
IDEA2021
Powering the Future: District Energy/CHP/Microgrids
Sept. 27-29 | Austin Convention Center | Austin, Texas

Bronx Zoo – MTW Upgrades

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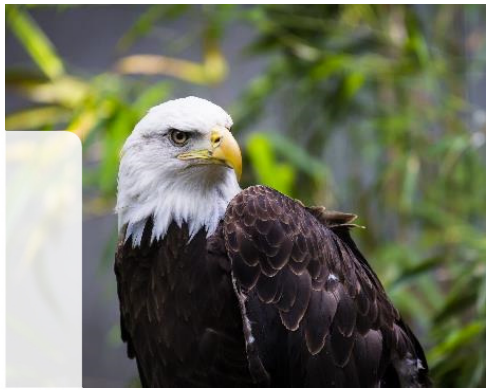
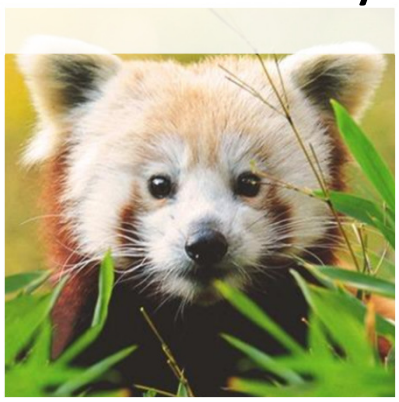
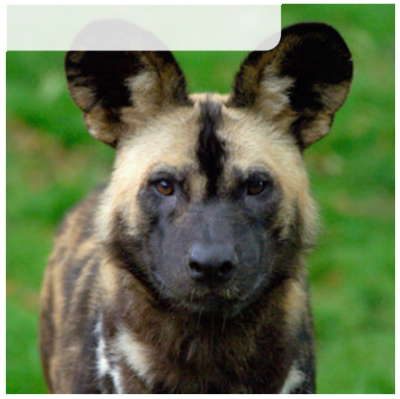
History

- **Bronx Zoo established in 1898**
  - Official **NYC landmark**
  - **265 acres** in the Bronx
  - **More than 650 species** of animals
  - **2.1 million visitors** each year

