A road map to Net Zero ready buildings
- A pure performance standard that uses a metrics based approach.

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Energy Step Code Council

PROVINCIAL GOV.

BUILDERS & DEVELOPERS

LOCAL GOVERNMENTS

TRADES & PROFESSIONALS

NGOs

UTILITIES

Do we need a new model?

- A growing amount of data to suggest that the current North American codes are not lowering carbon emissions in new construction.

- There is a significant range in energy use and carbon emissions in new construction.

- No transparency into how the programs we are developing are working

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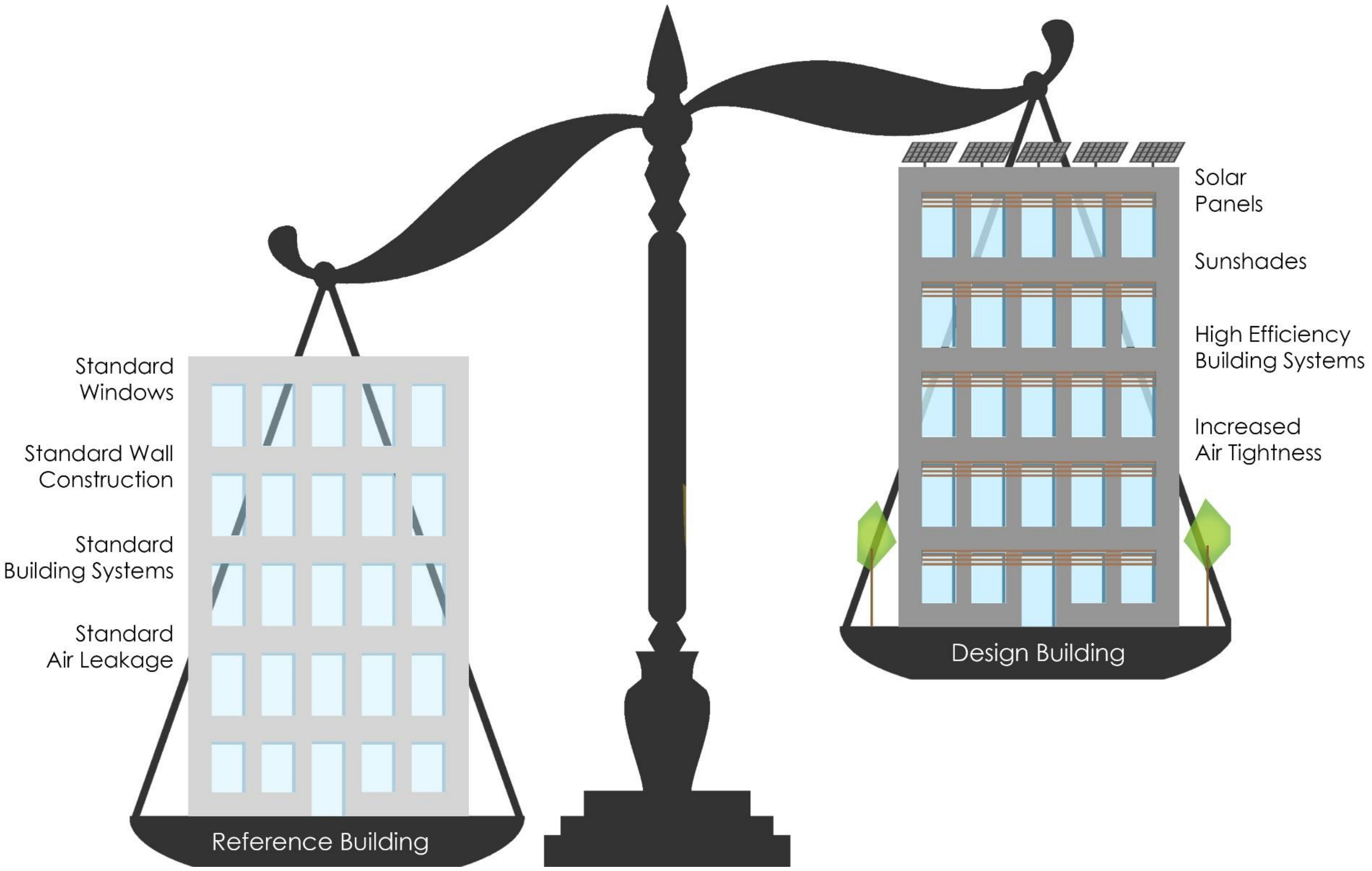
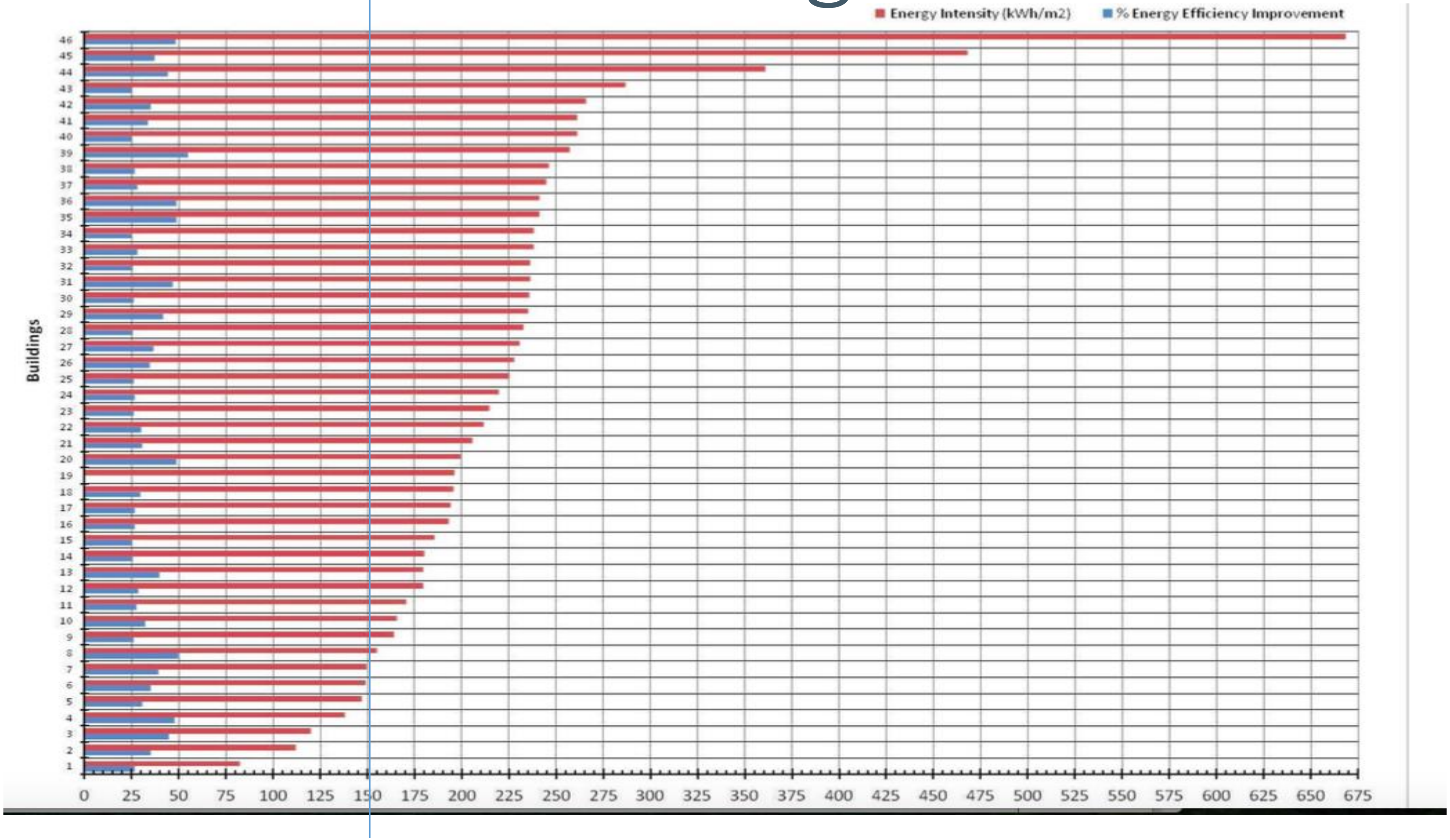
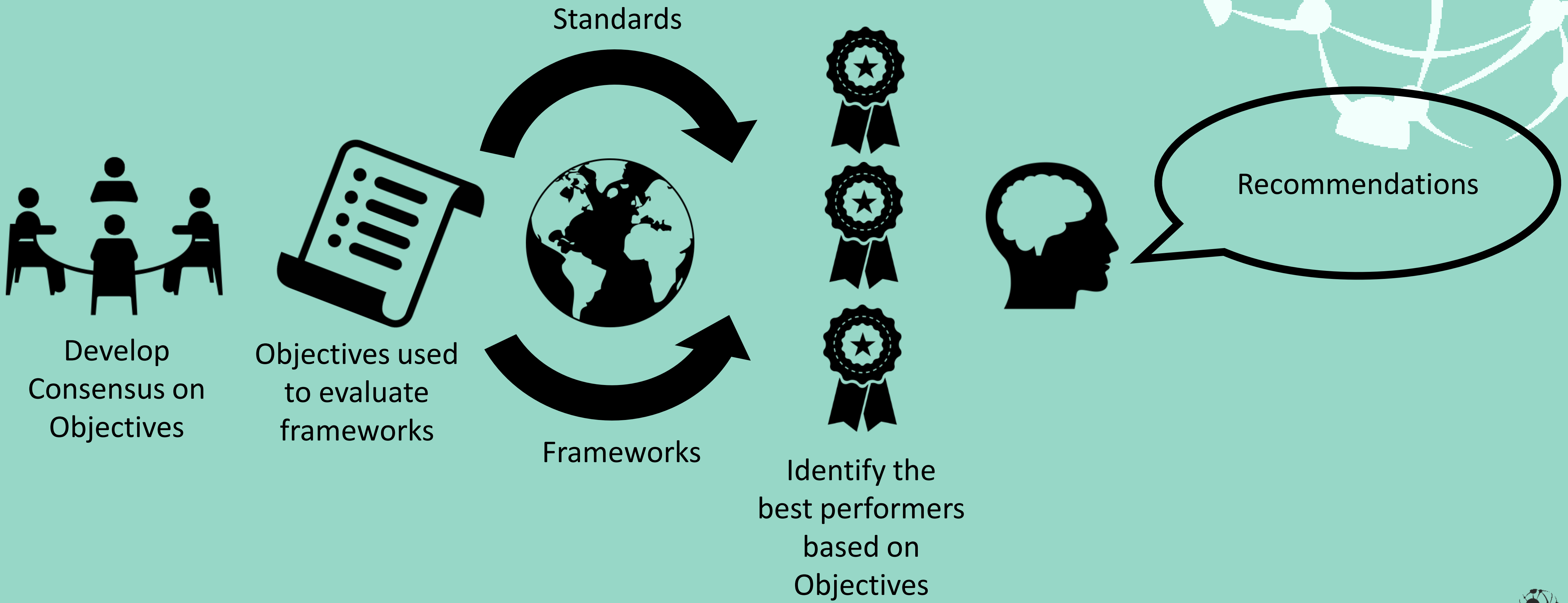
REFERENCE BUILDING



