



AEE Northern Ohio Chapter Presentation

Benefits & Designs of Free Cooling Systems

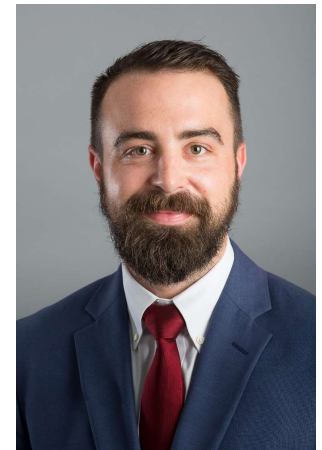


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Central Chillers



What is a central chiller?

- Large capacity systems
- Setpoint requires refrigeration
- Support multiple machines/processes
 - Entire facilities or large sections



Central Chillers



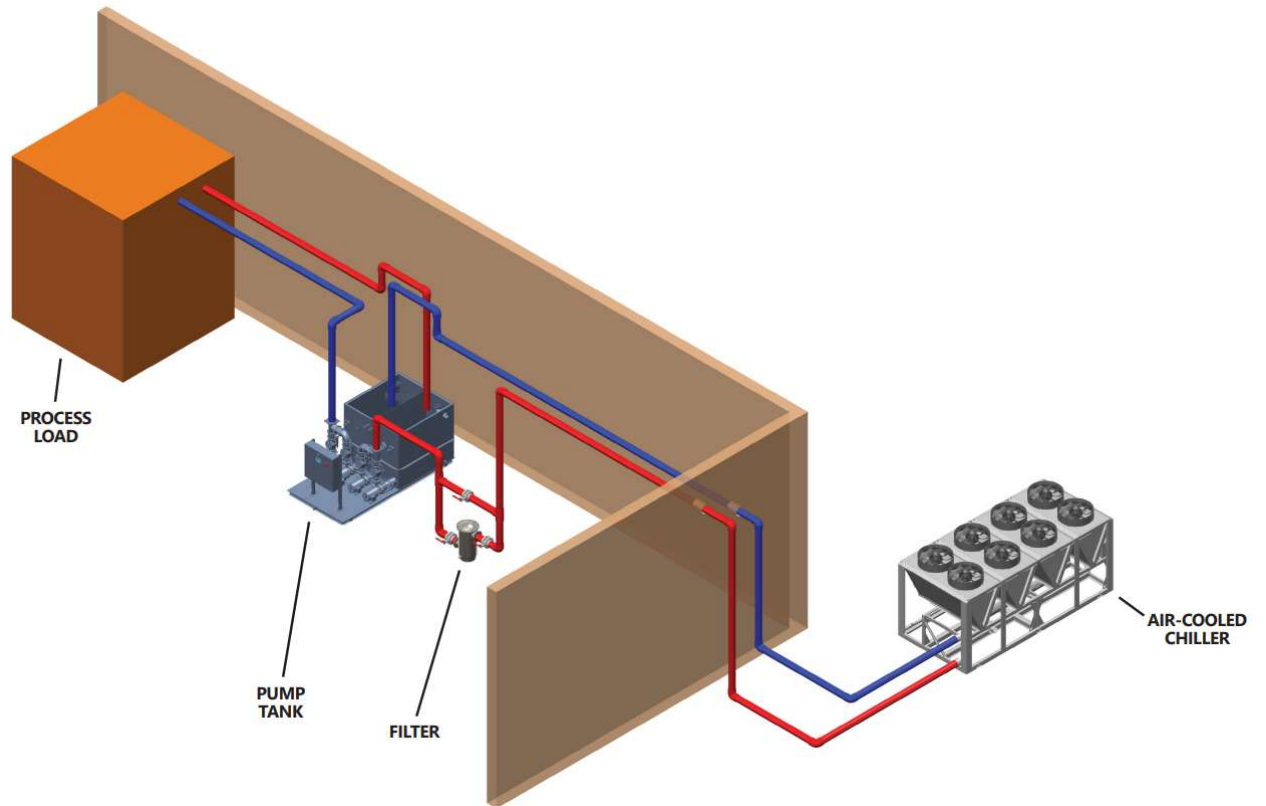
- "Centrally" located
- Mechanical Room
- Mezzanine
- Outside, slab or rooftop



