Campus Conversion to Climate Friendly Refrigerants

ATMOsphere America 2014
June 18, 2014

Genentech
A Member of the Roche Group

Agenda

- Brief Overview of Campus
- Project Objectives, Scope & Challenges
- Solutions (and lack of):
  - Specialty Equipment
  - Cold Rooms
  - Process Cooling
  - Building HVAC
  - Large Central Chillers
- Challenges to the Industry (and Opportunities)

Genentech Company Information

Genentech at a glance:

- Founded more than 35 years ago
- Leading biotechnology company that discovers, develops, manufactures and commercializes medicines to treat patients with serious or life-threatening medical conditions.
- Personalized Healthcare is a key element of our research and early development strategy.
- Focus on tailoring treatments to specific diseases and patients and identifying which patients are most likely to respond.

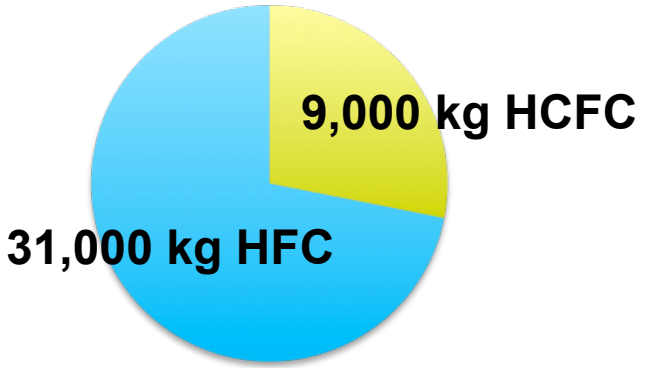
Project Overview

OBJECTIVE:

- Eliminate the use of substances which have a negative impact on the environment caused by ozone depletion, global warming, or persistence in the atmosphere

SCHEDULE:

- 2018: CFC's & HCFC's
- 2022: HFC's



SCOPE:

- 36 existing buildings and 5 scheduled new buildings.
- Equipment to be replaced include:
  - 47 large units over 100 tons
  - 618 mid size units below 100 tons
  - 3,533 small units of fractional ton capacity
- +40,000 kg of non-complaint refrigerant to be removed

Refrigerants

IDEAL REFRIGERANT ATTRIBUTES:

- Zero GWP
- Zero ODP
- Low persistence in the atmosphere
- ASHRAE Classification A1 (non-toxic, non-flammable)
- High coefficient of performance (COP)
- Commercially available equipment & service

AVAILABLE REFRIGERANTS:

Ammonia (NH_3)
Carbon Dioxide (CO_2)
Hydrocarbons
Water – Absorption Chiller
Water – Evaporative Cooling

Site Challenges

- 36 buildings and 650+ pieces of equipment
- Little consistency due to rapid growth
- Long distances between buildings
- Varying topography: ~120’ elevation change
- Numerous rooftop DX units
- GMP facilities & 24/7 operations
- Large quantity of specialty equipment

Process, Cold Room & Specialty Cooling Equipment

System Types	Supply Temp. Range (°C)	Quantity of Systems	Total Installed Capacity – Tons (kW)
Chillers	(-20) to 5	22	1,700 (6,000)
Cold Rooms	2 to 8	110	450 (1,580)
Freezer Rooms	(-20) to (-25)	10	60 (210)
Ice Equipment	(-12)	3	4 (14)
Lyophilizers	(-80) to (-70)	12	133 (470)
Kitchen Equip.	(-23) to 3.5	4	42 (150)
Misc.	TBD	5	40 (140)
Total	--	166	2430 (8550)

Specialty Equipment: -80C Freezers

Specialty Equipment: Lyophilizers & Freeze/Thaw

Ammonia (NH_3)
Carbon Dioxide (CO_2)
Hydrocarbons ✔
~~Water – Absorption Chiller~~
~~Water – Evaporative Cooling~~

Walk-in Cold Rooms & Freezers

Ammonia (NH_3)
Carbon Dioxide (CO_2) ✔
Hydrocarbons
~~Water – Absorption Chiller~~
~~Water – Evaporative Cooling~~

Industry Challenge #1
Improve packaged CO_2 transcritical units & build a service network

Industry Challenge #2
Develop CO_2 systems for the HVAC market

Process Cooling Chillers

Ammonia (NH_3)
Carbon Dioxide (CO_2)
Hydrocarbons ✔
~~Water – Absorption Chiller~~
~~Water – Evaporative Cooling~~

Industry Challenge #3
Clarify and simplify SNAP list. Why "Acceptable substitute for…." approach?