Reference Building (percent better)



Work Program



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BESTPRACTICECOMPARISON

STANDARD	COMMERCIAL	MULTI-FAMILY
ASHRAE 90.1	% Energy Cost Reduction	% Energy Cost Reduction
ASHRAE 189	Approx. 34% reduction over ASHRAE 90.1	Approx. 34% reduction over ASHRAE 90.1
BR10, Denmark	71.3 + (1650 kWh/yr/m2) Offices, Schools, Institutions, Other	52.5 + (1650 kWh/yr/m2) Residential, Student Accomm, Hotels
EnEV2009, Germany	Meet or exceed reference building kWh/m2/yr with pre-defined standards	Meet or exceed reference building kWh/m2/yr with pre-defined standards
IECC	% Energy Cost Reduction	% Energy Cost Reduction
NECB, Canada	Meet or exceed reference building kWh/m2/yr with pre-defined standards (performance path approach)	Meet or exceed reference building kWh/m2/yr with pre-defined standards (performance path approach)
Part L, UK (England + Wales)	Meet or exceed reference building kgCO2/m2/yr with pre-defined standards.	Meet or exceed reference building kgCO2/m2/yr with pre-defined systems standards. (39 kWh/m2/yr - MFH 2016)
Target Performance Path, Seattle	40 kBTU/sf/yr (approx. 125 kWh/m2/yr)	40 kBTU/sf/yr (approx. 125 kWh/m2/yr)
TEK10, Norway	150 kWh/m2/yr Office Building	115 kWh/m2/yr Apartment Buildings
Title 24, California	97.7 kWh/m2/yr Example office building	88.2 kWh/m2/yr Example residential building
RT2012, France	40-65 kWh/m2/yr (50 kWh/m2/yr baseline with climate zone and altitude coefficients)	40-65 kWh/m2/yr (50 kWh/m2/yr baseline with climate zone and altitude coefficients)
Architecture 2030	394.7 kWh/m2/yr Site Energy Use Ontario average value	188 kWh/m2/yr Site Energy Use Ontario average value
Minergie, Switzerland	40 kWh/m2/yr Public/Office Buildings	60 kWh/m2/yr Multi-Family Housing
LEED V4	2-5% reduction in energy use compared to and ASHRAE 90.1- 2010 baseline	5% reduction in energy use compared to and ASHRAE 90.1- 2010 baseline
Living Building Challenge	105% of project's energy needs must be supplied by on-site renewable energy.	105% of project's energy needs must be supplied by on-site renewable energy.
Passivhaus	120 kWh/m²/yr Max. total primary energy demand Max. heating / cooling demand (each) 15 kWh/m²/yr	120 kWh/m²/yr Max. total primary energy demand Max. heating / cooling demand (each) 15 kWh/m²/yr

How does it work?

