

THESE MINUTES ARE SUBJECT TO APPROVAL BY THE SUSTAINABLE ENERGY COMMISSION

The Sustainable Energy Commission held a regular meeting Thursday, July 19, 2018 in shared meeting room 3 of the Municipal Center located at 3 Primrose Street, Newtown, CT 6470.

The meeting was called to order by Chairman Kathy Quinn at 7:02pm.

Present: Chairman Kathy Quinn, Allen Adriani, Graham Clifford (7:21 p.m.), Jeff Jorgenson, Mark Sievel, Tom Snyad, Dave Stout, Vanessa Villamil

Also Present: Fred Hurley, Chuck Litty

Absent: George Brown

Communications: none.

Public Comment: none.

Acceptance of Minutes: Mr. Sievel moved to accept the minutes of the regular meeting of 6/21/18.
Ms. Villamil seconded. All in favor.

Business: Discussion and possible action

- a. **New Project – Sandy Hook School Solar/firehouses:** the work will begin soon; no change in pricing because everything was purchased before the tariffs went into effect.
- b. **Nunnawauk Meadows – solar:** no update.
- c. **ZREC for Community Center:** Mr. Hurley is almost ready to determine the size of the system for the Community Center. ZREC applications are due in September. Mr. Hurley needs elevations and roof mechanical information. A small ZREC can go right away.
- d. **Possible ZREC for Stratford Hall:** there will be a new asphalt shingled roof. Mr. Hurley thinks the panels taken from Reed can possibly be used on Stratford Hall.
- e. **Energy Savings program:**
 - Riverside Road Senior Center** – work has begun.
 - Library** – Tom D’Agostino and Kyle from Energy Resources met to start looking at the building.
 - Edmond Town Hall** – Ms. Quinn will follow up with Herb Rosenthal of the Board of Managers.
 - New Construction projects – Community Center** – see (c)
 - Police Department** – (att.) there may be opportunity for roof top solar at the new building. Mr. Adriani and Mr. Brown went on a tour of 191 South Main Street. Mr. Adriani said there is a back-up generator and fiber optic cable going into the building. Mr. Hurley thinks it may be functional, but is not sure. Mr. Jorgensen attended the Board of Selectmen meeting; the purpose was to discuss budget numbers and vote on a site for the new PD. Mr. Hurley said that there may be plans to move Social Services to Riverside Road when the Senior Center is relocated; the P&R offices will relocate to the community center and dispatch will move with the PD, leaving Town Hall South vacant. Mr. Litty did an energy evaluation of the building. Ms. Quinn spoke about incorporating space with the Pleasance and the wetlands in the back and making it a centralized sustainability center. The space can be used for regional presentations on zero energy and recycling programs.
 - General plan for schools** – no update.
- f. **Dashboard for website (API keys):** Mr. Hurley will get Florida Light & Power contact for Mr. Clifford. The electric bills are now showing a cash credit.

Rec'd. for Record 7.20.2018
Town Clerk of Newtown 3:10pm
Debbie Annalisa Halstead

- g. **Sustainable CT** – The next meeting is July 24 at 6:30 p.m. Ms. Quinn said they are going for the bronze level. Ms. Quinn talked about the official charter of the Sustainable Energy Commission and the Guidelines for Sustainable CT Team Guidance. Combining the Sustainable Energy Commission with the Sustainable CT functions need to be looked at.
- h. **Develop plan to reduce electric demand charge on town buildings:** Ms. Quinn said of the electric bills she accessed Sandy Hook School was the highest, in comparison to Hawley, Head 'o Meadow and Middle Gate. Mr. Stout said he has worked at LEED Gold, LEED Platinum buildings, with great equipment that was never commissioned correctly. The people know how to install the equipment, they do not know how to dial it in. The building needs to be retro commissioned. Mr. Hurley said that the Public Building & Site Commission is responsible to oversee any project. The facility manager handles ongoing oversight. Mr. Hurley said that there will be a ten year Capital Improvement Plan for capital projects. After discussion relative to incorporating energy efficiency into new projects the following motion was made: Mr. Adriani moved to have an ongoing liaison with the Public Building & Site Commission for energy and energy conservation matters. Mr. Stout seconded. All in favor.
- i. **Solomon Solar project/ Windham:** PURA is taking our request for clarification on Senate Bill 8, in terms of freeing up virtual net metering money now specifically for the Newtown, Westport and Norwalk projects. This adds up to 5 megawatts. Written comments are due in July 26.
- j. **Batchelder site potential for solar/community solar project:** Mr. Stout said that commercial contracts should be allowed with community solar; a problem with community solar is managing thousands of residential solar accounts.
- k. **Fuel Cell project and/or CHP (combined heat and power) discussion:** an RFP has been issued for a combined heat and power purchase agreement proposal. There is a mandatory site visit on August 1; proposals are to be back in August 21. Sustainable Energy Commission will make a recommendation at the Sept. 20 meeting. There is an opportunity to island the high school.

