
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

New Age Absorption Chillers

Amit Vatsa, BROAD USA Inc.

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BROAD USA 远大美国

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Q&A Will Not Be Answered Live

Please submit questions in the Q&A box.
The presenters will respond to questions off-line.

New Age Absorption Chillers and Heat Pumps

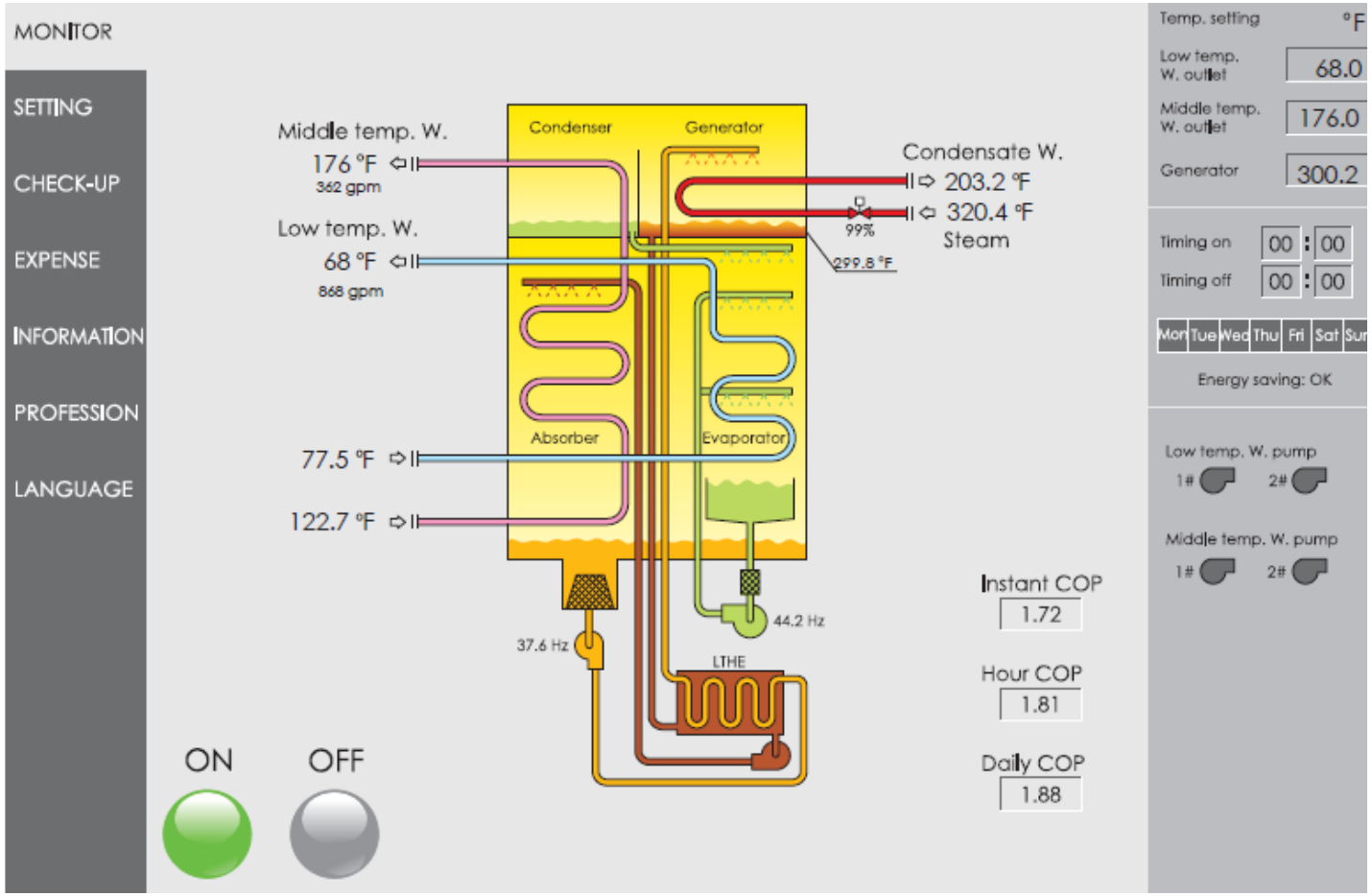
Old Age Absorption Units:

