Shining Cities 2022

The Top U.S. Cities for Solar Energy

ENVIRONMENT CALIFORNIA
RESEARCH & POLICY CENTER

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Cover photo: The Boston skyline is visible over the largest solar installation in Boston, located on a warehouse in the Seaport district. Image courtesy of Solar Design Associates - www.solardesign.com.

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Executive summary

Solar power continues to expand rapidly. The United States now has 121.4 gigawatts (GW) of solar photovoltaic (PV) capacity, producing enough solar energy to power more than 23 million homes.[1] Millions of Americans have invested in solar energy and millions more are ready to join them.[2]

America's major cities have played a key role in the clean energy revolution and stand to reap tremendous benefits from solar energy. As population centers, they are major sources of electricity demand and, with millions of rooftops suitable for solar panels, they have the potential to be major sources of clean energy production as well.

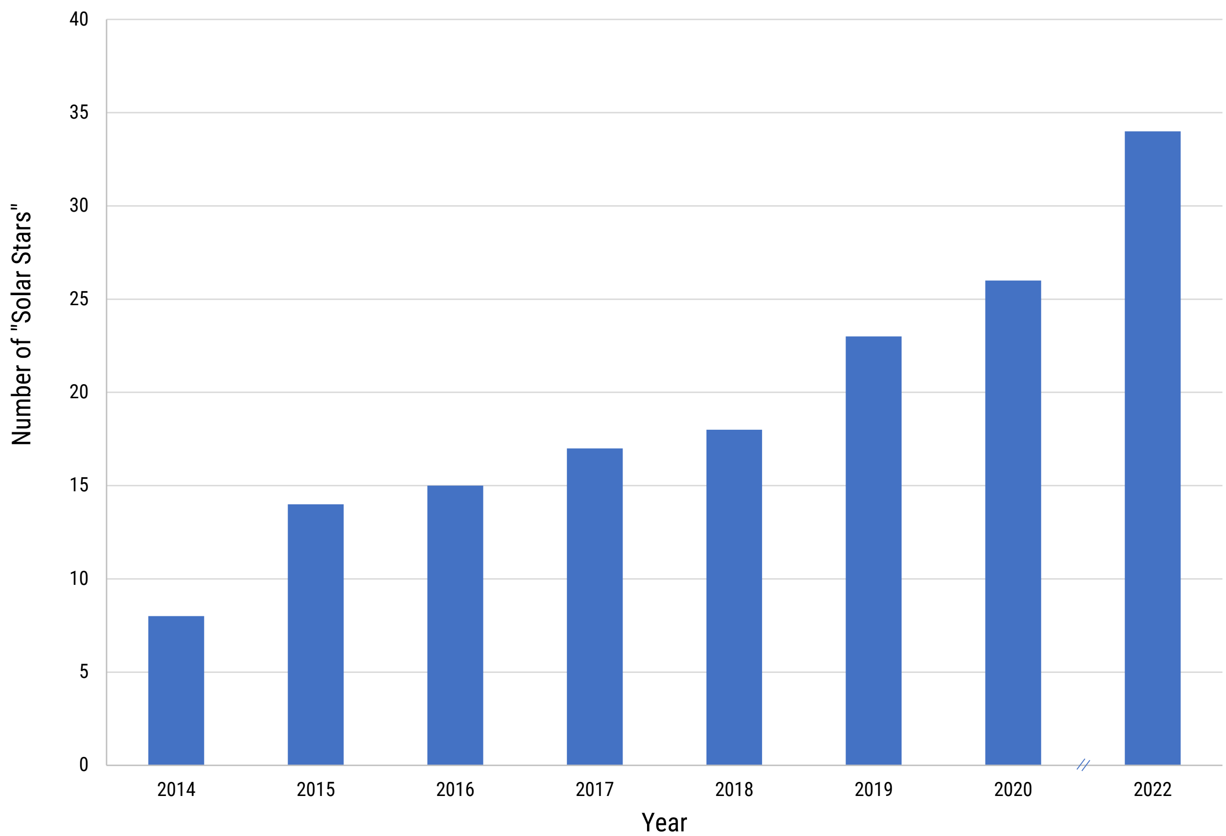

Figure ES-1. The number of cities with >50W of solar PV per capita ("Solar Stars" and "Solar Superstars") in each edition of Shining Cities

Our eighth survey of solar energy in America's biggest cities finds that the amount of solar power installed in just nine U.S. cities exceeds the amount installed in the entire United States 10 years ago.[3] Of the 56 cities surveyed in all eight editions of this report, 15 recorded a tenfold increase in their solar capacity between 2014 and 2022.

