BUILDINGENERGY NYC

Clean Energy from Dirty Water: Wastewater Energy Transfer (WET) System Showcase

Justin P. Mariniak (Egg Geo)
Aaron Miller (SHARC Energy)
Michael Scorrano (EN-POWER GROUP)

Curated by Amalia Cuadra and Joaquin Font

Northeast Sustainable Energy Association (NESEA) | October 24, 2024

MEET THE TEAM

Michael Scorrano, PE

Managing Director and Founder at EN-POWER GROUP

Aaron Miller, CEM, CEP

Eastern Regional Manager at SHARC Energy

Justin P. Mariniak, PE

Mechanical Engineer at Egg Geo

MICHAEL SCORRANO, PE

FOUNDER AND MANAGING DIRECTOR

With over 25 years of experience in both the generation and end-use sides of the energy industry, Michael founded EN-POWER GROUP with the vision of developing an engineering firm that does energy management "better". With that simple vision, EN-POWER GROUP evolved into an engineering firm that designs, develops, and delivers comprehensive, integrated, and practical energy solutions from concept to completion.

EDUCATION

- M.B.A. in Financial Management, Pace University
- B.S. in Mechanical Engineering, University of Central Florida

CERTIFICATIONS/LICENSES

- Licensed Professional Engineer (PE)
- Certified Building Commissioning Professional (CBCP)
- Certified Energy Manager (CEM)
- Multifamily Building Analyst (MFBA)

ABOUT US

ENGINEERING FIRM — DESIGNING, DEVELOPING, AND DELIVERING COMPREHENSIVE SOLUTIONS FOR BUILDING DECARBONIZATION.

Founded in 2003, ENPG comprises of engineers, auditors, designers, analysts, and project managers.

AMALGAMATED HOUSING CORP (AHC) BACKGROUND

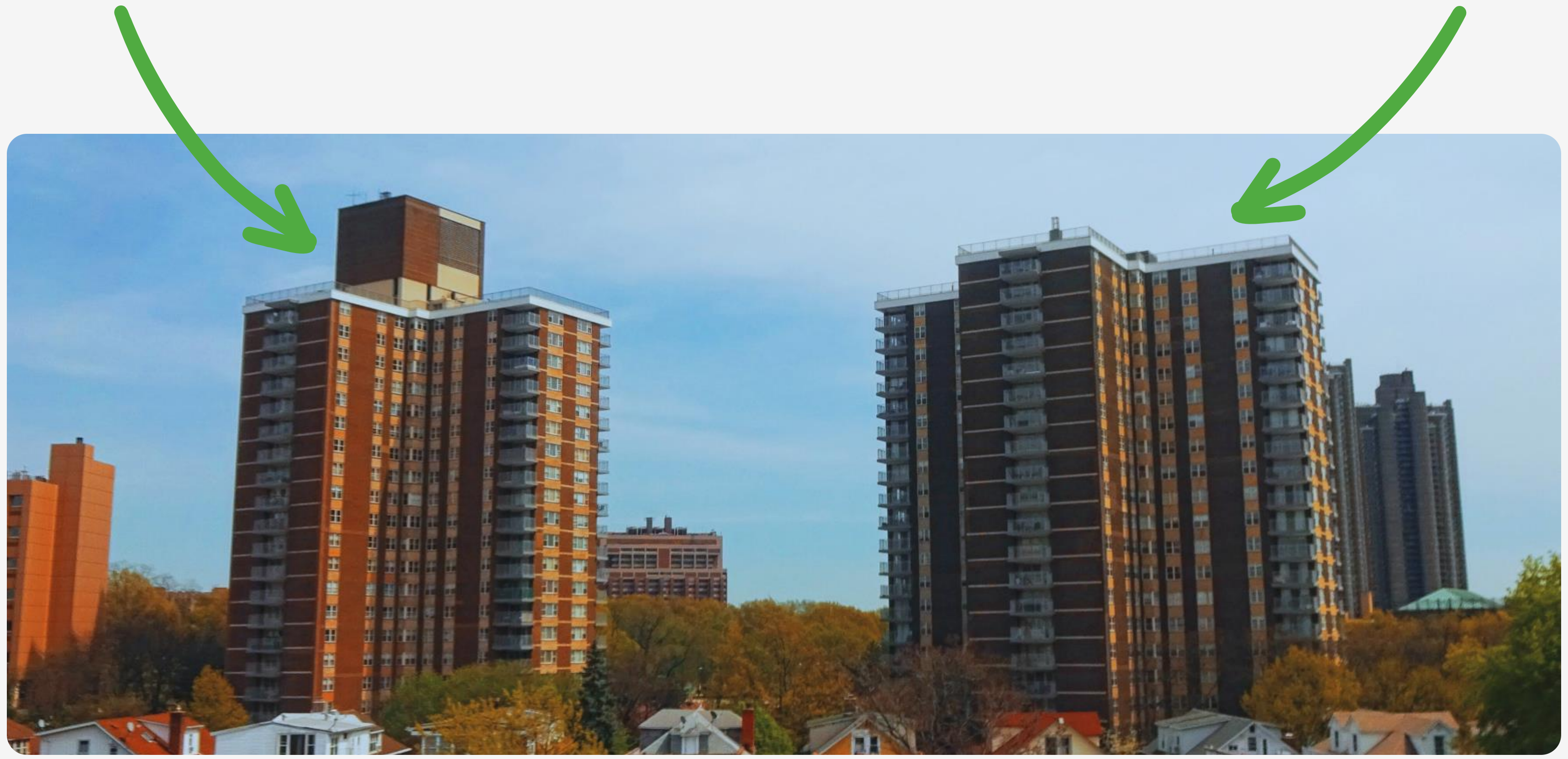
- AHC is the oldest affordable limited equity housing cooperative in the nation built in 1926.
- AHC has about **1,500 apartments** across **thirteen buildings.**
- Asset value under AHC ownership and management is $650,000,000.
- AHC's investment thesis is to maintain its status as an affordable housing cooperative to benefit all current and future shareholders
- AHC is an early adopter of energy efficiency

AHC'S ESTIMATED CARBON PENALTY FOR 2035 IS AROUND $900,000

AHC'S Overall energy and carbon emissions table below is based on pre-covid usage.

Fuel	Use	Units	Cost	Rate	MMBTU
Electricity	7,888,561	kWh	$1,427,585	$0.18	26,916
Gas	1,327,139	therms	$638,396	$0.48	132,714
Oil #4	93,253	gallons	$208,887	$2.24	13,615
Total	-	-	$2,274,869	-	173,245