- **Cooling COP:** 0.67 to 1.2
- Heating COP: ~ 1.3
- **Heat Source:** Steam/Hot Water/Gas
- Crystallization: intervention needed
- **Tube Metallurgy:** Copper/Cupro-Nickel
- Fuel Flexibility: was limited
- Fossil Fuel options: N. Gas/HSD
- **Heat Pump:** temp. limitations

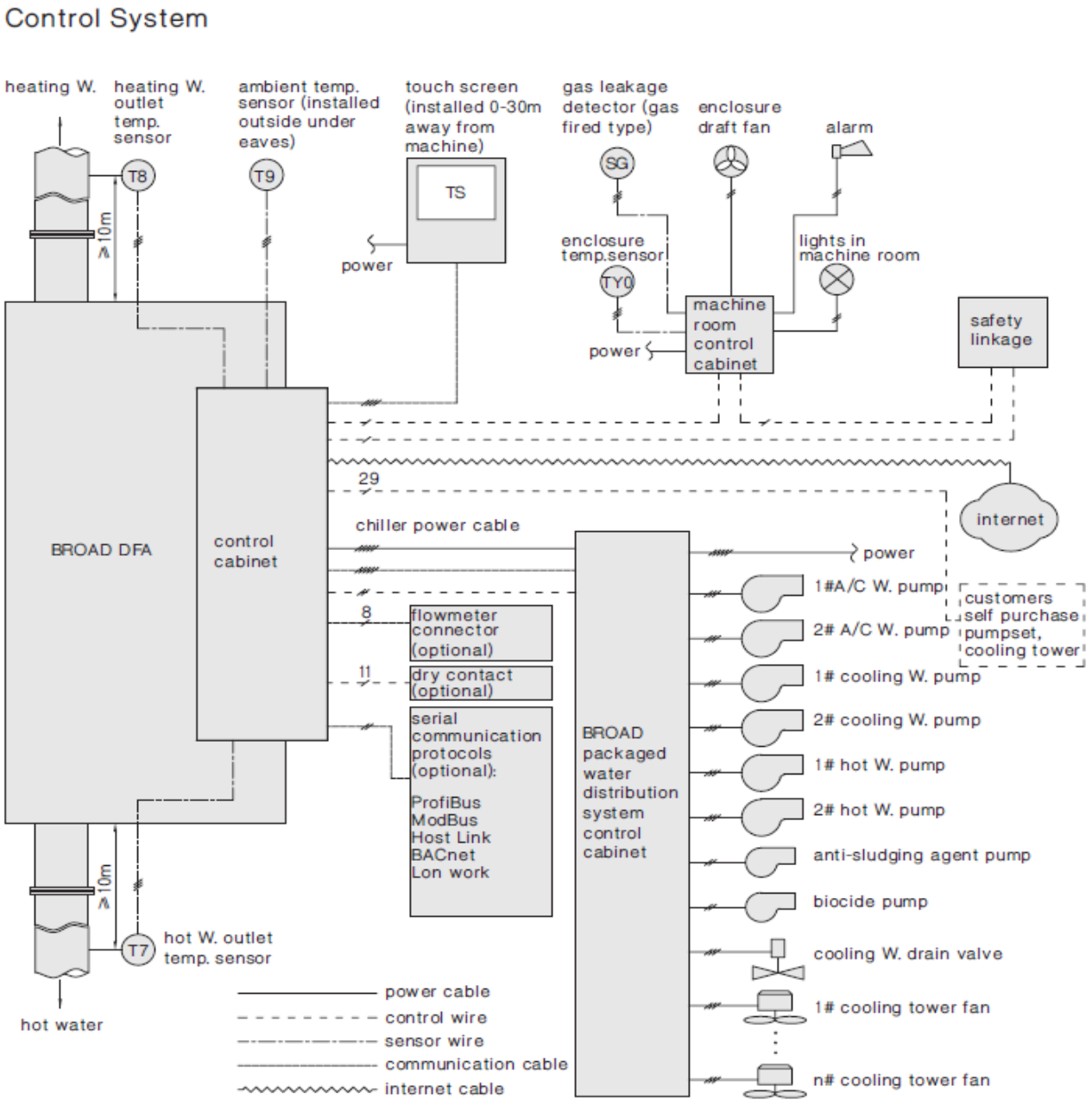
New Age Absorption Units:

- **Cooling COP:** 0.72 to 1.45
- Heating COP: ~ 1.7
- **Heat Source:** Multiple in one unit
- Crystallization: Auto De-crystallization
- **Tube Metallurgy:** Stainless Steel & Titanium
- Fuel Flexibility: Indirect Heat with Burner too
- Fossil Fuel options: N.Gas/Biogas/Flare gas/Propane
- **Heat Pump:** Huge flexibility in temp.

Self-Diagnostics/Auto Checks/Remote Monitoring



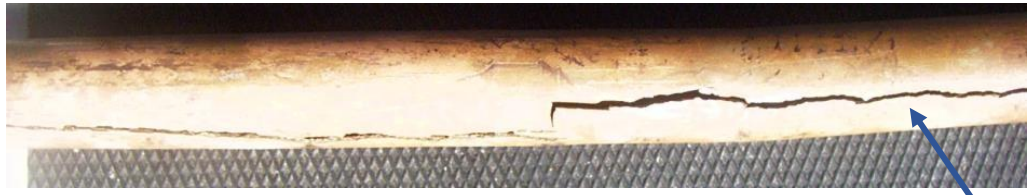
State of Art HMI Control Logics



Tube Metallurgy

Stainless Steel & Titanium tubes **replaces** Copper/Cupro-Nickel tubes

Site Issues	Copper	Stainless Steel	Titanium
Chlorine	Anti-corrosion only at low temp. and low concentration	Anti-corrosion level is different	**No**
Seawater	Corrosion	Less at conditions	**No**
Hydrazine/NH3	Serious corrosion	No corrosion	**No**
Polluted Air/ water	Corrosion	Light corrosion, Chlorine corrosion	**No**



No more such cracks/leakages

Case Study: Hjorring District Heating, Denmark

One of the prominent central Heating Plant in Denmark had 3 major targets:

- Increase the Heating system's energy efficiency & reduce the cost of heating
- Ensure achieving High Delta T (50.4F) of the Heating Network loop
- Meet the strict emission norms

"New Age Absorption Heat Pump" now could meet such concurrent targets

Problems faced in achieving the concurrent targets

- System's efficiency increase needed full recovery from Boiler's Flue Gas

  Latent heat of Flue Gas to be captured by cooling it below 60F

  Cold Water of 50F was a requisite for cooling

  Flue Gas should not condense in the chimney / No white fumes allowed

- Heating Network loop to maintain High Delta T (185F/113F)

  High Gate of 135 F (Med. Hot Water 185F – Cold Water 50F) was the challenge

Old Technology's Obstacle:

Requisite:

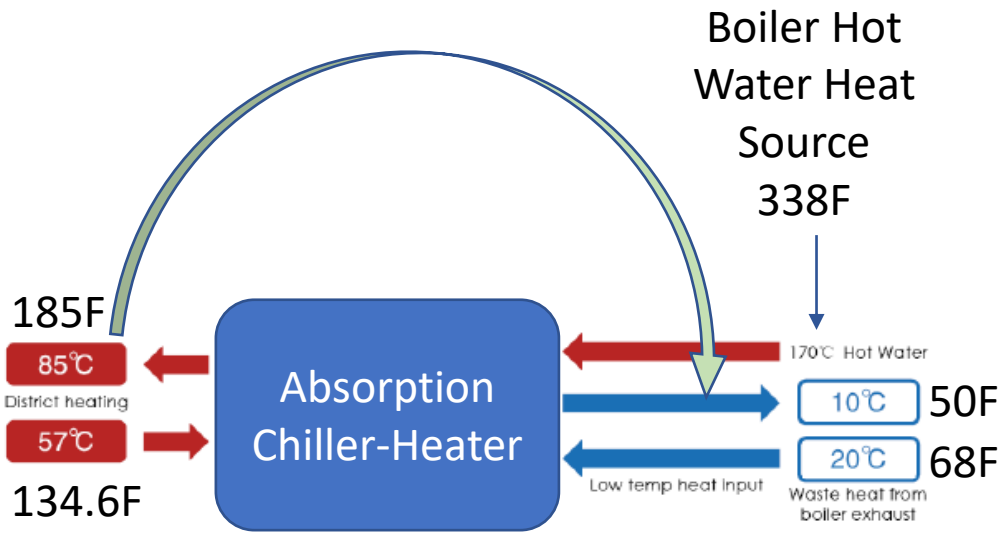
50F Cold water needed to extract the latent heat of 60F Flue Gas and be utilized inside the Absorption Heat Pump to add up and achieve 185F District Heating Hot Water. Reduces the fuel input calories in the Biomass Boiler/ improves the system's efficiency.

