



# Leveraging New Technologies to Modernize Infrastructure and Improve Energy Efficiency in America's Cities

A 103-City Survey

November 2021





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CONFERENCE OF MAYORS**

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The United States Conference of Mayors is the official non-partisan organization of cities with each city represented in the Conference by its chief elected official, the mayor.



Signify (formerly Philips Lighting) is the leader in lighting. We partner with cities to unlock the extraordinary potential of light for brighter lives and a better world. We work with mayors to understand their city's needs and help them take advantage of light far beyond illumination, to improve day-to-day operations and the lives of their constituents. Our Philips products, Genlyte Solutions collection of luminaire brands, Interact connected lighting systems and data-enabled services transform life in homes, buildings and public spaces. We continue to innovate with Li-Fi, 3D printing, UV-C, solar and horticultural lighting, to contribute to a safer, smarter and more sustainable world.

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# Foreward



**Tom Cochran**  
CEO and Executive Director  
The United States  
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The United States Conference of Mayors is pleased to release our 2021 survey, *Leveraging New Technologies to Modernize Infrastructure and Improve Energy Efficiency in America's Cities*, which reports on how mayors are changing the way energy is used and generated in their cities.

This report, like others before it, again demonstrates how mayors are leading the way on energy and climate action, documenting local efforts – be it greater energy efficiency with connected lighting and low-energy buildings to increased deployment of renewable energy and EV charging systems – that are charting the course to a new energy future.

A singular challenge we have as a country is sustaining and expanding the U.S. economy while reducing carbon emissions and strengthening resiliency to escalating climate threats. The findings in this survey capture just some of the local action that is making our nation less carbon dependent and more resilient to a changing climate.

Because of the urgency and scale of this undertaking, mayors have been especially vocal for a long time in calling for an all-hands-on-deck response, one that is grounded in this local action. This means marshaling more federal and state financial, regulatory, and programmatic support behind mayors and other local leaders to bolster their locally-based solutions — sooner rather than later, and on a much larger scale.

Whether it's public safety, infrastructure, or even climate change, federal (and state) officials can no longer ignore the calls from local elected officials for a stronger partnership on these issues. The immense energy and climate challenges we face call into question the notion that mayors are simply calling for another handout, as some so often suggest. We have built a national economy that consumes massive amounts of carbon – a carbon-consuming and carbon-emitting machine that is unprecedented in world history. This unhealthy and unsustainable carbon dependency has been built up over many decades and enabled by outsized private and public-sector commitments.

As we strive to change our nation's carbon footprint, it is unreasonable to suggest that cities, towns, and counties can do it alone: consider that local governments today account for only about 17 cents of every tax dollar that is raised. Local resources simply can't match the level of effort that will be required to build a future economy powered by renewable energy. To accelerate this change, we'll need all our tax resources on the table – as well as ever-increasing private-sector commitments.

These survey findings provide a glimpse into this future and the transition that is already underway, which will inevitably lead to the ubiquitous deployment of renewable energy and other technologies to help people and businesses use energy more efficiently and source more of their future energy from non-carbon sources.

This report can assist mayors in assessing their own efforts and help encourage additional local action. It can also provide our federal partners with new and timely information about how mayors are leading locally to address our energy and climate issues as well as guidance on how to invest new federal resources.



# Survey Results

This report, *Leveraging New Technologies to Modernize Infrastructure and Improve Energy Efficiency in America's Cities*, builds upon earlier Conference surveys and initiates new areas of inquiry to help document further local energy and climate action.

It provides timely information on how cities are using energy technologies and infrastructure improvements to promote greater energy efficiency and renewable energy use. Throughout this report, prior Conference surveys are referenced to support comparisons of these new findings with previous ones, allowing us to mark progress by cities in deploying energy technologies and in improving some city infrastructure.

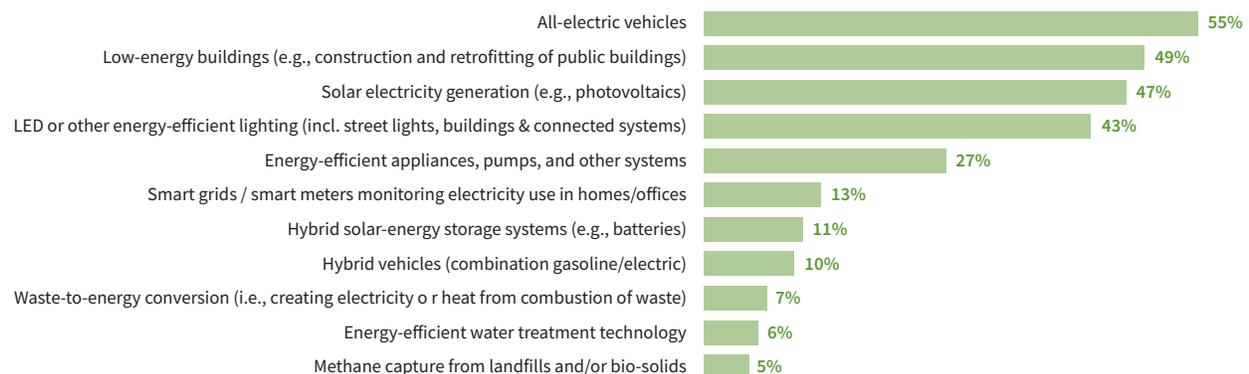
**More than half of the mayors in this survey identify All-electric Vehicles as the “most promising technology” for reducing energy use and carbon emissions in their cities.** The 103 U.S. mayors in this survey were asked to select the most promising technologies from a list of 20 options, with 55 percent of them identifying *All-Electric Vehicles*.

