

Project Description: Energy Center Pittsburgh – Uptown Plant – Pittsburgh, PA

Facing extreme changing weather patterns and aging utility grids, cities, communities, campuses, and healthcare facilities are all seeking more resilient, reliable and efficient energy infrastructure to support economic development in their communities, achieve sustainability objectives and enhance quality of life. New collaborative business models to enhance investments in local energy infrastructure are also gaining increasing focus as cities recognize the need for cleaner, more efficient and cost-effective energy delivery methods.

District Energy is a proven technology with a long history of solving some of the problems facing cities today. District energy plants allow a provider to supply steam, hot water, and/or chilled water to customers located within a specific grid. After operating a plant on the North Side of Pittsburgh for 18 years, Energy Center Pittsburgh LLC (a subsidiary of Clearway Energy, Inc. f/k/a NRG Yield Inc.) knew the timing was right to expand its operations to provide greener and healthier thermal energy services for a client in need. The EPC contractor for Energy Center Pittsburgh was NRG Business Services LLC (“NRG”).

Working with the city, NRG obtained approval to build a “next-generation” district energy plant in the Uptown neighborhood, a 1.5 mile stretch between Oakland and Downtown Pittsburgh. The plant would be a first of its kind in Pittsburgh and was considered precedent setting. The location for this new district energy plant was in an existing parking lot between PPG Paints Arena and Stevenson Street.

With chillers, boilers and backup power system that were at end of service life since it was taken over by UPMC, the hospital was in urgent need of new systems. Effective communication and the timely completion of this project was critical, for the hospital is a Level 1 Trauma and Burn Center, a major neurosurgical center, and a major cardiovascular treatment center. Disrupting operations for any part of the hospital, however temporary, was not an option. This plant would provide chilled water, steam, and backup electricity to UPMC Mercy Hospital, one of the biggest and busiest hospitals in Pittsburgh.

To further substantiate the need for a new plant, Roger Altmeyer, director of community project development for the hospital system, stated in a Trib Live article published in 2016, “Our situation at UPMC Mercy is a dire one relative to central energy needs. Routine emergency repairs are sort of the norm. We have a lot of temporary equipment on site all the time.”

In November 2016, NRG Energy selected Mascaro as the design-build contractor and CJL Engineering as the MEP engineer of record on the new Uptown District Energy Center project. Mascaro partnered with CJL Engineering, to finalize the design on the roughly 30,000-square-foot building. Along with the construction of the building, new piping and emergency power conduits had to be installed underneath heavily used and utility congested roads and connect to multiple locations on UPMC Mercy’s campus. Roughly 35,000 linear feet of underground



pipng and electrical conduits were installed, starting at the intersection of Our Way and Stevenson Street and continuing up Stevenson Street to UPMC Mercy’s campus.

What started out as a project to solve an immediate need, grew in size when UPMC announced its new expansion plan. When the design for the new plant was about 95% complete, UPMC announced its planned addition of the 300,000-square-foot UPMC Vision and Rehabilitation Hospital to the UPMC Mercy campus. About 8 months in to the design of the hospital, UPMC expanded the Vision Institute another 110,000 square feet. While the plant design had incorporated some future growth on the campus, the size of the plant had to be increased substantially to meet the new program. The chilled water plant capacity was increased by almost 25%, emergency generators were upgraded from Tier 2 to significantly more stringent Tier 4 emissions performance capabilities, and the 5MVA transformers were replaced with two (2) 10 MVA transformers. Piping distribution in the street was significantly increased in size to accommodate projected full campus future build-outs, changing out the one 5 MVA transformer, upsizing the vaults and electrical to accommodate two 10 MVA transformers, and adding Tier 4 emissions performance to the generators. In addition to added capacities, the Tier 4 emissions capabilities of the generators enables Energy Center Pittsburgh to operate the plant in a demand response mode, to reduce peak electrical demand for the plant and hospital during peak utility demand periods.

The footprint of the building couldn’t change due to URA site requirements, and the team was challenged with fitting the upsized plant equipment within the same building footprint. As Alan Traugott of CJL Engineering commented, “It was like solving a Rubik’s cube.”

The team scrambled to order new equipment and adjust to added changes. Without missing a beat, streets were dug up, piping was laid, and the project was completed on time, without impacting critical hospital operations.

The coordination and effort shown by the entire team exemplify the Engineering Society of Western Pennsylvania commercial and sustainable category awards.

Note: On August 31, 2018 NRG Yield Inc. changed its name to Clearway Energy Inc.

Project Team:

Owner:	Clearway Energy Inc. (formerly NRG Yield, Inc.)
Construction Manager:	Mascaro Construction
MEP Engineer:	CJL Engineering
Architect:	Avon Graf Architects, LLC
Structural Engineer:	Atlantic Engineering Services

Technical:

For this unique project, CJL Engineering designed the plant, incorporating:

- Three (3) 50,000 lb/hr Steam Boilers
- Three (3) 2,750 -ton dual compressor chillers
- Three (3) 2,250 -ton stainless steel plate and frame heat exchangers
- Three (4) 2.5 mega-watt Emergency Generators
- Three (3) 2,750 -ton Roof-mounted custom-built fiberglass cooling towers designed for high efficiency performance and quiet operation

Innovative Technical Features:

Constructing an energy plant in an urban environment places unique restrictions on a project. There were strict requirements for emissions and noise. The aesthetics of the facility needed to blend in with its surroundings and pass approval of the URA, the city, and the community.

