

## **Clifton's Streetlights: Coal Gas, Natural Gas, Incandescent, High-Pressure Sodium, and LED**

by Ronald W. Millard

edited and published by Amanda Frietsch

### **FOREWARD/INTRO** (by Amanda Frietsch) (344 words)

Walking the streets of Clifton, we all enjoy the history, the art and architecture, the community as a whole... but do you ever look up?

The gaslights of Clifton are so ubiquitous that they've become part of the fabric of the neighborhood, woven not just into the streets themselves, but into business names, local identity, and the quiet charm that makes Clifton feel like Clifton. They're always there, softly glowing at dusk, lining familiar routes, marking corners we pass without a second thought. And because of that, it's easy to overlook them.

But these lights have stories.

They are more than ornamental relics or aesthetic choices; they are living artifacts. They connect us to a time when the simple act of lighting a street required human hands, when lamplighters moved through the neighborhood at dusk and dawn, and when the infrastructure beneath our feet was just beginning to shape the modern city of Cincinnati we see today. They have endured technological revolutions, shifting energy sources, and changing priorities, yet they remain quietly persistent.

What makes Clifton's gaslights so special isn't just their age or rarity, but their continuity. We live in a world that constantly replaces and upgrades, pushed by the unrelenting forward motion of technology. Yet these lights have endured, protected by a community that values its past, and through every technological change, they persist while being ushered into the future. They remind us that history isn't something confined to museums or textbooks; it's something we live with every day, often without realizing it.

This book invites you to pause and look again.

To see the gaslights not just as background, but as central characters in Clifton's story. To understand how they came to be, how they've changed, and how they will keep "burning" into the future. And perhaps most importantly, to appreciate the role they play in shaping the sense of place that so many of us cherish.

Because once you start noticing them, really noticing them, you can't unsee them.

And Clifton feels just a little more magical because of it.

### **PREFACE** (398 words)

This book, sponsored by the Clifton Historical Society, is the third in its current series. The previous two books by Amanda Frietsch et al. are "*A Legacy of Landscapes*" (2024) and "*Clifton's National Treasure*" (2025). The first book explores the historical connections between Spring Grove Cemetery and Arboretum, the Clifton neighborhood, and the Cincinnati Horticultural Society. The second book focuses on the history, artistry, and preservation of two large stained-glass Davis and Wilson family windows at Clifton's Methodist Episcopal Church.

Here is the evolving story of Clifton's street lighting, from flat-flame town gas lamps to ground mounted phalanxes of globe lights to overhead LED and HPS. Taken together, Clifton's streetlighting is a combination of the historic, mid-20th century-modern, and cutting-edge 21st century technology, lighting its sidewalks and roadways.

The book includes illustrations on the origins, evolution, and likely future of Clifton's streetlighting. It identifies the foundries and inventors of Clifton's historic street lighting. We start with an exploration of dim coal gas-fueled and gasoline-fueled streetlights at the turn of the 20th Century. Then, in 1907 natural gas arrived from West Virginia to supply the historic streetlights on Clifton's secondary residential streets, in the city, and in its nearby suburbs. This book follows the timeline of Cincinnati's and Clifton's streetlighting and its gas supply pipeline, and later electric service networks. The past and present locations of myriad types of street lighting on Clifton's primary commercial routes and in its residential streets are identified.

The story of Cincinnati's town (coal) gas and gasoline-fueled streetlights begins in the early 19th century. It was half a century later when gas mains and laterals arrived in Clifton. Clifton's scions and investors in the Cincinnati Gas, Light and Coke Company and Clifton's growing population made this economically viable.

This story of Clifton's streetlighting begins in the waning days of the 19<sup>th</sup>-century as Cincinnati was annexing outlying villages including Clifton, and at the dawn of the "electric age". Over the decades since, fuel and energy sources for Cincinnati and Clifton's streetlights, public buildings, businesses, and residences have evolved. Advances in lighting types and technologies were at different times challenged, supported, and occasionally adopted. Today, only one-tenth of the city's historic gas streetlight system remain. At its peak as many as 10,000 coal gas- and gasoline-fueled streetlights lit the city's and neighborhood's sidewalks

Clifton's residents, always an engaged and civic-minded community, cherished the neighborhood's historic residential gas streetlights. At the turn of the 20th Century Clifton and Ludlow Avenues were the test strips for conversion from flat-flame to Welsbach mantles. Cliftonites successfully opposed mercury vapor lights. In 1978, they endorsed the inclusion of Clifton's gaslights as part of the city's gas streetlight system in the National Register of Historic Places. The community prevailed in keeping a quasi-historic streetlight appearance with LED streetlamps enclosing 18<sup>th</sup>-century frosted hurricane lamp chimneys along the Ludlow Avenue Business District. Subtle changes are afoot, for in the newer Clifton Ridge development Duke Energy installed similar lampposts with enclosed frosted hurricane lamp chimneys illuminated with a 30-watt LED emitting a warm white with a soft, yellowish glow.

Clifton's historic natural gas-fueled gas streetlights, a total of 255 with double mantle inverted (DMI) Welsbach burners, remain in many of its residential areas. The boundaries of Clifton's "gaslight district" are Lafayette Avenue on the north, Morrison Avenue on the west, Terrace Avenue on the south, and Biddle Street on the east.

Today, electrified globe-topped, light emitting diode (LED) lighted, ground mounted Boulevard style lampposts, and overhead "cobra" style LED arrays and high-pressure sodium (HPS) pole mounted lights are seen on many of Clifton's other residential streets and major commercial corridors. Clifton and Ludlow Avenues, where gas lamps once lined the streets, timed LED globe-topped lampposts have been in place for more than a century. Belsaw Place and Rawson Woods Circle are also lighted with the same timed globe-topped LED lampposts.

Beyond the globe topped lampposts, as Ludlow Avenue approaches Central Parkway, the sidewalks and roadway are bathed in the otherworldly yellow-orange rays from the overhead HPS lights. On Woolper Avenue from Vine Street connecting to McAlpin Avenue ending at Ludlow Avenue, and on Jefferson Avenue, a combination of overhead HPS and LED lights illuminate the entire route.

Clifton Avenue, beyond Lafayette Avenue, is washed first with near daylight by a series of overhead LED arrays on the S-curves, followed by HPS lights down the hill toward Mill Creek. Overhead LED arrays also brighten Evening Star Lane. Overhead HPS lights illuminate Wood and Terrace Avenues. Elsewhere, on Cypress Garden, Clifton Hills neighborhood streets, and the northern extension of Middleton Avenue are lit only by residence electric lights on posts or by lights beside the front doors.

## TABLE OF CONTENTS

PAGE

Foreword/Intro  
Preface

### **PART 1: IN THE BEGINING - ORIGIN of GAS STREETLIGHTS (APPENDIX A - GLOSSARY of TERMS)**

- 1.a. Coal Gas Supply for New Streetlights
- 1.b. Cincinnati and Clifton's Gas Streetlights: Coal Gas is Locally Generated
- 1.c. Gas lighting is installed in Cincinnati's Mozart Hall in 1863
- 1.d. Cincinnati's Coal Gas Streetlight System Expands
- 1.e. The Arrival of Electric Street Lighting
- 1.f. Welsbach Invents the Incandescent Gas Burner

### **PART 2: EVOLUTION OF CINCINNATI'S STREETLIGHTS GAS FUEL SOURCE**

- 2.a. Natural Gas Discovery in the U.S.
- 2.b. Lamplighters
- 2.c. Cincinnati's Gas Suppliers Challenges
- 2.d. Local Natural Gas - An Historic Challenger to Coal Gas
- 2.e. Natural Gas Arrives - West Virginia's Pipeline
- 2.f. Supply Pipelines replaced three times in 100 years.

### **PART 3: GAS STREET LIGHT TECHNOLOGY EVOLVES**

- 3.a. The First Gas Lamp in America
- 3.b. Early Clifton Residents Demanded Gas Street Lighting
- 3.c. London's Windsor Lamp Adopts the Welsbach Gas Burner
- 3.d. The Welsbach Gas Mantles and Lights made in New Jersey; sales office in Cincinnati.
- 3.e. Gas Lamps Designs Obtain U.S. Patent Protections
- 3.f. Clifton's First Tests of Welsbach Incandescent Burners for Cincinnati
- 3.g. Clifton's Lamp Fixture Designs
- 3.h. Cincinnati Mayor Forecasts the Era of Electric Streetlights 150 years ago

### **PART 4: CINCINNATI'S HISTORIC BUILDINGS AND CLIFTON'S GAS STREETLIGHTS (APPENDIX B-Cliftons Gas Streetlights Map)**

- 4.a. Where Are Clifton's Gas Streetlights Today?
- 4.b. Twenty-One Gas Lamppost Designs
- 4.c. Lamppost Foundry Marks
- 4.d. Gas Streetlights Are Added to Clifton's Historic Building, Structures & Districts List
- 4.e. Residents Petition City to Keep Clifton's Gas Streetlights Burning

### **PART 5: LOOKING FORWARD (APPENDIX C)**

- 5.a. Cincinnati Monitors Operating & Maintenance Costs for its Gas Streetlight System
- 5.b. Greenhouse Gas Emissions Measured from Natural Gas-fueled Streetlamps
- 5.c. Clifton's Streetlight Changes in the 20th Century
- 5.d. Clifton & Ludlow Avenue Removals & Replacements
- 5.e. Streetlight Retrofits on Ludlow Avenue
- 5.f. Overhead HPS and LED streetlighting

### **PART 6: THE NEXT REVOLUTION IN STREETLIGHTING HAS ARRIVED**

- 6.a. Gas Streetlights are Converted to LED in Cities Worldwide
- 6.b. U.S. Cities Convert Gas Streetlights to LED
- 6.c. Cost Estimates to Convert Gas Lamps to AC Electric or Low Voltage DC LED Illumination.
- 6.d. Clifton's Gas Streetlights Future - Cincinnati's DOTE Budget and the 2023 Green Plan
- 6.e. Clifton Town Meeting - 2026 Clifton Plan - Clifton's Community Actions
- 6.f. Gas to LED Conversion Cost Estimates
- 6.g. Enjoy Clifton's Streetlights and Report Gaslamp Outage

## **APPENDICES**

**APPENDIX A: Streetlighting Glossary of Terms**

**APPENDIX B: Cliftons Gas Streetlights Map, Streetlight Locations & Numbers**

**APPENDIX C: Color Comparison of LED lighting and Kelvin Spectrum**

**APPENDIX D: Clifton's Gas Streetlights Timeline**

**APPENDIX E: Clifton's Gaslight Iconography**

## **PART 1: IN THE BEGINING - ORIGIN of GAS STREETLIGHTS**

- 1.a. Coal Gas Supply for New Streetlights
- 1.b. Cincinnati and Clifton's Gas Streetlights: Coal Gas is Locally Generated
- 1.c. Gas Lighting is Installed in Cincinnati's Mozart Hall in 1863
- 1.d. Cincinnati's Coal Gas Streetlight System Expands
- 1.e. The Arrival of Electric Street Lighting
- 1.f. Welsbach Invents the Incandescent Gas Burner

## **PART 1: IN THE BEGINING - ORIGIN of GAS STREETLIGHTS (APPENDIX A: Glossary of Terms)**

### **Coal Gas Supply for New Streetlights:**

The replacement of oil-fueled lamps on the street-facing exteriors of urban residences and even along major roadways with gas piped from privately or municipality-owned facilities generating what was called "city gas" or "coal gas" grew worldwide beginning in the early 1800's.