Industry Challenge #4
Educate Fire Marshals about hydrocarbon refrigerant equip. & develop model code

Industry Challenge #5
Market hydrocarbon chillers in U.S., develop service network

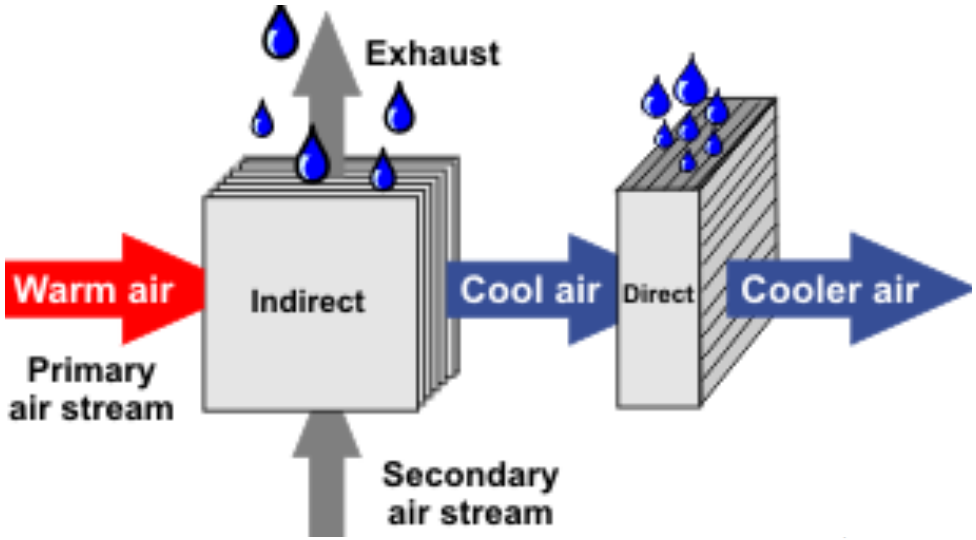
Building HVAC – Air-Cooled DX Systems

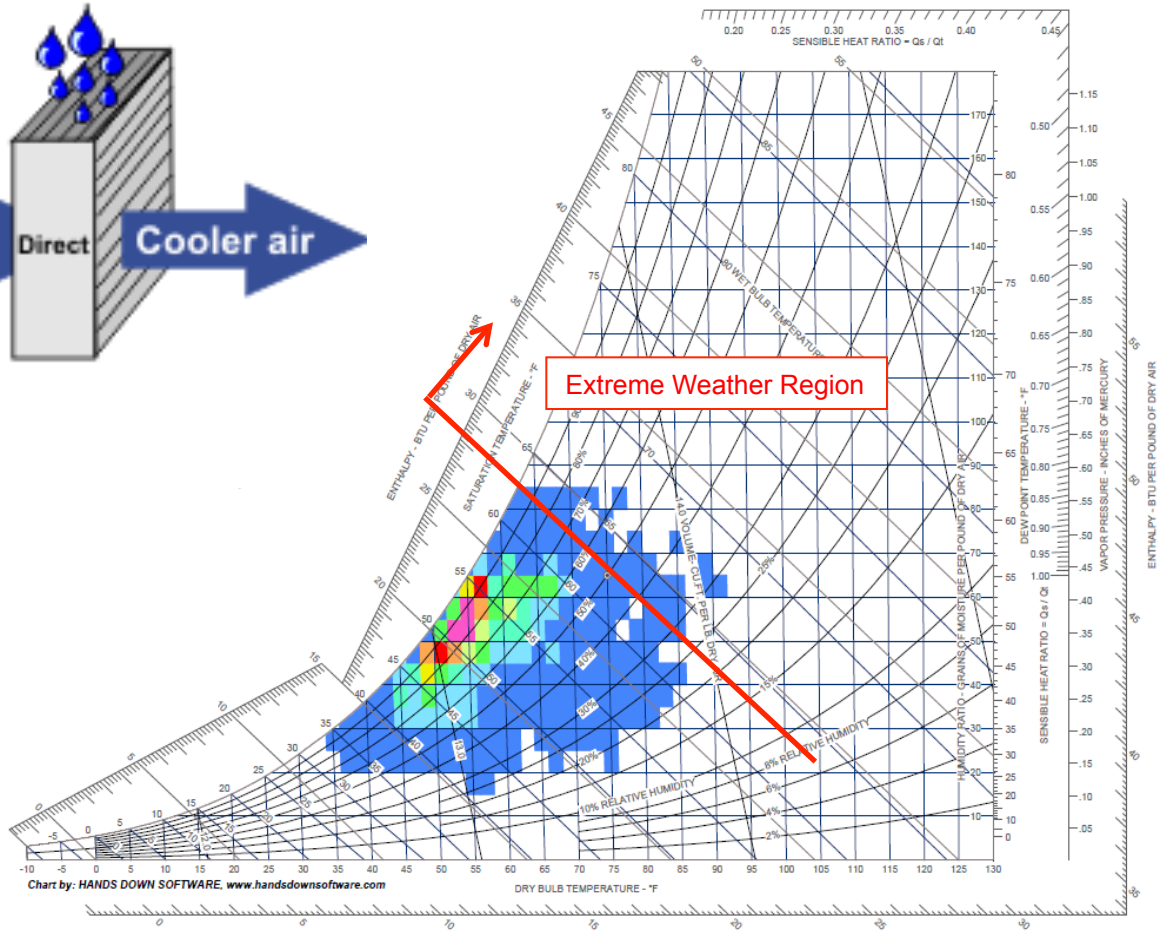
SOLUTIONS:

- Central chilled water
- Evaporative cooling??

~~Ammonia (NH_3)~~
~~Carbon Dioxide (CO_2)~~
~~Hydrocarbons~~
~~Water – Absorption Chiller~~
Water – Evaporative Cooling

Indirect / Direct Evaporative Cooling





So. San Francisco, CA

Building HVAC – Air-Cooled DX Systems

SOLUTIONs:

- Central chilled water
- Evaporative cooling??

