

Indoor Climate Research & Training

Heat Pump Performance Training

Website:

icrt.appliedresearch.illinois.edu

Context

- ▶ Heat pumps are strongly viewed as a (the?) major potential electrification measure
- ▶ Most single-family homes in Illinois have forced-air heating, so heat pumps would usually be split-system forced-air
- ▶ Failure to address the full system can severely reduce the potential benefits of heat pumps – training needed



Modeling analysis done in the early 2000s

- ▶ Done for the Northwest – not just Seattle, which is mild, but also cold places like Spokane
- ▶ Focused on impacts of duct losses on heat pump performance

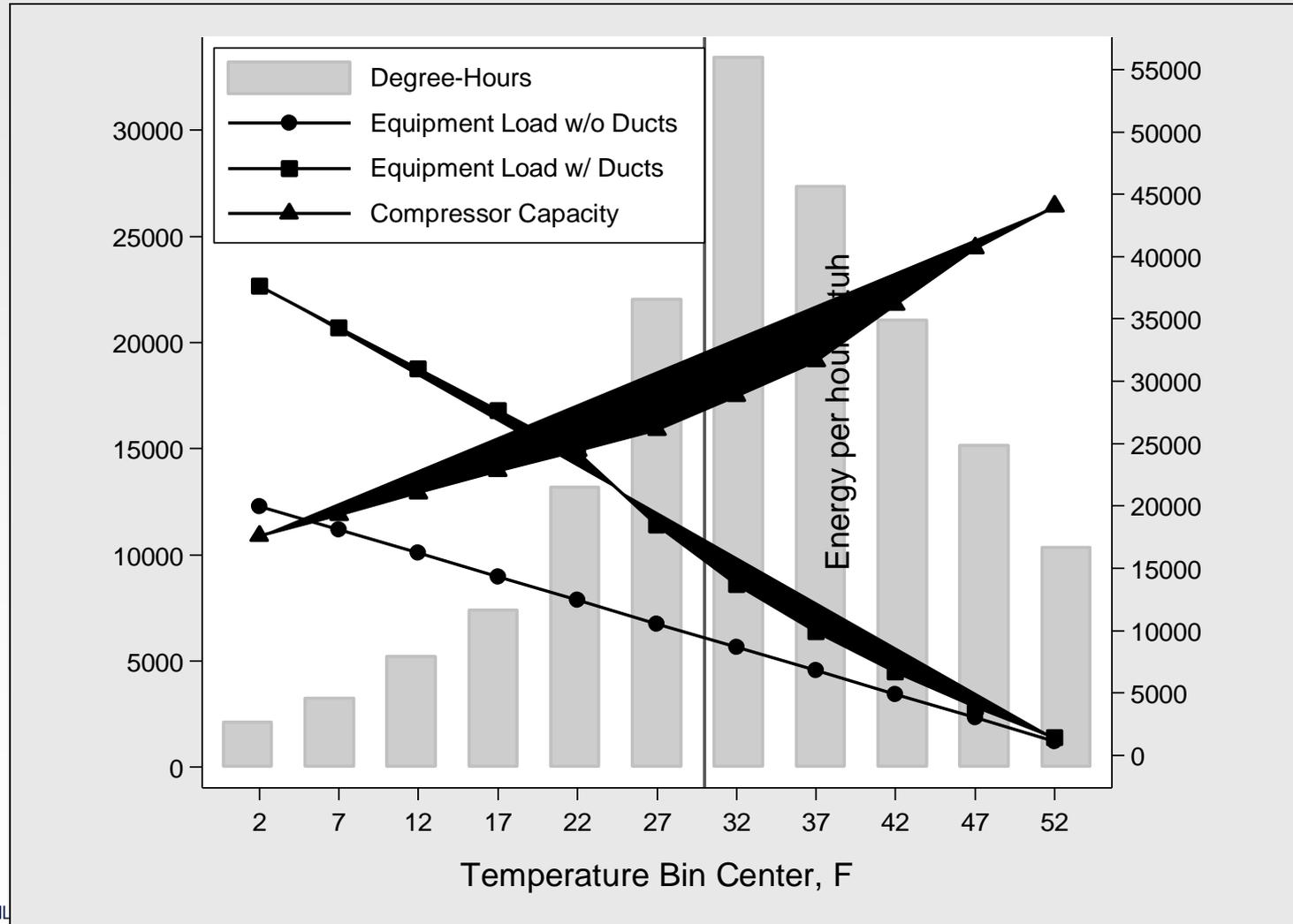
Duct Losses

- ▶ Supply ducts in crawl space
- ▶ Return ducts in attic
- ▶ Leakage to outside: 10% supply, 10% return
- ▶ R-4 supply, uninsulated return

Model

- ▶ Modified Bin Calculation
- ▶ House UA = 377 Btuh/F
- ▶ Uses manufacturer's data for heat pump performance
 - 3.5 ton, 8.2 HSPF
- ▶ Operates compressor as much as allowable
- ▶ Fills in with resistance
- ▶ Accounts for duct losses

Impact of Ducts - Spokane



Duct Losses

- ▶ Example: Spokane crawl space house, 8.2 HSPF heat pump
 - Energy use w/o ducts: 4860 kWh/yr.
 - Energy use w/ ducts: 8110 kWh/yr.
 - Energy loss due to ducts: 3250 kWh/yr – 67% penalty
 - Equivalent of 370 W running continuously all year
 - No contribution to the house

Takeaways

- ▶ Modest duct losses have a major impact on heat pump performance
- ▶ In existing homes, ducts are not often a major consideration
- ▶ More interaction with installers needs to be done to avoid problems – **TRAINING**