

# City of Charlotte, North Carolina Facility Energy Management and Energy Star

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## ABSTRACT

This article provides an overview of energy management efforts for City of Charlotte facilities. It considers energy management program implementation for new construction and the continuous maintenance and improvement of existing facilities. Energy management and the pursuit of Energy Star for the City of Charlotte's building portfolio is the responsibility of the Building Services Division of Engineering & Property Management (E&PM). This department oversees the maintenance of nearly 300 facilities and assets, including five million square feet of buildings, two million square feet of roof, and over four million square feet of parking. The diverse portfolio includes police stations, fire stations, administrative buildings, museums, fleet maintenance shops, parking decks and communication towers.

Energy management strategies are aligned, yet complex across the building portfolio. E&PM's focus on energy management has reduced the city's energy use intensity and energy costs. In 2016, the city readopted an updated Policy for Sustainable City Facilities, emphasizing energy efficiency and requiring a percentage reduction beyond ASHRAE 90.1 for new construction and major renovation projects. This article highlights efforts to promote energy efficiency through the city's pursuit and achievement of Energy Star certification for its facilities

## ENERGY MANAGEMENT STRATEGY & SUCCESS

In 2003 E&PM's building services division implemented a sustainable energy plan (SEP) which established a framework focused on data management, supply management, energy use in facilities, equipment efficiency and organizational integrity. The SEP outlines benchmarking standards and measurement methods for city facilities. The plan drives energy saving projects and helps maximize efficient building operations. The SEP promotes energy management, reducing the building portfolio's energy use intensity by 17.5% and avoiding over \$25.4 million in costs (Figure 1). The building portfolio's energy utilization index (EUI) for over 100 facilities declined from 77.5 in 2003 to 63.9 in 2016 as shown in Figure 2.

The SEP is now expanding to include water efficiency across the building portfolio. In July, 2016 the city readopted the updated Policy for Sustainable City Facilities, a highly collaborative and integrative approach to implementing sustainable aspects into the design, construction and operation of the city's facilities. A subset of the policy requires new facilities and large renovations to meet energy reductions beyond ASHRAE 90.1. Charlotte Mecklenburg Police Department (CMPD) Steele Creek Division Station (Figure 3) was designed to be 45% more efficient than required by energy code. Actual energy usage data indicate that the facility has operated 40% more efficiently than a similar building constructed to meet the energy code (Figure 3).

The notable energy reductions resulted from implementation of energy efficient technologies including geothermal heating, ventilating and air conditioning (HVAC) systems. The city has constructed three police division stations with geo-exchange systems. Two more division stations are planned through 2019. The completed stations with geo-exchange systems operate between 40% to 50% more efficiently compared to another station with a traditional direct expansion (DX) cooling system. Figure 4 displays the EUIs for three police stations; illustrating the operational efficiencies of geothermal technology. Both Providence and Steele Creek were constructed with geothermal technologies, while the metro station was constructed with traditional DX equipment.