Obstacle:

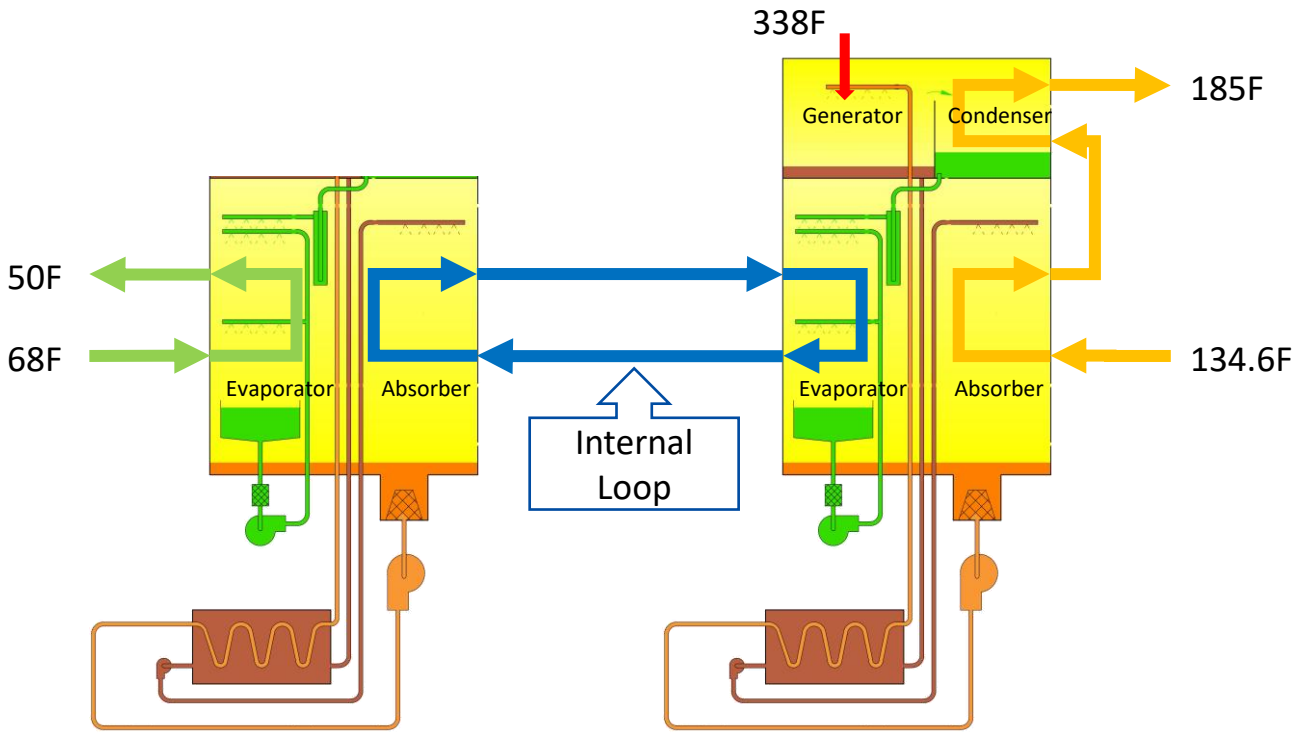
The temp. difference between Cold-water outlet (50F) and Medium Hot water outlet temp. (185F) widens enough (>50F), an impossible task to achieve by the old Absorption technology.