*Low-energy Buildings* (49%), *Solar Electricity Generation* (47%), and *LED Lighting/Other Energy Efficient Lighting* (43%) are the next three choices, with each achieving near majorities.

Other selections to register in double digits are *Energy Efficient Appliances, Pumps and Systems* (27%), *Smart Grids/Smart Meters* (13%); *Hybrid Solar-Energy Storage* (11%) and *Hybrid Vehicles* (10%).

What is notable about *All-electric Vehicles* as the “most promising technology” is its ranking in the Conference’s 2016 survey, *How Energy Technologies Are Reshaping America’s Cities*, where one in four mayors (25%) made it their fourth choice.

## Most Promising Technologies for Reducing Energy Use and Carbon Emissions in Cities



NOTE: Includes up to three choices per city.

# Survey Results

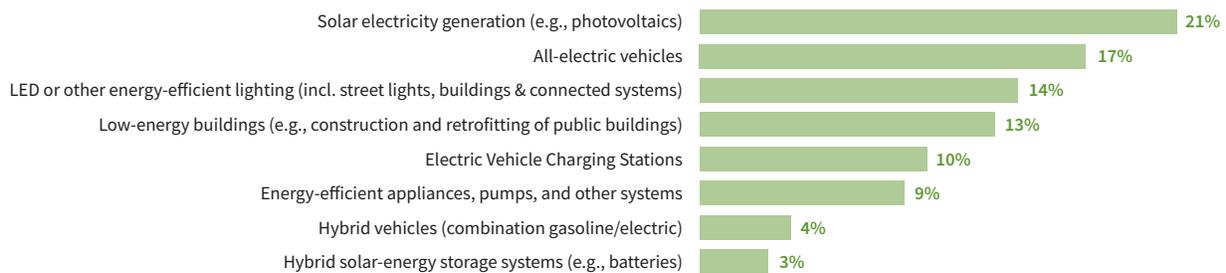
**When asked to identify ‘one’ technology that will receive top priority by their city over the next six months, one of five mayors identify Solar Electricity Generation.** After making *Solar Electricity Generation* their top choice (21%), mayors rank these technologies as their next highest priorities: *All-electric Vehicles* (17%); *LED/Other Efficient Lighting* (14%); and *Low-Energy Buildings* (13%).

It is noteworthy that these priorities diverge somewhat from earlier surveys. In the Conference’s 2014 survey, *Energy Efficiency and Technologies in America’s Cities*, two-thirds of the mayors (66%) identified *LED/Other Efficient Lighting*, *Solar Electricity Generation* and *Low-Energy Buildings* as their top three priorities. In the 2016 survey, three of four mayors (76%) chose the same technologies in the same order. In this new survey, less than half of the respondents (48%) identify these technologies, and they rank them differently, as shown in the chart below.

In earlier surveys, only a few cities identified (i.e., wrote in) other priorities beyond the 16 choices provided then; in 2021, eight percent of all respondents wrote in their own priority, even when provided with 19 answer options. (Among the many locally-identified priorities are *renewable diesel fuel* and “*zero net energy*” housing.)

In reviewing these priorities, as the following chart shows, it is notable that no single technology defines city priorities, as was the case in previous surveys. Moreover, this shifting of priorities reflects the reality that some technologies are already deployed at scale and, as such, are cited less often as an area of focus; the relatively low priority of *LED traffic lights*, as one example, reflects the early and broad adoption of this technology by cities.

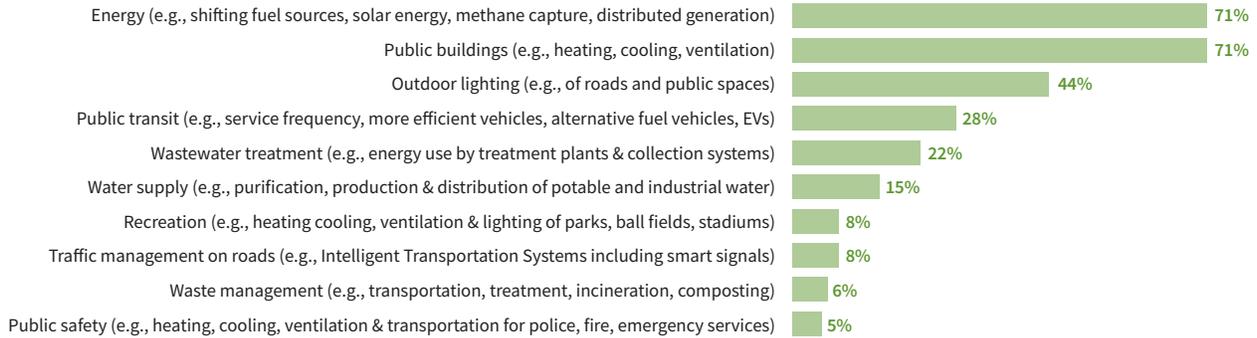
## Technologies Receiving ‘Top Priority’ in Next Six Months



**More than seven of ten mayors identify *Energy* (e.g., shifting fuel sources, solar energy, methane capture and/or distributed generation) and *Public Buildings* (e.g., heating, cooling, and ventilation) as the top two areas cities are targeting most for improved energy efficiency and reduced energy consumption.**

Beyond *Energy* (71%) and *Public Buildings* (71%), mayors are also targeting *Outdoor Lighting* (44%), *Public Transit* (28%) and *Wastewater Treatment* (21%). The following chart shows the city services mayors are targeting most often for energy improvements.