Additional Items for discussion:

- 1. **Municipal Energy Plan:** no update
- 2. **Energy Star Portfolio Manager:** no update.
- 3. **Website – Update Landfill photo, link to Sustainable CT:** The website needs to be updated. Mr. Jorgenson talked with Mr. Hurley about using a drone to photograph the landfill project.
- 4. **Organic Recycling:** Mr. Hurley is looking into re-vamping the transfer station, including the recycling area as well as the organic recycling. Mr. Hurley stated tonnage information relative to how many households participate in the organic recycling is accessible.
- 5. **Fracking Waste:** no updated.
- 6. **Plastic Bag Reduction resolution:** no update.

Adjournment: Having no further business the regular meeting of the Sustainable Energy Commission at 8:12 p.m.

The next meeting will be held September 20, 2018

Att: Net Zero article

Susan Marcinek, clerk



NET ZERO AND MISSION CRITICAL

BY TRACY STEWARD, MEMBER ASHRAE, AND JAMIE ACCURSO

Built as a sustainable, energy-efficient, and environment-friendly facility meeting LEED Platinum requirements, the new Cincinnati District 3 Police Station (CD3PS) is designed to generate as much energy as it consumes. Unlike many net zero energy buildings, the CD3PS is a 365/24/7 facility.

The 39,000 ft², \$16 million building is the first new police station the city has built in more than 40 years. The City of Cincinnati has long supported energy efficiency and sustainability in its public projects. LEED Silver was the original goal of the project.

The CD3PS was a design-build project. Net zero energy was not part of the original request for proposals' criteria. The winning team included net zero energy as a betterment option demonstrating in their proposal that net zero energy could be delivered within the owner's construction budget.

Obtaining drastic energy reduction was the key to achieving net zero energy status. The CD3PS achieved an almost 50% reduction in energy based on ASHRAE/IES Standard 90.1-2007 guidelines. The renewable energy is provided by a 329 kW solar photovoltaic array.

Beyond its sustainable design and technological upgrades, the station also features community gathering space and art. City planners worked with community members to determine the site for the station and a 25-member community advisory team worked with architects and the construction team to define the building's public spaces and make decisions regarding artwork.

Based on input from residents, the station's exterior plaza has 14 columns representing the district's neighborhoods, and the building has a rain garden with a community feature. An artistic map displaying the

district's neighborhoods adorns a wall in the lobby of the station, and the map includes images of iconic buildings, parks, or public spaces from each neighborhood. The glass walls of the station's community room are also decorated with notable buildings from each neighborhood, laser-etched into the glass.

Energy Efficiency

The design-build team used a collaborative design process to significantly reduce building energy consumption so that an affordable solar PV system could be constructed to achieve net zero energy (NZE) operation.

The building energy model exceeded the Standard 90.1-2007 minimum standards for energy efficiency by 49%. (DOE's EQuest was used as the modeling software.) The 2003 CBECS data indicated that the average EUI of police/fire stations was 79.4 kBtu/ft²·yr. This baseline data helped the NZE charrette attendees set the consumption goal at 35 kBtu/ft²·yr.

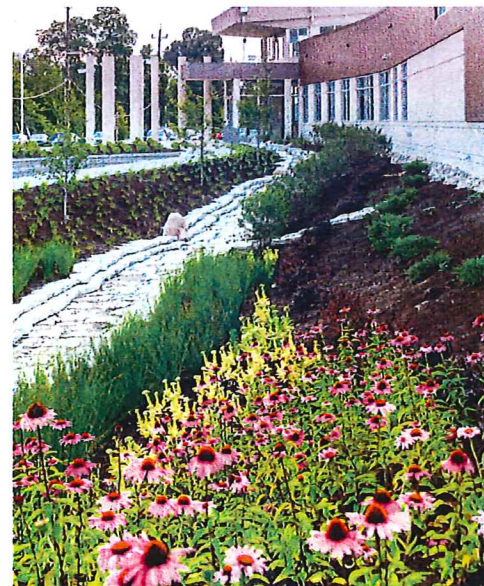
As the design evolved, and energy reduction strategies were vetted, the final LEED energy model predicted use at 32 kBtu/ft²·yr. After 12 months of operation, the actual energy performance is 26.7 kBtu/ft²·yr (June 2015–May 2016). The building has a power monitoring system that measures the energy consumption for each major energy-consuming

system. *Table 1* (Page 31) benchmarks the actual energy intensity of the building along with the CBECS data, charrette goal and the LEED baseline model.

