Webinar # 2

Incorporating Absorption Technology In District Cooling and Heating

Rajesh Dixit

Johnson Controls

November 1st, 2018

Welcome to the IDEA Webinar Series

- ❑ The webinar will start promptly at 1:00pm EDT (Boston time) and is scheduled to last sixty (60) minutes; including time for questions.
- ❑ Please mute your phone during the webinar. All lines are muted.
- ❑ If you are having problems with video or audio, please send a note via the Chat Box function on the right side. Click the Chat box and choose – "Chat privately to Cheryl Jacques (host)". Or call to IDEA at +1-508-366-9339.
- ❑ Questions to Presenters: Please enter your Questions in the Q&A box at the lower right of the screen. These questions will be moderated and addressed as time allows. We plan to handle Q&A at the conclusion of the presentation.
- ❑ Survey: Please complete the brief on-line survey following the webinar.
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Upcoming IDEA Conferences

DistrictCooling2018

Efficient Energy for Smarter Cities

DECEMBER 9-11, 2018 – ATLANTIS, THE PALM – DUBAI, UAE

CampusEnergy2019

February 26 - March 1, 2019 | New Orleans, LA | Hilton New Orleans Riverside

IDEA2019

The Energy for More Resilient Cities

110TH ANNUAL CONFERENCE & TRADE SHOW | June 24-27

David L. Lawrence Convention Center and The Westin Convention Center | Pittsburgh, PA

Johnson Controls

Speaker and Moderator

Speaker**:**
Rajesh Dixit
Director – Global Product Management
Johnson Controls York PA

Moderator:
Rob Thornton
IDEA President & CEO

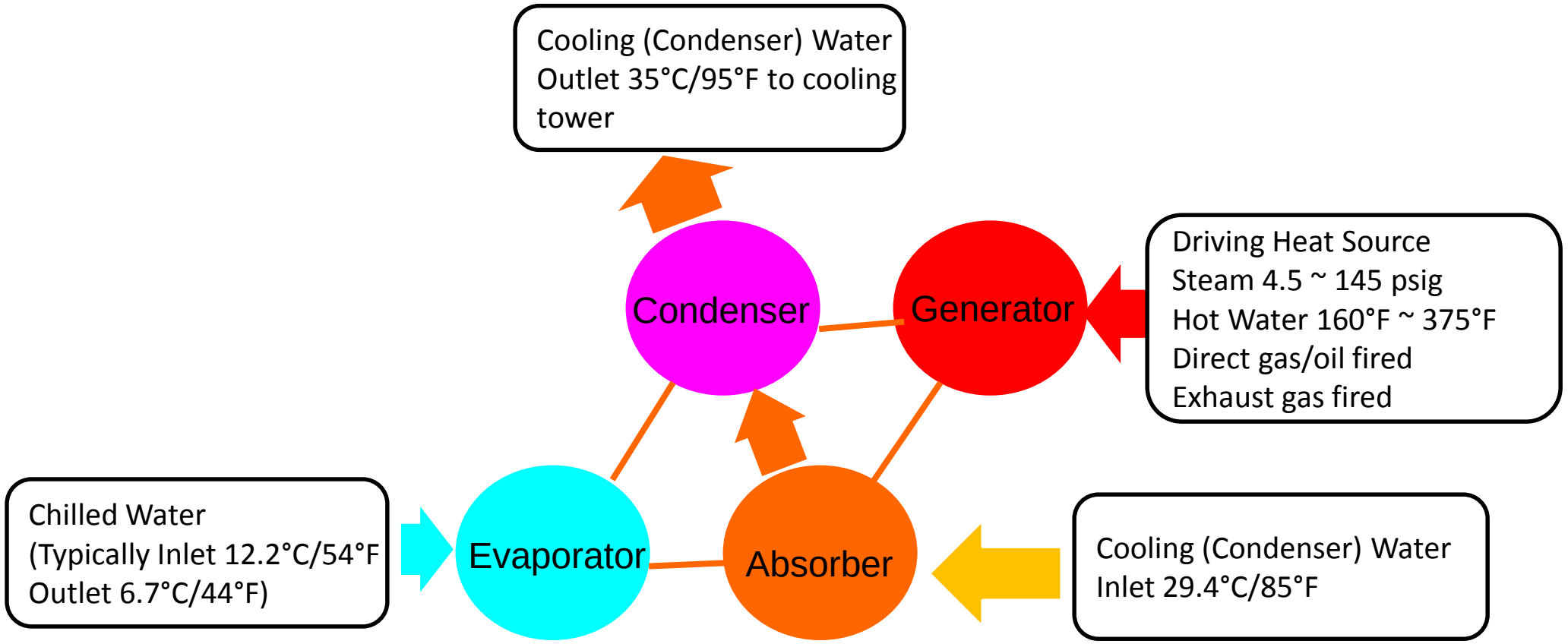
Learning Objectives

- Absorption Chillers - District Cooling Applications
- Absorption Heat Pumps - District Heating Applications