- Metrics based approach
  - Thermal Energy Demand Intensity
  - Total Energy Use Intensity
  - Peak Thermal Load (part 9 only)
  - Mechanical Energy Use Intensity (Part 9 only)
- Air tightness testing
- Energy Modelling

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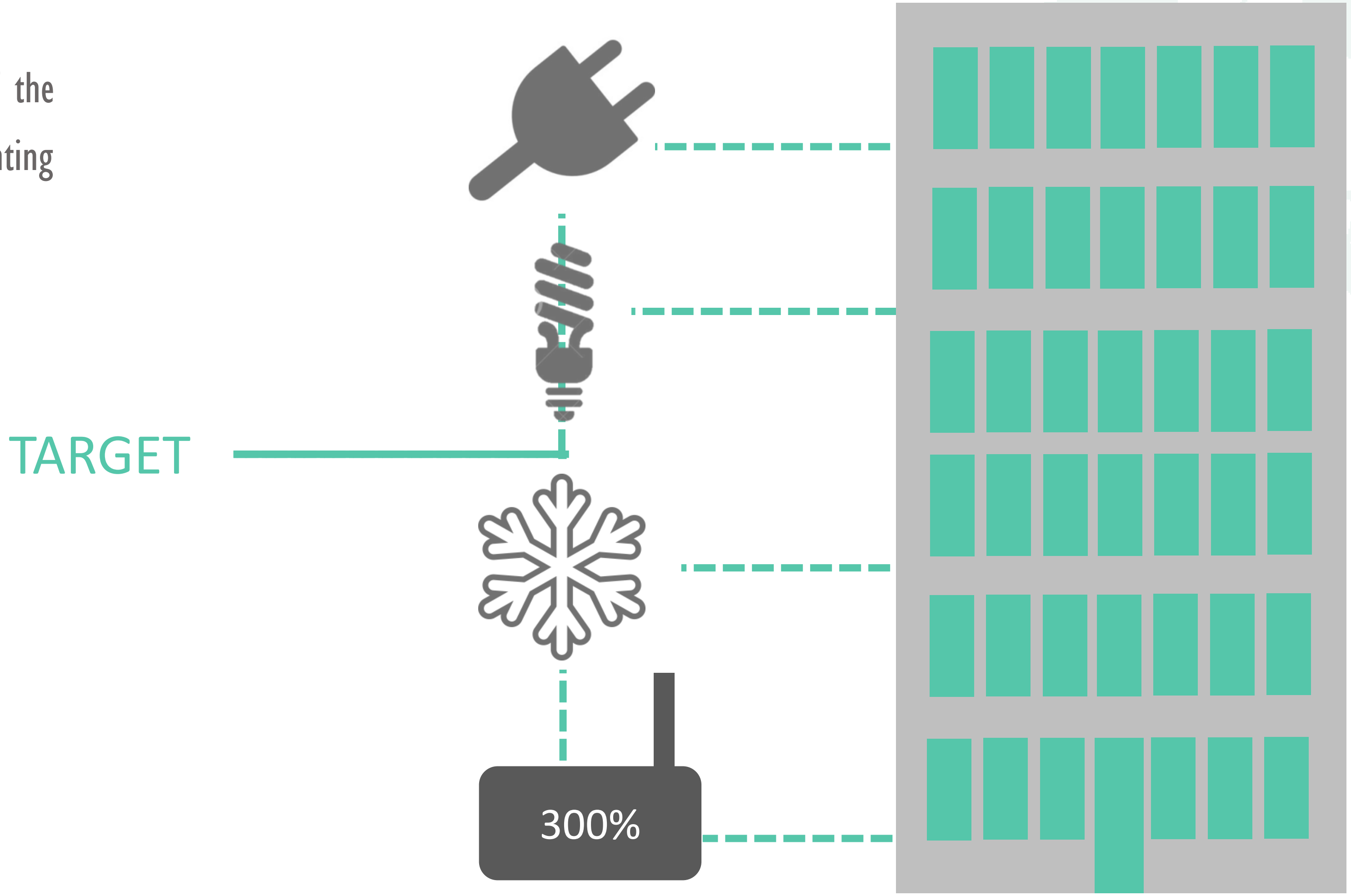
PERFORMANCE TARGETS: TOTAL ENERGY USE

What is it?

- The energy required to power all of the heating, cooling, ventilation and Lighting
- Includes efficiency
- Includes plug loads

Who uses it?

