PLEASE MUTE CELL PHONES

"Condenser Water Heat Recovery"

Julian de Bullet

ASHRAE Distinguished Lecturer

Director of Industry Relations

McQuay International

703-395-5054

What Is Sustainability ?

“ sustainable development meets the needs of today without compromising the ability of future generations to meet their own needs”

World Commission on Environment and Development 1987

ASHRAE Position

"supports building sustainability as a means to provide safe, healthy, comfortable indoor environment while simultaneously limiting the impact on the Earth's natural resources"


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August 2007
ASHRAE® JOURNAL
Kent W. Peterson, P.E.,
ASHRAE President
2007–2008
Greater Efficiency Today,
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ASHRAE® JOURNAL
The magazine of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
Bill Harrison,
ASHRAE President
2008–2009
Maintain
To Sustain
Delivering ASHRAE's
Sustainability Promise

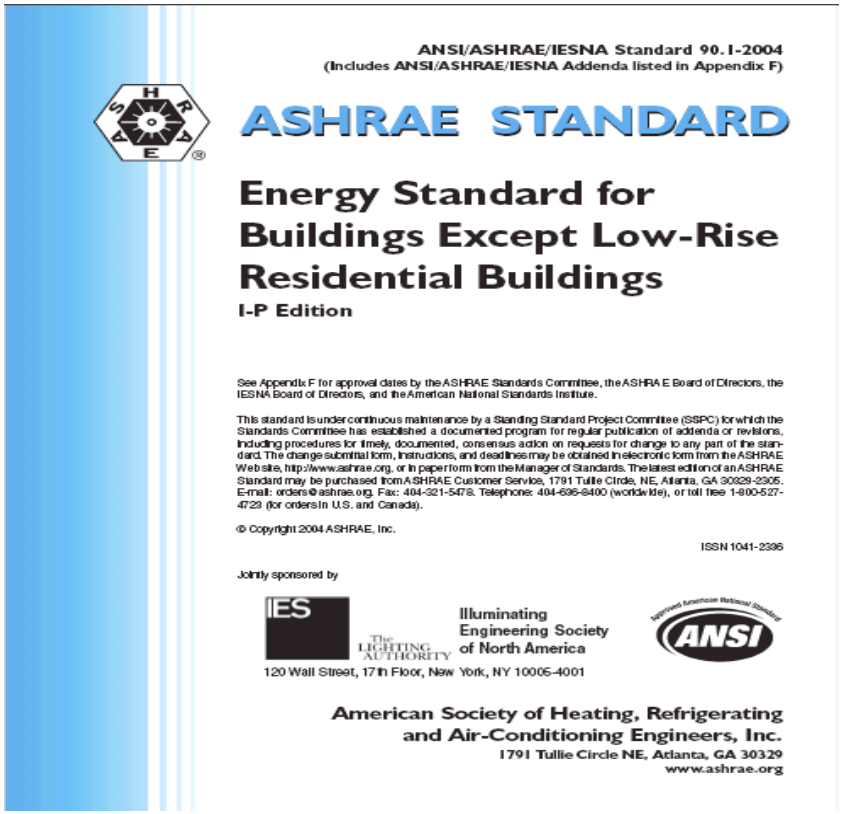
Why Sustainable Design?

- **Buildings In The US Consume 39% Of Our Total Energy**
- **70% Of Our Electricity Annually**
- **5 Billion Gallons Potable Water Per Day For Toilets**
- **Typical Construction Generates 2.5 lbs. Of Solid Waste Per Square Foot**
- **High Performance Building Practices Can Reduce These Negative Environmental Impacts**

What Is LEED?

- **6 Sections of LEED**
  - **Sustainable Sites**
  - **Water Efficiency**
  - **Energy & Atmosphere**
  - **Materials & Resources**
  - **Indoor Environmental Quality**
  - **Innovation & Design Process**

ASHRAE Standard 90.1



ANSI/ASHRAE/IESNA Standard 90.1-2004
(Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F)

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

ISSN 1041-2336

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120 Wall Street, 17th Floor, New York, NY 10005-4001

