CHAPTER/REGIONAL TECHNOLOGY AWARD - SHORT FORM

1. Category - Check one and indicate New, Existing, or Existing Building Commissioning (EBCx)

☒ Commercial Buildings	☐ New	☒ Existing or	☐ EBCx
Institutional Buildings:			
☐ Educational Facilities	☐ New	☐ Existing or	☐ EBCx
☐ Other Institutional	☐ New	☐ Existing or	☐ EBCx
☐ Health Care Facilities	☐ New	☐ Existing or	☐ EBCx
☐ Industrial Facilities or Processes	☐ New	☐ Existing or	☐ EBCx
☐ Public Assembly	☐ New	☐ Existing or	☐ EBCx
☐ Residential (Single and Multi-Family)			

2. Name of building or project: Eris Brewery and Cider House

City/State: Chicago, IL

3. Project Description: Geothermal heat pump with fermentation heat recovery system

Project Study/Design Period: 01/2015 (Begin date (mm/yyyy)) to 11/2016 (End date (mm/yyyy))

Percent Occupancy at time of submission: 100% of phase 1

4. Entrant (ASHRAE member with significant role in project):

a. Name: Olden, Robert, Jeremy
(Last, First, Middle)

Membership Number: 8238889

Chapter: Illinois

Region: VI

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e. Member's Role in Project: Lead Designer

f. Member's Signature: 

5. Engineer of Record: Daniel A. Couillard

By affixing my signature above, I certify that the information contained in this application is accurate to the best of my knowledge. In addition, I certify that I have discussed this entry with the owner and have received permission from the owner to submit this project to the ASHRAE Technology Awards Competition.

ERIS BREWERY AND CIDERHOUSE Submitted by: Rob Olden, Element Energy Consulting

EXECUTIVE SUMMARY: The craft brewing industrial is rife with opportunities for heat recovery innovations and smart investments in energy savings. The owners of Eris Brewery and Cider House seized on these opportunities in constructing the first of its kind: a geothermal based heat recovery system that recovers heat from the fermentation process to preheat domestic and process hot water. With a projected system payback of 4.1 years and 49% energy savings[1], the typical **cost effectiveness** hurdles of combined geothermal heat recovery systems were lowered with two key **innovations**:

1. The geothermal well-field was designed as a "hybrid system" utilizing just 8 geothermal wells for the 40 ton load. Conventional RTU's operate as back up sources for heating and cooling while "base loading" the geothermal system with four (4) 5-ton "split" heat pumps. The RTU's provide second and third stage conditioning.
2. A non-proprietary temperature control system was designed around the typical brewers advanced knowledge of thermodynamics and hydronics. Unlike most control systems, this was designed around the assumption of nearly daily interaction by the brewing teams who understand the concepts of waste heat recovery.

BUILDING FACTS: The Eris Brewery and Cider House makes its home in the historic 108-year-old Myrtle Masonic Temple located 4240 West Irving Park in Chicago. The renovations, design by WRAP Architects, sought to restore many of the original features of the building, the most noticeable of which is the cladding of stair cases and railings with the original steam radiator sections, an homage to the original heating system.

The total building area is 24,869 SF of which 15,937 SF are built out in this initial phase with planned expansion into event spaces and additional kitchen and dining on the 2nd and 3rd floors. The brewing and cider production areas largely reside in the basement level and make up 1,515 SF of the space. The first floor and mezzanine levels are comprised of a full-service kitchen and dining area to serve up to 209 patrons, with a retail space at the main entry. On the second floor there is a grain room and additional kitchen storage. The brewhouse and fermenting tanks are visible from the dining room through display windows.

SYSTEM DESCRIPTION: Far less visible to the casual observer, but no less important, are the heart and brain of the building's energy use. Underneath the patio adjacent to the building are eight (8) 450 ft deep geothermal wells and in a small basement mechanical room is the following equipment: the geothermal manifold piping, valving and headers; four (4) 5 ton heat pumps capacity stacked in a single frame; two (2) AO Smith high efficiency 100 gallon water heaters; a dual stage 14 horsepower "glycol" chiller; a 960 MBH steam boiler to serve the brewing process; a 300 gallon buffer tank; five (5) pumps including two (2) B&G ECOcirc pumps, with valving, controls and sensors to move heat around and monitor these systems overtime.