Between 1809 and 1813 William Murdoch, initially at his home in Cornwall and subsequently in Nottingham, England, developed the first practical "coal gas" lighting systems. London was one of the first cities to adopt street lighting powered by gas.

By 1816 the first municipal coal gas-generating plant in the USA was established in Baltimore, Maryland, and the same year one began in Freiburg, Germany. By 1860 the USA would have more than 400 coal gas companies, while Great Britain would have more than 900, and Germany a bit more than 250.

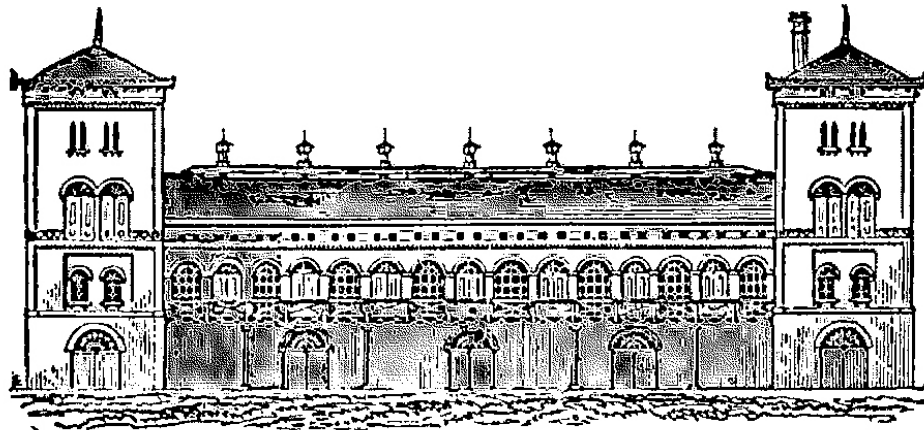
### **From Lard-Oil Lamps to Coal Gas Lamps - 1837 to 1875**

**Cincinnati's streets were first lit** only by a few lackluster **lard-oil lamps**. Cincinnati was known as "Porkopolis". In 1837 a group of Cincinnatians formed the Cincinnati Gas, Light, & Coke Company (a.k.a., Cincinnati Gaslight & Coke Company, or Cincinnati Gas-Light and Coke Company, in annual city department reports). The company, chartered by an act of the Ohio General Assembly, manufactured coal gas (a.k.a "town gas") (Figure 1) to address the need for a dependable system of street lighting in the growing city. It began to install distribution pipelines soon thereafter and supplied Cincinnati's first streetlamps with "artificial" ("coal") gas or "town gas" in 1843. The first working "coal gas" fixture in Cincinnati was lit at the *W.H. Harrison Drug Store* at Fourth and Main streets. The company began replacing the dim lard-oil lamps with coal-gas streetlights. Cincinnati's first set of 100 public streetlamps fueled by coal gas were ignited on September 27, 1843. There was no on/off switch. Lamplighters spread across the city igniting the bulbs each night and extinguishing them each morning. Many gaslights seen in Clifton today still have a crossbar where early lamplighters would rest their ladders. Local newspaper editors speculated about the prospect of having lighted streets. As the city grew, the more gas mains were laid, and the gas streetlight system was extended.

### **Coal Gas is Locally Generated**

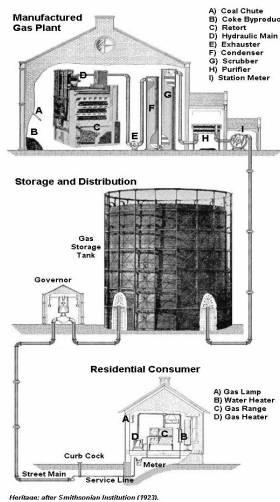
Coal gas is a complex mixture of hydrogen (H<sub>2</sub>), methane (CH<sub>4</sub>), ethylene (C<sub>2</sub>H<sub>4</sub>), and carbon monoxide (CO). At first, the coal gas supply fed open flat-flame streetlamps which yielded little light and were often extinguished in high winds.

FIGURE 1:



SOUTH GAS WORKS, CINCINNATI, OHIO.  
JOHN JEFFREY, Engineer and Architect.

## The Manufacture of Coal Gas



The period from 1843 to 1882 is considered Cincinnati's "*Gaslight Era*," creating an historic infrastructure of up to as many as 10,000 coal/natural gas-fueled and gasoline-fueled streetlamps at its peak before electricity arrived. Today only 1,109 natural gas-fueled streetlights remain, and since 1978 these are enrolled in the *National Register of Historic Places*.

The first 100 public coal-gas fueled streetlamps were lit on September 27, 1843, with the first gaslight in a building lit on January 14, 1843, at Fourth and Main streets. Starting in the 1840s and continuing into the 1870s, the company not only built coal-gas generating works but also laid an extensive underground gas mains network. No gas pipelines reached Clifton until at least 1875.

**A Dark Holiday Season:** The Cincinnati City Council, in a dispute with the Coal Light and Gas Company over who would determine which streets would be used for new gas mains, shut off the gas supply to all public streetlamps for 40 days in the depth of winter over the Christmas and

New Year's holidays, from December 20, 1849, to January 29, 1850. There was of course public outcry. The city prevailed and won a 25-year agreement that it would dictate which streets would be used for new gas mains.

On March 23, 1850, the official notice which started the Town of Clifton was posted "in the three most public places," the Clifton Chapel at Clifton and Lafayette Avenues, on Smith Andrews' barn on Cumminsville Road (Ludlow Avenue), and on the gate post of the Honorable William Johnston on Carthage Road (Vine street), On the very same day, the Ohio legislature at Columbus granted a charter to "The incorporated Town of Clifton."

By 1862, Cincinnati Gas-Light & Coke Company was serving 8,200 customers in the city. By 1862, nearly 250 employees serviced natural gas outlets around the city, including lamps lit and snuffed by lamplighters every day.

**FIGURE 2:**



**Gas lighting is installed in Cincinnati's Mozart Hall in 1863:** On September 12, 1863, when thousands of volunteers who had served in the Union Army from the start of the U.S. Civil War to May 1863 (13 men from Clifton) were being recognized, *The Cincinnati Daily Enquirer* reported that the city's reconstructed Mozart Hall in the Catholic Institute was opened for public inspection (Figure 2). The Hall, on the fourth floor of the Grand Opera House, at Vine and Longworth Streets, had acoustics adopted from the new Covent Garden Opera House in London, accommodated nearly 3,000 persons. Notably, Mozart Hall had gas fittings installed by Sullivan & McIntyre connecting to gas fixtures installed by McHenry & Carson.

### **Expanding the Gas Supply Lines:**

By 1869, over 98 miles of gas mains were in operation. The total number of 3,138 gas lamps were now operational, at a cost to the city for supplied (coal) gas, lighting, extinguishing, repairing, and cleaning, of \$123,788. In addition to the (coal) gas lamps, 176 coal oil lamps have been put in operation in Cincinnati's 17th Ward and on Walnut Hills. Eighty-nine (89) new gas lamps have been installed through the city, including five (5) on (lower) Clifton Avenue, west of Vine Street, leading to the Bellevue-Clifton Inclined Railway.

By 1875, 5,771 public coal gas-fueled streetlamps were connected by 186 miles of pipes. The cost to the city for gas supplied, lighting, extinguishing, repairing, and cleaning, of \$194,141. The lamps were lit by lamplighters every night, often using ladders placed against the lamp posts, a practice that persisted through much of this era. Of these, 16 new gas streetlights were installed in Cumminsville (Northside) along **Ludlow Avenue** between Spring Grove Avenue and the Miami Canal, and three (3) in Clifton Heights on **McMillan Street**, west of Vine Street.

in August 1877 Cincinnati Coal Light and Gas Company secured a 10-year franchise from the City with an exclusive right to supply the **Village of Clifton** with gas for public streetlamps on the "moon" schedule. During late 1877 and throughout 1878 **gas mains were laid throughout Clifton** on Ludlow Avenue from Brookline Avenue to John Morrison's gate; on Clifton Avenue; on Lafayette Avenue from Clifton Avenue to Robert B. Bowler's "Mount Storm" gate; on Crescent Avenue from Clifton Avenue to William G. W. Gano's gate; on Resor Avenue (from Clifton Avenue);

on Glenway (Glenmary) Avenue from Clifton Avenue to S. C. Foster's gate; and on Brookline Avenue between Jefferson Avenue and Glenway Avenue. It is highly likely that these owners joined by William and Rueben Resor whose properties had gas line laterals laid to their respective "gates" were not only among Clifton's "modernization movement" of the time, but may also have been investors in Cincinnati's Gas, Light, and Coke Company

By the end of 1880, there were a total of 6,334 gas lamps burning, and a total of 212 miles of gas mains were operational across Cincinnati. The cost to the city for public gas lamps - coal gas, lighting, extinguishing, cleaning, erecting, and re-erecting and keeping in repair - was \$180,728, and the cost for gasoline lamps was \$21,154. The previous contract with the American Gas-Light Company for gasoline lamps had expired and a new 2-year contract was made with Alexander McDonald at the rate of \$22 per lamp per annum for lamps on the all-night schedule, or \$20 per lamp if on the "moonlight" schedule. The "moonlight" table was used for all gas streetlight lighting; as it had been since 1868. Two (2) new lights were installed in Clifton Heights on **Ohio Avenue** from **Clifton Avenue** to McMillan Street and eleven (11) on McMillan Street from Auburn Avenue to Highland Avenue.

By the end of 1890, there were 8,168 coal gas-fueled streetlights burning, and a total of 307 miles of gas mains were operational across Cincinnati. The cost to the city for (coal) gas and lighting, extinguishing, and maintenance services for the streetlamps network was \$183,194.

By 1890, **Clifton** had thirty-nine (39) new gas streetlights installed on **Clifton Avenue**, six (6) on **Howell Avenue**, two (2) on **Morrison Avenue**, ten (10) on **Terrace Avenue** from Morrison Avenue to Whitfield Avenue, and six (6) **Morrison Place**. There were also 1,715 gasoline-fueled streetlights in Cincinnati, with a fuel and maintenance annual cost of \$38,284. Also, there were two (2) gasoline-fueled streetlights on **Clifton Avenue**; one was at the intersection of Riddle Road, and the second at the steps to Cross Street.

At the turn of the 20th century Cincinnati had 376 miles of gas mains in operation. Due to the availability of, and conversion to, electric street lighting, 1,325 gas lamps were discontinued and removed, mostly in the Ninth Electric-Light District within city. The cost to the city for coal gas and lighting, extinguishing, and maintenance services for the network of gas streetlamps was sharply reduced to \$35,729. At the same time there were still 766 gasoline streetlamps burning, a decrease of 815 lamps from the previous year, 1899, all in the Ninth Electric District.

Also in 1900, **Clifton property owners** also deeded parcel portions for an extension of Middleton Avenue, where the roadway was widened, and sidewalks were installed from Resor Avenue to McAlpin Avenue. Other **public works in Clifton** included the Electric Street Railway Company laying tracks, sewerage system construction draining to the Mill Creek, and some granite, asphalt, and brick street and sidewalk paving.