To continue America's progress toward renewable energy, cities, states and the federal government should adopt strong policies to make it easy and affordable for homeowners, businesses and utilities to "go solar."

The cities with the most solar PV installed per resident are the "Solar Superstars" – cities with 100 or more watts of solar PV capacity installed per capita. Next are "Solar Stars" with over 50 watts per person. **In 2014, only eight of the cities surveyed for this report had enough solar PV per capita to be ranked as "Solar Stars," but now 34 cities have earned the title.**

Honolulu leads the United States for solar power per person among cities surveyed, followed by Las Vegas, San Diego, Albuquerque and San Jose. All of the "Solar Superstars" have experienced strong and sustained growth in solar energy and are setting the pace nationally for solar energy development.

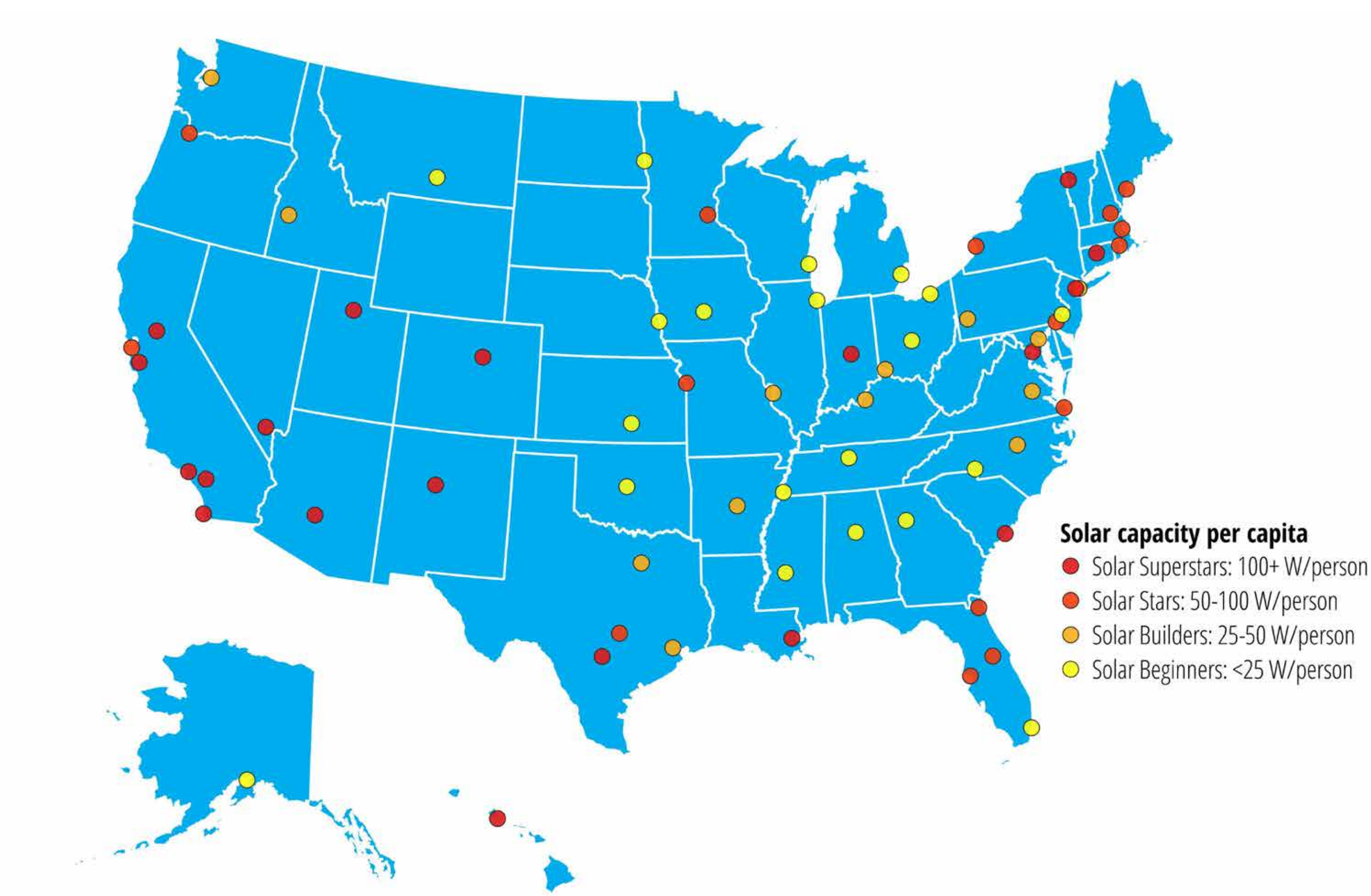

Figure ES-2. Major U.S. cities by installed solar PV capacity per capita, end of 2021 (watts per person)

Table ES-1. The "Solar Superstars" (cities with 100 or more watts of solar PV per person, end of 2021)

Per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar capacity (MW) ǂ	Total solar rank
1	Honolulu	HI	Pacific	1,133.5	397.8	4
2	Las Vegas*	NV	Mountain	689.9	442.8	3
3	San Diego	CA	Pacific	337.4	468.0	2
4	Albuquerque	NM	Mountain	295.5	166.8	9
5	San Jose	CA	Pacific	287.1	290.9	8
6	San Antonio	TX	South Central	247.4	354.9	5
7	Burlington	VT	Northeast	222.9	10.0	46
8	New Orleans	LA	South Central	218.0	83.7	15
9	Phoenix	AZ	Mountain	212.7	342.0	7
10	Washington*	DC	South Atlantic	203.3	140.2	10
11	Riverside	CA	Pacific	195.0	61.4	19
12	Denver	CO	Mountain	189.0	135.3	11
13	Salt Lake City	UT	Mountain	182.8	36.5	24
14	Los Angeles	CA	Pacific	166.7	649.9	1
15	Sacramento	CA	Pacific	159.8	83.9	14
16	Indianapolis	IN	North Central	142.1	126.1	12
