

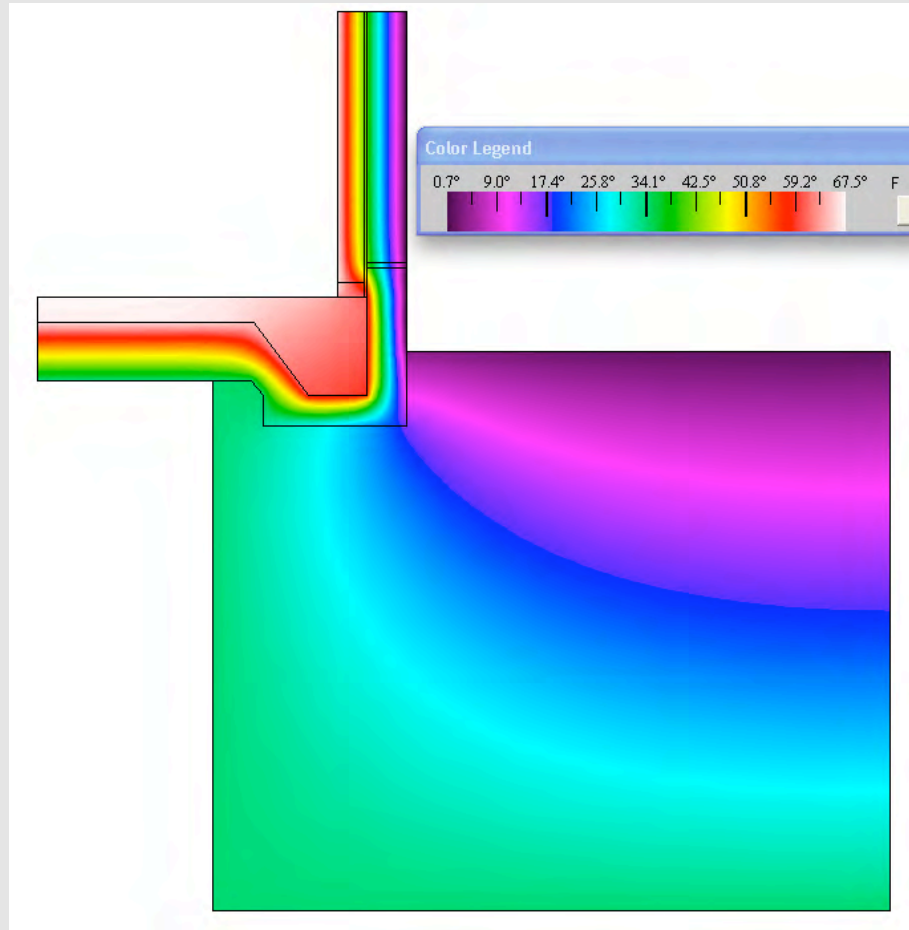
Introduction to Passive House

- Passivhaus is a German concept that combines very high levels of superinsulation with passive solar gain and fresh air distribution to achieve extremely low heating loads and aims at total energy usage levels that are justifiable when viewed through the lens of climate stabilization.
- Criteria are:
 - $<15 \text{ kWh/m}^2/\text{yr}$ heating load ($4.75 \text{ kBTU/ft}^2/\text{yr}$)
 - $<15 \text{ kWh/m}^2/\text{yr}$ cooling load
 - $<120 \text{ kWh/m}^2/\text{yr}$ total primary energy ($38 \text{ kBTU/ft}^2/\text{yr}$)
 - $<0.6 \text{ ACH}_{50}$

- Because the criteria are universal, it is challenging to build a PH in northern New England (but there are two in northern MN so it's not impossible)
- Because the criteria are based on treated floor area, it is more challenging to meet them with a smaller house
- Criteria for heating and cooling are based on the modeled loads of the house, not the consumption
- Treated floor area is the net usable floor area
- In Germany, the concept is that the loads are so low that heating load can be met by adding heat to the ventilation air, thereby dropping out a separate heating system

What appeals about Passive House is that it has defined targets - this is different than US-based approaches

- Houses designed to be PHs are analyzed in PHPP, a spreadsheet with over 30 tabs that describes the house in excruciating detail.
- There is a maximum allowable thermal bridge value before the condition must be included as a separate heat loss entry.