## Areas Cities Are Targeting Most for Improved Energy Efficiency or Reduced Energy Consumption



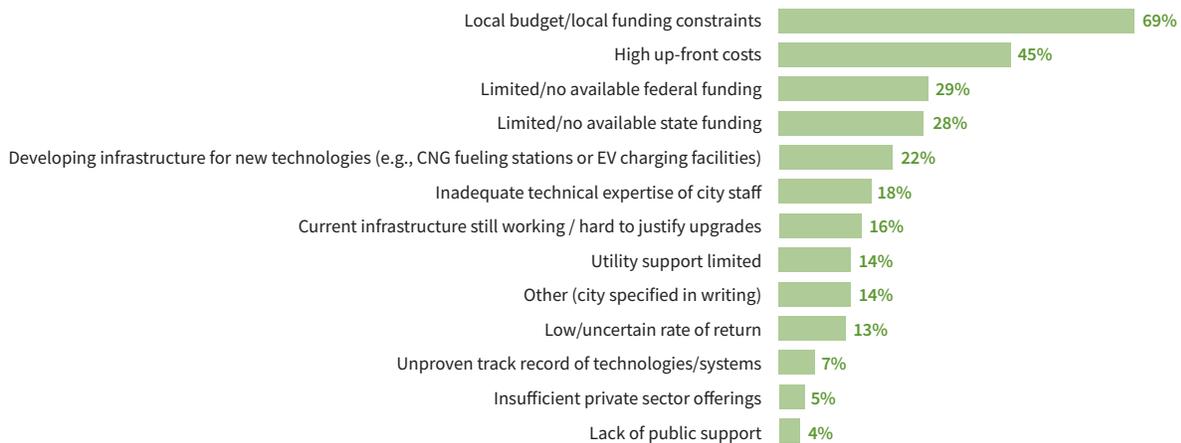
NOTE: Includes up to three choices per city.

When asked to identify the “most significant challenges” to increasing energy efficiency and conservation in these areas, survey respondents overwhelmingly cite financial constraints and costs. Mayors rank these four funding concerns as their top choices: 1) *Local budget/local funding constraints* (69%); 2) *high up-front costs* (45%); 3) *limited/no available federal funding* (29%); and 4) *limited/no available state funding* (28%).

These top challenges are the same – and in identical order – as the 2016 survey found, with similar percentage shares (i.e., local funding now at 69% vs. 67%, up-front costs at 45% vs. 49%, federal funding at 29% vs. 33%, and state funding at 28% vs. 29%).

Listing challenges under the *Other* selection, mayors cited *state legislation, preemption by state governments,* and *lack of state legislative support,* among other written submittals.

## Most Significant Challenges to Increasing Energy Efficiency and Conservation in these Areas



NOTE: Includes up to three choices per city.

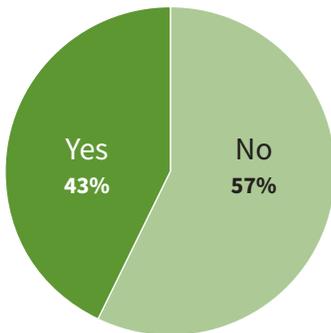
## CITY ENERGY PLANS

**More than two of five mayors – 43 percent of all respondents – have already developed a comprehensive city energy plan, with nearly all others anticipating their city will have a plan within the next three years.**

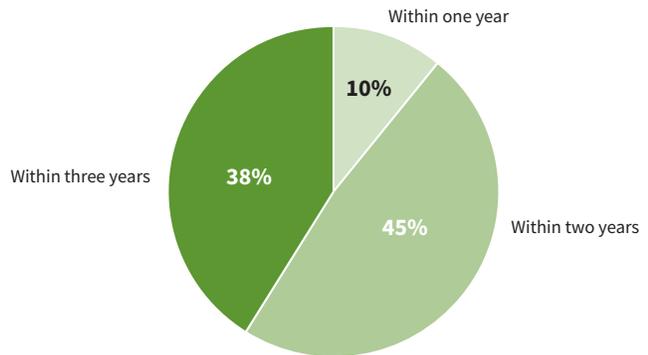
For cities without an energy plan (57%), one in ten of mayors (10%) expect to develop one within the next year, nearly half (45%) within two years, and a sizable share (38%) within three years.