AHC PROJECT BACKGROUND: THE TOWERS

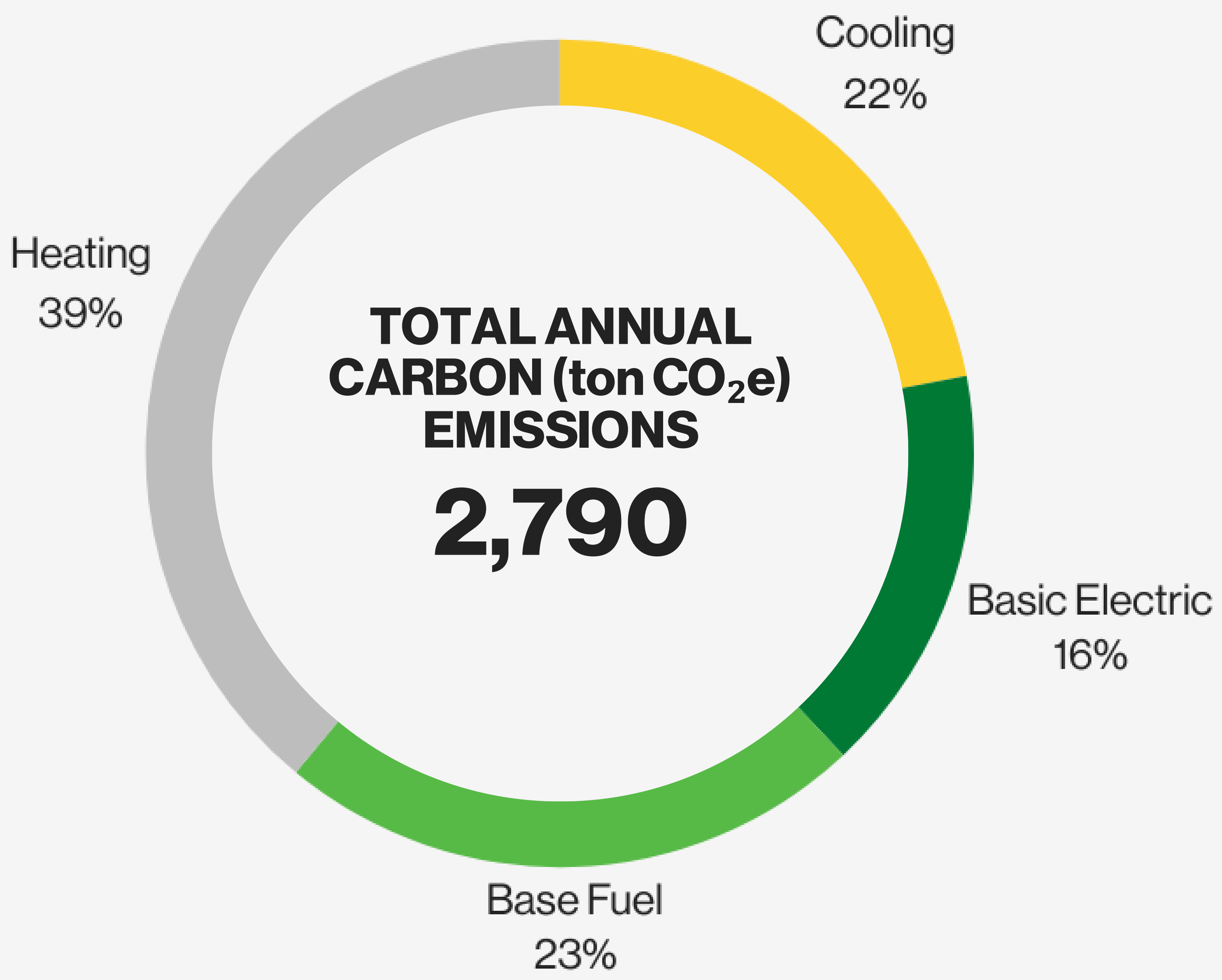


Two AHC buildings, Tower 1 and Tower 2, will participate in EBC. The Towers share many characteristics:

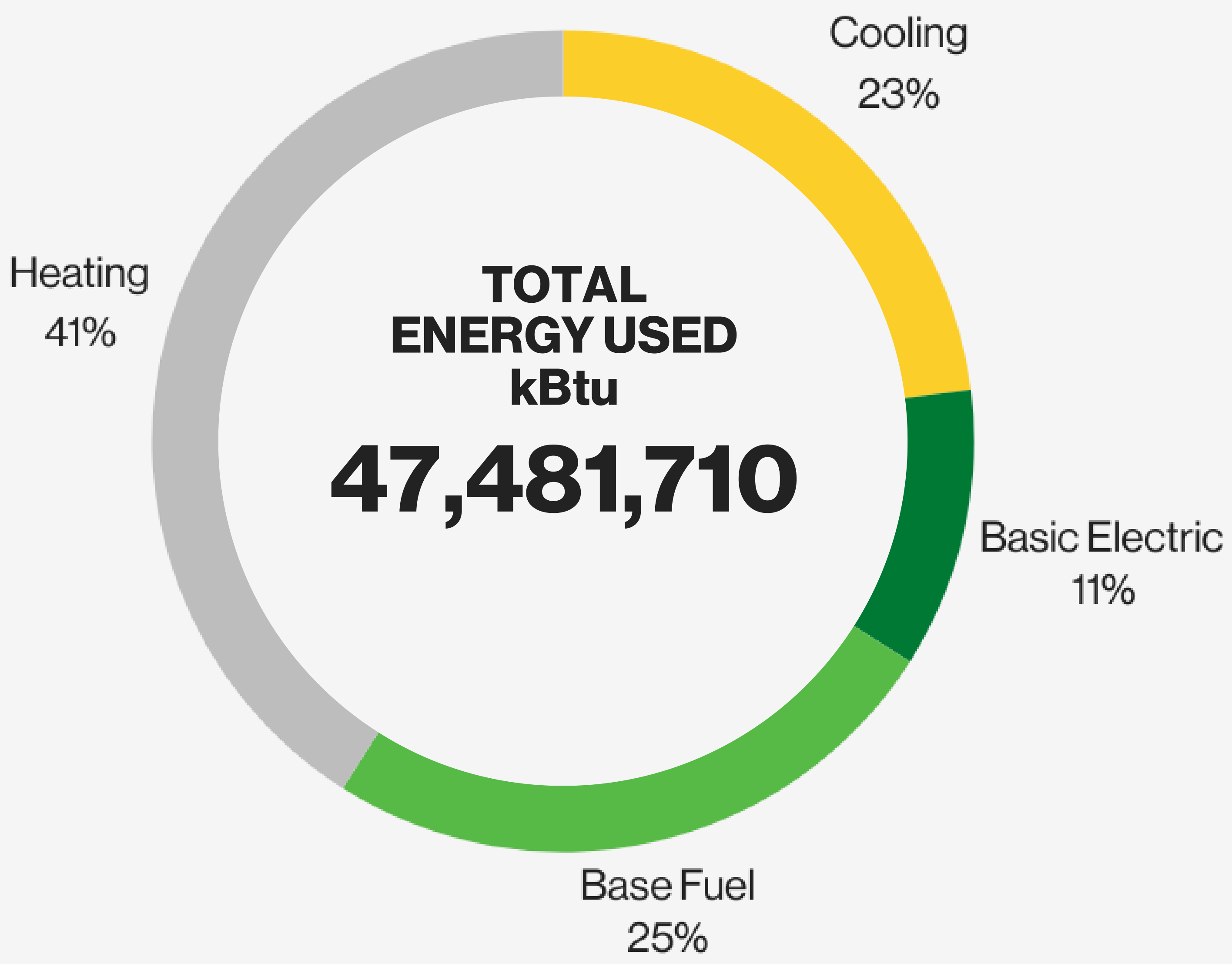
- Built in 1968 (Tower 1) & 1971 (Tower 2)
- 20 Floors
- **Heating:** High-pressure steam from the complex's dual-fuel boiler plant
- **Cooling:** Single-stage steam absorption chiller
- **Distribution:** Dual temperature loop