A geothermal HVAC system was installed that included forty, 400 ft vertical pipe bores, which allows the earth to be used as thermal storage. The majority of the heat pump units had two-speed compressors to increase part-load performance. A decentralized pumping strategy was incorporated into the design. Each heat pump unit had a respective

water recirculating pump that only operates when the heat pump operates. The piping system was designed to minimize pressure drop through the indoor and outdoor piping system. The pumps were selected for only 37 ft total dynamic head.

A single dedicated outdoor air unit is located in the second floor mechanical room and includes a heat recovery wheel and two-pipe coil for final tempering of the air. Water-to-water heat pump units provide a source of summer chilled water and winter hot water, which is piped to



TOP LEFT To conserve energy, radiant floors were used in the garage area for heating.

TOP RIGHT The CD3PS site was designed incorporating bioswales and biofiltration/retention basins to mitigate combined sewer overflow and cleanse storm water runoff. These design features also bring the entire site to net zero storm water.

BOTTOM "Let's be careful out there." Each shift of patrol officers uses the Roll Call room for briefing prior to heading out on patrol.

BUILDING AT A GLANCE

| | |
|----------------------------------|--|
| Name | Cincinnati District 3 Police Station |
| Location | Cincinnati |
| Miles from nearest major city | 0 |
| Owner | City of Cincinnati |
| Principal Use | Police Station Includes Offices, garage, community rooms, workout area, locker room |
| Employees/Occupants | 161 |
| Expected (Design) Occupancy | 227 |
| Percent Occupied | 71% |
| Gross Square Footage | 38,500 |
| Conditioned Space | Heat only ~ 3,500 |
| Distinctions/Awards | 2017 ASHRAE Technology Award |
| Total Cost | \$14,349,000 |
| Cost per Square Foot | \$372.70 |
| Substantial Completion/Occupancy | June 2015 |

ENERGY AT A GLANCE

| | |
|--|-----------------------------|
| Annual Energy Use Intensity (EUI) (Site) | 26.60 kBtu/ft ² |
| Electricity (Grid Purchase) | -7.40 kBtu/ft ² |
| Electricity (On-Site Solar or Wind Installation) | 34 kBtu/ft ² |
| Annual On-Site Renewable Energy Exported | 7.4 kBtu/ft ² |
| Annual Net Energy Use Intensity | -14.8 kBtu/ft ² |
| Annual Source (Primary) Energy | -46.62 kBtu/ft ² |
| Savings vs. Standard 90.1-2007 Design Building | 57.44% |
| Heating Degree Days (Base 65°F) | 4,744 |
| Cooling Degree Days (Base 65°F) | 1,155 |
| Annual Hours Occupied | 8,760 |

KEY SUSTAINABLE FEATURES

Water Conservation The landscaping is native and adaptive species with no piped irrigation. The reduction of water use in flush (toilets, urinals) fixtures is 23% and flow (sinks, showers) fixtures is 44.75% for a combined consumption of 30.36% below the baseline water use.

Recycled Materials The project's recycled content value is a quarter of all total materials cost—over \$670,000 worth.

Daylighting Daylighting control strategies were considered but not implemented due to a lighting power density of 0.54.

Individual Controls Individual controls for HVAC and lighting were not implemented due to cost considerations.

Carbon Reduction Strategies Low EUI with onsite photovoltaic systems were used to reduce carbon footprint.

Transportation Mitigation Strategies This site has good access to Metro bus routes which is important for such a civic-minded institution. The building also contributes to the planned bicycle route along Ferguson Avenue. The bike racks allow for the station to be a destination. The Cincinnati area has a high ratio of LEED-certified buildings per capita. As such, many of its citizens recognize and appreciate the convenient parking for low-emitting vehicles.

Other Major Sustainable Features The first LEED Platinum (pending) and net zero energy police station in the U.S., employing 329 kW of solar and 40 geowells. This 24/7/365 operating building consumes 26.7 kBtu/ft²-yr. The blower door test registered at 0.09 cfm/ft² at 50 Pa. The construction team and its subcontractors were able to divert 80.34% of the construction waste from the landfill. The LEED consultant specified low-emitting sealants, adhesives, paints, coatings, flooring systems and composite wood. A combination of LED and fluorescent lighting was used throughout. This site sits atop the Lick Run Watershed, which includes one of the worst combined sewer overflows in the country. As such, the design team ensured that the quantity and quality would be better than mandated by code.

