2019 MAINE AFFORDABLE HOUSING CONFERENCE | Augusta Civic Center Augusta, ME | October 1st, 2019 | Shaping Our Housing Future

Why Build High Performance Buildings?
Breakout Session #3
Lincoln – 2:15 - 3:00

Presented by

Todd Rothstein, CPHC

Avesta Housing

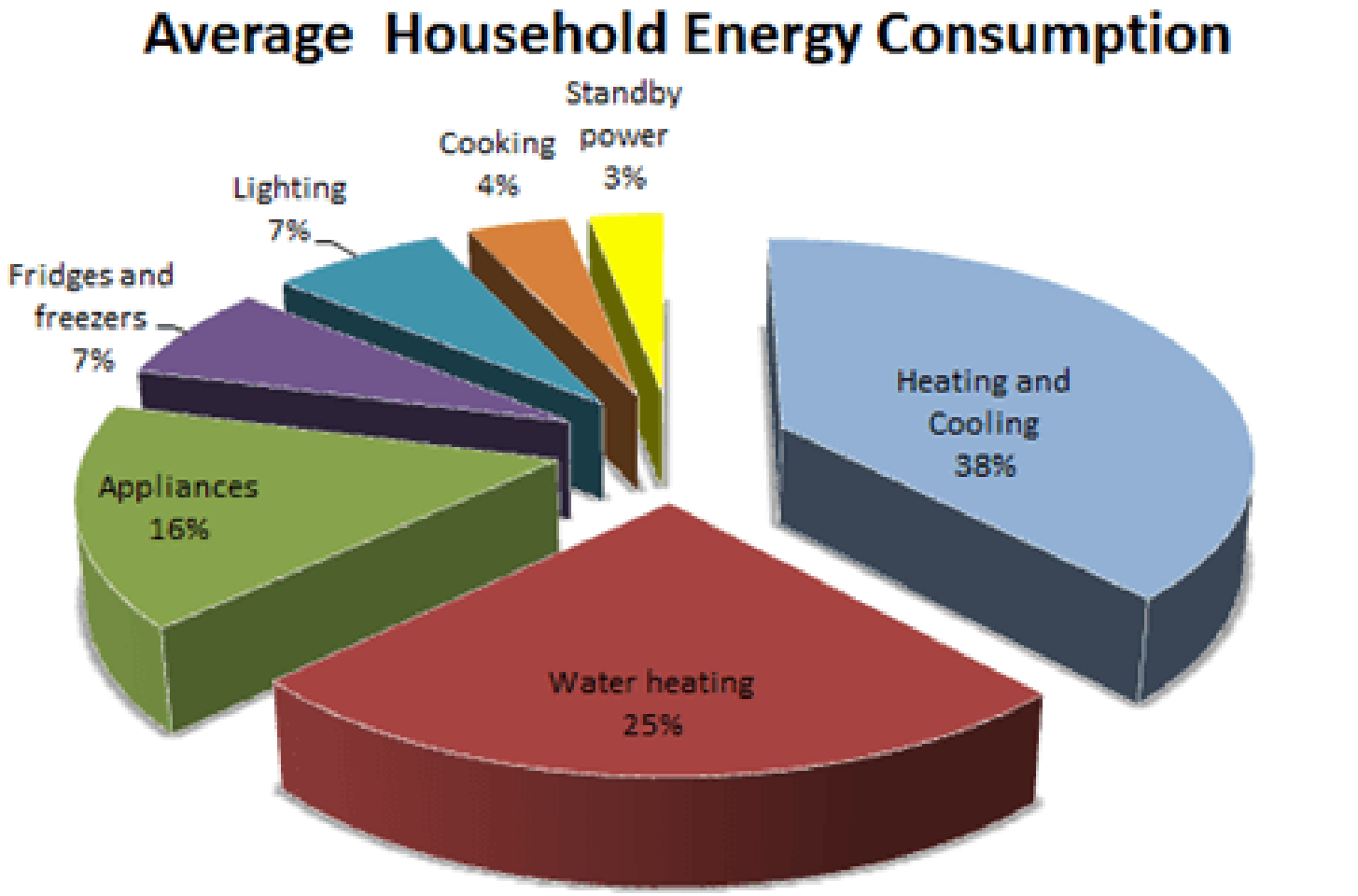
HOW DO WE ADDRESS HEAT ENERGY IN BUILDINGS?

