Streetlights Are Getting Smarter—Are We?

The installation of 65,000 network-enabled LED lights in Detroit brought many city blocks back from total darkness. Credit: Haomin Wei/ Detroit PLA.

IN 1879, A DELEGATION of officials from Detroit took a steamship across Lake Erie to Cleveland, where they examined the nation's first electric street- lights. Three weeks earlier, inventor and engineer Charles Brush had flipped the switch on a dozen "arc lamps" in a public square. "Most people seemed struck with admiration," reported Cleveland's *Plain Dealer* newspaper, "both by the novelty and brilliancy of the scene."

Detroit quickly embraced the new lighting technology, as did other major cities including San Francisco and Boston. In other places, including Brush's own Cleveland, leaders debated whether to make the switch from gas lamps. (They were still arguing the point a few years later when Brush hired fellow Cleveland inventor John C. Lincoln to work at his company; the latter went on to found the Lincoln Electric Company

and the Lincoln Foundation, which evolved into the Lincoln Institute of Land Policy.)

Eventually, of course, electric streetlights became ubiquitous. During the 20th century, streetlight technology evolved gradually, with the carbon rods in Brush's lamps giving way to Thomas Edison's incandescent bulbs, then to mercury and sodium bulbs. In the past decade or so, that evolution has accelerated dramatically, thanks to two developments. First is the emer- gence of light-emitting diodes (LEDs), which offer considerable energy savings. Second is the more recent explosion of interest in outfitting street- lights with "smart city" technologies that go well beyond lighting—think everything from surveil- lance cameras to Wi-Fi hotspots.

All of this underscores, and complicates, the often-overlooked role of streetlights in planning

and land use. "A street lighting system is there for traffic safety, pedestrian safety, and to make people feel safe in cities where there may be high crime," says Beau Taylor, executive director of Detroit's Public Lighting Authority (PLA).

More than a century after it installed those innovative arc lamps, Detroit was essentially forced back to the leading edge of lighting. By 2014, some 40 percent or more of its 88,000 sodium streetlights had become non-functioning at any given time. The city's lighting infrastructure, spread over 139 square miles, had been designed for a thriving city of 2 million people in the 20th century. Maintaining it had become untenable.
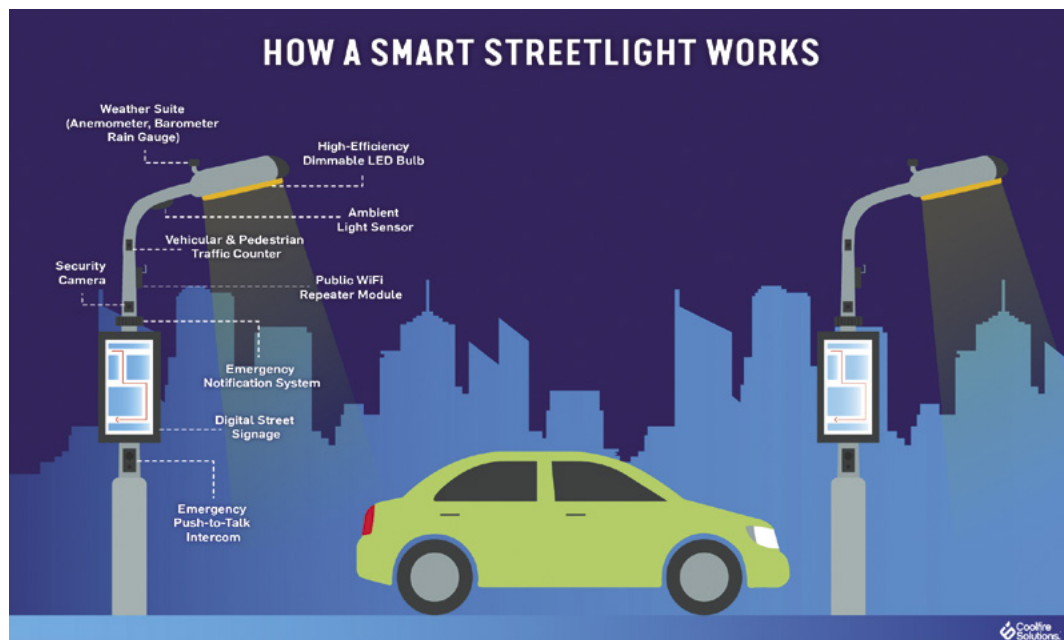
A $185 million bond funded 65,000 new LED streetlights, making Detroit the first large U.S. city to convert to LEDs. This upgrade was not just a matter of swapping out bulbs. The lighting from LEDs is different—a sodium bulb produces light that gradually tapers, while LEDs produce a more direct shaft that's twice as bright—and Detroit's population has shrunk, so planners had to install new poles in a revised configuration.

