

# Electric Heat Pumps – Technology Intro

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# Basic Categories

- Ducted / non-ducted (mini-split)
- Conventional / cold climate

# Cold-Climate Heat Pumps

Conventional technologies – under high “lift” of cold outdoor conditions discharge temperatures get very high, capacity falls, COP (efficiency) falls.

Heat loads are higher than cooling loads – a heat pump sized for heating is oversized for cooling, leading to cycling and reduced summer performance.

Heat pumps commonly use indoor unit electric heat to supplement output under very cold conditions

Technical approaches to improved cold climate performance

- Variable speed compressor (inverter)

- Vapor injection cycle

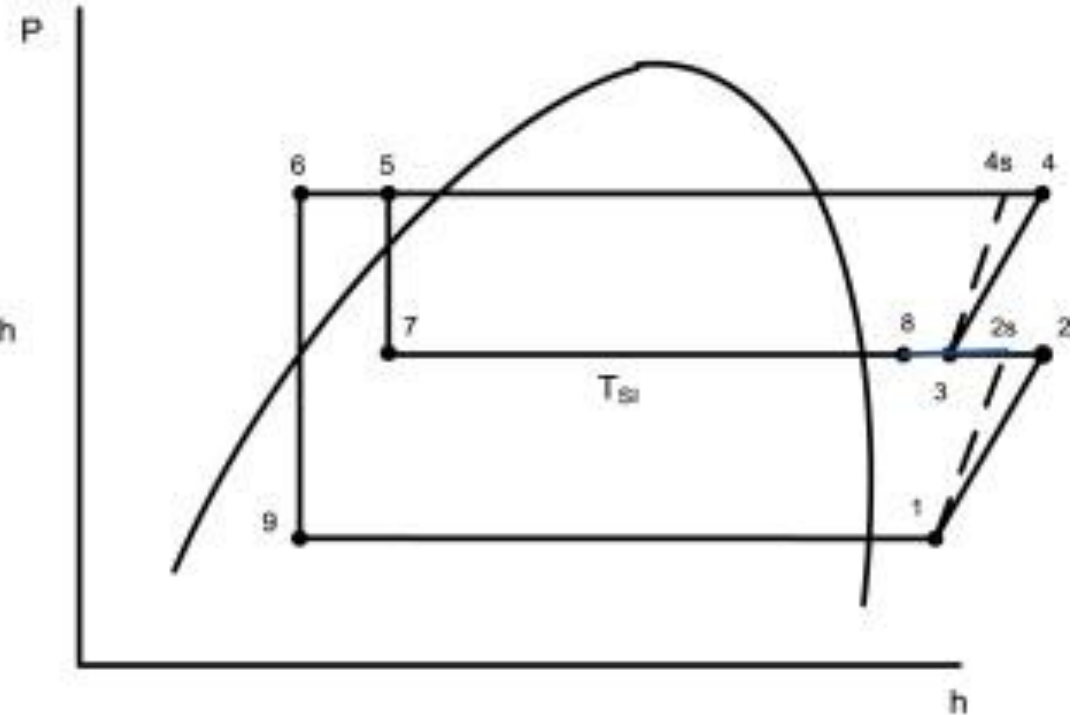
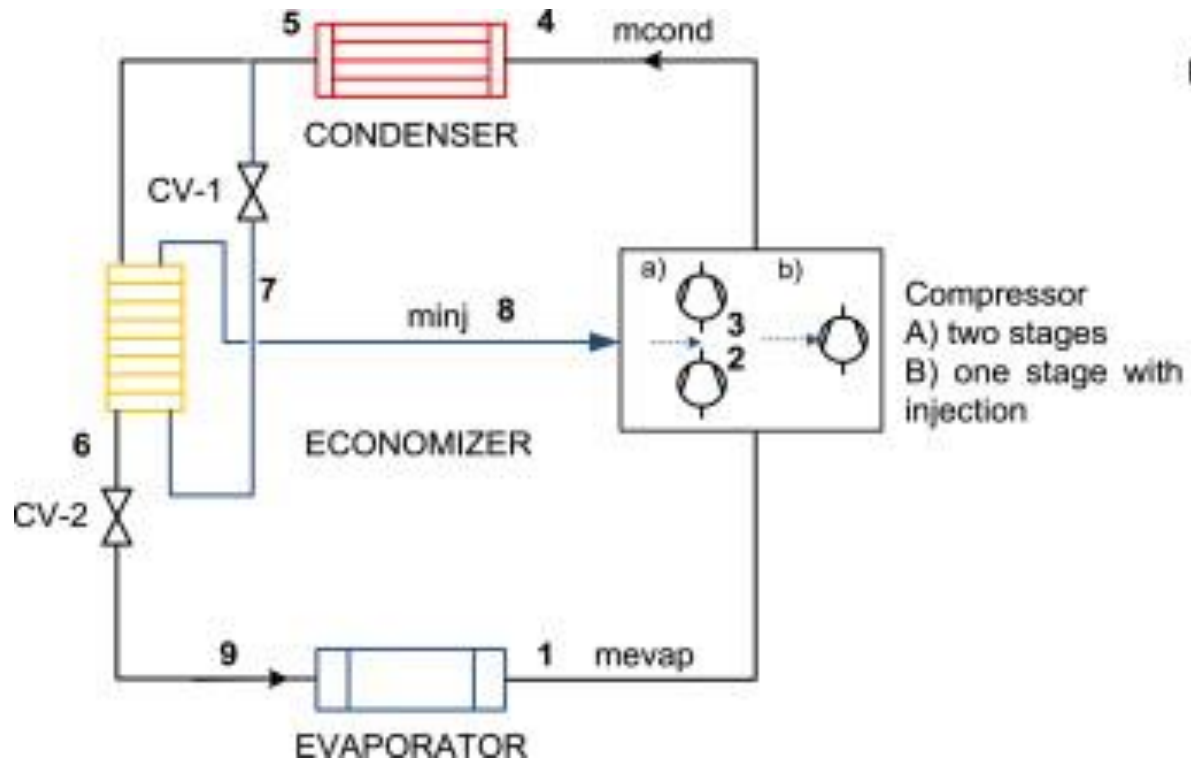
- multi-stage compressors