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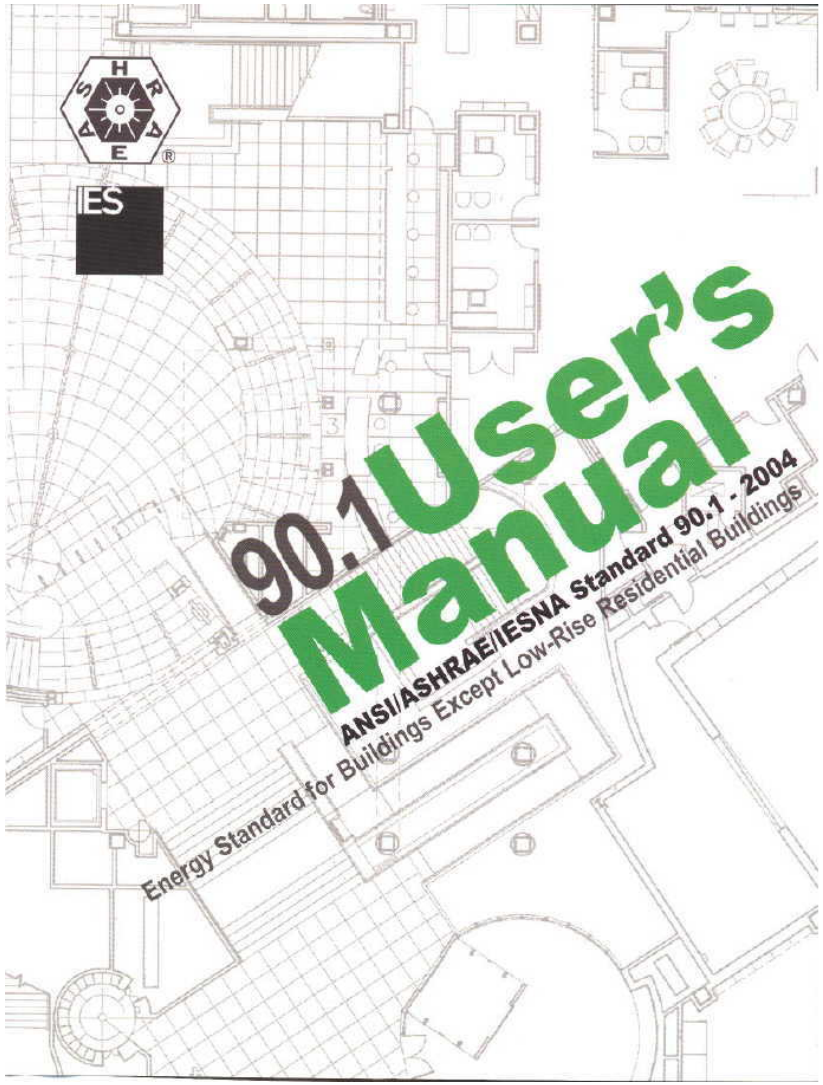
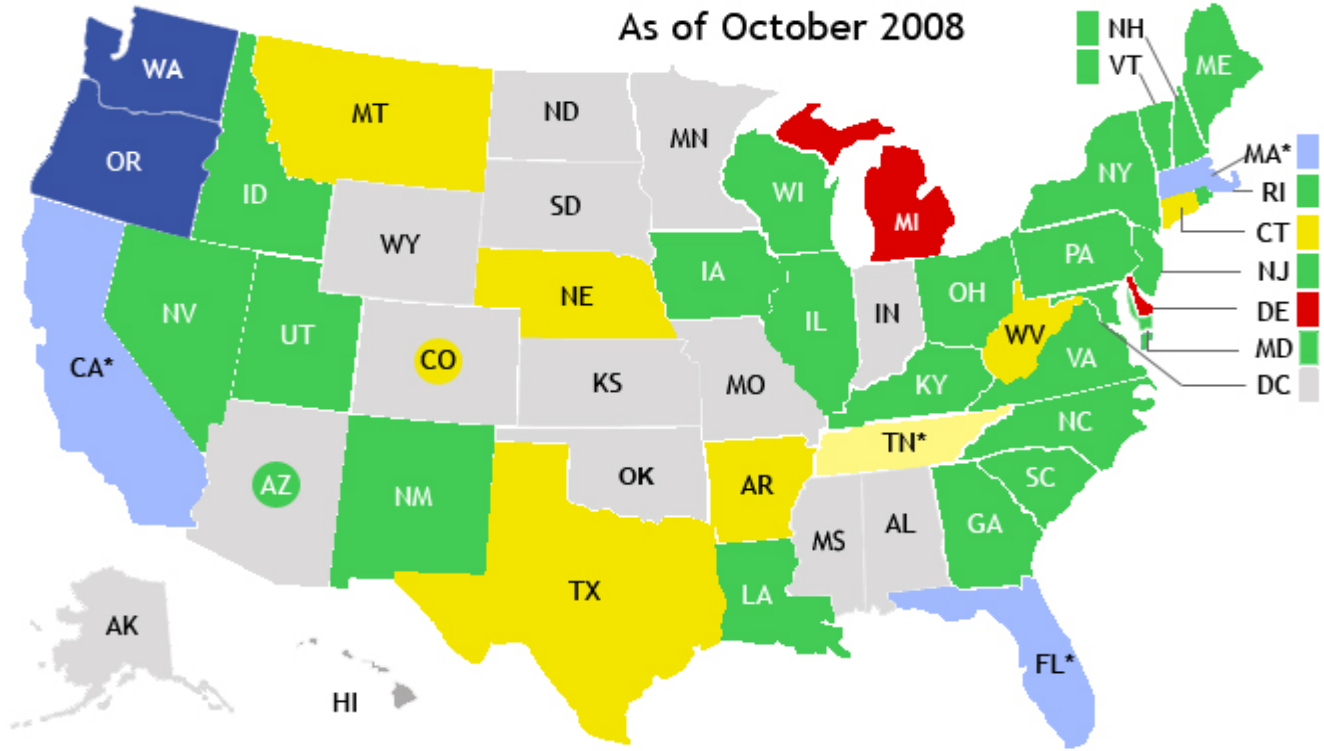