BUILDING ENVELOPE

Roof

Type TPO 6 in. polyiso
Overall R-value R-30
Reflectivity 30%

Walls

Type Precast Concrete
Overall R-value R-26
Glazing Percentage 23%

Windows

Effective U-factor for Assembly 0.29
Solar Heat Gain Coefficient (SHGC) 0.44
Visual Transmittance 70%

Location

Latitude 39.1
Orientation 84.7

BUILDING TEAM

Building Owner/Representative
City of Cincinnati: Jamie Accurso

Architect Emersion Design: Dan Behnfeldt

General Contractor
Messer Construction: Jonathan Boeckling

Mechanical Engineer
CMTA Engineers: Ken Seibert

Electrical Engineer
CMTA Engineers: John Hamilton

Energy Modeler
CMTA Engineers: Dennis Finn

Structural Engineer
Emersion Design: Mark Simon Sapsford

Civil Engineer
Genesis Design LLC: Steve Stewart

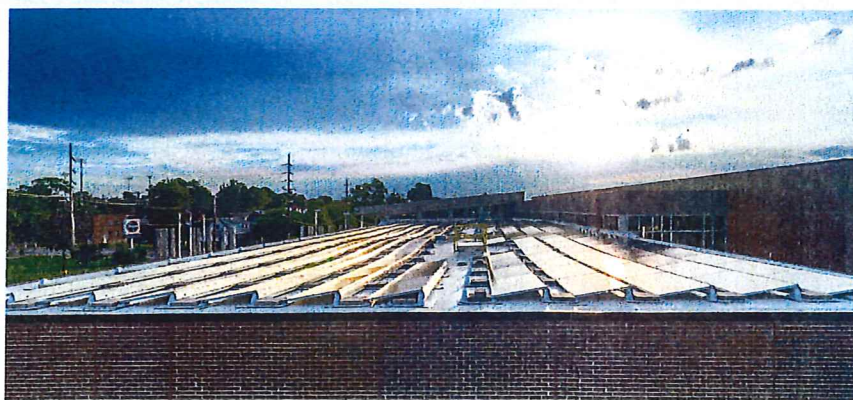
Environmental Consultant None

Landscape Architect
Human Nature: David Whitaker

Lighting Design
CMTA Engineers: John Hamilton

LEED Consultant
Emersion Design: Megan Griffith

Commissioning Agent
ZH Commissioning: Ian Holten



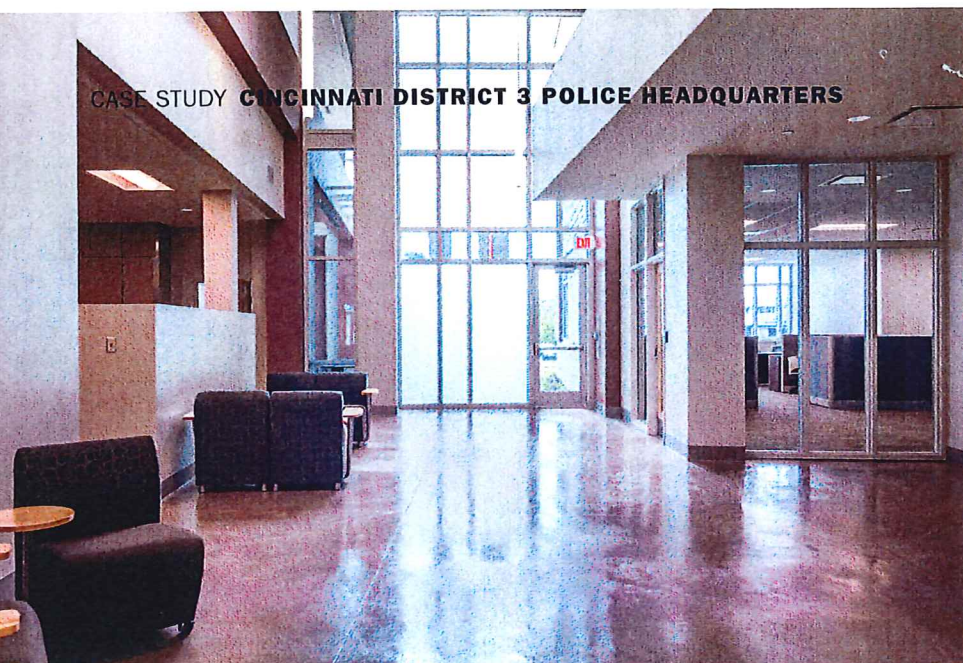
LEFT A total of 1,078 crystalline photovoltaic panels covers the facility's roof and parking canopies.

the dedicated outdoor air system unit water coil and the garage underslab heating system. Domestic hot water heat generation is via a water-to-water heat pump unit to increase system efficiency and remove heat from the thermal storage.

The lighting is LED in occupied spaces with fluorescent lighting in service and mechanical spaces. The project is lit to 0.54 W/ft². Occupancy sensors were used in areas that were not required to be welcoming to the public 24/7. Exterior lighting is LED with occupancy sensors used for foot-candle reductions.

An EQuest energy model was developed during schematic and design development to target energy conservation measures that had a lower life-cycle cost for construction than energy production. The net zero design charrette identified several envelope efficiency design enhancements.

