

De-Carbonizing the Campus: Planning, Tools & Technologies

CampusEnergy2023

February 27 – March 2, 2023

Gaylord Texan Resort & Convention Center | Grapevine, Texas



INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION

Utility Optimization, Minimization, Decarbonization

Andrew Witteck and Rajkumar Gnanaraj
Armstrong International



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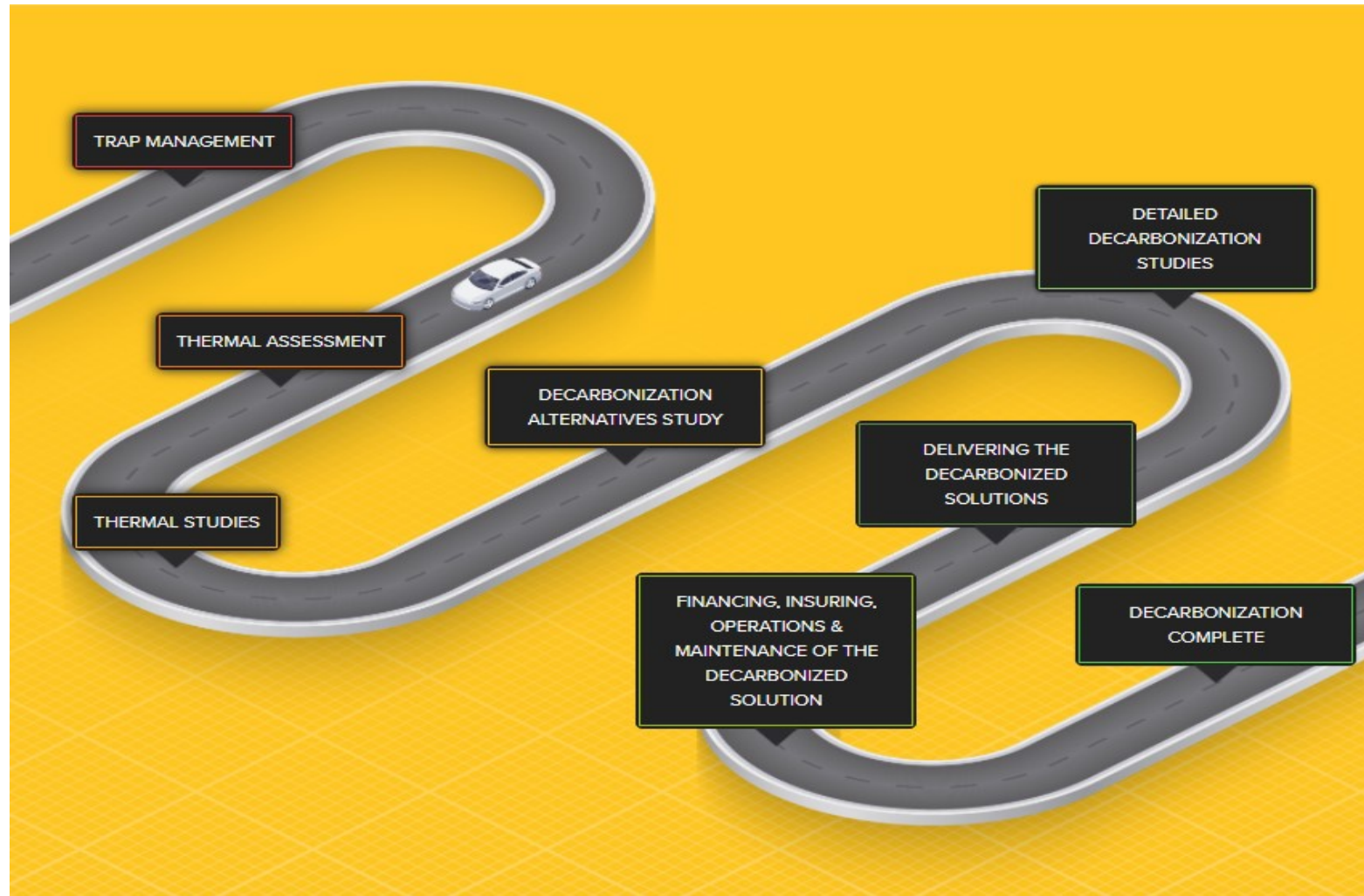
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How does your Roadmap look and where are you?



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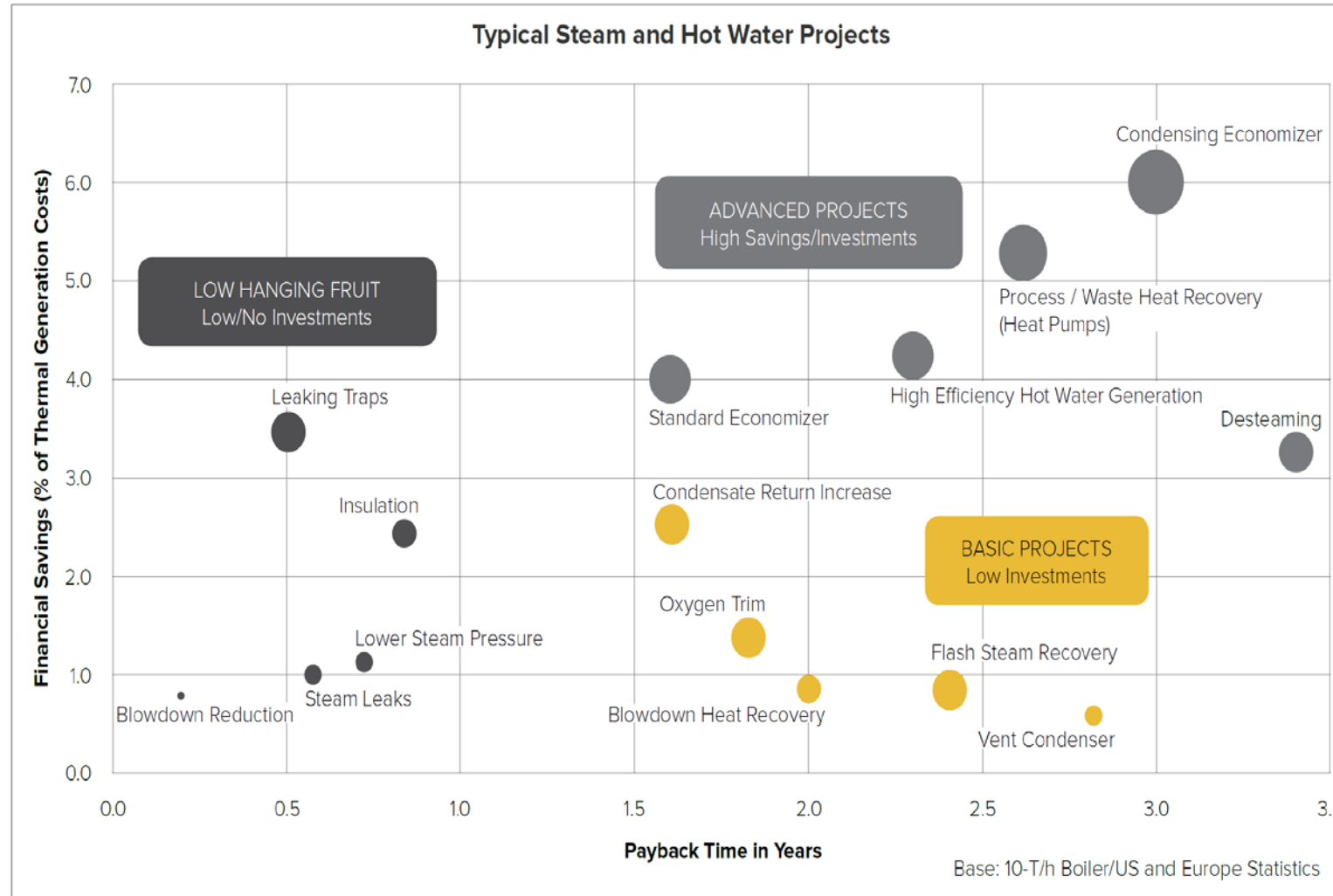