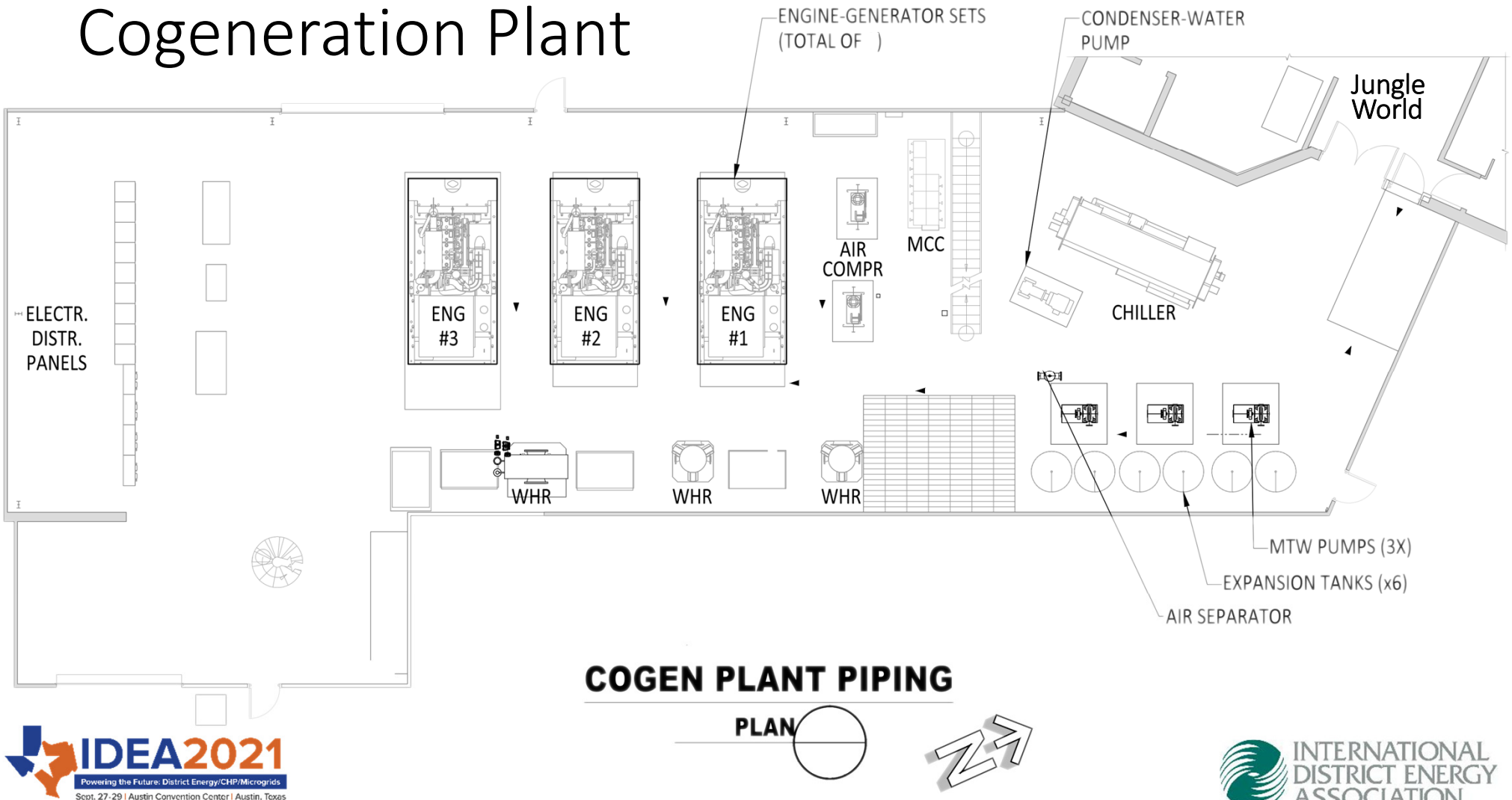







Cogeneration Plant



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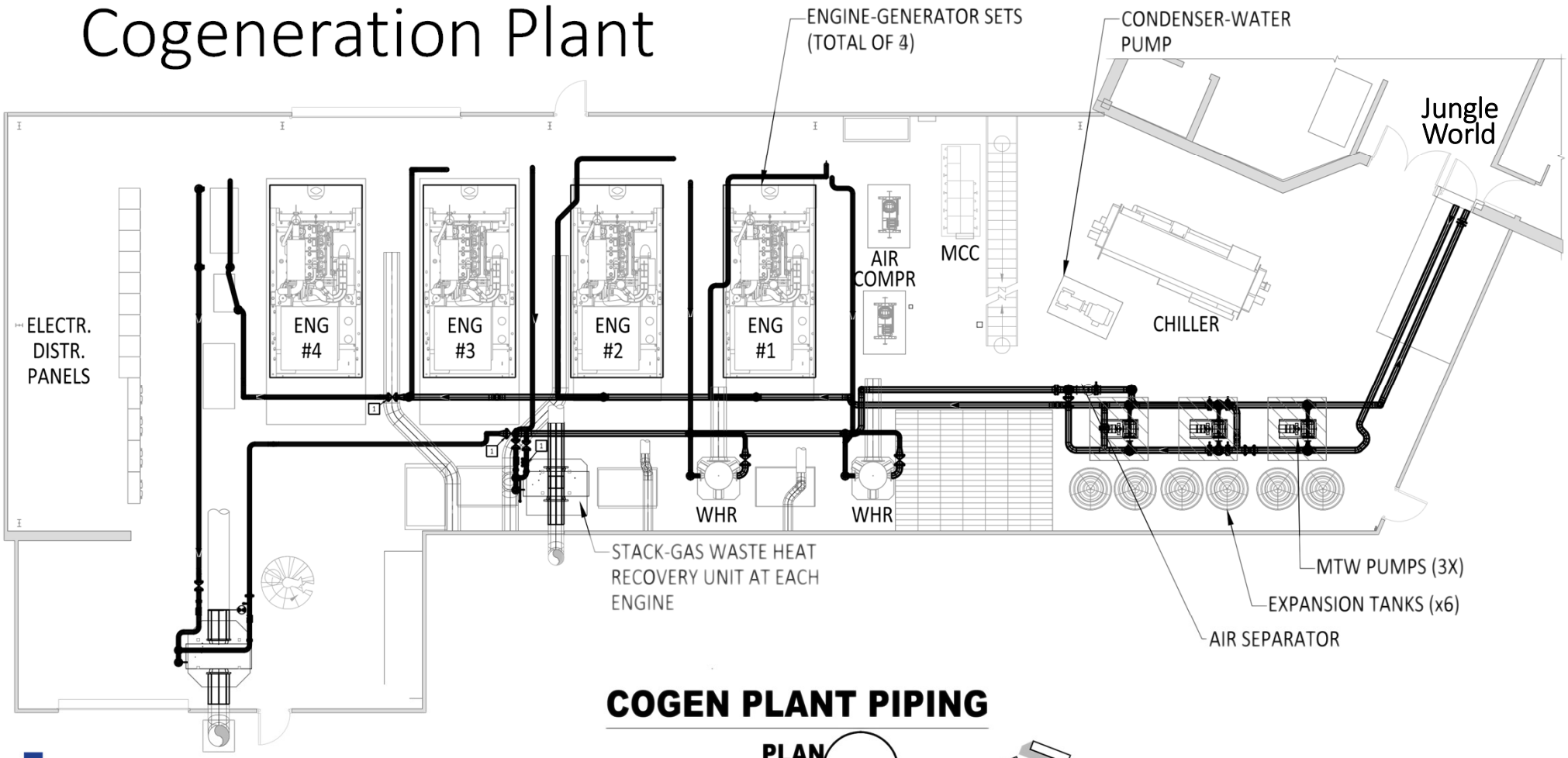
INTERNATIONAL DISTRICT ENERGY ASSOCIATION