### Comprehensive Energy Plan Development

**Has Your City Developed a Comprehensive Energy Plan**



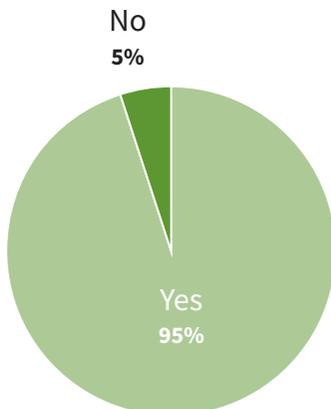
**For Cities without a Comprehensive Energy Plan, Anticipated Timeframe for Developing One**



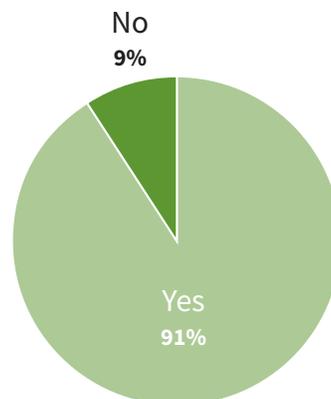
For cities with comprehensive plans in place, these mayors were queried further about two areas of focus, specifically did the city’s plan include “specific energy targets for increasing renewable energy use in city operations and/or for the broader community” and did it “set forth specific targets for energy use in city operations and/or across the broader community.”

### City Energy Plans with Specific Targets for...

**Increasing Renewable Energy Use in City Operations/by Broader Community**



**Reducing Energy Use in City Operations/by Broader Community**



## BUILDINGS

Cities continue to place priority on improving the energy performance of buildings, as shown in earlier Conference surveys and throughout this new report.

**Almost three of four cities benchmark the energy performance of their own buildings.** In five years, the share of cities that benchmark city-owned buildings increased, from 62 percent to 73 percent today, making this practice nearly routine, as tracking tools are more readily available and more broadly deployed, largely driven by the growing use of U.S. EPA's ENERGY STAR Portfolio Manager.

Often cited as *Low-energy Buildings* or *City-owned Buildings*, all these surveys show that retrofitting city-owned buildings is a top priority for cities. These surveys also use various queries to highlight how cities are addressing building energy performance, including asking mayors to estimate the share of city-owned buildings “now available for significant energy retrofits or improvements.”

**This year's survey found that the inventory of municipal buildings available for significant retrofits and improvements is growing.** While one quarter of mayors indicate nearly “all” city buildings are available for significant improvements, the same share as reported five years ago, the survey finds that 32 percent of cities have up to three-quarters of buildings available, up from 23 percent just five years ago. Similarly, cities with half of their building inventory available for significant improvements rose to 28 percent, up from 23 percent in the 2016, with only 12 percent reporting that less than one quarter of their building inventory is available, down from 17 percent in 2016.

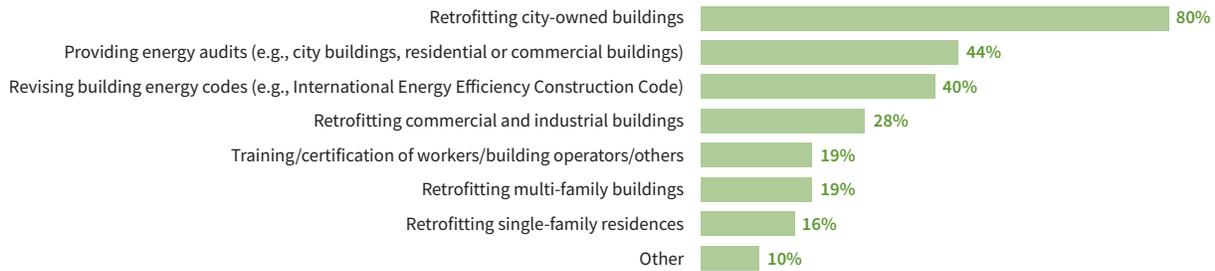
This finding is inconsistent with other findings in this survey and others showing cities making progress on municipal building energy performance, suggesting that further inquiry is needed. It is widely understood that COVID-19 has upended the building sector, as building owners evaluate ways to modify and modernize HVAC systems and undertake other building improvements to reduce public health risks, especially for public and commercial buildings. Whether it is improved central air filtration and/or increasing air flow rates to reduce exposure to viruses, such changes have significant implications for future energy use and operational and capital expenditures. As such, it is certain that COVID-19 has affected how city assess their building inventories for significant energy efficiency and other improvements, going forward.

**In describing cities' activities to improve energy efficiency in buildings, mayors again overwhelmingly identify retrofitting city-owned buildings as their top priority.** Four of five mayors (80%) are now targeting city-owned buildings for improving the efficiency of buildings in their cities.

In addition to this emphasis on city-owned buildings, mayors cite *providing energy audits* for public and private buildings (44%) and *revising building energy codes* (41%) most often. More than one quarter of the mayors (28%) identify *retrofitting commercial and industrial buildings* as a key practice.

This emphasis on *retrofitting city-owned building* and *providing energy audits* has remained about the same compared to five years ago, while other activities are now receiving more attention, such as *revising building energy codes* which increased from 25 percent to 41 percent and *retrofitting commercial and industrial buildings* which increased from 20 percent to 28 percent.

## City Activities That Are Current Priorities for Improving Energy Efficiency in Buildings



NOTE: Includes up to three choices per city.

Mayors were queried about city policies/formal actions “requiring” benchmarking of non-municipal buildings. While this is not a widespread practice, as the chart below indicates, it is a policy on the rise. Consider that the 2016 survey found that only 13 percent of cities required some form of benchmarking for non-municipal buildings.