TOWERS 1 & 2 EMISSIONS ACCOUNT FOR APPROX A THIRD OF AHCS OVERALL ESTIMATED PENALTIES

CARBON EMISSIONS AND LL97 IMPACT

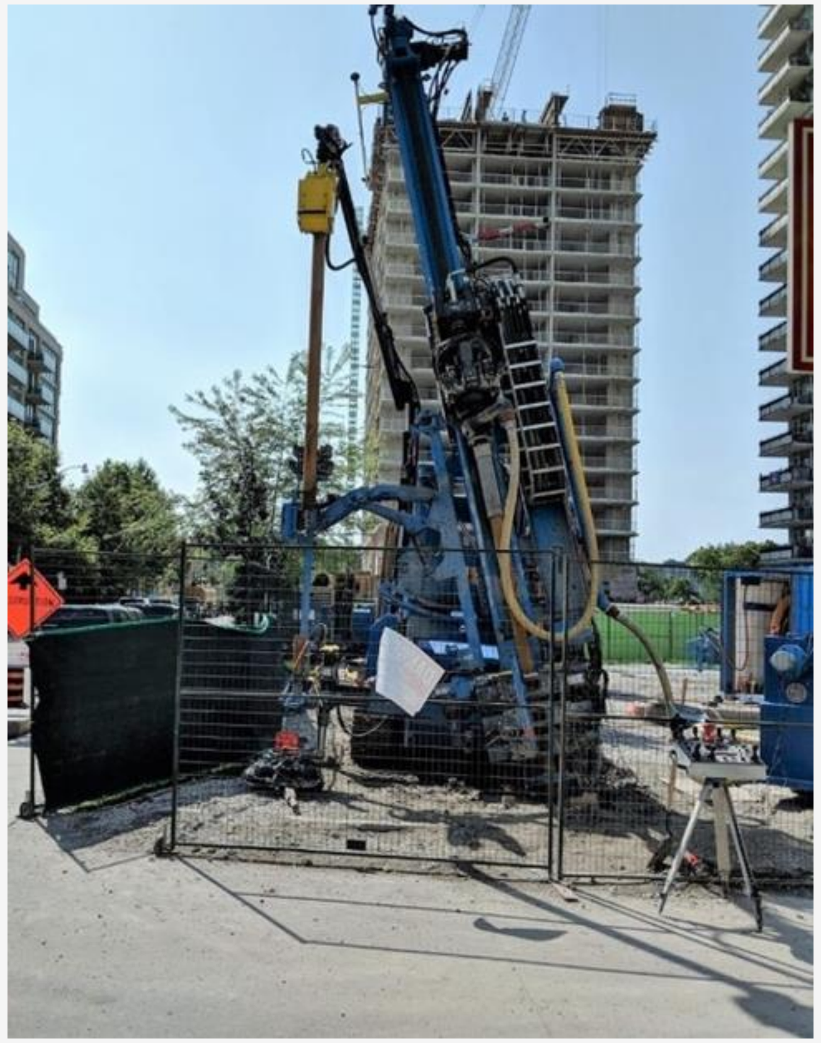


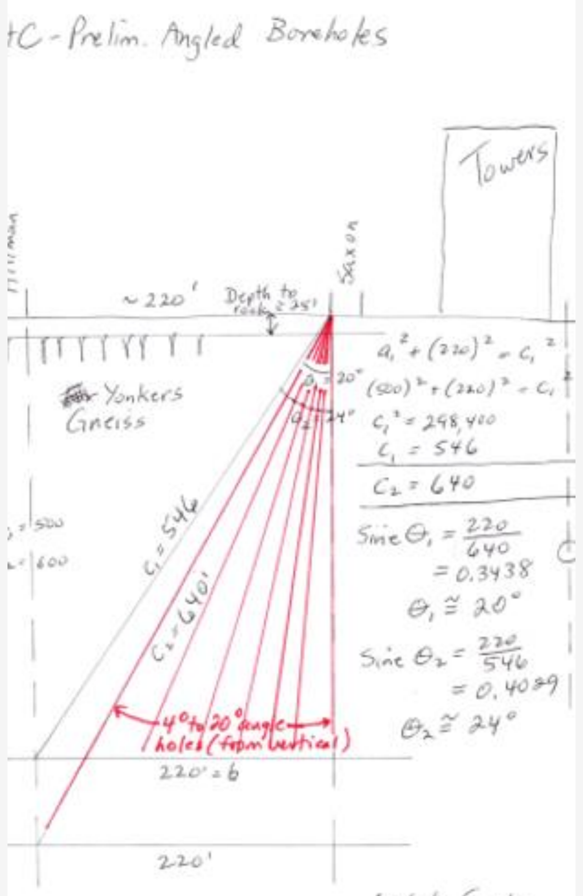
ENERGY USAGE



EN-POWER'S ROADMAP TO DECARBONIZATION

1. Retrofit Heating & Cooling Distribution System (Piping and Fan Coils)
2. Install Wastewater Energy Transfer System
3. Upgrade Ventilation & Lighting System
4. Upgrade Envelope
5. Install Ground Source Heat Pump System
6. Install Control System & Variable Frequency Drives
7. Install Submetering & Solar PV System
8. Electrify Appliances (Laundry & Stoves)





AARON MILLER, CEM, CEP

Eastern Regional Manager at SHARC Energy

Aaron is a seasoned professional with extensive experience working on both sides of the energy meter. He began his energy career designing low voltage lighting, HVAC control, and building automation systems for New York City multi-family residential and commercial buildings. Upon earning his Certified Energy Manager (CEM) and Certified Energy Procurement Professional (CEP) accreditations, Aaron provided supply-side and sustainability advisory services to many of the nation's largest healthcare and commercial real estate companies.

EDUCATION

- B.A. in Cultural Anthropology from Duke University

CERTIFICATIONS/LICENSES

- Certified Energy Manager (CEM)
- Certified Energy Procurement Professional (CEP)

WHAT IS THE VALUE OF WASTEWATER?

U.S. DEPARTMENT OF ENERGY

ESTIMATES OVER

350,000,000,000 kWh

ARE DISCARDED DOWN THE DRAIN IN THE U.S. ON AN ANNUAL BASIS

NYC DEP HANDLES 1.3 BILLION GPD OF WASTEWATER

~1300 MW_{th}

The Average Person Uses **30 Gallons** of **Hot Water** per Day at **120°F***

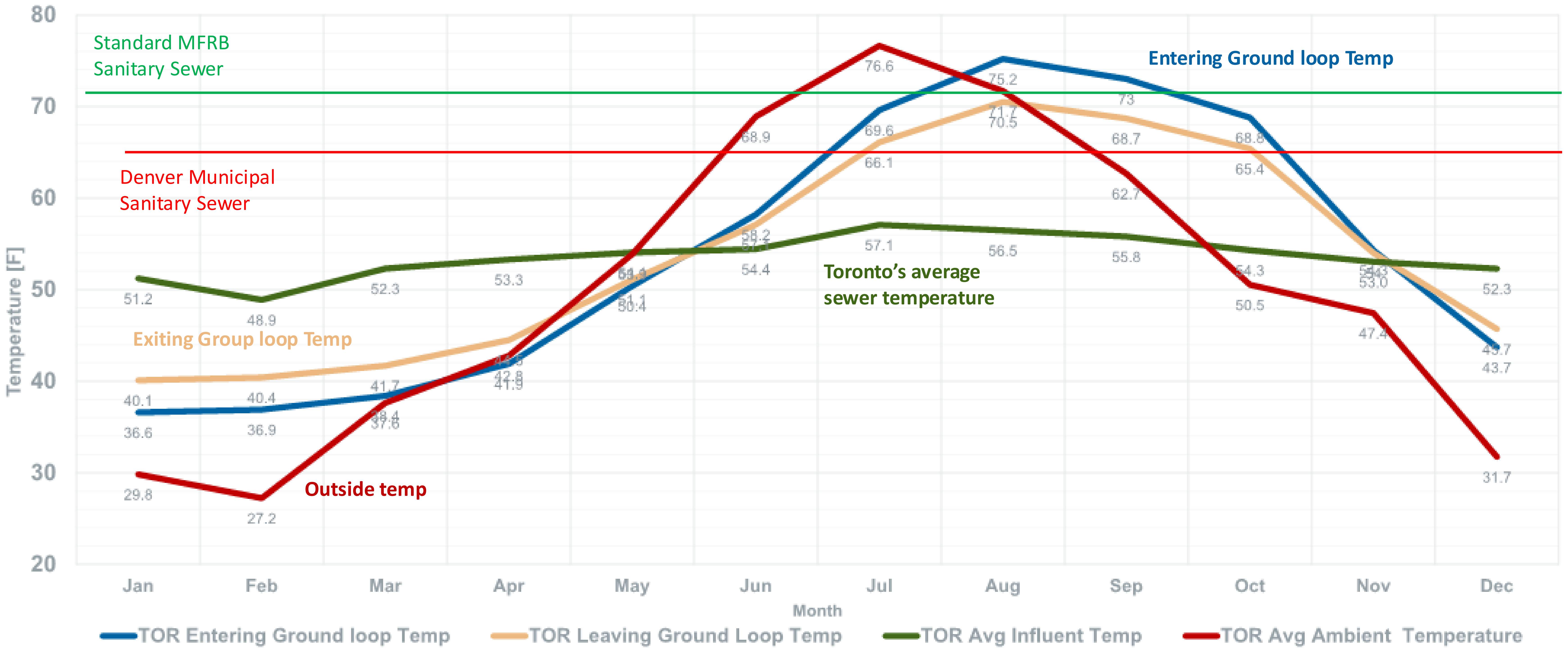
- Producing an estimated **60 gallons/day** of wastewater
- Average Residential Wastewater Temperature is **70°F**
- Commercial, Industrial, & Healthcare Wastewater Temperature can reach **140°F** or Higher

Wastewater sources:

- Black and Grey Water Within Buildings
- Sanitary Sewers
- Lift Stations/Treatment Centres

* Hot-Water Demand and Use Guidelines for Apartment Buildings, Medium Average Daily - Table 7.
ASHRAE Heating, Ventilating & Air-Conditioning Applications, Chapter 50 - Service Water Heating