### **Electricity Arrives in Cincinnati in the 1880s - Electricity and Local Natural Gas Discovery Challenge Coal Gas for the City's Gas and Light Supplier Contract**

In the early 1880s electric service arrived in Cincinnati shortly after Thomas Edison introduced the first commercially viable light bulb. Starting around 1882 a major infrastructure expansion occurred laying more gas distribution supply lines and street gas lighting before the arrival of electricity. By 1883, dozens of small electric generating companies sprouted up throughout the city. In 1887 Cincinnati Gas, Light & Coke started acquiring Cincinnati Electric Company stock. Also, starting in 1877 the company navigated two "*Light Wars*" when local natural gas proponents first challenged, and lost, to coal-gas, and when electricity was a looming replacement on the horizon.

In 1888 Cincinnati hosted the *Centennial Exhibition of the Ohio Valley and Central States* in Washington Park where 100,000 electric lights powered by on-site dynamos were showcased. A year later, Cincinnati Gas, Light & Coke Company constructed its own electric generating station adjacent to the company's initial West End Gas Works station.

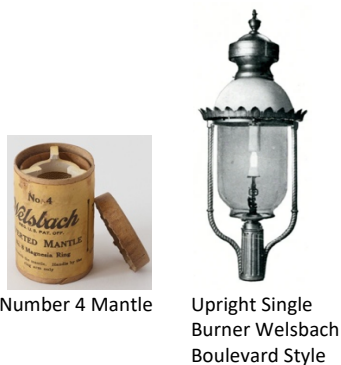
Also, during the 1880s the company constructed the East End Gas Works. The company had acquired a new, low-cost European system of coal carbonization which helped reduce coal gas manufacturing costs.

By 1890, Cincinnati Gas Light & Coke Company had purchased a half dozen local electric companies, becoming Cincinnati's "*electrical power king*." But the 1892 arrival of Cincinnati Edison Electric Company gave Cincinnati Gas Light & Coke renewed competition, leaving the city's electric business divided between the two companies for the remainder of the century. In 1901 a truce was called in Cincinnati's "*Light Wars*" when the city's two major electricity providers agreed to consolidate their operations, merge Cincinnati Edison into Cincinnati Gas, Light & Coke, and rename the corporation the Cincinnati Gas & Electric Company. All the consolidated company's electric production was transferred to Edison's Plum Street Station, built in 1899.

### Arrival of Electric Street Lighting:

However, by 1882, electric lighting was being introduced, marking the beginning of the end of the "*Gaslight Era*". Within six years, there were 6,159 electric poles, 1,517 commercial electric arc lamps, and 2,986 arc lamps on overhead circuits and 54 on underground circuits, as well as 5,078 incandescent lamps. The cost of electricity for the city's lighting of streets and markets in 1888 was \$138,656.

FIGURE 3:



### Welsbach Invents the Upright Incandescent Gas Burner:

The major "improvement" in gas burner technology was the incandescent mantle developed by Carl Auer von Welsbach at the University of Vienna in 1882. The first fabric mantles contained small quantities of radioactive thorium and cerium. In the United States, the *Welsbach Incandescent Gas Lighting Company* had offices in Philadelphia and a factory on the Delaware River at Gloucester, New Jersey. Many of the factory workers were women, who sewed and packed the mantles for sale across the country. Soon the company had sales offices in major U.S. cities, including one in Cincinnati. The Welsbach No. 36 *Boulevard* gas lamp (Figure 3), patented on October 31, 1899, was among the first successful transitions from the square-sided lamp to a round lamp.

### Cincinnati's Gas Streetlight System:

The story of the natural gas-fueled streetlights found today along some of Clifton's and Cincinnati's other neighborhoods' secondary residential streets can be traced back to the mid 19th Century. By 1890 Cincinnati would have an inventory of nearly 10,000 coal gas-fueled streetlamps in Pleasant Ridge, Western Hills, Hyde Park, Avondale, and Clifton neighborhoods, and in the Village of Glendale. But the city's inventory of gas streetlights would fall to 7,362 by 1897. Today, just 1,109 of the city-owned historic gas streetlamps remain.

While some of Cincinnati's oldest gas streetlights date to 1843, but most of Clifton's gas streetlights are considered to have been installed in the Victorian Period from the 1890's. This occurred when the city and the *Cincinnati Gas, Light, & Coke Company* was laying miles of gas supply lines throughout the city.

**Figure 4:**



single upright mantle  
Welsbach burner

This new single upright mantle Welsbach burner (Figure 4, lamp on Clifton Avenue), an efficient gas lamp mantle that was as bright as electric models but only half as expensive, was first tested in 1899 on gas streetlights in Clifton (Clifton Avenue and Ludlow Avenue) and in Avondale (Reading Road), and soon thereafter this Welsbach burner was adopted for the street gas lighting system citywide. (Photo from Cincinnati Historical Society-Clifton Archives)

By the early 20<sup>th</sup>-century Clifton Avenue and Ludlow Avenue were straightened and widened. New globe-topped electric (now LED illuminated) lampposts lined both streets, replacing former gas streetlight. (Figure 5) One portion of the original Ludlow Avenue, renamed Old Ludlow Avenue bordering Dunore Park and the historic Clifton United Jewish Cemetery, was retained in the straightening, and widening process.

**Figure 5:**



Clifton Avenue Looking North, 1896  
Original Gas Streetlight (far right)



(Photo from Cincinnati Historical Society-Clifton Archives)  
Clifton Avenue Looking North, 1906  
Overhead Streetcar electric wires  
Lined with globe-topped,  
Boulevard style streetlamps

## The "anatomy" of the Boulevard style streetlamp anatomy

The elements of the streetlamp - post and lighting source - were inadvertently revealed at Cornell Place and Ludlow Avenue following a collision.



The fractured cast iron post



The Polymer Globe



The LED Element

## PART 2: EVOLUTION OF CINCINNATI'S STREETLIGHTS GAS FUEL SOURCE

- 2.a. Natural Gas Discovery in the U.S.
- 2.b. Lamplighters
- 2.c. Cincinnati's Gas Suppliers Challenges
- 2.d. Local Natural Gas - An Historic Challenger to Coal Gas
- 2.e. Natural Gas Arrives - West Virginia's Pipeline
- 2.f. Supply Pipelines replaced three times in 100 years.

### EVOLUTION OF CINCINNATI'S STREETLIGHTS GAS FUEL SOURCE

#### West Virginia Natural Gas Pipeline Arrives in Cincinnati in 1907

In 1907 Cincinnati Gas and Electric Company's (CG&E) natural gas supplier, Columbia Gas & Electric Company, completed a 183-mile pipeline running from its natural gas sources in West Virginia to Covington and from there a pipeline was on the bed of the Ohio River to connect with Cincinnati's existing coal gas distribution network (Figure 6) guaranteeing the community enough gas to meet demand. Soon afterward CG&E stopped manufacturing coal gas, began using the advertising slogan "*Heat with gas; light with electricity,*" and added gas burners and gas furnaces to the appliances it marketed. The company's business was more profoundly affected in 1907, when natural gas was introduced and quickly adopted in Cincinnati, offering a cleaner and safer fuel than manufactured coal gas with the ability to "*heat twice as fast at half the price*".

The 1907 pipeline was replaced with two 12-inch natural gas lines placed on the bottom of the river in 1947. In 2015, with the end of the useful lives of these two vintage 1947 supply lines drawing near, it was time to replace them. Installing a new connector pipeline took some engineering savvy. The new pipeline, dug by Duke Energy contractors, is 115 feet below the river bottom. Contractors used directional drilling technology. A 2,250-foot path was tunneled through shale and limestone. To install the line, sections of welded pipe were pulled through the opening from Ohio to the Kentucky side by using the same drilling rods that created the new path. Crews accomplished this feat in July 2015. This 16-inch diameter pipeline now services Cincinnati's distribution pipeline system.

#### FIGURE 6:



**Cincinnati's Natural Gas Distribution Lines- 1915**

**Increased Demand for Natural Gas leads to Construction of Gas Storage Caverns in 1917**

CG&E had 500 natural gas customers in 1909. By 1917 CG&E was providing natural gas heating service to 20,000 residential customers. Following an exceptionally cold winter in 1917 which taxed gas supplies, the company constructed stand-by gas (liquid propane) storage caverns to provide reserve capacity for future weather-related and winter peak demands. One storage cavern for propane was mined within bedrock approximately 400' below ground surface at the East Gas Works property. This propane was "flared off" in 2020.

**Cincinnati's First 1843 Gas Light is Replaced by an Electric Light in 1930**

Despite the Great Depression which struck the nation in 1929, CG&E's corporate headquarters were completed in 1930, giving new electrical light to the corner of Fourth and Main in Cincinnati where in 1843 the W. H. Harrison's drugstore had become the company's first commercial coal gas-fueled gaslight customer.

**CG&E Becomes a Publicly-Owned Company in 1946**

In 1946 CG&E went public after Columbia Gas & Electric completed its divestiture of CG&E, and stock held by the former parent was sold to CG&E stockholders and new subscribers.

**Coal Gas, Natural Gas, Oil Gas; Substitutions and Mixtures Abandoned in 1948**

1948 CG&E abandoned the mixing of manufactured coal-gas and natural gas and converted its gas-making equipment at the East Gas Works to produce an oil gas that was interchangeable with natural gas.

**Natural Gas Shortage Scales Back Usage in 1977**

A natural gas shortage in 1977, which forced CG&E to curtail gas usage and require over 400 of its largest customers to scale back their natural gas usage to a bare minimum.

**Cincinnati's Natural Gas Source Diversification Allowed in 1989**

In 1989 CG&E won a settlement with its primary natural gas supplier, Columbia Gas Transmission Corporation, a descendant of CG&E's former parent company. The settlement, worth about \$300 million over 15 years, ended more than 20 cases CG&E had brought against its former parent relating to the supplier's gas pricing practices in the 1980s. As a result of the settlement, CG&E (which as late as 1983 received 100 percent of its natural gas from Columbia) was allowed to diversify up to 80 percent of its gas supply away from Columbia. In the settlement, CG&E also received its own underground natural gas storage facilities for the first time and gained exclusive control of the local pipeline market through a newly won right to buy 32 percent of a feeder pipeline into the Cincinnati market.

#### **Four Interstate Natural Gas Pipeline Companies Supply Cincinnati Starting in the 1990s**

CG&E entered the 1990s looking to new sources of electrical power and new suppliers for its natural gas. During the early 1990s CG&E took advantage of its increased access to low-cost natural gas supplies and began diversifying its supply portfolio to include four interstate pipeline companies. New gas supplies were purchased through both long-term and spot market agreements and from both on-shore and off-shore supplies. The company also gained access to a second gas storage facility, which allowed CG&E to purchase gas at favorable prices and store it for future use. The company has continued to diversify its source of natural gas supplies, leading to a more financially sound natural gas business. At the same time, CG&E has increased its reserve electrical generating capacity, giving the company opportunities for increased electrical sales both inside and outside of its service area.