Brief Introduction to building systems

HOUSEHOLD ENERGY USAGE

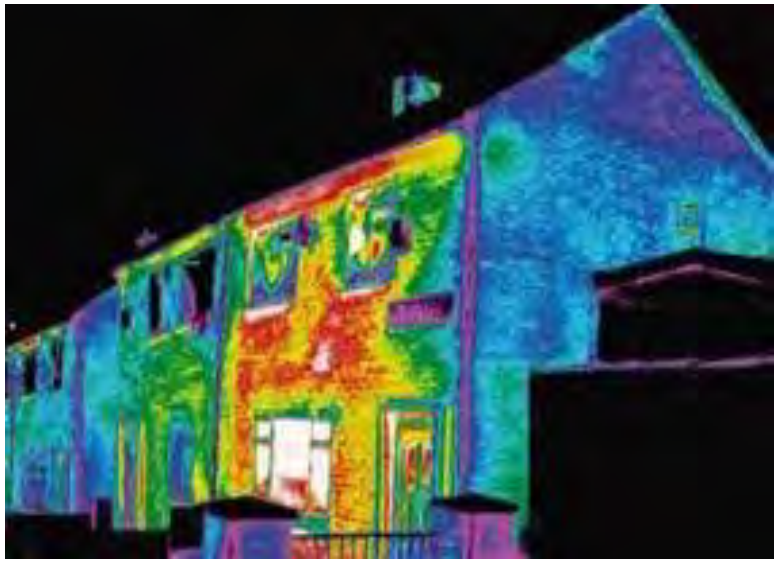
MAJOR SYSTEMS

HEATING	38%
HOT WATER	25%
TOTAL	63%



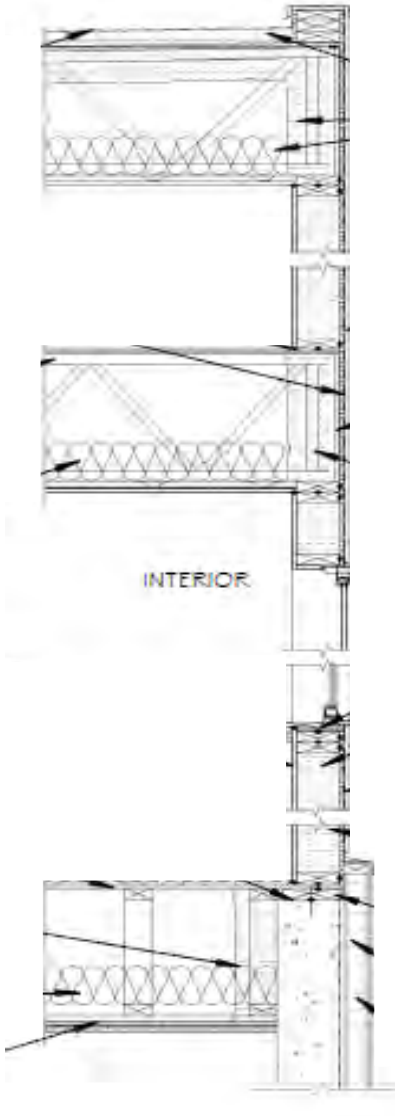
HEAT ENERGY EXIT STRATEGIES

IDENTIFY HEAT ENERGY LEAKS

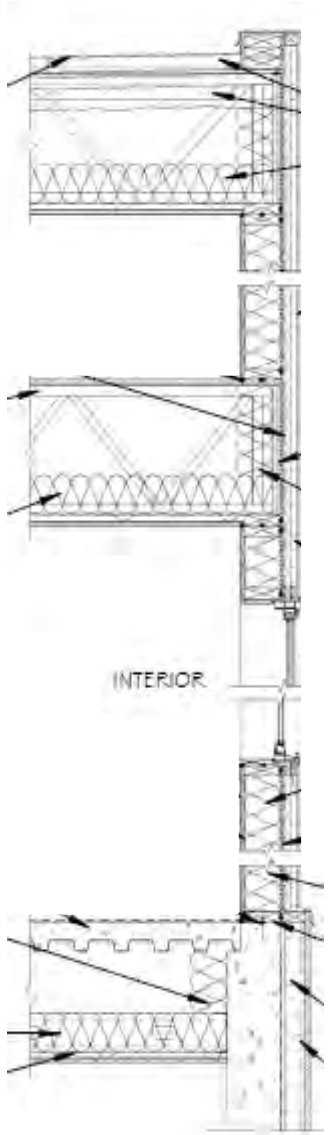


FLOOR, WALL & ATTIC INSULATION

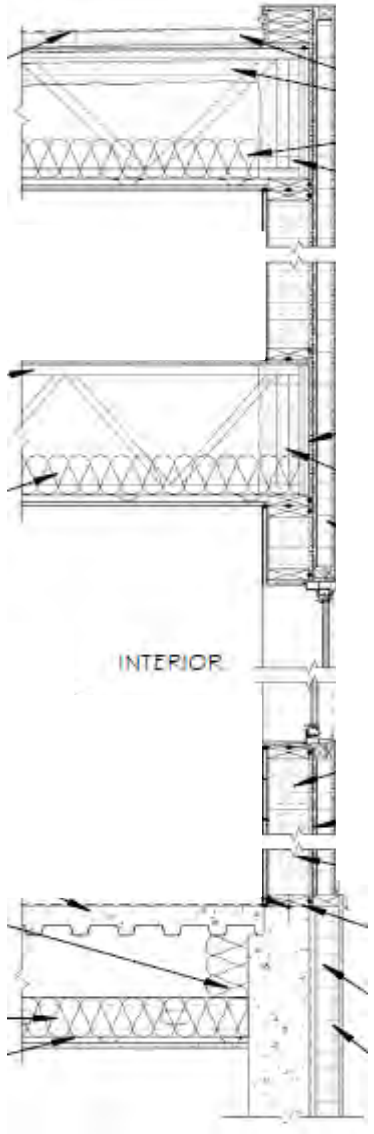
BUILDING ENVELOPE APPROACHES



R 21- 2 x 6 Wall
Foam Insulation



R 21- 2 x 6 Wall
Fiberglass / Rigid



R 38 - 2 x 6 Wall
Spray Foam/Rigid

BUILDING AIR BARRIERS

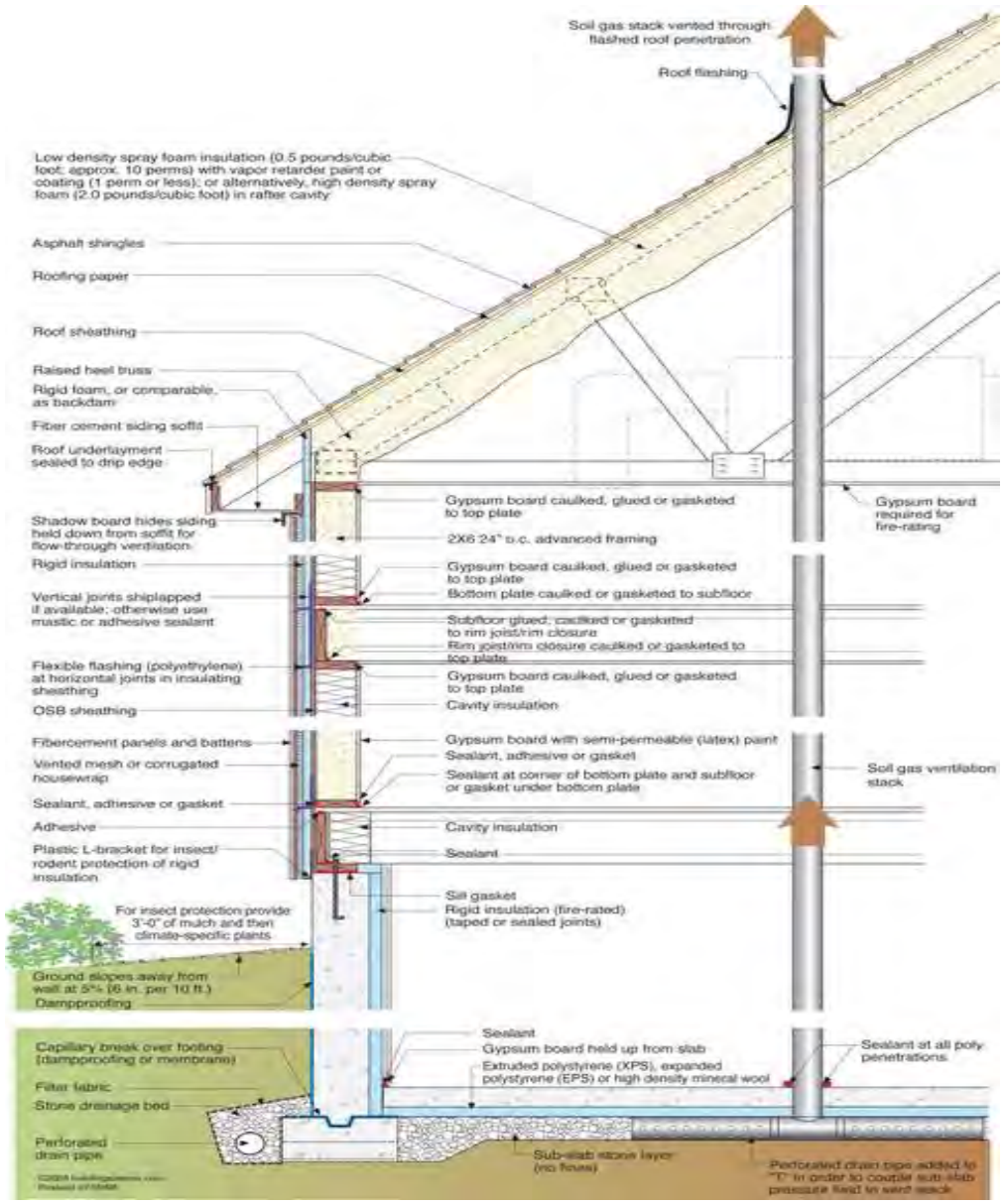