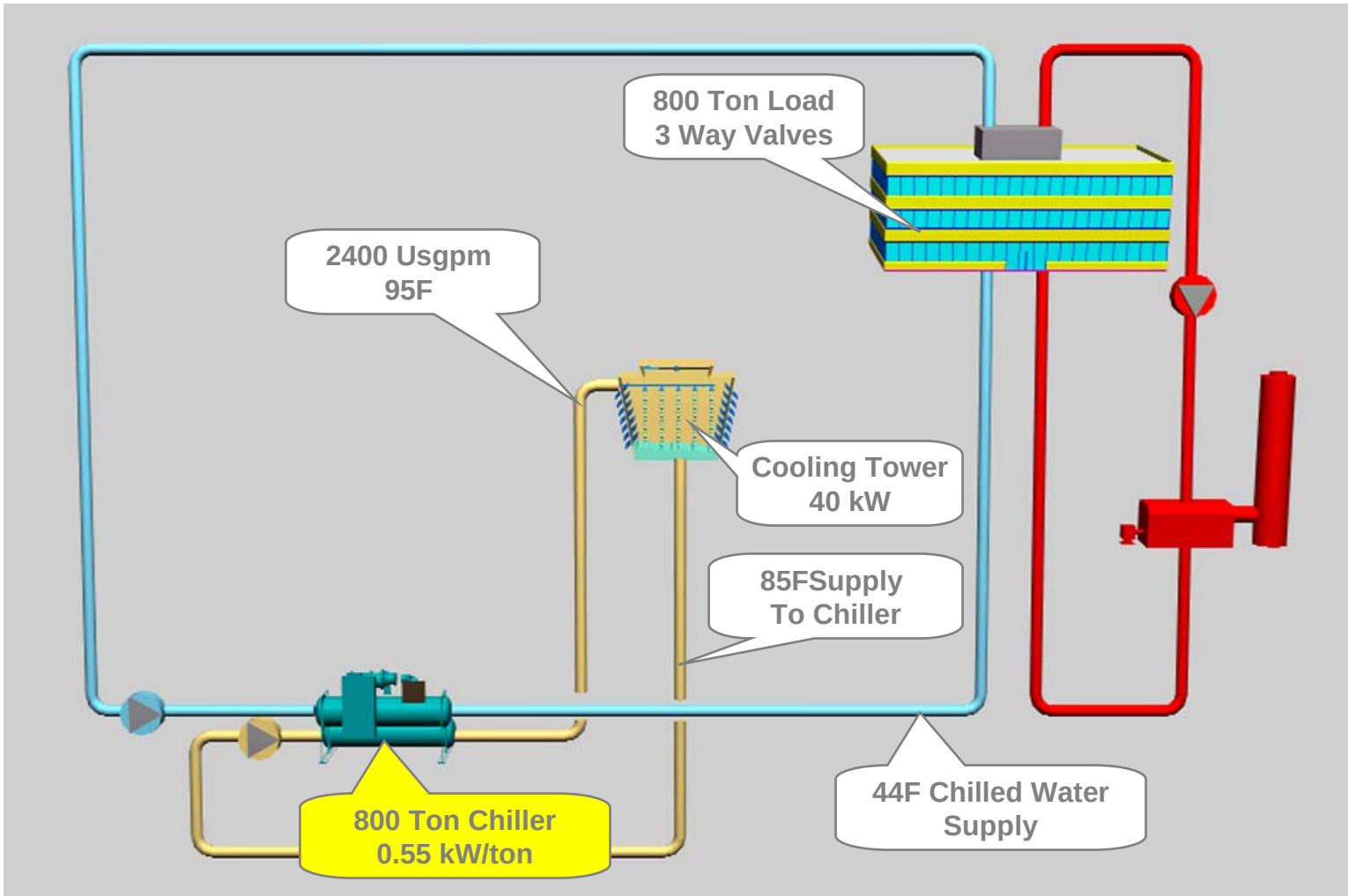
Commercial State Energy Code Status



- Effective code meets or exceeds ASHRAE 90.1-2007 or equivalent
- Meets 2006 IECC / ASHRAE 90.1-2004 or equivalent
- Meets 2003 IECC / ASHRAE 90.1-2001 or equivalent
- Meets 2001 IECC / ASHRAE 90.1-1999 or equivalent (meets EPCA)
- Precedes ASHRAE 90.1-1999 or no statewide code
- Significant adoptions in jurisdictions
- * Lighter color indicates code has been adopted but not yet effective

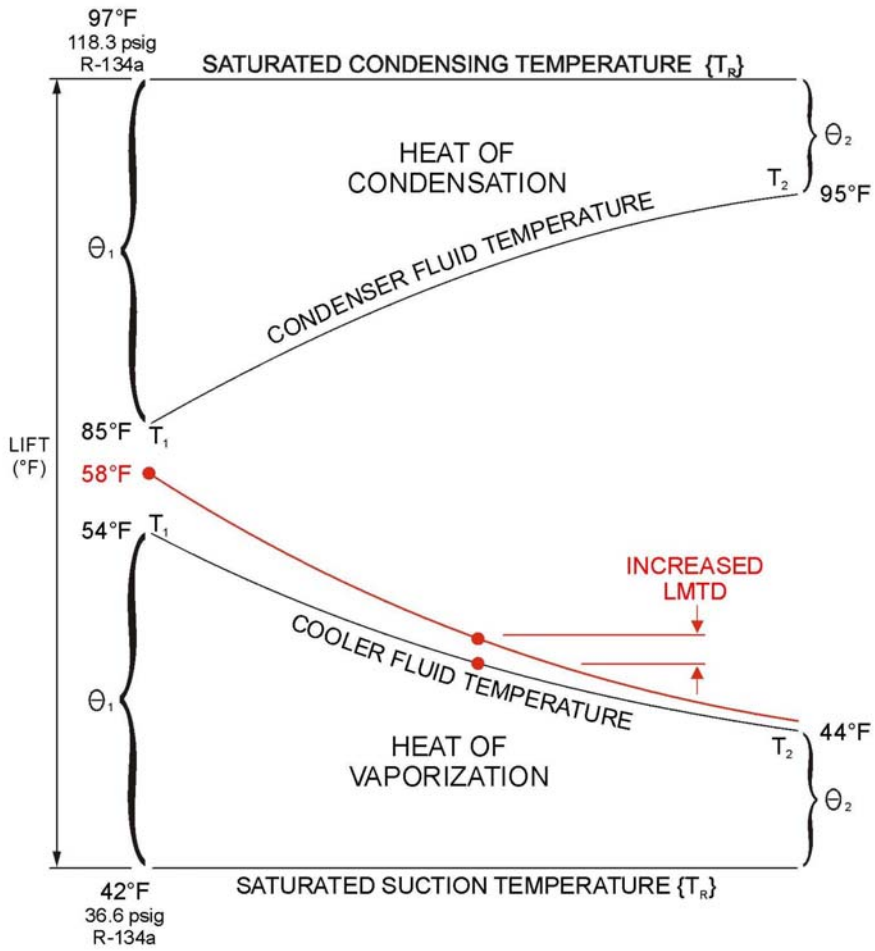
Source:
Building Codes Assistance Project
www.bcap-energy.org

Single Chiller Design



Range Vs. Supply Water Temperature

- **Change To 14F Range**
  - **Smaller Pumps, Pipes etc.**
- **Maintain Supply Water Temperature**
- **LMTD Increases**
  - **Improves Chiller Performance**
- **Hurts Chilled Water Coil Performance**
  - **Deeper Coils Required**
  - **Increased Fan Static Pressure**



Why Consider Heat Recovery?

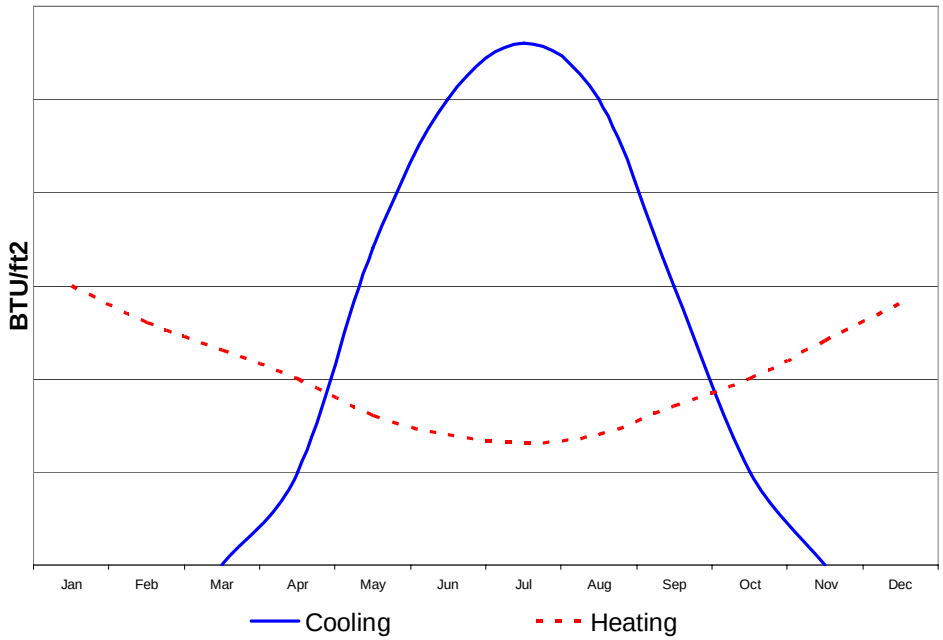
- **Green Is Good**
  Conservation of Natural Resources
- **Lower Annual Energy Usage**
  - **Reduce Operating Cost**
- **Provide a Good Life Cycle Analysis**