#### **CLIFTON'S HISTORIC BUILDINGS, DISTRICTS, AND GAS-FUELED STREETLAMP SYSTEM**

Within Cincinnati's Historic Places List, **Clifton has twenty-one (21) registered historic buildings and structures**. These are: (1) the Henry Probasco house at 430 West Cliff Lane, (2) the John Uri Lloyd house at 3901 Clifton Avenue, (3) the William Resor house at 254 Greendale Avenue, (4) Scarlet Oaks at 440 Lafayette Avenue, (5) the Sir Alfred T. Goshorn house at 3540 Clifton Avenue, (6) the Morrison house at 750 Ludlow Avenue, (7) the Rason house at 3767 Clifton Avenue, (8) the George B. Cox house at Brookline and Jefferson Avenues, (9) the Hewson-Gutting house at 515 Lafayette Avenue, (10) the Balch house at 267 Greendale Avenue, (11) the A.E. Burckhardt house at 400 Forest Avenue, (12) Calvary Episcopal Church Sunday School at 3770 Clifton Avenue, (13) the George Hummel house at 3423 Whitfield Avenue, (14) the Probasco Fountain on Clifton Avenue, (15) the Moses Goldsmith house at 356 Bryant Avenue, (16) the Cedric G. Boulter and Patricia Nils house at 1 Rawson Woods Circle, (17) The Freund-Heintz house at 3332 Whitfield Avenue, (18) the Clifton Methodist Episcopal Church at 3418 Clifton Avenue, (19) the German Evangelical Protestant Cemetery Chapel at 3701 Vine Street, (20) Parkside Apartments at 3315-3317 Jefferson Avenue, and (21) the S. Gale and Agnes P. Lowrie house at 20 Rawson Woods Circle.

**Clifton also has two (2) registered historic districts:** (1) the **Clifton Avenue Historic District** with an irregular pattern along Clifton Avenue, and (2) a portion of the **Cincinnati Street Gas Lamp District** comprising 1,109 streetlamps at various locations throughout Cincinnati. In essence, listing by the National Register provides a "*badge of honor*" and opens doors to resources that help preserve a property for future generations.

#### **Gas Streetlights Are Added to Clifton's Historic Building, Structures & Districts List**

In 1978, Cincinnati submitted an inventory and detailed descriptions of its existing gas streetlights and posts system for addition to its existing historic list to the National Register of Historic Places. The descriptions of the approved 1,109 gas streetlights are in the application. Newspaper articles describe support by a number of leading Clifton residents (Tom Fruth and David Lee Smith).

### PART 3: GAS STREET LIGHT TECHNOLOGY EVOLVES

- 3.a. The First Gas Lamp in America
- 3.b. Early Clifton Residents Demanded Gas Street Lighting
- 3.c. London's Windsor Lamp Adopts the Welsbach Gas Burner
- 3.d. The Welsbach Gas Mantles and Lights made in New Jersey; sales office in Cincinnati.
- 3.e. Gas Lamps Designs Obtain U.S. Patent Protections
- 3.f. Clifton Tests Upright Welsbach Incandescent Burners
- 3.g. Clifton's Lamp Fixture Designs
- 3.h. Cincinnati Mayor Forecasts the Era of Electric Streetlights 150 years ago

### GAS STREET LIGHT TECHNOLOGY

#### Evolution in Types of Gas Lamp Burners:

- The first burner used was the **single-jet burner**, which produced a small flame. (Figure 7) The tip of the burner was made of lead, which absorbed heat, causing the flame to be smaller in size. It was discovered that the flame would burn brighter if the metal was mixed with other components, such as porcelain.

Figure 7:



lighted Single-Jet Burner



Single-Jet, stopcock control

- **Flat burners** were invented mainly to distribute gas and light evenly to the systems.
- The **fishtail burner** was like the flat burner, but it produced a brighter flame and conducted less heat.
- The **Welsbach single upright and double mantle inverted** burners were the final iteration in gas lamp burners at the end of the 19th century. The light shed was much brighter, and equal to nearly 50-watts. (Figure 8)

Figure 8:



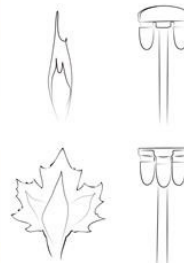
Welsbach Upright Single Mantle



Welsbach Upright Single Mantle Lamp



Open Flat-Flame/Fishtail Burner Lamp



sketches



Welsbach Double Mantle Inverted Burner Lamp

### First Gas Street Lighting Patents, the Windsor Lamp, and the Welsbach Incandescent Mantle

Frederick Albert Winsor, originally Friedrich Albrecht Winzer (born 1761 in Braunschweig, Principality of Brunswick-Wolfenbüttel – died 11 May 1830 in Paris), was a German inventor; one of the pioneers of gas lighting in the UK and France. Three years after Winsor demonstrated the first public gas street lighting in London, England, in 1807, the US Patent and Trademarks Office (USPTO) issued the first patent for gas lighting to David Melville in 1810.

FIGURE 9:



Flat-flame gas burners

In 1817, the open first flat-flame commercial gas streetlight was installed in Baltimore, Maryland. Cincinnati's first coal gas-fueled streetlight supplied by the *Cincinnati Gas, Light, and Coke Company* was lit at Fourth and Main streets in 1843. An enclosed flat-flame gas burner lamp (Figure 9) can be viewed in Clifton on Middleton Avenue

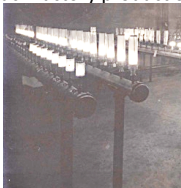
### The First Gas Lamp in America.

Notably, in 1806, a year before the first streetlamp in London, David Melville of Newport, Rhode Island, lit his own house and the front street with "hydrogenous gas" (a.k.a. "coal gas") from burning coal and wood on his premises. Melville was granted the first American gas light patent on March 24, 1810, and a subsequent patent on March 18, 1813, but neither is still extant as the U.S. Patent Office and all its records and models were destroyed by fire on December 15, 1836. (Like all U.S. patents before 1836, they were unnumbered.)

FIGURE10:



Women in the Gloucester, New Jersey Welsbach factory production line.



Welsbach Factory tests Single Upright and Inverted Incandescent mantles.

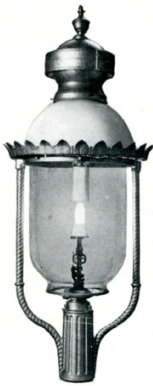
### The Welsbach Gas Mantles and Lights made in New Jersey.

The gas lamp mantle was one of the many inventions of Carl Auer von Welsbach, an Austrian chemist who studied rare-earth elements in the 1880s, and who had been a student of Robert Bunsen ("Bunsen Burner" for chemistry students). Welsbach's first gas mantle contained a mixture of magnesium oxide and yttrium oxide and received a US patent in 1887 (#359,524). Two years later, in 1891, Welsbach received a US patent (#399,174) for a stronger mantle containing a mixture of 99% thorium dioxide and 1% cerium dioxide (both radioactive chemicals!) that gave off a much whiter light. The new Welsbach mantle was commercially available in Europe by 1892 and was widely adopted. Shortly thereafter the Welsbach factory, where mostly women were employed, was established in Gloucester, New Jersey, and sales offices opened in major US cities, including in Cincinnati. (Figure 10)

### London's Windsor Lamp Adopts the Welsbach Gas Burner

In 1898, the William Sugg Company of Westminster, London, England, designed and introduced the "*Windsor Lamp*" (not "Winsor"), the first lantern designed specifically for use with a single upright Welsbach-type mantle gas burner as opposed to an open flat-flame atop a street lamp post. The Windsor lamp was likely named after the place in which it was first used – the Royal Borough of Windsor on Thames, London, England.

**FIGURE 11:**



Upright Welsbach  
Single Burner  
Boulevard Style Lamp

### **Clifton Selected to Test Welsbach Upright Burners:**

Clifton residents were at the forefront of supporting the test of new gas lamp technologies. The *Cincinnati Enquirer* reported on October 10, 1899, a "DEMONSTRATION: OF PRACTICAL VALUE OF INCANDESCENT GAS LIGHTING DESIRED BY THE BOARD OF LEGISLATION", will be conducted in deference to the express wishes of citizens residing in certain suburban districts (specifically Clifton & Avondale). A movement in favor of a return to gas lighted streetlights has emerged. The rationale for this reconsideration was that (1) "great improvements" have been made within the past 3 years (since 1896) in methods of using gas for street lighting, including light intensity and favorable economic factors, and (2) most European cities and many other U.S. cities (Boston, Baltimore, Washington, etc.) have already adopted the modern system of incandescent gas lighting (converting from open flat-flame to Welsbach incandescent upright single mantles) resulting in streets and avenues more brilliantly and uniformly illuminated at less cost than possible by electricity.

Gas streetlights were selected for testing the new upright single Welsbach incandescent gas burner (Figure 11). The tests were conducted in late 1899, when Cincinnati's Board of City Affairs ordered *Boulevard* style globed gas lamps with an upright incandescent Welsbach burner (illustrated above) in place of existing open flat-flame burners. These new incandescent burners were installed on existing gas posts and connected to the coal gas supply.

The 1899 tests were conducted on three of Cincinnati's major streets - two in **Clifton** and one in **Avondale**. In Clifton, **Clifton Avenue** between Ludlow Avenue and north corporation line and **Ludlow Avenue** between Clifton Avenue and the Miami and Erie Canal were the test streets. In Avondale, **Reading Road** (or Main Avenue), Avondale, between Maxwell Avenue and north corporation line was the test location. The test results led to the Cincinnati Board recommending adoption of the "*new Welsbach incandescent mantle technology*" on all the city's gas streetlights because it yielded ten times more illumination than the old open flat-flame burners.

In 1906, the total number of (gas) lamps was 1,926, of which 751 were flat flame burners, which are useless as a streetlamp, and 176 of the flat flame burners were changed to (single upright) incandescent Welsbach burners. Changing the remaining 575 flat flame burner lamps was completed in 1907. The candle power of the (single) incandescent lamps is about 60 while the flat flame is about 12. (5 times more light!) The only difference is the additional cost of about seven mantles per year, as the *Gas Company* charges the same for gas consumption and for lighting and extinguishing for all single burner lamps.

**FIGURE 12:**



Double Mantle  
Inverted Welsbach  
Gas Burner

By the early 20th century, the upright mantle burner, used for the tests, had been modified first to a double mantle inverted (DMI) burner to avoid water vapor condensation in the supply line from gas combustion. The DMI Welsbach incandescent burner markedly increased street illumination (Figure 12). The entire Cincinnati gas streetlight system had DMI Welsbach burners installed in the early years of the 20<sup>th</sup>-century. Today, this DMI style of gas lamp burner, manufactured by American craftsmen sits in the American made lamp fixtures atop Clifton's gas streetlight posts cast by Cincinnati and other American foundries.

## **GAS LAMPS DESIGNS OBTAIN U.S. PATENT PROTECTIONS**

**FIGURE 13:**



In concert with adoption of the new technology Welsbach incandescent mantle, a new lamp fixture was adopted for Cincinnati's gas lampposts. The gas lamp fixtures atop the posts were more complicated to fabricate, requiring skilled crafts persons, than the cast-iron lampposts themselves. These lamps may have originally been either the "Elegant" model illustrated in *Boston's Globe Gas Light Company 1877* catalog, or the *Welsbach Lighting Company's "Boulevard"* model patented in 1899. This model is very similar to the lamps atop many of Clifton's lampposts today (Figure 13) and is specifically referenced in Cincinnati's application for listing of its gas streetlight system by the National Register of Historic Places.

### **Improvements in Gas Streetlight Components and Designs**

Numerous patents were issued in the second half of the 19th century for all manner of improvements in gas lamps, burners, and mantles - including the Welsbach incandescent mantles, and gas lamp post structure, material, and design. Notable among these US patents were (1) #116,234 issued in 1871 to Roland H. Smith of Pittsburgh, PA, for the construction and arrangement of an improved streetlamp post, and (2) #170,451 issued in 1875 to Edward S. Ritchie of Brookline, MA, for improvements by incorporation of parabolic and flat mirrors in the collection and projection of light from lantern burners used to illuminate streets or other public or private ways and places. This latter improvement is not found on Clifton's gas lamps.