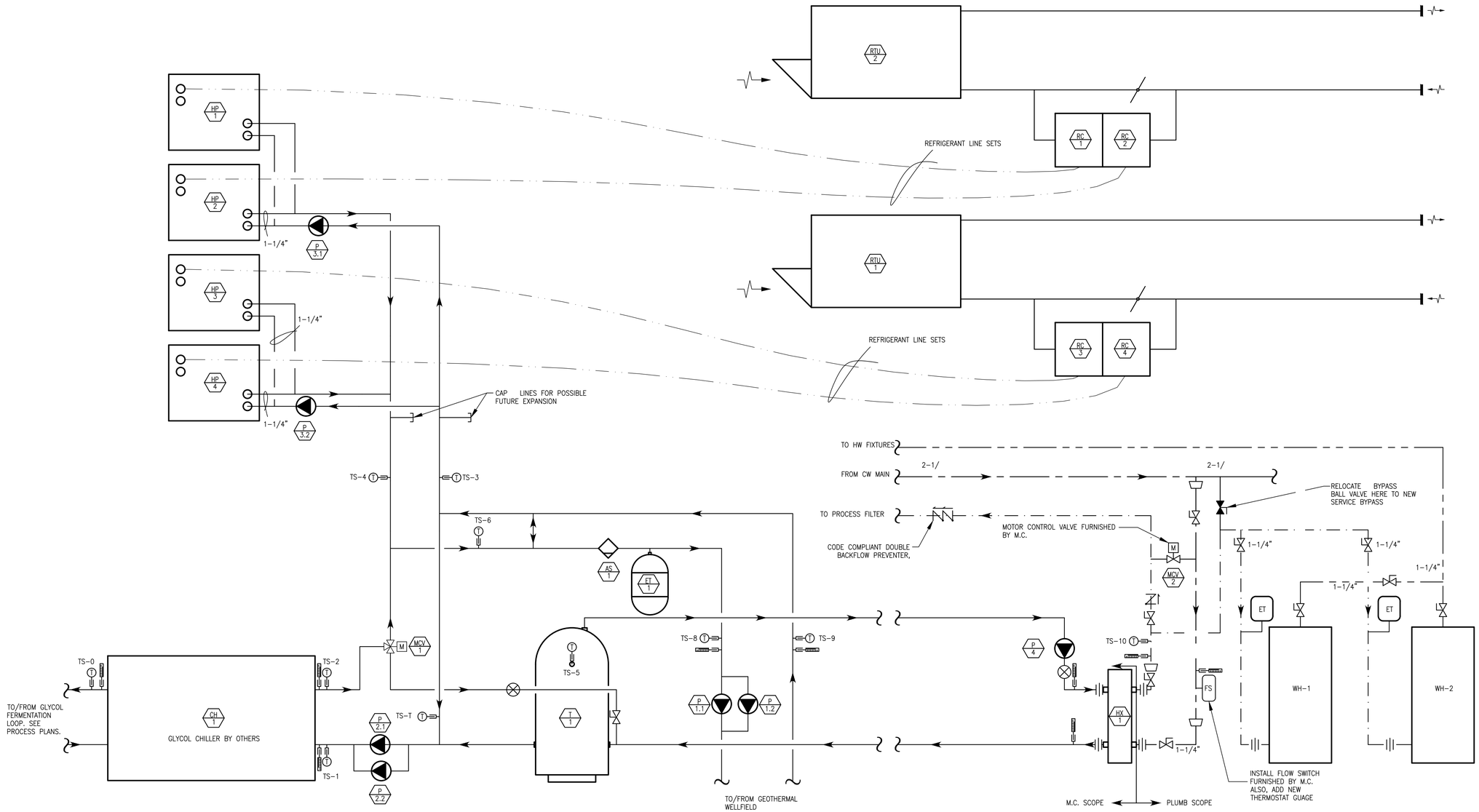
[1] Based on preliminary feasibility study with modest variation from the installed system. Validation of energy saving is underway and will be completed after the first full year operational data can be collected

The beer brewing process is energy intensive, with large amounts of heat being required for the initial mixing and brewing (provided by the steam boiler), as well as simultaneous and constant chilling of each fermentation tank (provided by the "glycol chiller"). Furthermore, the full-service kitchen and bar consume significant amounts of domestic hot water. The heat recovery design and controls are simple with only two (2) 3-way, 2 position control valves that operate with the primary goal of directing waste heat from the glycol chiller into the buffer tank (up to 115F). This free heat is directed to a flat plat heat exchanger that preheats inlet cold water from the city mains. The result is the water heaters and boiler use **significantly less energy** to bump the pre-heated water up to the desired temperatures (200F for the brewing process, and 140F for the kitchen and domestic loads). Furthermore, In the winter time, the glycol chiller benefits from cooler source temperatures transferred from the geothermal heat pumps. Lastly, the geothermal heat pumps themselves are **30% more efficient** in cooling and **400% more efficient** in heating than the RTU's. Based on all these measures, the total building energy use savings is roughly 49% from the baseline, for a net cost savings of ~$10k per year.

