LED SMART LIGHTING

Smart LEDs

Smart LED systems can come with a variety of added technologies but generally split into two different types, internal and external systems:

Internal smart systems include features that the LED comes equipped with. LED light output can be controlled by varying the drive current (or pulse width) to achieve a range of selectable fixed light levels, as well as continuous dimming capabilities. LEDs can also be designed to emit a range of light spectra, different combinations of phosphors to provide 'white light' at various color temperatures, in some situations allowing for tunable colors for architectural lighting. In combination, these two abilities can supply **varying colors, dimming, and overall adaptive lighting.**

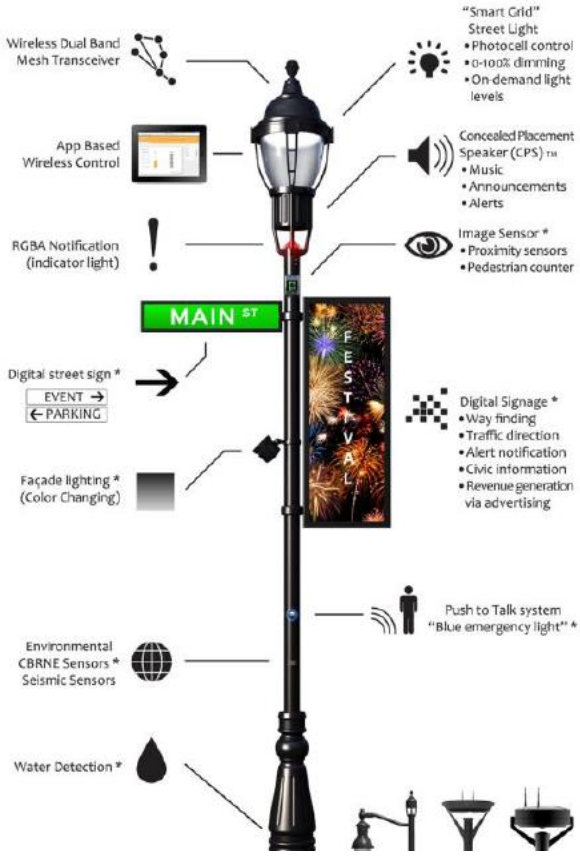

Image: http://www.gizmodo.com.au/2014/02/newarks-fancy-new-led-lights-have-little-spy-cams-inside/

External smart systems include systems that connect to a central system. LEDs' benefits are ideal for use with 'smart' controls and applications, as they do not require a warm-up period for maximum light output. The addition of a Centralized Management System (CMS) can offer the capability to control LEDs individually to dim performance monitors, and to reprogram LED luminaires individually, as well as to supply the central node to which other current or future city infrastructures and smart technologies can connect. Public safety personnel can raise lighting levels or have LED lights flash at locations where accidents or emergencies occur. Motion sensors can be programmed to switch on lamps or raise dimmed lighting levels when cars or pedestrians pass by. While the CMS represents an additional expense for lighting managers, both in terms of a two-way wireless communication module required for each LED luminaire and the central control system hardware, these costs can be outweighed by the benefits and future-proofing that a CMS provides.

Future Proofing

Multiple services and technologies could ultimately link together in future smart cities—but many are in development, and the protocols defining how they would interact still need to be defined and tested. One approach is to define interfaces to a city 'digital cloud'—and avoid trying to specify the operating requirements and standards across a multitude of technologies—many of which are still evolving. Another option is to apply standard sockets that can later be used to upgrade the LED lighting. There are two important factors for upgrading LED lights within the system itself. The first is the socket for the lighting unit. While there are a few different types of sockets, the NEMA 7-pin receptacle socket has the greatest potential for future proofing.

Financial Savings

Any dollar savings depend on what type of LED is installed. LEDs compared with conventional alternatives have initial savings anywhere between 50-70%, while the addition of programing on/off times and the ability to dim, can increase the savings by another 5-25%. Finally, a connected, centralized system may save an extra 10% on average, once installed (excluding still evolving costs at the outset). Malfunctioning lights trigger immediate service alerts. Technicians only have to visit a light when there's a known problem discovered proactively by the system and not reactively to observer reports.

This graph is an example of the types of savings that can result from LEDs. The lightest green represents consumption based on traditional lights. The middle green represents the savings based on upgrading to LEDs. Finally, the spikes represent the power consumption of LEDs that have sensors to detect motion. These types of LEDs can be programmed to turn on in blocks so that individuals walking at night will have a stretch of light at a time.

Graph comparing power consumption for different street lamps

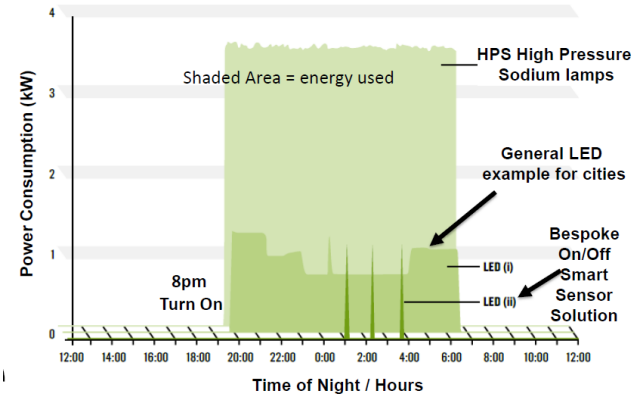

Image: https://www.theclimategroup.org/sites/default/files/archive/files/LED-Consultation-Handout.pdf

Considerations

As is true currently in the DTE Energy service territory, if there is a flat fee administered by a public utility, the City will not see the same types of savings with smart technology.