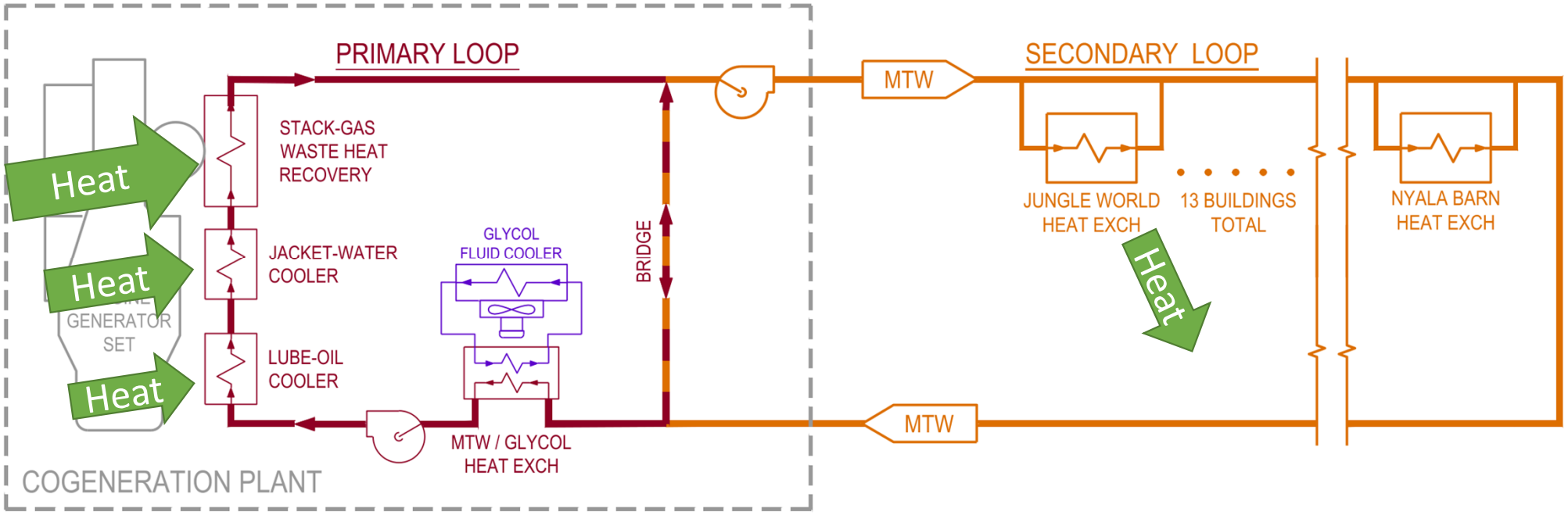
Cogeneration Plant



COGEN PLANT PIPING

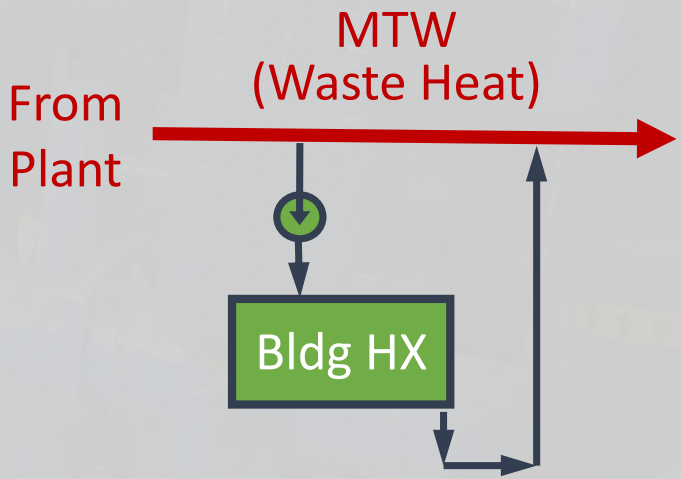
PLAN

Cogeneration Plant Flow Diagram



MTW Distribution System

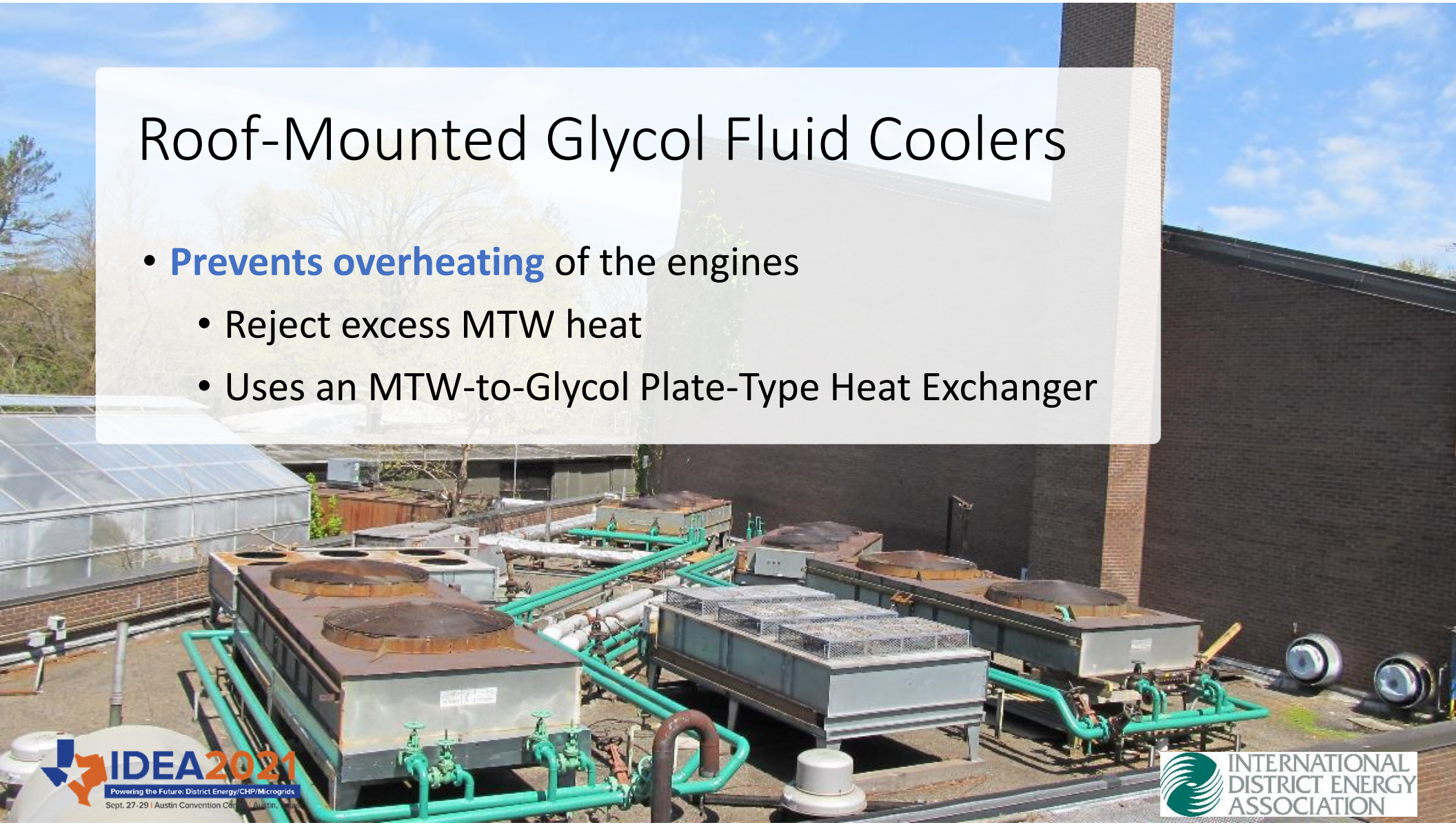
- Original design of secondary MTW system was a constant volume, one-pipe system
  - MTW pipe passes buildings on the loop
  - MTW returns to Cogen Plant