Today, many of Clifton's gas lamp assemblies atop the 255 lampposts are the 1899 patented "Boulevard" Style No. 36 marketed by the *Welsbach Light Company*, while other lampposts such as those at the end of Cornell Place, Morrison Place, and along Middleton Avenue feature a similar "Windsor" style lamp fixture designed by Shaw & Sanderson of the *Pennsylvania Gas Globe Light Company* (U.S. design patent #31,745, October 31, 1899). This patented design is described as "a harp which comprises a base and two arms having surface ornamentation and being surmounted by a crown-like ring (b), ornamented with leaf-like forms from which supports an inverted bell-shaped structure, of which the skirt encircles the base of the harp. From the crown-like ring rises a dome, which is surmounted by an ornamental cap...". In Clifton, and throughout the Cincinnati gas streetlight system, the gas lampposts, since 1899, have been topped by these "Boulevard" style lamps, similar in design to the original British "Windsor" style lamps.

**FIGURE 14:**



Clifton's Historic Clock  
Retrofitted LED Lamppost

Beside Clifton's historic 1909 firehouse-engine 54 building at corner of Ludlow & Clifton Avenues the vintage village clock, restored by funds from the Clifton Community Fund, keeps time beside a late 19<sup>th</sup>-century retrofitted historic gas lamp curiously enclosing an 18<sup>th</sup>-century frosted kerosene hurricane lamp chimney (Figure 11). The streetlight is today lighted by an internal overhead light emitting diode (LED) on an automatic timer.

**Early Clifton Residents Demanded Gas Street Lighting:**

If Clifton's gas lamppost numbers tell a story of Clifton's early residential development and its residents' demand for night lighting, it is this. Gas streetlights followed the network of gas supply lines laid by the *Cincinnati Gas, Light, and Coke Company*, and in Clifton this likely meant that the earliest gas streetlights were installed along Clifton and Ludlow Avenues. None of these gas streetlights remain today.

## PART 4: CINCINNATI'S HISTORIC BUILDINGS AND CLIFTON'S GAS STREETLIGHTS

4.a. Where Are Clifton's Gas Streetlights Today? (APPENDIX B)

4.b. Twenty-One Gas Lamppost Designs

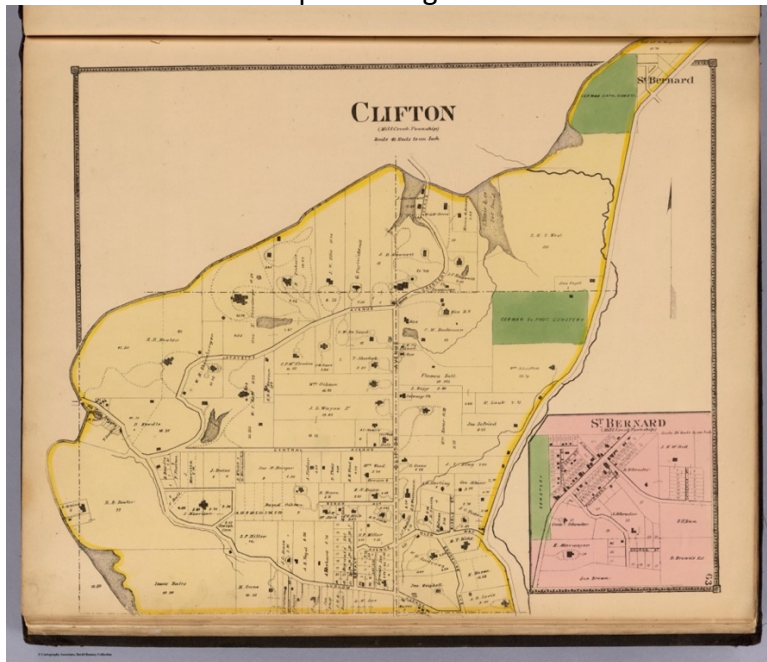
4.c. Lamppost Foundry Marks

4.d. Gas Streetlights Are Added to Clifton's Historic Building, Structures & Districts List

4.e. Residents Petition City to Keep Clifton's Gas Streetlights Burning

**[Historic Note:** In 1838 William G. W. Gano had purchased land in Section 16 (in the "School Section") and built a house reached by Crescent Avenue, a private road which curved easterly and northward from Lafayette Avenue and Clifton Avenue. He was the first of a new wave of Clifton inhabitants, people who worked in the city and commuted to their homes. A few commercial establishments appeared at the corner of Ludlow and Clifton Avenues and a regular horse-drawn omnibus line, on which for 12 cents one could take the one-hour ride from Sixth and Main downtown, to Clifton and Ludlow. In 1844 the first school in the area was erected, a log cabin on a quarter-acre donated by Gano (just behind 4030 Clifton Avenue), and in 1848 the first local church was established. The Village of Clifton was incorporated in 1850 because of the efforts of Flamen Ball, a law partner of Salmon P. Chase. The 1,200-acre village had 40 families, which had increased by 1856 to 87 families for a total population of 585.]

**FIGURE 15:** 1869 Clifton Map with original street locations and names.



**FIGURE 16: Map of Clifton's Gas Streetlights**



Data from a recent study of Cincinnati's gas streetlights are found in the URL below. Table S1 contains latitude and longitude information for all natural gas streetlights identified within the Cincinnati city limits. Table S2 contains methane emission rates measured from a subset of natural gas streetlights in Cincinnati. Measurements were made by Dr. Amy Townsend-Small and her students. The entire map of Cincinnati's gas streetlight system locations, including those in Clifton and the associated data can also be viewed at <https://www.google.com/maps/d/edit?mid=1oEm033LLFI0KN3wIYVYyjkjUUCmxsF0&usp=sharing>

**WHERE ARE CLIFTON'S GAS STREETLIGHTS NOW? (See Appendix B)**

The majority of the earliest numbered gas lampposts (5000 to 5099) are in the historic "center" of Clifton, on residential streets North and South of Ludlow Avenue, West of Brookline Avenue, and East of Morrison Avenue. (Figure 12 and/or Appendix B)

Numbered gas streetlights can be found on Morrison Avenue (5000-5005), Wirham Place (5006-5007), Gano Avenue (5008-5011), Lyleburn Place (5012-5017), Howell Avenue (5021-5028), Whitfield Avenue (5030-5040), Evanswood Place (5041-5044 and 5055-5064), Cornell Place (5045-5054), Morrison Place (5065-5069), Old Ludlow Avenue (5070-5074, 5078), Dunore Road (5075-5076), Crooked Stone Road (5077), Thrall Street (5085-5088), Telford Street (5089), and Senator Place (5092, 5097-5099).

[**Historic Note:** The first "small lot" subdivision in Clifton occurred in 1851, when Brookline Avenue, Glenmary Avenue, and Biddle Street were constructed.]

The second wave of gas streetlight installations (numbers 5100 to 5199) likely illuminated two more of Clifton's residential districts. These two sectors are located (1) **between Middleton & Clifton Avenues** - North of Ludlow Avenue to Resor Avenue between Middleton and Clifton Avenues, and (2) **anchored by Brookline Avenue** - North of Jefferson Avenue to Biddle Street and Interwood Place and East of Clifton Avenue.

These gas streetlights can be found on Shiloh Street (5100-5102), Middleton Avenue (5103-5112) from Ludlow Avenue to Resor Avenue, Resor Avenue (5113-5118) from Middleton Avenue to Clifton Avenue, Resor Avenue (5119 to 5121) from Hedge Row to Middleton Avenue, Hosea Avenue (5170-5172) from Bishop Street to Brookline Avenue, Wentworth Avenue (5163-5165), Oxford Terrace (5173-5175), Biddle Street (5187-5190), Interwood Place (5191-5194), and Interwood Avenue (5195-5198).

[**Historic Note:** By 1870 Clifton's population was just over 1,000, due partly to a third influx of people, most of whom had grown wealthy because of their enterprises supporting the Civil War. The center of population was the corner of Clifton and Ludlow Avenues.]

The final round of Clifton's remaining gas lampposts (numbers 5200 to 5450) was installed in two additional residential sectors: (1) **North of Central (McAlpin ) Avenue toward Lafayette Avenue**, and (2) on **both sides of Clifton Avenue from Central (McAlpin) Avenue to Lafayette Circle & Avenue**.

Notably, six additional lampposts to the six already extant were installed on Senator Place (5225-5228), and then on Middleton Avenue (5251-5258) from Warren Avenue to Lafayette Avenue and later (5366 to 5372) from McAlpin Avenue to Warren Avenue. Other gas lampposts were installed on Loraine Avenue (5205-5211), Brookline Avenue (5211-5218), Hosea Avenue (5219 to 5225, a duplicate number on Senator Place) from Brookline Avenue to Clifton Avenue, Greendale Avenue (5231-5239), Warren Avenue (5240-5250), Middleton Avenue (5251-5258) from Warren Avenue to Lafayette Avenue, Lafayette Circle (5259-5282) from Middleton Avenue across Clifton Ave, Lafayette Avenue (5305-5338) from Middleton Avenue to McAlpin Avenue, and lastly on Crestmont Lane (5450).

[**Historic Note:** from the Welsbach Corporation ledger entries: **Lafayette and Middleton Avenues: Gas Streetlamps Temporarily Discontinued:** In the spring of 1923, twenty-nine gas streetlamps were ordered discontinued on portions of Lafayette and Middleton Avenues, presumably because of repairs or utility installations on these streets, since twenty-one of these lamps were re-installed and re-lit on October 1, 1925.]

[**Historic Note:** from the Welsbach Corporation ledger entries: **Newer Clifton Gas Streetlamps: Installed between 1947 and 1952:** Major installations of new gas streetlamps occurred between 1947 and 1951 along Woolper, McAlpin, and Lafayette Avenues, and on the streets bordered by or connecting to Clifton, Jefferson and Glenmary Avenues and Bishop Street. From 1948 to 1952 new gas streetlamps were also installed in the Amazon Park subdivision along Amazon and Egbert Avenues.]

Lamppost numbers missing in the above sequences may have been installed in other Clifton residential streets, but later removed - possibly those along Clifton and Ludlow Avenues outside the Business District. The lamppost numbers for original lampposts on Clifton and Ludlow Avenues are not in Cincinnati's gas streetlight system inventory, as these have either been

removed or retrofitted with electric lights. There are no gas lampposts on either Clifton or Ludlow Avenues today.

Historical records (as noted previously) indicate that gas lampposts were located along Clifton Avenue from Ludlow Avenue to the North corporation line and along Ludlow Avenue from Clifton Avenue to the Miami and Erie Canal (current terminus of Central Parkway). At the turn of the 20<sup>th</sup>-century gas lampposts along these two major streets, as well as on Reading Road in Avondale, were selected for testing the new Welsbach upright single incandescent mantles. These mantles provided much brighter illumination than the open flat-flames fueled by the city's coal gas that existed previously and subsequently were adopted for the city's entire gas streetlamp system. All gas streetlamps on these two major avenues in Clifton were removed and replaced with electric streetlights over a five-year period from 1922 to 1927.

**[Historic Note:** From the Welsbach Corporation ledger entries: **Clifton Avenue: Gas Streetlamps Removed from Ludlow to Spring Grove Avenues:** In October 1922, two gas streetlamps on the Clifton Avenue at the Mill Creek Bridge were removed. In December 1923, six gas streetlamps were removed on Clifton Avenue between Lafayette Avenue and the Mill Creek. In October 1924, all gas streetlights along Clifton Avenue between Ludlow and Lafayette Avenues were ordered removed. This removal included twenty-seven single upright burners and two double inverted burners along Clifton Avenue between Ludlow and Warren Avenues, and nine more gas lamps between Warren and Lafayette Avenues. In June 1927, the last four lamps along Clifton Avenue from the Mill Creek Bridge to Spring Grove Avenue were permanently removed.]