- **Site Design.** To maximize the logistics of the sloping site, the utility vaults and office/conference and locker rooms were placed on the lower level, allowing most of the equipment to reside on the main second floor. Chilled water pumps, piping distribution, and utility entries are also located on the lower level. The building has dual services for primary utilities for reliability and redundancy.
- **Building Design.** The architecture of the building reflects a neo-industrial, techy design. Masonry provided a sturdy base to relate it to the neighboring buildings, while color changing iridescent metal panels (gray to green) bring an interesting, colorful look to the building. Similarly, the building that houses the chilled water heat exchangers, the connection point to UPMC Mercy, utilized brick and architectural detailing to complement the hospital's exterior.
- **Acoustic Design.** The inside of the building is "built like a battleship" with heavy mass walls and sound attenuators to absorb the high decibel sound levels during generator operations. The cooling towers incorporate special features to ensure there were no acoustical transmission issues to adjoining properties.
- **Air Emissions.** Each generator had to meet stringent Tier 4 air emissions requirements so that they could be used to curtail plant energy use during peak utility demand periods, such as hot, humid days when air conditioning usage is at its' highest. This capability reduces stress on the utility grid and provides savings for UPMC. The boilers incorporate ultra-low-NOx burners to meet the City and County's stringent air emissions requirements. The energy plant has a customized field-fabricated cooling tower, one of only two in the city (the other is at Duquesne University). The tower reduces drift by

50% in comparison to typical cooling towers, which results in significantly lower emissions, energy and water use. Clearway follows very strict water treatment protocols for health and safety. The tower is also three times quieter than a regular commercial tower. District Energy plants reduce overall Greenhouse Gas (GHG) Emissions to the environment, in comparison to multiple standalone plants.

- **Sustainability.** The building itself is sustainable, built with steel and concrete, and environmentally responsible finishes, with a very compact footprint. There is no wasted space. The chillers are dual compressor machines, which provide redundancy and reliability for the hospital, while also providing very high efficiency part- and low-load performance capabilities for energy efficient operations. The boilers have very efficient burners, with excellent turndown ratios for low load conditions. They also include economizers, utilizing exhaust heat to preheat makeup water. Chillers, cooling towers, and pumps incorporate Variable Frequency Drives (VFD's) to enable very efficient part load energy performance. The plant has state-of-the-art controls and monitoring for plant equipment and utilities that continually optimizes operations for efficient performance. The Tier 4 emergency generators will enable the plant to operate in a Demand Response mode, providing power for plant operations during peak utility demand periods. This reduces stress on the utility grid during periods of highest demand, which also reduces the utility's need to depend on inefficient and polluting "peaker" plants.
- **Piping.** All the underground chilled water piping is made of High-Density Polyethylene (HDPE), which has significant advantages over steel piping. Based on NRG's evaluation, advantages include: piping is "slipperier" than steel, resulting in less friction and pumping energy losses. It has a very long lifespan of almost 100 years; it doesn't corrode; once installed, it doesn't leak; and at 3-inches thick, it acts as its own insulator. It is the first time it has been used on this scale in Pittsburgh.

Awards, Patents, Licenses: (N/A)

Commercial:

This project provided the means to sell steam, chilled water and emergency backup electricity to UPMC Mercy. The remote plant freed up real estate, which enabled UPMC to build the new Vision and Rehabilitation Hospital on the UPMC Mercy campus.

Original Schedule versus Actual Schedule:



The challenges faced by the team covered many facets: Difficult terrain, restricted workspaces, unforeseen conditions, and a very fast-track schedule. Despite these challenges, the project was finished on time without impacting critical Hospital operations.

Original Budget versus Actual Budget:

(No Comment. Budget data is proprietary. Refer to NRG Business Services for additional info)

Unique Contractual Conditions:

(No Comment. Refer to NRG Business Services for additional info.)

Performance Warranties and Tests:

This project has met all warranties for Chilled Water and Steam Production.

Benefit to Society:

District Energy Systems are efficient ways to deliver energy to a variety of customers, while maximizing the efficiencies of equipment and operations through economies of scale. They result in substantially lower GHG emissions and pollutants, power, fuel and water usage, as well as ancillary environmental impacts, such as reduced transportation, longer service lives and reduced replacement cycles. With the completion of this project, UPMC Mercy no longer carries the direct cost of operating its own steam, chiller, emergency power plant and can direct investments to Patient Care and other Hospital Services. Energy Center Pittsburgh established the Uptown plant to serve UPMC Mercy as anchor customer in expanded regulated utility service territory including the Uptown corridor. As additional customers are added, the economies of scale and other operating efficiencies are increased.

Impact on Employment:

Despite having an in-house Hospital Service now outsourced, there was zero negative impact for employees at UPMC Mercy, who were repurposed to other engineering and maintenance requirements in the hospital. They now spend more time on Preventive Maintenance and efficient operations. While there was no measurable increase in employment at Mascaro and CJL Engineering for this project, management of personnel and other projects were given every consideration to ensure all milestones were met. The District Energy plant itself represents new employment within the city.

Impact on Safety, Health, and Environment for Workers and for the Outside General Public:



The Energy Center Pittsburgh-Uptown meets or exceeds all compliance on strict air pollution standards. The new boilers are ultra-low NOx, which improves local air quality conditions. Cooling towers are significantly lower emissions, and generators are Tier 4, which also reduces emissions.

Public Relations Activities Associated with the Project:

Ground Breaking ceremony March 7, 2017

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