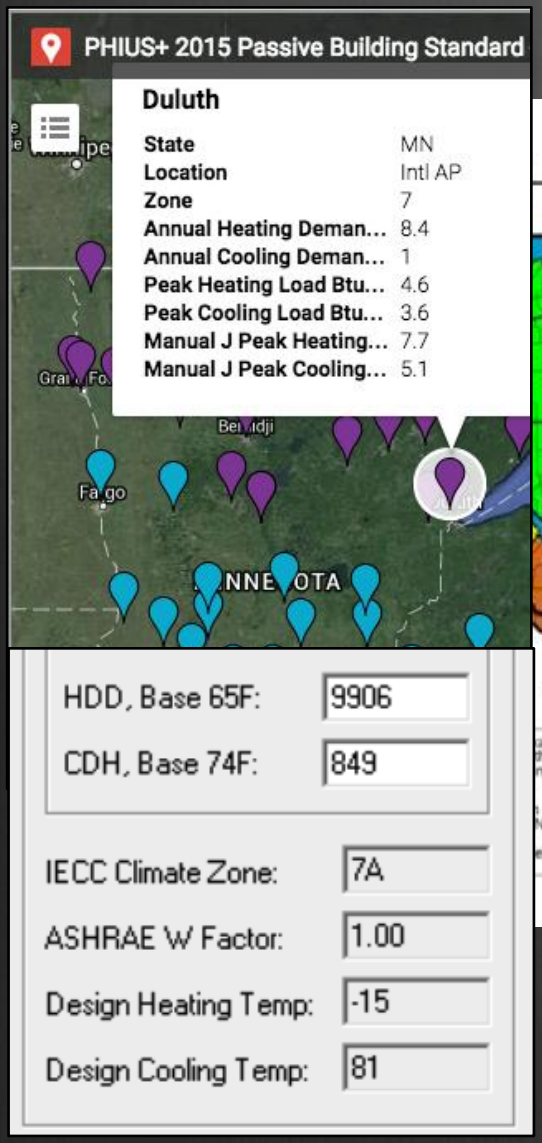
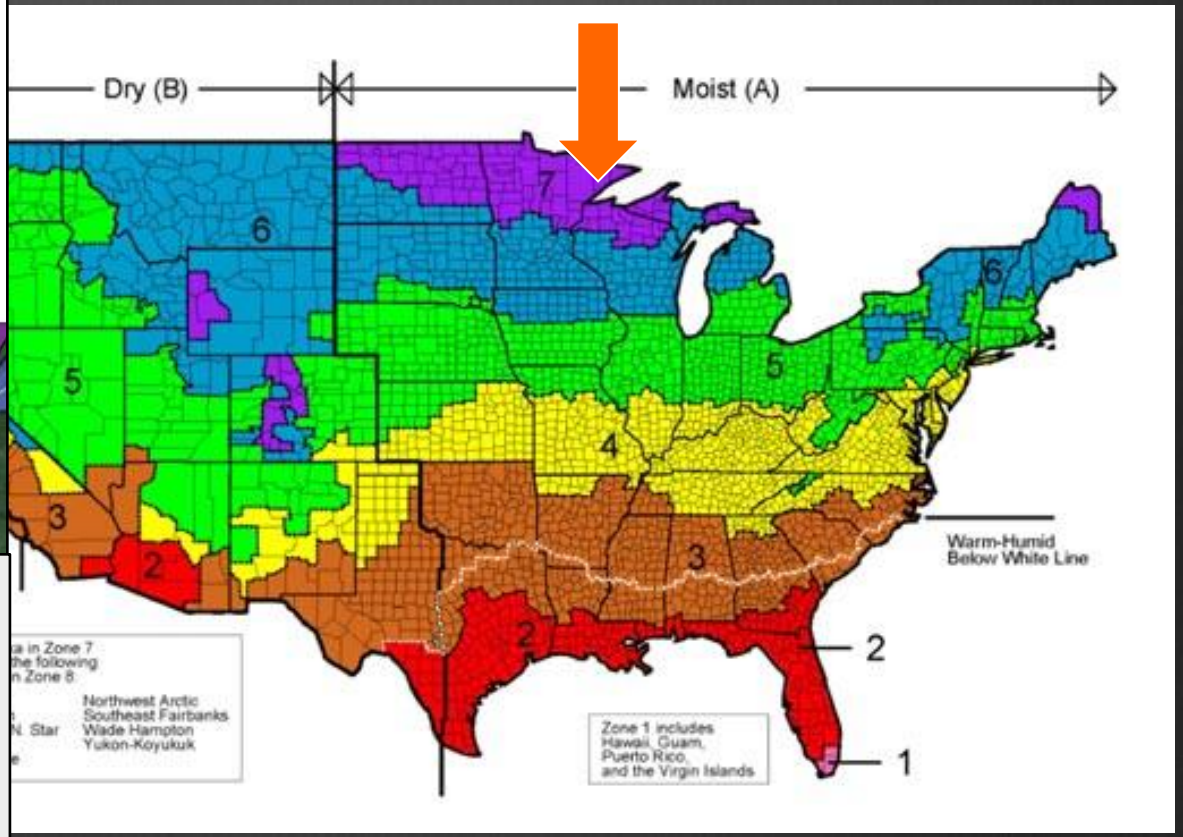
How We Sleep at Night in Climate Zone 7