One of the immense benefits of designing control systems for breweries is that the operators of the building have a solid understanding of hydronics. This allowed for a more interactive control system. For example, there are times when the head brewer wants only cold filtered water entering the brewhouse. Rather than programming an automated system to bypass the heat recovery system, email alerts notify the brewer of the buffer tank temperature, so they are aware that they need to manually override the controls. This saves on cost and complexity which makes the system straightforward **to operate and maintain** without sacrificing the energy benefits.

The geothermal heat pumps are integrated with the packaged rooftop units in an innovative way. The rooftop units are built on a steel frame off the north exterior wall. This was done to retain the roof for a future occupied deck which is planned for the next stage of the buildout. Because the two RTU's were located close together, the geothermal system could feed dual temperature refrigerant coils in the return air ductwork passed by the mechanical room. This reduced the need for substantial geothermal piping and hydronics in the building as well as additional air side equipment. The rooftop units provide packaged VAV fan controls while also providing modulating fresh air dampers that provide the makeup air to the building. During occupied hours this amounts to 25% make up air which provides more than enough fresh air to maintain a **healthy indoor air quality.**

SUMMARY: Geothermal systems are well known for their **environmental benefits**. The geothermal loops last 50-100 years and use the earth as a much more efficient source of heat and as a sink for cooling. This dramatically reduces the use of fossil fuels. The expiration of geothermal tax credits and the reduced cost of natural gas has decreased the prevalence of these systems, but the owners of Eris Brewery and Cider House understand the importance of saving on energy costs over time. They are excited to share the data related to their system performance and conduct tours of the innovative building.



1 Piping and Instrumentation Diagram with Revised Domestic Piping
NO SCALE

SYMBOL LEGEND

- PUMP
- AIR SEPARATOR
- PIPE UNION
- AIR EXHAUST VALVE, AUTOMATIC
- PROBE GAUGE PORT / TEST PLUG
- PLUG OR CAP
- PIPE CONTINUATION INDICATOR
- FLOW DIRECTION INDICATOR
- CHECK VALVE
- BACK-FLOW PREVENTER
- BUTTERFLY VALVE
- PRESSURE RELIEF VALVE
- BALL OR BUTTERFLY VALVE, NORMALLY OPEN
- BALL OR BUTTERFLY VALVE, NORMALLY CLOSED
- CALIBRATED CIRCUIT SETTER VALVE, WITH PRESSURE PORTS
- TRIPLE-DUTY / MULTI-PURPOSE VALVE
- MANUALLY ADJUSTABLE ORIFICE/NEEDLE VALVE
- MOTORIZED PRESSURE INDEPENDENT FLOW LIMITING VALVE
- FT — ELECTRONIC SENSOR/TRANSMITTER, FLUID FLOW RATE
- FS — ELECTRONIC SWITCH, FLUID FLOW STATUS
- DPT — ELECTRONIC SENSOR/TRANSMITTER, DIFFERENTIAL PRESSURE
- PT — ELECTRONIC SENSOR/TRANSMITTER, GAUGE PRESSURE, WITH ISOLATION VALVE
- T — ELECTRONIC SENSOR/TRANSMITTER, TEMPERATURE, WITH IMMERSION WELL
- WYE STRAINER
- FLEXIBLE CONNECTOR
- PRESSURE GAUGE, WITH ISOLATION VALVE
- TEMPERATURE GAUGE, WITH IMMERSION WELL
- M — 2-WAY CONTROL VALVE, MOTOR ACTUATED
- M — 3-WAY CONTROL VALVE, MOTOR ACTUATED
- S — NORMALLY CLOSED SOLENOID VALVE
- PRESSURE REDUCING VALVE
- PIPE REDUCER

PIPING LEGEND	
LINETYPE	DESCRIPTION
— · — · —	REFRIGERANT LINESET BY MC
—— – ——	COLD WATER BY PC (CW)
—— – – ——	HOT WATER BY PC (HW)
— · — · —	PRE-HEATED WATER BY PC (PHW)
————	HYRONIC PIPING BY MC

MECHANICAL PIPING DIAGRAM

ISSUED FOR ASHRAE TECHNOLOGY AWARD APPLICATION 09/21/18

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