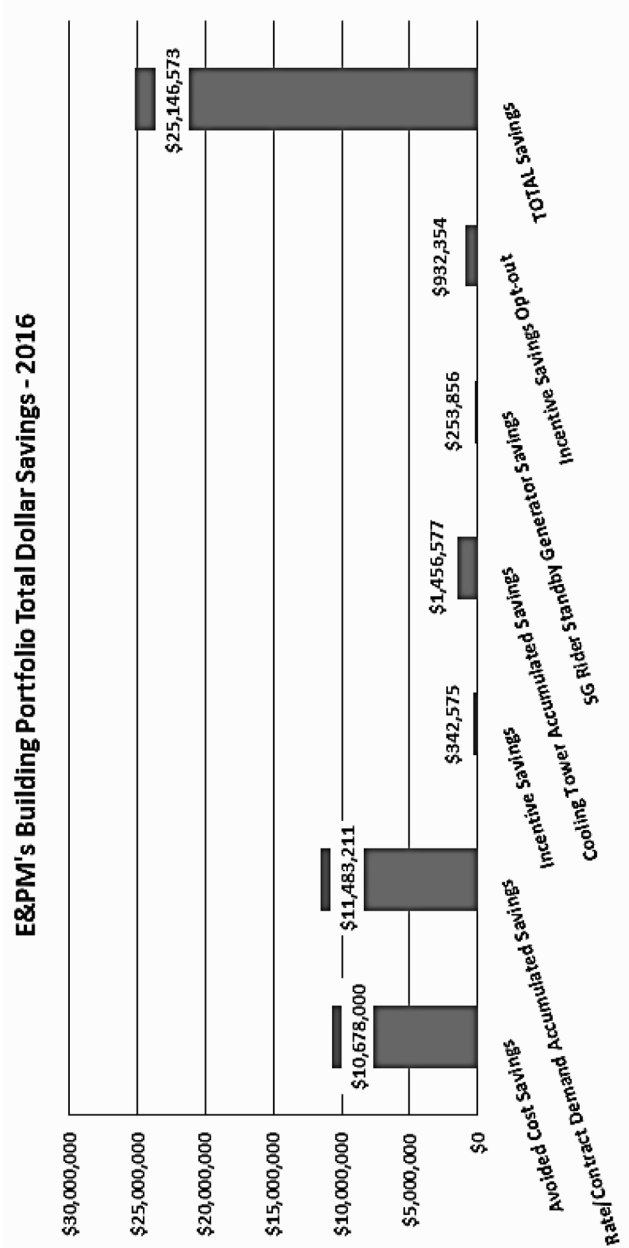


Figure 1. E&PM's building portfolio total avoided energy costs.

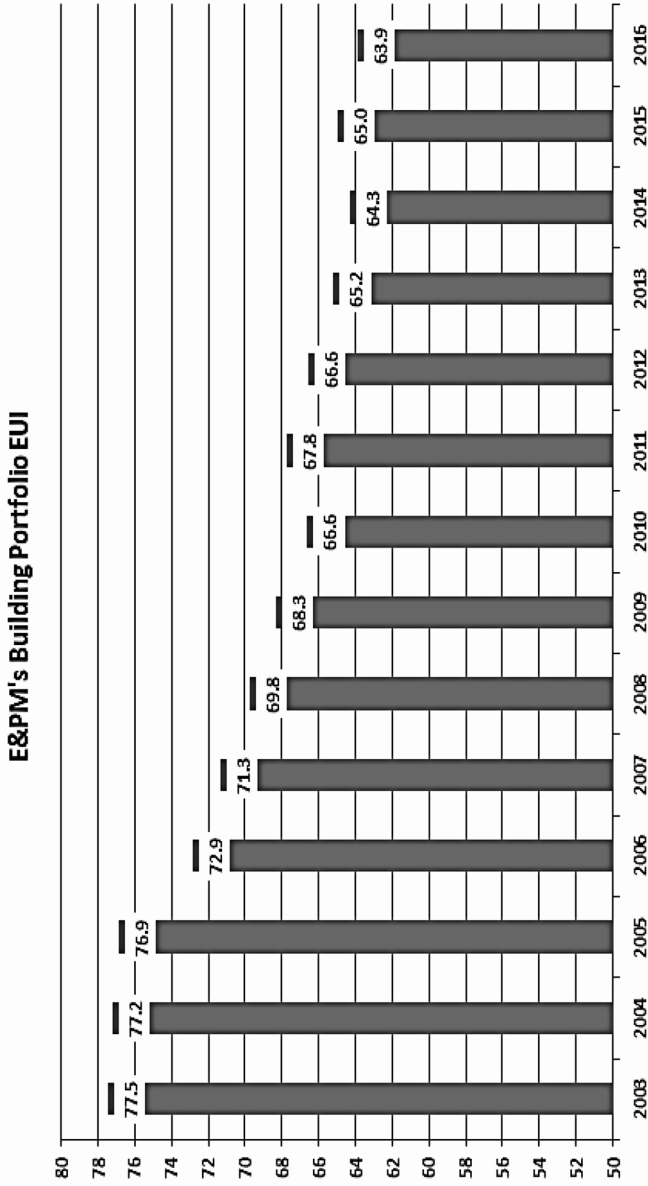
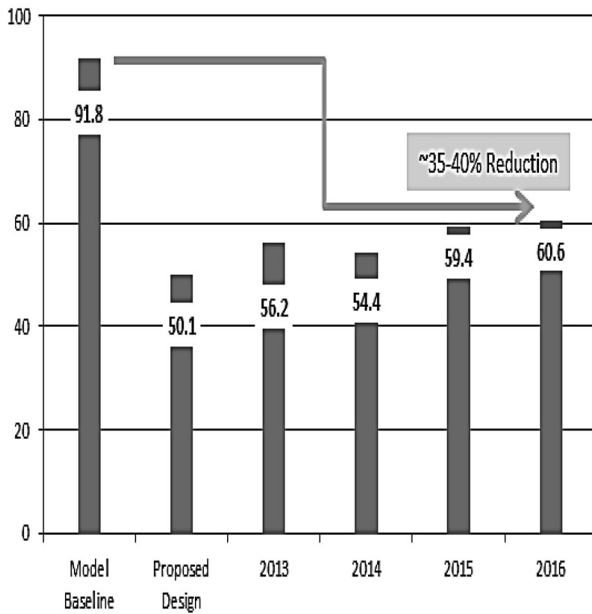