The Journey to Thermal Decarbonization

- **Optimize** the Thermal Networks total efficiency, including recovering ALL the waste heat
- **Minimize** the current level of Thermal Demand
 - New equipment with higher efficiency
 - Lowering set points where possible
- **Decarbonize** the remaining Thermal Generation

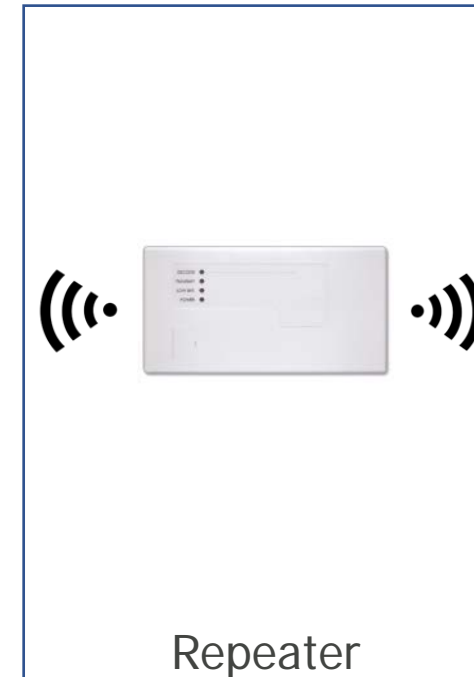
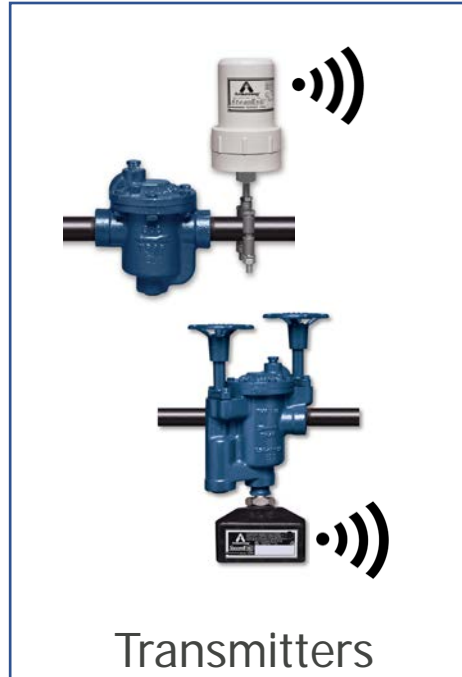


How can you advance on your Roadmap to achieve your goals?