17	Newark	NJ	Northeast	112.0	34.9	27
18	Hartford	CT	Northeast	102.1	12.4	41
19	Charleston*	SC	South Atlantic	101.5	15.2	38

ǂ Throughout the report, includes all solar PV capacity (rooftop and utility-scale solar installations) within the city limits of each city in DC megawatts. Does not include solar power installed in the extraterritorial jurisdictions of cities, even those installed by or under contract to municipal utilities. See Methodology for an explanation of how these rankings were calculated. See Appendix B for city-specific sources of data.

* Due to an improvement in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

Los Angeles leads the nation in total installed solar PV capacity among all cities surveyed in this report, as it did from 2014 to 2016 and from 2018 to 2020, after briefly being topped by San Diego in 2017.

Leading solar cities can be found in every region of the country. Leaders in per capita solar capacity by census region include **Honolulu** in the Pacific region, **Las Vegas** in the Mountain region, **Indianapolis** in the North Central region, **San Antonio** in the South Central region, **Washington, D.C.,** in the South Atlantic region, and **Burlington** in the Northeast region.

Fossil fuel interests and some utilities are working to slow the growth of distributed solar energy. Over the past few years, many states have considered or passed rollbacks to net metering – the critical practice of crediting solar energy customers for the excess energy they supply to the grid.[4] Additionally, some states and utilities continue to target solar customers with special fees, charges and rate designs in order to reduce the appeal and financial promise of installing solar panels. These changes undermine the value of solar power and can stall cities' development of their solar resources.