Central Chillers – Condenser Types



Air-Cooled

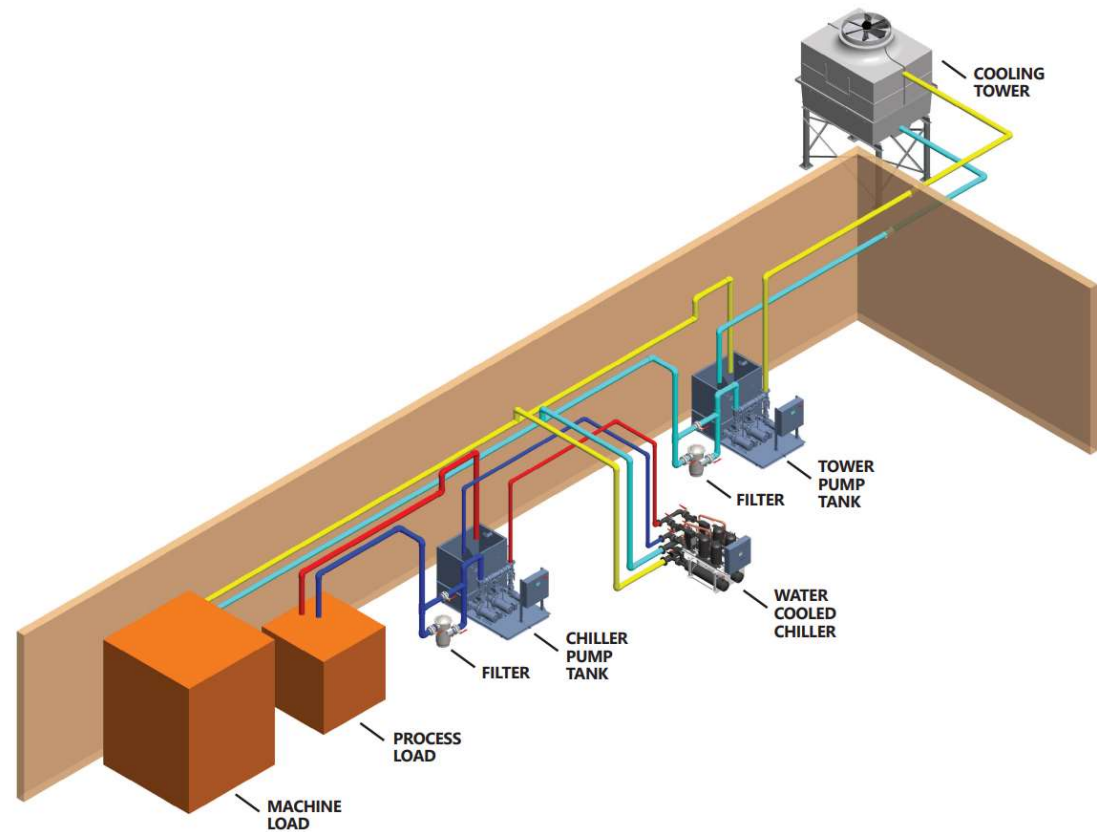


Central Chillers – Condenser Types



Air-Cooled

Water-Cooled



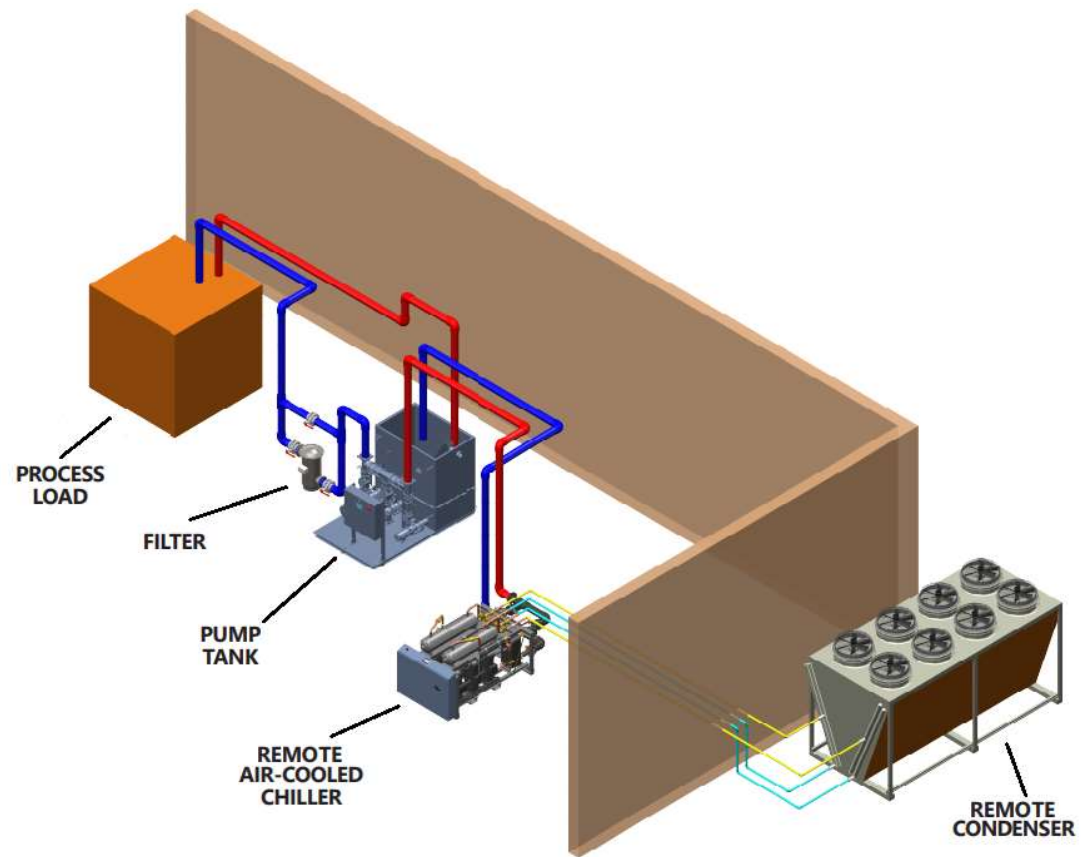
Central Chillers – Condenser Types



Air-Cooled

Water-Cooled

Remote Air-Cooled



Cooling Towers

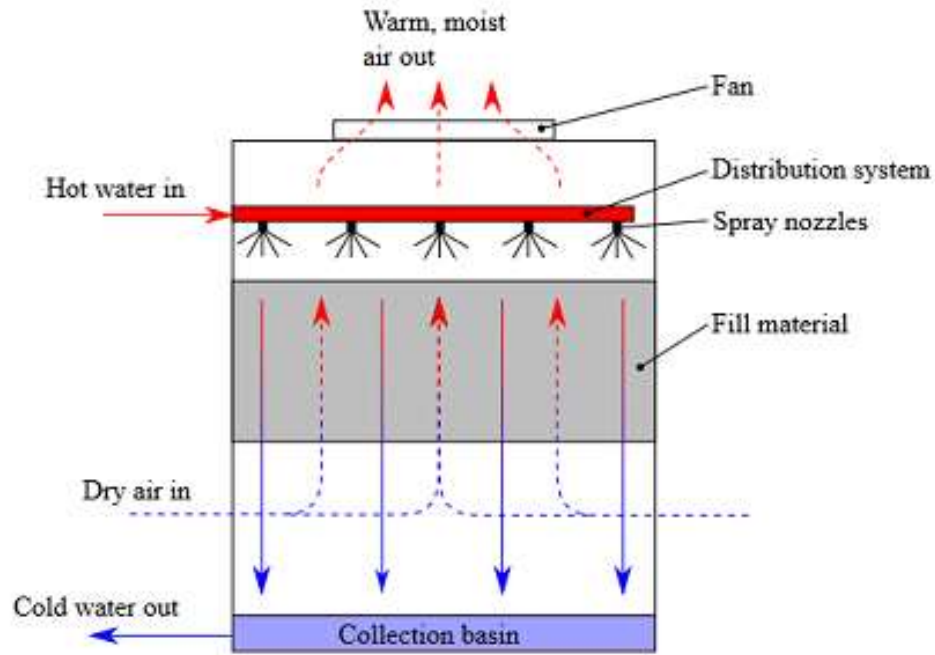


What is a cooling tower?

- Setpoint achieved with evaporation
- Open to atmosphere
- High contamination
 - Debris, dissolved solids, corrosion



Cooling Towers - Operation



Counter-Flow Cooling Tower



Fluid Coolers

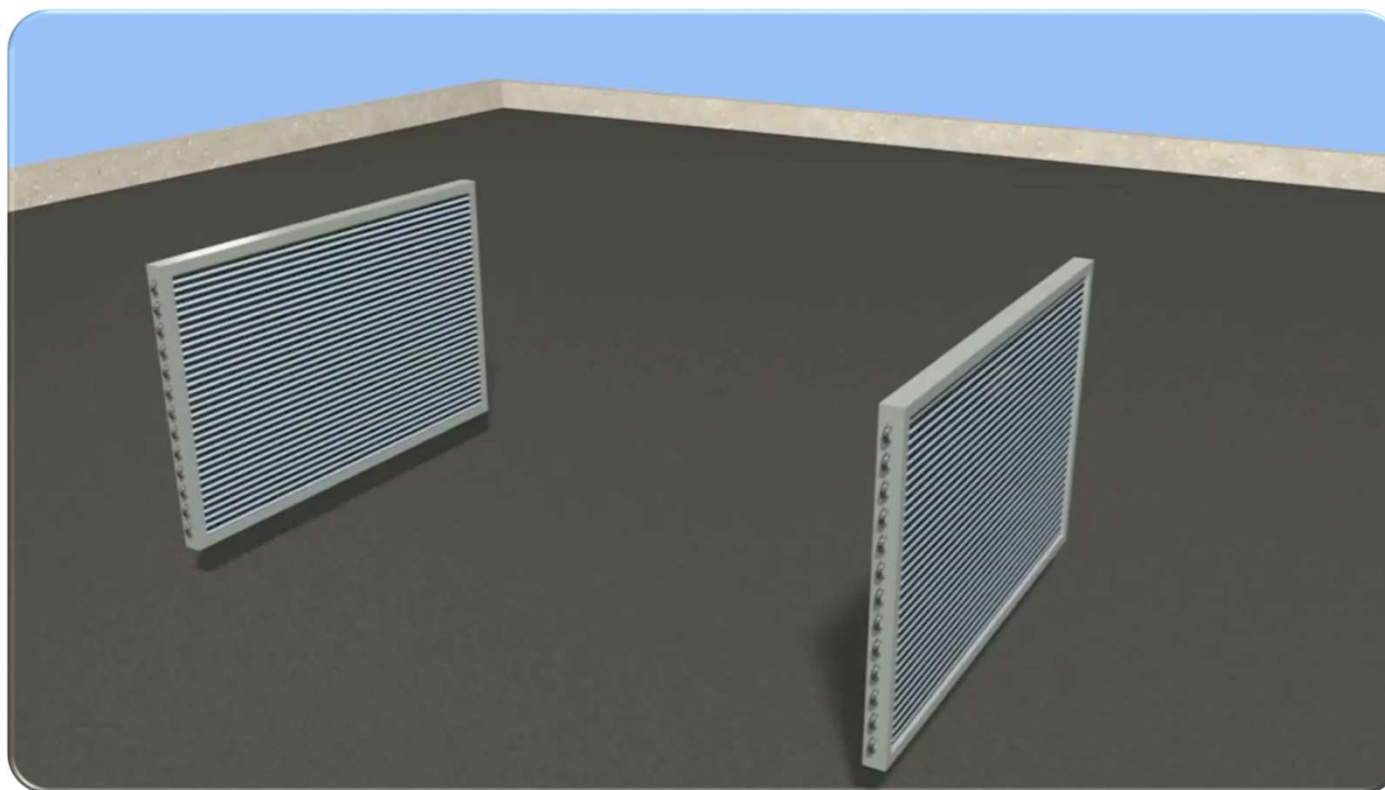


What is a fluid cooler?