BUILDING EXTERIOR

All sides = Shell or envelope.

Insulate = Thermal break.

Slab – Wall – Roof

Roof – Wall – Slab



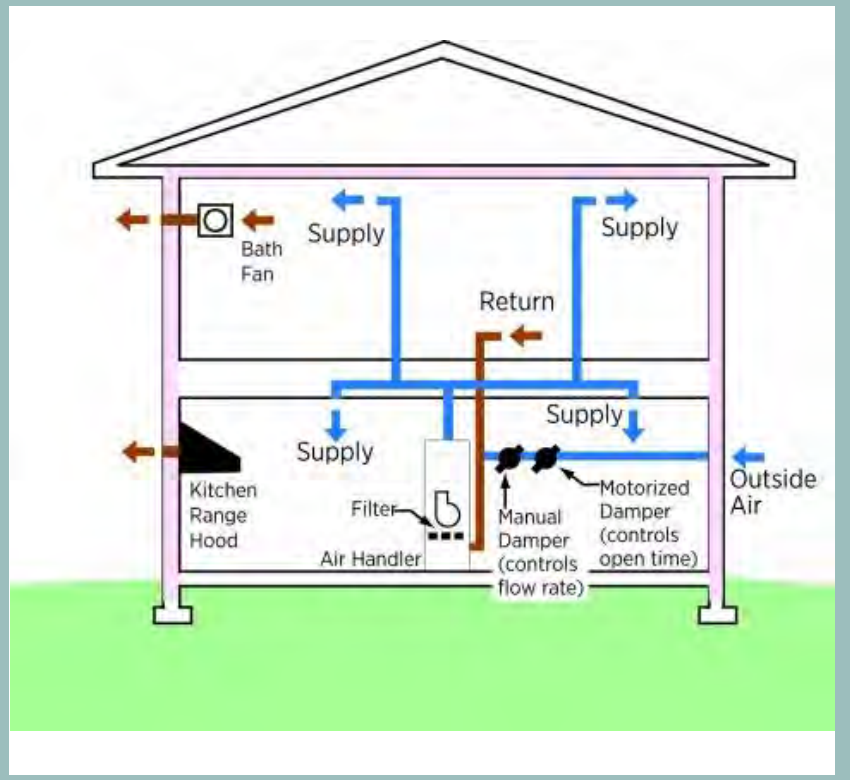
HOW DO WE ADDRESS FRESH AIR SOLUTIONS

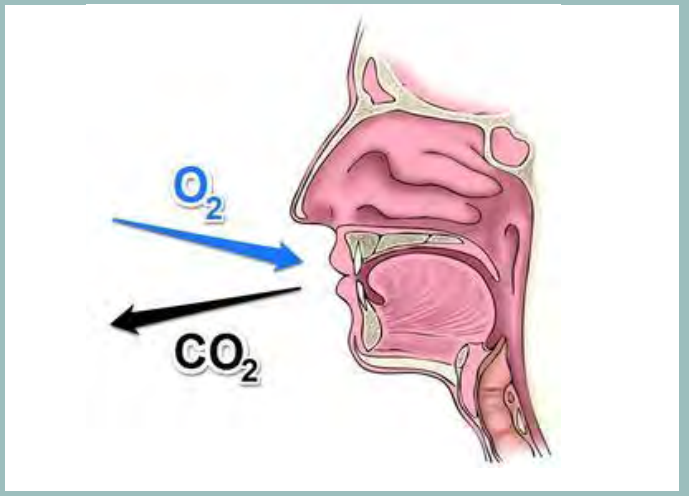
Brief Introduction to Air Quality

INDOOR AIR QUALITY

Why Ventilate?

- Spend more time indoors
- Items brought into our homes – chemicals, plants, pets
- Tighter houses and reduce air infiltration
- Increase comfort and the health of occupants
- Prevent Mold growth opportunities
- Higher expectations of our health and well-being