## Share of Cities that ‘Require’ Benchmarking of the Energy Performance of Non-Municipal Buildings by Sector

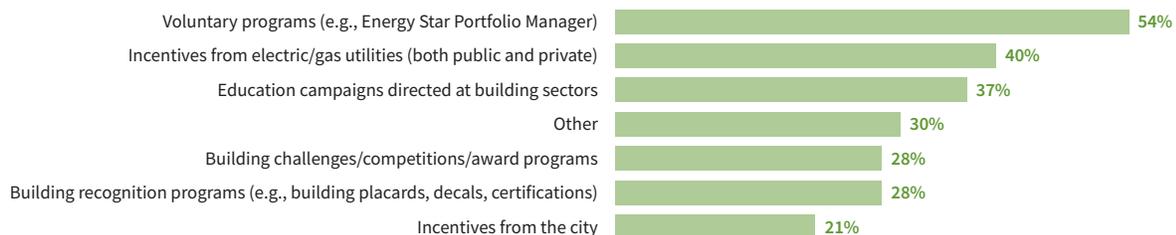


Many more cities “encourage” the benchmarking of the energy performance of non-municipal buildings. This survey, like prior surveys, finds that cities that benchmark their own municipal buildings are much more likely to “encourage” this practice by other building owners in their cities.

**Cities that don’t require benchmarking of non-municipal buildings were asked to identify activities they use to “encourage” benchmarking of non-municipal buildings, with more than half citing voluntary programs as their top priority.** Beyond *voluntary programs* (54%), the *offering of incentives from public and private electric/gas utilities* (40%) and *education campaigns directed at building sectors* (37%) are most often cited.

In responding to this query, *Other* was the fourth choice with three of ten (30%) making this selection, identifying actions that included *all electric reach codes*, *a local incentive revolving loan fund*, and *compliance with state law requiring benchmarking for buildings of a certain size*.

## Ways Cities Encourage Benchmarking of the Energy Performance of Non-Municipal Buildings

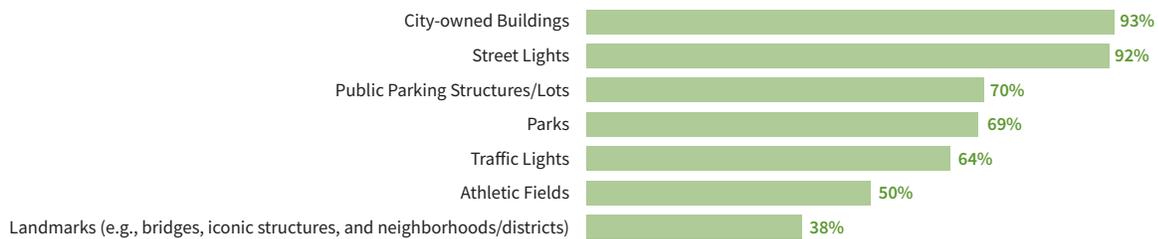


## LED LIGHTING

Like low-energy buildings, LED lighting is a dominant technology that has been deployed by cities for some years, as this survey affirms. Mayors were again queried about the use of LED technology in buildings and other publicly-owned facilities. This survey initiates new areas of inquiry on how connected LED lighting systems are helping to modernize city infrastructure and service delivery.

**More than nine in ten cities deploy energy-efficient LED lighting in city buildings and for street lights, continuing a trend toward near universal deployment of this technology in cities.** The high adoption levels in *city-owned buildings* (93%) and for *street lights* (92%) is certainly not unexpected or surprising, as prior surveys pointed to the growing dominance of this technology as a key element of city energy strategies. In 2016, nearly three in four cities had already deployed LED technology in *city-owned buildings* (74%) and for *street lights* (73%).

### Where Cities Have Already Deployed LED Lighting

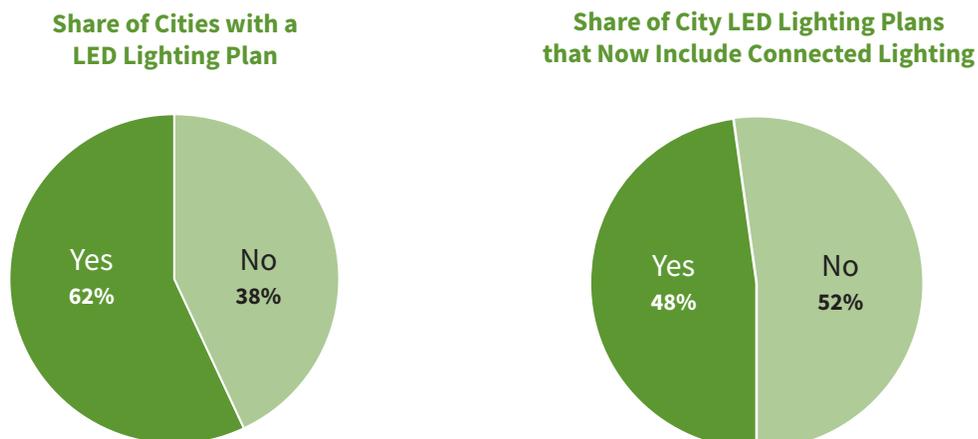


NOTE: Cities asked to indicate all that apply.

