



Messiah College Natural Gas and Combined Cooling, Heat and Power Plant

- For the past decade, Messiah College wanted to bring natural gas to its campus, eliminating the use of propane and associated maintenance challenges.
- Messiah College worked extensively with UGI Enterprise, Inc., to evaluate and develop a Combined Cooling, Heat and Power project.
- The \$7.5 million dollar project consisted of the construction of the natural gas pipeline, and installation of the CCHP system, electrical distribution to connect the Campus Center as well as hot water and chilled water that will connect to the colleges central chilled water infrastructure.

- The project also involved converting all campus building boilers from propane to natural gas along with the excavation, removal and sale of 52 buried propane tanks.
- The CCHP system includes a Capstone C1000 Microturbine Generator System, a 288 ton absorption chiller, an exhaust gas to hot water heat exchanger and other required ancillary equipment
- Together the systems provides 1,000 KW of power and 1.75 MMBTU per hour of hot water and 288 tons of cooling

- Combined Cooling Heat and Power (CCHP) energy solutions offers improved efficiency over grid power and traditional heating and air conditioning systems.
- CCHP also results in meeting climate change and environmental goals by reducing emissions of CO₂ and other pollutants, for Messiah College we expect that we will reduce overall emissions by 25%
- On-site power generation offers many advantages over importing power from utility grid including higher reliability, backup generation, energy independence, improved energy efficiency and cost savings.

- To understand CCHP and become comfortable with the new technology, the Messiah College team visited several local CCHP sites with UGIPS and learned first-hand from system owners more about the experiences and the different CHP technologies.
- The goal was to create a system for the Messiah College that would be functional at all times and provide redundant power when the grid is down, so that the campus can operate as a standalone facility in cases there's a power outage in the area.

Gas Line Installation

Over 4 miles of natural gas lines installed to serve the Messiah College Campus



Mechanical Equipment

Propane to Natural Gas Conversion



Converted various pieces of equipment that included boilers, hot water heaters, roof-top units, emergency generators, Bunsen burners, Engineering equipment, art equipment and kitchen cooking equipment



Excavation of Propane Tanks



Excavation of Propane Tanks



The project utilizes a Capstone C1000 Microturbine generator system (five 200kW turbine units), a Broad 288 ton absorption chiller, and a Cain exhaust gas to hot water heat exchanger, in addition to all required ancillary equipment.



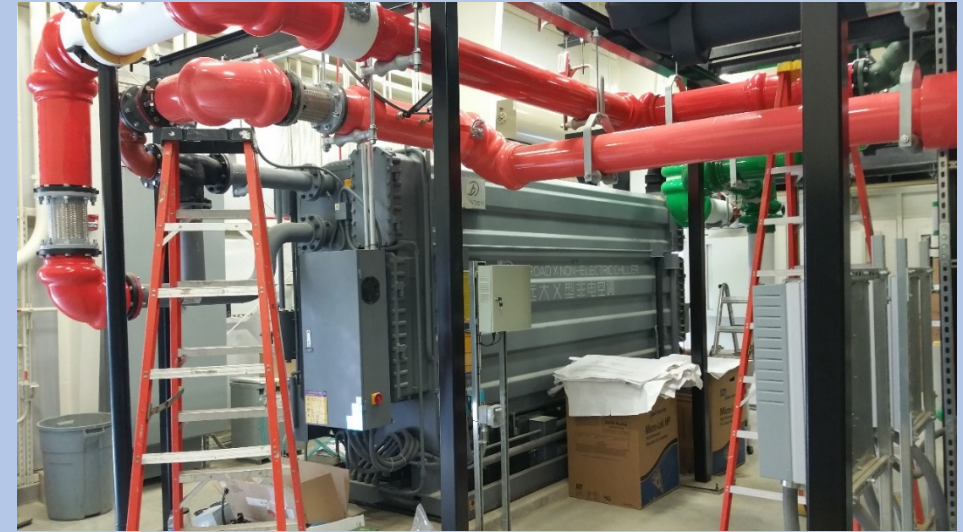
CCHP Building



Associated pumps supply heating/chilled water to seven buildings for cooling and five buildings for heating