Today the agency says the associated energy costs of the new lights are about half what they would have been with conventional lights. And an analysis by the Detroit Greenways Coalition, a policy and advocacy group, found that "pedestrian fatalities in dark, unlighted areas dropped drastically, from 24 in 2014 to just one in 2017," concluding that the new lights were the primary factor.

Those are significant outcomes. But there could be more to come: Detroit's new streetlights are equipped with fixtures that can be retrofit to perform various "smart" functions. And this brings us to the technological revolution that has attached itself to the formerly humble streetlight.

"When we use the word 'smart,' it means connected," says Dominique Bonte, a vice president at consultancy ABI Research, which forecasts the smart streetlight market will grow 31 percent between 2018 and 2026. Lights that are connected by a network, whether Wi-Fi or fiber-optic cable, can be monitored or controlled remotely. These connections also open

The new generation of streetlights can do everything from monitor the weather to listen for gunshots. Many city officials view this as a boon, but some civil rights organizations are calling for stronger regulations. Credit: Coolfire Solutions.

HOW A SMART STREETLIGHT WORKS

Weather Suite (Anemometer, Barometer, Rain Gauge)

High-Efficiency Dimmable LED Bulb

Ambient Light Sensor

Vehicular & Pedestrian Traffic Counter

Security Camera

Public WiFi Repeater Module

Emergency Notification System

Digital Street Signage

Emergency Push-to-Talk Intercom

Coolfire Solutions.

new possibilities, particularly as the more robust cellular network technology known as 5G rolls out over the next few years. "Streetlights, in the future, can become more like hubs or platforms," Bonte continues.

Streetlights are ideal for this role, as Austin Ashe, general manager for intelligent cities at GE subsidiary Current, explained to engineering trade publication *IEEE Spectrum*: "They have power, ubiquity, and the perfect elevation—high enough to cover a reasonable radius, low enough to capture a lot of important data."

This notion has already captured the imagination of cities around the world: if streetlights are already on every block, why not figure out what else they can do?

A study by research firm IoT Analytics estimates the total number of connected streetlights in North America will reach as high as 14.4 million over the next five years, naming Miami as the city with the most extensive deployment of connected LED streetlights, with nearly 500,000. In Los Angeles, 165,000 networked streetlights are designed to serve as a kind of backbone for the deployment of other technologies, such as noise-detection sensors that monitor gunshots and other sounds. San Diego has tested streetlights outfitted with audio and visual surveillance technology, plus sensors that monitor temperature and humidity. In Kansas City, a new 2.2-mile downtown streetcar line is dotted with Wi-Fi kiosks, traffic sensors, and LED streetlights with security cameras attached, all linked by fiber-optic cable. And Cleveland is embarking on a $35 million effort to replace 61,000 fixtures with smart camera-enabled LED streetlights. Similar efforts are underway in Paris, Madrid, Jakarta, and other cities around the world.

But as these experiments play out, concerns are coming into view. The ACLU and others take issue with the idea of camera-enabled streetlights watching the public's every move, calling for government oversight to ensure that "smart cities" don't become "surveillance cities." As municipal enthusiasm for new technologies outpaces their regulation, some leaders are considering caution: "Technology is advancing at a rapid pace," a San Diego City Council member told the *Los Angeles Times*. "As elected officials, we have to not only keep up with the increasing developments, but also ensure that the civil rights and civil liberties of our residents are protected."

And then there are the economics of it all. Streetlights can eat up to 40 percent of municipal energy bills, according to the U.S. Department of Energy, so basic efficiency upgrades tend to pay off over time. But as ABI's Bonte points out, the return on investment for more elaborate projects isn't always clear, and realizing the benefits can take decades.

Looking ahead, Taylor of the Detroit PLA says his agency is tracking the experiments underway in other cities and participating in efforts to figure out which smart products or services might actually benefit the people of Detroit. If the city decides to, for example, add more public Wi-Fi to parks or other spaces, retrofitting the streetlights is an option. But that's in the future. "Smart city technology is more of a multiplier effect for a street lighting system," he says. "Our primary focus was getting the lights back on."

Even that comparatively cautious approach came with risks: In a frustrating development, the PLA found that lights supplied by one of its vendors are burning out far more quickly than they should. The city now has to swap out those lights, at a cost of around $9 million, and has sued the supplier.

No wonder Taylor seems happy to wait and watch as others experiment. The last thing a city wants, given the pace of technology, is to have to overhaul its "smart" system a decade from now. "It's not about getting it all done up front," he says. "It's about keeping options open."

Rob Walker is a journalist covering design, technology, and other subjects. His book *The Art of Noticing* was published in May 2019.