- The team focused on a great thermal envelope. The wall R-value was 26 and roof was R-30.
- Minimizing air infiltration was a priority. The team decided during the charrette to pressure test the building. The target set was a leakage rate of 0.15 cfm/ft² when pressurized to 50 Pa. The results of the pressure test were an actual leakage rate of 0.09 cfm/ft² at 50 Pa. The tight envelope was quickly noticed. The contractor had to spend only one-third of the temporary heating/cooling budget.
- Minimizing solar heat gain was a goal. The building was oriented and selected glazing sizes to maximize natural light and minimize solar heat gain. An example is the large meeting room where public events may be held. When the building was energy modeled, the meeting room's solar heat gain was too high. The team added an overhang and a variety of glasses with different



ABOVE Main hallway of the CD3PS. Finding the bulletproof glass required by the Cincinnati Police Department that was also energy efficient was a challenge for the design team.

RIGHT The building's roof was not large enough to hold the needed number of solar PV panels to achieve net zero energy. Parking canopies were built to support needed panels and protect police vehicles from the elements.



shading coefficients to improve the envelope efficiency.

- Finding a bulletproof glass that met Standard 90.1-2007 prescriptive requirements, maximum U-value of 0.50 and shading coefficient of 0.40 was a challenge. In the end, the team was able to find bulletproof glass with a U-value of 0.29 and shading coefficient of 0.44.

Indoor Air Quality (IAQ) And Thermal Comfort

The project was designed to comply with ASHRAE Standard 62.1-2010 and ASHRAE Standard 55-2004. The ventilation system for the building consists of one outdoor air unit to provide dedicated outdoor air to the building distributed via variable air volume boxes directly to occupied spaces or to the return air ductwork of heat pump units. The outdoor air unit consists of a variable air volume supply fan and exhaust fan, total

energy recovery wheel and supplemental heating/cooling coil with face and bypass control. The system is designed to eliminate any energy wasting reheat strategies through the implementation of face and bypass on the unit as well as two-stage compressor heat pump units. The two-stage units operate a low fan and compressor speed the majority of the time, allowing for better dehumidification and thermal comfort in the building.

Due to the nature of the facility, ventilation within the CD3PS is exhaust dominated. Negative pressurization is designed and controlled by supplying outdoor air throughout the facility and demand response control ventilation. Since the facility is exhaust dominated, the airflow monitoring station was better designed within the exhaust airstream, while outdoor air is modulated from minimum to maximum at the VAVs to control negative pressurization in the



ABOVE Heat pump units serving the armory, men's locker, women's locker and fitness rooms are provided with energy-efficient hot gas reheat to allow for better humidity levels and thermal comfort control.



RIGHT The station also features community gathering space (shown) and art. Community members had input into the site selection and design of the public spaces.

required spaces. Additionally, carbon dioxide differential levels are measured in the meeting room, roll call, break room and investigations work area where large variations in occupancy counts are expected.

To meet the thermal comfort design intended, activity levels were considered in the design approach.

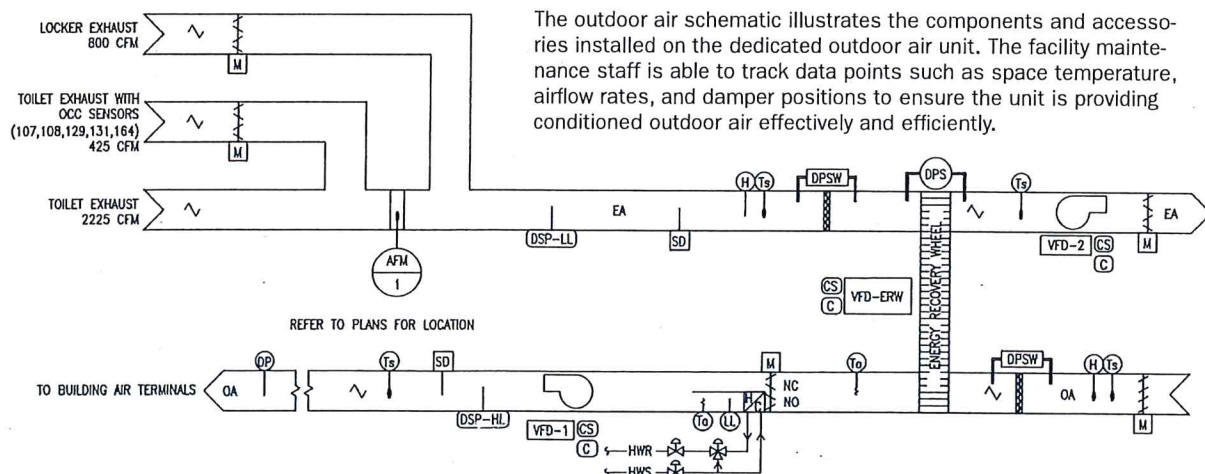
Activities in this building range from typical office work activities to physical activity within the fitness area. Thermal comfort is accomplished using multiple geothermal heat pumps and a dedicated outdoor air system to condition all occupied areas of the building.