**[Historic Note:** from the Welsbach Corporation ledger entries: **Ludlow Avenue: Gas Streetlights Removed from Clifton to Lafayette/McAlpin Avenues:** Beginning in 1925 and continuing to 1927, more than thirty-five gas streetlamps were removed from Ludlow Avenue from Clifton Avenue to Lafayette/McAlpin Avenues. The gas streetlamp at the corner of Ludlow and Whitfield Avenues was the first to be removed on January 1, 1925. Next, sixteen gas streetlamps were discontinued on Ludlow Avenue (between Lyleburn Place and Lafayette/McAlpin Avenues) in December 1926. The final thirteen gas streetlamps on Ludlow Avenue (in the current central business district) between Clifton Avenue and Lyleburn Place were removed in June 1927.]

full ivy, flutes, smooth, & ringed  
Clifton Gas Lamppost Designs

FIGURE 17:

LAMPOST DESIGNS



**Twenty-One Gas Lamppost Designs**

Cincinnati's 1,109 gas lamppost system includes many post designs (Figure 16). Many of these early cast iron lampposts feature decorative vines, leaves, berries, and flowers, but often these details are difficult to see due to encrusted layers of paint. In fact, 21 specific lamppost designed are found in Cincinnati's gas streetlamp system. The original lampposts are cast iron while some newer lampposts are cast aluminum. More than half, approximately 544, of the lampposts are tapered and fluted. The next most common types are 195 "full ivy" posts, then 81 "composite" posts, then 68 "half ivy" posts, while the few remaining posts have different designs. The city's 1978 application to add its gas streetlight system to the National Register of Historic Places asserts "*all posts for the gas lamps were manufactured circa 1895.*"

**FIGURE 18:  
LAMPPOST FOUNDRY MARKS**



**Clifton's Lamppost Foundries & Foundry Marks**

The manufacturers of some of Clifton's gas lampposts can be ascertained by visible foundry marks (Figure 17). Among Cincinnati's foundries whose lampposts can be found along Clifton's residential streets are those manufactured in the late 19th-century by the *Hoefinghoff & Laue Foundry Co.* (Forest Avenue at the Cincinnati, Lebanon, and Northern Railway in East Norwood) and the *Hoefinghoff & Wolf Foundry*. Other cast iron gas lampposts found in Clifton were made by the *J. Nash Company Foundry* (Carr Street, Cincinnati) and the *Addyston Pipe & Steel Co.* (A.P. & S. Co.). Other lampposts have been manufactured by St. Louis's *Banner Iron Works*, *KKC Mfg. Co.* and *LCL Co.*, and still others by *Welsbach Street Light, Inc. of America*, and *American Gas Lamp Works, Pittsburgh, PA.*

**FIGURE 19:  
CLIFTON'S LAMP FIXTURE DESIGN**



Boulevard/Windsor Lamp style

**Lamp Design and Cincinnati's Gas Lamp Manufacturers**

The city's 1978 application to add its gas streetlight system to the National Register of Historic Places notes that *"The lamp fixtures have been replaced over time and very few of the original Boulevard fixtures remain identified."* Reproduction Boulevard and Windsor style lamps are found today on all lampposts (Figure 18). There were several Cincinnati gas lamp and lantern factories by the late 19th-Century including *Alba Lamp Co.*, *Clipper Manufacturing Co.*, *McHenry Co.*, *Post & Co.*, *Queen City Lamp Co.*, as well as offices of the *Welsbach Lighting Company.*

## REPLACING COAL GAS

### Natural Gas Discovery in the U.S.

It is likely that both indigenous peoples and the early white explorers probably knew natural gas existed in the Ohio Valley. By 1825 natural gas was being used as a novelty, and in the 1840's gas from Pennsylvania and West Virginia wells was used in those locales to evaporate salt brine (making salt). Even after the discovery of petroleum (1859) at Titusville, Pennsylvania, investors generally regarded gas as useless, for at the time there were no methods for transporting the fuel to the bigger urban centers. Natural gas was therefore not used for general industrial purposes until about 1883.

## FIGURE 20:

### LAMPLIGHTERS



Women were employed as gas lamplighters during WWI

**Lamplighters:** In 1875 the Cincinnati city council contracted with the *Globe Light Company* to hire lamplighters to light and extinguish street gas lamps at a rate of \$29 per lamp a year. Difficulties soon arose. The wind frequently blew out these open flat-flame streetlights. Engineers struggled for years before they solved the problem by using a new kind of glass globe-enclosed burner. The gas streetlamps were lit each evening and extinguished each morning by a lamplighter (Figure 19). Today, all Clifton's gas streetlamps fueled since 1907 by natural (methane) gas shine 24-hours a day, each with dual inverted Welsbach incandescent mantles.

## HISTORIC GAS SUPPLIER CHALLENGES

### Locally Sourced Natural Gas - Challenging Locally Generated Coal Gas:

Two competing forces emerged in Cincinnati in 1899 as suppliers of lucrative gas supply contracts for the streetlights and households. One long established company, *Cincinnati Gas, Light, & Coke Company* headed by (General) Andrew "Andy" Hickenlooper, had held the city contract for decades, providing "coal gas" from its generating plant as a public fuel and a street lighting source. The newer company, the *Cincinnati Natural Gas and Illuminating Company*, having discovered pockets of natural gas along the Mill Creek valley floor, proposed the replacement of "coal gas" with "natural gas". A natural gas reservoir had been discovered in Cumminsville in 1870, the *Fleishmann Distillery* near Sedamsville struck sufficient gas in 1880 to illuminate its factory, and a well in Cincinnati's West End produced commercial natural gas quantities.

The contest for the city contract to supply gas came to a head on July 27, 1899, before the *Committee on Light of the Board of Legislation*, when the *Cincinnati Natural Gas and Illuminating Company* challenged the *Cincinnati Gas, Light, & Coke Company*. The cost of gas per thousand cubic feet, the illumination (typically 16 candle power) provided by the gas, and the duration of

the fixed price contracts were the points of comparison. Cincinnati's coal gas forces prevailed until 1909 when a (methane-rich) natural gas pipeline from the West Virginia wells arrived.

## **NATURAL GAS TO THE RESCUE**

### **West Virginia's Natural Gas Pipeline Arrives:**

The inflection points for the transition from coal gas to natural gas for Cincinnati's street lighting, homes and businesses occurred around 1905. The demand for locally manufactured ("coal") gas became so great that executives of the *Cincinnati Gas & Electric Company* (est. 1895) discussed the possibility of bringing natural (methane) gas to the city. To do this more capital was needed. In the following year the *Union Gas & Electric Company* was organized, leased all property of the *Cincinnati Gas & Electric Company*, and prepared to build a pipeline from West Virginia to supply Cincinnati's growing demand. Three important challenges presented by this goal were: (1) a substantial outlay of capital, (2) purchase of sufficient wells, and (3) construction of a pipeline. The project involved laying a high-pressure 20-inch diameter pipeline from West Virginia gas fields across more than 185 miles of Kentucky lands to end in Covington. The *Columbia Corporation*, later the *Columbia Gas & Electric Company*, was formed on September 11, 1906, and its subsidiary, *Cincinnati Gas Transportation Company*, built and finished the gas line serving Cincinnati in June 1909.

In 1909, a large 183-mile-long pipeline from West Virginia's gas wells to Covington, Kentucky, first delivered natural gas to the city's existing network of distribution lines through pipelines laid across the bottom of the Ohio River. Notice of the arrival of natural gas was made by flaring the gas atop a 75-foot-high pipe visible by Cincinnati residents. The arrival of natural gas delivered by the West Virginia pipeline sounded a death knell to the city's coal gas era.

Everything was now in ready for substitution of "natural" gas for the "artificial" coal gas product, according to Secretary W. T. Hunter, of the *Columbia Company*. Soon thereafter, thousands of Cincinnati's homes were using natural gas for cooking and lighting, and hundreds of the city's streetlights, including those in Clifton, were illuminated by "natural" gas light.

*On June 25 the Cincinnati Post announced: "A flaming torch, one hundred feet in height, at the foot of Greenup St., Covington, Kentucky, will proclaim to the citizens of Cincinnati the turning on of natural gas Wednesday night. The actual turning on of the gas into the pipes of Cincinnati will not take place until Thursday morning. A standpipe is being erected on the Kentucky side of the Ohio River opposite Walnut St., from which the huge flame will burn Wednesday night from darkness until midnight. It will make light the territory for miles around. . . ."*

## **CINCINNATI MAYOR FORECASTS THE ERA OF ELECTRIC STREETLIGHTS 150 YEARS AGO**

### **In 1877, Cincinnati's Prescient Mayor Foresees the Future Electrification of Gas Streetlights:**

Robert M. Moore, Cincinnati's mayor in 1877, noted in his annual report to the Common Council that the city had recently acquired title of the "*Paris of America*". This prescient forecast occurred a decade before the *1888 Centennial Exhibition of the Ohio Valley and Central States* held at Cincinnati's Washington Park where 100,000 electric lights were on display. He then offered the following comments on the status and likely future of the city's street lighting. One idea was to change from coal gas to gasoline, another was to await electricity.

*"The existing contract with the gas company (Cincinnati Gas, Light and Coke Company) requires the city to pay a certain rate, fixed by the price in certain other cities; but we are not forced to use any quantity; we may light as many lamps or as few as we please. A vast saving, probably \$150,000 per annum, might be made*

*by using coal oil on all the streetlamps, and I believe it would be advisable in the times of high taxes, for Council to advertise for proposals to light the streets with gas, gasoline, or otherwise; and to make a contract in whichever way would be cheapest. It seems to me that, as the city now owns the lamps and lamp-posts (valued at \$75,000), it would take but very little to change the lamps to burn gasoline, when the lamps could be lighted for less than twenty dollars each, the year round. If individuals find it much cheaper to discontinue gas and burn gasoline, why not the city do likewise?"*

And the mayor goes on to make a forecast of the conversion of street lighting from gas to electric. "I make the prediction that it will not be long until all our streets will be brilliantly lighted by suspended (electric) lights at proper elevation, supported from the four corners of the streets forming intersections, so as not to interfere with public travel; and will be so arranged as to throw a flood of light in four directions as will brilliantly light up the streets in many squares."

He further suggests that the city adopt a "wait-and-see" position regarding the future fate of the city's gas streetlights. "The immense strides now being made in the development of the electric light for personal and public use, is a matter worth thinking of in this connection. This summer will see this matter tested and developed at the Paris Exhibition, and we shall also see experiments carried on in Cincinnati, which will show the practicality and utility of this method of lighting - in fact, one machine is in private use in this city at present. there are also improvements being made which cheapens the cost of coal gas, and altogether I believe it would be unwise to make any contract for lighting the streets for a longer period than one year."

To justify his recommendation, the mayor referenced a 10-year city ordinance that took effect on January 1, 1870, whereby coal gas would be purchased by the city for use in public buildings and by citizens or private consumer at \$2.52 per 1,000 cubic feet and would expire on January 1, 1880.