- demand-based defrost vs timing based defrost

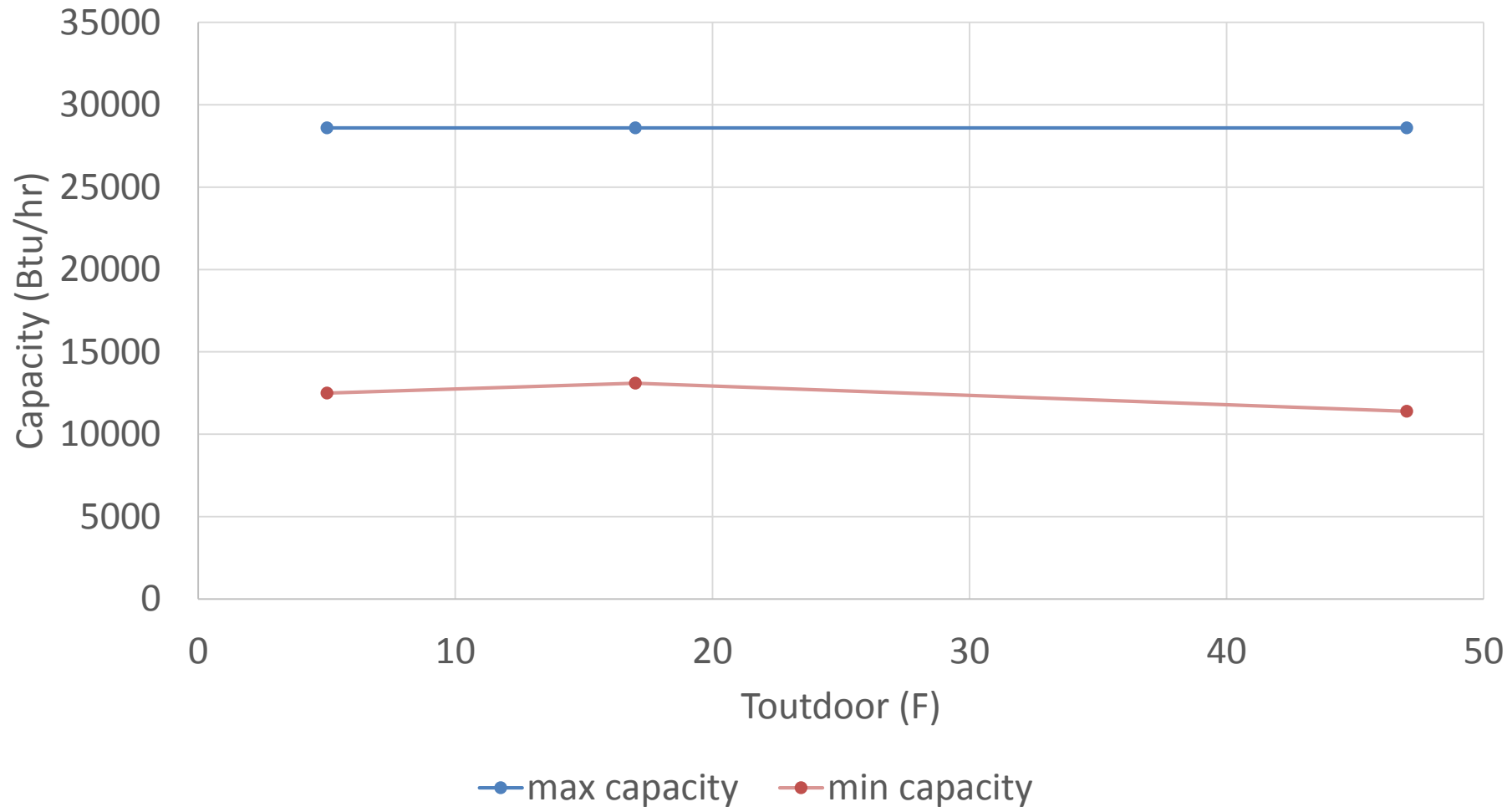
- improved outdoor unit heat transfer (heat exchanger size, fin density)