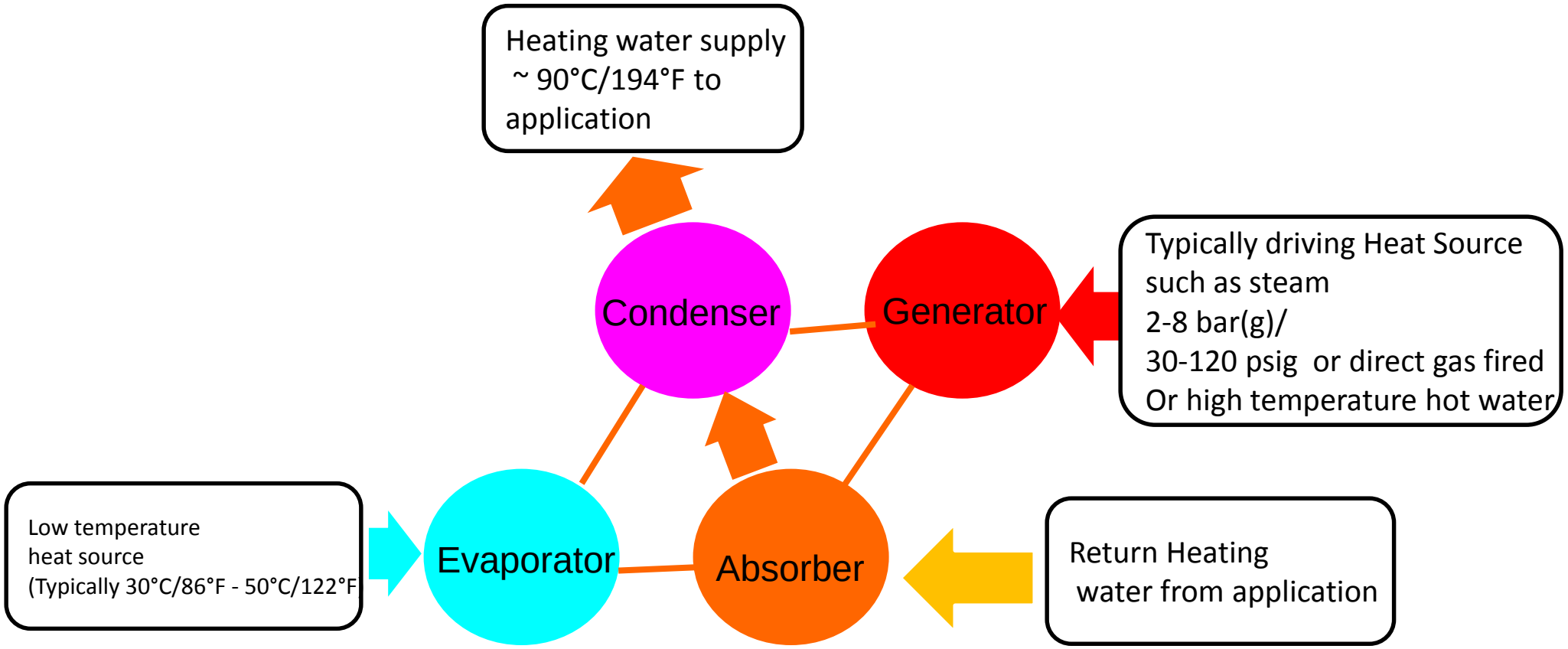
Outline

1. Overview of the Technology
2. Real World Applications
3. Conclusions

Four Basic Components
Chiller Mode



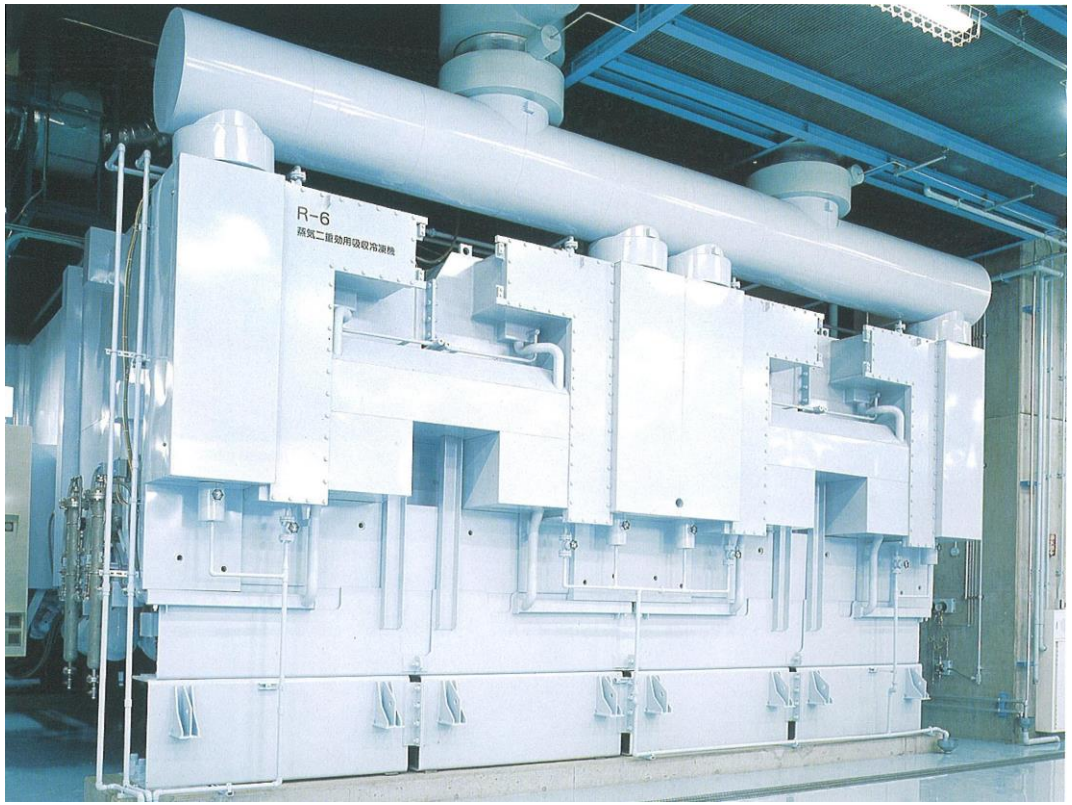
Four Basic Components
Heat Pump Mode



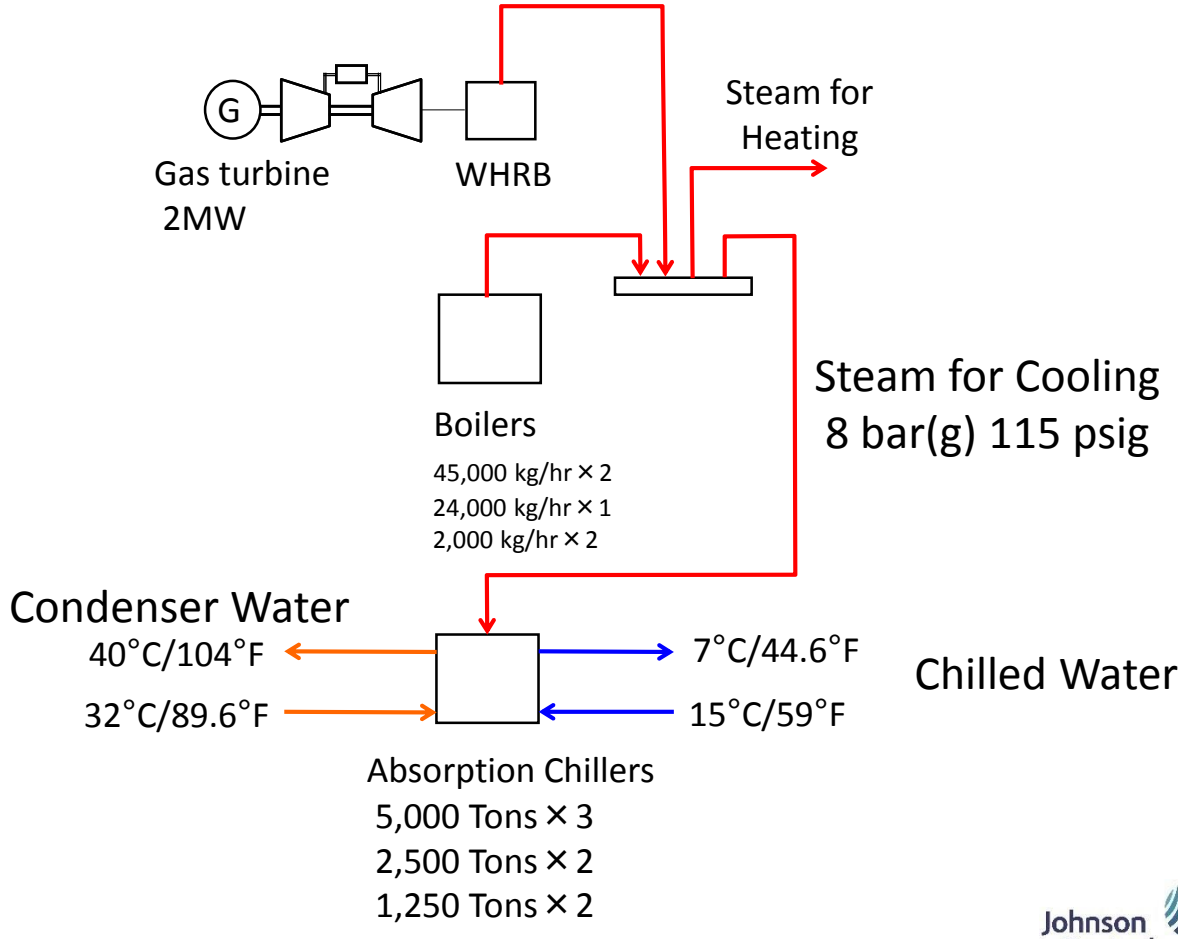
Overview of the Absorption Technology

1. Water as the refrigerant, Lithium Bromide as the absorbent
2. Driven by waste heat, low cost natural gas, renewable energy
3. Very less (negligible) electric consumption by the unit
4. Around ~ 75 years
5. Thousands of commercial, industrial installations worldwide