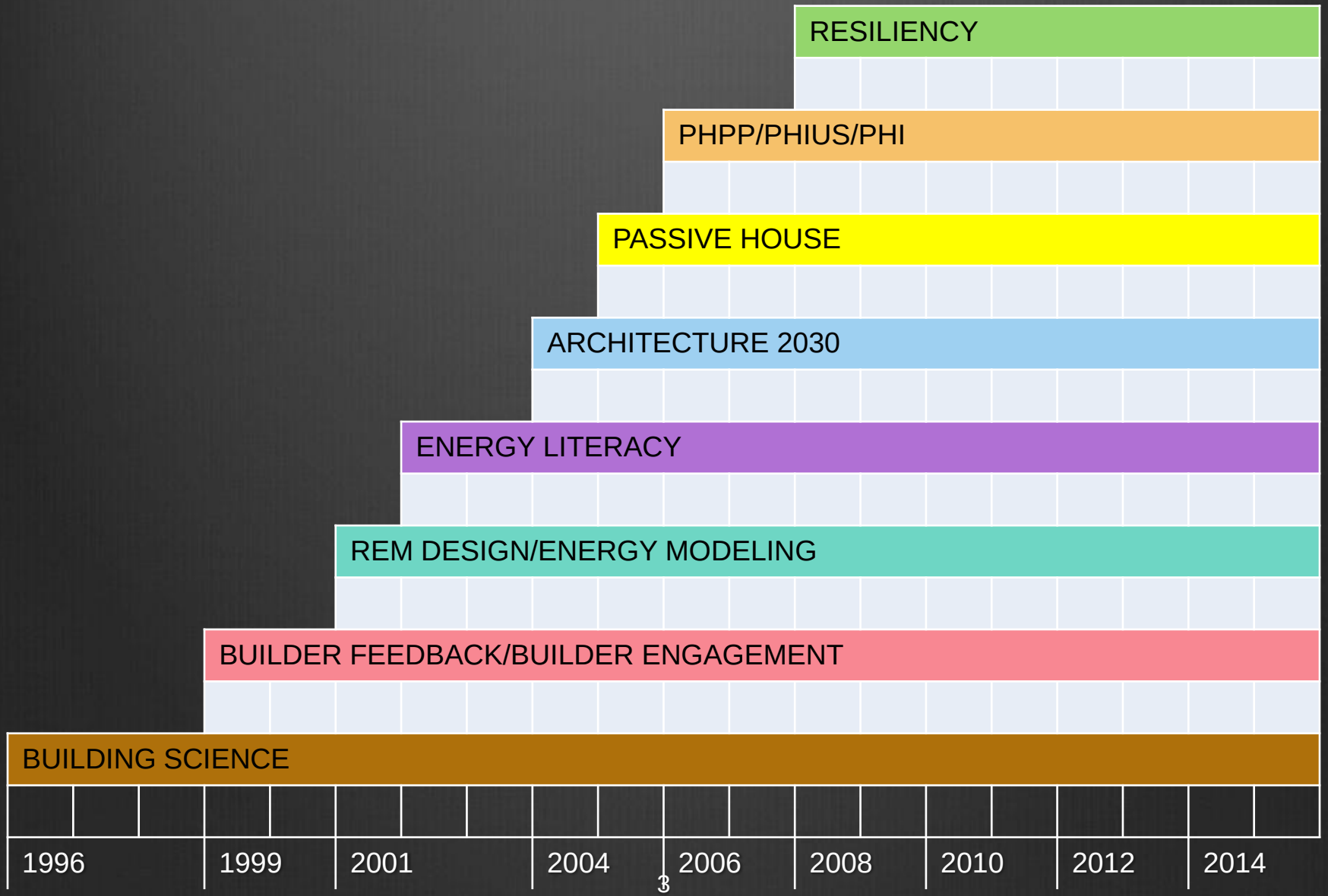


Where I live and work



Harsh weather, lots of remote areas, low population density.
Culture of resourcefulness.

How Did We Get Here?



Appropriate Metrics?

	E's House	Cornett House	Code
Under Slab	35	27	10/15
Above grade walls	21 cav/28 c.i.	34 cav/11 c.i.	21 cav
Windows (U)	.16-.18	.2	0.3
Roof	80	70	49
ACH50	.23	.8	3
Conditioned area	1575 ft2	2330 ft2	n/a
Peak Heating Load	12,700 Btu/hr	17,600 Btu/hr	n/a
Peak Load/ft2	8 Btu/hr/ft2	7.5 Btu/hr/ft2	(~16)
AHD	17.2 MMBtu	26.8 MMBtu	
AHD/ft2	10.9 Kbtu/ft2/yr	11.5 kBtu/ft2/yr	(~30)
Floors above grade	1	2	
# occupants	2	3	

Note: Loads modeled with REMDesign. “”Code” estimated peak load/ft2 and AHD/ft2 is an average for a 2000 ft2 home.

Real Energy Use

Esko Farmhouse
2 stories + basement
2690 ft2 conditioned space
Built 2009

Total annual energy 13,800 kWh*

3000 kWh/yr avg. elec heating energy
3.8 kBtu/ft2/yr + ~ 1 cord dry aspen
* Includes shop, garage, chicken house, food production.

Cornett House
2 stories slab on grade + sunspace
2,330 ft2 conditioned space
Built 2014

Total annual energy 6,550 kWh

Estimate 3500 kWh electrical heating energy in first year of operation
5.1 kBtu/ft2/yr + 2 cords damp oak

RESILIENCY

E's House
no heat/unoccupied
February 28-29, 2016

Surface Temp	5:30 pm/18 degrees F	6:30 am/3 degrees F
Living Room Floor	56.7	55.5
Living Room Ceiling	59.6	54.3
SW corner, low	54.5	53.1
NE corner, entry door	49.7	51.5
Interior, south glass	59.1	47.9

Balancing Enclosure and Systems

- Invest in the envelope: enough to manage AHD, occupant comfort, building durability, and resiliency.
- Get design and peak loads compatible with simpler space conditioning systems.
- Recognize that the cost of building (enclosure) is going up but the cost of PV is going down.
- Efficient technologies (HPWH, ASHP, monitoring systems) are getting better (and different) faster.
- Don’t overinvest in initial systems.
- Design so that equipment and systems can be upgraded.

“In the beginner’s mind there are many possibilities, but in the expert’s there are few.”

- Shunryu Suzuki (1904-1971)

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