- Dry and Adiabatic
- Setpoint achieved forced air/evaporation
- Closed to atmosphere



Fluid Coolers –Video

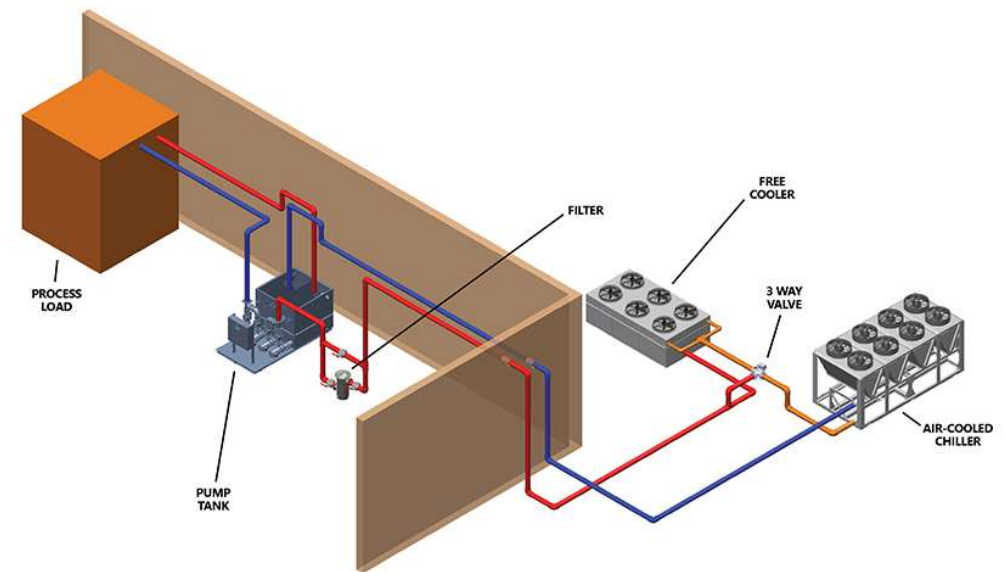


Free Cooling – Series Piping



Free cooler is installed in series with chiller

- 3-way valve actuates on ambient
- Simple, easy operation
- Allows load shedding
- Requires glycol

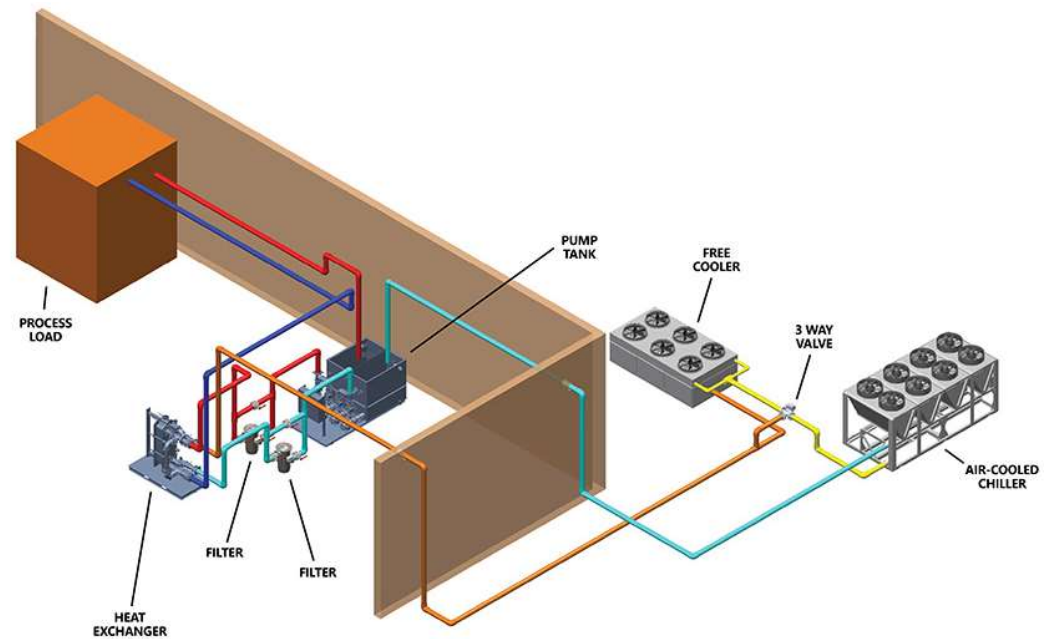


Free Cooling – Series Piping



Free cooler is installed in series with chiller

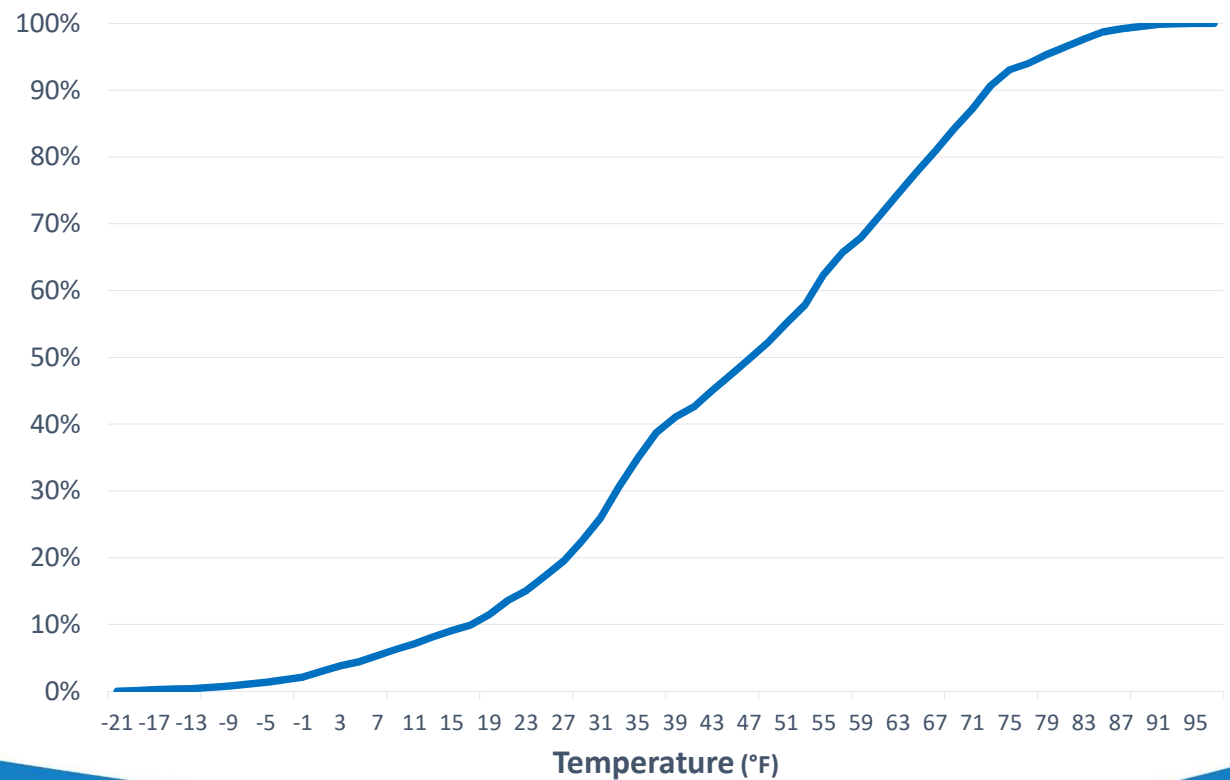
- 3-way valve actuates on ambient
- Simple, easy operation
- Allows load shedding
- Requires glycol
- **Glycol isolation design**



Savings - Considerations



Annual HR/YR Ambient Temperatures
Madison, WI (ASHRAE 2017 data)