DISTRICT COOLING APPLICATION
22,500 TONS STEAM DRIVEN

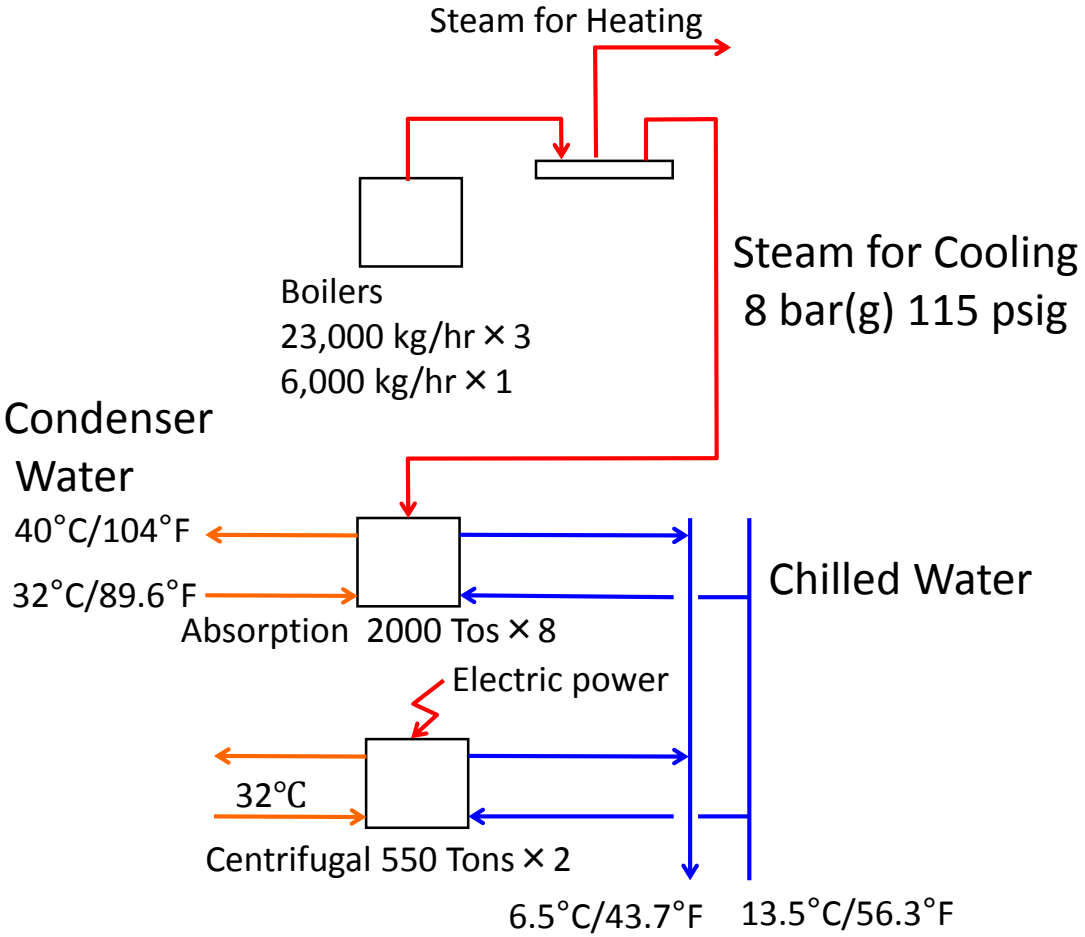


SYSTEM INVOLVES STEAM ABSORPTION CHILLERS

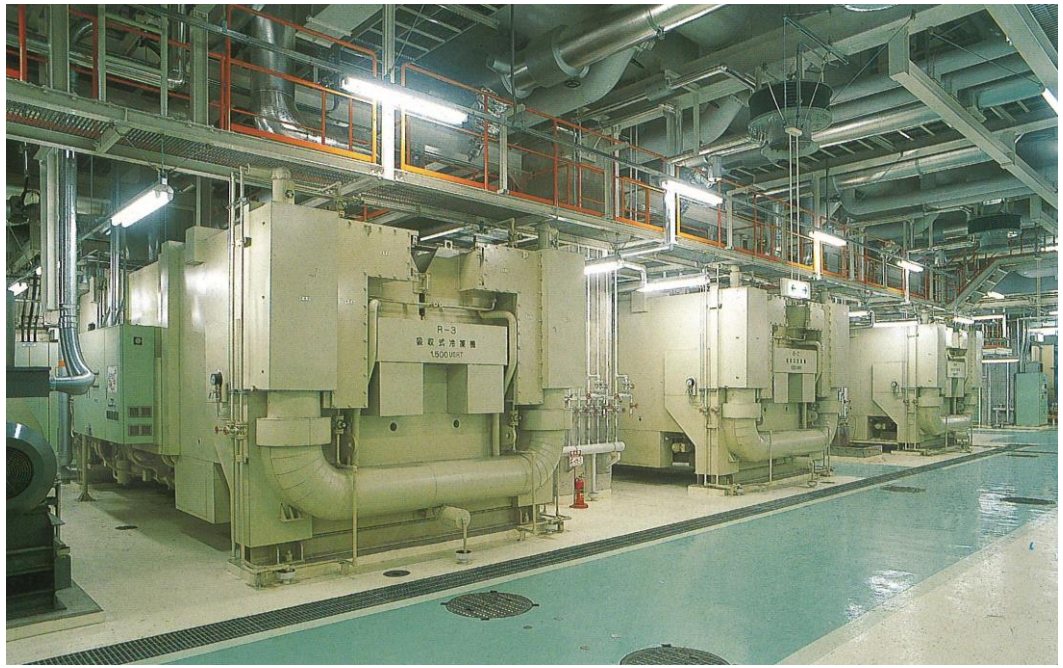


DISTRICT COOLING APPLICATION
17,100 TONS STEAM + ELECTRIC

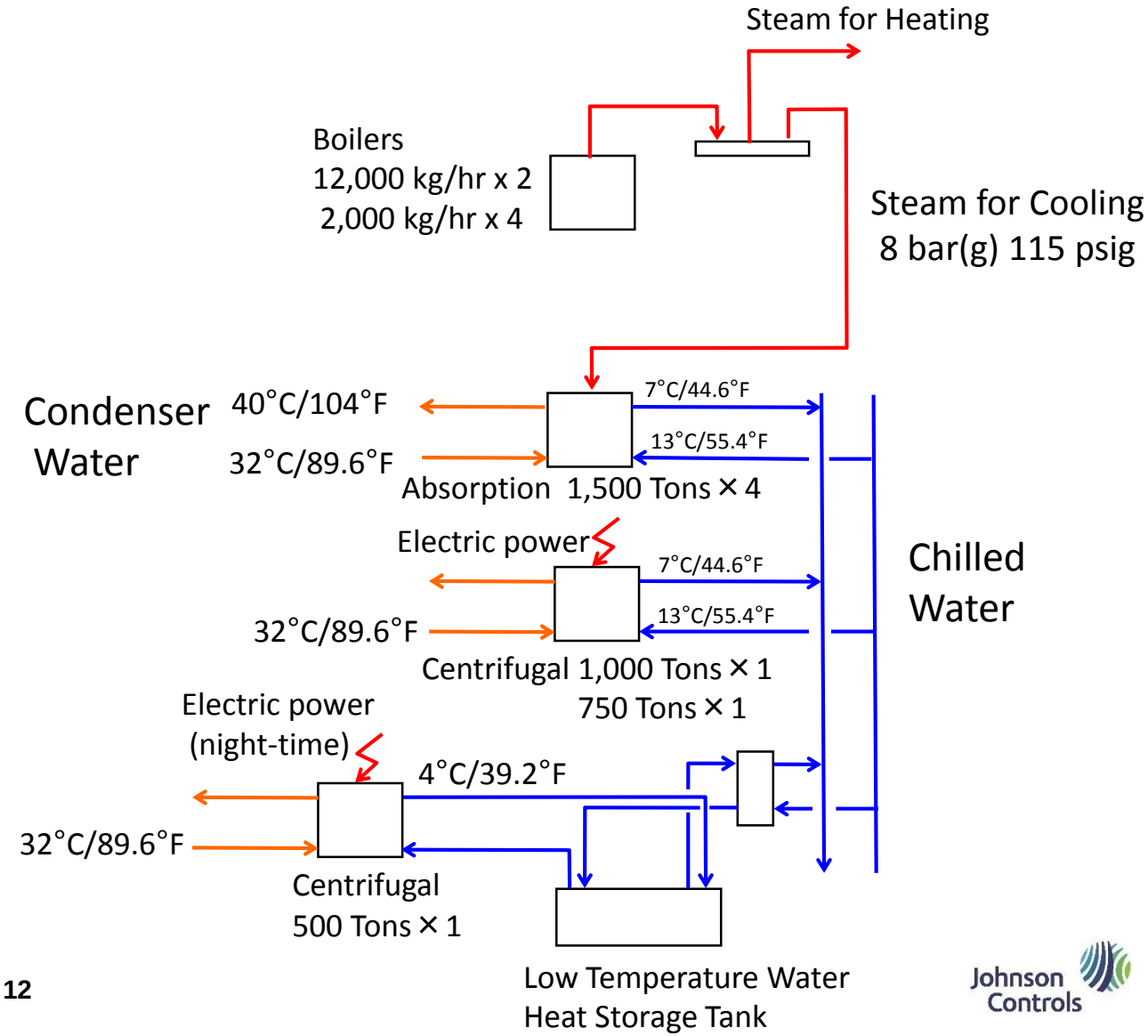