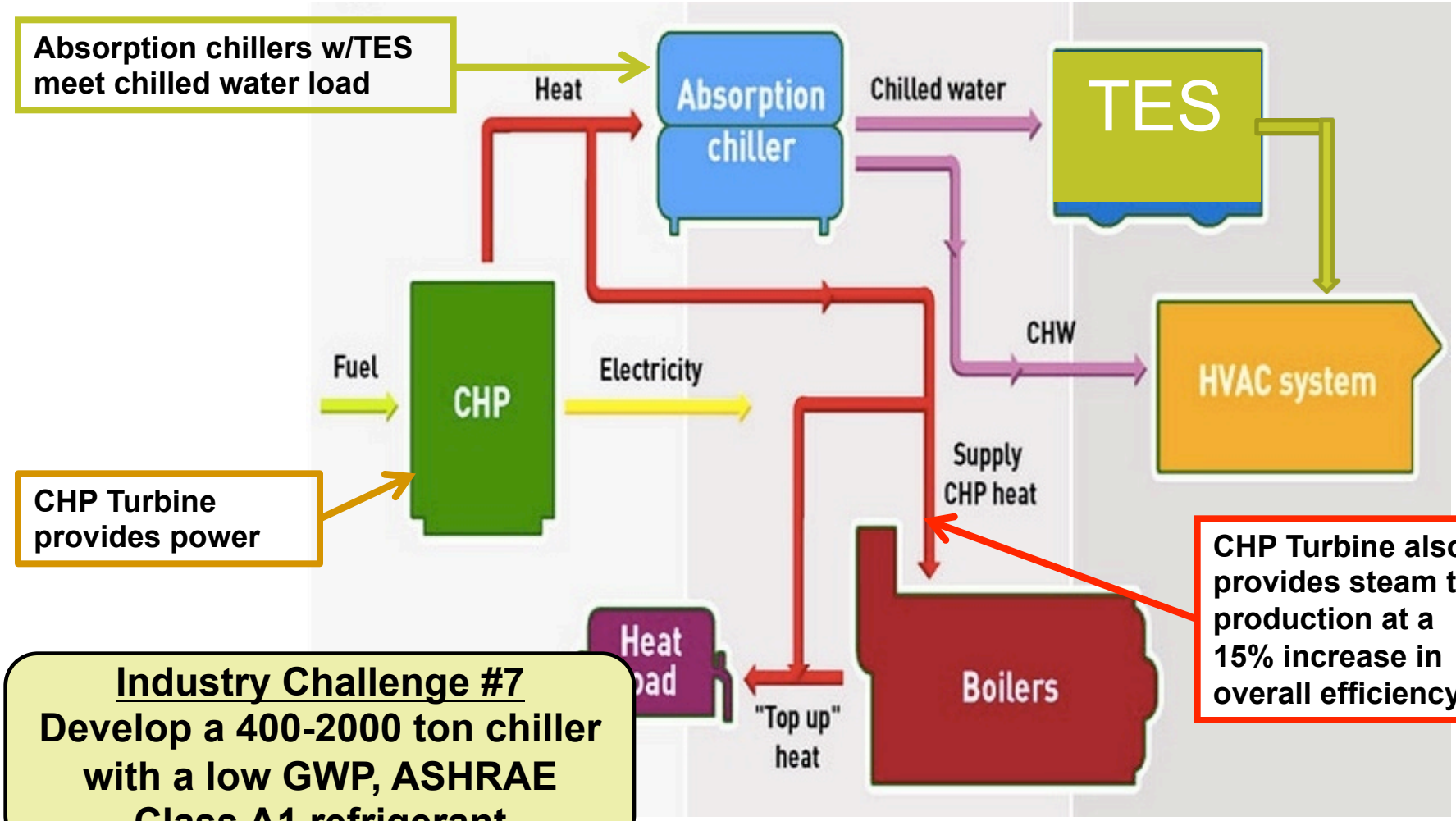
~~Ammonia (NH_3)~~
~~Carbon Dioxide (CO_2)~~
~~Hydrocarbons~~
~~Water – Absorption Chiller~~
Water – Evaporative Cooling

<u>Industry Challenge #6</u>
Develop an air-cooled packaged rooftop DX unit with low GWP refrigerant

Large Central Chillers

Ammonia (NH_3)
~~Carbon Dioxide (CO_2)~~
~~Hydrocarbons~~
Water – Absorption Chiller
~~Water – Evaporative Cooling~~

Combined Heat & Power (CHP) w/ Absorption Cooling



Challenge to the Industry - Summary

Industry Challenge #1
Improve packaged CO_2 transcritical units & build a service network

Industry Challenge #2
Develop CO_2 systems for the HVAC market

Industry Challenge #3
Clarify and simplify SNAP list. Why "Acceptable substitute for R-xx …" approach?

Industry Challenge #4
Educate Fire Marshals about hydrocarbon refrigerant equip. & develop model code

Industry Challenge #5
Market hydrocarbon chillers in the U.S. & develop service network

Industry Challenge #6
Develop an air-cooled packaged rooftop DX unit with low GWP refrigerant

Industry Challenge #7
Develop a 400-2000 ton chiller with a low GWP/ODP, ASHRAE Class A1 refrigerant

Industry Challenge #8
Are there other low GWP/ODP, Class A1 refrigerants?

Ammonia (NH_3)
Carbon Dioxide (CO_2)
Hydrocarbons
Water – Absorption Chiller
Water – Evaporative Cooling
R-???