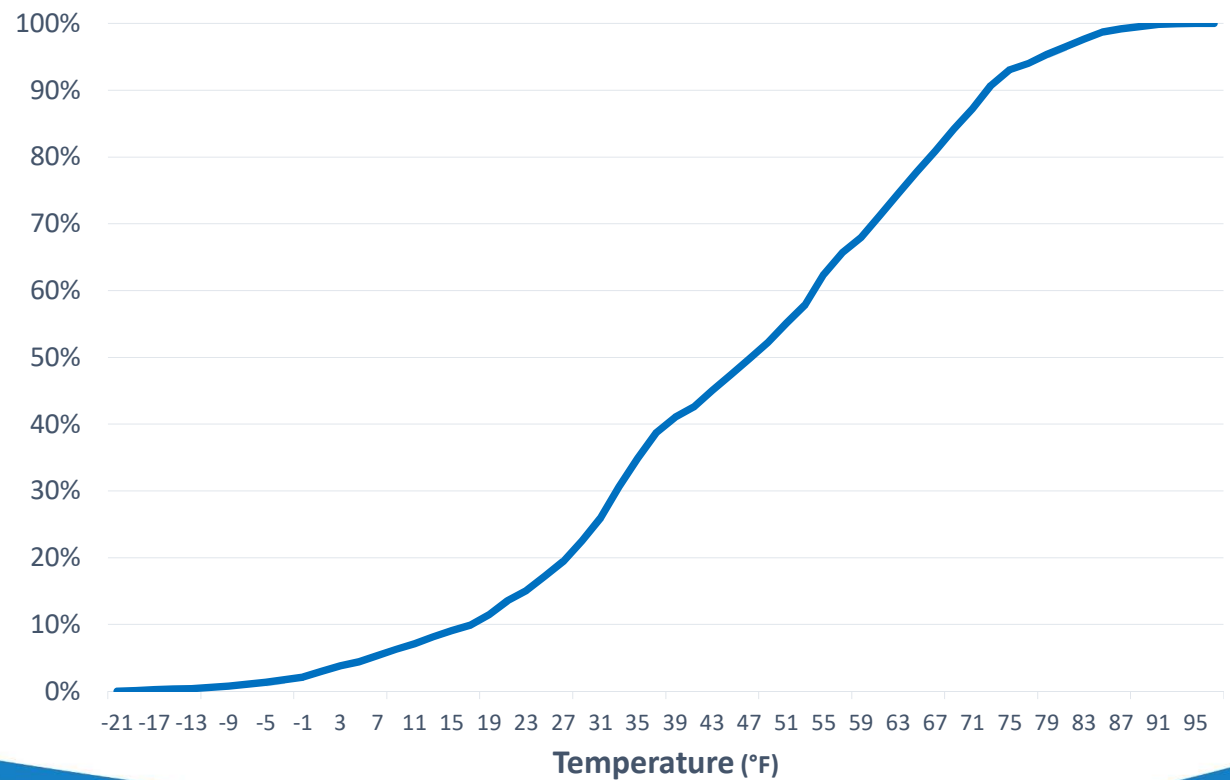


Savings - Considerations



- Adjust design setpoint

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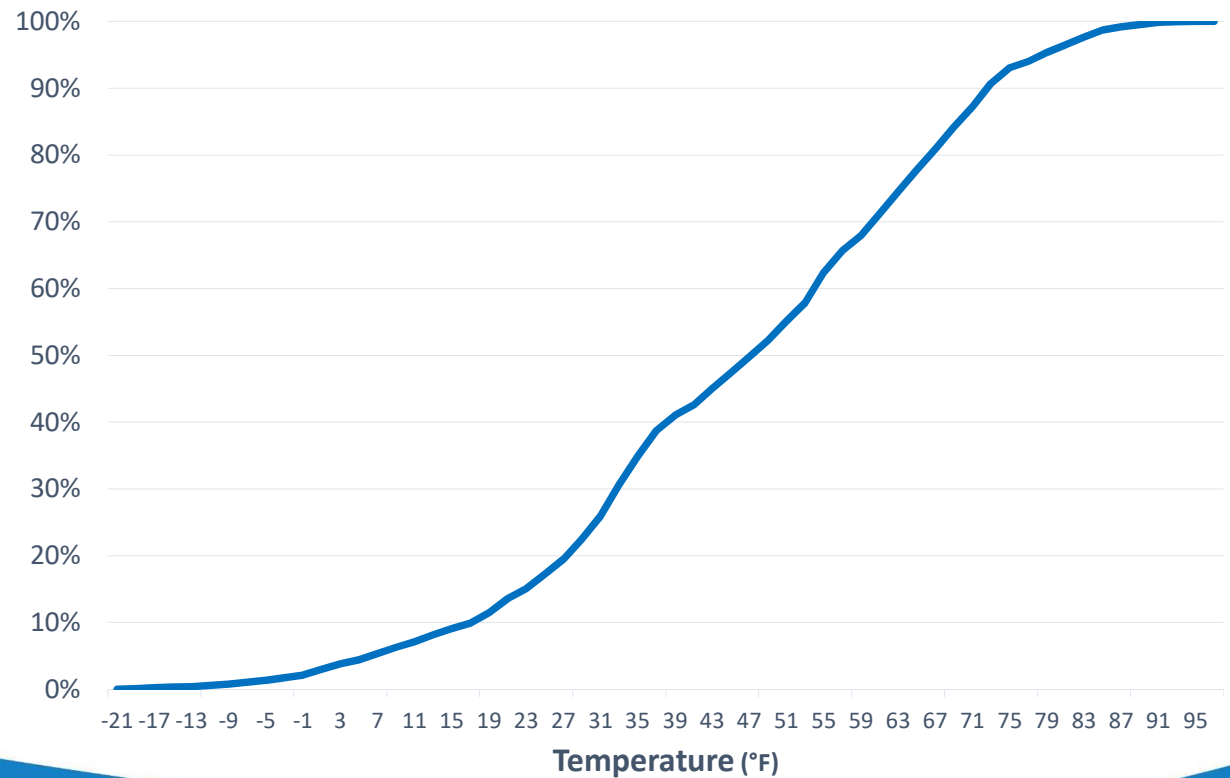


Savings - Considerations



- Adjust design setpoint
- Hour/Year affect

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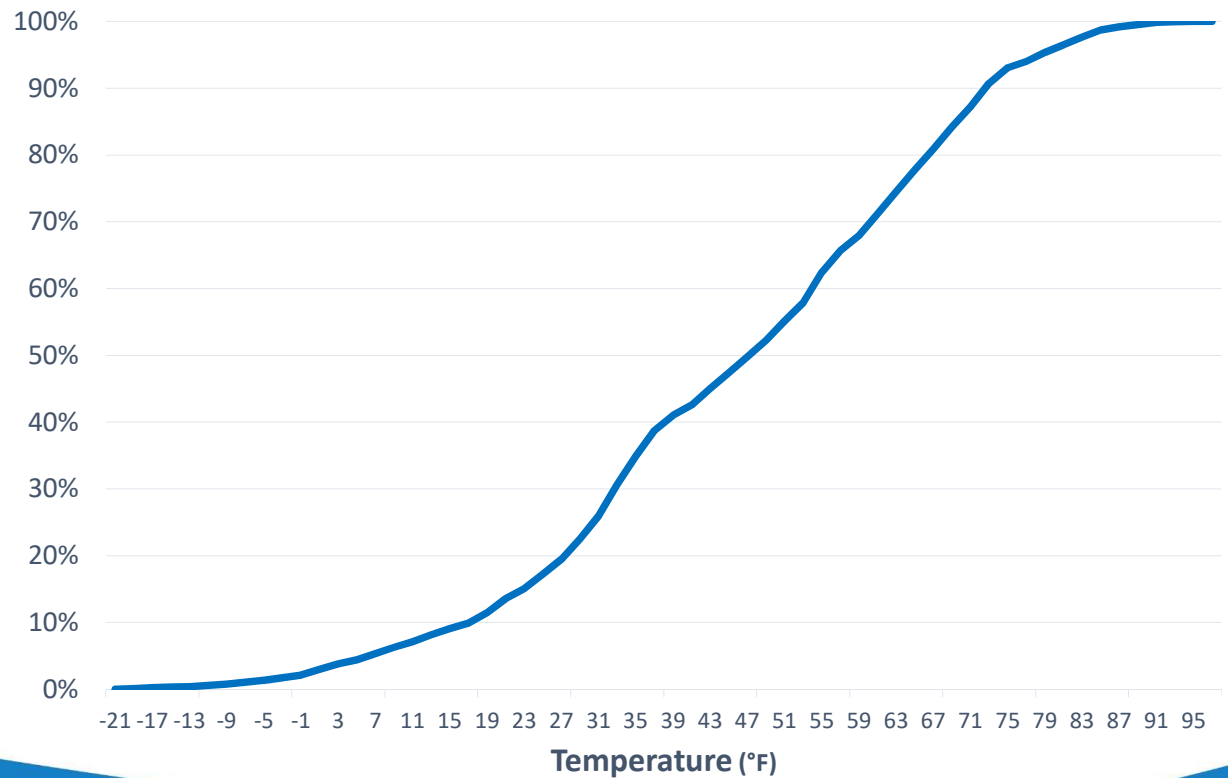