Wastewater – Geothermal – Ambient Temps



** Source: City of Toronto presentation*

PIRANHA HC

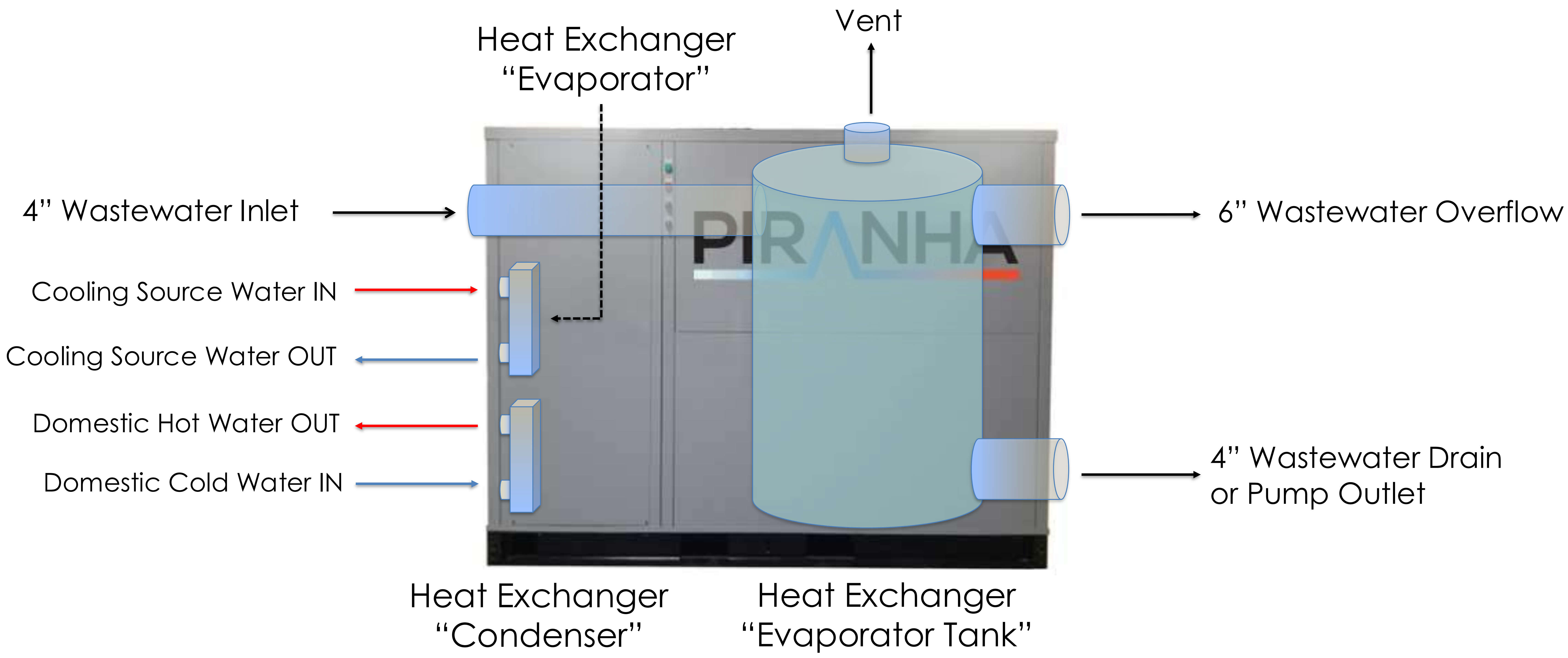
The PIRANHA is a self-contained heat pump that uses a specifically designed direct expansion heat exchanger to recover thermal energy from a building's wastewater for domestic hot water heating

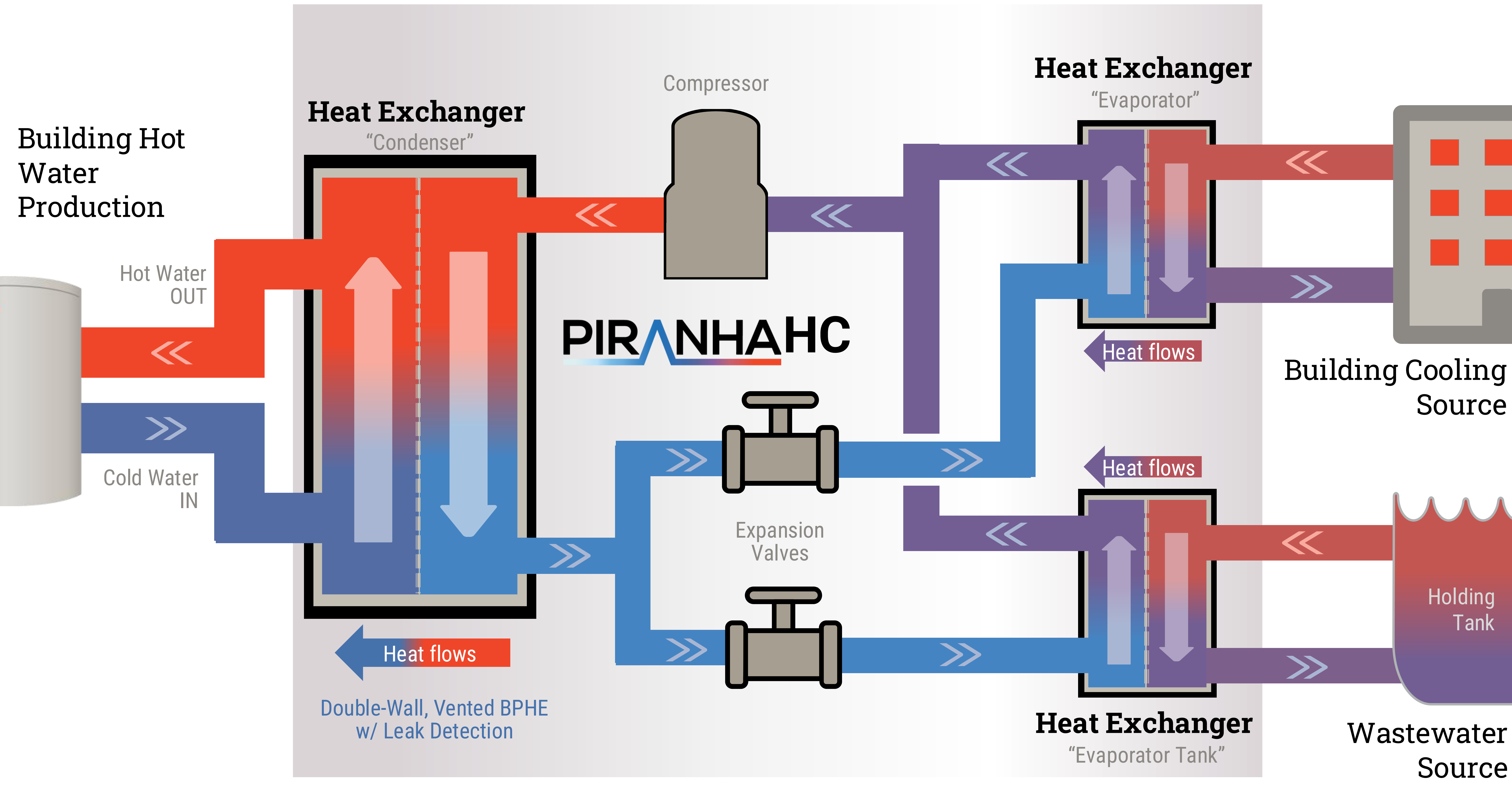
PIRANHA HC Combines Wastewater Energy Recovery with Space Conditioning

- **Models: T5 HC/T10 HC/T15 HC**
  - Design Heat Output
    - ➢ **60/120/180 MBH**
  - Design Cooling Capacity
    - ➢ **48/96/144 MBH**
    - ➢ Increase output scalable with multiple units
  - Designed to fit through standard double door
- Average combined COP up to 7*
- DHW production while Cooling Spaces
- **NSF-372 rated BPHE**
  - Double-wall, leak detection
- R-513a
  - 56% Lower GWP than R-134a (573 vs. 1,430)
  - Same performance

*Average COP across a range of source temperatures, output temperatures and application types.

THE PIRANHA HC




Building Hot Water Production
Hot Water OUT
Cold Water IN
Heat Exchanger
"Condenser"
Heat flows
Double-Wall, Vented BPHE w/ Leak Detection
Compressor
PIRANHAHC
Expansion Valves
Heat Exchanger
"Evaporator"
Heat flows
Building Cooling Source
Heat flows
Holding Tank
Heat Exchanger
"Evaporator Tank"
Wastewater Source

New York WET Projects

- ✓ Domestic Hot Water
- ✓ Heating & Cooling
- ✓ Geothermal Field Offset
- ✓ Thermal Energy Networks

Empire Building Challenge
PARTNER
Reimagining Low-carbon Buildings

NEW YORK STATE OF OPPORTUNITY. | NYSERDA

The Towers by Amalgamated Housing Cooperative

Bronx, NY

SHARC

CASE STUDY

Low Carbon Retrofit

AMALGAMATED HOUSING COOPERATIVE

New centralized hydronic distribution piping for two 20-story towers. Using geothermal and wastewater heat recovery that captures heat from domestic water sources, allows Amalgamated to decommission its cooling towers.