Green

- **ANSI/ASHRAE/IESNA Standard 90.1**
  - **LEED requires you comply with 90.1 and exceed it for more points.**
  - **LEED requires some water conservation and reducing evaporation from towers qualifies.**
  - **Heat Recovery chiller in the condenser stream reduces water evaporation.**

Heat Recovery Requirements

Simultaneous Heating And Cooling



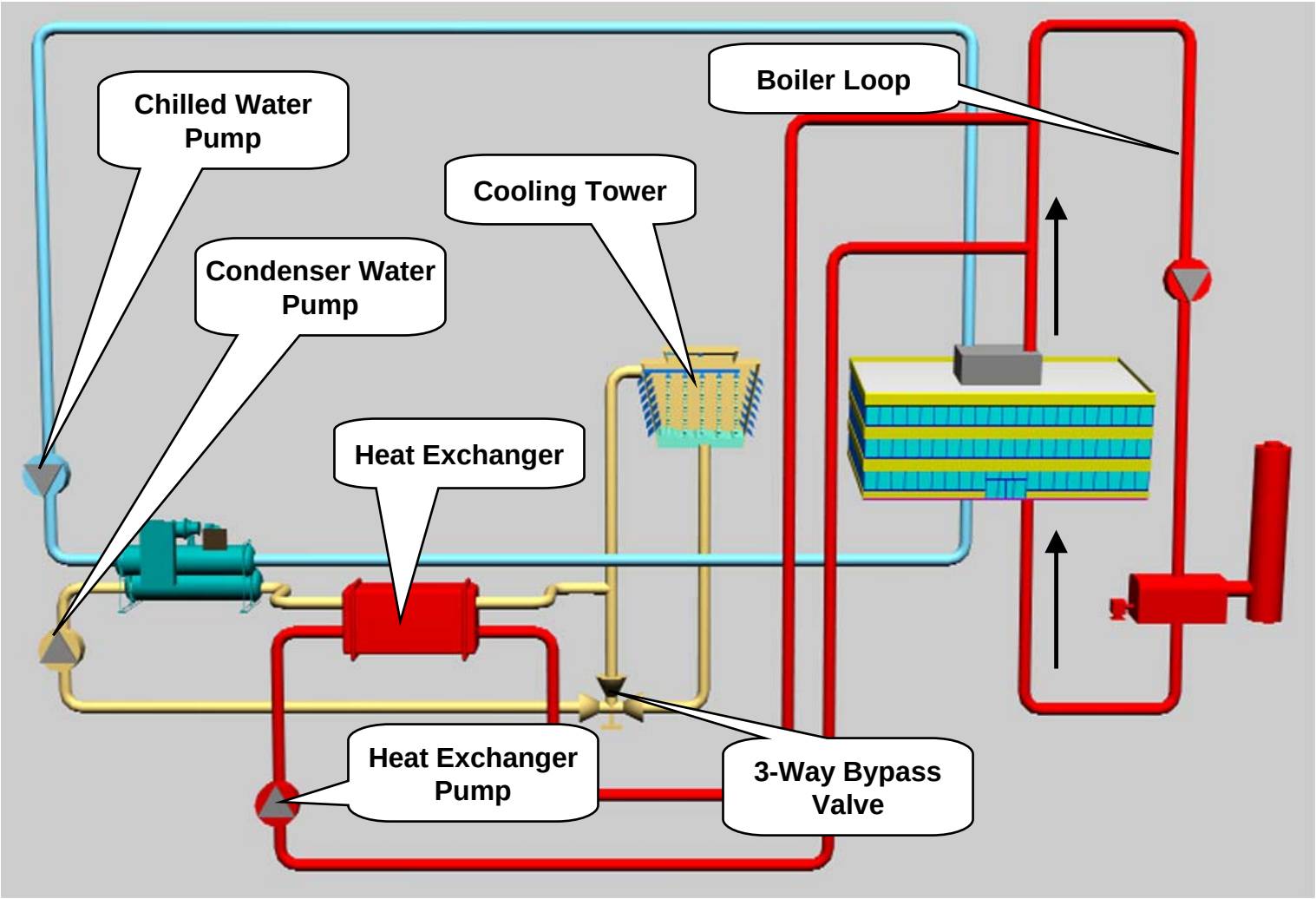
- **The Potential Heat Recovery At Any Point In Time Is The Lesser Of The *Heat Source* Or The *Heat Load***

Critical !!!