Savings - Considerations



- Adjust design setpoint
- Hour/Year affect
- Full replacement

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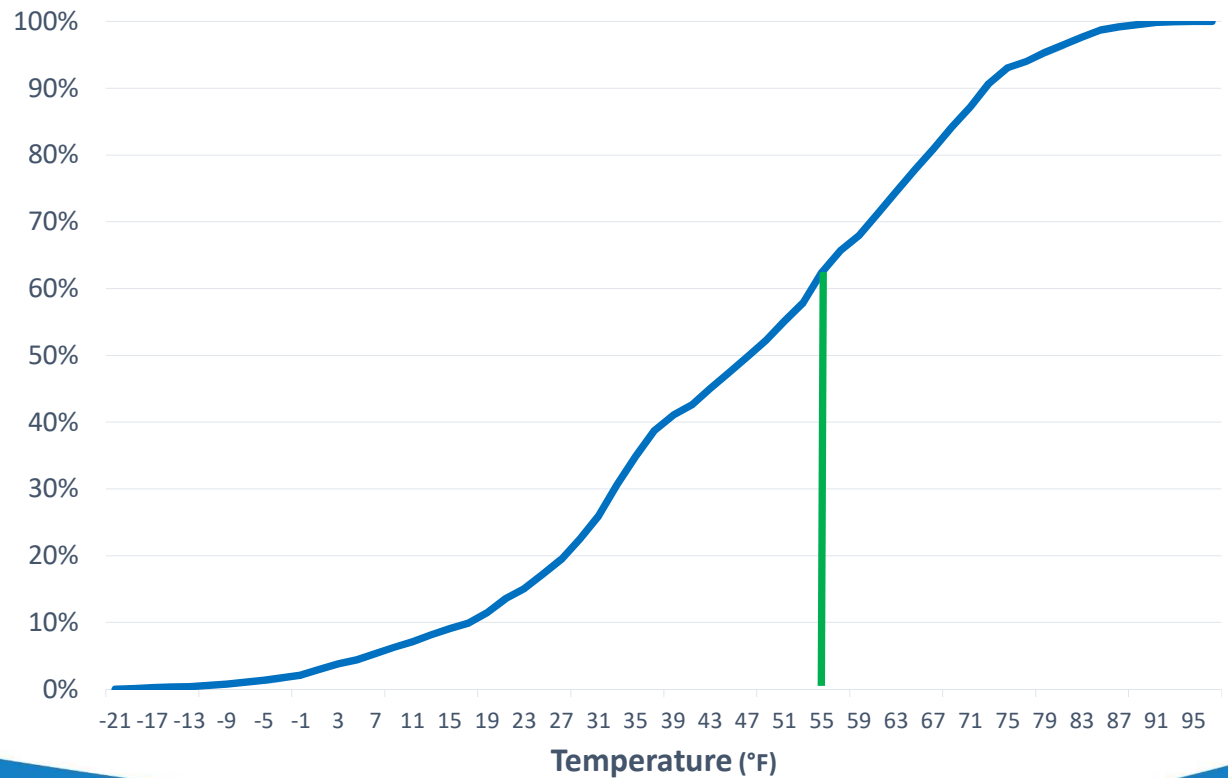


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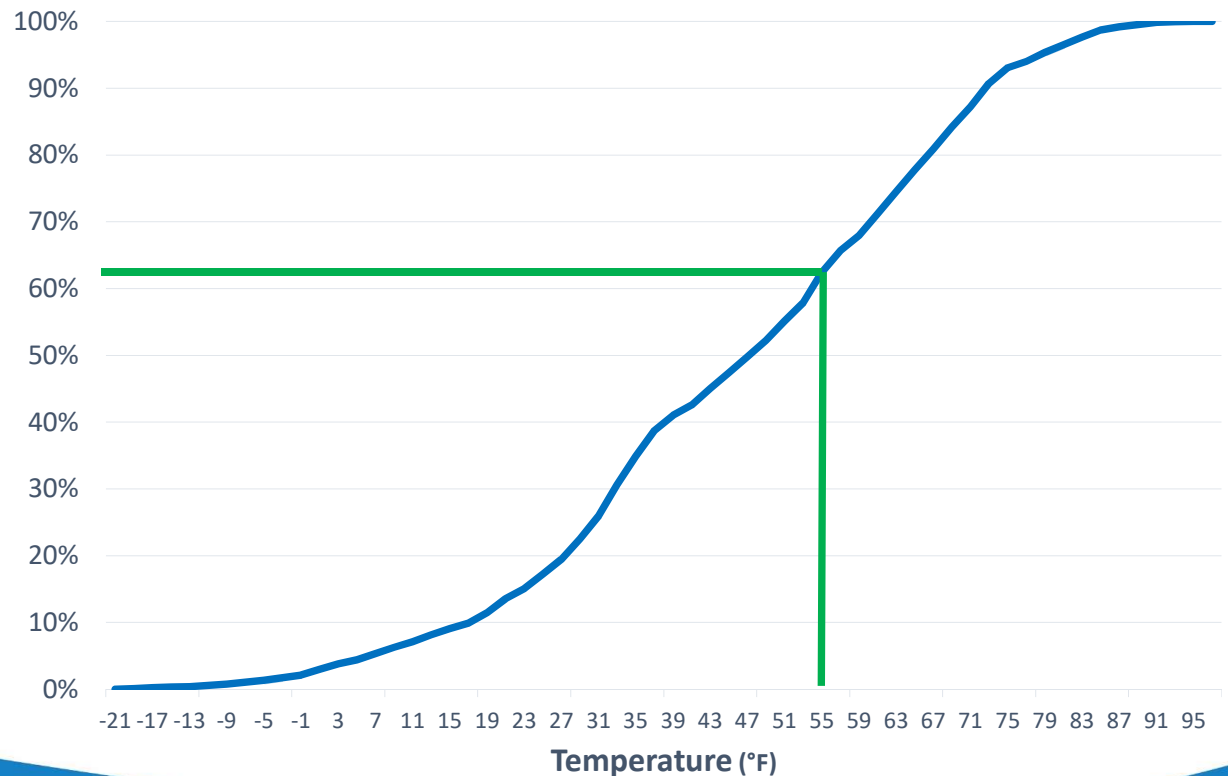