NEEP – (Northeast Energy Efficiency Partnership) – maintains a specification for what is a cold climate heat pump and list of the performance of qualifying units (fee-based for manufacturers)

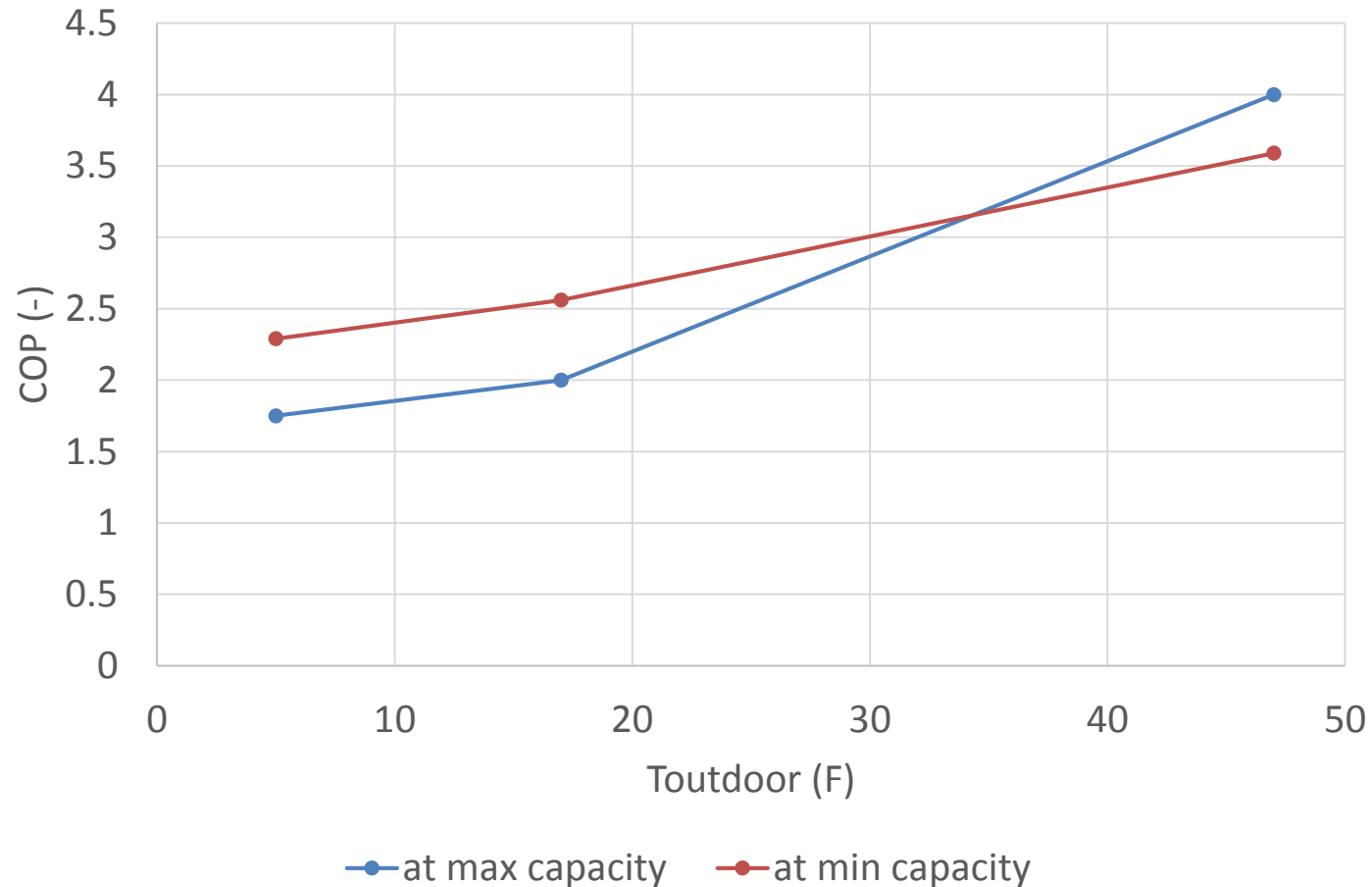