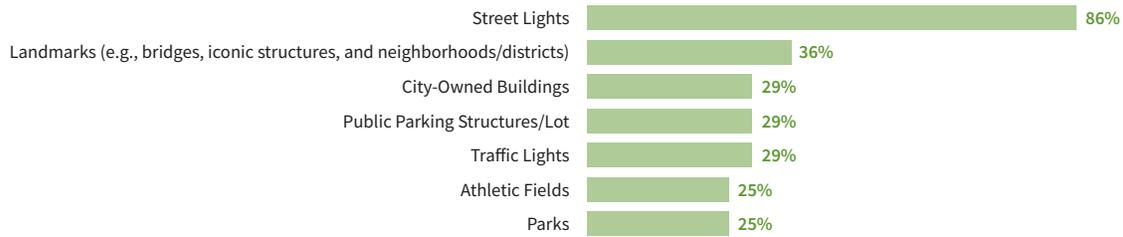
**When queried about efficiency upgrades to lighting systems in city-owned buildings, nine in ten mayors indicate they are considering shifting to LED lighting.** Representing a substantial share of all survey respondents (93%), these same mayors were queried about including other potential lighting technologies, with 39 percent of them considering Li-Fi (i.e., utilize light to transmit wireless data) technology and 13 percent considering Tunable White (i.e., ability to adjust color temperature of a lamp in real time) as part of their lighting improvements.

**More than six of ten cities have developed a formal/informal plan for deploying LED lighting more broadly.** Mayors with a plan (62%) for deploying LED lighting throughout their cities were queried further, with nearly half of them (48%) indicating their city plan includes connected lighting. These findings and others are summarized in the charts that follow.

### Share of City LED Lighting Plans



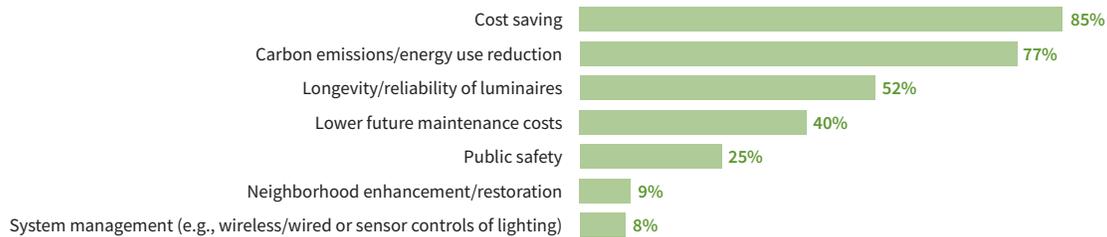
## Facilities Now Being Targeted for Connected Lighting in City Lighting Plans



NOTE: Cities asked to indicate all that apply.

When asked what they believe are the key benefits of deploying LED and connected lighting systems, mayors overwhelmingly identify cost savings and carbon emissions/energy use reduction. By significant majorities, mayors cite *cost savings* (85%) and *carbon emissions/energy use reduction* (77%) as what they believe are the key benefits of deploying LED technology, followed by *longevity/reliability of the luminaires* (52%) and *lower future maintenance costs* (40%). These and other benefits cited by mayors are set forth in the chart below.

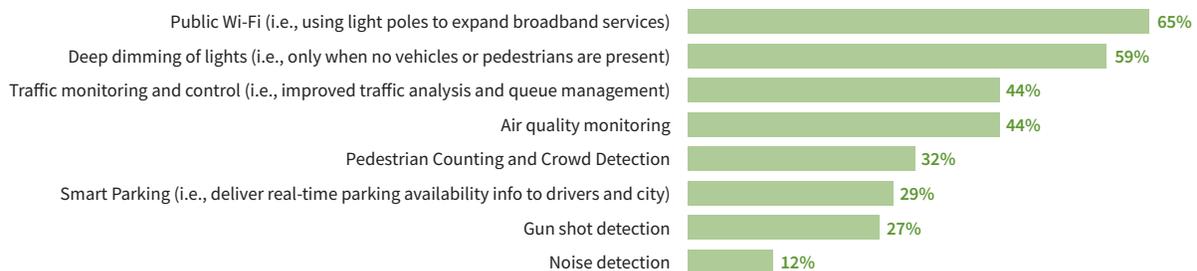
## Key Benefits of LED Lighting Including Connected Lighting



NOTE: Includes up to three choices per city.

For cities that have deployed connected lighting or are now considering such deployments, nearly two in three mayors expect this technology to help them leverage local infrastructure to deliver additional capabilities, citing public Wi-Fi as their top choice. In addition to expanding public Wi-Fi (65%), a significant majority of mayors (59%) also identify *deep dimming of lights* (i.e., when no vehicles or pedestrians are present), followed by *air quality monitoring* (44%) and *traffic monitoring and control* (44%).