Figure 2. E&PM's building portfolio (EUIs for 2003-2016).



### CMPD Steele Creek Division EUI



**Figure 3. Charlotte Mecklenburg Police Department Steele Creek Station (EUIs for 2013-2015).**

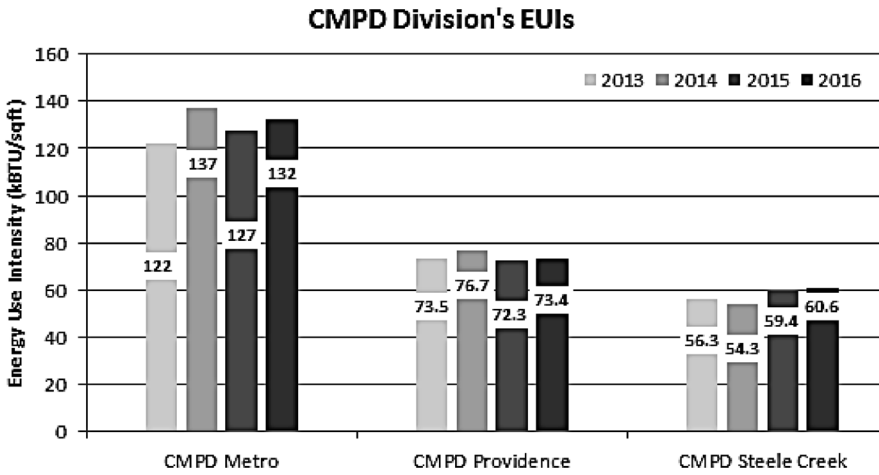


Figure 4. EUI comparisons for the CMPD stations.

### ENERGY STAR CERTIFICATION

On average, Energy Star certified buildings use 35% less energy and cause 35% less greenhouse gas emissions than similar buildings [1]. The city buildings receiving this designation include Charlotte-Mecklenburg Government Center, Old City Hall, Charlotte Water’s Brookshire Administrative Building, Landscape Management, Spratt Street Facility and Charlotte Mecklenburg Police Department Law Enforcement Center. All six facilities earned Energy Star certification in 2016.