Smart LED Examples

National

Los Angeles, California ~ has converted 140,000 of its 210,000 lights to LED lights. Of those 140,000, around 64,027 have been converted to smart LED street lights with monitoring capabilities. The monitoring system uses a mesh network and gateway system.[1] The system includes smart sensor chips manufactured by Philips for their *CityTouch Ready* system (Philips has set up smart systems in London, Buenos Aires, and Surakarta).[2] The technology uses cellular networks to transmit information to the Bureau of Street Lighting's asset maintenance system through banking-level encryption. Every 6 months, the bureau reaches out to manufacturers to understand the latest monitoring controls and sensors, and to see if they should change manufacturers for a better or more economic alternative.[3] This system allows the lights to provide streetlight diagnostics (operations, power, consumption, etc.). The City also has the ability to turn LEDs on and off. The lights also have GPS location.

San Diego, California ~ GE installed custom LED street lights, replacing 3,000 city lamps in San Diego's downtown district with wireless lighting controls at the end of Spring, 2014. The switch to a smart system is expected to save San Diego $250,000 annually.[4] The lights are part of GE's LightGrid control system, which allows for remote operation along with GPS tracking and monitoring of all fixtures through a web-enabled central management system.[5]

San Jose, California ~ Philips installed 50 smart poles on a trial basis. The smart poles act as a wireless transmitter to allow cell phone companies to rent out the poles and broadcast stronger signals to cell phones, along with providing more bandwidth for Wi-Fi, thereby essentially replacing the role of cell phone towers.[6] Verizon Wireless is the first wireless carrier to take advantage of the new technology. The LEDs also have a

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[1] Los Angeles Bureau of Street Lighting

[2] http://images.philips.com/is/content/PhilipsConsumer/PDFDownloads/Global/ODLI20160315_001-UPD-en_GB-City-Touch-general-brochure.pdf

[3] http://www.govtech.com/dc/articles/Los-Angeles-Deploying-Smart-Streetlight-Network.html

[4] http://pressroom.gelighting.com/news/san-diego-to-save-more-than-a-quarter-of-a-million-dollars-annually-with-ge-smart-lighting-technology#.V5EZUfkrIdU

[5] http://www.gelighting.com/LightingWeb/na/solutions/control-systems/lightgrid-outdoor-wireless-control-system.jsp

[6] http://www.sanjoseca.gov/index.aspx?NID=4688

custom energy meter on top of the smart poles with connections for future developments.[7]

Jacksonville, Florida ~ GE's Lightgrid went under a trial period with 48 intelligent LEDs tested. The test resulted in unexpected benefits, such as capturing 2-3 more parking violations per space per month, and the city gained an extra $2,400 in citation revenue, along with an increased ability to detect and stop crimes. The fixtures came with lighting control, real time voltage monitoring, and proactive maintenance. In the end, the pilot ended as it would have cost the city $50.1 million to change out their LED for a smart system versus $1.4 million to convert them to regular LED fixtures[8].

Chattanooga, Tennessee ~ Coolidge Park in Chattanooga received an upgrade of approximately 350 smart LED lights. The system that was installed had wireless capabilities and a dimming function. Police were given the ability to control the lights from their cars. The city invested $20 million in upgrading another 27,000 regular bulbs to smart LED lighting.[9]

The Port of New York & New Jersey ~ launched a pilot smart LED project, which begun October, 2013. The pilot included 171 LED lights with sophisticated lighting controls and added security features for airport terminals. The cameras are intended to monitor foot traffic and to identify unattended baggage.[10]

Las Vegas, Nevada ~ LEDs with video and audio recording capabilities, as well as the ability to broadcast audio outside of city hall.[11]

Tucson, Arizona ~ considering switching their lights to smart LEDs, with the hope of saving $180,000 a month. The system might include new lights that operate on a WI-FI network, which will allow the lights to be dimmed and turned off remotely. The decision is still pending. Note: Phoenix already has LEDs but they are not connected to a smart system.[12]

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[7] http://www.computerworld.com/article/3013031/sustainable-it/san-jose-gets-smartpoles-with-lte-led-lights-and-energy-meters.html

[8] http://www.bizjournals.com/jacksonville/news/2016/05/12/remember-those-smart-streetlights-ge-announced.html

[9] http://www.govtech.com/public-safety/Chattanooga-Tenn-Expanding-Streetlight-of-the-Future-Installation.html

[10] http://www.govtech.com/data/Will-Streetlamps-Become-Information-Hubs-for-Cities.html