Broad Absorption Cooler



Capstone 1000 Turbine Generator



Cain Heat Exchanger

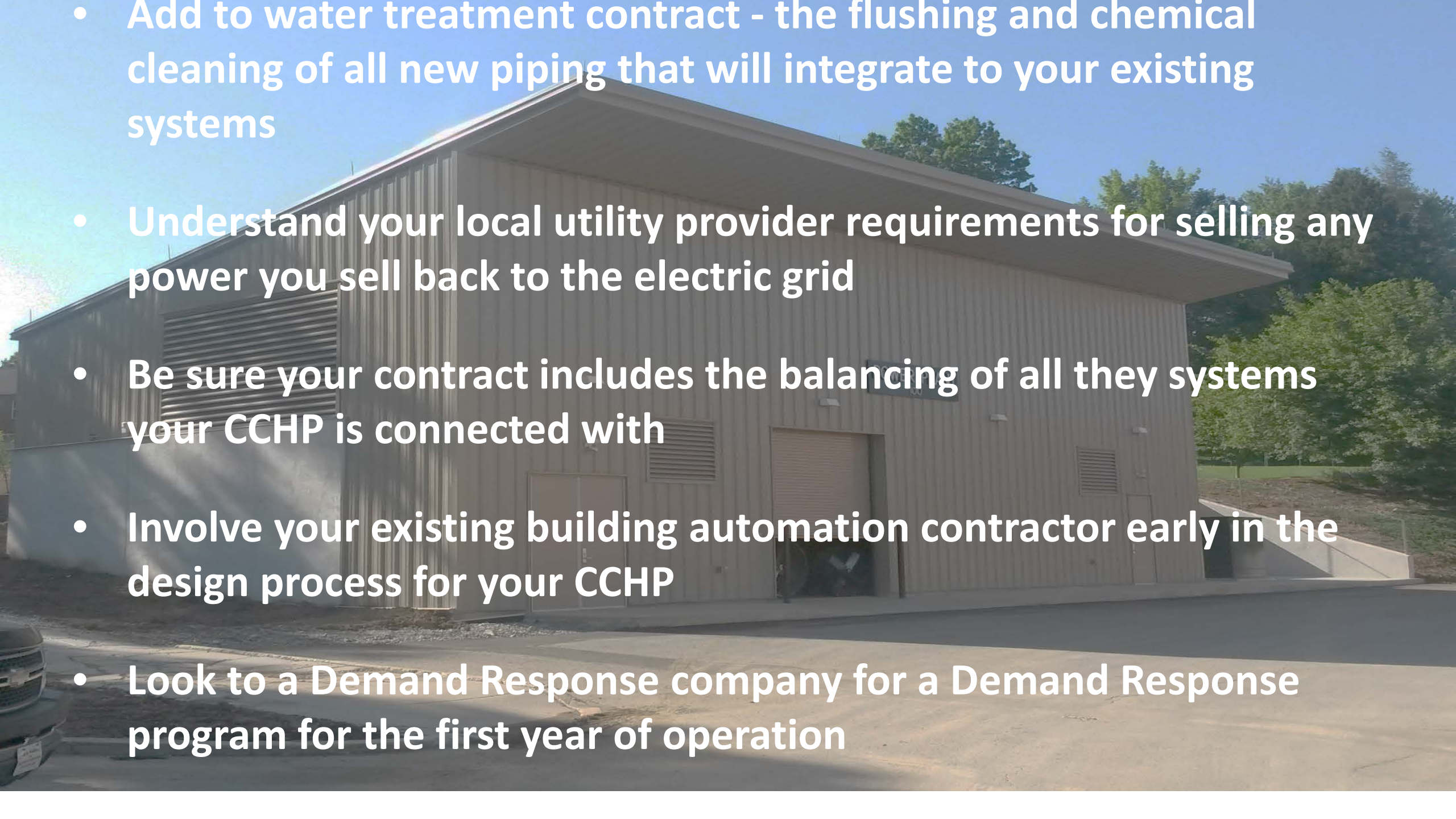


Lessons Learned

- Over-design the building exhaust system so heat from the power generator can be properly rejected from the building
- Research the design build contractor's experience. Do not rely on the design engineer's recommendations
- Add money to your budget for third party outside system commissioning
- Make sure water treatment is started the day the system is started
- Read, understand and question equipment submittals



- Add to water treatment contract- the flushing and chemical cleaning of all new piping that will integrate to your existing systems
- Understand your local utility provider requirements for selling any power you sell back to the electric grid
- Be sure your contract includes the balancing of all the systems your CCHP is connected with
- Involve your existing building automation contractor early in the design process for your CCHP
- Look to a Demand Response company for a Demand Response program for the first year of operation



- Before moving forward with any design build CCHP project, get a third party financial review of the proforma provided to verify actual savings
- Messiah experienced many design issues which had to be corrected after start up
- Expect to spend a considerable amount of time managing start up and performance problems. We have been operational for 17 months and are still having performance issues
- Budget for and hire a third party Commissioning Agent. Involve that agent early in the design and through the construction process