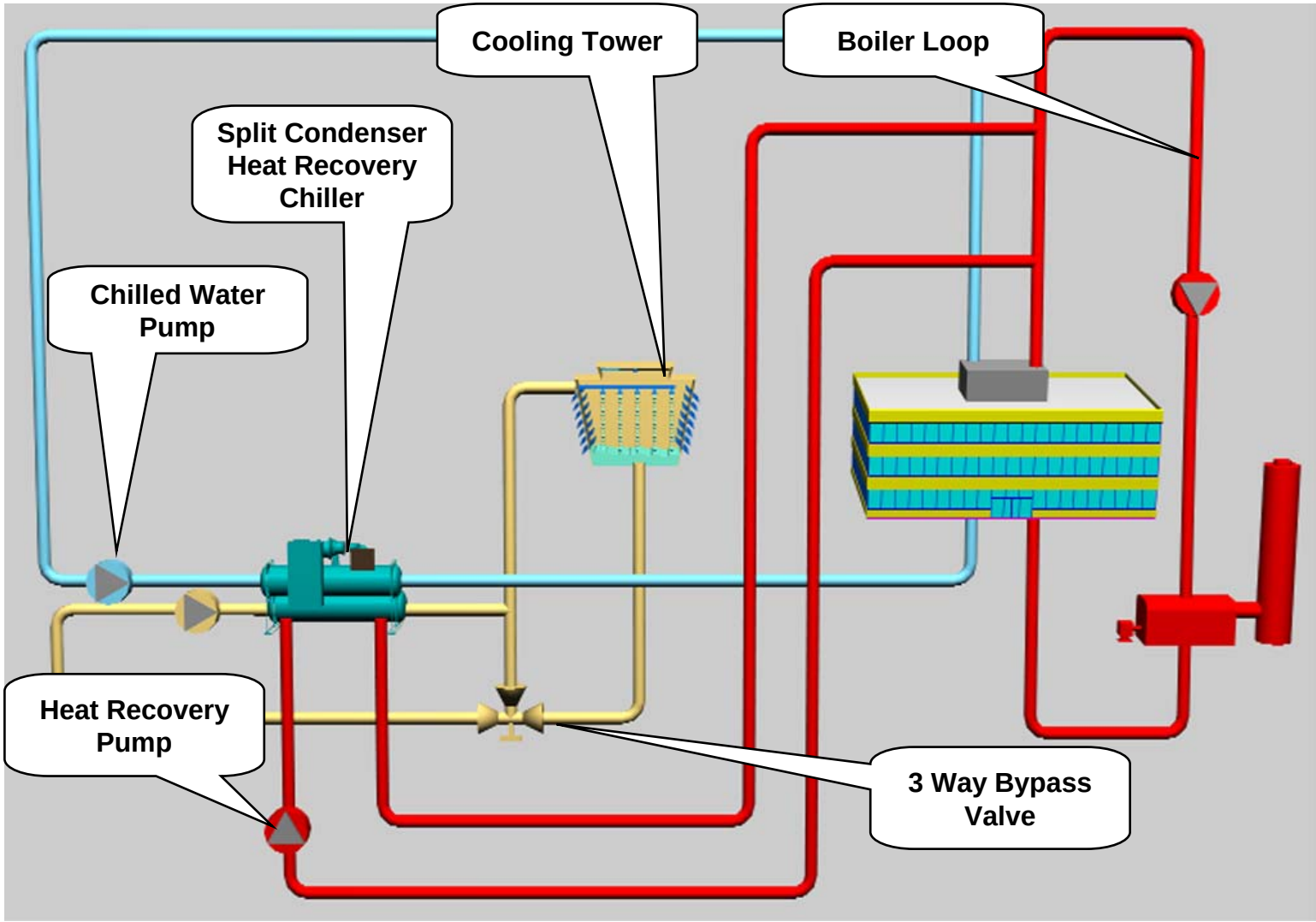
Must have a heat source

Cooling & heating loads are coincident

Single Condenser HR Design

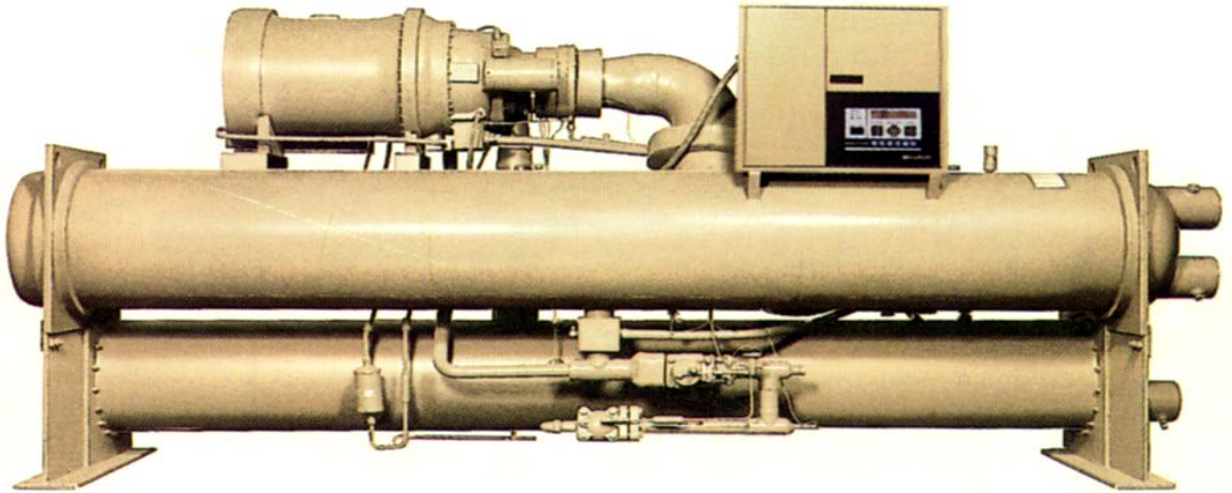


Split Condenser HR Design

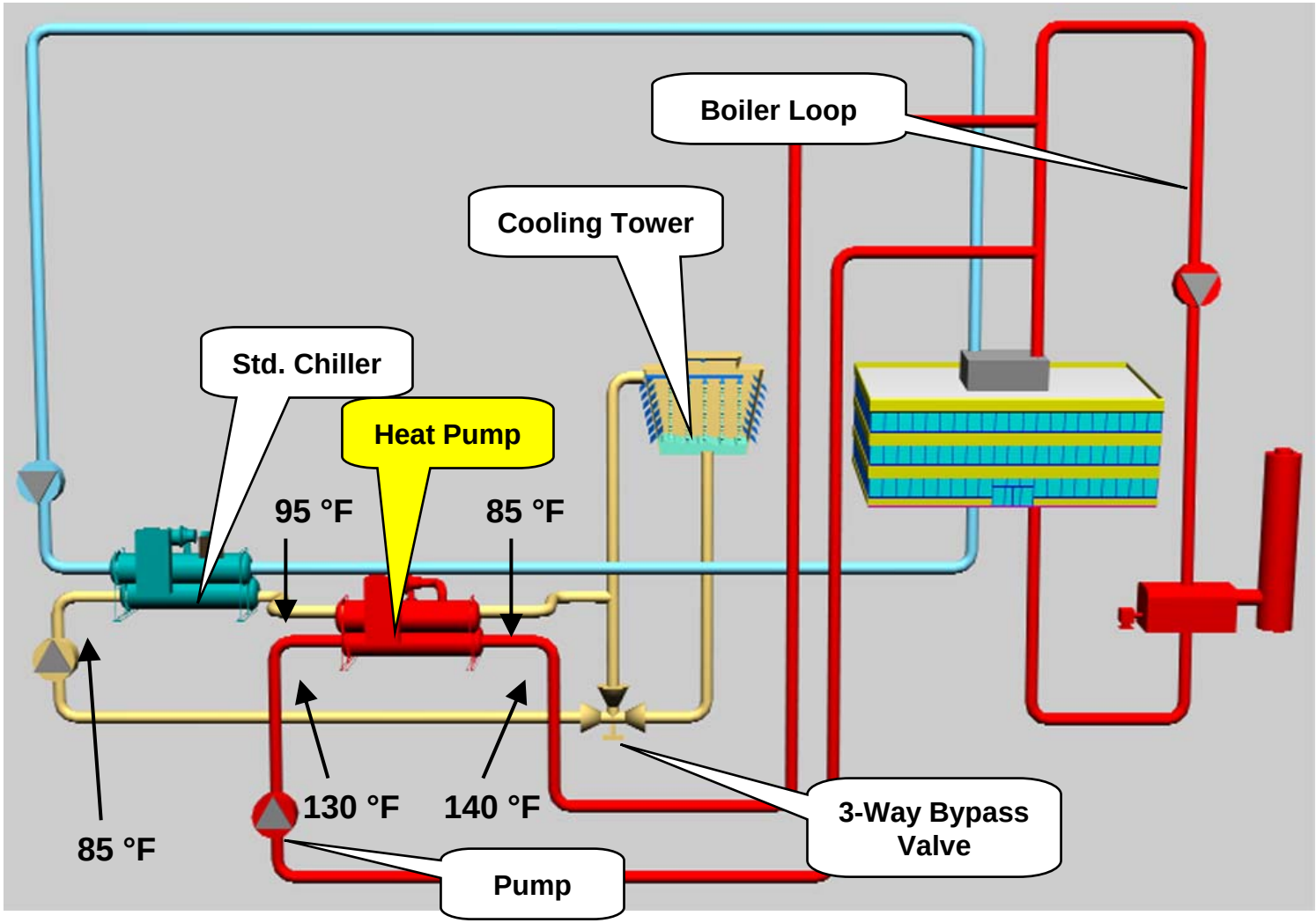


Looks like a normal chiller!

They are!!!

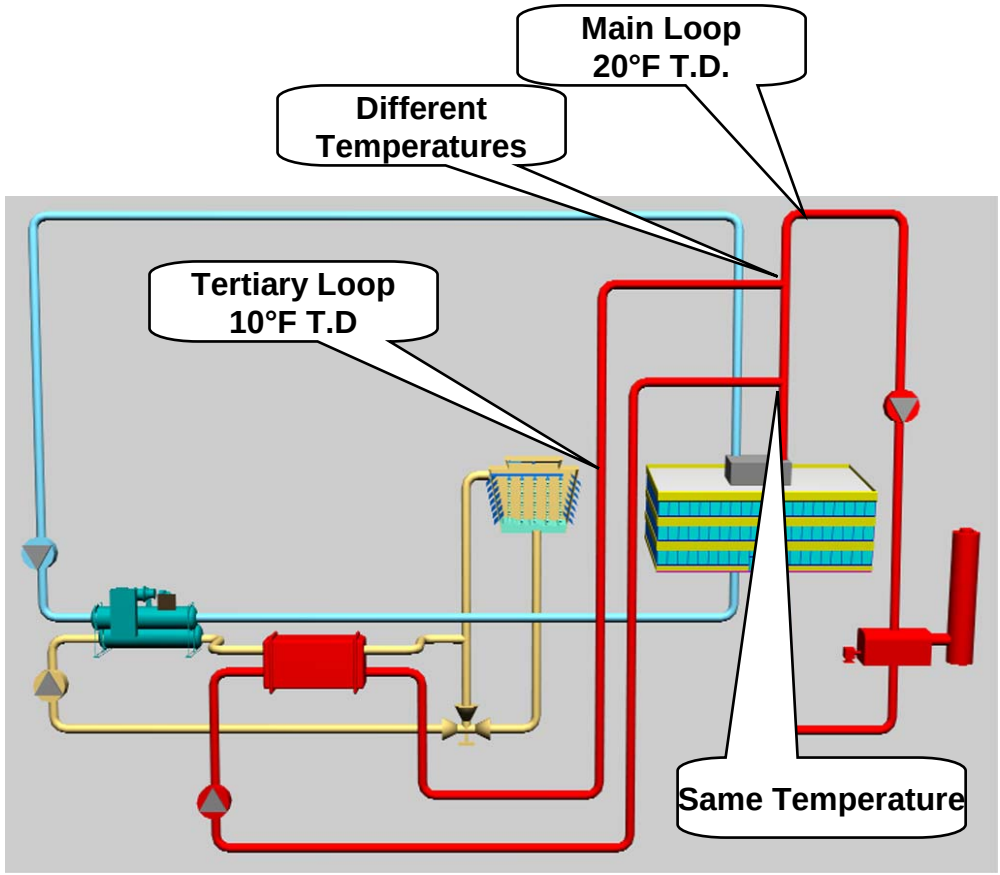


Heat Pump Chiller Design



Tertiary Loop Design

- Allows Different Flowrates And Temperature Ranges In HR Loop From Boiler Loop
- Can Reclaim Max. Energy
- Isolates Loops
- Pump Only Operates When Required
  - Std 90.1 Requires Pump Pressure Drop Exceeds 20 ft



Heat Recovery Design

- Generally Design Boiler Load Greater Than Design Chiller THR (Total Heat of Rejection)
  - Actual Design Heat Recovery Rate Requires Annual Energy Analysis
  - Almost Never Boiler Or THR Design Capacity
  - Load Will Be Met By Combination Of HR And Boiler
- THR = 1.25 x Chiller Capacity
- Only One Chiller Need Be HR Type In Multiple Chiller Plant
  - Must Be First On, Last Off