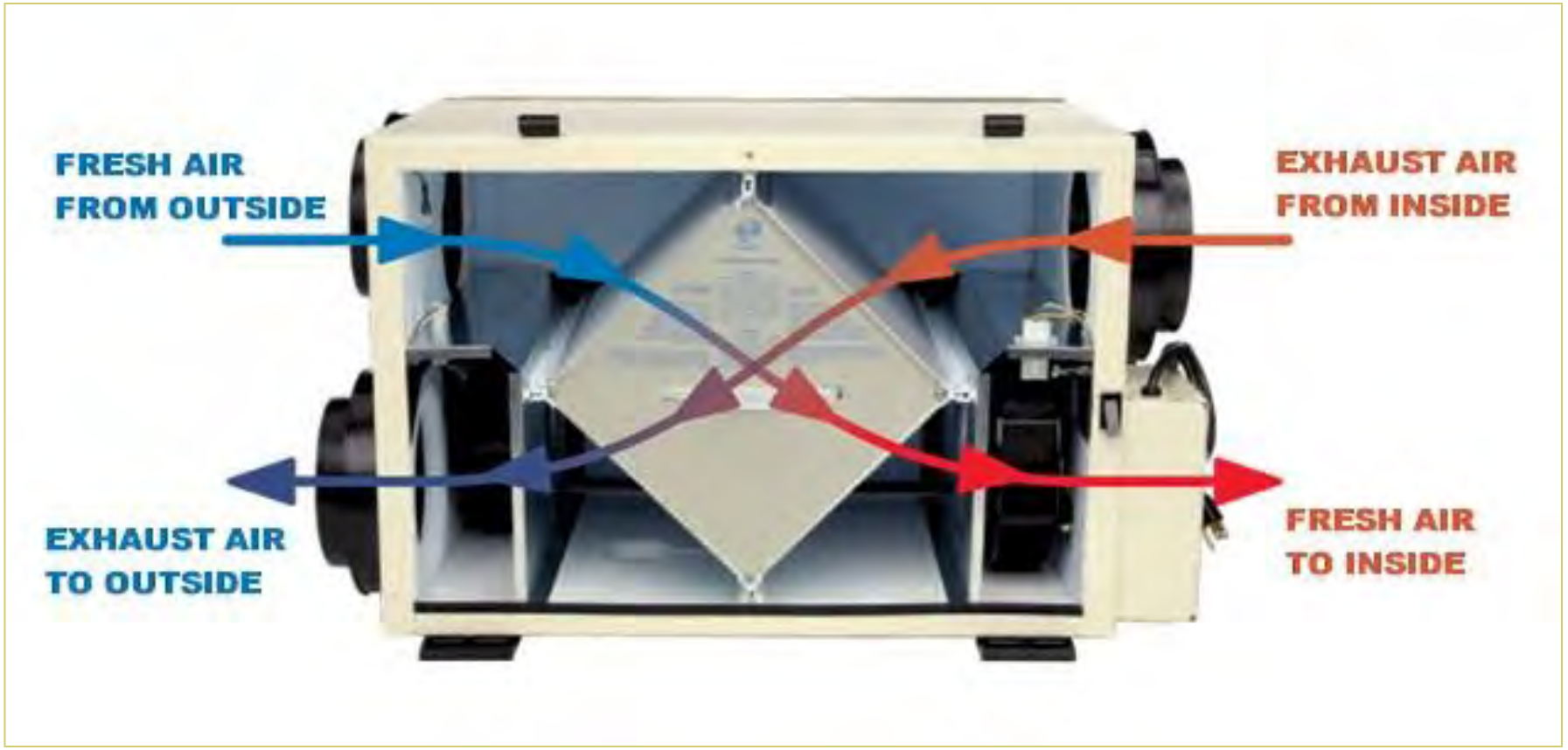
HOW TO VENTILATE?

- Windows
- Exhaust in Kitchen and Bathrooms
- Energy/Heat Recovery Ventilation Systems (ERV/HRV)

INDOOR AIR QUALITY

Heat or Energy Recovery Ventilators (HRV / ERV) “the LUNGS of the Home”

Advancing the Value of Residential Ventilation for Healthier Living
Typically 70% - 80% Efficient



HOW DO WE CREATE HEAT ENERGY

Brief Introduction to Energy Creation

- BATH FAN VENTILATION ($500)
- INTEGRATED HOT WATER
- CONDENSING GAS BOILER + INDIREC TANK + BASEBOARD ($14,000)

BATH FANS

BOILER

DHW

BASEBOARD

PRO	CON
CHEAP NATURAL GAS = INEXPENSIVE	PROPANE = COST SAME AS OIL
STANDARD NEW ENGLAND SYSTEM	NO COOLING
	EXPENSIVE VENTILATION HEAT LOSSES

- GOOD QUALITY HRV / ERV + DUCTWORK ($5,000)
- ELECTRIC RESISTANCE HOT WATER ($1,500)
- 2 - 3 HEAD WALL-MOUNTED MINI-SPLIT ($8,000 - $10,000)

HRV

DHW

HEAT PUMP

PRO	CON
COOLING INCLUDED	COOLING INCLUDED
MINIMAL PLUMBING	EXPENSIVE HOT WATER COSTS, HIGH SOURCE ENERGY
NO SOURCE ENERGY PENALTY FOR ELECTRIC HEATING	EXPOSED WALL MOUNTED HEATING & COOLING
	POINT SOURCE HEATING & COOLING, DISTRIBUTION ISSUES

- TOP QUALITY HRV / ERV + GROUND LOOP ($7,000)
- ELECTRIC RESISTANCE HOT WATER ($1,500)
- ELECTRIC BASEBOARD HEATING ($500)

HRV + PREHEATER

DHW

ELECTRIC

PRO	CON
SIMPLE, VERY FEW MOVING PARTS	ONLY EFFECTIVE WITH PASSIVHAUS BUILDING SHELL
MINIMAL PLUMBING	EXPENSIVE HOT WATER COSTS, HIGH SOURCE ENERGY
QUICK RESPONSE TIME	NO COOLING

RENEWABLE ENERGY

- Installing Solar Photovoltaic (PV) units on a property will produce electrical energy.

- Highly efficient heat pumps and heat pump hot water systems use less electricity.

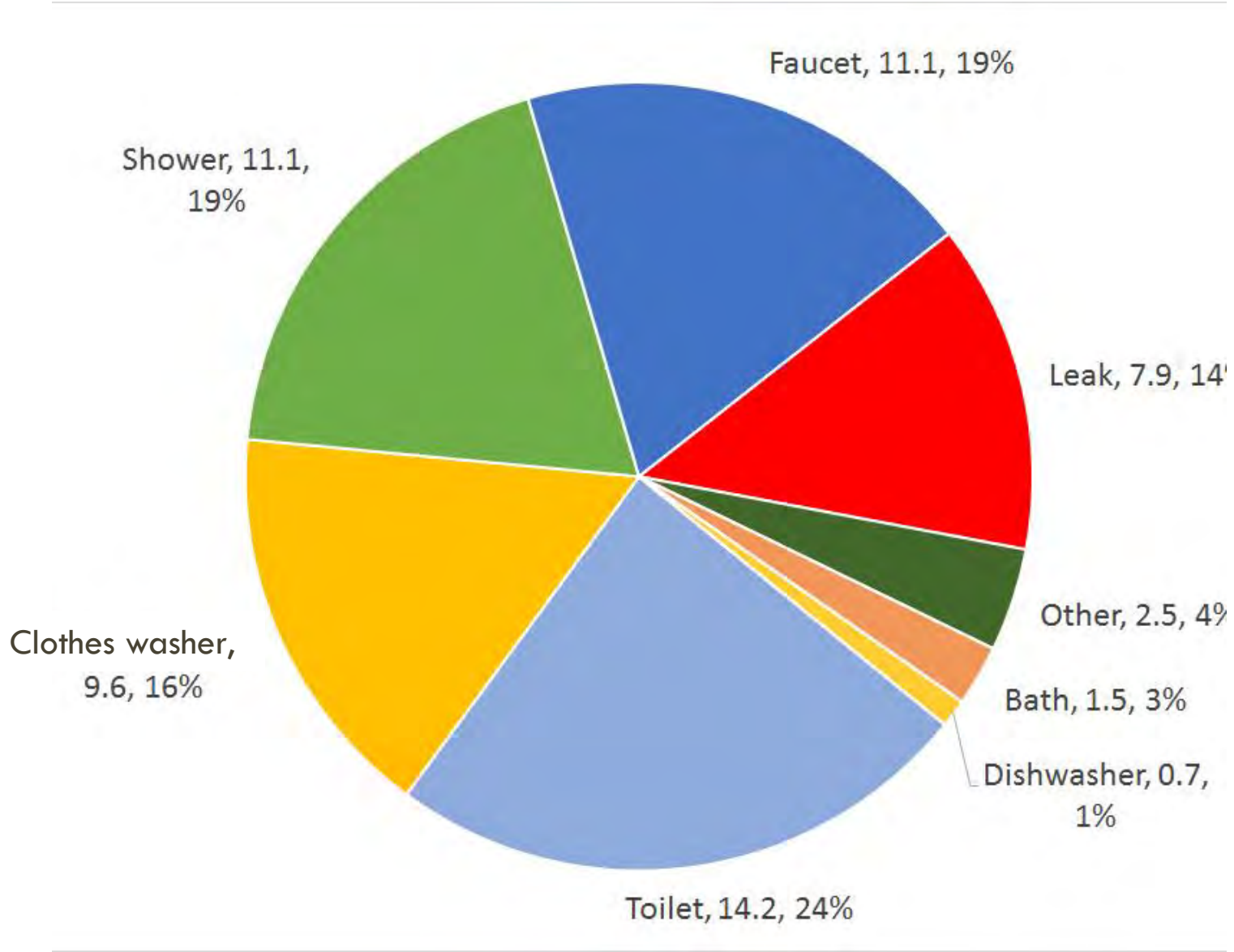
- Average Household use 6,000 – 10,000 KWH per year
- 18 Panels – 27 Panels – 7,800 – 10,800 KWH per year

