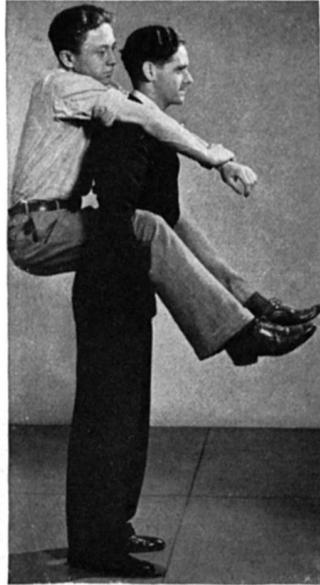


High Performance **Buildings**

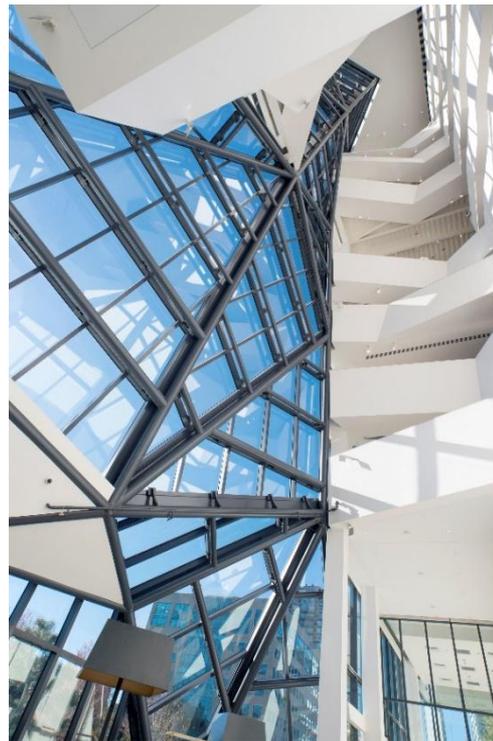
- Everything else probably matters more!



Education First



- Cambridge, MA
- 302,000 ft², 10 floors
- UFAD w/ perimeter fan-coil system
- Radiant slabs
- 34% savings from ASHRAE baseline



Tata Hall – Harvard Business School



- Boston, MA
- 153,700 ft², 7 floors
- LEED Platinum
- 43% savings from ASHRAE baseline
- Displacement ventilation
- Perimeter radiation
- 4-pipe fan-coil system

High Performance HVAC Systems

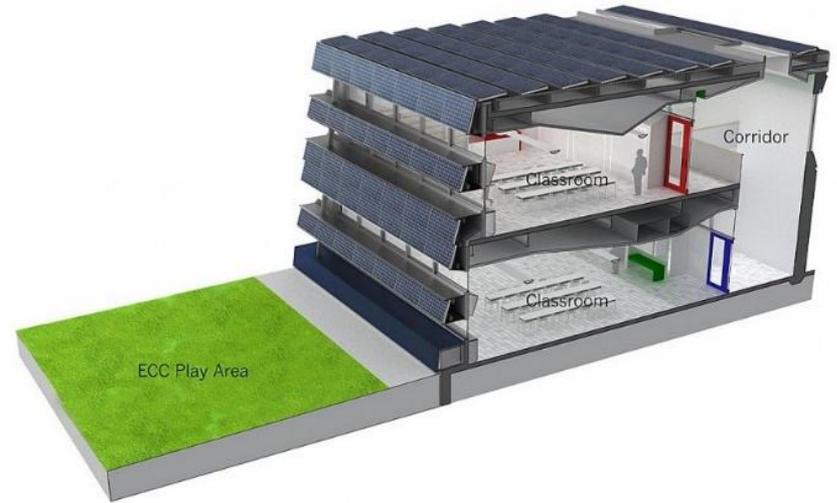
- Worst case vs. the other 8758 hours
- Full load vs. real loads
(capability vs. reality)
- Effective vs. efficient