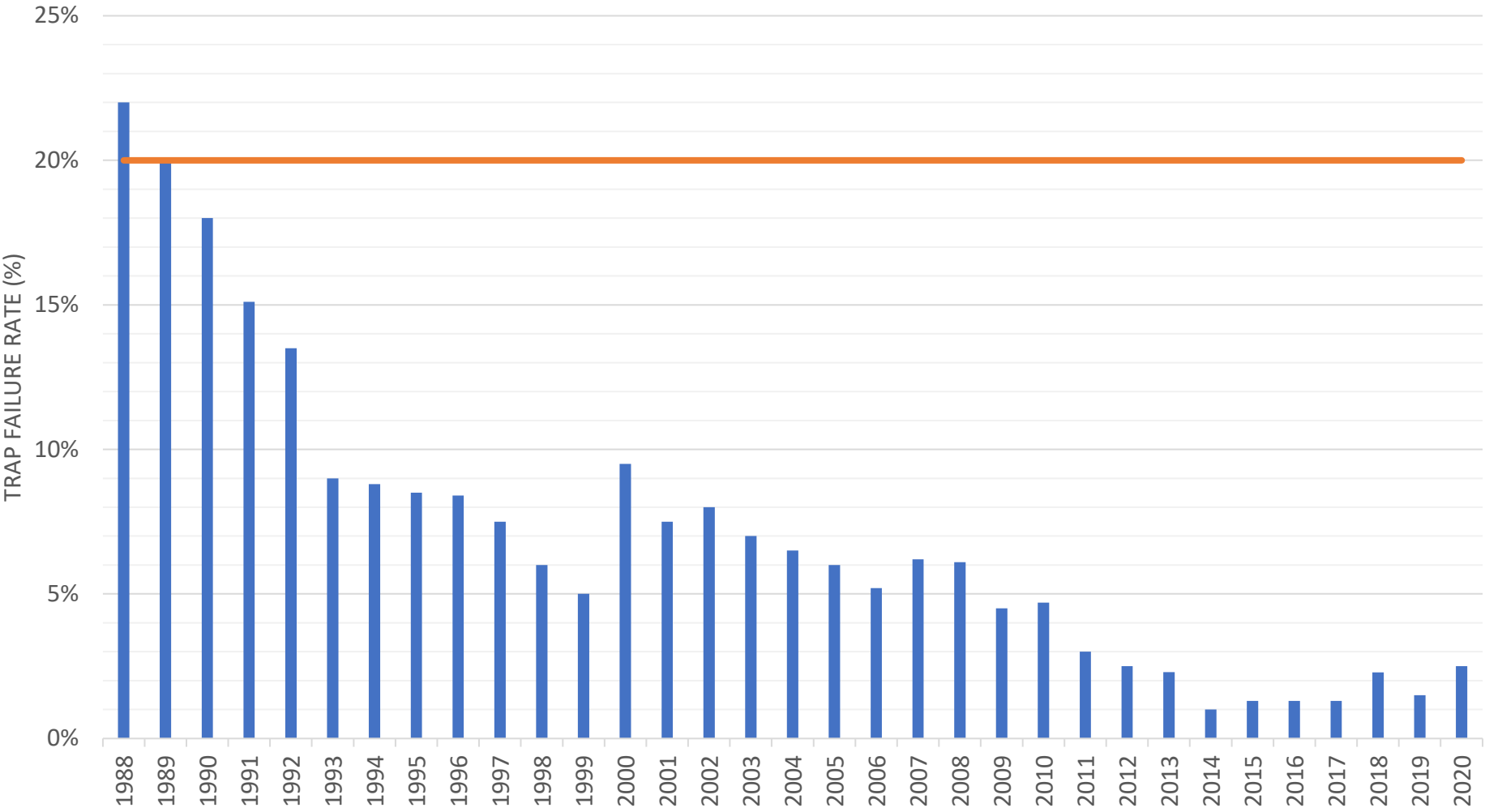
Keys to an Optimal Steam Trap Program

- Annual Steam Trap Surveys
- Online database
 - Trend Performance
 - Track losses (monetary and environmental)
 - Workorder reports
 - Identify poorly performing traps
- Realtime monitors for critical/hard to access installations
- Change failed traps ASAP!





WMU Trap Failure Rate



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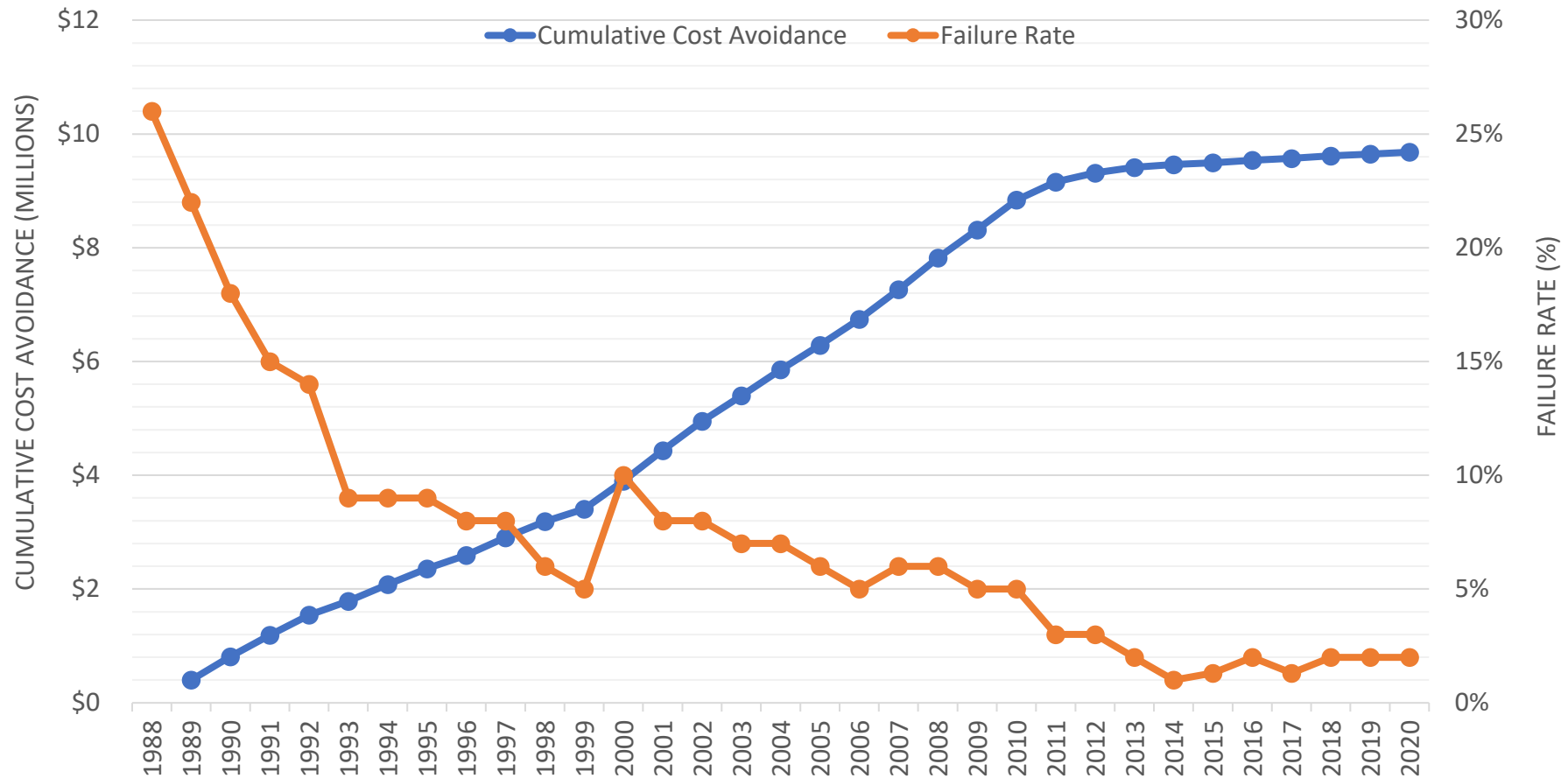
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Cost Avoidance Summary