- **(3x) PIRANHA T15 HC cover 91% of DHW load**
  - **Average COP of 3.5**

- Wastewater Energy Transfer allows for a reduction in the number of geothermal boreholes required

Current baseline	Expected by 2035
111.6 kBtu/SF/yr	**32.5** kBtu/SF/yr **Reduction of 71%**
84% Natural Gas + **14%** Electricity + **2%** Oil	**100%** Electricity
2,771 tCO2e/yr	**202** tCO2e/yr **Reduction of 93%**

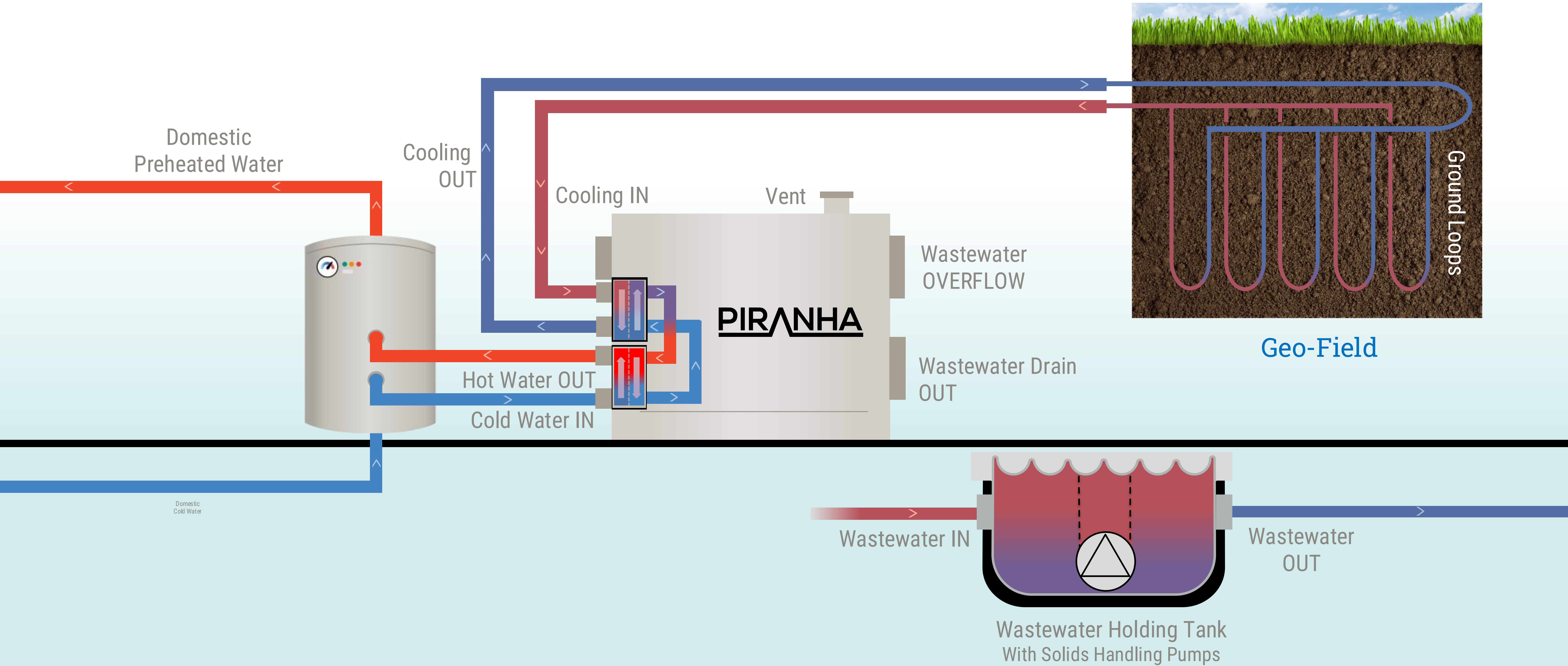
EN-POWER GROUP

egg geo

Empire Building Challenge PARTNER Reimagining Low-carbon Buildings

PIRANHA HC paired with Geothermal

Simultaneous Heating + Cooling



Retrofit Checklist

Qualify a building for a possible WET opportunity

WASTEWATER ACCESS

- Where is the primary sanitary invert located?
- Can a wastewater holding tank be installed to capture enough sanitary flow?
- Do No Harm to the natural gravity outflow of the building

ADEQUATE POWER

- Does the building have enough electrical capacity?
- Amperage & voltage requirements are determined by equipment & pump selections
- Bringing new service to a building can ruin project economics & schedules

SPACE

- Is there room for the PIRANHA / SHARC, tanks & auxiliary components?
- Ample clearances for service and access to the mechanical areas
- Use existing infrastructure whenever possible – ejector pits, piping, etc.

HOT WATER PLANT

- Can the PIRANHA / SHARC output be connected to the building systems?
- Are other hydronic assets available? Condenser loop, chiller plant, steam quench, etc.
- Locate the WET system components close to each other

JUSTIN P. MARINIAK, PE

Mechanical engineer

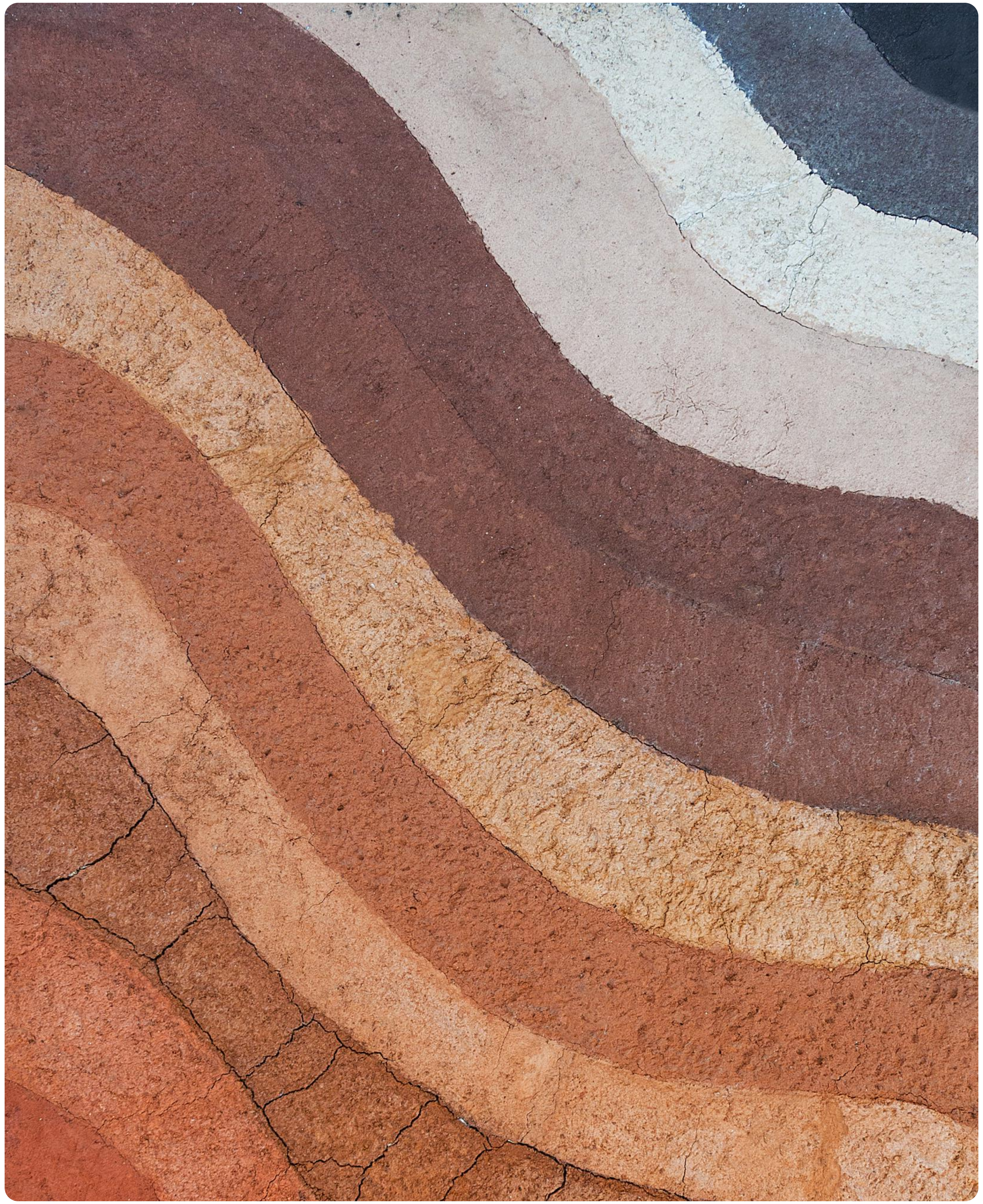
As a PE and project manager, Justin's role on projects ranges from providing geothermal payback analysis to full geothermal system design. His background as a mechanical engineer began in conventional HVAC design, including DX and Chilled Water, before focusing full time on thermal energy applications. He is passionate about being part of the solution in providing consistent renewable, cutting edge energy for heating and cooling needs.