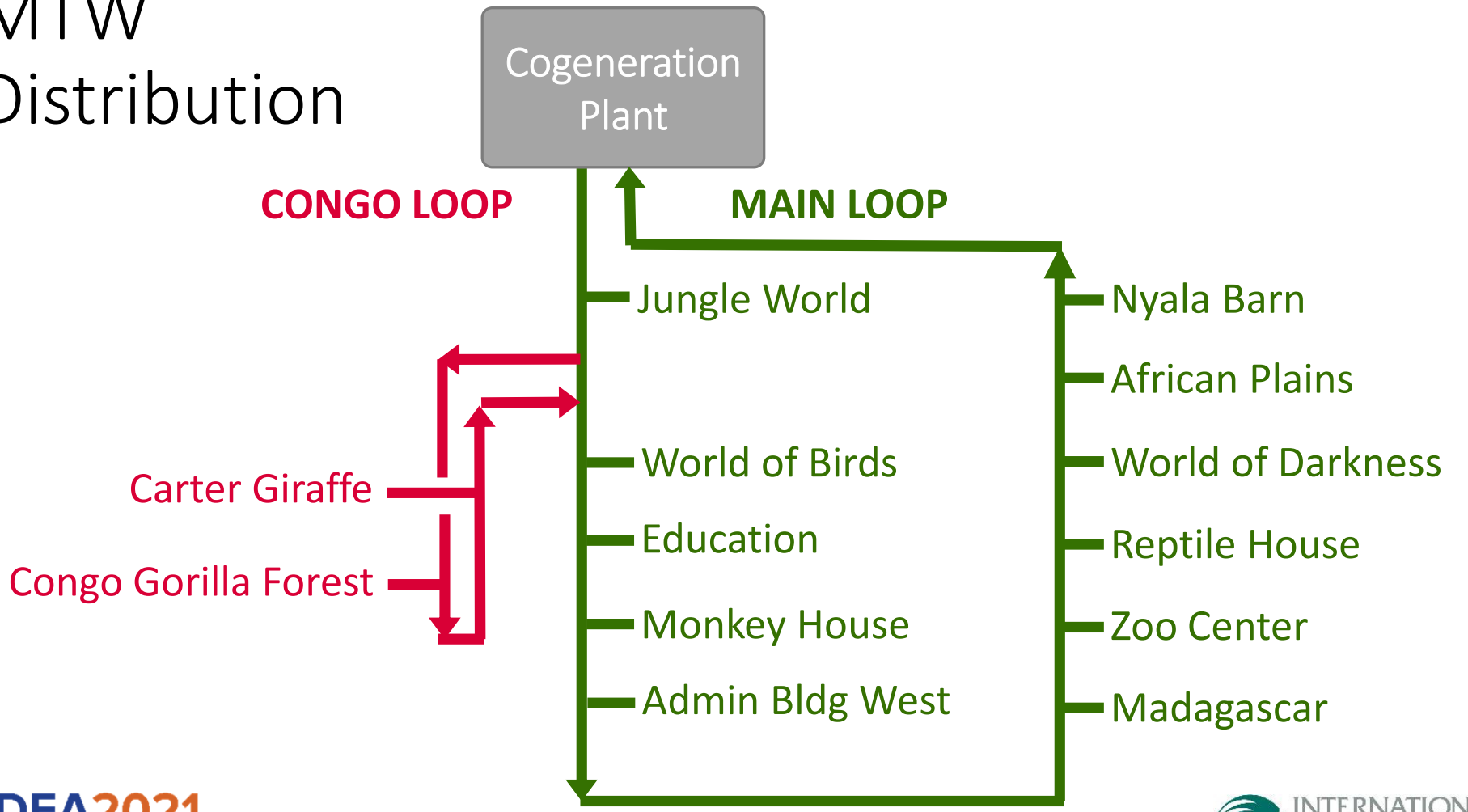
One-Pipe System

Roof-Mounted Glycol Fluid Coolers

- **Prevents overheating** of the engines
  - Reject excess MTW heat
  - Uses an MTW-to-Glycol Plate-Type Heat Exchanger