#### Charlotte Mecklenburg Government Center

This Charlotte Mecklenburg Government Center (CMGC), constructed in 1987, is a 14-story commercial office building. It serves citizens and staff within the City of Charlotte, Charlotte Mecklenburg County and Charlotte Mecklenburg Schools.

Beginning in the mid-1990s, energy management staff focused on improving and ensuring the optimal energy and financial performance of the CMGC. Over the past 20 years, the CMGC has undergone two energy audits and retro-commissioning. Energy saving initiatives included lighting upgrades (e.g., T12 to T8 fluorescent retrofits, light emitting diode fixtures, among others), HVAC equipment and controls improvements, sub-metering, elimination of a plaza fountain and large

server loads, plug load analysis and staff educational outreach. Recent improvements include new chillers plus smart elevator interface and controls. Since 1999, E&PM's building services department has reduced energy consumption by nearly 32%, avoided about \$2.5 million in costs, and aided in the CMGC earning Energy Star certification for several years, including 2016. Figure 5 displays the EUIs for the CMGC since 1999.

### **Old City Hall**

Old City Hall is recognized by the Charlotte Mecklenburg Historic Landmarks Commission as a historic landmark [2]. This building was constructed in 1925 and presently provides administrative space for several city departments (Figure 6).

In 2009, the facility's obsolete pneumatic controls failed which required diligent manual operations to offset operational inefficiencies. The needed control upgrades prompted an extensive renovation focused on energy efficiency. The renovation involved interior lighting, HVAC equipment, isolation of the server area, building automation and control upgrades. After being renovated, energy use in Old City Hall was reduced by 50%. The energy-saving improvements resulted in an accumulated cost avoidance of \$164,000. The energy use intensity at Old City Hall dropped from 119.9 to 60.6 (Figure 6). Old City Hall earned Energy Star certifications in 2013, 2014, 2015, and 2016.

### **Charlotte Water Brookshire Administrative Building**

This two-story facility, constructed in 1975, provides office and conference space for the staff of Charlotte Water. Many water utility technicians begin and end each day at this location.

Prior to 2011, this facility was identified as one of the building portfolio's worst energy performers and was placed on a priority list for energy improvements. Those improvements were completed in 2012 and included upgrading the chiller, boilers, motors, and installing new light fixtures with timers or occupancy sensors. The renovation resulted in improved indoor air quality and HVAC reliability. Charlotte Water Brookshire has reduced energy use by 58%, resulting in an accumulated cost avoidance of \$398,000. The energy use intensity of the Charlotte Water Brookshire Administration Building has declined from 129.2 in 2006 to 54.7 in 2016 (Figure 7). This facility earned Energy Star certifications in 2014, 2015 and 2016.

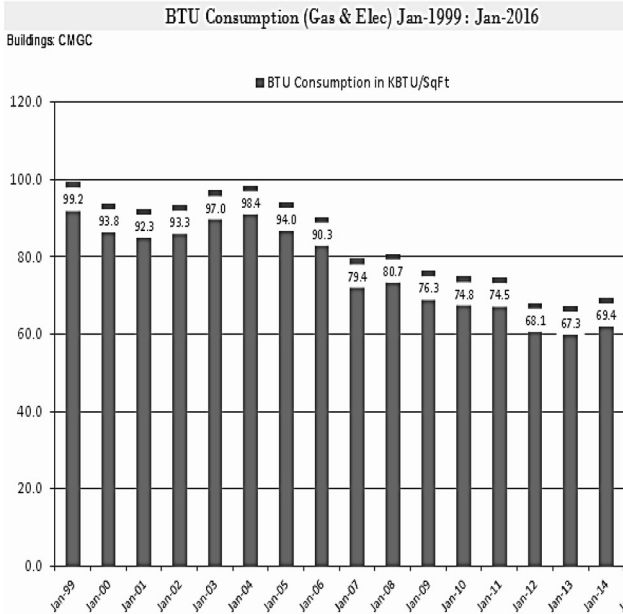


Figure 5. Charlotte Mecklenburg Government Center (EUIs for 1999-2016).