EDUCATION

- B.A. of Science in Mechanical Engineering from Florida State University

CERTIFICATIONS/LICENSES

- Licensed Professional Engineer (PE)

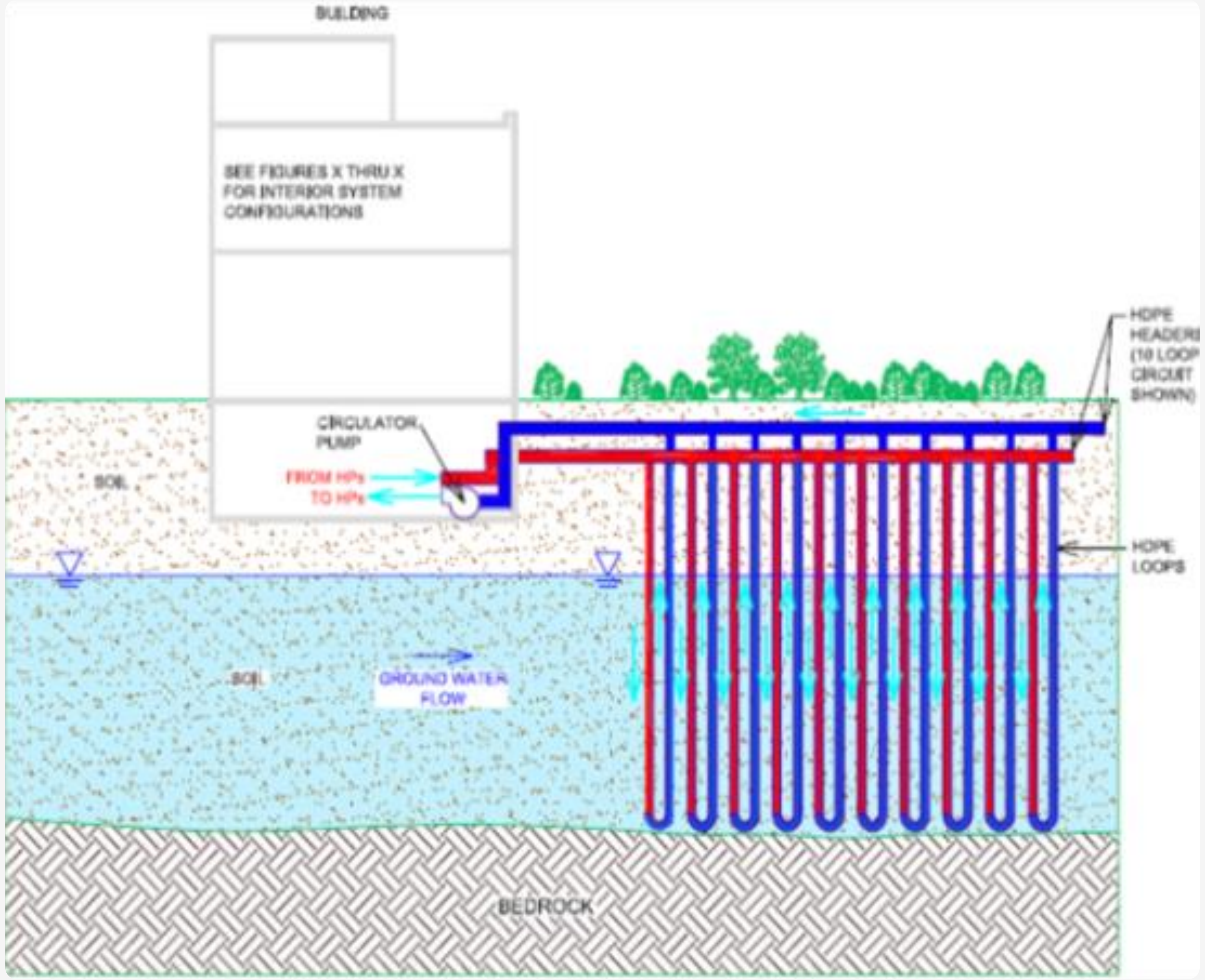


GEOTHERMAL EXCHANGE SOURCES

- Wastewater
- Surface water
- Closed Loop Geothermal
- Standing Column Geothermal
- Open Loop Geothermal

GEOTHERMAL CHALLENGES

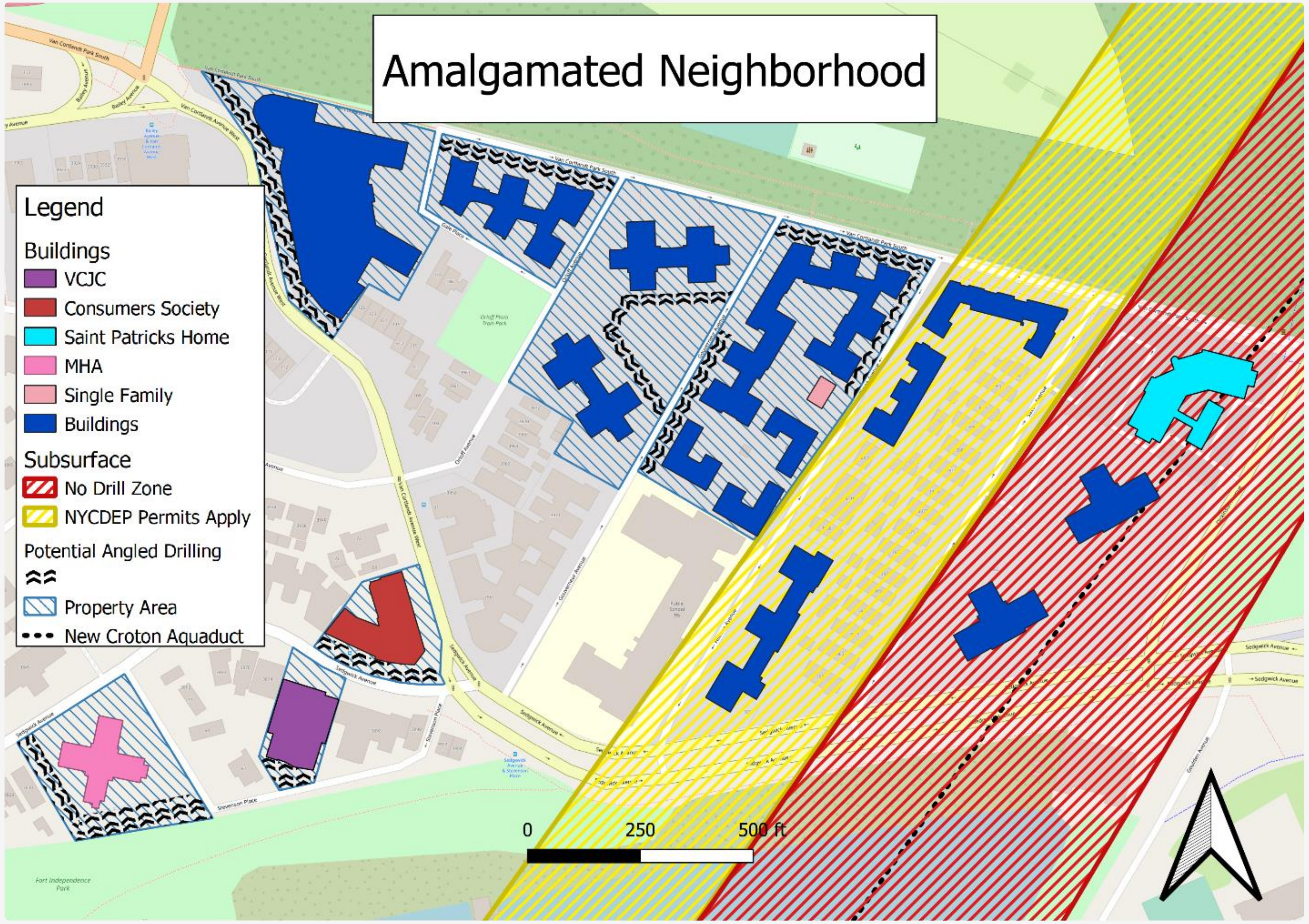
- Ground Lithology
- Existing Ground Infrastructure
- Required Areas to Avoid
- Maximum Drilling Depths allowed by Authorities Having Jurisdiction (AHJ)
- Wastewater Flow – Quantity and Temperature
- Plumbing Infrastructure, both Domestic Hot Water and Sanitary
- Space for Heat Pump and Storage Tanks



CLOSED LOOP

- Closed loop is the preferred method based on ground lithology
- Surface area can be maximized by potentially increasing well depth
- New closed loop technologies are being developed that may increase this estimated capacity in the near future
- Angled drilling