Rooms with similar envelope, occupancy type, lighting and equipment loads have been grouped together in distinct zones so that temperature can be controlled effectively. Design temperatures for heating and cooling throughout the facility range from 65°F to 68°F and 72°F to 74°F,

respectively, while relative humidity levels are maintained around 50%, always staying within the thermal comfort parameters required by Standard 55-2004. Heat pump units serving the armory, men's locker, women's locker and fitness rooms are provided with energy-efficient hot gas reheat to allow for better humidity levels and thermal comfort control.

When lower humidity is needed, these heat pumps will operate in full cooling and use hot gas reheat in the refrigeration circuit for free reheat. Additionally, airflow from the diffusers, supplied by the heat pump, work

CONTROL SCHEMATIC



on the Coanda effect, which slows and distributes the air to below 40 fpm before reaching occupants.

Innovation

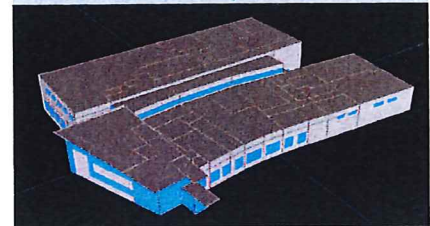
The design of the CD3PS for the City of Cincinnati introduced many new approaches or concepts that pushed the envelope in the construction industry. Many of these were firsts to the Ohio region. These innovations included creating a net zero energy design-build project, net zero storm water on site, and drastic energy reduction.

The two-stage selection process by the city shortlisted many contractor-led design-build teams, then selected based on low costs and the potential

for a betterment option. The betterment criterion was open ended and allowed creativity and innovation. This team proposed exceeding the LEED Silver requirement and achieving net zero energy by focusing on drastic energy reduction while staying in budget. A main reason given by the city for the selection of this team was due to proposing the first net zero energy police station in the U.S. The extra LEED points for energy reduction and for renewable energy will push the project to LEED Platinum level.

The team's focus on energy resulted in a 49% reduction in energy, acquiring all 19 LEED energy reduction points (EA Credit 1) and one Optimize Energy Exemplary

Figure 3 3-D RENDERING OF ENERGY MODEL

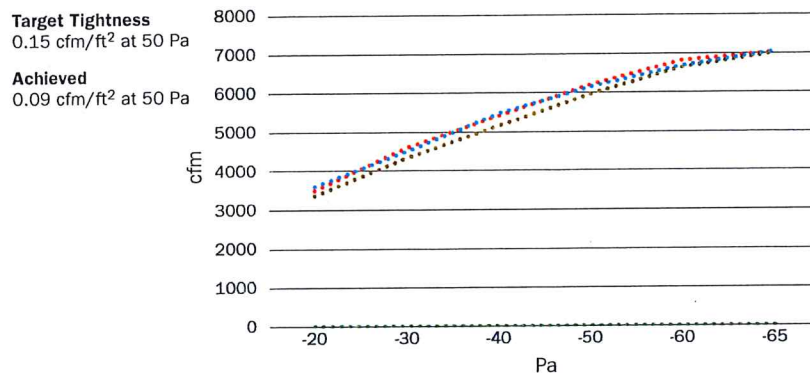


Energy modeling that accurately predicts post-occupancy is critical to the design of a net zero energy building.

Figure 2 ENERGY CONSUMPTION (KBTU/FT²-YR)

| System | 90.1 | 2003 CBECS | Charette Goals | LEED Model | Actual Performance |
|---------------|------|------------|----------------|------------|--------------------|
| HVAC | 35.4 | 37.1 | 12.4 | 11.2 | 10.8 |
| Water Heating | 0.6 | 14 | 3.6 | 0.4 | 0.7 |
| Lighting | 14.5 | 11.4 | 6.5 | 8.4 | 8.9 |
| Plug Loads | 12 | 16.9 | 12.8 | 12 | 6.3 |
| Total | 62.1 | 79.4 | 35.3 | 32 | 26.7 |