# Vapor Injection Cycle



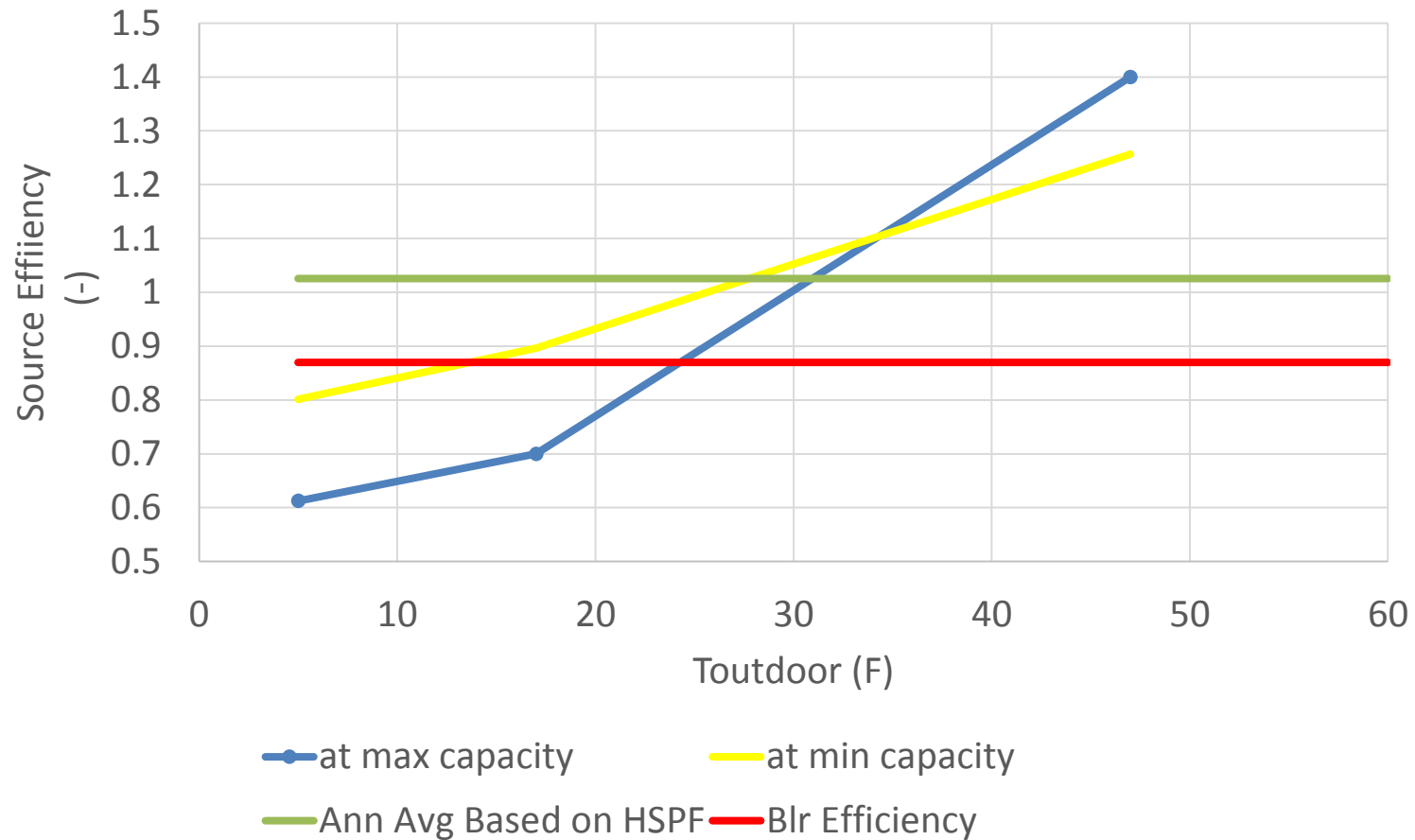
# Example minisplit - MHi



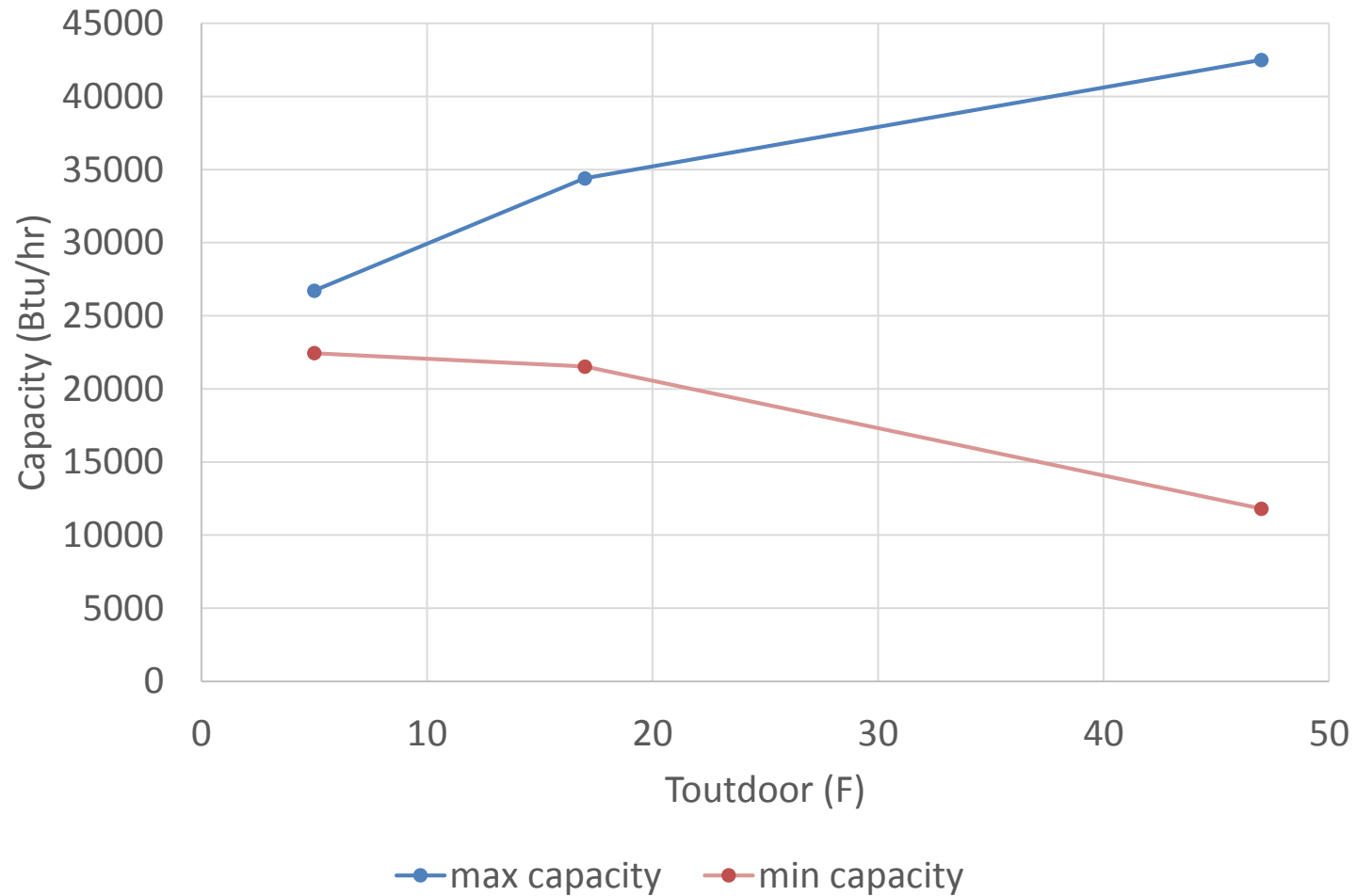