Net Zero Typology

California Cool



Passivhaus Parti



Camden Friends, Camden, DE



- NESEA Zero Net Energy Award 2011
- LEED Platinum
- EUI = 8.0 kbtu/sf/year
- Closed loop, ground coupled geothermal heating & cooling
- Radiant slabs
- Mixed-mode ventilation
- Energy recovery

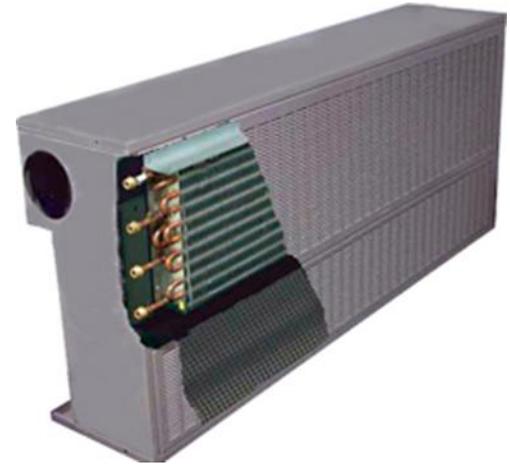
PS62 Elementary School

- Staten Island, NY – 65,000 ft²
- Net Zero School & LEED Platinum (equivalent)
- Grades PK-5, 344 students
- EUI – 29 kbtu/sf/year
- Operating Hours: M-F 7:30 am – 6:00 pm (year round school use + additional community use)



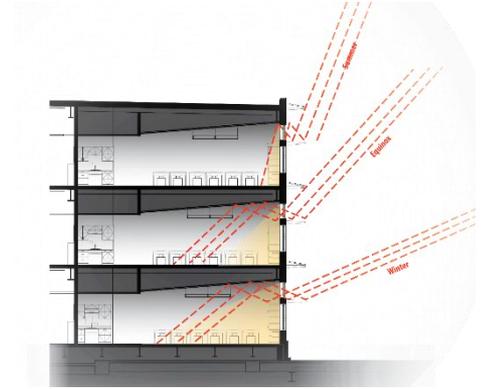
PS62 Elementary School

- Closed loop, ground coupled geothermal heating & cooling
- Induction/Displacement HVAC units in classrooms
- Demand control ventilation
- Energy recovery



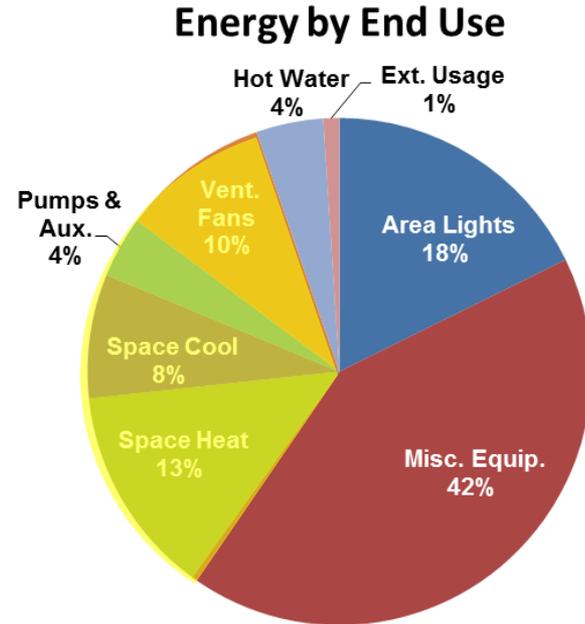
MLK School

- Cambridge, MA - 165,000 ft²
- Low Energy School (Not NZE)
- Grades PK-8, 750 Students
- EUI – 35 kbtu/sf/year
- Operating Hours: 7:00 am – 10:00 pm (7 day/week, year round school + community use)



MLK School

- Hybrid closed loop, ground coupled geothermal heating & cooling with gas boilers
- Water-to-air heat pumps
- Demand control ventilation
- Energy recovery



HVAC= 35% annual energy

Lessons Learned

- Just because it is possible, doesn't mean people will accept it.
- High performance through simplification, not complication.
- Real performance is defined by the occupants, not the designer.