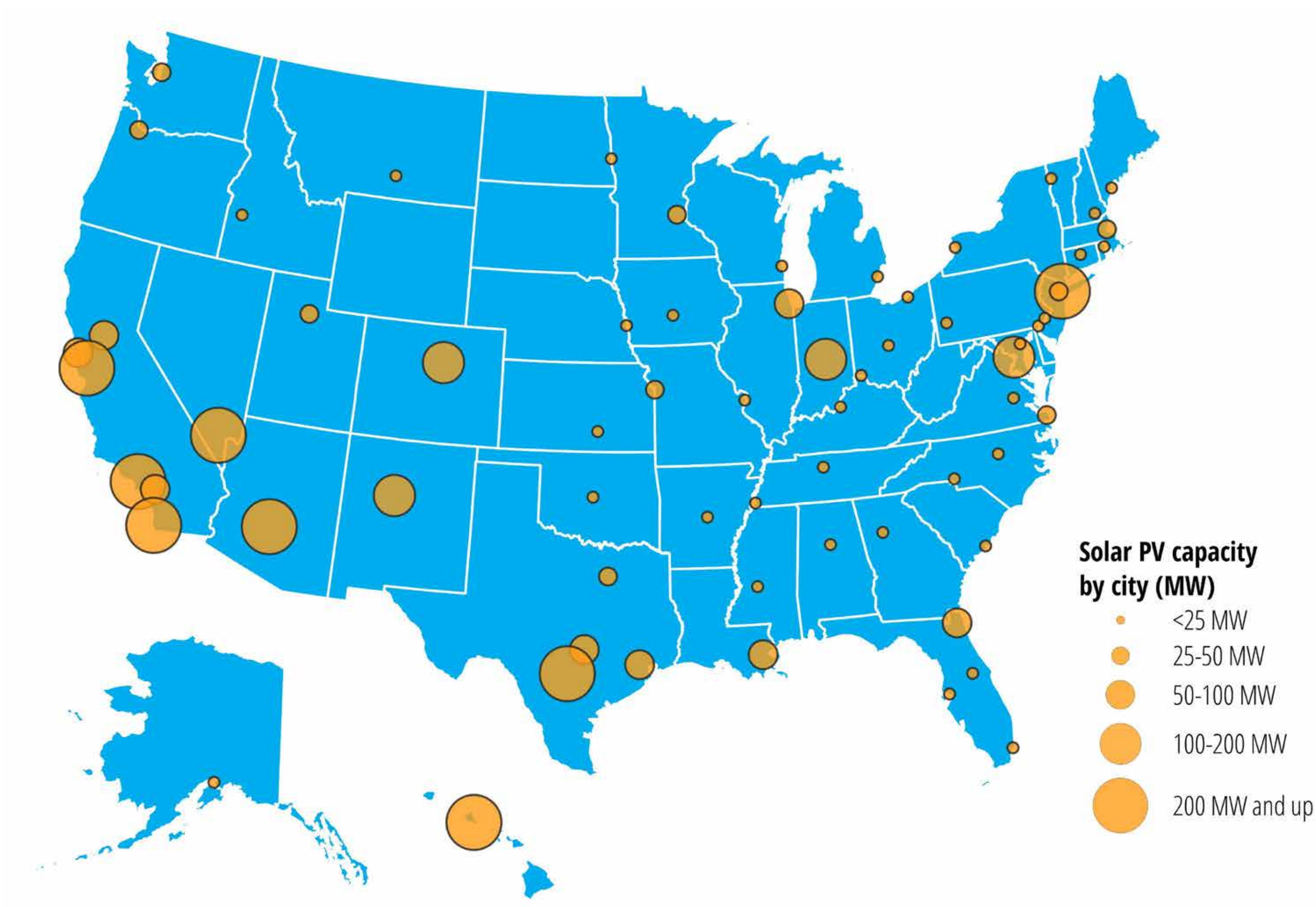

Figure ES-3. Major U.S. cities by total installed solar PV capacity, end of 2021 (MW)

Table ES-2. Top 20 shining cities by total installed solar PV capacity, end of 2021