- California
- Seattle



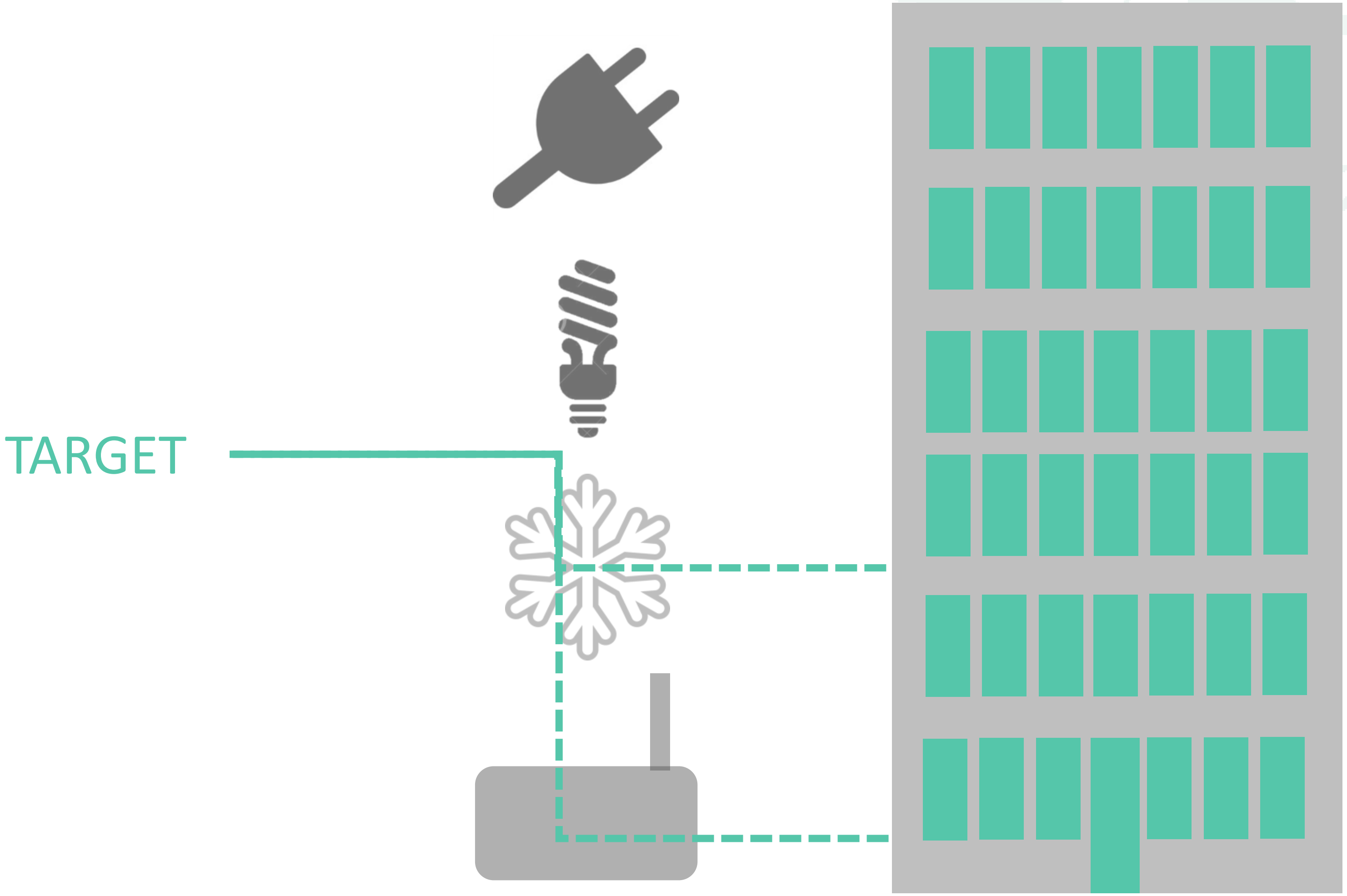
PERFORMANCE TARGETS: THERMAL DEMAND

What is it?

- A buildings demand for heating and cooling
- Lighting is included as part of thermal calculation
- Does not include equipment efficiency
- Does not include plug loads

Who uses it?

- Denmark
- France
- Passive Haus
- Minergie



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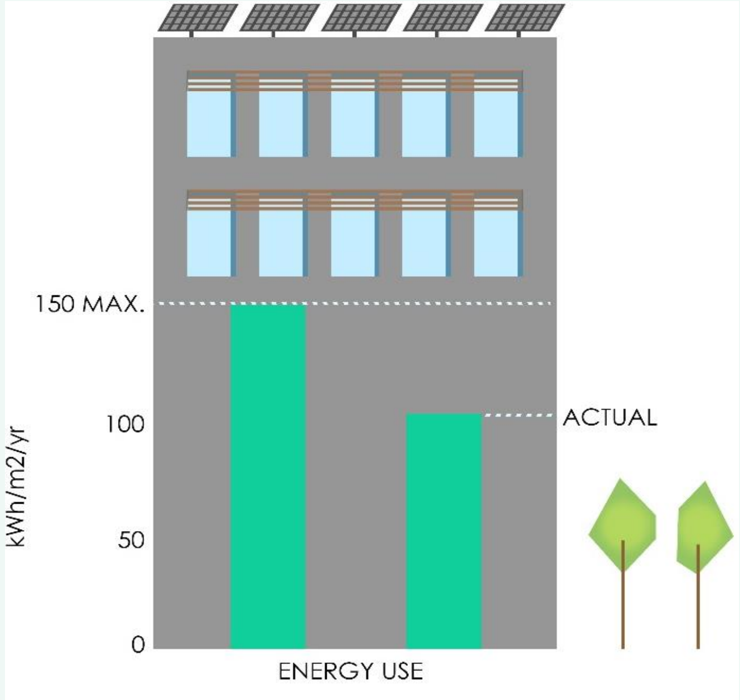
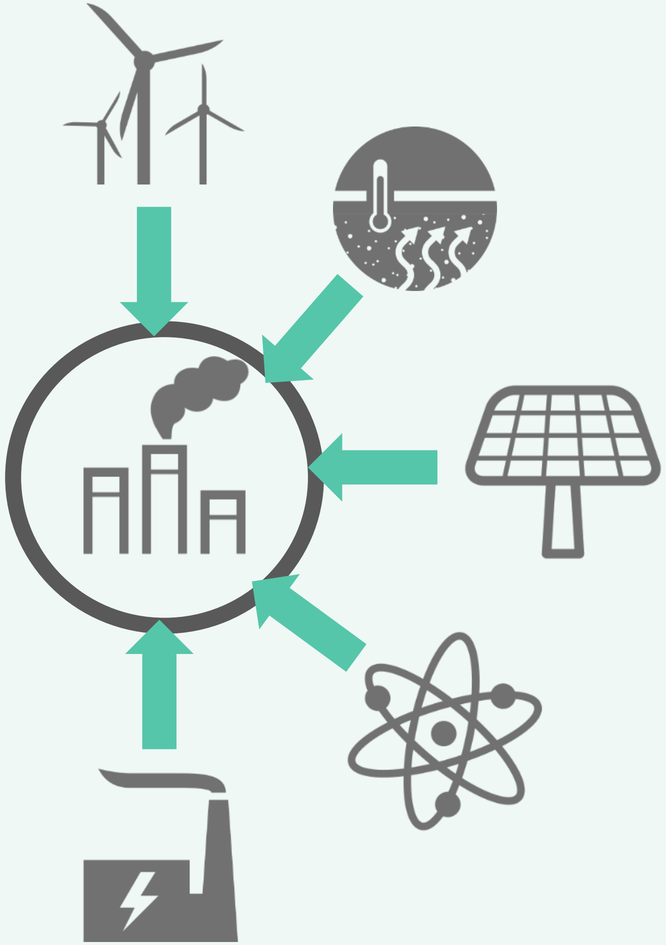
3. Carbon Intensity