[11]http://www.ledinside.com/news/2013/11/las_vegas_installs_smart_led_street_lights_with_voice_recording_features http://www.citylab.com/cityfixer/2015/10/copenhagens-smart-new-street-lamps-shine-brighter-for-cyclists/411154/

[12] http://www.ledsmagazine.com/articles/iif/2014/06/phoenix-begins-comprehensive-led-street-light-retrofit-with-ge-lighting.html

Miami, Florida ~ Ericsson-Philips and Silver Spring Networks have partnered to deploy 75,000 smart lights across the city. The system allows for quicker servicing of downed lights and greater control over dimming.[13]

International

Copenhagen, Denmark ~ 20,000 of the 40,000 LED lamps have smart functions. It is predicted that energy consumption will be reduced by 57 percent. Silver Spring Networks have networked the wireless system for new streetlights. The lights are connected to a central console that uses individual modules in the fixtures to dim the lights at different times of the day. They have set up the new fixtures to shine brighter when people approach. They are also hoping to monitor garbage cans so that city trucks can empty them as they fill.[14]

Glasgow, Scotland ~ The City is testing out intelligent lighting with the ability to monitor noise disturbances on streets, movement detection to monitor foot traffic, air pollution detection, and Wi-Fi enabling services. There are three locations where these LED lights will be deployed.[15]

Madrid, Spain ~ Philips lighting retrofitted 225,000 of Madrid's streetlights with smart LED technology. Madrid underwent the retrofit with the hope of increasing energy efficiency, decreasing costs by a predicted 44%, and extending the lifespan of city lights, while still being able to control light pollution by controlling the intensity of the lighting though a smart system.[16][17]

Águas de São Pedro, Brazil ~ Located 187 kilometers from São Paulo and with a population of 3,000, Águas de São Pedro's government paired with Sony Ericsson to install remote dimming street lamps, leading to a 35% reduction in electricity costs on top of the initial savings from switching to LED. [18]

Buenos Aires, Argentina ~ Philips CityTouch assisted in replacing 91,000, or 70%, of street lights across Buenos Aires with LED lighting. 28,000 of those lights can be controlled remotely through a smart system that allows for measuring data usage and that controls the lights of each light individually. Monitoring light data, such as

[13] http://www.forbes.com/sites/heatherclancy/2014/03/10/miami-contract-ericsson-philips-partnership-shine-spotlight-on-smart-street-lights/#4dbed4a070a9
[14] http://www.citylab.com/cityfixer/2015/10/copenhagens-smart-new-street-lamps-shine-brighter-for-cyclists/411154/
[15] http://futurecity.glasgow.gov.uk/intelligent-street-lighting/
[16] http://www.govtech.com/fs/Bright-Future-Seen-for-Smart-LED-Streetlight-Projects-.html
[17] https://www.theclimategroup.org/news/madrid-upgrade-100-its-street-lights-smart-and-sustainable-led-system
[18] http://www.rcrwireless.com/20150818/americas/inside-the-brazils-first-smart-city-whats-there-and-whats-missing-tag5

consumption and life span, paired with traffic data, as well as sunset and sunrise, helps the system determine the intensity needed from the LED lamps.[19]

Doncaster, England ~ PLANet system, Telensa has converted 33,000 LED street lights in Doncaster to smart LEDs. The system helps ensure that the LED systems are wirelessly connected, and can control light levels and record power consumption. Telecells are plugged into each streetlight, which allows the light to connect wirelessly to a cloud. Smart lighting is predicted to deliver savings of approximately 1.3 million pounds annually and to reduce consumption by 8.7 million kilowatt hours, resulting in a reduction of 4,700 metric tonnes (5,181 US tons) of carbon emissions.[20]

Szczecin, Poland ~ Philips City Touch has switched out 5,000 streetlights, which are connected through a remote management system to control brightness and provide information on the status of LED lamps. It is estimated that the smart LED system paired with the LED lamps will lead to 70 percent energy savings.[21]

Indonesia ~ Philips Lighting has partnered with multiple Indonesian government entities to bring smart LED lighting to national monuments in Jakarta, Heroes Monument (Tugu Pahlawan) in Surbaya, and Ampera Bridge (Jembatan Ampera) in Palembang, along with monumental buildings, such as the Indonesia Convention Exhibition (ICE), one of the largest buildings in Southeast Asia.[22]

Paris, France ~ Silver Spring Networks, a California-based company, has deployed a wireless canopy to connect controllers for both LED streetlights and traffic signals across Paris. The system allows for remote control and monitoring of the traffic signals and LED lamps. The total cost of the project is set to be between $650 and $900 million.[23]

[19] http://www.gizmag.com/philips-connected-lighting-citytouch-buenos-aires/33076/
[20] http://www.ledsmagazine.com/ugc/2015/11/30/telensa-deploys-smart-city-wireless-control-system-for-33000-led-streetlights-in-doncaster-uk.html
[21] http://inhabitat.com/philips-to-install-led-streetlights-in-poland-for-a-70-percent-energy-savings/
[22] http://nowjakarta.co.id/philips-introduces-smart-and-innovative-lighting-solution-in-indonesia/
[23] http://www.greentechmedia.com/articles/read/silver-spring-to-network-parisian-street-lights