## How Connected LED Lighting Systems Can Leverage Local Infrastructure to Deliver Additional Capabilities



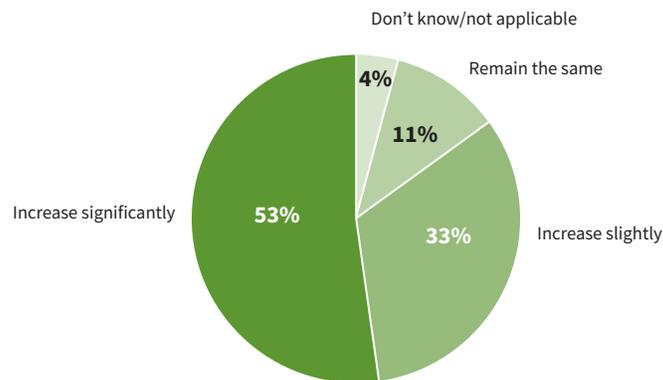
NOTE: Cities asked to indicate all that apply.

## SOLAR

**When asked to look forward over the next five years, more than half of all mayors expect to “increase significantly” the deployment of solar energy technologies on city buildings and facilities.** About six of every seven mayors indicate their goals for deploying solar energy technologies on city building and facilities will either increase significantly (53%) or increase slightly (33%).

Compared to previous surveys, this year’s report shows an expanding commitment to the deployment of solar energy technologies. In 2016, only two-thirds of mayors expected their goals for deploying solar energy technologies on city building and facilities to increase; three in ten cities expected deployments to increase significantly (30%) and more than one-third of cities expected deployments to increase slightly (35%).

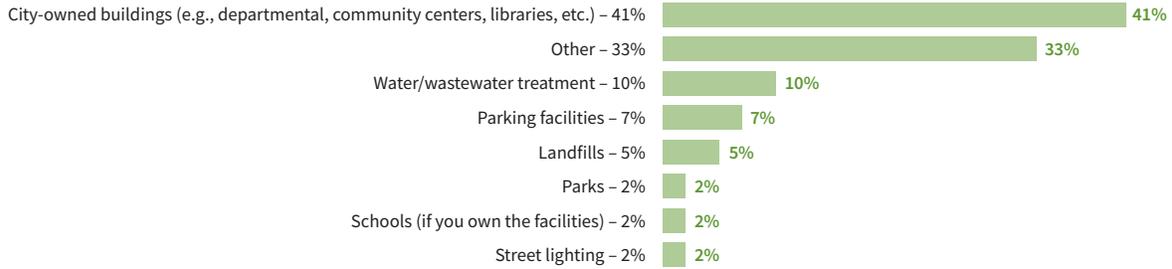
### Solar Energy Deployments on City Buildings and Facilities over Next 5 Years are Expected to ...



**Six in ten mayors indicate their cities have a plan to install solar energy technologies on city-owned buildings and other assets.** This 60 percent share of mayors with a solar energy plan in place represents a significant increase over five years ago; the Conference’s 2016 survey found that only 37 percent of cities had a solar energy plan.

**Mayors with a plan were asked to identify a single target area for solar installations on city-owned buildings and assets, with more than two of five mayors selecting city-owned buildings.** While buildings are the top choice (41%), one in three respondents (33%) indicate Other as their top choice, writing that they would have selected “all of the above” or some combination of the listed options if given the choice.

## Area Targeted in City Plans for Solar Energy Installations



**When asked about various practices/initiatives to advance solar energy, mayors cite solar power purchase agreements as their top choice.** After *solar power purchase agreements* (45%), mayors identify these choices most often: *community solar program* (43%), *solar energy production/use goals* (42%), and *roof conditions on city-owned buildings monitored/managed rooftop solar potential inventory* (41%). The following practices/initiatives, as shown below, are cited most frequently by cities.

## Adopted City Practices/Initiatives to Promote/Develop/Expand Solar Energy Use



NOTE: Cities asked to indicate all that apply.

## VEHICLES - EV CHARGING

With increased attention to the deployment of electric vehicles to “electrify” more of the transportation sector, this survey queried mayors on specific issues relating to the increased use of electric vehicles (EVs).

**When queried on the issue of EV charging infrastructure, more than two of three mayors indicate their city has a plan/strategy for building out this infrastructure.** These mayors with a plan/strategy (69%) were then asked if the technology’s implementation was dependent upon securing additional resource commitments from federal, state and/or private sector partners. Nearly nine of ten mayors (89%) are counting on partner resources to help fund their EV charging infrastructure.

**Nearly every mayor (97%) indicates that their EV charging infrastructure plan/strategy was part of a larger city effort to reduce energy use/climate emissions in the transportation sector.**

## OTHER TECHNOLOGIES

Among other questions pertaining to technology deployments and use, mayors were asked to identify their primary reasons for developing renewable energy supplies and other distributed generation systems.

**Nearly nine of ten mayors identify carbon emission reductions as the top choice among their primary reasons for developing renewable energy and other distributed energy systems.** In addition to carbon emission reductions (87%), mayors make climate resiliency a close second, with 81 percent of mayors citing this reason.

When mayors were asked a related question in 2016, specifically to identify their top two reasons for adopting and developing new energy technologies, cost savings (81%) and energy savings (75%) were cited most often, with lower carbon emissions as their fourth choice (37%).

### Primary Reasons Cities Are Developing Renewable Energy and Other Distributed Generation Systems



*NOTE: Cities asked to indicate all that apply.*

When queried about energy storage systems, mayors were asked if they had a plan to build out energy storage infrastructure to help sustain critical public services during energy emergencies. **More than one of three mayors – 35 percent of respondents – have a city plan for energy storage infrastructure, citing a broad range of services and activities such plans seek to protect.** Public services that were often cited in their written responses were public safety and emergency operations centers, 911 call centers, evacuation centers, drinking water and wastewater treatment, among others.