Lower Demand



Reduce Emission



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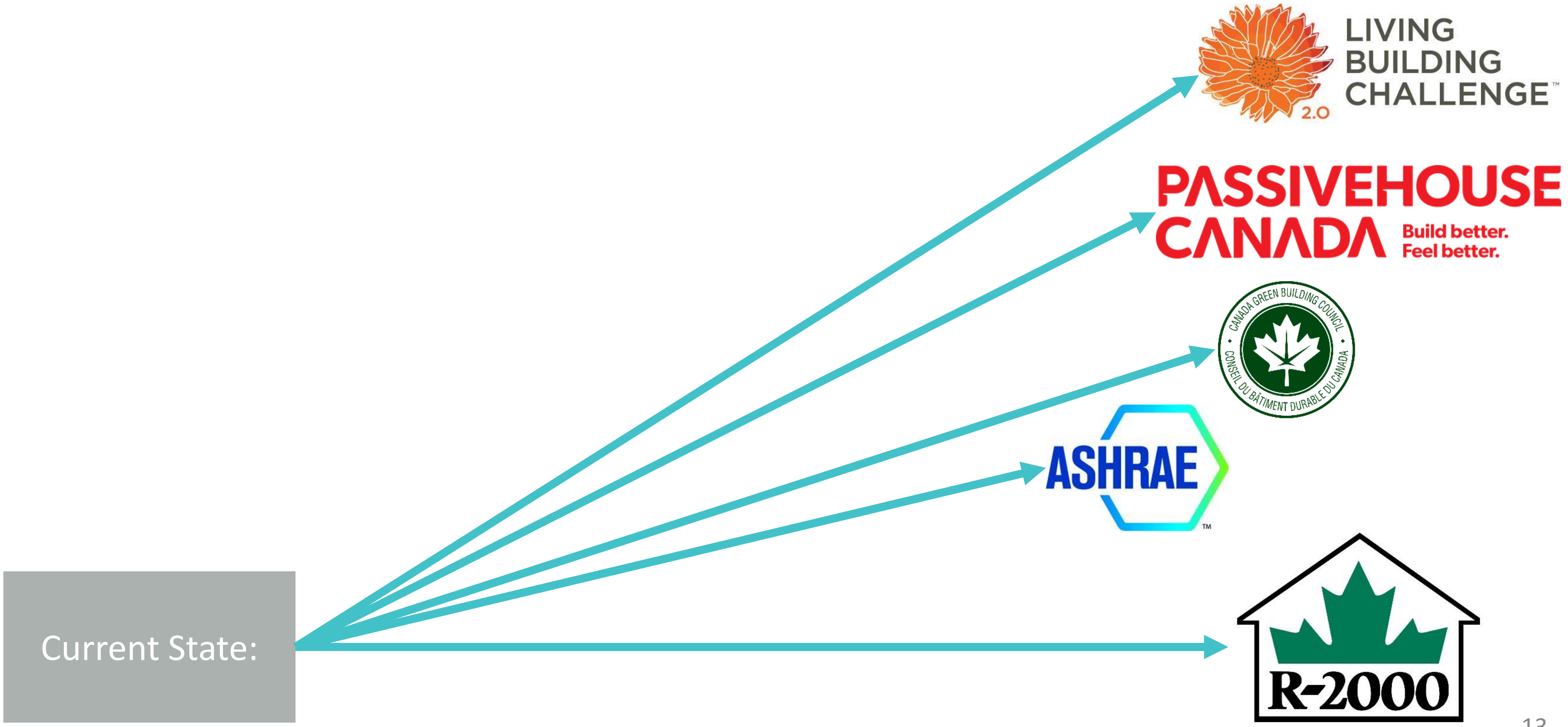
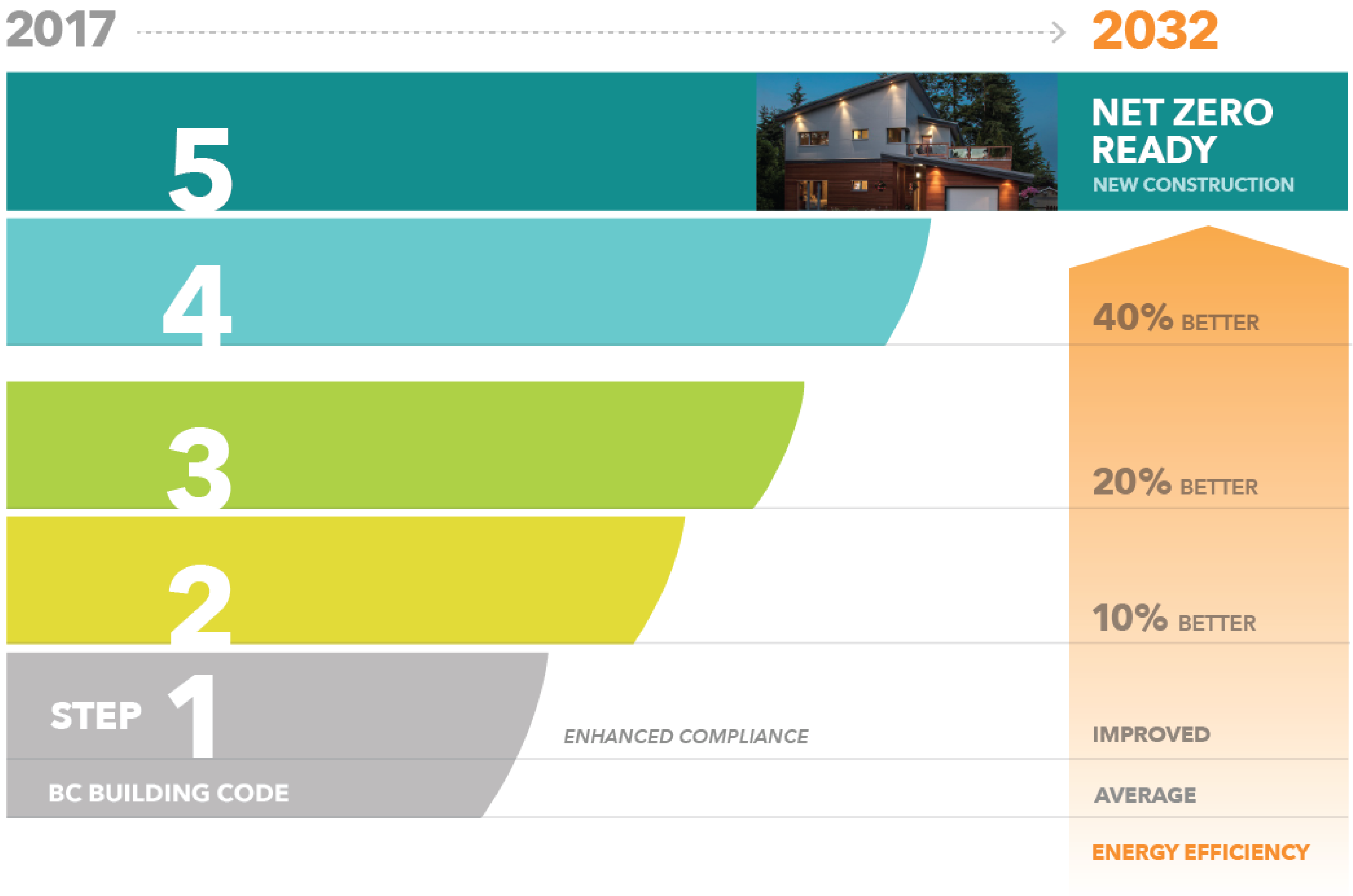
Fragmentation hinders investment and skills training



Energy Step Code



PASSIVEHOUSE CANADA
Build better.
Feel better.

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What Buildings?