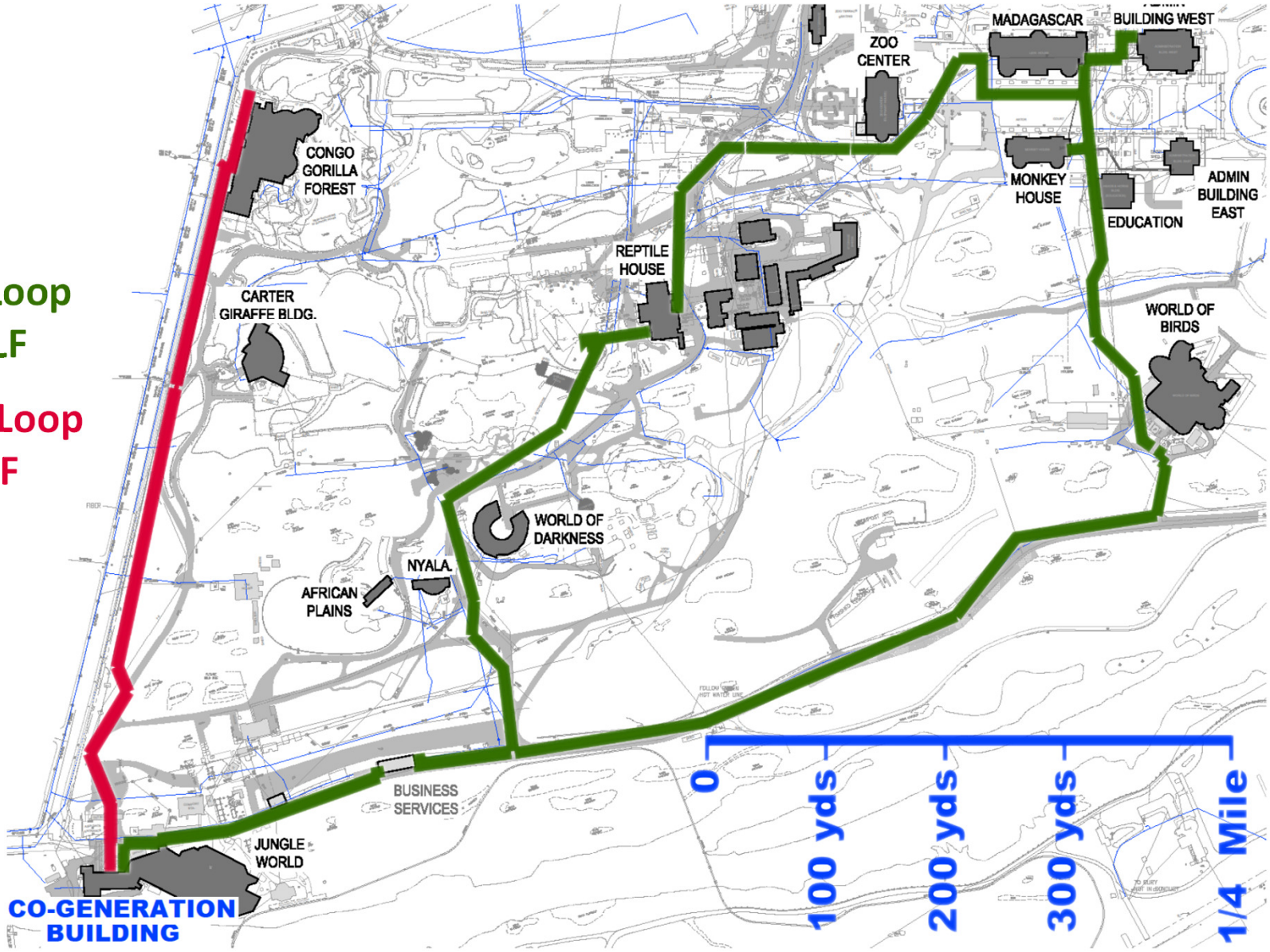
MTW Distribution



Site Map

Main Loop
7,400 LF

Congo Loop
3,900 LF



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Operational Issues
Resulting from Changes to Original Design

Congo Loop was added to the distribution system

1998

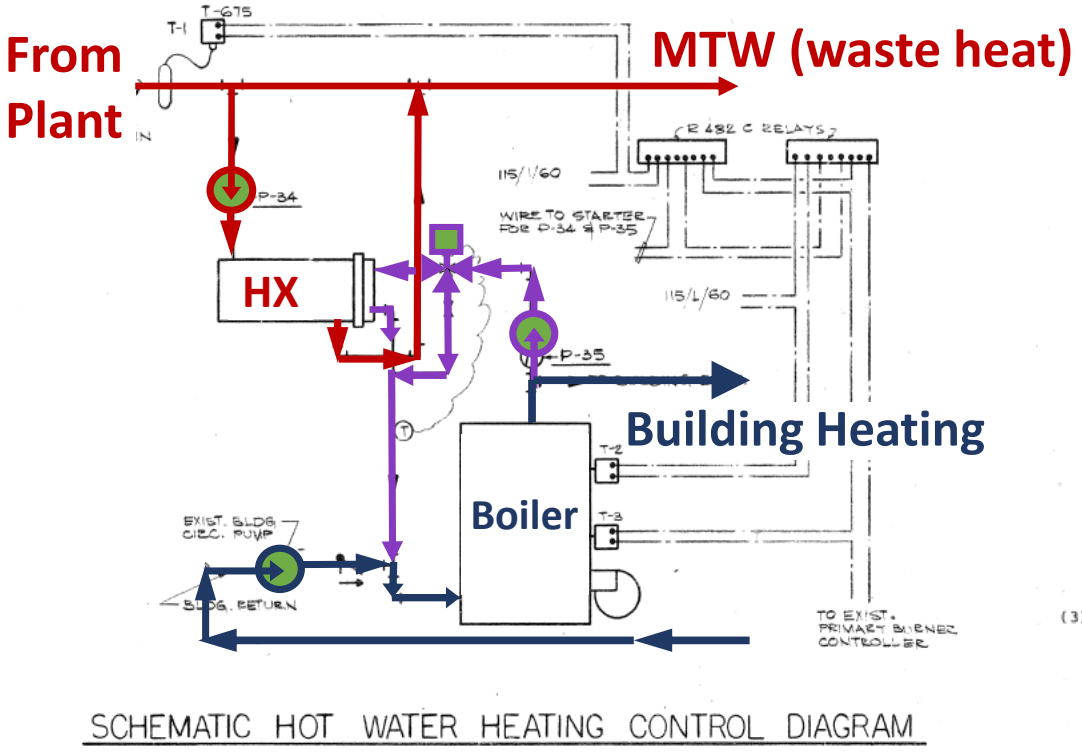
All four engines converted from diesel oil/natural gas to natural gas only

2007

WHR Units at the end of useful life

2020

Original Heat-Recovery



SCHEMATIC HOT WATER HEATING CONTROL DIAGRAM

SEQUENCE OF OPERATION

(2) NORMAL OPERATION - ENERGY FLOW FROM SITE TO BUILDING SYSTEMS.

(a) PRIMARY HOT WATER TEMPERATURE IS ABOVE BOILER WATER TEMPERATURE SETTING.

WHEN THE PRIMARY WATER TEMPERATURE FROM THE SITE DISTRIBUTION SYSTEM IS ABOVE THE SETTING OF EXISTING BOILER AQUASTAT T-3 (T-1 > T-3), NEW AQUASTATS T-2 WILL CYCLE BOTH PRIMARY AND SECONDARY CIRCULATING PUMPS, TO MAINTAIN THE SECONDARY WATER TEMPERATURE IN THE BOILER. BOTH PUMPS ARE INTERLOCKED AND RUNNING.