Total solar rank	City	State	Region	Total solar capacity (MW)	Per capita solar (watts per person)	Per capita rank
1	Los Angeles	CA	Pacific	649.9	166.7	14
2	San Diego	CA	Pacific	468.0	337.4	3
3	Las Vegas*	NV	Mountain	442.8	689.9	2
4	Honolulu	HI	Pacific	397.8	1133.5	1
5	San Antonio	TX	South Central	354.9	247.4	6
6	New York	NY	Northeast	354.4	40.3	38
7	Phoenix	AZ	Mountain	342.0	212.7	9
8	San Jose	CA	Pacific	290.9	287.1	5
9	Albuquerque	NM	Mountain	166.8	295.5	4
10	Washington*	DC	South Atlantic	140.2	203.3	10
11	Denver	CO	Mountain	135.3	189.0	12
12	Indianapolis	IN	North Central	126.1	142.1	16
13	Austin	TX	South Central	92.3	96.0	20
14	Sacramento	CA	Pacific	83.9	159.8	15
15	New Orleans	LA	South Central	83.7	218.0	8
16	Houston	TX	South Central	81.4	35.3	41
17	Jacksonville^	FL	South Atlantic	63.6	67.0	30
18	San Francisco*	CA	Pacific	62.8	71.9	26
19	Riverside	CA	Pacific	61.4	195.0	11
20	Chicago	IL	North Central	51.8	18.9	51

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

^ Updated data not available. Capacity estimate is from Shining Cities 2020.

To take advantage of the nation's vast solar energy potential and move America toward 100% renewable energy, city, state and federal governments should adopt a series of strong pro-solar policies.

Local governments should, among other things:

- Establish goals for 100% renewable energy and create roadmaps and programs to meet those goals.
- Adopt Solar Automated Permit Processing (SolarAPP+), a fast, automated online permitting system developed by the Department of Energy and available free of charge for local governments.
- Expand access to solar energy to apartment dwellers, low-income residents, small businesses and nonprofits through community solar projects, virtual net metering and third-party financing options such as power purchase agreements (PPAs).
- Implement policies that support energy storage, electric vehicle smart charging and microgrids.

State governments should, among other things:

- Adopt and preserve strong interconnection and net metering policies that support, not punish, solar adoption.
- Set a target of using 100% renewable energy, put a plan in place to reach that goal, and encourage utilities to pursue a 100% renewable energy supply.
- Encourage solar energy installations through incentives such as rebate programs, green bonds, Commercial Property Assessed Clean Energy (C-PACE) financing, tax credits and financing programs such as low- or zero-interest loans.

The federal government should, among other things:

- Continue and expand financing support for solar energy, particularly the Solar Investment Tax Credit, which currently provides a 26% tax credit for the cost of installing solar panels.[5] The credit should be restored to 30% and extended to apply to energy storage systems, such as stand-alone batteries.
- Continue to support research to drive solar power innovations, such as the U.S. Department of Energy's Solar Energy Technologies Office.

Introduction

Solar power shines as an American success story. The United States now has enough solar energy installed to power more than 23 million homes – more than 16% of all homes in America.[6] After growing by 19% in 2021, America's total solar capacity now exceeds 121 gigawatts (GW).[7] Improvements in solar technology and rapidly declining costs continue to make solar energy more attractive with each passing year.

Photo credit, design and construction by Michigan Solutions of Commerce Michigan.

Solar on a former Jeep factory in Detroit.

Much of the recent growth of solar energy is the result of public policy. Federal tax credits for renewable energy have played a key role in encouraging growth in solar power (although, the current solar investment tax credit of 26% is slated to fall to 22% in 2023 and disappear entirely for residential systems in 2024).[8]

State and local policies are also core ingredients of a successful solar market. In the cities where solar energy succeeds, utilities fairly credit solar homeowners for the energy they supply to the grid, installing solar panels is easy and hassle-free, attractive options for solar financing exist, and local governments and officials are committed to supporting solar energy development.

Thanks in large part to strong local and state policies, America's cities are at the center of the solar energy revolution. In these densely populated areas, solar energy now powers hundreds of thousands of homes, office buildings, schools and businesses, all while helping to clean the air and reduce carbon pollution.

Today, solar energy is at a tipping point. In many states, electricity from solar panels is cost-competitive with electricity generated by fossil fuels, and utility-scale solar is now cheaper than new coal or methane gas power plants in many places, even without public subsidies.[9]

Fossil fuel interests and some utilities, however, see the rise of solar power not an opportunity, but as a threat. These interests have united in an effort to slow the progress of solar energy.[10]

In some states, including California and Florida, key policies that have provided a solid foundation for the growth of solar power are now under threat. This includes "net metering," the critical practice of crediting solar energy customers for the excess energy they supply to the grid. The outcome of these debates will determine how rapidly cities and the rest of the nation can gain the benefits of solar energy.