- Residential Payback on investment 8 -12 years
- Commercial Payback on investment 6 – 10 years

HOW DO WE CREATE DOMESTIC HOT WATER

Brief Introduction to Energy Creation

WATER USAGE


Faucet, 11.1, 19%
Shower, 11.1, 19%
Leak, 7.9, 14
Other, 2.5, 4
Clothes washer, 9.6, 16%
Bath, 1.5, 3%
Dishwasher, 0.7, 1%
Toilet, 14.2, 24%

HOW MUCH WATER DO YOU CONSUME PER DAY ?

Bath	36 Gallons per tub
Showers	2 – 5 Gallons per minute
Brushing Teeth	1 – 2 Gallons per minute
Dishwasher	6 – 16 Gallons per cycle
Washing by Hand	8 – 27 Gallons per meal
Laundry	25 – 40 Gallons load
Toilet Use	1.5 – 3 Gallons per flush
Outdoor use	2 Gallons per minute
Face / Leg Shaving	1 – 2 Gallons per minute
Cooking & Drinking	???

Insta-hot

Combi Boiler

Heat Pump

Tankless DHW

WATER HEATING DEVICES

SOLAR HOT WATER SYSTEMS

Small panel systems pre-heating hot water reduce fuel consumption


ANY
QUESTIONS
?

WHY BUILD HIGH PERFORMANCE BUILDINGS?

Brief Introduction to design approach

TODAYS HOUSING CRITERIA

MEETING THE CHALLENGES

Budget

- ❑ Fixed cost cap financing
- ❑ Rising Labor and Material costs

Nature

- ❑ Exterior Temps Range from **-10° to 90°**+
- ❑ Exterior Humidity Range from **55% - 95%**

Resident

- ❑ Interior Temp Range from **70° to 75°**
- ❑ Interior Humidity Range from **40% - 60%**

Management

- ❑ Properties that reduce Energy Demands
- ❑ Provide Residents with Thermal Comfort

THERMAL COMFORT

ESSENTIAL FACTORS
PASSIVE HOUSE

- Air Temperature
  - Consistent temp range
- Surface Temperatures
  - Radiant Temp between surfaces 7.56*F
- Local Temperature Differences
  - Temp from ankle to head seated 3.6*F
  - Room to Room Temp 1.44*F
- Eliminate Drafts
  - Unwanted heat, cold & moisture
- Relative Humidity of the air
  - Limited moisture content
- Clothing and degree of activity
  - Based on resident personal preferences

THERMAL COMFORT

BUILDING & SYSTEM STRATEGIES
PASSIVE HOUSE

- **Continuous Insulation**
  Walls & Roof =/>R-30 to R-60
  Floor =/>R-11

- **Airtight Barrier**
  Eliminate Thermal Bridging
  =/<0.06/h n50 (blower door test)

- **High Performance Windows**
  SHGC of 45%-55%
  Windows R-7.1 (triple glazed)

- **Heat Recovery Ventilation**
  75% Efficient Heat Recovery
  =\<0.76 W/cfm electricity demand

- **Electrical Appliance**
  Energy Efficient / Energy Star

- **Glazing Design**
  Location & Size
  (larger-southern exposure)

EXAMPLES OF HIGH PERFORMANCE BUILDINGS

Brief introduction of the results

RIDGEWOOD II
2017 NEW CONSTRUCTION
LEED PLATINUM

- Gorham Maine
- Completed in 2017
- 24 Units - Senior housing
- 1 Bldg. 23,026 Gross SF
- Wood Frame Construction
- Electric Baseboard
- Solar Array
- Natural Gas for DHW

PROJECT OUTCOME

- Cost per watt - $0.15
- Cost per therm.- $1.14

- Average Energy Cost –
- $23,358 per year

- Total Unit – 24
- Total Gross SF – 23,026

- Unit Energy Cost –
- $70.74 per month

- Building Energy Usage Cost –
- $0.88 per SF / per year
- $0.07 per SF / per month

2017	USAGE	COST
Nat Gas	2,336	$ 2,663
KWH	140,680	$21,102

2018	USAGE	COST
Nat Gas	2,435	$ 2,776
KWH	117,320	$17,598

- Portland Maine
- Completed in 2017
- 45 Units – Family Housing
- 1 Bldg. 37,815 SF
- Wood Frame Construction
- Electric Baseboard
- Solar Array
- Natural Gas for DHW

BAYSIDE ANCHOR
2017 NEW CONSTRUCTION
PASSIVE HOUSE

PROJECT OUTCOME

- PHPP estimated electricity use – 188,052kWH/YEAR
- Estimated cost at $0.15 - $28,207/YEAR

- PHPP estimated GAS use- 242,438kBTU/YEAR
- Estimated cost at 1.14 therm. - $2,763/YEAR