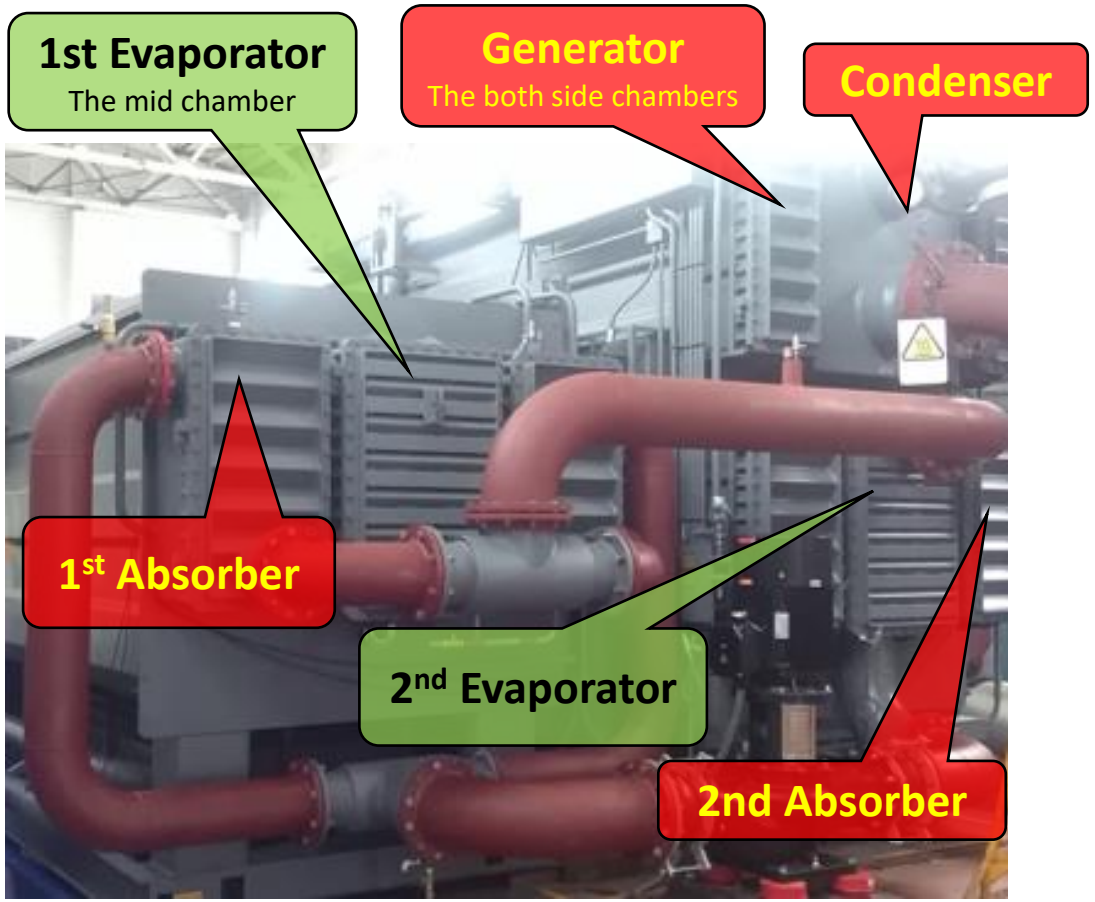
A new age Absorption Heat Pump design was inevitable to meet this target.