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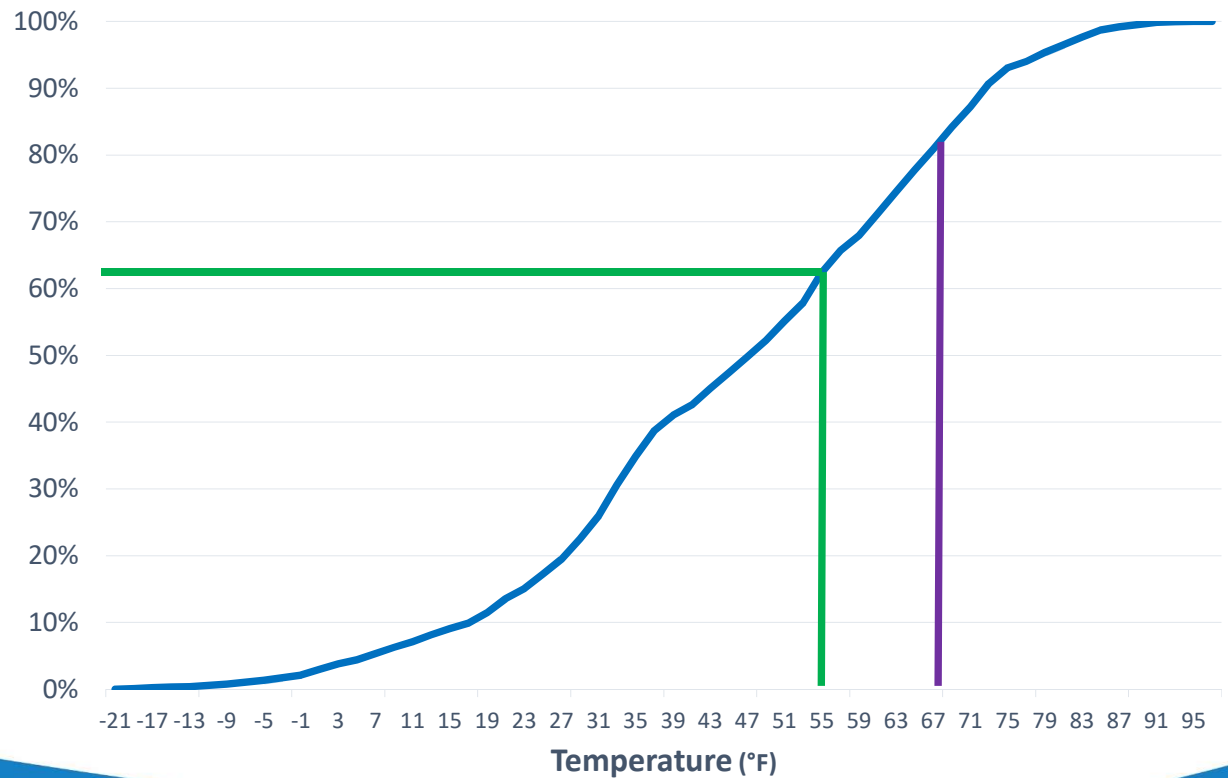


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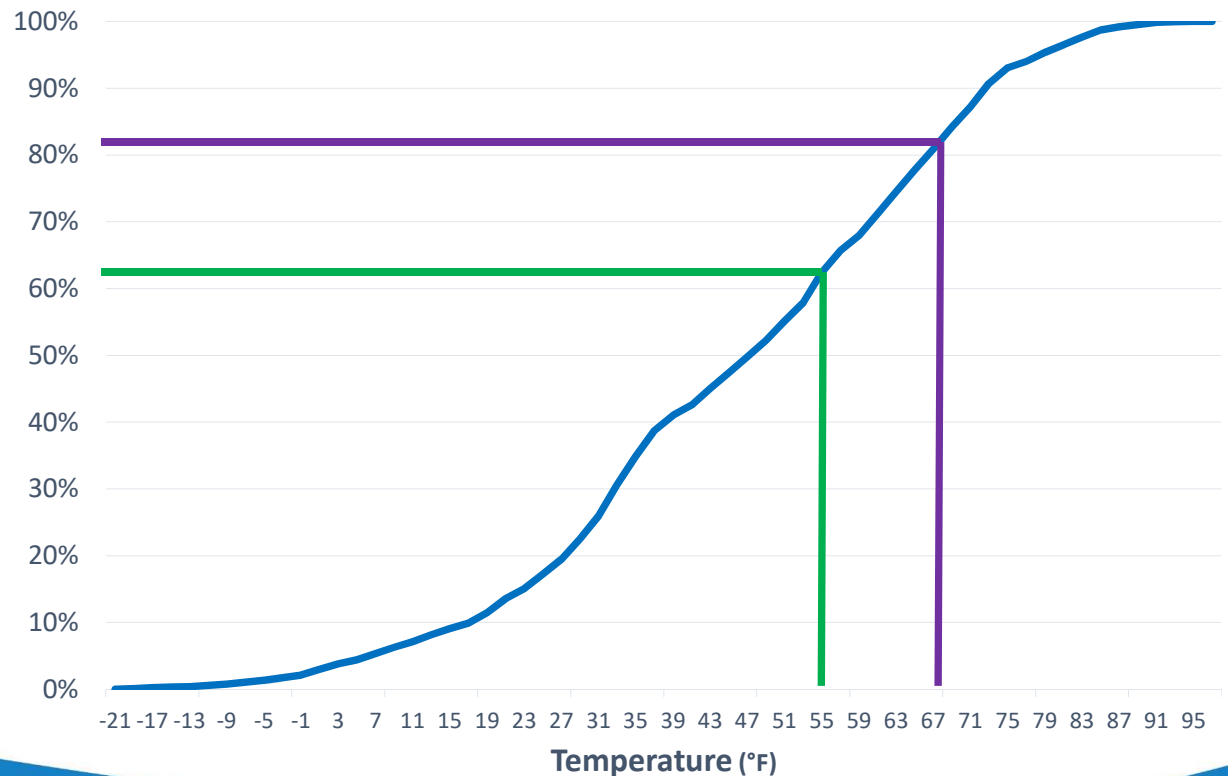


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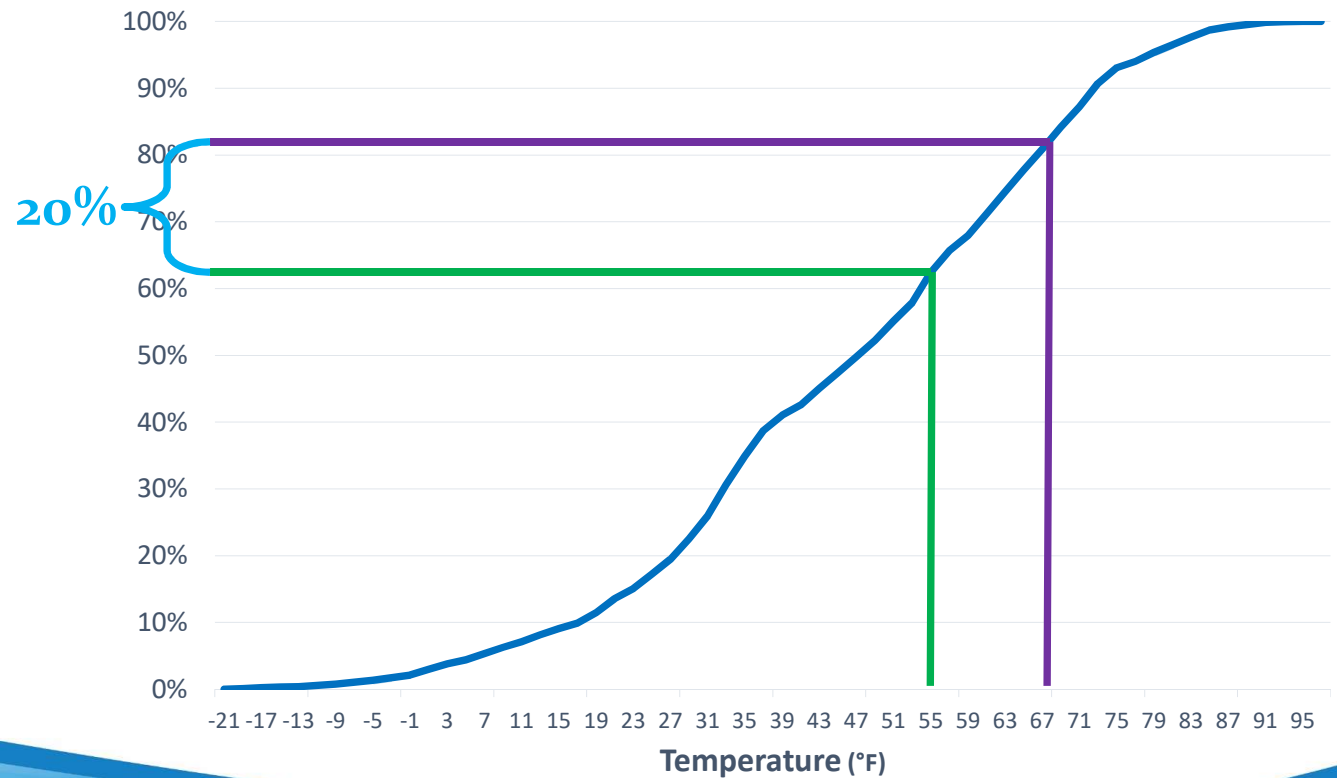