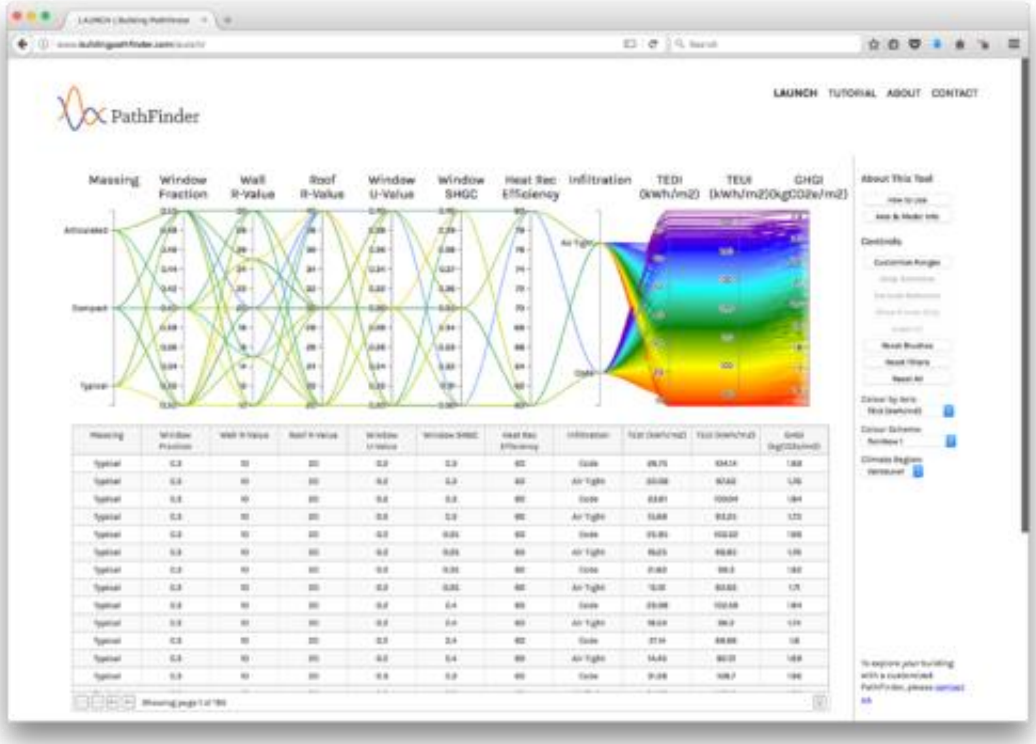
- Part 3
  - Multifamily, Commercial Office, Retail
- Part 9
  - All residential buildings

Not included:

- Schools, Hospitals, Institutional, Industrial

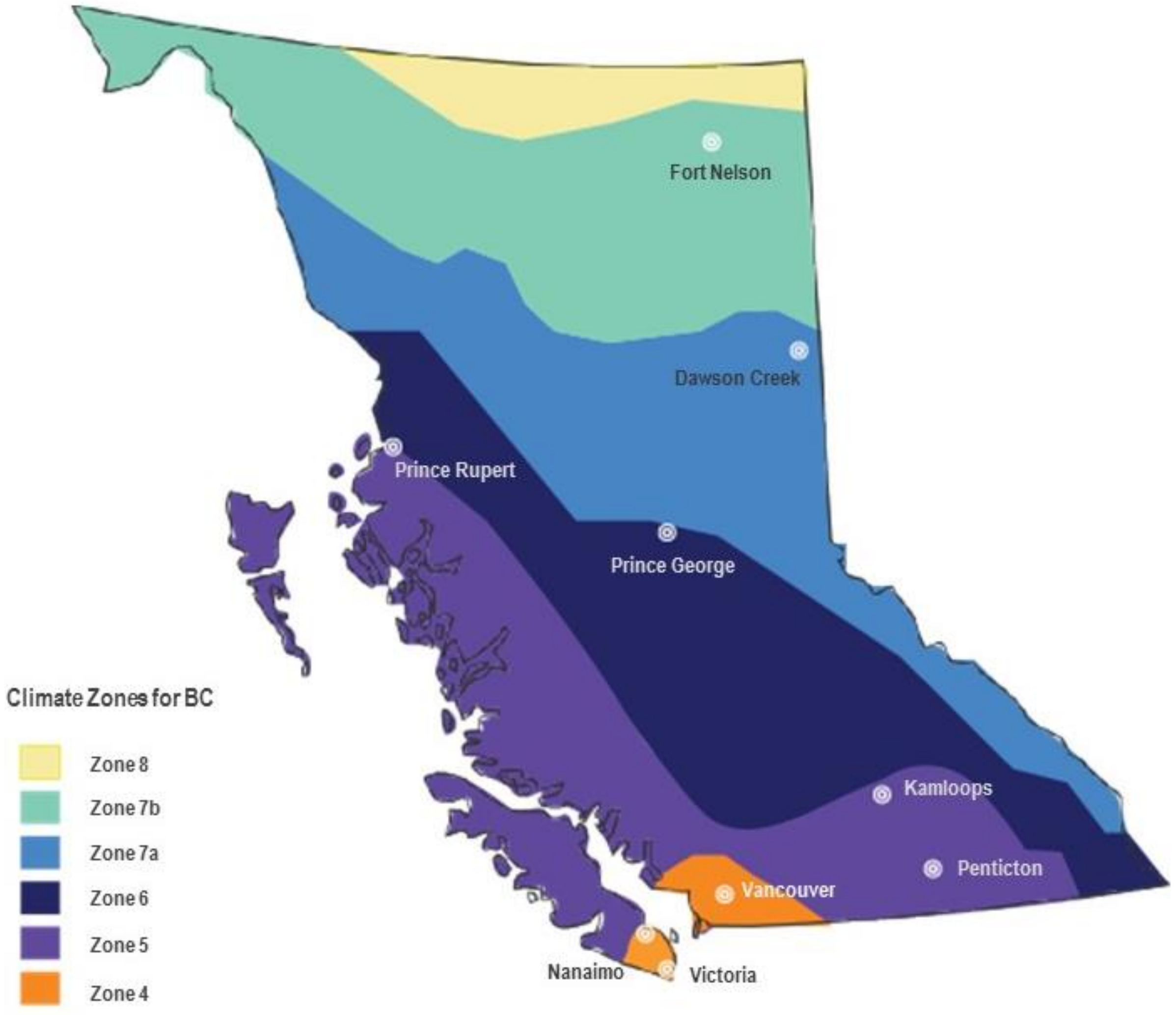
Methods & Scope

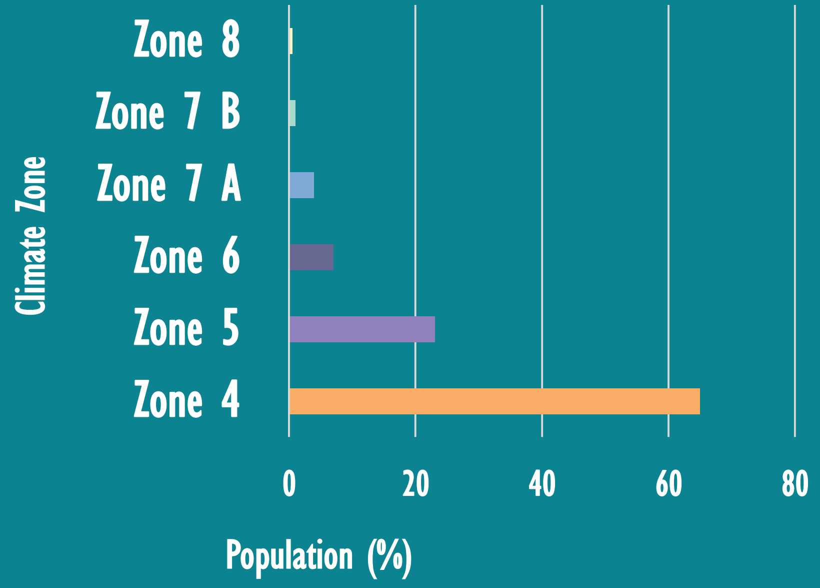
ECM –Simulations Diagram



- Each archetype was designed with various combinations of the energy conservation measures (ECM)
- Resulting in millions possible modelling combinations that for each archetype
- Each archetype was further modelled across BC’s 4 Climate Zones that have data for Part 3 buildings
- Housing Technology Assessment Platform (HTAP) was used to examine the costs and benefits of increasing energy efficiency in residential buildings

