ENERGY STEPCODE BUILDING BEYOND THE STANDARD

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- 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.



Energy Step Code Council



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



REFERENCE BUILDING



Reference Building (percent better) Energy Intensity (kWh/m2) % Energy Efficiency Improvement Buildings 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500 525 550 575 600 625 650 675

Work Program



Identify the best performers based on Objectives Recommendations



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
BRID Denmark	71.3 + (1650 kWh/yr/m2)	52.5 + (1650 kWh/yr/m2)
	Offices, Schools, Institutions, Other	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)
TEKIN Norway	150 kWh/m2/yr	115 kWh/m2/yr
	Office Building	Apartment Buildings
Title 74. California	97.7 kWh/m2/yr	88.2 kWh/m2/yr
	Example office building	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)
Apphitapture 2020	394.7 kWh/m2/yr Site Energy Use	188 kWh/m2/yr Site Energy Use
	Ontario average value	Ontario average value
Mineroje Switzerland	40 kWh/m2/yr	60 kWh/m2/yr
	Public/Office Buildings	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, beating / cooling demand (each) _ 15 kWb/m²/yr	120 kWh/m²/yr Max. total primary energy demand Max, beating / cooling demand (each) , 15 kWb/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



PERFORMANCE TARGETS: TOTAL ENERGY USE

TARGE1

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



GROUP

Fragmentation hinders investment and skills training

Energy Step Code

What Buildings?

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

Not included:

• Schools, Hospitals, Institutional, Industrial

Methods & Scope

ECM – Simulations Diagram

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- 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

Building Insights

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

Shape/Massing (Vertical Surface Area to Floor Area)

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)
		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
	4	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
		Δ	Boiler	20	20	40	2	РН	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
	1 2 5 3 4	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
School			ASHP	20	20	40	2	Improved	80% HR with DCV	25	121.2	27.2	7.6
		Δ	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
		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
	6	2	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	РН	80% HR with DCV	50	108.7	29.2	7.1
		1									444.6	197.9	66.6
	74	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	РН	80% HR with DCV	0	129.8	31.7	7.7
		4*	ASHP	10	40	40	0.8	РН	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%

rchetype	Climate Zone	Step Achieved	Incremental Capital Cost (%)	Energy Savings (%)	GHG Savings (%)	Simple Payback (Years)
		1				
		n	0.4	45.8	61.4	2.1
		2	0.3	53.6	79.5	1.5
	4	2	2.2	52.9	72.1	10.5
		5	0.6	56.3	80.1	3
		Л	5.2	60.1	73.1	19.9
		4	2.5	60.1	80.6	10.5
		1				
		2	3.7	55.3	67.7	12.8
			0.2	57.8	81.9	0.8
	5	3	5.6	61.4	72.4	17
School			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
		1				
		2	6.3	61.4	69.7	17.3
	6		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
		1				
	74	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

									Lighting			GHGI
	Step			Wall R-Value	Roof R-Value	Window			Savings	TEUI	TEDI	(kgCO2e/
	Achieved	HVAC	WWR	(effective)	(effective)	USI-Value	Infiltration	Vent. Savings	(%)	(kWh/m2)	(kWh/m2)	m2)
-	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
	Z	ASHP	20	10	20	2.5	Code	60% HR with DCV	0	127.5	50.2	7.2
	2	Boiler	20	20	40	1.6	Improved	80% HR with DCV	0	129.5	15	9.8
	5	ASHP	20	10	40	2.5	Improved	80% HR with DCV	0	120.2	24.7	7
	Λ	Boiler	20	20	40	2	РН	80% HR with DCV	50	109.7	14.5	9.5
	4	ASHP	20	10	40	2.5	РН	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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