- Cost per watt - $0.15
- Cost per therm.- $1.14

- Average Energy Cost –
- $32,404 per year

- Total Unit – 45
- Total Gross SF – 37,815

- Unit Energy Cost –
- $69.71 per month

- Building Energy Usage Costs –
- $0.99 per SF / per year
- $0.08 per SF / per month

2017	USAGE	COST
• Nat Gas	2,496	$ 2,845
• KWH	162,120	$24,318

2018	USAGE	COST
• Nat Gas	3,287	$ 3,747
• KWH	225,978	$33,897

1BR (Bedroom)

Heating	$107
Cooking	$ 11
Lighting	$ 32
DHWS	$ 32
Range	$ 9
Fridge	$ 11
Total	$203

Ridgewood II

- Unit Energy Cost –
- $70.74 per month

Allowances for Tenant-Furnished Utilities and Other Services

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

Date: January 1, 2019

Locality: 4,5,6,7

Unit Type: **Low Rise,Walk up, Row,Garden,Townhouse**

Utility or Service	Monthly Dollar Allowances						
	0BR	1BR	2BR	3BR	4BR	5BR	6BR
HEATING							
a. Oil	77	107	140	174	221	247	284
b. Electric	77	102	154	195	222	258	297
c. Natural Gas	46	65	77	87	103	114	127
d. Bottle Gas(Propane)	90	123	159	192	246	282	324
e. Wood	38	51	67	81	94	110	138
f. Kerosene	89	124	162	201	255	286	328
g. Electric(heat pump)**Other/Other**	36	43	51	57	63	70	75
AIR CONDITIONING							
COOKING							
a. Electric	9	11	14	18	24	28	30
b. Natural Gas	5	6	8	9	12	14	15
c. Bottle Gas(Propane)	16	19	25	30	38	44	49
OTHER ELECTRIC LIGHTING REFRIGERATION, ETC.	24	32	42	52	64	75	80
WATER HEATING							
a. Oil	27	33	43	55	70	79	91
b. Electric	30	41	54	67	86	99	105
c. Natural Gas	17	23	29	36	45	53	60
d. Bottle Gas(Propane)	41	46	60	74	96	109	126
WATER	11	13	17	21	25	29	34
SEWER	13	15	20	25	30	35	40
TRASH COLLECTION	27	27	27	27	27	27	27
RANGE	9	9	9	9	9	9	9
REFRIGERATOR	11	11	11	11	11	11	11

ACTUAL FAMILY ALLOWANCES
(To be used by family to compute allowance)

Name of Family

Address of Unit

Number of Bedrooms

Utility or Service	Per Month
Heating	
Air Conditioning	
Cooking	
Other Electric	
Water Heating	
Water	
Sewer	
Trash Collection	
Range	
Refrigerator	
Other	
TOTAL	

2 BR (Bedroom)

Heating	$154
Cooking	$ 14
Lighting	$ 42
DHWS	$ 54
Range	$ 9
Fridge	$ 11
Total	$284

Bayside Anchor

- Unit Energy Cost –
- $69.71 per month

WHAT IS THE COST DIFFERENCE FOR A HIGH PERFORMANCE BUILDING

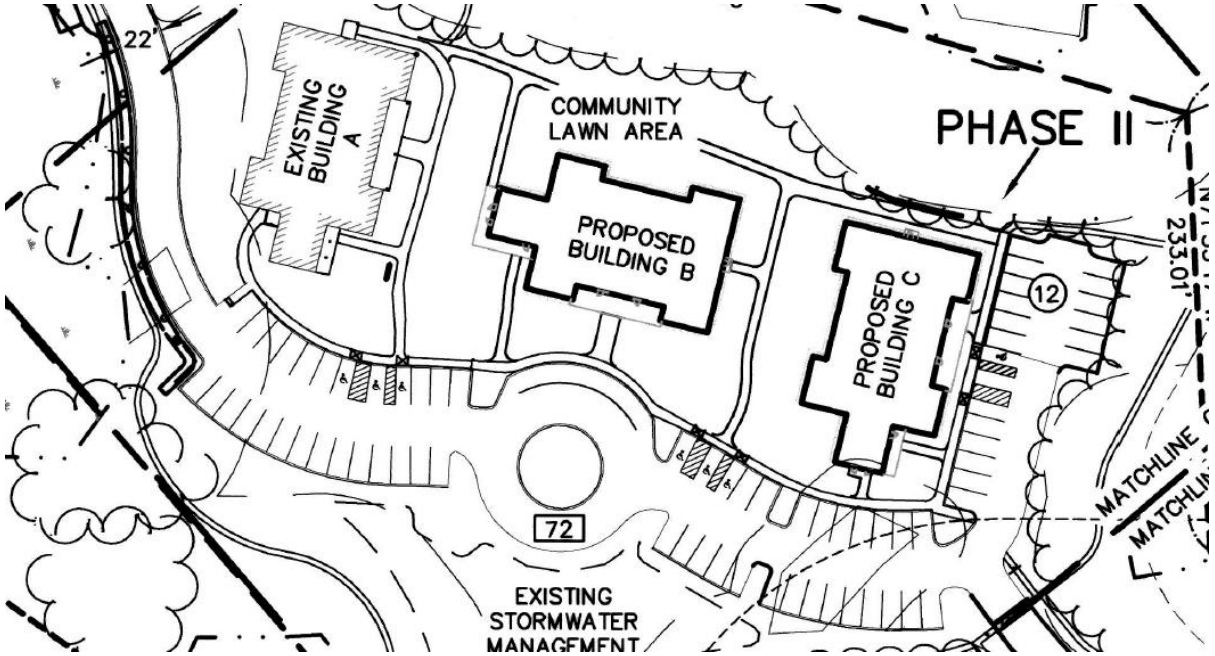
Brief introduction into The Meadows

THE MEADOWS AT GRAPEVINE RUN

2017 New Construction – code compliant – Red
2019 New Construction – passive house – Blue

- Constructed in 2017
- (1) 24 Unit housing in Hampton Falls
- 1 Bldg. 20,290 SF
- Slab on grade wood structure
- Central Boiler system – Baseboard fixtures
- Propane Fuel

- Completion in 2019
- (2) 24 Unit housing in Hampton Falls
- 2 Bldgs. 20,290 SF Each
- Slab on grade wood structure
- Heat Pump Heating, Cooling & DHW
- Electric Fuel Source


22'
EXISTING BUILDING A
COMMUNITY LAWN AREA
PROPOSED BUILDING B
PROPOSED BUILDING C
PHASE II
233.01'
12
72
MATCHLINE
EXISTING STORMWATER MANAGEMENT