Solution: Double Lift Abs. Heat Pump with High Gate (CH Outlet Vs HW Outlet)



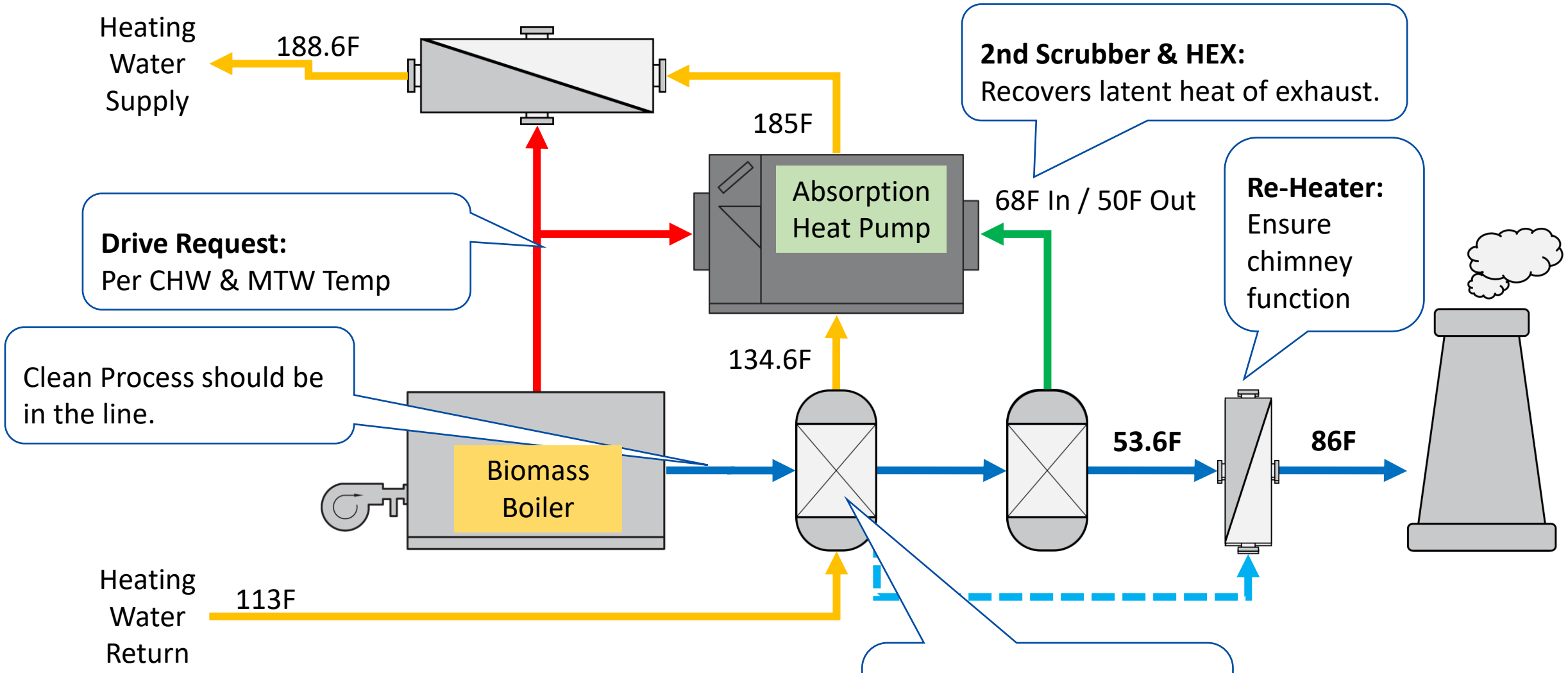
Solution: **Double Lift Absorption Unit** (2 units combined in 1)





A unit with 2 Evaporators and 2 Absorbers are merged. The 1st Absorber combines with the 2nd Evaporator and forms an inner closed circle. This allows the cold-water heat energy be transferred and lifted by two times/ a Double Lift design.