Cities are a central part of America's transition to a 100% clean, renewable energy system. With tremendous unmet potential for solar energy in every city, now is the time for cities, as well as states and the federal government, to recommit to the policies that are bringing a clean, renewable energy system closer to reality.

Solar energy benefits cities

Solar energy helps cities in many ways, including by combating global warming, reducing local air pollution, strengthening the electric grid, and stabilizing energy costs for residents.

Solar energy reduces greenhouse gas emissions

America can limit future impacts of global warming by slashing the use of fossil fuels. Over 180 cities have set goals to use 100% renewable electricity.[11] Unlike fossil fuel power plants, solar energy systems produce no carbon emissions. Accounting for total life cycle emissions, including manufacturing, transportation, installation and decommissioning, solar photovoltaic energy produces 96% fewer greenhouse gas emissions than electricity from coal, and 91% fewer greenhouse gas emissions than electricity from gas-fired power plants.[12] By replacing electricity from fossil fuels with solar power, we can dramatically cut carbon pollution and reduce the impacts of global warming.

Solar energy reduces air pollution, improving public health

Pollution from fossil fuel combustion causes major health problems in American cities. According to the World Health Organization, outdoor air pollution is linked to strokes, heart disease, acute respiratory disease, asthma and lung cancer.[13] These conditions can lead to disability, prolonged absences from work or school, and even death.[14] One study estimated that the 330 coal plant shutdowns in the U.S. between 2005 and 2016 have saved 26,610 lives.[15] Another report associated 11,000 premature deaths with coal power plant emissions in 2018 and 1,800 premature deaths with methane gas power plant emissions in 2019.[16]

Cities in the Midwest and Mid-Atlantic, such as Baltimore, Cincinnati and St. Louis, bear a particularly heavy health burden from pollution due to the high number of coal-fired power plants remaining in those areas.[17] In a high solar adoption scenario, for many cities in the East and Midwest, the most significant decreases in harmful air pollution occur during the most polluted days.[18]

Solar energy reduces the need for electricity generated by polluting, fossil fuel resources. From 2007 to 2015, wind and solar energy were estimated to prevent between 3,000 and 12,700 premature deaths in the U.S. by improving air quality.[19] The times when the most solar energy is generated, i.e. when there is the most sunlight, tend to coincide with times of peak demand for air conditioning. As a result, solar energy can help replace the need for “peaker” power plants, which only operate when electricity demand is highest and tend to be the oldest, most expensive and most polluting power stations.[20] The impact of harmful air pollution such as smog is exacerbated by high temperatures, meaning replacing high-polluting “peaker” plants with solar energy further benefits public health.[21]

Solar energy makes cities more resilient to disasters

Solar energy, when paired with energy storage or integrated into microgrids, can help keep the power on during disasters when the main electric grid has gone down. Hospitals, fire stations and storm shelters can use solar and battery storage in order to stay online and respond to community needs in times of crisis.[22] Fire stations in Fremont, Calif., Portland, Ore., Charlotte, N.C., and Chicago use solar microgrids to bolster resilience.[23]

After a devastating hurricane in Puerto Rico in 2017, a water treatment plant and children's hospital installed solar panels and batteries, as did several fire stations and community centers. These microgrids kept their facilities powered even after a 2020 earthquake knocked out the island's largest power plant.[24] Research into Puerto Rico's hurricane recovery found that reinforcing critical infrastructure networks with microgrids could help avoid cascading failures and blackouts even if a large fraction of the network is rendered inoperable.[25]

Solar energy helps cities conserve water in times of drought. Nationally, electricity production accounts for about 34% of freshwater withdrawals.[26] Unlike the fossil fuel-fired power plants that currently generate the bulk of American electricity, solar PV systems do not require high volumes of water for cooling. In fact, solar PV systems consume 1/680th of the water of coal power plants and 1/200th of the water of methane gas plants, per unit of electricity produced.[27]

Solar power also helps prepare for unexpected disasters. In February 2021, an Arctic cold front brought freezing temperatures to large parts of Texas and the southern U.S., and more than 4.5 million Texans lost power. There were 13 days during the cold snap on which power production fell short of forecasted demand; on 11 of those days, a full deployment of rooftop solar could have supplied more than enough power to meet the aggregate daily shortfall in power demand.[28]

Photo: The University of Texas at San Antonio

The San Antonio skyline beyond rows of solar panels.