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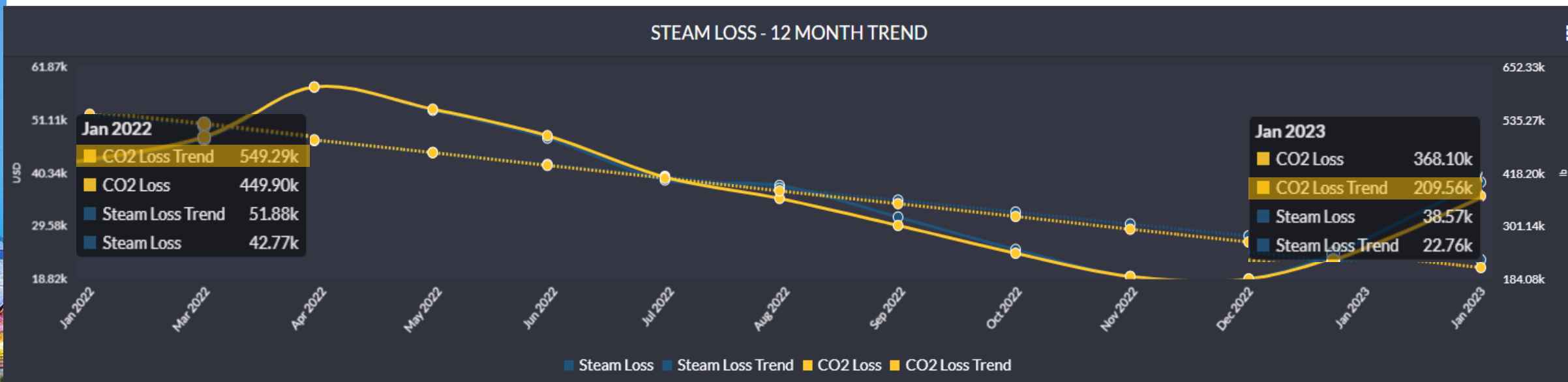
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CO₂ Avoidance Summary



ANNUAL STEAM LOSS

Steam loss	33,887,029 lb
Fuel used to generate steam loss	47,082 MMBTU
CO ₂ emissions due to steam loss	5,507,496 lb
Savings potential	587,318 USD

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The challenge of Thermal Decarbonization

From a Global Leader in Thermal Energy and Enjoyable Experiences

Circular Thermal™

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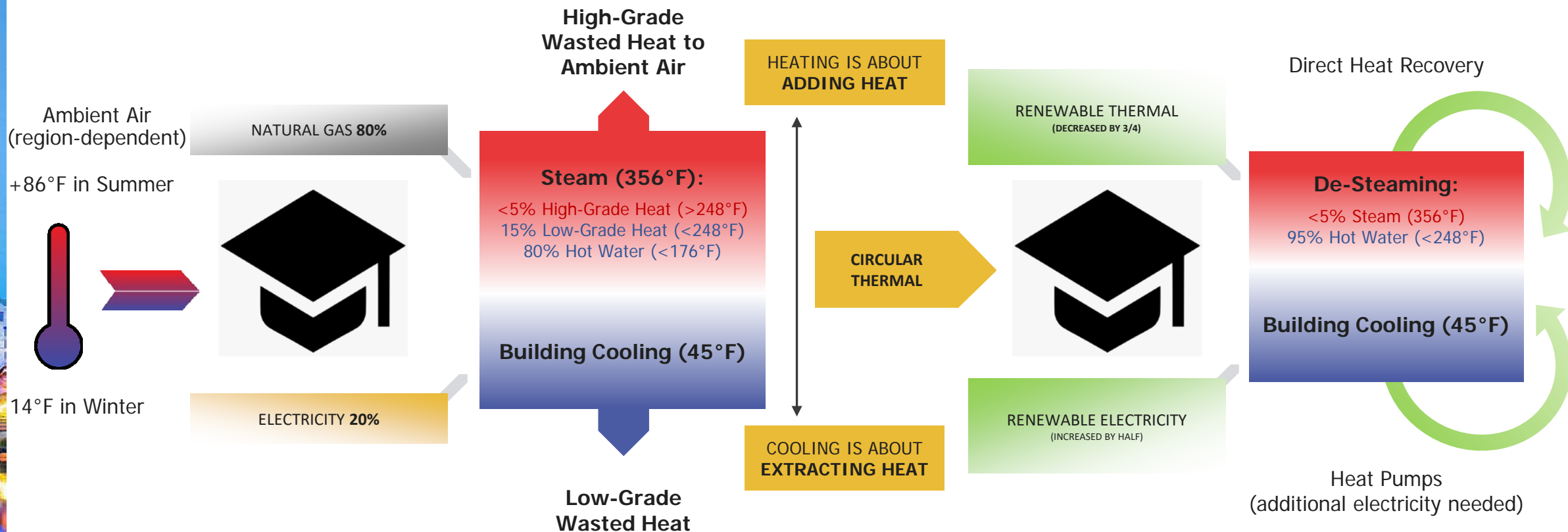
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CIRCULAR THERMAL BY ARMSTRONG



What is Heat pump?