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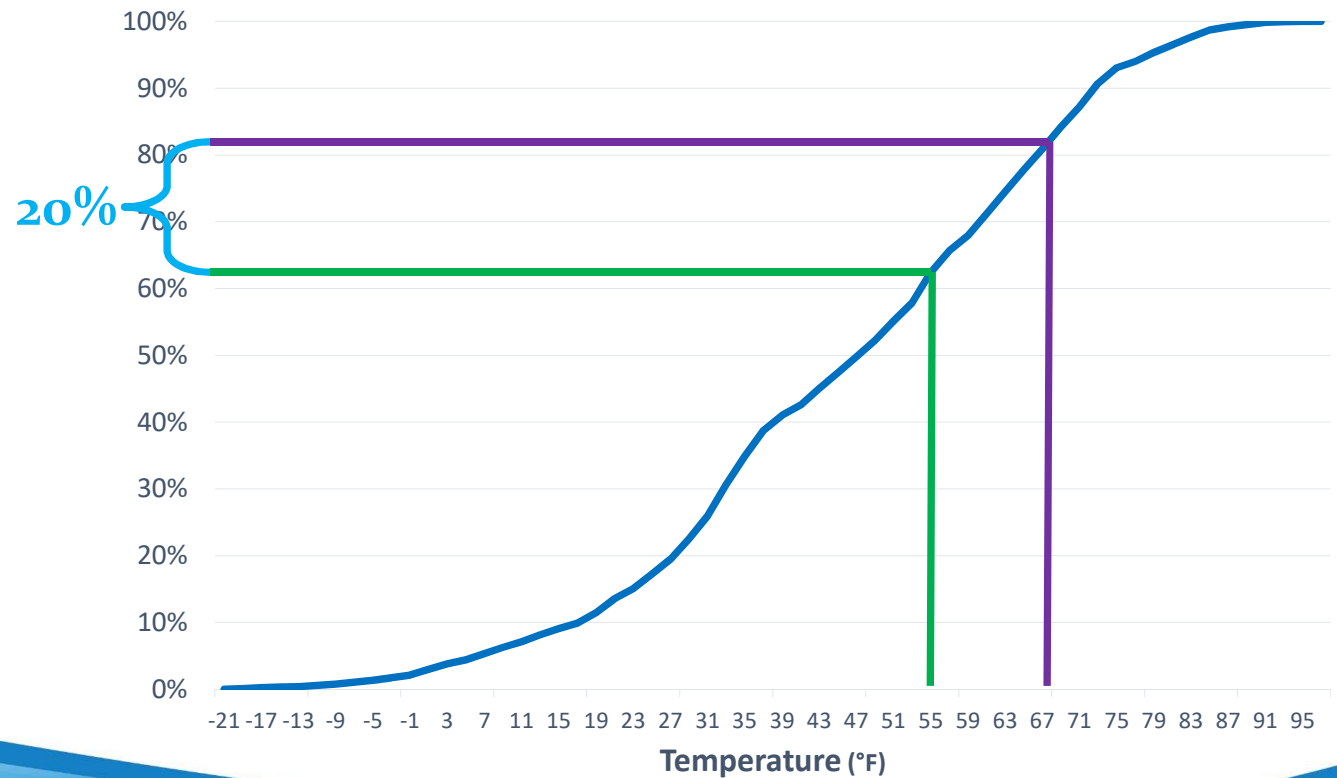


Savings - Considerations



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- Hour/Year affect
- Full replacement
- Dry vs Adiabatic

Annual HR/YR Ambient Temperatures
Madison, WI (ASHRAE 2017 data)

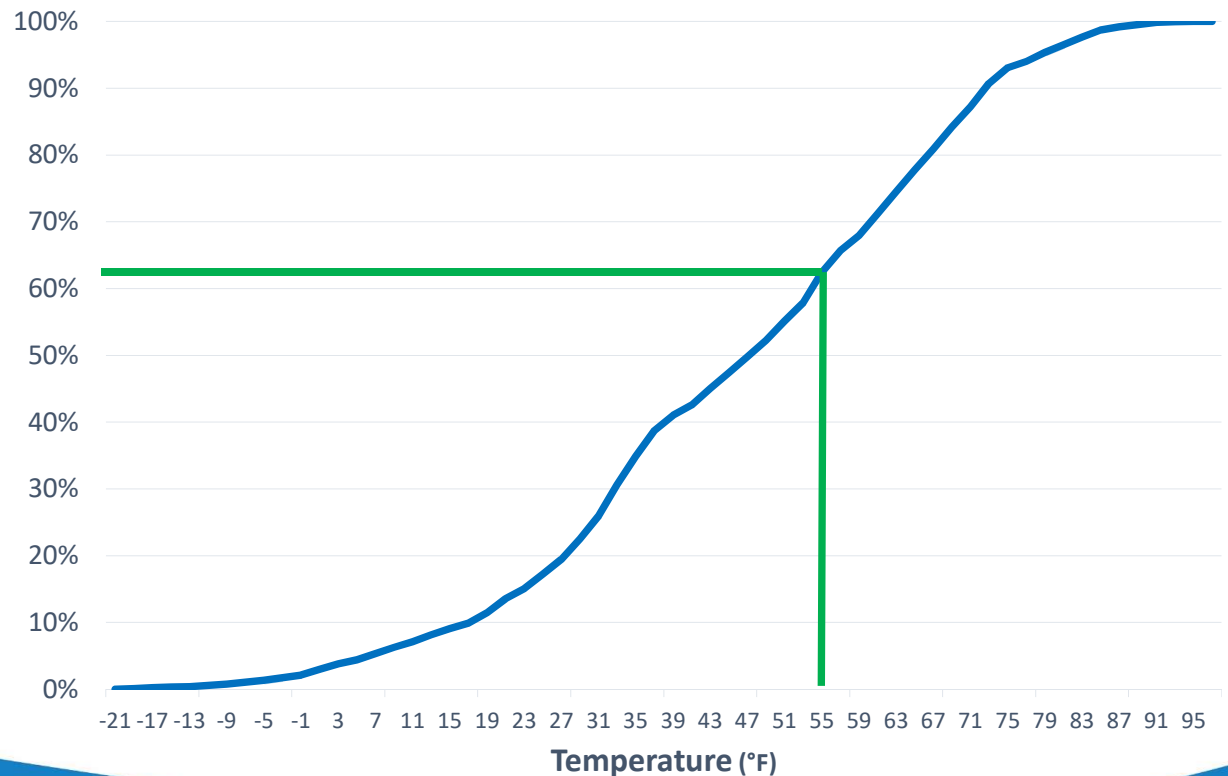


Savings - Considerations



- Adjust design setpoint
- Hour/Year affect
- Full replacement
- Dry vs Adiabatic
- Load Shedding