Figure 2 BUILDING ENVELOPE PERFORMANCE

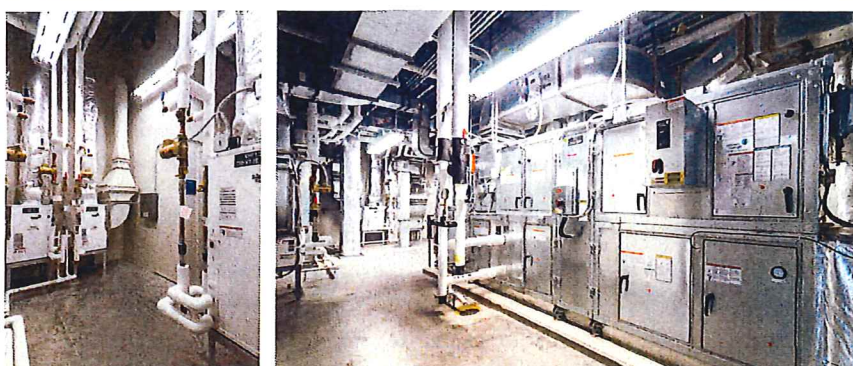


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|--------------------------------|------|------|------|------|------|------|
|Test 1 (Negative) 7:15 am | 0 | 0 | 0 | 0 | 0 | 0 |
|Test 2 (Negative) 7:30 am | 3500 | 4600 | 5420 | 6200 | 6815 | 7020 |
|Test 3 (Negative) 7:45 am | 3370 | 4340 | 5150 | 5950 | 6640 | 7000 |
|Test 4 (Negative) 8:00 am | 3605 | 4505 | 5480 | 6150 | 6680 | 7050 |

Performance point; seven Renewable Energy points (EA Credit 2); and one On Site Renewable Energy Exemplary Performance point.

The net zero energy design was achieved by the installation of a 329 kW solar photovoltaic system. The generation tracking data for the solar PV system has not been as consistent since the building's opening as the energy consumption tracking. This problem was resolved in March 2016, and from March 2016 through June 2016 there is good data. The system has produced 173,223 kWh, within 1% of the projected production calculated using the NREL PV Watts program. For this same period, the building consumed only 106,543 kWh, generating 63% more energy than consumed and ahead of schedule for being net zero energy.

Another innovation was the introduction of net zero storm water where all storm water is contained on the site. This was accomplished by bioswales and biofiltration/retention basins to mitigate combined sewer overflow and cleanse storm water runoff. These approaches were new to the Metropolitan Sewer District of Greater Cincinnati (MSDGC) and followed their Lick Run Watershed Master plan.



TOP The second floor mechanical room houses geothermal heat pumps, the geothermal domestic hot water system, and hot water storage tanks.

BOTTOM LEFT The CD3PS uses a distributive pumping system, eliminating the need for a full system shutdown when repairs are needed.

BOTTOM RIGHT The ventilation system for the building consists of one outdoor air unit to provide dedicated outdoor air to the building distributed via variable air volume boxes directly to occupied spaces or to the return air ductwork of heat pump units.

Operation and Maintenance

Through careful design and collaboration, the CD3PS was able to achieve incredible sustainable performance without sacrificing operability, serviceability, or maintenance life-cycle costs. During the design process, the design team, the City of Cincinnati and the commissioning authority worked collaboratively to ensure this was achieved. The owner tracks work orders, and in the past

year, only five work orders have been filed—all for minor repairs.

The majority of the building's HVAC system features a decentralized plant which allows maintenance engineers the ability to avoid HVAC system shutdowns. Any centralized equipment has $n+1$ redundancy for maintenance or failures. Also, all equipment is manufactured with components that are easy to obtain and exhibit low downtimes.

All equipment is tied into a building automation system that allows the building to be monitored, adjusted, and diagnosed remotely prior to dispatching a service technician and eliminates the need for onsite personnel. The building also features an energy management system, which allows maintenance personnel the ability to ensure the building is operating at peak performance.

Avoiding service contracts helps to minimize life-cycle costs. This project does not require service contracts for chillers, cooling towers, boilers, and chemical treatment. The geothermal system uses water without an antifreeze solution as the heat transfer fluid.

Cost Effectiveness

The design-build project delivery method allowed a high performance, net zero energy building to be delivered within the owner's construction budget. From the initial charrette meetings and throughout the schematic and design development phases, the focus was on designing the most energy-efficient building in a cost competitive environment.