SYSTEM INVOLVES STEAM ABSORPTION AND ELECTRIC CENTRIFUGAL CHILLERS



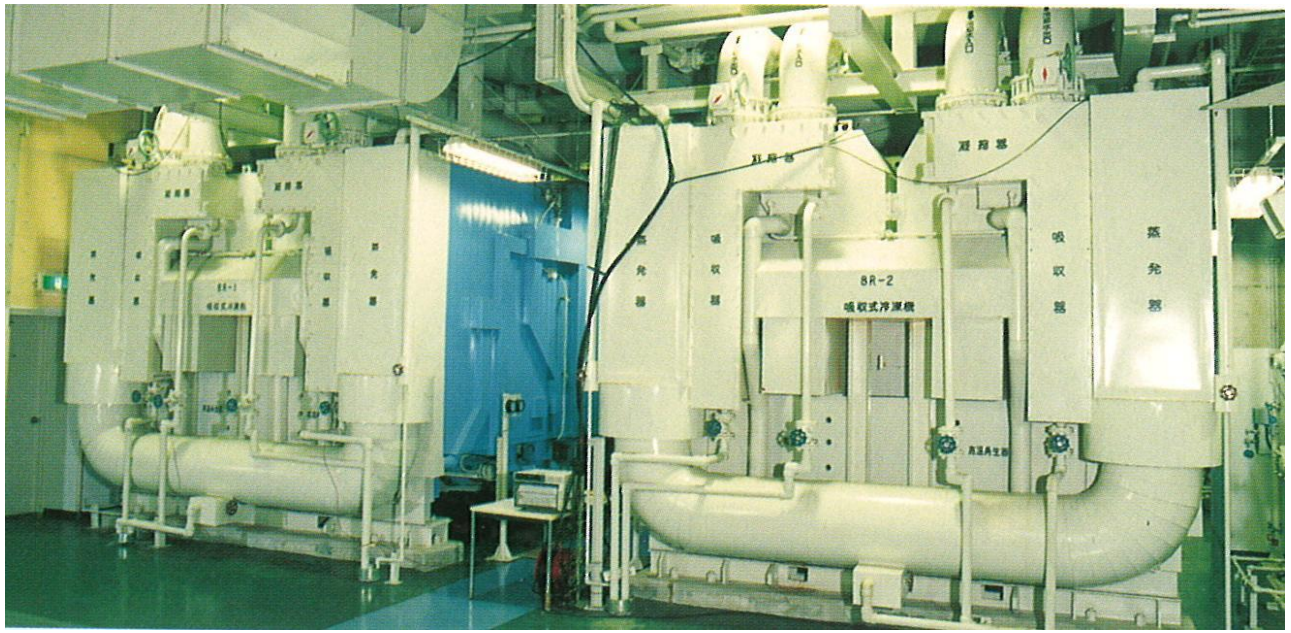
DISTRICT COOLING APPLICATION
8250 TONS STEAM+ELECTRIC+HEAT STORAGE



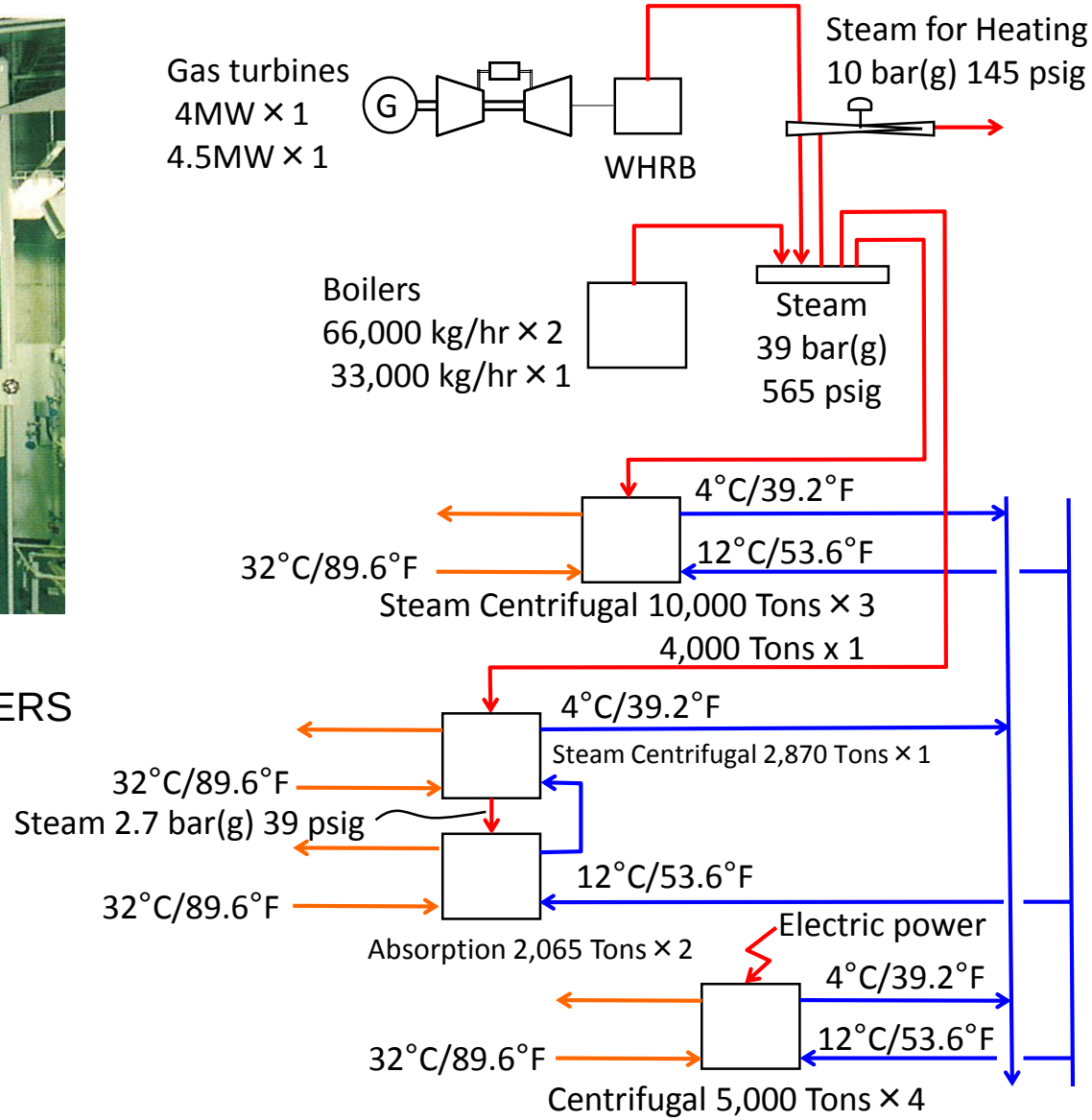
SYSTEM INVOLVES STEAM ABSORPTION,
ELECTRIC CENTRIFUGAL CHILLERS
AND LOW TEMPERATURE WATER HEAT STORAGE