**More than three in four mayors indicate their city has a plan or strategy to address cybersecurity threats to critical local infrastructure.** In addition to these cities (77%) with a plan or strategy, all the other cities – nearly one in four (23%) – expect to develop one within three years.

## CITY ENERGY PLANS AND LOCAL PRIORITIES

This final section of the report compares two groups of respondents in this survey – those mayors whose city has already developed a comprehensive energy plan (43%) and those mayors whose city has yet to do so (57%). While the responses were mostly consistent across both groups, the following table highlights some of the areas where there were differences, with arrows indicating responses above or below the percentages shown in the report’s findings.

### Differences Above or Below the Percentages Shown in the Report’s Findings

	Cities <b>With</b> Energy Plan		Cities <b>Without</b> Energy Plan
<b>MOST PROMISING TECHNOLOGIES:</b> Reducing Carbon Emissions/ Energy Use	▲	All-electric vehicles	▼
	▲	Low-energy Buildings	▼
<b>TARGETED AREAS:</b> Energy Efficiency/ Reduced Energy Use	▲	Energy (shifting fuel sources)	▼
	▼	Outdoor Lighting	▲
	▲	Public Transit	▼
	▼	Wastewater Treatment	▲
<b>BUILDINGS:</b> How Cities Encourage Non-Municipal Benchmarking	▲	Education Campaigns for Building Sectors	▼
	▲	Incentives from Electric/Gas Utilities	▼
<b>LIGHTING:</b> Areas Targeting for Connected Lighting	▲	City-owned Buildings	▼
	▼	Traffic Lights	▲
<b>SOLAR:</b> Areas Targeted for Solar Installations	▼	City-owned Buildings	▲
	▼	Waste/Wastewater Facilities	▲
<b>SOLAR:</b> City Practices to Advance Solar Installations	▲	Solar Energy Production/Use Goals	▼
	▲	Solar Power Purchase Agreements	▼
<b>NEW INFRASTRUCTURE:</b> Plan/Strategy to Build Out Other Technologies	▲	Energy Storage Systems	▼
	▲	EV Charging Infrastructure	▼



# Participating Cities

Albany, NY  
Anaheim, CA  
Arlington, TX  
Augusta, GA  
Aurora, CO  
Austin, TX  
Baltimore, MD  
Bend, OR  
Bethlehem, PA  
Beverly, MA  
Beverly Hills, CA  
Birmingham, AL  
Boston, MA  
Bridgeport, CT  
Burnsville, MN  
Campbell, CA  
Carmel, IN  
Chapel Hill, NC  
Charlotte, NC  
Chicago, IL  
Cincinnati, OH  
Clayton, MO  
College Park, MD  
Columbia, SC  
Columbus, OH  
Concord, NC  
Dallas, TX  
Dayton, OH  
Denton, TX  
Denver, CO  
Des Moines, IA  
Detroit, MI  
Edina, MN  
Elizabeth, NJ  
Eugene, OR  
Evanston, IL  
Fayetteville, AR  
Fort Wayne, IN  
Fresno, CA  
Gary, IN  
Grand Rapids, MI  
Green Bay, WI  
Gresham, OR  
Hartford, CT  
Hazel Crest, IL  
Henderson, NV  
Hillsboro, OR  
Honolulu, HI  
Houston, TX  
Huntington, WV  
Issaquah, WA  
Kansas City, MO  
Lima, OH  
Lincoln, NE  
Long Beach, CA  
Los Angeles, CA  
Louisville, KY  
Madison, WI  
Manchester, NJ  
Mesa, AZ  
Miami, FL  
Midland, TX  
Milwaukee, WI  
New Bedford, MA  
New Orleans, LA  
New York, NY  
Newark, NJ  
Normal, IL  
Norman, OK  
North Lauderdale, FL  
Orlando, FL  
Petaluma, CA  
Philadelphia, PA  
Phoenix, AZ  
Piscataway, NJ  
Pittsburgh, PA  
Portland, OR  
Redmond, WA  
Reno, NV  
Richmond, VA  
Rochester, MI  
Rochester, MN  
Rochester Hills, MI  
Romeoville, IL  
San Antonio, TX  
San Francisco, CA  
San Jose, CA  
San Leandro, CA  
San Rafael, CA  
Santa Monica, CA  
Schaumburg, IL  
Schenectady, NY  
Sesser, IL  
Sheboygan, WI  
Shreveport, LA  
St. Louis, MO  
St. Petersburg, FL  
Tampa, FL  
Tucson, AZ  
Washington, DC  
West Palm Beach, FL  
Westland, MI  
Winston-Salem, NC

## ABOUT THE SURVEY

This report was prepared by The U.S. Conference of Mayors and sponsored by Signify. From July 1, 2021 through October 22, 2021, mayors could complete the survey electronically, with 103 responses received by the deadline. By email, the Conference contacted about 1,400 mayors, nearly all representing cities with a population of 30,000, requesting mayors to complete the survey. We would like to thank all those who participated in the survey.



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