SHOULD THE BOILER WATER TEMPERATURE DROP BELOW THE SETTING OF EXISTING AQUASTAT T-3; THE BURNER SHALL ALSO BE ENERGIZED AND WILL CYCLE TO MAINTAIN BOILER TEMPERATURES.

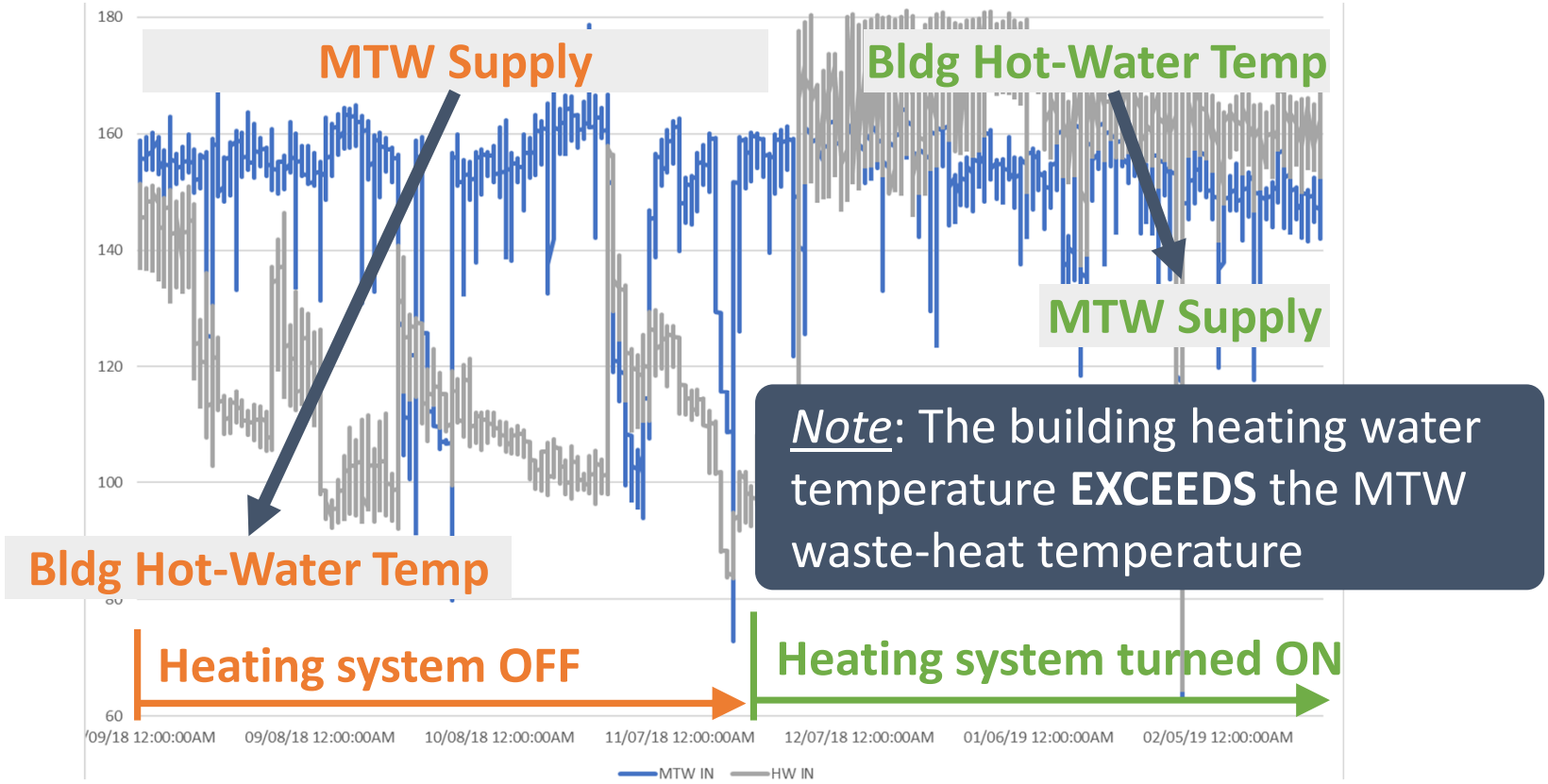
(b) PRIMARY HOT WATER TEMPERATURE IS BELOW BOILER WATER TEMPERATURE SETTING.

WHEN THE PRIMARY WATER TEMPERATURE (T-1 < T-3) IS LESS THAN THE BOILER WATER TEMPERATURE AS SET BY T-3, THE EXISTING AQUASTAT T-3 SHALL CYCLE THE EXISTING BOILER BURNER. THE EXISTING AQUASTAT T-3 SHALL ACT AS HIGH LIMIT TO MAINTAIN BOILER WATER TEMPERATURE. PRIMARY AND SECONDARY PUMPS SHALL BE OFF.

(3) HEAT SUPPLY OPERATION - HEAT FLOW FROM BUILDING BOILER TO SITE SYSTEM.