ZIP system


ZIP system

THE MEADOWS AT GRAPEVINE RUN

Project: Meadows One		Date: 8/15/16
SCHEDULE OF VALUES		
Location: Hampton Falls, NH		
Description	**Total Cost**	
General labor	$	83,200.00
Construction layout	$	5,000.00
Final clean	$	7,463.00
Rubbish removal	$	14,700.00
Site improvements	$	2,400.00
Foundation	$	56,235.00
Flatwork	$	62,707.00
Masonry	$	23,279.00
Metal fabrications	$	11,340.00
Rough carpentry, roofing, siding	$	535,214.00
Homasote Layer	$	15,000.00
Finish carpentry & cabinetry	$	151,575.00
Insulation	$	88,240.00
Gutters & downspouts	$	8,000.00
Snowguards	$	6,660.00
Roof hatch	$	1,500.00
Access doors	$	3,600.00
Firestopping	$	5,000.00
Windows	$	35,851.00
Storefront/glass	$	16,310.00
Doors and hardware	$	101,611.00
Drywall	$	163,950.00
Flooring	$	82,163.00
Acoustic ceiling	$	12,317.00
Painting	$	49,495.00
Specialties/FRP	$	42,947.00
Appliances	$	37,589.00
Window treatment	$	5,946.00
Fire protection *	$	210,283.00
Elevator	$	77,860.00
Plumbing	$	185,000.00
HVAC	$	348,543.00
Electrical	$	409,017.00
Solar Electric Photovoltaic (PV)	$	0.00
Construction equipment	$	10,000.00
Winter Conditions	$	26,000.00
Total		**2,895,995.00**

Project: Meadows Two		Date: 9/5/18
SCHEDULE OF VALUES		
Location: Hampton Falls, NH		
Description	**Total Cost**	
General labor	$	0.00
Construction layout	$	0.00
Final clean	$	0.00
Rubbish removal	$	10,000.00
Site improvements	$	2,400.00
Foundation	$	58,500.00
Flatwork	$	53,214.00
Masonry	$	20,592.00
Metal fabrications	$	4,500.00
Rough carpentry, roofing, siding	$	422,092.00
Homasote Layer (gypcrete)	$	15,706.00
Finish carpentry & cabinetry	$	281,417.00
Insulation	$	369,094.00
Gutters & downspouts	$	0.00
Snowguards	$	0.00
Roof hatch	$	0.00
Access doors	$	3,000.00
Firestopping	$	0.00
Windows	$	57,106.00
Storefront/glass	$	12,800.00
Doors and hardware	$	158,351.00
Drywall	$	285,750.00
Flooring	$	122,771.00
Acoustic ceiling	$	14,900.00
Painting	$	49,748.00
Specialties/FRP	$	30,248.00
Appliances	$	38,803.00
Window treatment	$	13,250.00
Fire protection *	$	51,960.00
Elevator	$	72,600.00
Plumbing	$	185,000.00
HVAC	$	381,000.00
Electrical	$	405,875.00
Solar Electric Photovoltaic (PV)	$	0.00
Construction equipment	$	0.00
Winter Conditions	$	30,000.00
Total		**3,150,677.00**

ANSWER THE QUESTIONS

Can we prove that high performance buildings work?

Is it worth the money?

Can we display the findings in dollars and cents (sense)?

ENERGY PERFORMANCE

BENCHMARKING TOOLS & SERVICES

	Operational Metrics - 2018												
	Consumption Data - 2018												
Property	# Residents (Dec 2018)	Electricity - Total (KWH)	Total Per SQ Foot	Per Unit	PUPM	Fuel (Therm	Per SQ Foot	Per Unit	Water (gal)	Per SQ Foot	Per Unit	Gal/Person (Annual)	Gal/Person (Day)
Meeting Place 3	19	36,400	0.94	847	71	259	0.01	6	65,000	1.68	1,512	3,421	9
Blackstone II	22	59,912	4.10	3,328	277		0.00	0	235,000	16.09	13,056	10,682	29
Meadows 1	26	188,325	8.69	7,847	654	4,411	0.20	184		0.00	0	0	0
Carleton Street	46	64,356	2.38	1,739	145	12,993	0.48	351	530,000	19.64	14,324	11,522	32
Bartlet Woods	34	110,700	4.58	3,954	329	5,763	0.24	206	456,000	18.88	16,286	13,412	37
Bayside Anchor	57	224,943	5.95	4,999	417	3,274	0.09	73	836,000	22.11	18,578	14,667	40
Butler Building	46	185,785	11.11	3,318	276	21,860	1.31	390	761,000	45.50	13,589	16,543	45
Huston Commons	29	146,805	6.87	4,894	408	11,041	0.52	368	637,000	29.80	21,233	21,966	60
Payson Building	20	72,117	4.31	1,288	107	15,172	0.91	271	249,000	14.89	4,446	12,450	34
409 Cumberland	61	159,803	2.84	2,804	234	17,919	0.32	314	1,462,000	25.97	25,649	23,967	66
Meeting Place 1	61	27,097	0.76	695	58	29,768	0.83	763	1,081,000	30.21	27,718	17,721	49
Ridgewood II	28	117,320	5.10	4,888	407	2,435	0.11	101	375,000	16.29	15,625	13,393	37
Thomas Heights	18	102,565	7.62	5,698	475	5,659	0.42	314	271,000	20.15	15,056	15,056	41
Young Street	35	132,760	5.19	4,741	395	3,632	0.14	130	1,509,000	58.96	53,893	43,114	118
Pearl Street II	121	126,129	3.49	2,336	195	31,648	0.88	586	1,506,000	41.69	27,889	12,446	34
Cascade Brook	34	190,373	6.50	6,346	529	11,036	0.38	368	580,000	20	19,333	17,059	47
Emery School	29	83,303	3.06	3,471	289	10,337	0.38	431	565,000	20.73	23,542	19,483	53
Meeting Place 6	28	56,858	1.45	2,187	182	1,329	0.03	51	320,000	8.18	12,308	11,429	31
Oak Street Lofts	38	74,570	2.95	2,015	168	12,496	0.49	338	1,941,000	76.83	52,459	51,079	140
Park Street Apartments	36	153,375	3.95	5,113	426	11,744	0.30	391	485,000	12.50	16,167	13,472	37
Florence House	25	396,752	12.66	15,870	1,323	17,903	0.57	716	2,109,000	67.28	84,360	84,360	231
Pearl Place	86	136,362	4.68	2,273	189	31,648	1.09	527	2,994,000	102.69	49,900	34,814	95
Logan Place	30	78,965	4.29	2,632	219	13,351	0.73	445	1,120,000	60.85	37,333	37,333	102