- Chilled water return
- Air
- Sewage
- Geothermal
 - Lake
 - River
 - Borewell

650,000
Btu/hr @50°F

HEAT PUMP



1,000,000 Btu/hr @ 160°F
Hot Water

55 TR cooling



- Cooling tower water return

650,000
Btu/hr @86°F



1,000,000 Btu/hr @ 180°F
Hot Water



- Flue gas heat recovery
- CHP plant waste heat

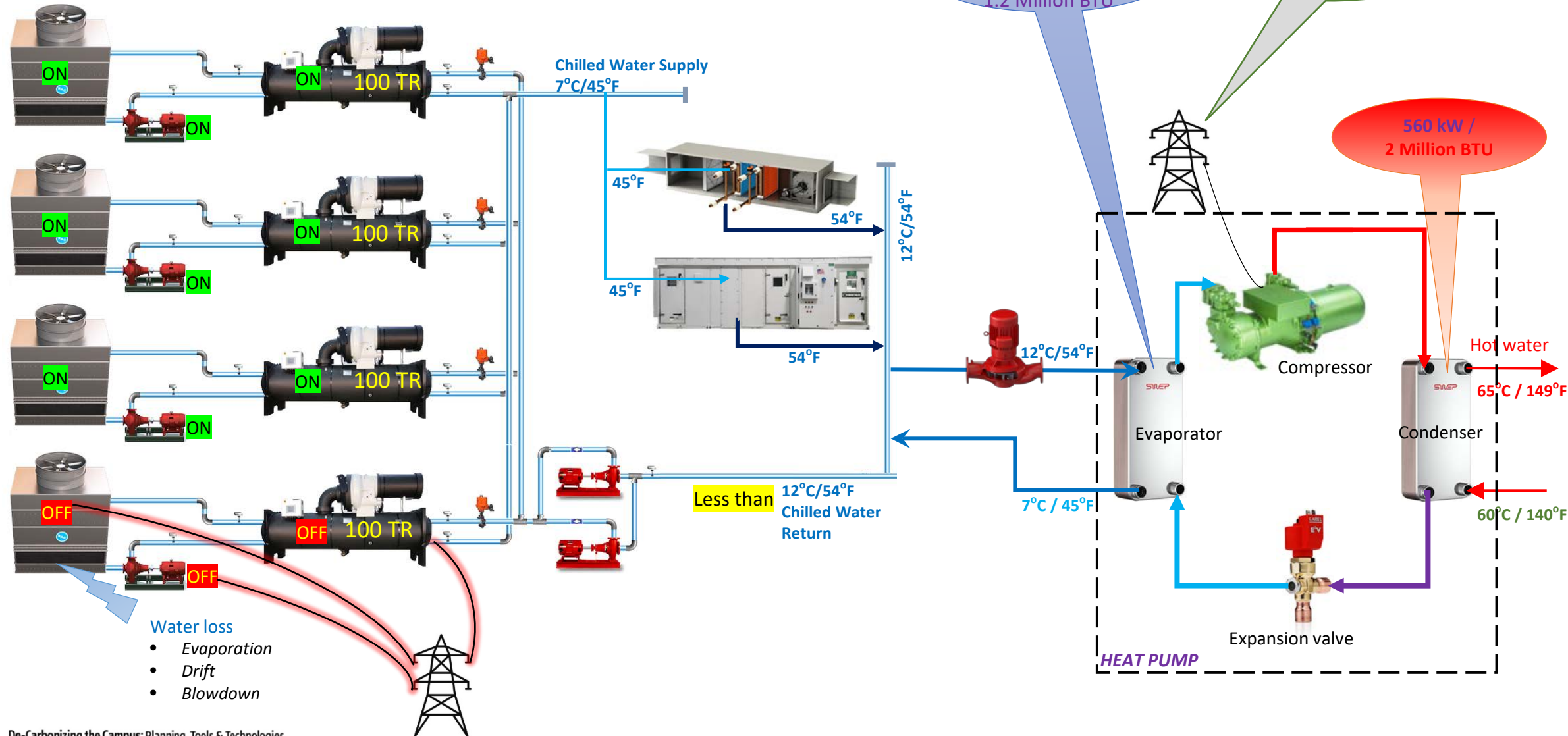
650,000 Btu/hr
@140°F



1,000,000 Btu/hr @ 250°F
Hot Water



Heat Pump Integration!



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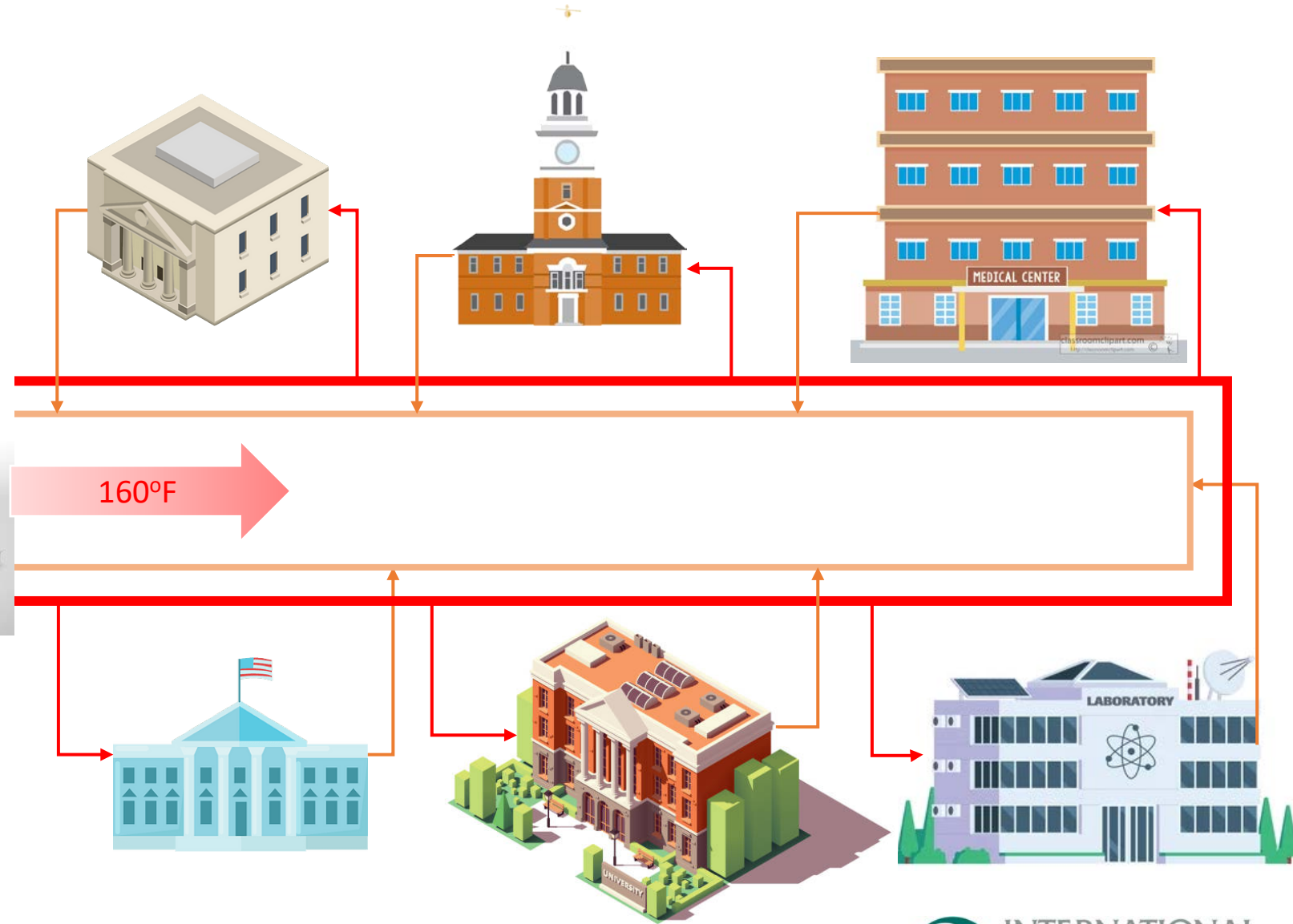
Centralized Hot Water System