# Example minisplit - MHi



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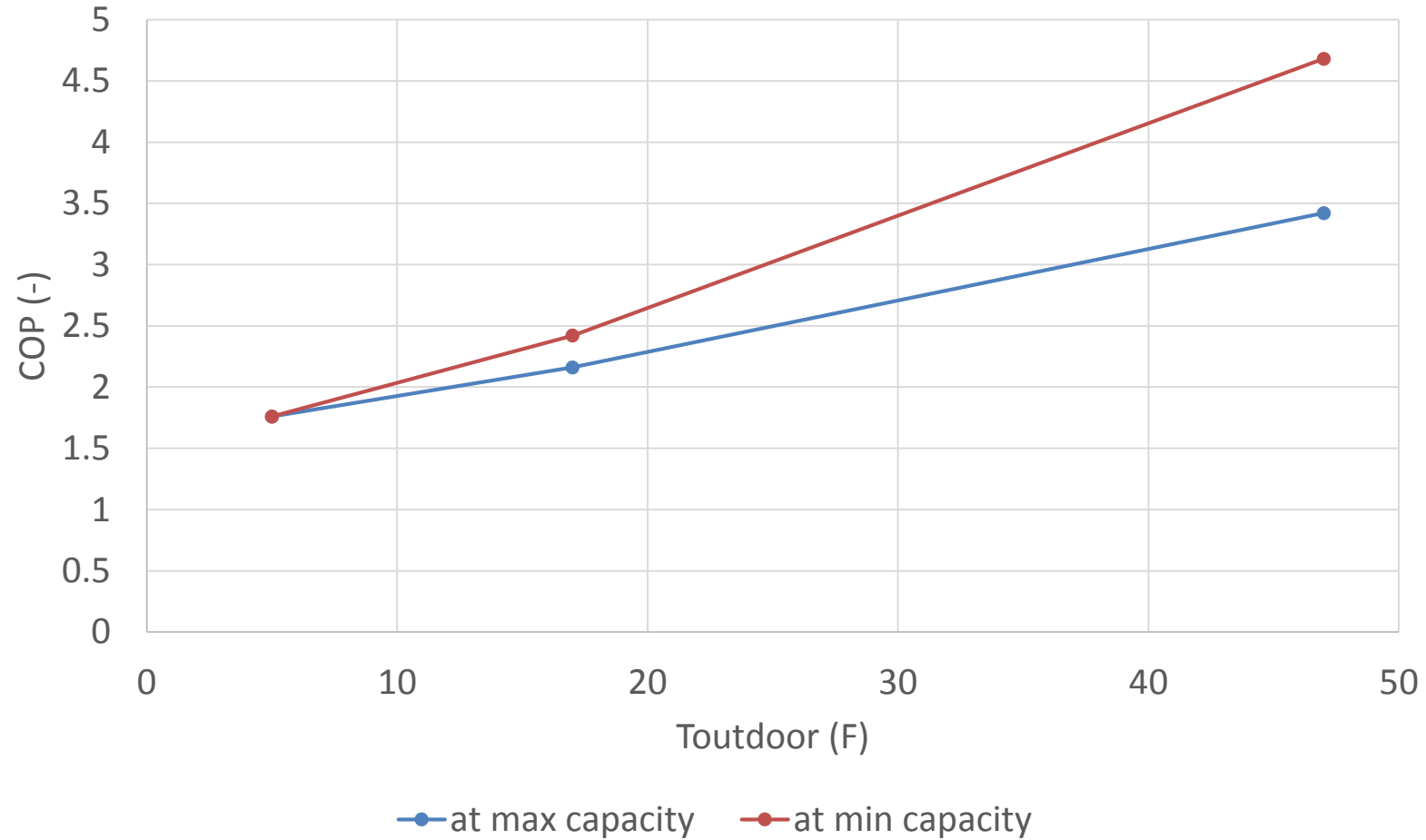