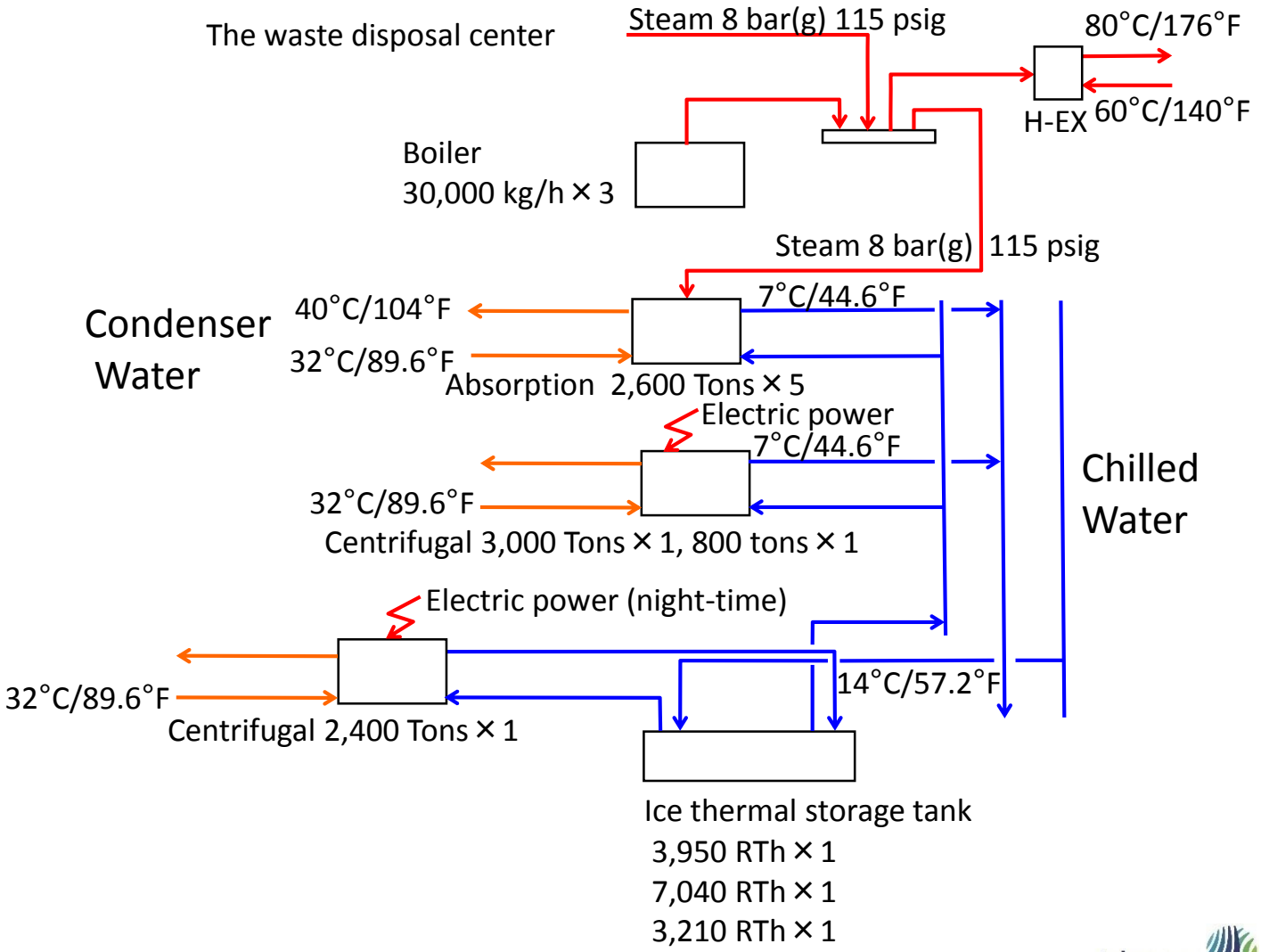
DISTRICT COOLING APPLICATION
61,000 TONS HYBRID SYSTEM



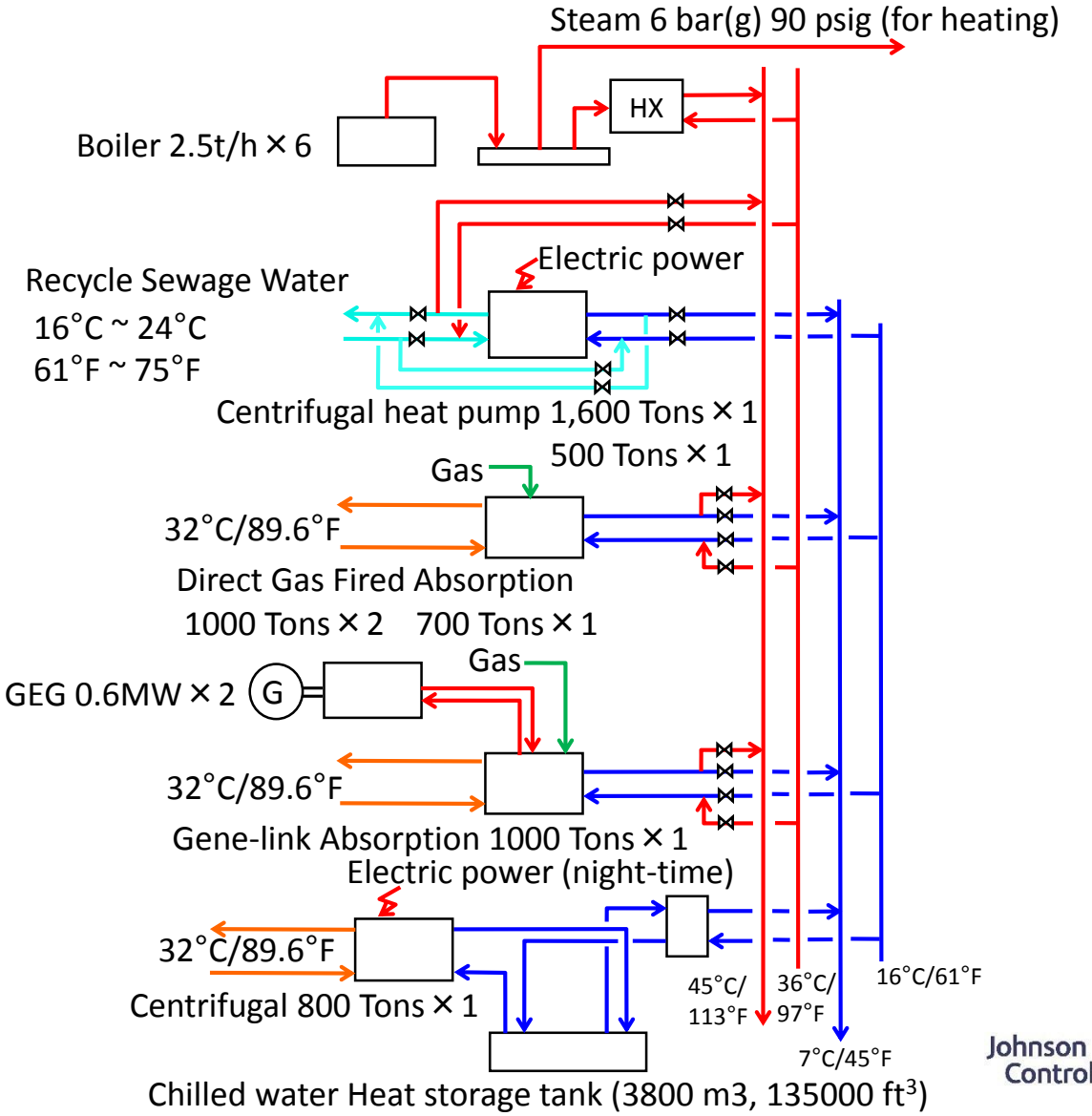
SYSTEM INVOLVES STEAM CENTRIFUGAL,
STEAM ABSORPTION AND ELECTRIC CENTRIFUGAL CHILLERS