Waste heat of $>50^{\circ}\text{F}$

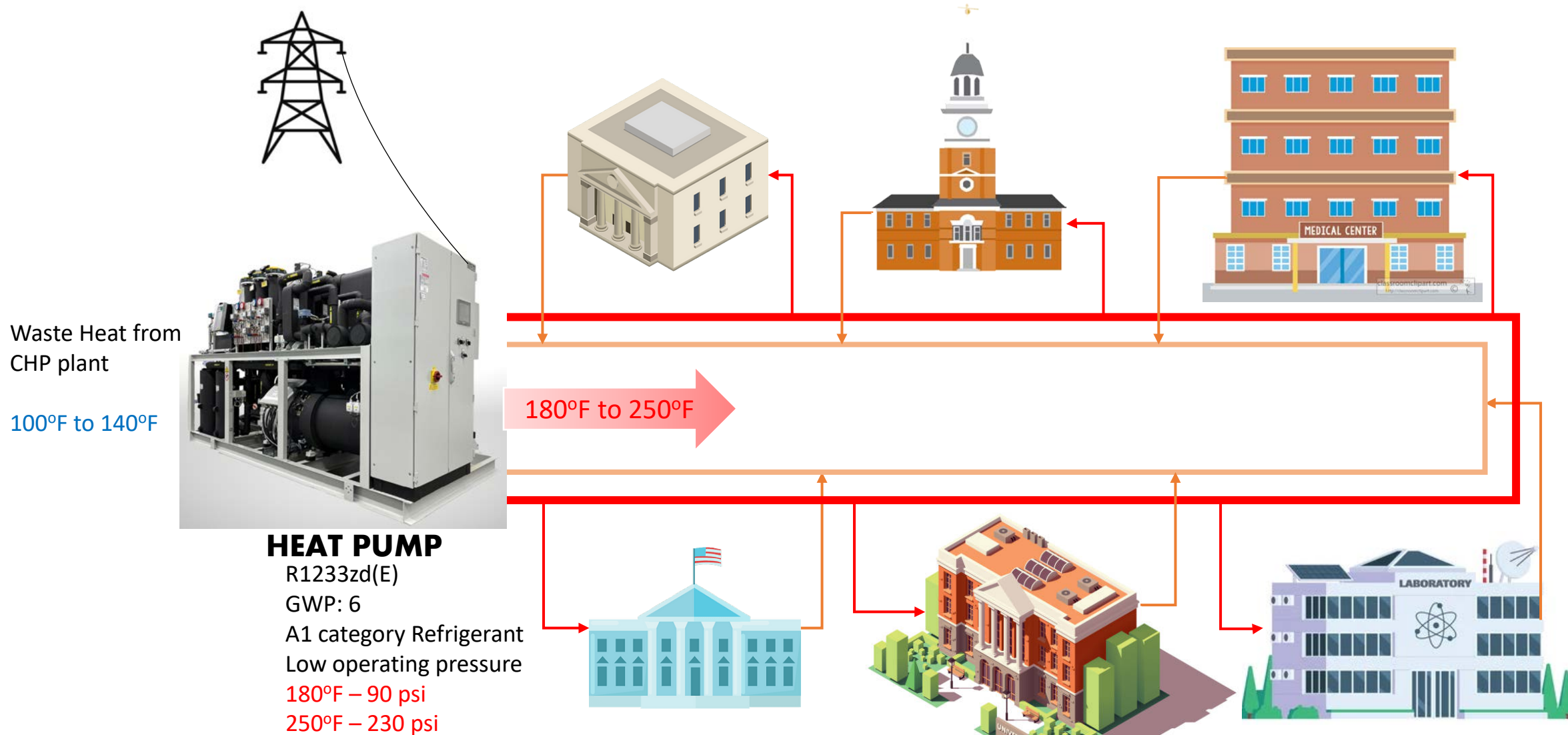
- In chilled return water
- Cooling tower returns water
- Geothermal
 - Lake
 - River
 - Borewell



HEAT PUMP



Centralized Hot Water System



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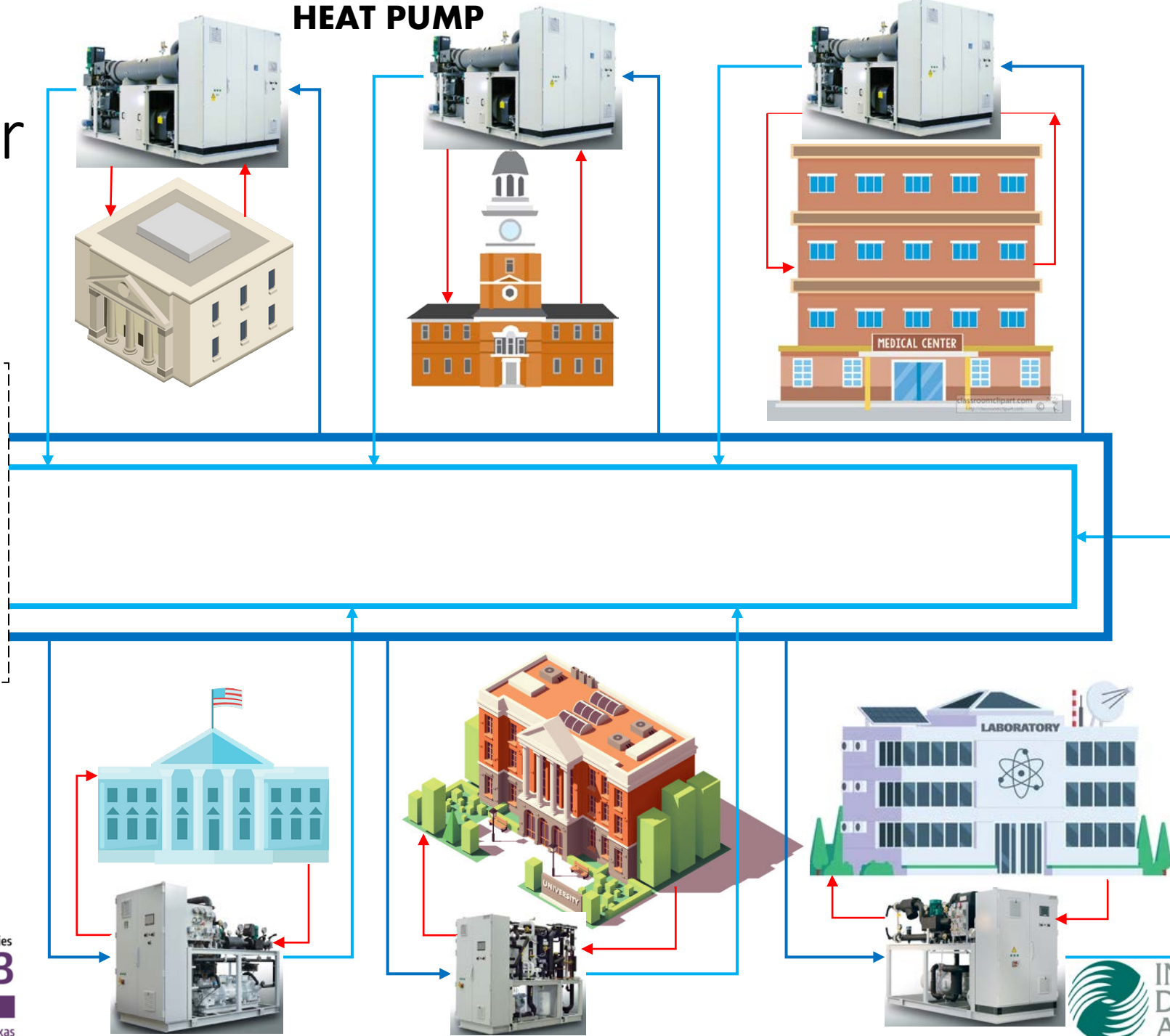
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Localized Hot Water System