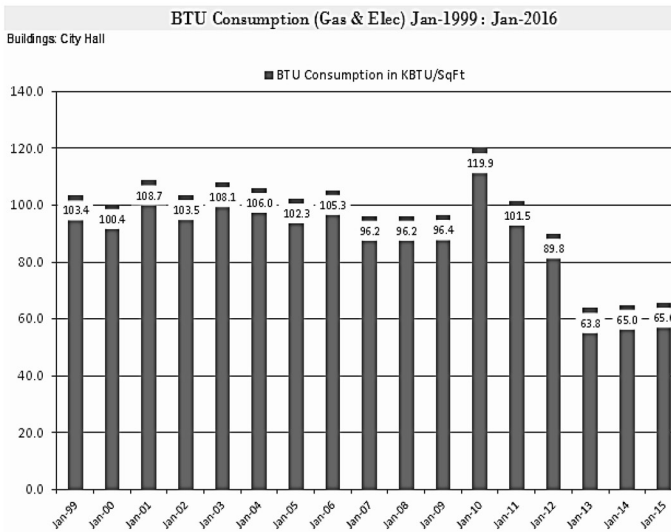
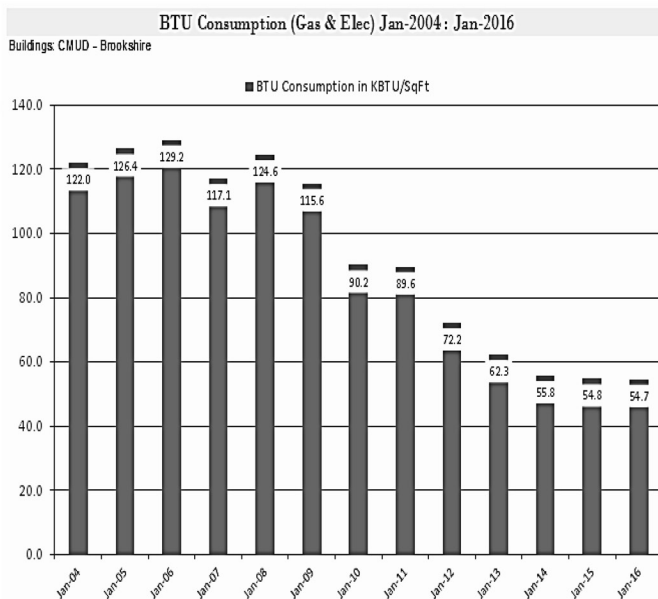


Figure 6. Old City Hall (EUIs for 1999-2015).

### Landscape Management

The Landscape Management building provides administrative and warehouse space for field crews. This department coordinates the landscape design for Charlotte roadway projects and neighborhood improvement projects and maintains landscaping at city facilities. The facility has achieved reductions in energy use of 18% due to improved roofing, ceiling insulation, lighting systems, control upgrades and new



**Figure 7. Charlotte Water Brookshire Administrative Building (EUIs for 2004-2015).**

HVAC equipment. This resulted in an accumulated cost avoidance of \$32,000. The energy use intensity of the Landscape Management building has dropped from 30.4 in 2005 to 25.0 in 2016 (Figure 8). This facility earned Energy Star certifications in 2014, 2015, and 2016.