DISTRICT COOLING APPLICATION
20,200 TONS HYBRID SYSTEM



DISTRICT COOLING APPLICATION
6,600 TONS HYBRID SYSTEM

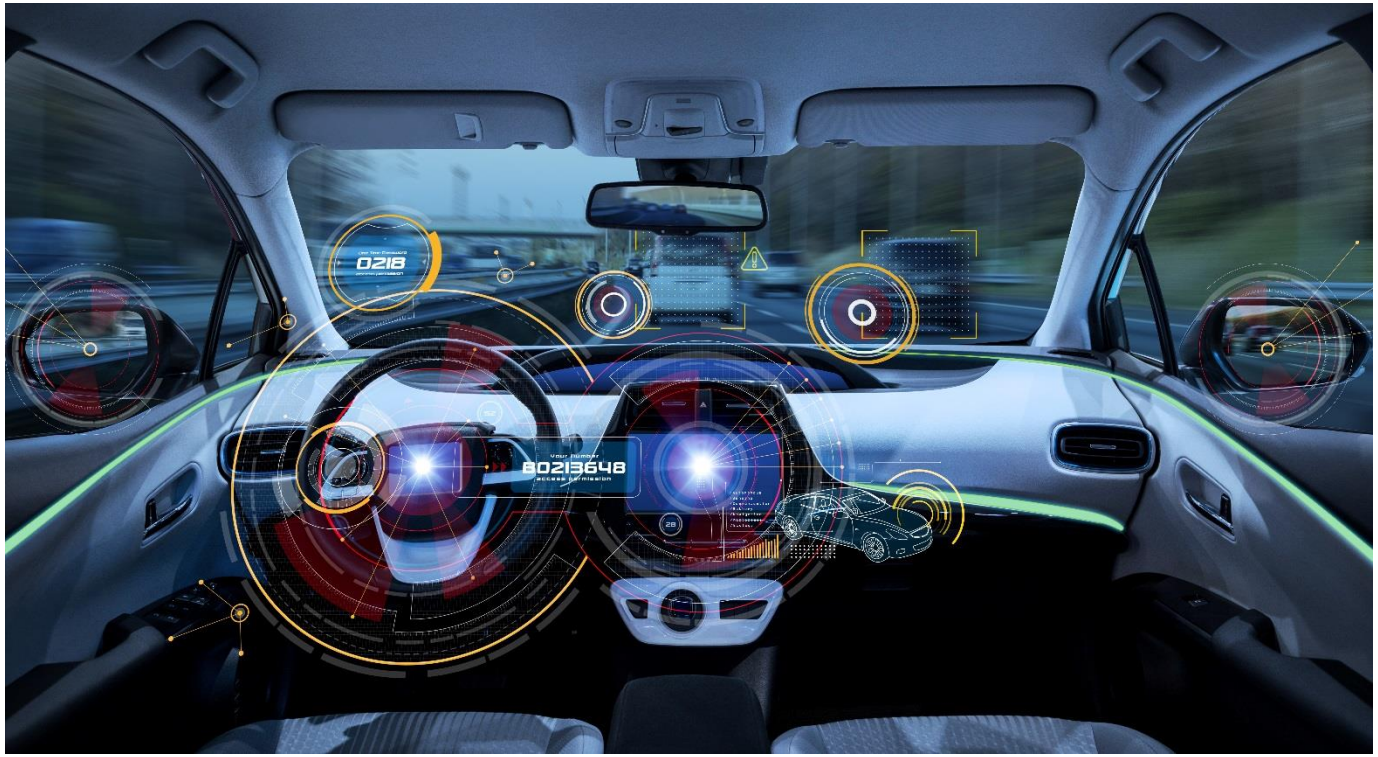


GAS ENGINE BASED CHP SYSTEM UNIVERSITY CAMPUS COOLING

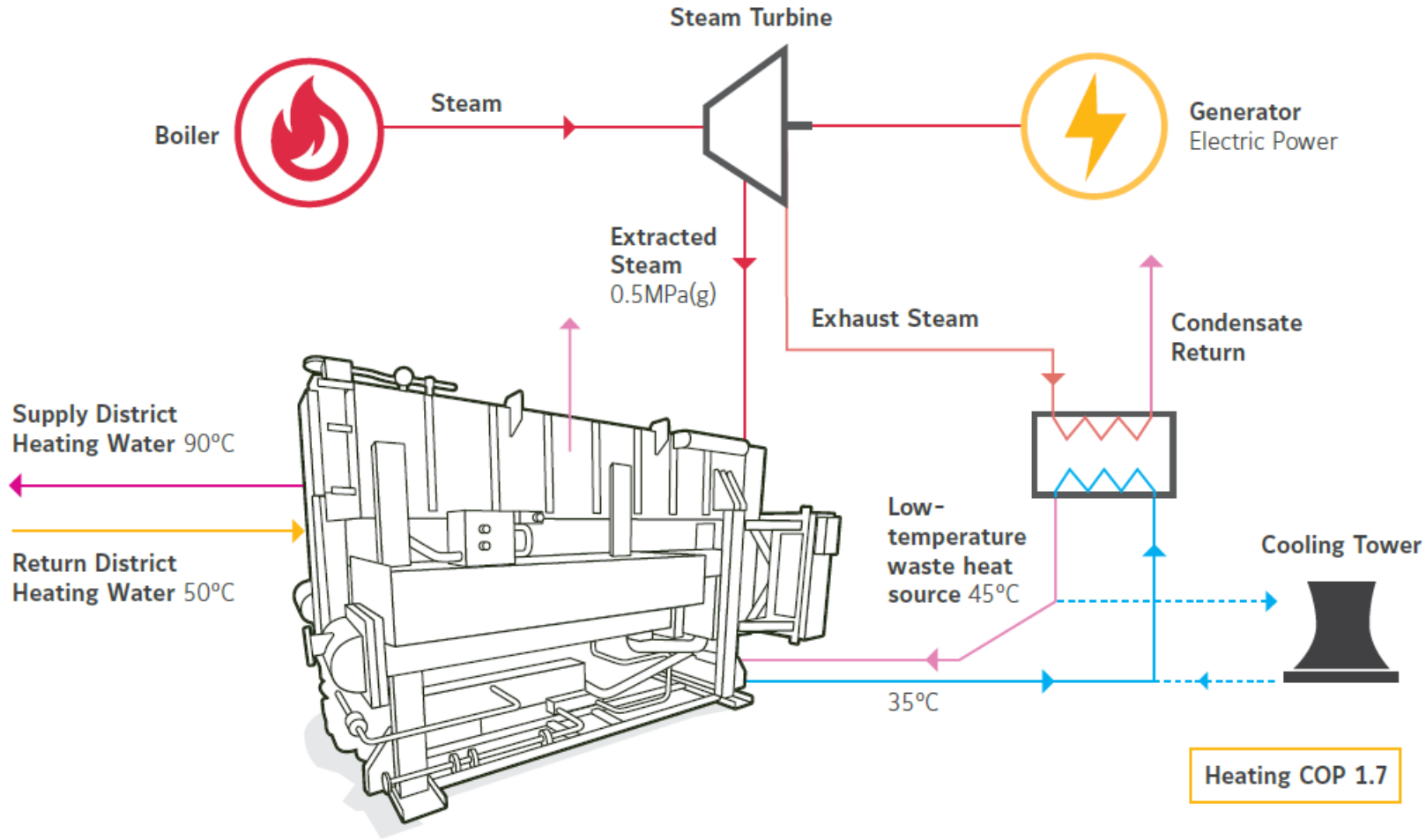
1. CHP SYSTEM EFFICIENCY 84.7%
2. DELIVERS 6°C/43°F CHILLED WATER
3. DRIVEN BY JACKET HOT WATER
   105°C/221°F 75°C/167°F