HEAT PUMP



Waste heat $>50^{\circ}\text{F}$

- In chilled return water
- Geothermal
 - Lake
 - River
 - Borewell
- CHP plant

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WASTE HEAT RECOVERY FROM EXHAUST AIR

Airtable - Public View

https://airtable.com/shrI0jzltLvCKUHRU/tblbkED5gx2LZ1ZJn

Public View | Use this data

4 hidden fields | Filtered by Ventilation Type (current) | Grouped by 3 fields | Sort | ...

	Equip Name	Area Served (Description)	AHU...	Ventilation Type (...)
BUILDING NAME	Genome & Biomedical Sciences Facility 6		Filled 100%	
145	Genome & Biomedical Sciences Facility A...	South Labs, Floors 1-6		100%OA
146	Genome & Biomedical Sciences Facility A...	West Labs, Floors 1-6		100%OA
147	Genome & Biomedical Sciences Facility A...	North Labs, Floors 1-6		100%OA
148	Genome & Biomedical Sciences Facility A...	East Labs, Floors 1-6		100%OA
149	Genome & Biomedical Sciences Facility A...	1st Floor Auditorium and main lo...		100%OA
150	Genome & Biomedical Sciences Facility A...	Basement		100%OA
BUILDING NAME	Ghausi Hall 2		Filled 100%	
151	Ghausi Hall AHU-1	1st floor Labs		100%OA
152	Ghausi Hall AHU-2	2nd floor Labs		100%OA
BUILDING NAME	Gourley Clinical Teaching Center 5		Filled 80%	
153	Gourley Clinical Teaching Center AHU-1	Administration		100%OA
154	Gourley Clinical Teaching Center AHU-2	Surgery & Animals		100%OA
155	Gourley Clinical Teaching Center AHU-3	Large Animal Area		100%OA
156	Gourley Clinical Teaching Center AHU-4	Smaller Animal Area		100%OA
157	Gourley Clinical Teaching Center EF1-4, E...			100%OA
BUILDING NAME	Green Hall (Life Sciences) 4		Filled 0%	
158	Green Hall (Life Sciences) AHU-1			100%OA
159	Green Hall (Life Sciences) AHU-2			100%OA
160	Green Hall (Life Sciences) AHU-3			100%OA
161	Green Hall (Life Sciences) AHU-4			100%OA

Airtable - Public View

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Public View | Use this data

4 hidden fields | Filtered by Ventilation Type (current) | Grouped by 3 fields | Sort | ...

	Equip Name	Area Served (Description)	AHU...	Ventilation Type (...)
BUILDING NAME	Center for Neuroscience 3		Filled 0%	
123	Center for Neuroscience AC-1			RA + OA
124	Center for Neuroscience AC-2			RA + OA
125	Center for Neuroscience AC-5			RA + OA
BUILDING NAME	CFA Administration Building 1		Filled 100%	
126	CFA Administration Building AHU-1	Entire Building		RA + OA
BUILDING NAME	Chemistry 3		Filled 0%	
127	Chemistry AH-1S			RA + OA
128	Chemistry AH-2S			RA + OA
129	Chemistry AH-3S			RA + OA
BUILDING NAME	Cole A 2		Filled 100%	
130	Cole A AHU-1	Rooms 130, 131, 131A, 131B, 131...		RA + OA
131	Cole A AHU-2	Offices 102, 117, 117B, 117C, 117D		RA + OA
BUILDING NAME	Contained Research Facility 6		Filled 0%	
132	Contained Research Facility AHU-4			RA + OA
133	Contained Research Facility AHU-5			RA + OA
134	Contained Research Facility AHU-6			RA + OA
135	Contained Research Facility AHU-7			RA + OA
136	Contained Research Facility AHU-8			RA + OA
137	Contained Research Facility AHU-9			RA + OA