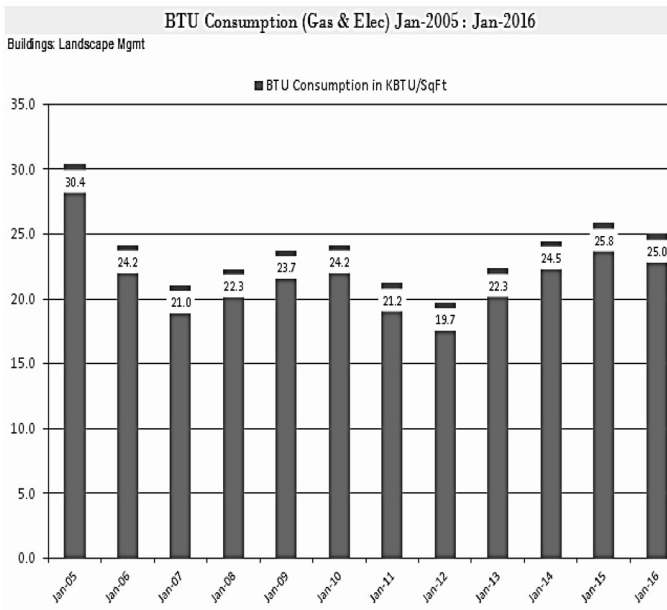
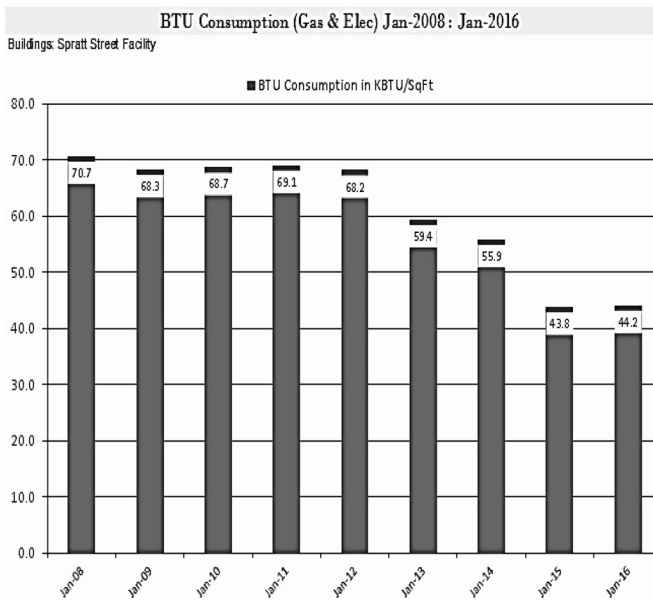


Figure 8. Landscape Management (EUIs for 2005-2015).

### Spratt Street Facility

The Spratt Street Facility provides mixed use warehouse and office space for the staffs of the E&PM department of transportation and innovation and technology. Over several years, energy projects and optimized operations initiatives included replacing HVAC equipment, upgrading to LED exterior and office lighting, replacing T12 fluorescent

fixtures with T8 lighting and installing occupancy sensors. These improvements reduced energy use by 38%. The accumulated cost avoidance totals \$78,000. The energy use intensity at Spratt Street has reduced from 70.7 in 2008 to 44.2 in 2015 (Figure 9). This facility earned Energy Star certifications in 2014, 2015, and 2016.



**Figure 9. Spratt Street Facility (EUIs for 2008 -2015).**

### **Charlotte Mecklenburg Police Department Law Enforcement Center (CMPD-LEC)**

CMPD-LEC is a police headquarters facility for the City of Charlotte. The four story facility was constructed in 1995 and is occupied continuously. It includes offices, laboratory space, a 911 call center and various meeting spaces.

Prior to 2013, this facility was identified as exhibiting high annual energy use and was placed on a priority list for energy improvements. Those improvements were completed in 2014 and included upgrading the chiller, cooling tower, installation of interior LED light fixtures and retro-commissioning the control systems. The facility's parking deck was upgraded to LED light fixtures. Additionally, the energy renovation included sub-metering for the parking deck and information technology equipment. CMPD-LEC has achieved an energy use reduction of 25%. This has resulted in an accumulated cost avoidance of \$269,000. The energy use intensity at CMPD-LEC has been reduced from 136.6 in 2013 to 102.4 in 2016 (Figure 10). This facility earned an Energy Star certification in 2016.