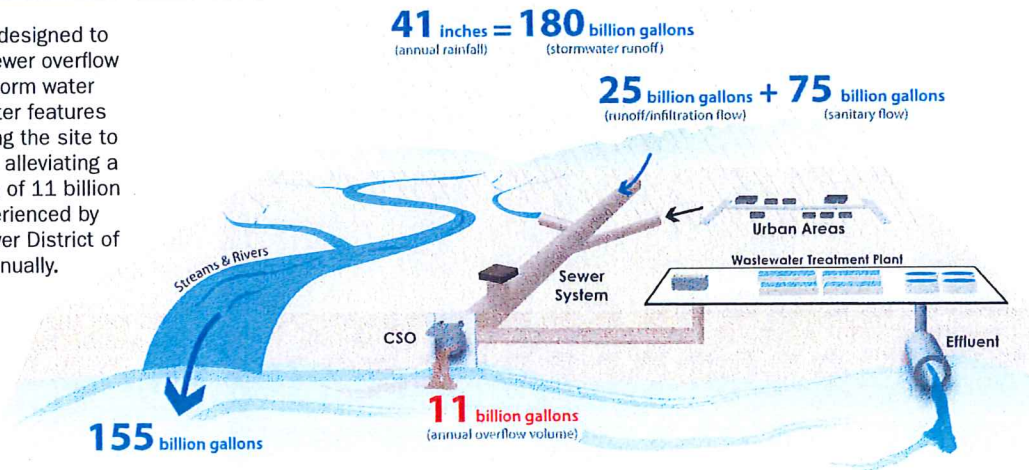
The key design strategy for any successful NZE project is drastic energy reduction. This project prioritized energy-efficiency strategies which have significant effect on both the annual and lifetime energy savings of an NZE project. The team quantified the annual cost savings for both the energy reduction and PV generation for equipment life of 20 years.

A police station is occupied 365/24/7 so the energy intensity of these buildings is higher than typical buildings. The latest CBECS data for police stations indicates an average EUI of 79.4 kBtu/ft²-yr. The new CD3PS is operating at an EUI of 26.7 kBtu/ft²-yr, which is one-third the energy usage of the average CBECS station. The first year energy reduction savings is \$36,900, and the total 20-year savings is \$991,516.

The 329 kW solar PV system produces 403,500 kWh annually. Revenue is received from selling all electricity back to the utility provider in a "net metered" arrangement. Additionally, revenue is realized by the selling of the solar renewable energy credits or "SRECs." In Ohio SRECs are marketable and, as of September 2016, can be sold for

Figure 4 SEWER SYSTEM DURING WET WEATHER

The CD3PS site was designed to mitigate combined sewer overflow (CSO) and cleanse storm water runoff. The storm water features were designed to bring the site to net zero storm water, alleviating a portion of the burden of 11 billion gallons of CSOs experienced by the Metropolitan Sewer District of Greater Cincinnati annually.



\$30/SREC. The system will produce 403 SRECs annually. (An SREC is the production of a 1,000 kWh.) The revenue produced by the PV system in the first year is \$82,077, and the total 20-year revenue is \$1,213,922.

Considering escalation, the combined 20-year return on the investment for this high performance, net zero energy building is \$2,205,439. This is revenue that the City of Cincinnati can use on other programs that benefit its citizens more than purchasing utilities.

Environmental Impact

The CD3PS located in the western part of the City of Cincinnati may be one of the greatest achievements in environmentally sensitive design and high performance engineering in the history of the City of Cincinnati.

The CD3PS site provides great neighborhood and community access but also allowed for brownfield redevelopment of an existing site that had been abandoned for many years. It also allowed for many planning and design principles that were introduced in the Metropolitan Sewer District of Greater Cincinnati's (MSDGC) Lick Run Watershed

Master plan. This master plan was developed as part of a consent decree between the U.S. EPA, the Ohio EPA, Hamilton County, the City of Cincinnati, and the MSDGC to help solve one of the worst combined sewer overflows (CSOs) in the nation. CSOs threaten public health, negatively impact the environment and degrade the quality of life across the entire Cincinnati community. After heavy rains many area waterways are unsafe for swimming or wading due to high levels of *E. coli* bacteria that are discharged during CSO events. Aquatic life is also impacted by this water pollution caused by these events.

The CD3PS site was designed incorporating bioswales and biofiltration/retention basins to mitigate combined sewer overflow and cleanse storm water runoff supporting the Lick Run Watershed master plan and the Project Groundwork Initiative. These storm water features were designed to alleviate the burden of this site on CSOs, the worst overflow in MSDGC's system. These design features also bring the entire site to net zero storm water.

The solar photovoltaic array is the other major design feature of the

CD3PS having a significant environmental impact. The 329 kW array is comprised of 80 kW of parking canopy modules, 195 kW of building roof-mounted modules, and 54 kW of roof-mounted modules on the storage building. This array has generated over 300,000 kWh since coming on line. Producing solar renewable energy on site plays an important role in reducing the city's overall carbon footprint.

Ohio will have to drastically reduce its CO₂ emissions when EPA's new Clean Power Plan is approved. This project is an excellent example of how the EPA's Clean Power Plan can be successful. The CD3PS eliminates 214.48 metric tons of CO₂ emissions.

The Cincinnati District Three Police Station is an exemplary model of a high performance building that is cost effective for the owner and has a positive impact on the surrounding community and the environment. ●

ABOUT THE AUTHORS

Tracy Steward is a principal at CMTA Consulting Engineers in Prospect, Kentucky. **Jamie Accurso** is a senior architect for the City of Cincinnati.