## **KEEPING THE GAS SUPPLY FLOWING**

### **Cincinnati's Natural Gas Supply Lines Replaced Three Times in 100 Years.**

Approximately four decades later, in 1947, two replacement 12-inch natural gas lines were laid across the bottom of the Ohio River at Covington, Kentucky, to service Greater Cincinnati's homes, businesses, and gas streetlight system. And then two decades on, in 1965, these 1947 exposed gas supply lines were replaced by Cincinnati Gas and Electric Company when it drilled under the Ohio River and installed two new pipelines connecting to the main natural gas line in Covington, Kentucky. Most recently, in 2015 - five decades after the last supply lines were laid, Duke Energy connected a replacement pipeline under the Ohio River from Covington to Cincinnati. The 2,281-foot pipeline was drilled through bedrock to avoid potential river traffic risks, ensuring enhanced reliability.

## **CLIFTONITES DEMAND GAS STREETLIGHTS REMAIN**

### **Residents Petition City to Keep Clifton's Gas Streetlights Burning:**

In the 1950s, Cincinnati decided against timers in favor of leaving the gas streetlights burning all day and night. In 1960, residents of Clifton and other neighborhoods successfully petition city officials against removals and replacements of gas streetlights with electric alternatives, viewing gas streetlights as symbols of historic charm and community identity. By 1962, Cincinnati City Council established a policy to maintain gas lamps unless most street residents petitioned for their removal, a direct response to this grassroots pressure.

## **PART 5: LOOKING FORWARD**

### **5.a. Cincinnati Monitors Operating & Maintenance Costs for its Gas Streetlight System**

- 5.b. Greenhouse Gas Emissions Measured from Natural Gas-fueled Streetlamps
- 5.c. Clifton's Streetlight Changes in the 20th Century
- 5.d. Clifton & Ludlow Avenue Removals & Replacements
- 5.e. Streetlight Retrofits on Ludlow Avenue
- 5.f. Overhead High Pressure Sodium (HPS) and Light Emitting Diode (LED) streetlighting

## COSTS TO OPERATE AND MAINTAIN GAS STREETLIGHT SYSTEM

### Cincinnati Monitors Operating Costs for its Gas Streetlight System

in 1894, Cincinnati was paying \$185,977 for coal gas and gasoline supplied to public lamps and for lamplighters to light and extinguish gas lamps daily, and others to repair, clean, erect or re-erect of gas lamps. Three years on, in 1897, the combined cost of coal gas and gasoline for the city's streetlamp system had barely budged, an 0.03% increase, to \$186,036, due to a fixed price contract with *Cincinnati Gas, Light, and Coke Company*. More than a century later, in 2015, the annual natural gas bill for Cincinnati's gas streetlight system was \$136,500, or approximately \$124 per lamp - nearly double the cost of equivalent electric lighting - paid through a fixed fee to Duke Energy without individual gas streetlight metering. The City also contracts with the *Cincinnati Gaslite Company* of Elsmere, Kentucky, for annual repairs and maintenance of its gas streetlight network. This contract is estimated to be more than \$200,000 annually. The combined gas and service contract cost is therefore over \$300,000 annually.

## THE ENVIRONMENTAL COSTS OF GAS STREETLIGHTS

### Greenhouse Gas Emissions Measured from Natural Gas-fueled Streetlamps:

So-called "natural" gas is a mixture of hydrocarbons - primarily of methane (CH<sub>4</sub>), with smaller amounts of ethane (C<sub>2</sub>H<sub>6</sub>), propane (C<sub>3</sub>H<sub>8</sub>), butane (C<sub>4</sub>H<sub>10</sub>), and pentane (C<sub>5</sub>H<sub>12</sub>) - as well as non-hydrocarbons - nitrogen (N<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), hydrogen sulfide (H<sub>2</sub>S), and water vapor (H<sub>2</sub>O). An odorant that smells of rotten eggs is added before delivery so gas leaks can be detected. Incomplete combustion of natural gas can release methane, a potent atmospheric greenhouse gas, when natural gas burned incompletely or when it is leaked without combustion from all the City's streetlamps.

In 2025, a University of Cincinnati research team measured methane emissions from approximately 10 per cent of the system's gas streetlights. Their results, extrapolated to the entire 1,109 gaslight system, were summarized in an article in *Cincinnati Magazine*. The team estimated that approximately 18 tons of methane was released into the atmosphere by the gas streetlight system; equivalent as a "greenhouse gas" to nearly 500 tons of carbon dioxide or 1 million miles driven in a gas-powered automobile. And while emission of carbon dioxide from natural gas combustion is often a talking point, natural gas combustion is said to emit 45% less carbon dioxide than that required for the equivalent electricity generation.

## EVOLUTION: RETROFIT and REPLACE CLIFTON'S GAS STREETLIGHT BURNERS

### Clifton's Streetlight Changes in the 20th Century: Removals, Replacements, and Retrofits

The 1975 Clifton Plan urged the city to "maintain the existing gaslights and electric boulevard lights throughout Clifton."

**FIGURE 21:**  
Ludlow & Clifton Avenues  
Globe Streetlights



All original gas streetlamps used in the 1899 test of the new upright Welsbach incandescent lamp along Clifton Avenue - North and Electric Boulevard Lights

South of Ludlow Avenue - and on Ludlow Avenue - from Whitfield Avenue to McAlpin Avenue - have been removed and replaced with visually attractive, day-night timed round white globe incandescent "boulevard" lamps. This type of streetlight is also found on Rawson Woods Circle and on Belsaw Place. The supplier of these Boulevard style streetlights may have been the *Cincinnati Electric Railway Company* (Figure 21).

**FIGURE 22:**  
Ludlow Avenue 's  
Retrofit LED Streetlights



All original gas streetlamps in Clifton's Business District (a.k.a. *Clifton's Gaslight District*) have been remounted on concrete pedestals and retrofitted with two different electric LED lighting types. About half of these electrified LED streetlamps contain a frosted hurricane lantern glass chimney; an apparent nod to the 18<sup>th</sup>-century oil/kerosene era before gas was available. The other half have what appears to be an inverted cylindrical internal LED fixture. Newer 30-Watt 3,000 Kelvin LED historic streetlight replicas can be seen on Clifton Ridge Drive. (Figure 22)

The remaining 255 natural gas-fueled streetlamps on Clifton's residential streets are positioned in a zig-zag pattern on alternate sides of the street at approximately 100-foot intervals and provide dim night lighting for all who walk along the sidewalks. The double mantles burn 24 hours a day and the illumination varies considerably due the uneven clarity of the Plexiglas globes. Plexiglas clarity can age over time, eventually becoming yellowed, reducing the light from the gas burners. In cities like Cincinnati, gaslights dating back to the late 1800s require durable, sometimes modern materials to keep the lamps operational in today's environment. Modern, high-performance acrylics are used to retrofit or maintain these historic lamps, providing a protective, clear housing for updated, more efficient lighting elements. In summary, properly specified Plexiglas housing on gas streetlights is designed to prevent, or significantly delay, typical degradation such as yellowing, embrittlement, and loss of transparency, making it suitable for long-term outdoor service.

The origin of the zig-zag gas streetlamp pattern on Clifton's streets can be traced to a royal decree regarding public street lighting issued in Stockholm, Sweden, in 1749. The decree ordered property owners to keep lanterns lit during dark (winter) months from dusk to midnight, except on bright moonlight nights. Lanterns were to be placed in a zig-zag pattern from one side of the street to the other with at most 30 steps (circa 75 feet) between. This order for citizen participation stood until electric lighting was installed in 1929. Gas street lighting was turned off in Stockholm, Sweden in 1941.

**FIGURE 23: Clifton's  
Overhead Streetlights**



**HPS Streetlight**



**LED Streetlight**

The 1975 Clifton Plan encouraged the city to replace "unattractive" overhead streetlights with "attractive" fixtures. Today, beyond the gaslit streets, timed high-pressure sodium (HPS) and light emitting diode (LED) overhead lights illuminate Clifton's other residential

streets. On Ludlow Avenue, from McAlpin Avenue to the viaduct leading to Northside adjacent to Cincinnati State University the streetscape is bathed in the HPS yellow-orange light. A similar combination of overhead streetlight "luminaires" illuminates the night on Jefferson Avenue, on Clifton Avenue North of Lafayette Avenue (formerly Crescent Avenue which curved easterly and northward from Lafayette Avenue and Clifton Avenue, see Figure 19, 1869 map), and on Woolper Avenue throughout McAlpin Avenue (formerly Central Avenue). These main arterial roadways are lighted by a combination of timed LED and HPS fixtures mounted on arching frames anchored to telephone poles. The fixtures are owned and maintained by Duke Energy. (Figure 23)

### **Transition in Gas Streetlighting to Electrification leading into the 21st Century.**

By the early 20th century inventors, entrepreneurs, and manufacturers were receiving patents to light and extinguish gas lamps remotely or with timers, safety features such as automatic cut-off valves, better gas control valves, and improved ways to handle moisture resulting from gas combustion. In the era of electricity and the incandescent filament light bulb starting in the last decade of the 19th century and continue into the 20th century the U.S. Patent and Trademark Office (USPTO) issued numerous patents for electric streetlights and electric conversions of existing gas streetlights.

#### **PART 6: THE NEXT REVOLUTION IN STREETLIGHTING HAS ARRIVED**

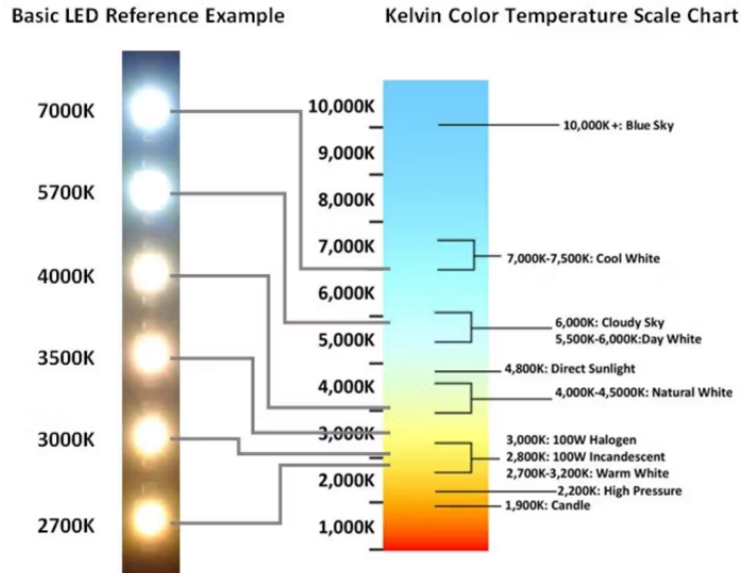
- 6.a. Gas Streetlights are Converted to LED in Cities Worldwide
- 6.b. U.S. Cities Convert Gas Streetlights to LED
- 6.c. Cost Estimates to Convert Gas Lamps to AC Electric or Low Voltage DC LED Illumination.
- 6.d. Clifton's Gas Streetlights Future - Cincinnati's DOTE Budget and the 2023 Green Plan
- 6.e. Clifton Town Meeting - 2026 Clifton Plan - Clifton's Community Actions
- 6.f. Gas-to-LED Conversion Cost Estimates and Return on Investment
- 6.g. Dark Sky International Guidelines
- 6.h. Enjoy Clifton's Streetlights and Report Gaslamp Outages

#### **THE NEXT REVOLUTION IN STREETLIGHTING - CLIFTON'S GAS STREETLIGHTS TOO?**

##### **Converting Gas Lamps Worldwide to Low Voltage LED Illumination.**

The 2014 Nobel Prize in Physics was awarded to three Japanese scientists for the invention of efficient blue light-emitting diodes (LEDs). This breakthrough which occurred in the early 1990s enabled bright, energy-saving white light sources, transforming modern lighting technology and facilitating the creation of white LED lamps. Subsequent changes to the chemistry of the LED made possible the 3K (3,000 Kelvin) streetlight which produces a **warm white** light with a slight yellowish or soft white hue. This was achieved by using **indium gallium nitride** (InGaN) with specific yellow and red phosphors to convert blue light to a warmer ~3,000K spectrum. This color temperature is increasingly popular for historic applications because it provides a comfortable atmosphere while still offering enough brightness for visibility. (Figure 24) An LED and Kelvin color comparison chart can be found in Appendix C.