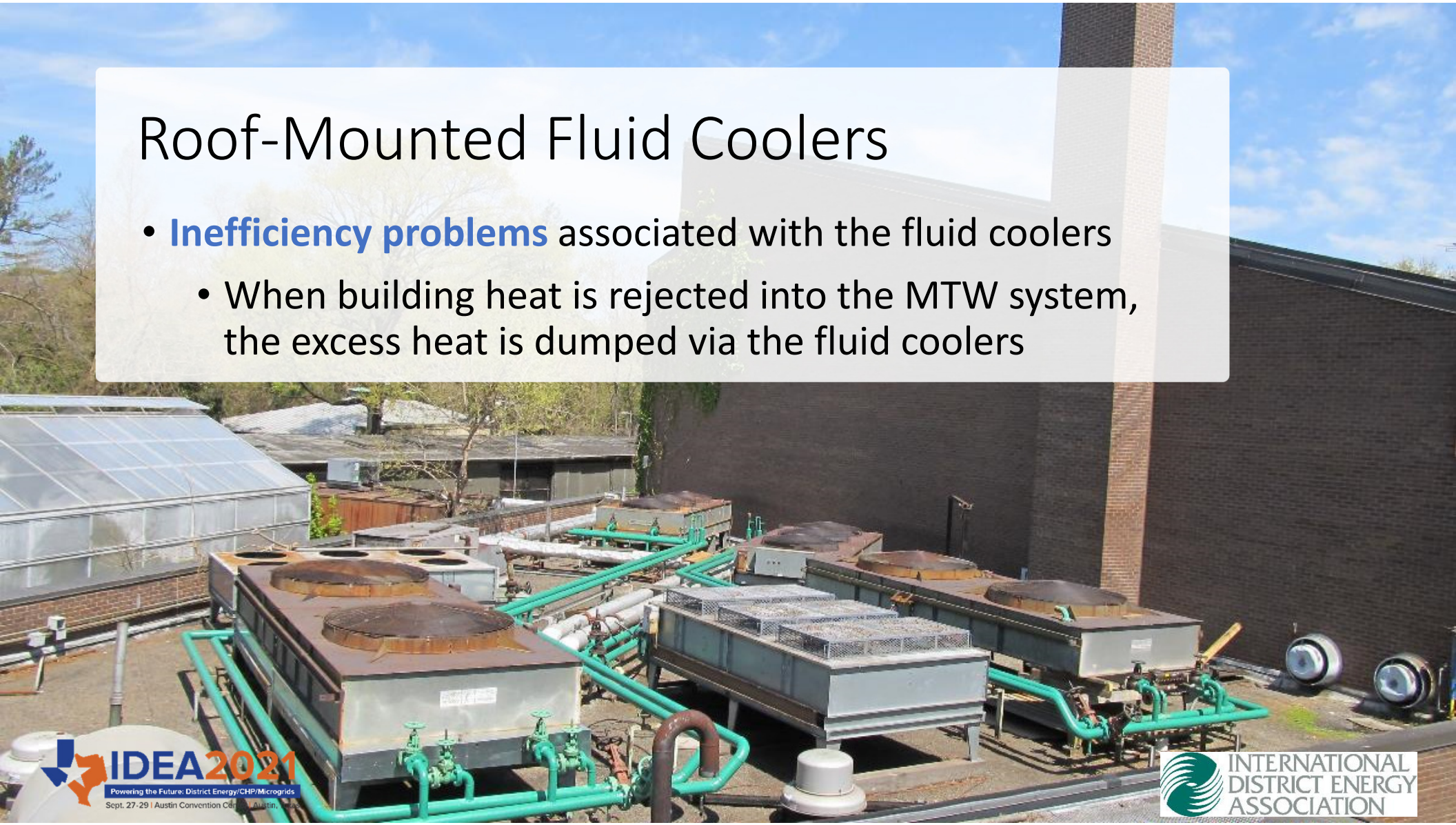
WHENEVER THE NEW AQUASTAT T-1 REGISTERS A TEMPERATURE LESS THAN THE BOILER WATER TEMPERATURE AS REGULATED BY T-3, THE OWNER SHALL MANUALLY START BOTH PRIMARY AND SECONDARY PUMPS BY RE-SETTING THE PUMP STARTERS FROM "A" TO "H" POSITIONS. BOTH PUMPS WILL RUN (INTERLOCKED) AND THE BURNER WILL BE ENERGIZED TO MAINTAIN THE BOILER WATER TEMPERATURE AS PER SETTING

Administration West Water Temperatures



Roof-Mounted Fluid Coolers

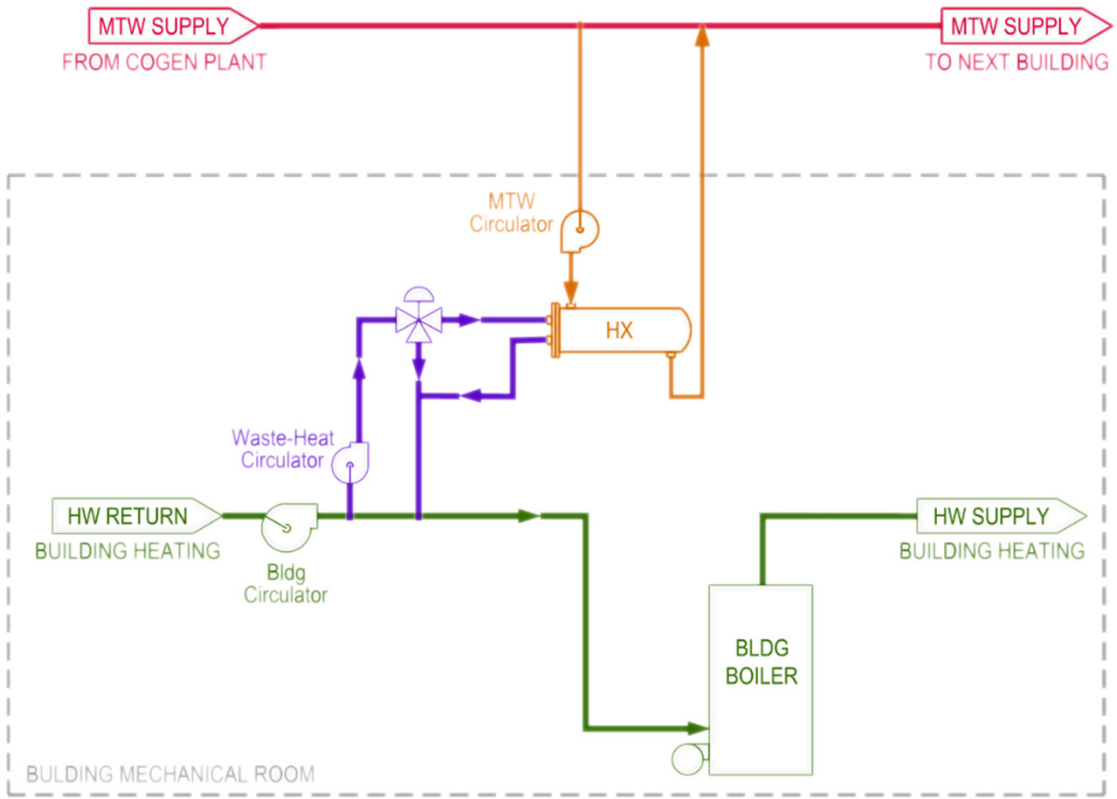
- **Inefficiency problems** associated with the fluid coolers
  - When building heat is rejected into the MTW system, the excess heat is dumped via the fluid coolers