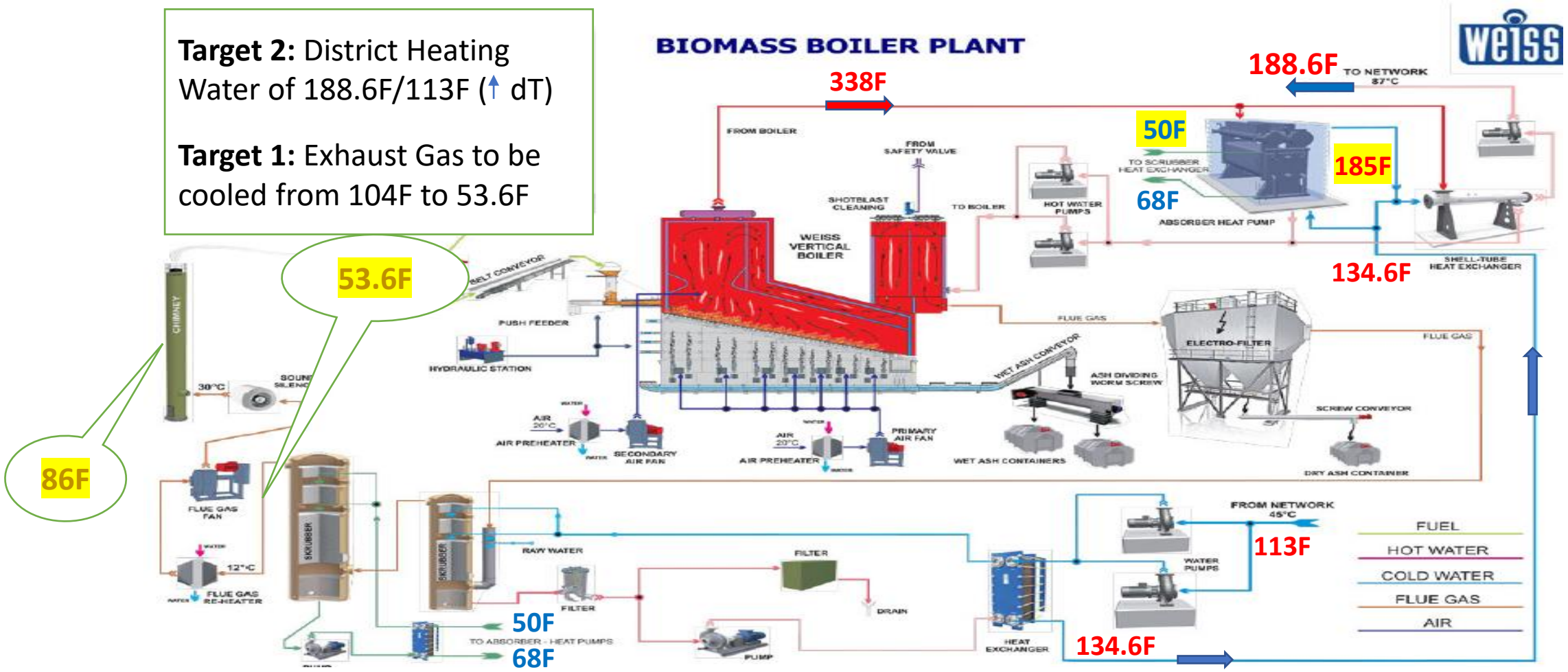
Solution: Exhaust Heat Recovery from the Boiler Flue Gas



Schematic Diagram of District Heating on Absorption Heat Pump

Target 2: District Heating Water of 188.6F/113F (↑ dT)

Target 1: Exhaust Gas to be cooled from 104F to 53.6F



Conclusions:

District Heating company could now offer low heating prices to the consumers by increasing their existing system's efficiency. The new age Absorption Heat Pump cools and recycles the waste heat of the boiler's flue gas/reduced the input fuel calories and hence the cost of heating.

The Double Lift type Absorption Heat Pump could achieve the highest temperature difference (75°C) between cold and hot water by generating 50°F cold water for cooling the flue gas in the scrubbers.

Flue gas gets cooled from 104F to 53.6°F and the two cooling circuits pick up it's latent heat to add up in the District Heating Network.

This Flue gas heat recovery helped add **3 MW of extra heat** to the local heating network and met the emission norms too. (No more white fumes)

Eventually, the high delta T of the Heating Network (185F/134.6F) also achieved.

Conclusions:

System efficiency increased to **120%**

Total Heating delivered by Absorption Heat Pump: **13 MW**

Carbon footprint reduced: **1800 tons/year**

Emissions: Meets the compliance norms of Denmark set for 2022

Savings: **$445,000/ Year**

Payback: **3 years**

Amit Vatsa

Questions?