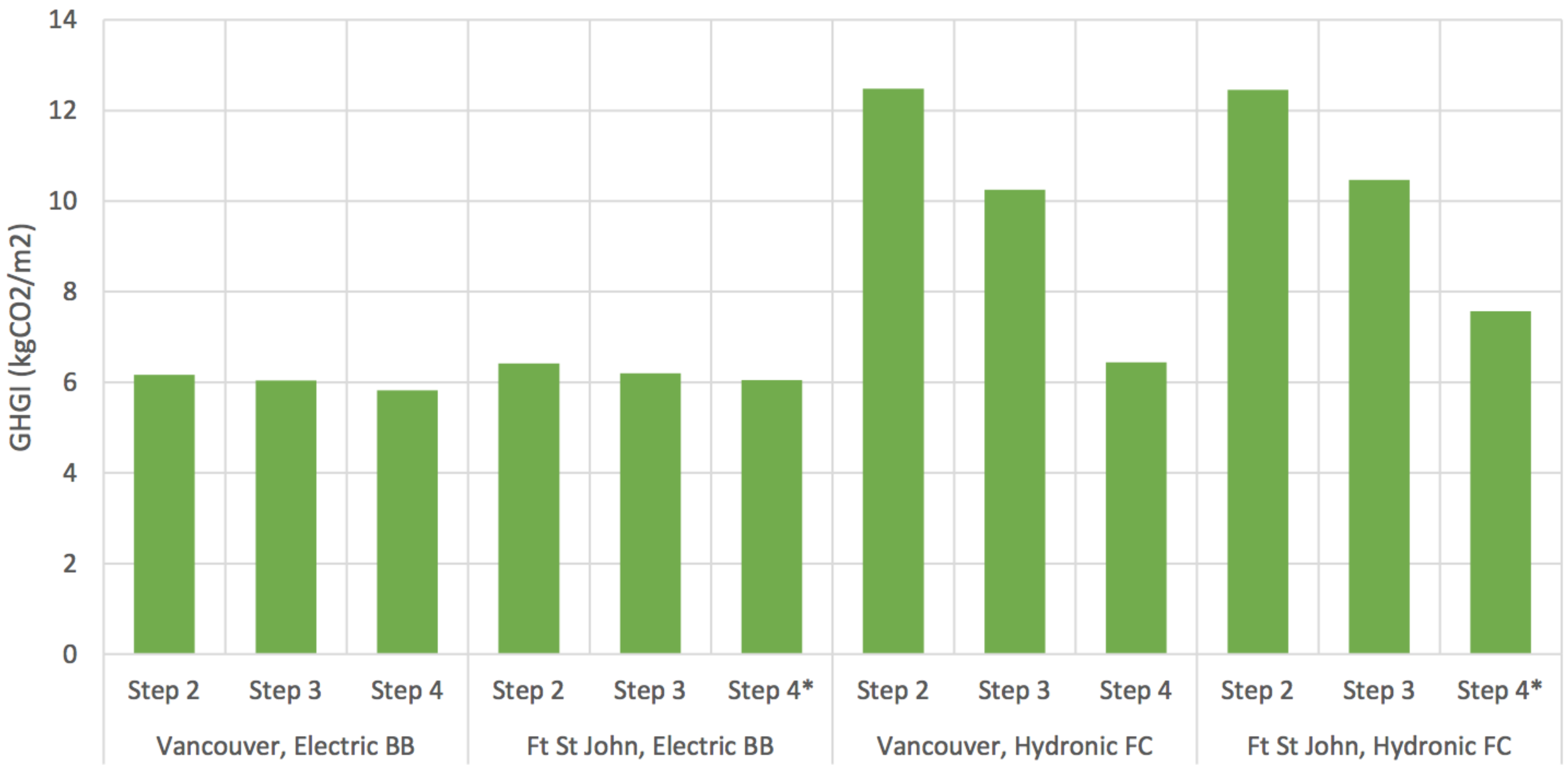
Where do people Live? Where





~ 90% of the population of BC lives in climate zones 4, 5, and 6

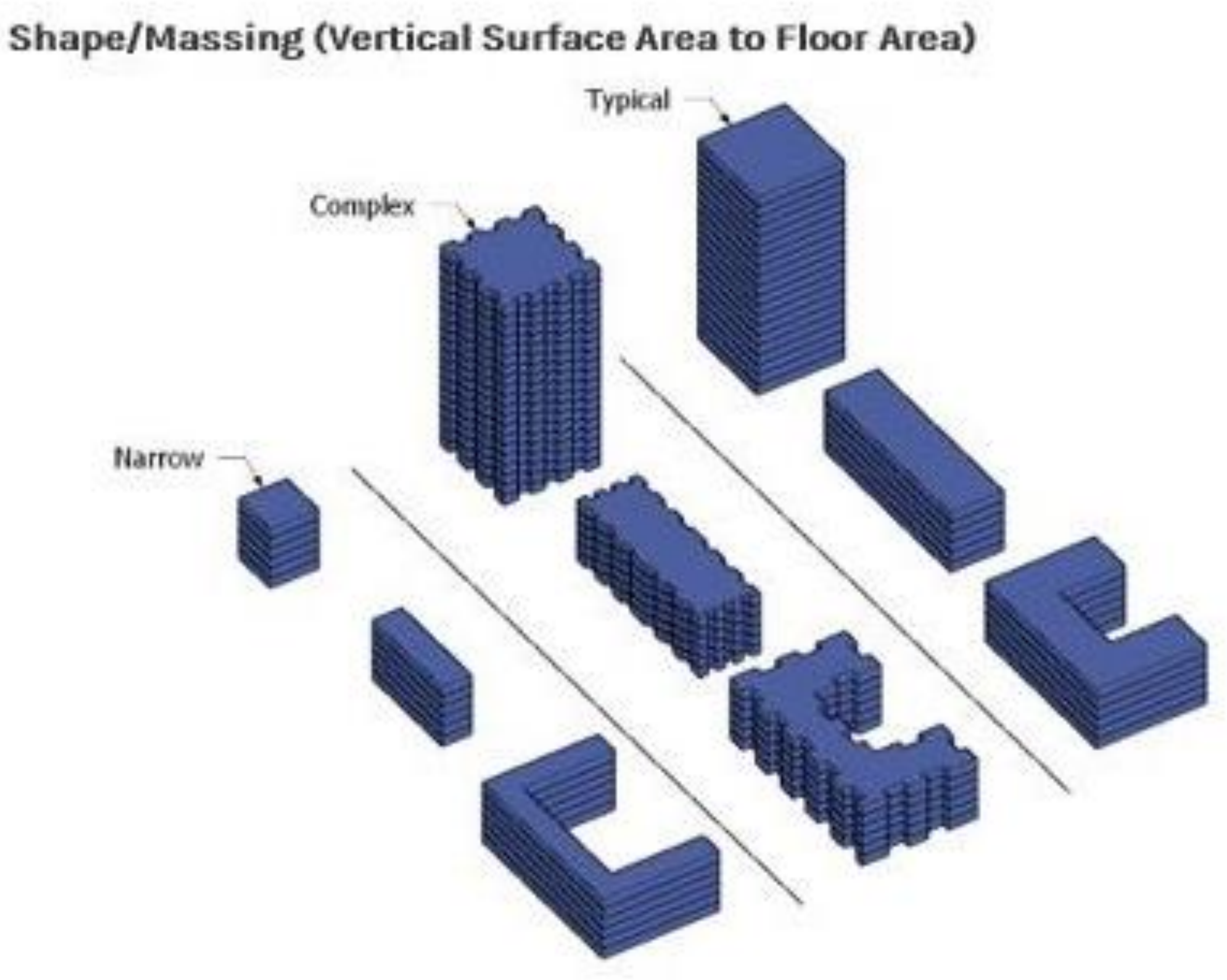
Building Insights



**Represents the most feasible scenario which approaches, but does not meet the performance requirements*

Building Insights

- Your design matters
- Thermal bridging matters
- Form Factor Matters a lot.
- Simple forms are easier
- Larger Floorplates are easier



What is unique about schools

- Surprisingly form factors are generally not good
- The occupant densities are high which positively impacts TEDI's
- Low glazing ratios
- Generally heating dominant

Building Insights

Archetype	Climate Zone	Step Achieved	HVAC	WWR	Wall R-Value (effective)	Roof R-Value (effective)	Window USI-Value	Infiltration	Vent. Savings	Lighting Savings (%)	TEUI (kWh/m2)	TEDI (kWh/m2)	GHGI (kgCO2e/m2)
School	4	1									275	100.4	35.3
		2	Boiler	20	10	40	2.5	Code	80% HR with DCV	0	148.9	34.4	13.6
			ASHP	20	10	20	2.5	Code	60% HR with DCV	0	127.5	50.2	7.2
		3	Boiler	20	20	40	1.6	Improved	80% HR with DCV	0	129.5	15	9.8
			ASHP	20	10	40	2.5	Improved	80% HR with DCV	0	120.2	24.7	7
		4	Boiler	20	20	40	2	PH	80% HR with DCV	50	109.7	14.5	9.5
			ASHP	20	10	40	2.5	PH	80% HR with DCV	25	109.9	20.7	6.9
	5	1									334.1	118.6	44.3
		2	Boiler	20	20	40	1.2	Code	80% HR with DCV	25	149.3	34	14.3
			ASHP	20	10	20	2.5	Code	80% HR with DCV	0	141	58	8
		3	Boiler	20	20	40	1.2	Improved	80% HR with DCV	50	129.1	25	12.2
			ASHP	20	20	40	2	Improved	80% HR with DCV	25	121.2	27.2	7.6
		4	Boiler*	20	40	40	0.8	PH	80% HR with DCV	50	117.1	13.2	9.9
			ASHP	20	40	40	2.5	PH	80% HR with DCV	50	109.2	22	7.3
	6	1									387.6	161.9	55.8
		2	Boiler	20	40	40	1.2	Code	80% HR with DCV	50	149.5	49.4	16.9
			ASHP	20	20	40	2.5	Code	80% HR with DCV	0	134.7	59.6	7.9
		3	ASHP	20	40	40	1.2	Improved	80% HR with DCV	0	127.4	29.4	7.6