ENERGY PERFORMANCE

BENCHMARKING TOOLS & SERVICES

AVESTA HOUSING - NEW CONSTRUCTION 2005 - 2017											
Property	C.O. Yea	Resident Type	Number Unit	Gross Floor Area	Total MMBTU	MMBTU / Uni	MMBTU / Sq. F	Total Operating Costs (elec, heat, water)	Total Operating Costs/Ur	Total Operating Costs / Sq. I	Building Design
Bartlet Woods	2017	Senior	28	24,147	954	34	0.040	$23,175	$828	$0.96	High Performance
Carleton Street	2017	Family	37	26,986	1,519	41	0.056	$24,465	$661	$0.91	High Performance
Bayside Anchor	2016	Family	45	37,815	1,095	24	0.029	$37,474	$833	$0.99	Passive Design
Huston Commons	2016	Housing First	30	21,375	1,605	53	0.075	$34,607	$1,154	$1.62	Code Compliance
Ridgewood II	2015	Senior	24	23,026	644	27	0.028	$20,374	$849	$0.88	LEED
Young Street	2015	Senior	28	25,594	816	29	0.032	$24,127	$862	$0.94	High Performance
409 Cumberland	2015	Family	57	56,286	2,337	41	0.042	$44,398	$779	$0.79	High Performance
Thomas Heights	2015	Housing First	18	13,452	916	51	0.068	$21,836	$1,213	$1.62	Code Compliance
Meeting Place 1	2015	Family	39	35,780	3,069	79	0.086	$38,000	$974	$1.06	Code Compliance
Pearl Street II	2013	Family	54	56,764	3,594	67	0.063	$54,998	$1,018	$0.97	Code Compliance
Oak Street Lofts	2012	Family	37	25,263	1,504	41	0.060	$25,431	$687	$1.01	LEED
Cascade Brook	2012	Senior	30	29,278	1,753	58	0.060	$47,096	$1,570	$1.61	Code Compliance
Florence House	2010	Housing First	25	31,345	3,144	126	0.100	$79,922	$3,197	$2.55	Code Compliance
Pearl Place	2007	Family	60	65,279	3,629	60	0.056	$56,533	$942	$0.87	LEED
Fore River Apartments	2006	Family	20	20,189	1,272	64	0.063	$21,473	$1,074	$1.06	Code Compliance
Little Falls Landing	2006	Senior	24	20,805	1,766	74	0.085	$32,917	$1,372	$1.58	Code Compliance
Logan Place	2005	Housing First	30	18,407	1,604	53	0.087	$27,065	$902	$1.47	Code Compliance

ENERGY PERFORMANCE

BENCHMARKING TOOLS & SERVICES

AVESTA HOUSING - NEW CONSTRUCTION 2005 - 2017											
Property	C.O. Yea	Resident Type	Number Unit	Gross Floor Area	Total MMBTU	MMBTU / Uni	MMBTU / Sq. F	Total Operating Costs (elec, heat, water)	Total Operating Costs/Ur	Total Operating Costs / Sq. I	Building Design
Ridgewood II	2015	Senior	24	23,026	644	27	0.028	$20,374	$849	$0.88	LEED
Bayside Anchor	2016	Family	45	37,815	1,095	24	0.029	$37,474	$833	$0.99	Passive Design
Young Street	2015	Senior	28	25,594	816	29	0.032	$24,127	$862	$0.94	High Performance
Bartlet Woods	2017	Senior	28	24,147	954	34	0.040	$23,175	$828	$0.96	High Performance
409 Cumberland	2015	Family	57	56,286	2,337	41	0.042	$44,398	$779	$0.79	High Performance
Pearl Place	2007	Family	60	65,279	3,629	60	0.056	$56,533	$942	$0.87	LEED
Carleton Street	2017	Family	37	26,986	1,519	41	0.056	$24,465	$661	$0.91	High Performance
Oak Street Lofts	2012	Family	37	25,263	1,504	41	0.060	$25,431	$687	$1.01	LEED
Cascade Brook	2012	Senior	30	29,278	1,753	58	0.060	$47,096	$1,570	$1.61	Code Compliance
Fore River Apartments	2006	Family	20	20,189	1,272	64	0.063	$21,473	$1,074	$1.06	Code Compliance
Pearl Street II	2013	Family	54	56,764	3,594	67	0.063	$54,998	$1,018	$0.97	Code Compliance
Thomas Heights	2015	Housing First	18	13,452	916	51	0.068	$21,836	$1,213	$1.62	Code Compliance
Huston Commons	2016	Housing First	30	21,375	1,605	53	0.075	$34,607	$1,154	$1.62	Code Compliance
Little Falls Landing	2006	Senior	24	20,805	1,766	74	0.085	$32,917	$1,372	$1.58	Code Compliance
Meeting Place 1	2015	Family	39	35,780	3,069	79	0.086	$38,000	$974	$1.06	Code Compliance
Logan Place	2005	Housing First	30	18,407	1,604	53	0.087	$27,065	$902	$1.47	Code Compliance
Florence House	2010	Housing First	25	31,345	3,144	126	0.100	$79,922	$3,197	$2.55	Code Compliance

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Bartlet Woods	2017	Senior	28	24,147	954	34	0.040	$23,175	$828	$0.96	High Performance
Bayside Anchor	2016	Family	45	37,815	1,095	24	0.029	$37,474	$833	$0.99	Passive Design
Ridgewood II	2015	Senior	24	23,026	644	27	0.028	$20,374	$849	$0.88	LEED
Young Street	2015	Senior	28	25,594	816	29	0.032	$24,127	$862	$0.94	High Performance
Logan Place	2005	Housing First	30	18,407	1,604	53	0.087	$27,065	$902	$1.47	Code Compliance
Pearl Place	2007	Family	60	65,279	3,629	60	0.056	$56,533	$942	$0.87	LEED
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Thomas Heights	2015	Housing First	18	13,452	916	51	0.068	$21,836	$1,213	$1.62	Code Compliance
Little Falls Landing	2006	Senior	24	20,805	1,766	74	0.085	$32,917	$1,372	$1.58	Code Compliance
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SUMMATION OF HIGH PERFORMANCE BUILDINGS

EXCEED EXPECTATIONS

Budget
- ❑ Modest increase of 3%-5% first costs

Nature
- ❑ Create more resilient buildings

Resident
- ❑ Residents receive thermal comfort

Management
- ❑ Building can save operations Money
- ❑ Building can reduce Energy consumption
- ❑ Building can reduce or eliminate Carbon output

CONCLUSION

- Comfort is a primary objective in providing exceptional housing to residents
- The better the envelope the simpler the mechanical systems
- 5% cost increase – 50% reduction in expenses – 100% reduction in carbon emission
- Buildings are more resilient to weather, water and air infiltration
- Management can focus on resident needs and less on building needs
- Buildings can be constructed with standard and accessible materials


ANY
QUESTIONS