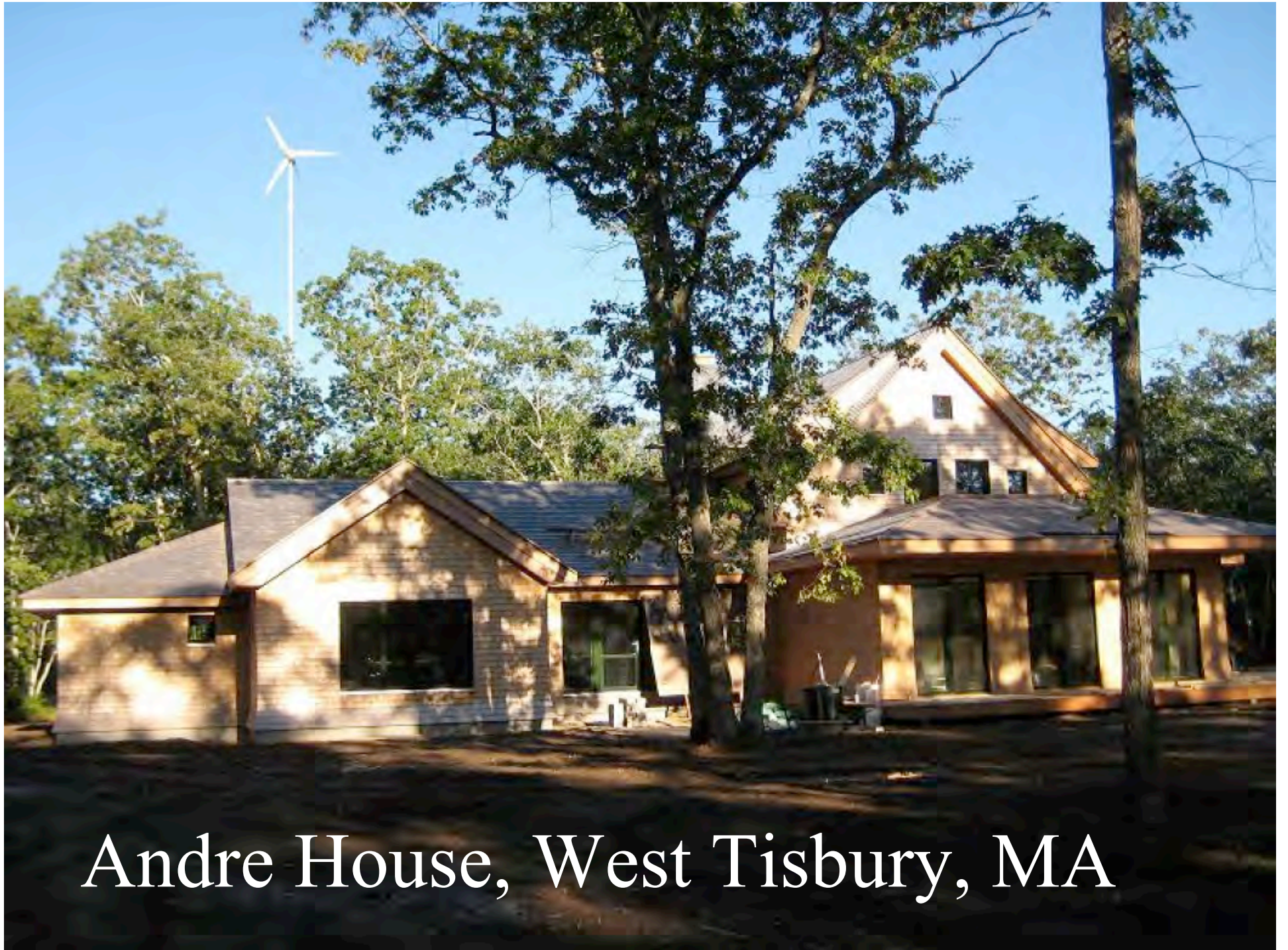


Passivhaus Development in Ulm, Germany



Kat Klingenberg's House, Urbana, IL

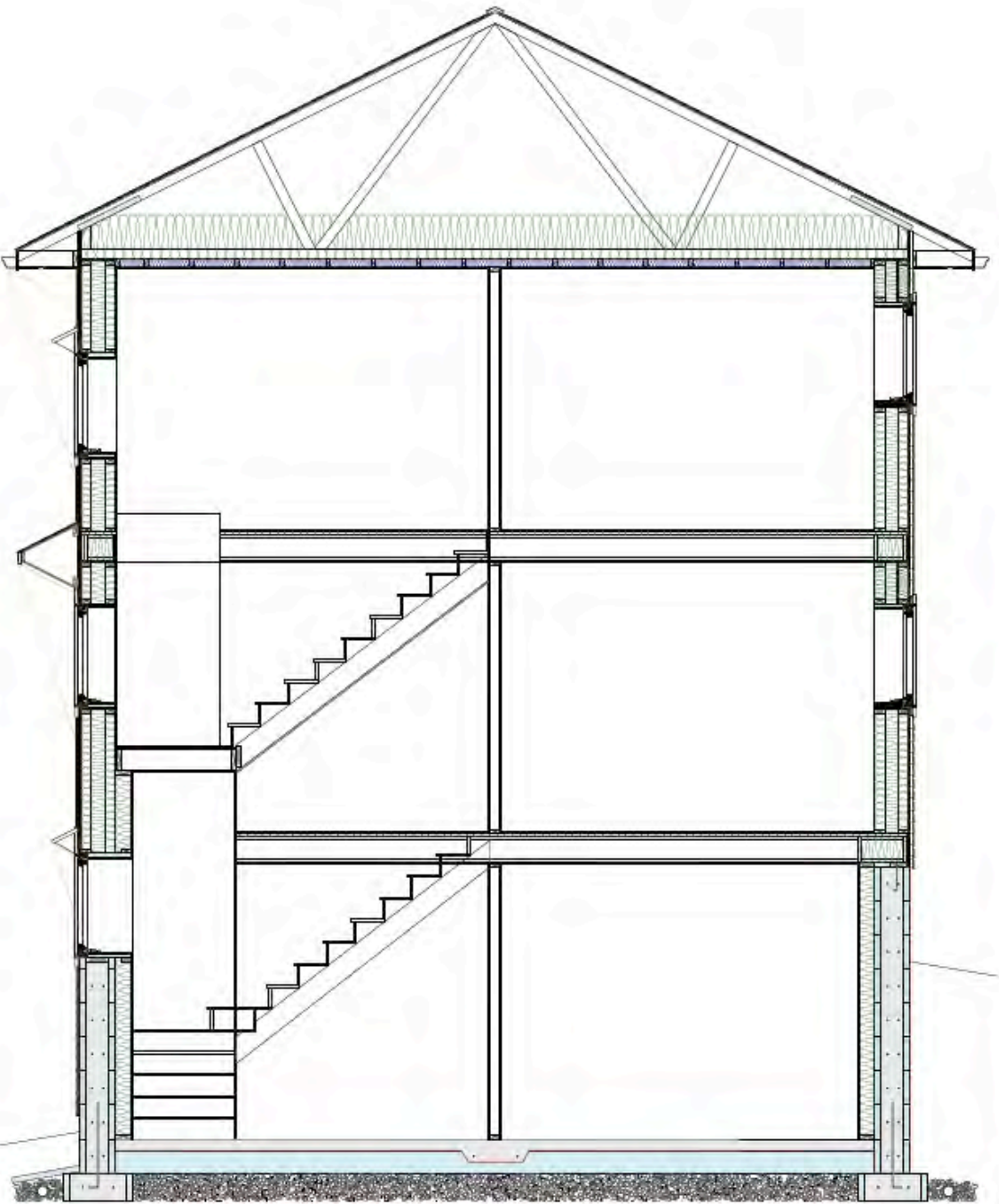
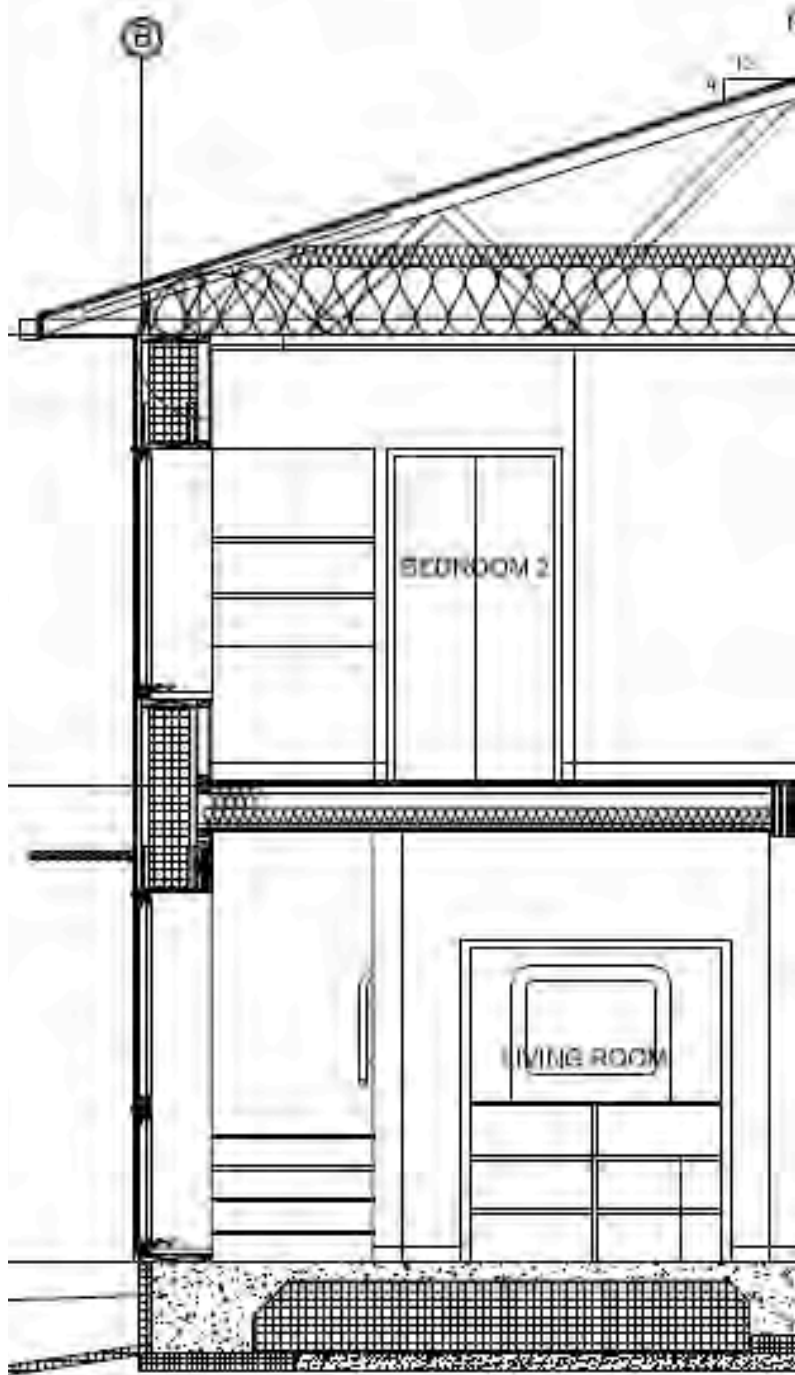




Andre House, West Tisbury, MA



Biohaus, Bemidji, MN



The Passivhaus progress in Germany (>10,000 built) has led to tremendous product innovation in windows, doors, heat recovery ventilation, integrated mechanical systems, and construction materials for thermal bridge-free construction. In milder climates like Germany, the heat is delivered with the ventilation air.



Passive House Planning Package

Areas

U values

Ground

Windows

Shading

Ventilation

Annual Heat Demand

Monthly Heat Demand

PE