# Example Ducted - York

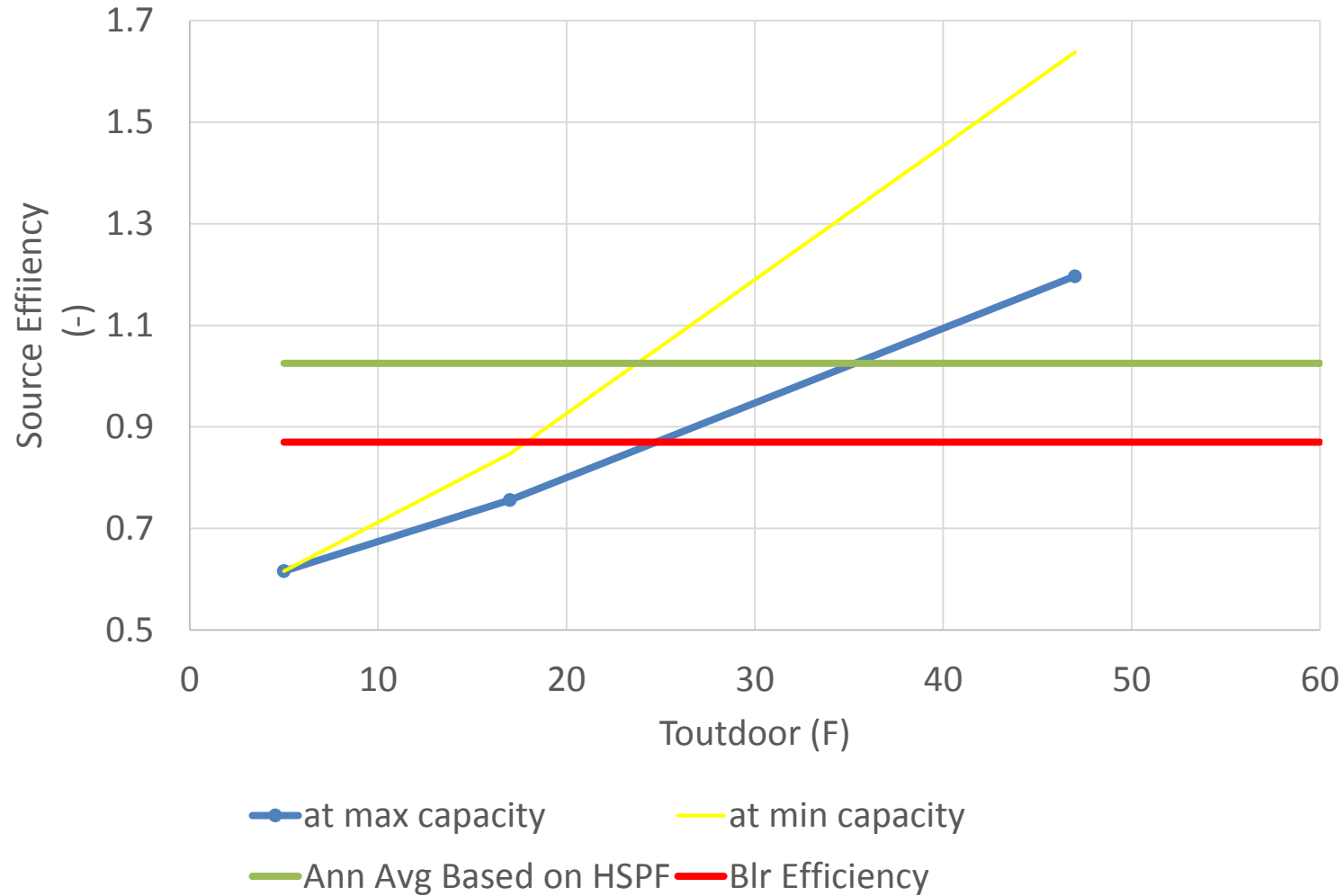




# Example Ducted - York

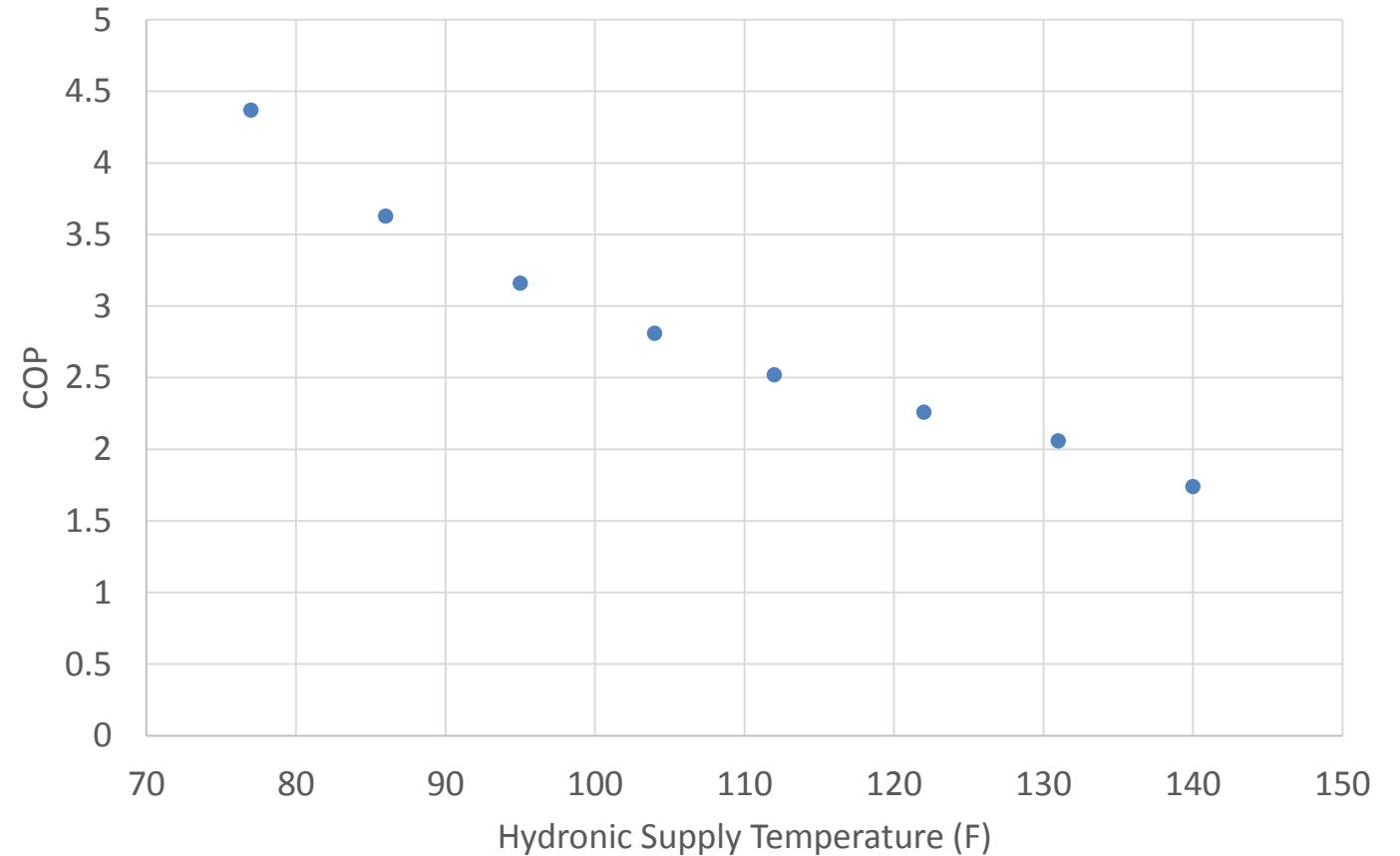


# Example Ducted - York



# Air-to-water heat pumps

Example performance at 30 F outdoor temperature.



# Observations from NORA Integrated Heat Pump/Hydronic Field Study

- Minisplits installed mostly for solving problems in parts of homes, emphasis on cooling.
- Manual switchover between heat pump and oil-fired hydronic, not done consistently;
- Recovery from night or away setback takes a very long time. Under cold conditions defrost very frequent.