**FIGURE 24: LED & Kelvin Color Comparison (see Appendix C)**



Subsequent inventors have enabled this gas-to-LED "lighting revolution" by turning their attention to designs and methods to electrify historic vintage gas streetlamps with a low voltage direct current supply for light emitting diodes (LED). One such invention for a "post gas lantern energy conversion device" was issued a U.S. patent in 2007 to Mark Young of *Charm-Lite, Inc.*, Anderson, Indiana. The patent describes a method to convert natural gas-powered streetlamps and/or 110 voltage post lantern lights to 12-volt or 24-volt direct current electric energy. This patent adapts the existing gas lamp double Welsbach mantle support assembly following a method to replace gas or 110 electric fixture components with inverted bulb low voltage bulbs following the invention's wiring procedure.

Soon, cities worldwide began converting not only their high-pressure sodium (HPS) and mercury vapor (MV) overhead streetlights, but also their historic gas streetlights to LED illumination at a record pace. London, England, Berlin, Germany, Wellington, New Zealand, as well as the first gas streetlight cities in America - Baltimore and Boston - have either completed or are undergoing the conversion. Phoenix, Arizona, claims to have replaced more HPS and MV streetlighting with LED, 100,000 total, than any other US city. Overhead LED streetlights are replacing HPS and MV lamps at a record pace. Los Angeles claims the world record.

Global streetlight conversion to LED is rapidly accelerating from 3% of market share in 2013 to a projected 87% by 2030 when 90% of streetlights worldwide are projected to be LED offering a 40-60% energy savings, lower maintenance, and improved light quality. The shift includes massive, city-wide retrofits in major cities worldwide. Smart controls, which add 10-30% more energy savings, are growing, with 32.9 million installed at the end of 2024, and over 100 million smart streetlights expected by 2030.

Community input and myriad considerations have been researched including night sky illumination, bird migratory effects, reproduction effects, all manner of behaviors of myriad natural species in the natural world. The outcomes of these various stakeholder and expert inputs have been conversion from gas to LED with a small number (as few as one in Baltimore, and four in Westminster, London, England) gas lamps protected and preserved as historical objects.

*Dark Sky International* (<https://darksky.org/>) make the following recommendations concerning conversions to LED lighting. "Better for the environment" should also consider the impact of

LED light (avoid blue light) on plants, animals, and human health. LED technology has a lot of potential to reduce light pollution – if it’s done right. Their 5-point guiding principles for outdoor lighting are (1) use light only if it is needed, (2) direct the light to where it is needed, (3) use only as much light as is needed, (4) provide lighting only when needed, and (5) use only warm-colored light where possible.

**Clifton's Gas Streetlights Future - Cincinnati's Budget and the 2023 Green Plan**

On pages 30 and 260 of Cincinnati's 2026-2027 budget report, the Department of Transportation and Engineering (DOT) notes on the city's gas streetlight system "*it has determined that all the city's gas streetlights are "obsolete". and that "100% of gas streetlights are beyond their service life".* The 5-year DOT proposed budget of \$172,000 supports a plan to "upgrade and replace the aging gas streetlight infrastructure". The proposed 5-year budget aligns with the **2023 Green Cincinnati Plan**, which envisions the replacement of the current double mantle inverted (DMI) Welsbach-type gas burners with LED illumination in all existing gas streetlamps, ostensibly by 2030.

**Clifton's Community Actions**

CTM's Environmental Committee received community input on the gas streetlight conversion idea in 2025.

**FIGURE 25:** Evolution of Clifton's Historic Gas Streetlamps and LED Retrofits:

Flat-Flame, Welsbach Upright, Dual Inverted Mantle, LED with Hurricane Lamp Chimney, LED with Standard Lamp



Open Flat-Flame  
Coal-Natural Gas



Upright Welsbach  
Coal Gas



Inverted Dual Mantle  
Welsbach Natural Gas



Retrofit LED with



Retrofit LED  
Hurricane Chimney

The idea of updating gaslights, not eliminating them, but changing the original coal gas-fueled open flat-flame, has occurred several times over the years since gas streetlights were first installed in the mid-19th century. The type of gas used has changed from coal to natural, burners have improved from open flat-flame to upright Welsbach mantles to inverted double Welsbach mantles. Some former gas lights in Clifton, those along Ludlow Avenue in the Business District have been converted to LED. Others have been removed and replaced with electric lights along Clifton and Ludlow Avenues beyond the Business District. (Figure 25) Most recently light emitting diode (LED) technology has arrived as the next iteration and alternative for gas combustion in Clifton's residential natural gas-fueled streetlights. This idea originated not only within the CTM's Environmental Committee but also through broader community engagement, including at CTM board meetings and other forums.

**Streetlight Illumination Trends: 2026**

**Baltimore**, the first US city to install gas-fueled streetlights, removed nearly all of them. A sole, token gas lamp is located at N. Holliday Street and E. Baltimore Street as a monument to the first gas lamp in America, erected at that location.

**New Orleans'** French Quarter features approximately 945 electric replica streetlights styled to evoke historic gas lighting. While New Orleans' lamps emphasize ornate, wrought-iron designs

inspired by 19th-century Creole architecture, no gas-fueled fixtures remain. While lacking the decorative flair of New Orleans lamps, Cincinnati's gas-fueled streetlights offer broader illumination.

Aligned with Boston's Beacon Hill neighborhood, Cincinnati shares a commitment to preservation. Both cities have maintained gas-fueled lamps as cultural icons listed on historic registers. However, change is happening. Boston's approximately 2,800 lamps—primarily in historic neighborhoods such as Beacon Hill, Back Bay, and Bay Village—are undergoing LED retrofits for energy efficiency.

In **London** there were about 1,500 working gas streetlamps as of 2018, although there were plans to replace 299 of those in **Westminster**, London (the first city in the world lit by gas) with LED lighting by 2023, which sparked public opposition. Today, only four of Westminster's gas-fueled streetlights have been preserved as historic icons.

The topic (conversion of gas streetlights to LED illumination) is currently in progress worldwide as advances in technology now allow for comprehensive evaluation of possible solutions. The 1,109 historic gaslights in Cincinnati contribute a significant amount of CO<sub>2</sub> and methane (greenhouse gases) emissions, presenting an issue that warrants thorough analysis. In 2025, CTM trustees approved the installation of a small number of retrofitted, easily reversible gaslights to LED illumination, and recommended a community evaluation through an independent survey. Forming opinions without tangible case studies or examples is counterproductive to informed decision-making. The concerns of Clifton residents about its gaslights provides a great opportunity for more civic engagement, on all items in the updated Clifton Plan. City staff will lead the Clifton community through the review and finalization process.

At the December 2025 public meeting Clifton Town Meeting Trustees endorsed a test of LED conversion of one or more existing gas streetlights on a Clifton gaslit street to obtain community input on the quality, intensity, and aesthetics of the emitted light by LED compared with that of nearby gas-fueled streetlights. A revised and updated **Clifton Plan** is likely to emerge on or before 2027.

### **Gas-to-LED Conversion Cost Estimates & Return on Investment**

Streetlight conversions to LED worldwide are rapidly increasing due to significant energy savings (often 50-70%) and lower maintenance costs, despite substantial upfront capital requirements. Major city total conversions to LED can range from millions to tens of millions, such as a \$5.5 million program in Massachusetts, \$10 million program in Grand Rapids, and a \$26 million project in Mississauga, Ontario, Canada.

Individual project costs vary based on fixture type and labor, the conversion to LED typically costs roughly \$150 per fixture for standard, basic, or utility-driven retrofits. The key cost drivers are (1) labor: Electrician costs for installation usually range between \$200 and \$250 per fixture, and (2) fixture type: Converting historic fixtures are more labor-intensive and more costly.

Return on Investment (ROI) is an important concern. Most projects see a payback period of 4 to 8 years. However, conversion to LED can reduce operational costs by roughly 45% to over 60% annually.

### **Meanwhile, Enjoy Your Drive or Walk and Report Any Gaslight Outages You Observe:**

So, let's keep the gaslights burning properly, and when on a quiet walk alone or with friends or with your dog along any of Clifton's gas streetlamp populated streets enjoy the illumination, and stop to enjoy the lamppost details.

If you detect a problem with a streetlamp or mantle (malfunctioning or out), please note the streetlamp's number and the nearest street address and report the problem to the *Cincinnati Gas Lite Company* which, under contract, maintains Cincinnati's historic gas streetlights. For information and repair services contact the *Cincinnati Gas Lite Company* by phone 311 or at 859-727-1331 or email [cincinnatiogasliteco@netzero.net](mailto:cincinnatiogasliteco@netzero.net)

## LIST OF FIGURE TITLES & LEGENDS (for ILLUSTRATIONS) IN TEXT

FIGURE 1: South Gas Works building- *Cincinnati Gas, Light & Coke Company*, Coal Gas Generation and Distribution

FIGURE 2: Gas Lighting is Installed in Cincinnati's Mozart Hall in 1863

FIGURE 3: Welsbach's Incandescent Gas Burner (2 images: mantel in box + upright gas lamp)

FIGURE 4: Welsbach Single Upright Mantle Burner in Lamp on Ludlow Avenue test

FIGURE 5: Clifton Avenue, 1906. Lined with globe-topped, Boulevard style streetlamps.

FIGURE 6: Map of Cincinnati's Gas Distribution Lines - 1915

FIGURE 7: Gas Lamp with Single-jet Burner

FIGURE 8: Evolution of Gas Lamp Burners

FIGURE 9: An Early Open Flat-Flame Gas Burner

FIGURE 10: Welsbach Gas Mantles and Lights Made in New Jersey (2 factory photos)

FIGURE 11: Upright Welsbach Single Burner in *Boulevard* Style Lamp

FIGURE 12: Double mantle inverted (DMI) Welsbach incandescent burners

FIGURE 13: New Types of Gas Lamp Fixtures: *Windsor* and *Boulevard*

FIGURE 14: Clifton's Vintage Village Clock and 19th-Century LED Retrofitted Historic Gas Lamp

FIGURE 15: 1869 Clifton Map with Original Street Locations and Names

FIGURE 16: Map of Clifton's Gas Streetlights

FIGURE 17: Clifton's Lamppost Designs

FIGURE 18: Clifton's Gas Lamppost Foundry Marks

FIGURE 19: Clifton's Gas Lamp Fixture Design

FIGURE 20: Lamplighter (from Internet Archive Source)

FIGURE 21: Ludlow & Clifton Avenues Replacement Globe Streetlights

FIGURE 22: Ludlow Avenue's LED Retrofitted Gas Streetlights

FIGURE 23: High-Pressure Sodium (HPS) and light emitting diode (LED) Overhead Streetlighting

FIGURE 24: Color Chart for LED and Kelvin Scale

FIGURE 25: Evolution of Clifton's Historic Gas Streetlamps