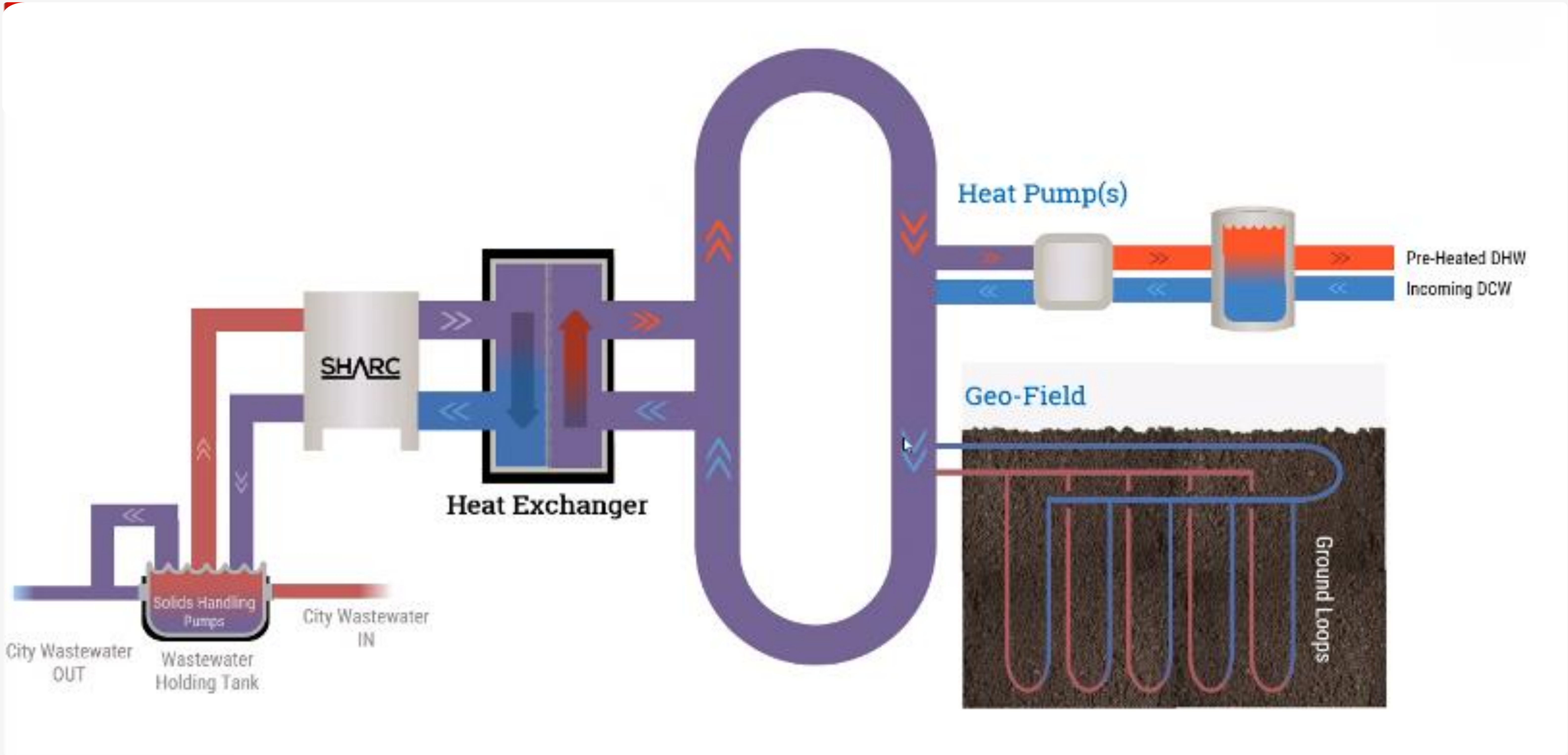
DRILLING SPACE



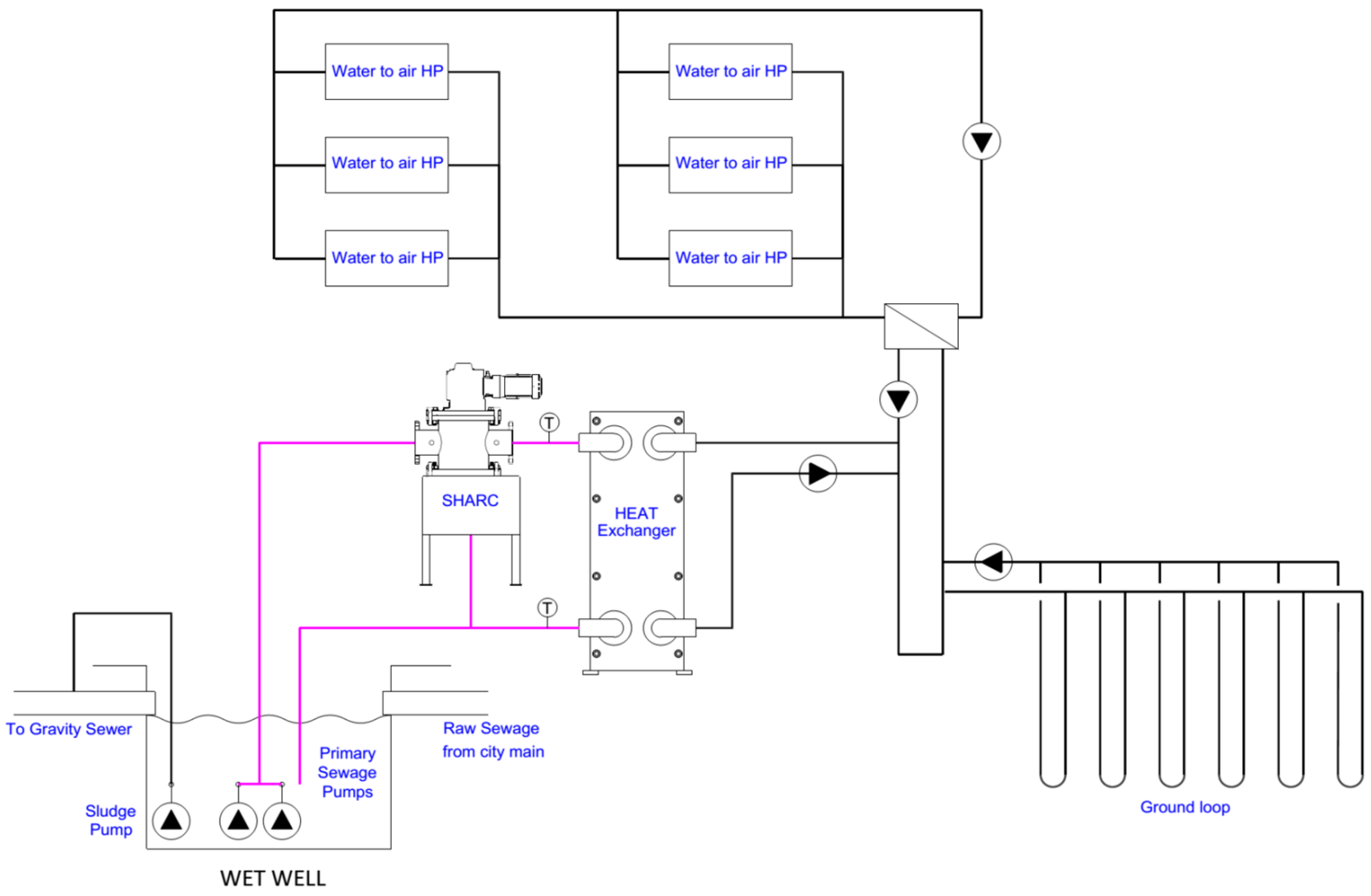
ANGLED DRILLING

Angled drilling can increase the capacity of a system by up to 30% by decreasing the amount of surface space needed