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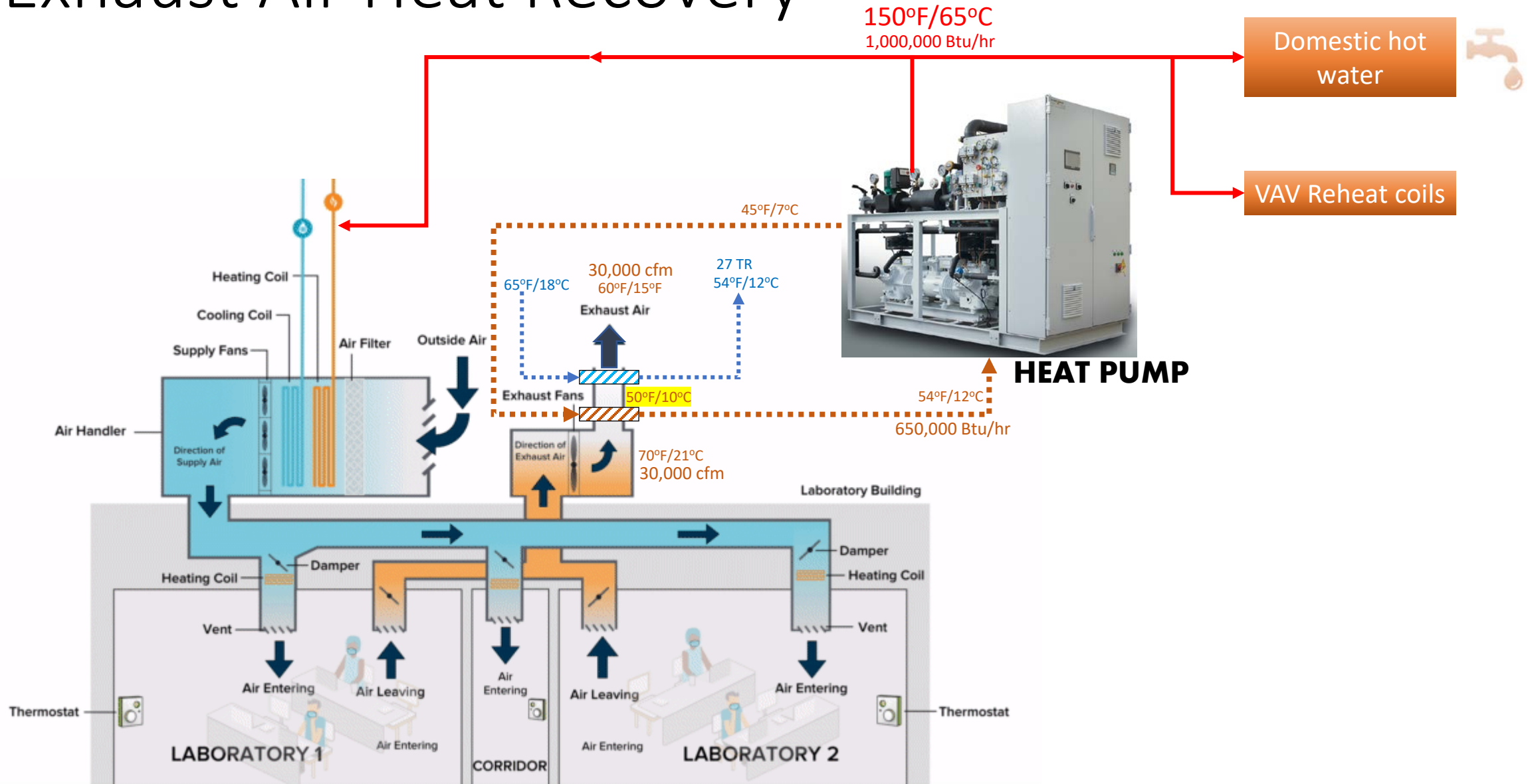
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University of California, Davis



Exhaust Air Heat Recovery



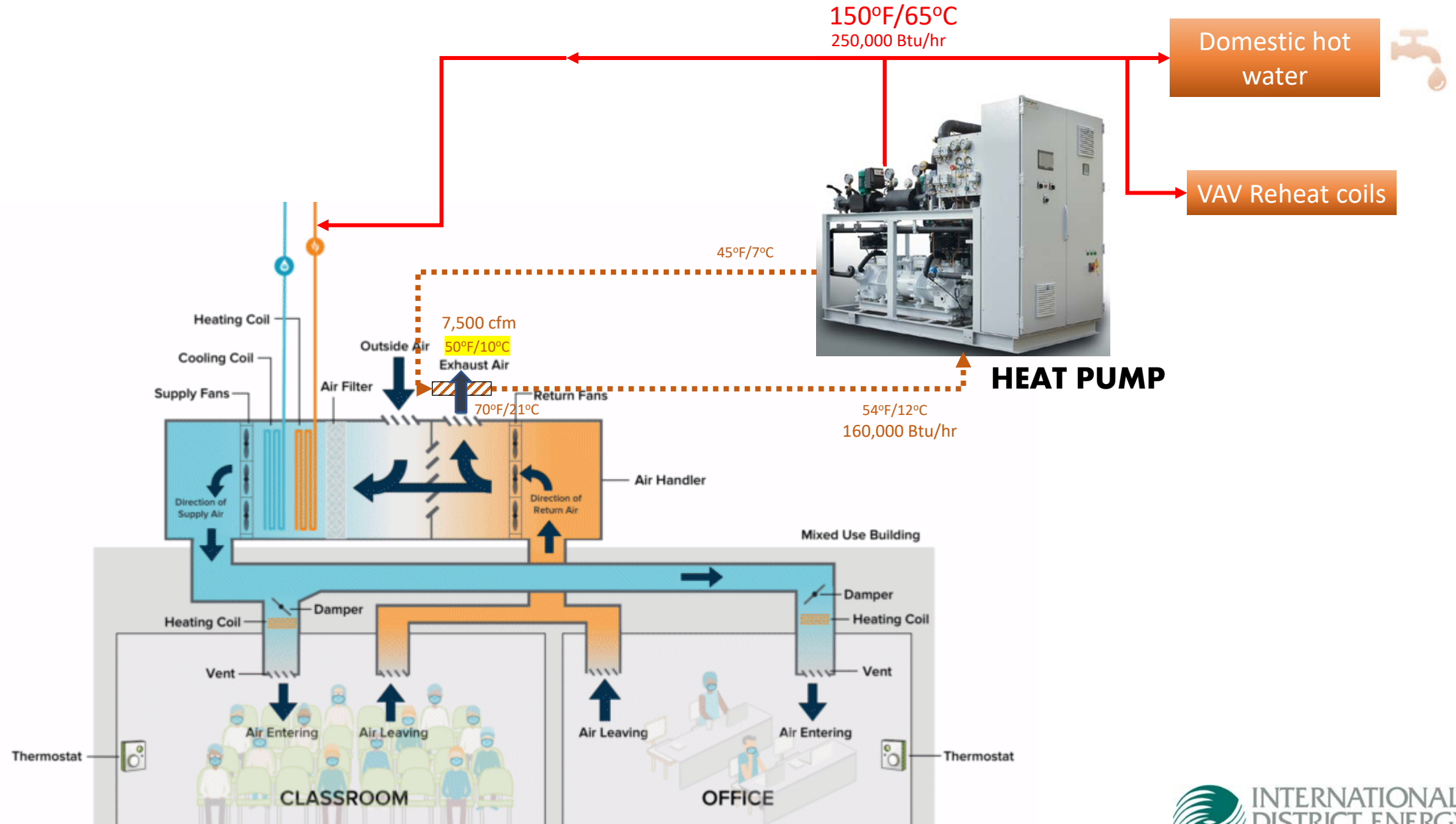
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Exhaust Air Heat Recovery



A vertical strip on the left side of the slide shows a building at night with lights reflecting in water.

QUESTIONS?

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Thank You!



Andrew Witteck



Rajkumar Gnanaraj



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