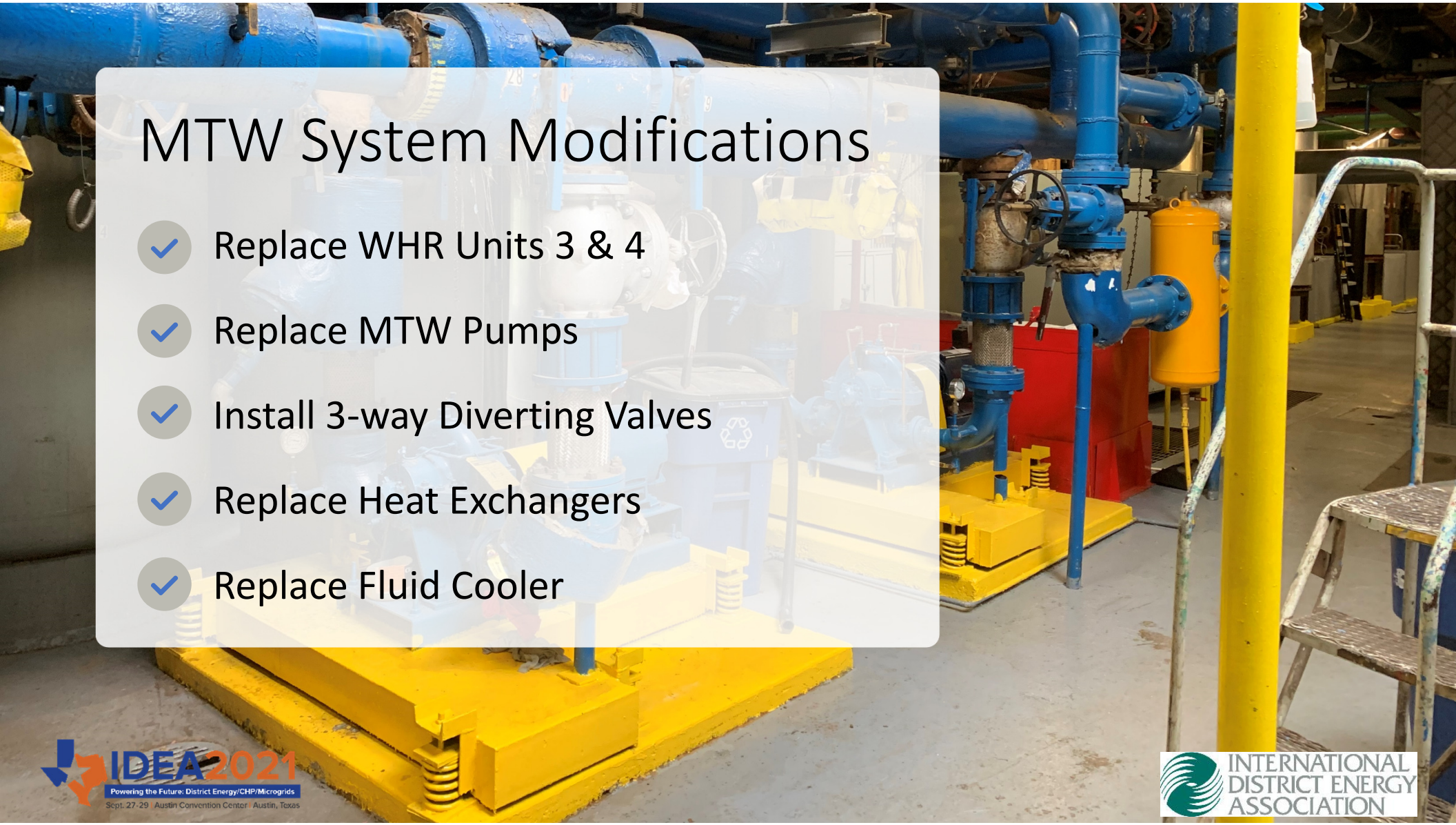


Original Heat-Recovery System

Some buildings **WORK PROPERLY**	Some buildings **DO NOT WORK PROPERLY**	**SYSTEM MISBEHAVIOR**
• Building heat supplied from MTW loop • MTW loop transports engine waste-heat energy • Building boiler supplements heat shortages	• Building heating-water temperature exceeds the MTW temperature at times • Building connection to MTW is on boiler outlet. • Heating system behavior is dynamic	• Building boiler generates heat • Boiler heat is rejected into the MTW system • Unused rejected heat is rejected into fluid coolers in the plant (if not used by other buildings in the MTW loop)

Modified Heat-Recovery System diagram





MTW System Modifications

- Replace WHR Units 3 & 4
- Replace MTW Pumps
- Install 3-way Diverting Valves
- Replace Heat Exchangers
- Replace Fluid Cooler

Project Challenges

- **Working in animal areas**
  - Noise sensitivity
  - Contractor access to MER's
  - Continued access for visitors with limited paths
  - Phasing and avoidance of service interruptions
  - Movement of personnel/vehicles through the zoo

Q&A

Thank You!

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