INDEPENDENT MICRO GRID
LARGE AUTOMOTIVE

1. CHP SYSTEM
2. DELIVERS 8°C/46.5°F CHILLED WATER
3. DRIVEN BY JACKET HOT WATER
   110°C/230°F 70°C/158°F

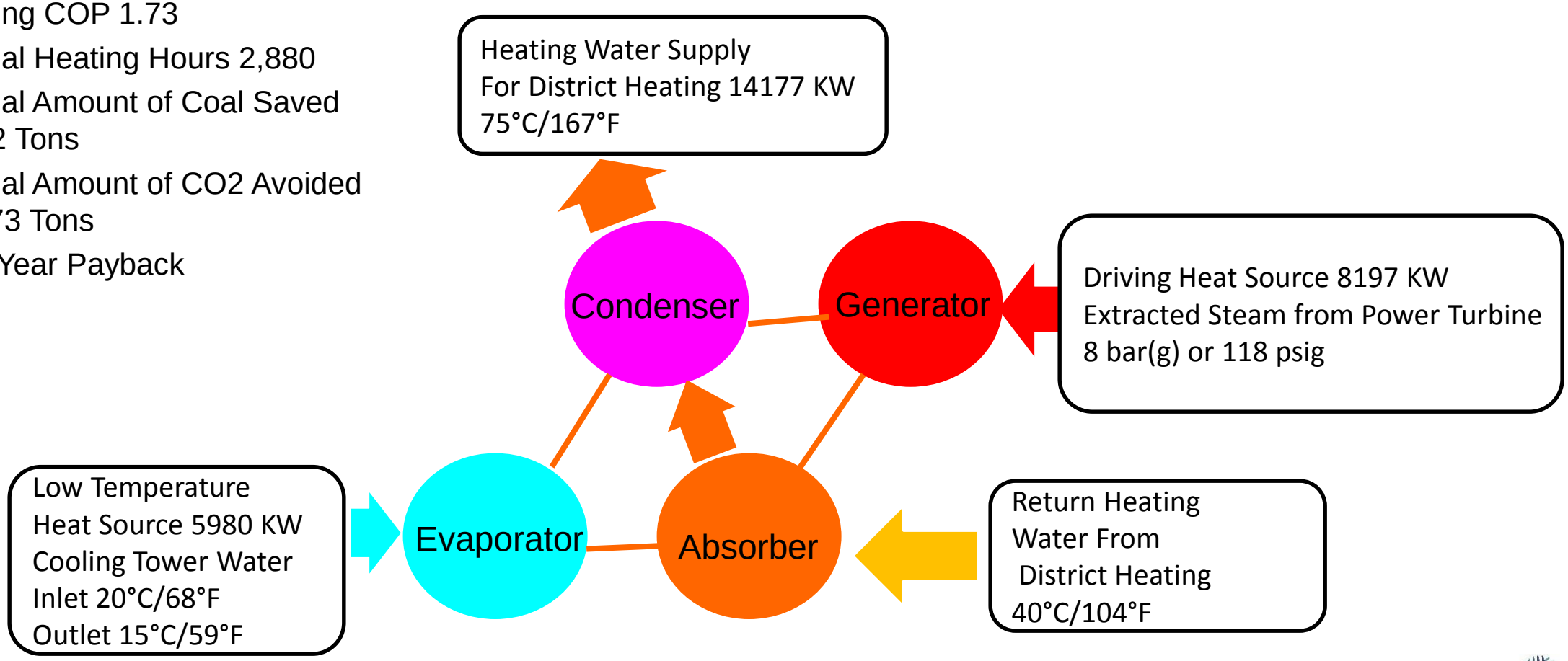


ABSORPTION HEAT PUMP THERMAL POWER PLANT



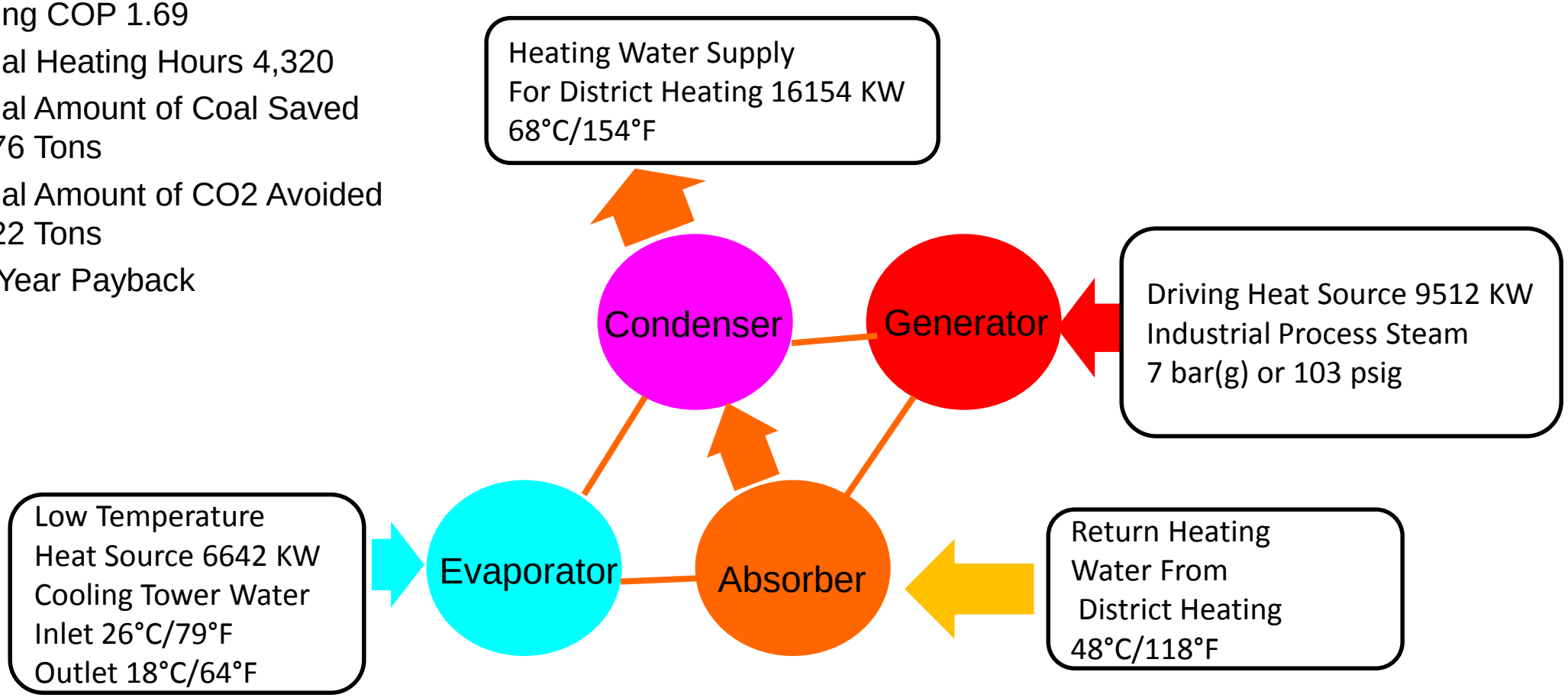
ABSORPTION HEAT PUMP 28 MW THERMAL POWER PLANT

1. Two Units, Each 14 MW
2. Heating COP 1.73
3. Annual Heating Hours 2,880
4. Annual Amount of Coal Saved 4,232 Tons
5. Annual Amount of CO2 Avoided 11,173 Tons
6. One Year Payback



ABSORPTION HEAT PUMP 48 MW CHEMICAL FACTORY

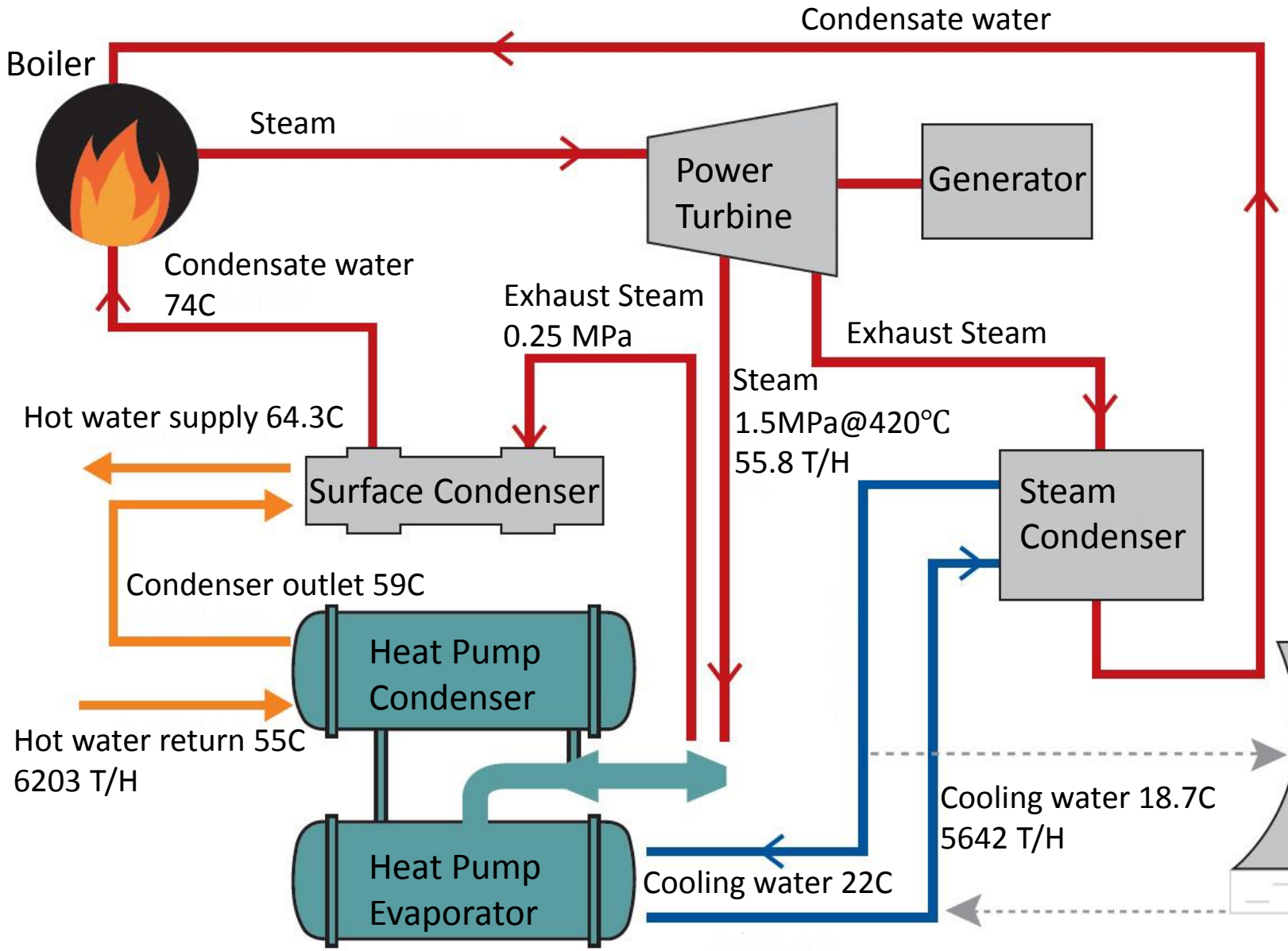
1. Three Units, Each 16 MW
2. Heating COP 1.69
3. Annual Heating Hours 4,320
4. Annual Amount of Coal Saved 10,576 Tons
5. Annual Amount of CO2 Avoided 27,922 Tons
6. One Year Payback



DISTRICT HEATING
BIOMASS BASED SYSTEM

1. DRIVING HEAT SOURCE – HOT WATER FROM BIOMASS BOILER (170°C/338°F)
2. EVAPORATOR WATER COOLS FLUE (EXHAUST) GASES FROM THE BOILER
   INLET 49°C/120°F OUTLET 40°C/104°F
3. HEATING CAPACITY 15 MW, COP 1.67
4. DELIVERS 88°C/190°F FOR 100,000 HOMES
5. PRIMARY ENERGY CUT BY 17%
6. PAYBACK ~ 2 YEARS
7. CO2 EMISSIONS REDUCED BY 41,000 TONS ANNUALLY

STEAM TURBINE DRIVEN CENTRIFUGAL HEAT PUMP



Conclusions

1. Driven by waste or low cost heat
2. Water as the refrigerant
3. Ideal for District Cooling and District Heating
4. Fast payback
5. Saves energy, water and cuts emissions
6. Truly green sustainable solution

Acknowledgements

- Hitachi-Johnson Controls A/C Japan
  - Shuichiro Uchida

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Thank you for attending

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Questions?

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November 15th, 2018
Absorption 101