### **SUMMARY**

The City of Charlotte plans to continue expanding its energy management efforts. Presently, E&PM is revising the departmental SEP. This program offered a framework for data management, supply management, energy use in facilities, equipment efficiency and organization integrity. The SEP outlines best practices, benchmarking standards and measurement methods. Future revisions of the SEP will ensure increased energy savings, promote energy reduction projects and maximize efficient building operations. Successful energy management requires the commitment and determination of trained trade staff. Additional staff training is being planned to provide understanding and implementation of energy efficiency efforts.

The recently re-adopted and updated Policy for Sustainable City Facilities began an initiative to seek Leadership in Energy and Environmental Design Operations & Maintenance (LEED O+M) Certification. Presently, two Energy Star certified facilities are being considered for their potential to earn LEED O+M certification. The continued recertification of the city's Energy Star facilities remains an annual goal with

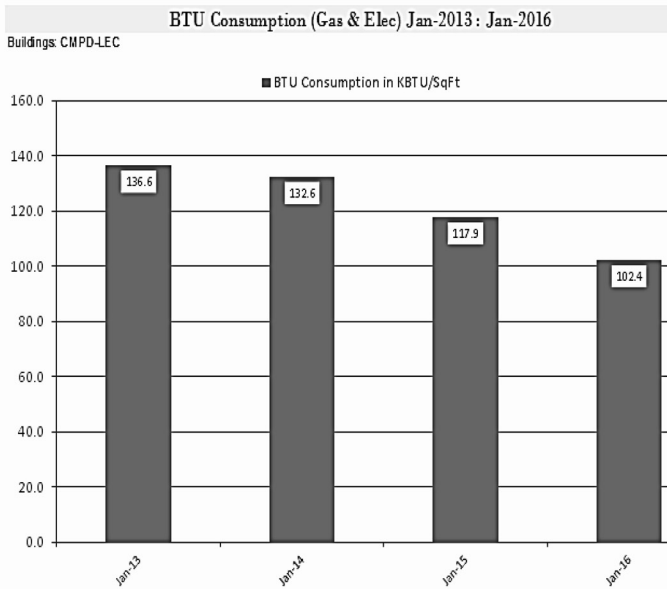


Figure 10. Charlotte Mecklenburg Police Department Law Enforcement Center (EUIs for 2013 -2015).

aspirations for additional facilities to achieve Energy Star designation. Presently, facility energy consumption and usage data is being analyzed to determine the next Energy Star candidate. Highlighting the Energy Star certified facilities offers a fresh perspective of the energy management efforts necessary to meet such standards and the resulting dollar savings possible through dedicated energy efficient efforts.

### References

- [1] Energy Star, [www.energystar.gov](http://www.energystar.gov).
- [2] Charlotte Mecklenburg Historic Landmarks Commission, <http://www.cmhpf.org>.

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### ABOUT THE AUTHOR

**Laurie Sickles** is the assistant building services manager for Engineering & Property Management, City of Charlotte. Laurie oversees the maintenance and operation of numerous city facilities and assets, with a primary focus on museums, performing arts facilities, and Charlotte Area Transit facilities. She is responsible for capital planning efforts, energy, sustainability strategies, and benchmarking measures across the city's portfolio of nearly 200 buildings. Laurie also works closely with various trade specialties to ensure superior maintenance of the city's facilities. She has extensive project management experience in energy audits, projects, and renovations that focus on energy efficiency.

Laurie is a licensed professional engineer and a LEED certified professional, and holds the designations of certified energy manager (CEM) and professional energy manager (PEM). Laurie earned a bachelor of science degree in biology from Chatham College and a master's degree in civil engineering from University of North Carolina, Charlotte. Email: [lsickles@charlottenc.gov](mailto:lsickles@charlottenc.gov).