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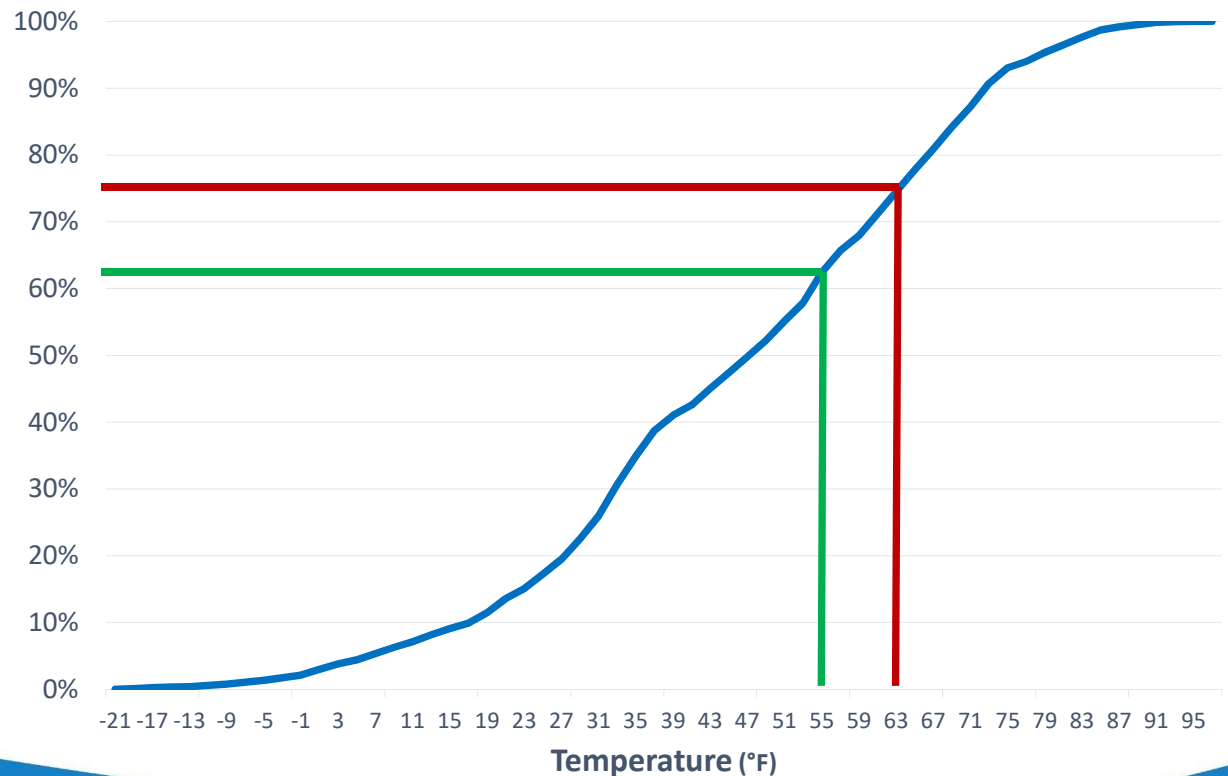


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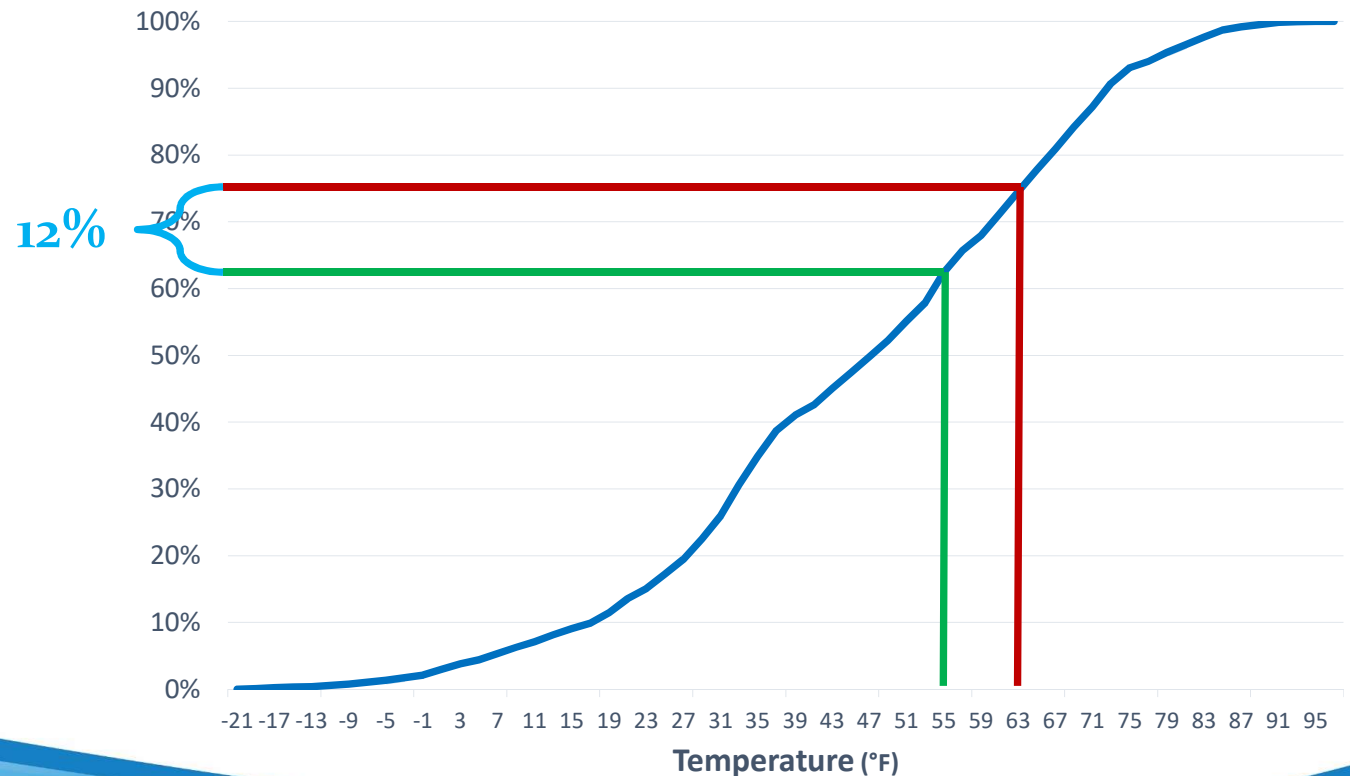


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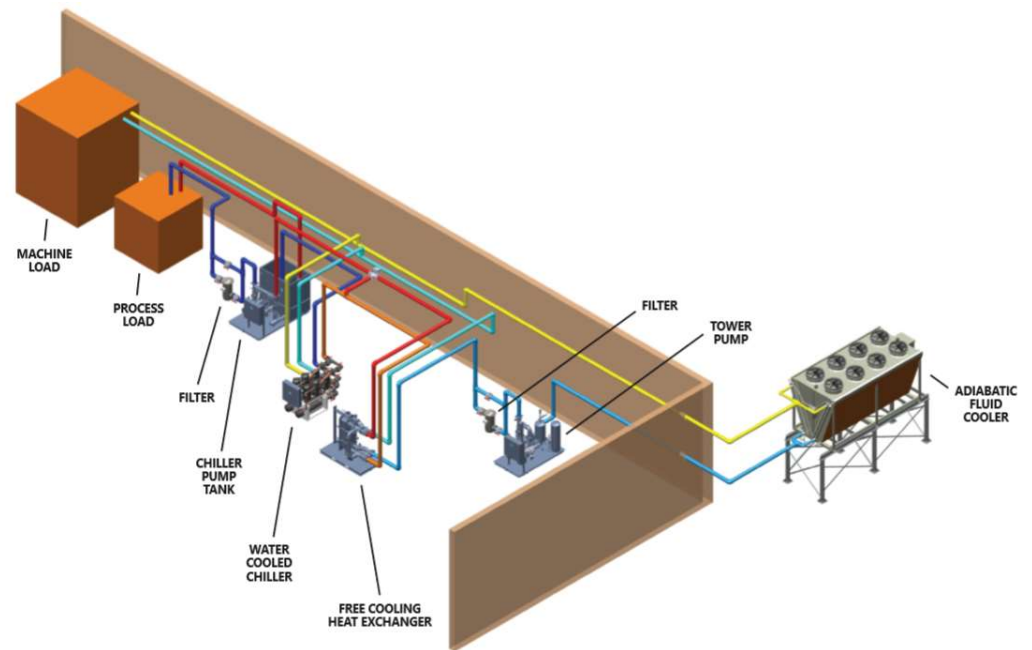
Annual HR/YR Ambient Temperatures
Madison, WI (ASHRAE 2017 data)



Alternative Free Cooling Design



- High temperature loop for chiller condenser and machine load
- Free cooling HX to unload chiller during winter





Thank you

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