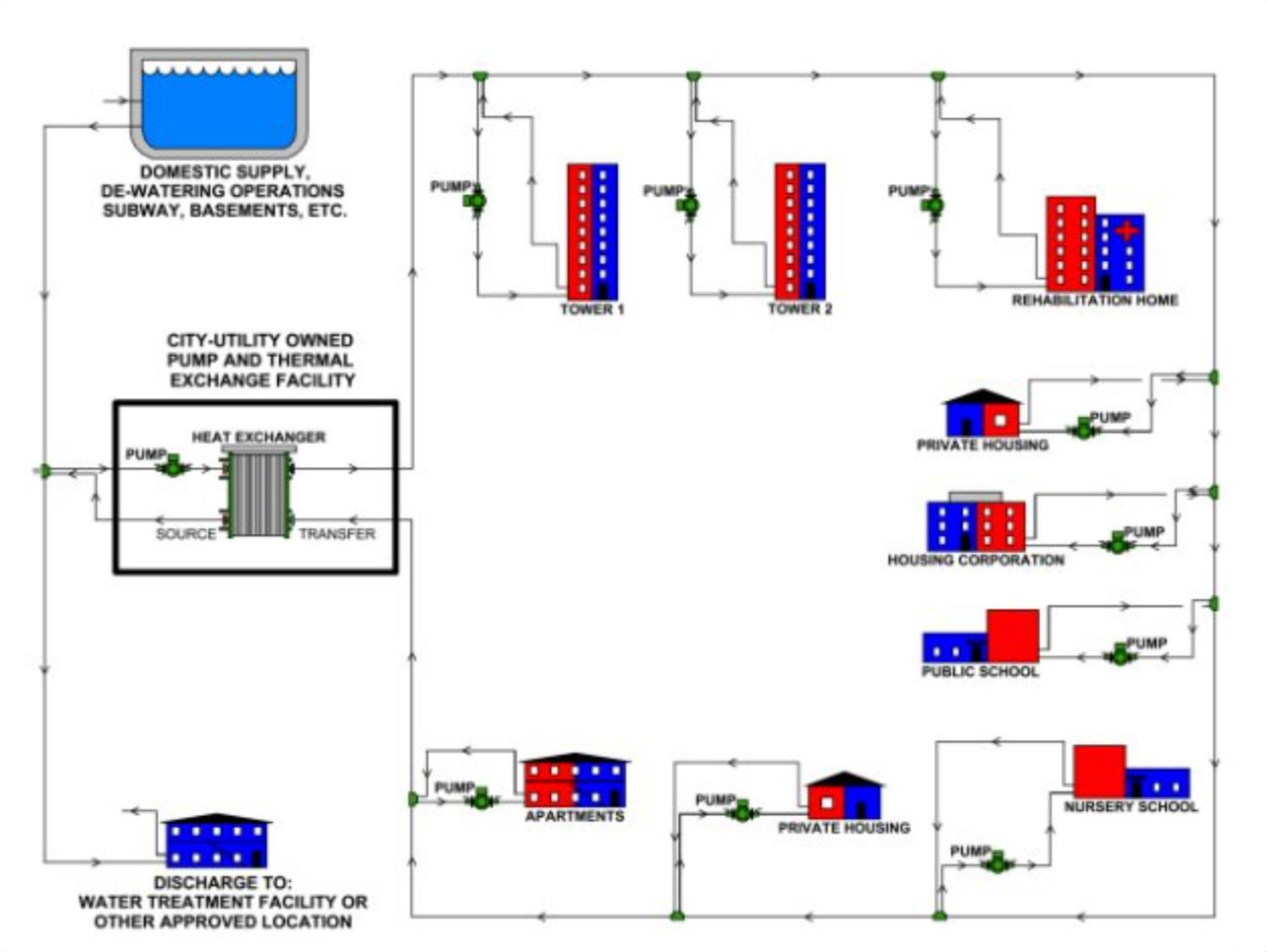
HOW IT WORKS: GEOTHERMAL + WASTEWATER HEAT RECOVERY (OVERVIEW)



HOW IT WORKS: GEOTHERMAL + WASTEWATER HEAT RECOVERY (TECHNICAL)



SOME MORE POSSIBILITIES FOR THE SITE



PROJECT IMPACT ON TOWERS: TOWERS 1 & 2 CARBON EMISSION REDUCED BY 70%

			Annual Energy Savings			Annual Savings		
#	Description	Projected Timeline	Electric(kWh/yr)	Natural Gas(MMBTU/yr)	Oil #2 (MMBTU/yr)	Cost	Ton CO2e Savings	CO2e Penalty Savings ($)
1	Retrofit Heating & Cooling Distribution System	2024 - 2026	228,000	2,638	0	$18,906,080	206	$55,205
2	Install Wastewater Energy Transfer System	2024 - 2026	-501,794	5,276	217	$1,000,000	151	$40,552
3	Upgrade Ventilation System	2024 - 2026	4,328	1,629	0	$147,825	88	$23,522
4	Upgrade Lighting	2024 - 2025	109,633	0	0	$27,500	32	$8,490
5	Upgrade Envelope	2026 - 2028	0	3,624	0	$5,417,000	192	$51,582
6	Install Ground Source Heat Pump System	2026 - 2028	-2,108,899	25,160	868	$2,700,000	791	$212,060
7	Install Control System & VFDs	2026 - 2028	91,200	0	0	$332,000	26	$7,063
8	Install Submetering	2026 - 2028	153,664	0	0	$315,000	44	$11,900
9	Install Solar PV System	2028 - 2030	130,933	0	0	$347,700	38	$10,140
10	Electrify Laundry	2030 - 2032	-194,050	1,104	0	$460,000	3	$686
11	Electrify Stoves	2032 - 2034	-37,046	379	0	$3,728,800	9	$2,526
	Total		-2,124,032	39,810	1,085	$33,381,905	1,581	

HOW TO KNOW IF A BUILDING QUALIFIES FOR A WET SYSTEM

WASTEWATER ACCESS

- Where is the primary sanitary invert located?
- Can a wastewater holding tank be installed to capture enough sanitary flow?
- Do no harm to the natural gravity outflow of the building

SPACE

- Is there room for the PIRANHA / SHARC, tanks & auxiliary components?
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WET MARKET APPLICATIONS

RESIDENTIAL	COMMERCIAL	INDUSTRIAL
Student Housing Senior Living Community Housing Corrections Multi-Family Housing (PIRANHA [35–350 Units]) (SHARC [350+ Units])	Hospitals Micro-Breweries Hospitality Commercial Laundry & Car Wash	Commercial Food Production Pulp and Paper Textiles District Energy

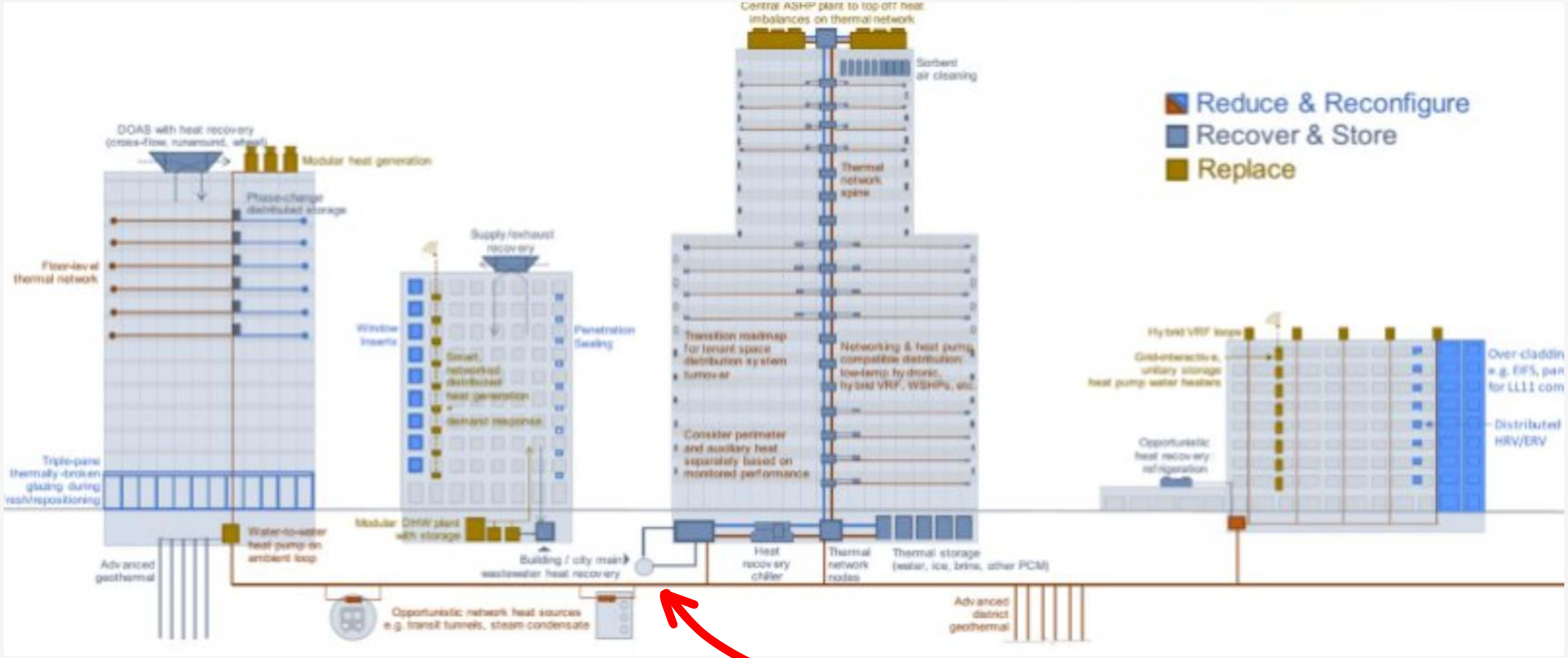
PIRANHA SERIES

- Wastewater-source heat pump
- Active energy recovery
- No filtering needed
- Small footprint
- No odor

SHARC SERIES

- High capacity
- High-volume filtration
- Uses custom heat exchanger
- Small footprint
- No odor

POTENTIAL THERMAL ENERGY NETWORK ADDITIONS



WASTEWATER COMPONENT

LET'S DISCUSS

MICHAEL SCORRANO, PE

FOUNDER AND MANAGING DIRECTOR OF EN-POWER GROUP

AARON MILLER, CEM, CEP

EASTERN REGIONAL MANAGER AT SHARC ENERGY

JUSTIN P. MARINIAK, PE

MECHANICAL ENGINEER AT EGG GEO