Heat Recovery Control

"During Heat Recovery Mode, Maintain Boiler Return Water Temperature At 95ºF"

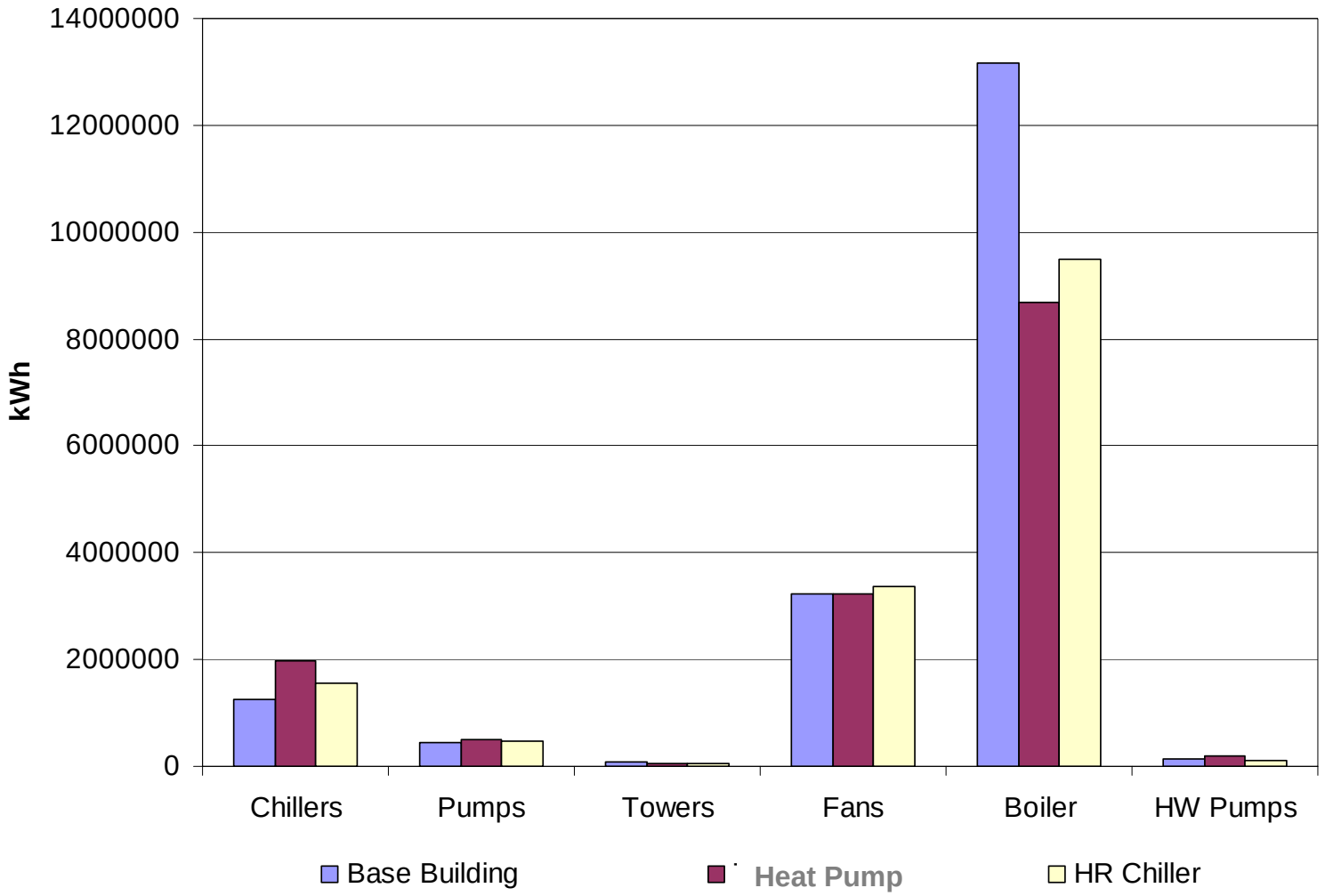
- Boiler Supply Water Temperature Will "Float" Depending On Actual Heating Load In Building
- 25% Boiler Load = 100°F SWT (5°F Temperature Range)

Not

"During Heat Recovery Mode, Maintain Boiler Supply Water Temperature At 105ºF"

- 25% Boiler Load = 100°F RWT
- Entering Condenser WT will be 5°F Higher Than Above
- Boiler Will Still Be Required
- Same Amount Of Energy Will Be Recovered
- Chiller will Work A Lot (10%) Harder