		4	ASHP	20	20	40	0.8	PH	80% HR with DCV	50	108.7	29.2	7.1
	7A	1									444.6	197.9	66.6
		2	ASHP	20	20	40	1.6	Improved	80% HR with DCV	0	137	57.9	8.1
		3*	ASHP	10	40	40	0.8	PH	80% HR with DCV	0	129.8	31.7	7.7
		4*	ASHP	10	40	40	0.8	PH	80% HR with DCV	50	111.3	36.8	7.3

Building Insights

Costs:

- In many cases 80% savings can be achieved for 2-3% incremental Capital.
- Simple Paybacks are reasonable
- Energy savings are generally more than 50%

Archetype	Climate Zone	Step Achieved	Incremental Capital Cost (%)	Energy Savings (%)	GHG Savings (%)	Simple Payback (Years)
School	4	1				
		2	0.4	45.8	61.4	2.1
			0.3	53.6	79.5	1.5
		3	2.2	52.9	72.1	10.5
			0.6	56.3	80.1	3
		4	5.2	60.1	73.1	19.9
			2.5	60.1	80.6	10.5
	5	1				
		2	3.7	55.3	67.7	12.8
			0.2	57.8	81.9	0.8
		3	5.6	61.4	72.4	17
			3.3	63.7	82.8	10.5
		4	7.3	64.9	77.6	21.3
			5.7	67.3	83.6	16.7
	6	1				
		2	6.3	61.4	69.7	17.3
			0.7	65.2	85.9	2.2
		3	3.2	67.1	86.4	9.2
		4	6.1	72	87.2	15.1
	7A	1				
		2	1.9	69.2	87.8	4.6
		3*	3.2	70.8	88.4	7.7
		4*	6.5	75	89	13.9

Building Insights

	Step Achieved	HVAC	WWR	Wall R-Value (effective)	Roof R-Value (effective)	Window USI-Value	Infiltration	Vent. Savings	Lighting Savings (%)	TEUI (kWh/m2)	TEDI (kWh/m2)	GHGI (kgCO2e/m2)
4	1									275	100.4	35.3
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	4	Boiler	20	20	40	2	PH	80% HR with DCV	50	109.7	14.5	9.5
		ASHP	20	10	40	2.5	PH	80% HR with DCV	25	109.9	20.7	6.9

- Effective Wall Values are R-10
- 80% Heat Recovery
- 80% GHG Reductions

Air-tightness

Buildings all have to be tested – they do not have to pass

Testing happens close to occupancy – Schedule is critical

- Building has to be empty
- The building has to be prepped
- It can take 12 hours

- Services offered building science firms

Thank You!

Questions?

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