Results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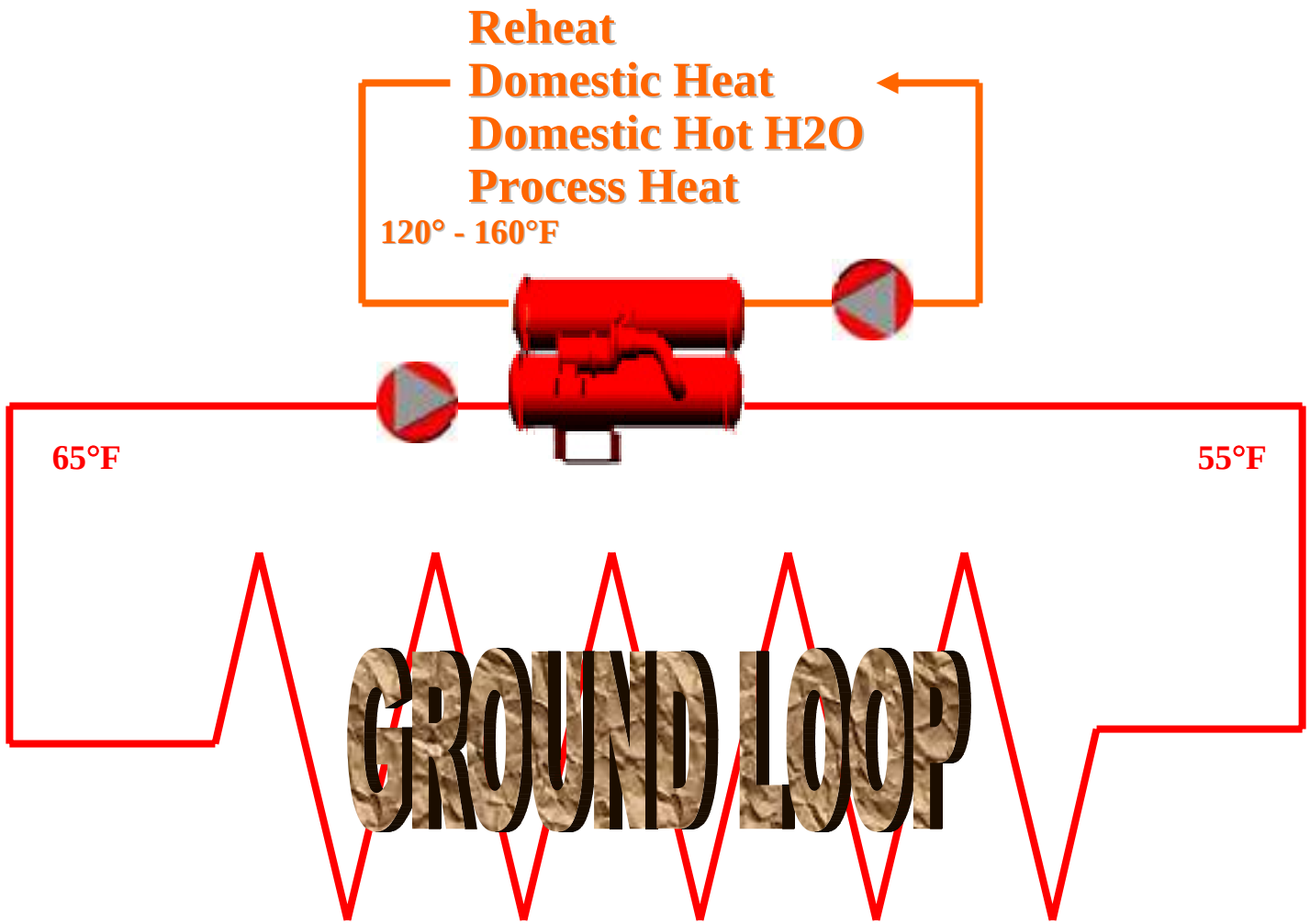
Boiler
HW Pumps
Base Building
Heat Pump
HR Chiller

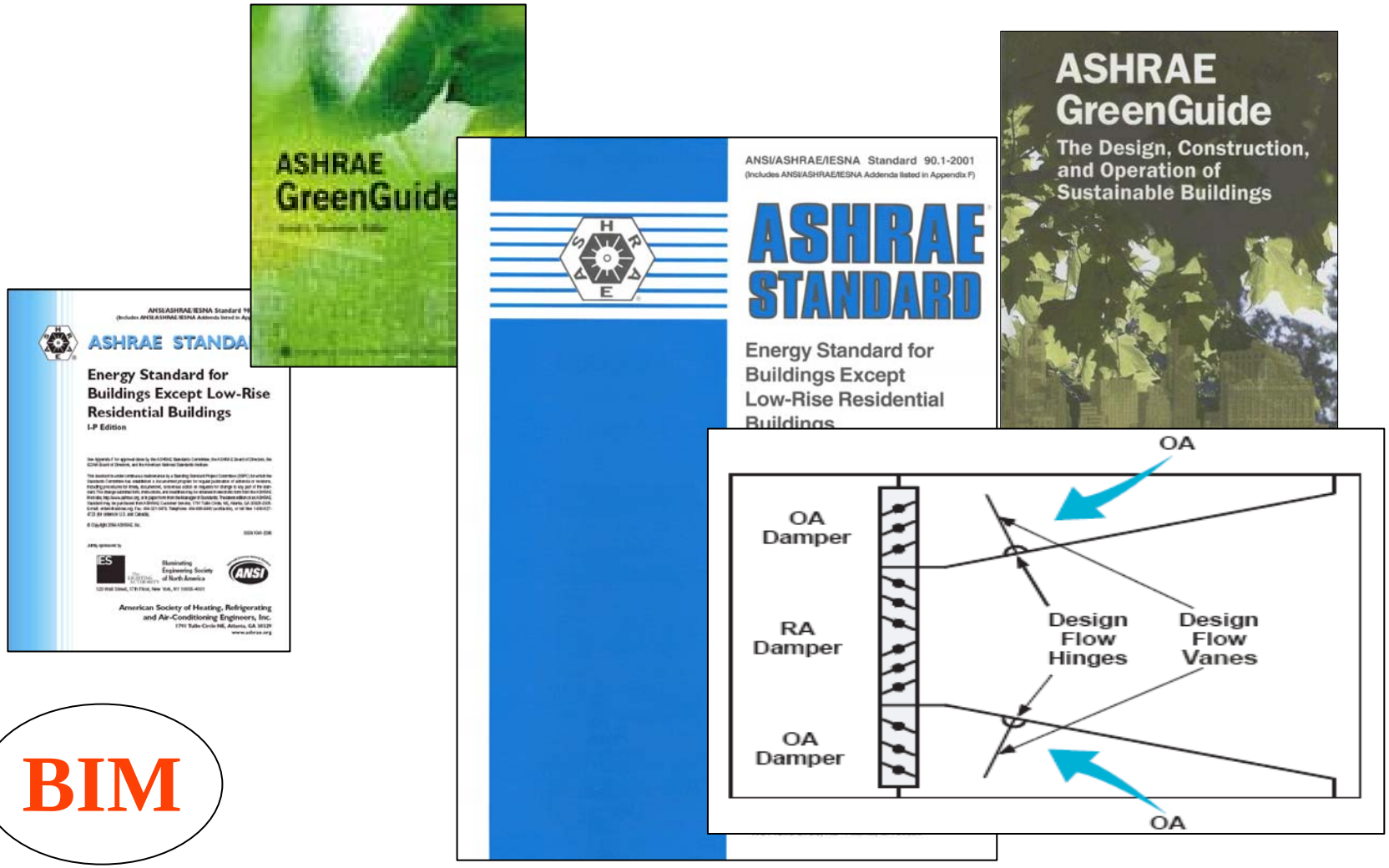
Geothermal Heating



Heat Pump Benefits

- Recovers Waste Heat
- Heats Water Economically
- Saves Water
- Saves Chemical Treatment
- Reduces Blowdown & Sewer Charges
- Improves Chiller Efficiency

Analysis is a MUST



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Questions?