Solar energy benefits consumers

Cities that make solar energy accessible and affordable provide direct and indirect benefits to their residents, including solar energy customers and other members of the community.

Homeowners and business owners who install solar panels on their buildings can generate their own electricity, which helps protect them from increases in fossil fuel prices – particularly when they pair their solar panels with energy storage systems, such as batteries. Solar can insulate consumers from unpredictable price spikes associated with fossil fuels, such as those due to geopolitical conflict or natural disasters.

In states with net metering, when solar panel owners generate more energy than they need at a given point in time they can export this energy to the grid in exchange for credit. They can then use the credit to pay for electricity they receive from the grid later, when their solar panels aren't generating enough energy to provide for their needs. On average, about 20-40% of a solar energy system's output is exported back to the electric grid, helping meet the need of nearby customers with clean, locally produced solar energy.[29] The credits collected by system owners can help them recoup initial investments made in PV systems, often in eight years or fewer.[30]

Distributed solar energy benefits the broader electric grid

The benefits of solar energy extend beyond the buildings on which PV panels are installed. Having more customers produce their own electricity with solar PV panels, particularly when they are paired with batteries, helps utilities avoid the need to turn on – and sometimes even build – "peaker" power plants that are only used when electricity demand is highest. These power plants tend to be the most expensive to operate, so replacing them with solar energy can help save electric utilities money.

Generating more electricity closer to the locations where it is used reduces the need to construct or upgrade expensive transmission and distribution lines. Localized electricity generation also minimizes "line losses," the 5% or more of energy lost during transmission.[31] If electric utilities pass these savings on in the form of lower electric bills, solar energy can help save all electric customers money. An analysis by the Coalition for Community Solar Access found that expanding local solar and storage could save more than $300 billion by 2050.[32]

Batteries and electric vehicles expand solar energy's potential

The price of lithium-ion batteries has fallen 89% since 2010, leading to rapid growth in the markets for home energy storage systems and electric vehicles.[33] These products expand opportunities to use solar power as a replacement for fossil fuels, helping further reduce greenhouse gas emissions and air pollution. When solar panels produce more electricity than is immediately needed by a home, energy storage systems can capture the energy to be used later. This allows solar panels to meet a higher percentage of electricity needs more of the time.

Electric vehicles can serve a similar function by charging when solar panels are producing excess energy. EVs also enable solar energy to power the transportation sector of our economy, the leading source of greenhouse gas emissions in the United States in 2020.[34] Fleets of electric cars and buses could someday stabilize the grid by banking solar power in their batteries for later deployment. One study focused on the PJM Interconnection found that widespread deployment of "vehicle to grid" capable EVs could increase renewable energy development by nearly 30% over scenarios without such a deployment.[35]

America's top shining cities are building a clean energy future

City leaders and residents are taking advantage of the opportunities offered by solar energy. In leading cities, officials are setting ambitious goals for solar energy adoption, putting solar panels on city buildings, and working with utilities to upgrade the electric grid and offer their customers incentives to invest in solar energy systems. In these cities, permitting departments are taking steps to reduce fees and processing times for solar installation applications. As a result, city residents, individually and with their neighbors, are cutting their electricity bills and contributing to a cleaner environment by going solar.

This report is our eighth review of installed solar PV capacity in major U.S. cities. This year, the list of cities surveyed starts with the primary cities in the top 50 most populous Metropolitan Statistical Areas in the United States, according to the U.S. Census Bureau.[36] If a state did not have a city included in that list, its most populous city was added. Charleston, W. Va., Cheyenne, Wyo., and Sioux Falls, S.D., have not provided data for this report within the last four years and are not represented in this year's report. For a complete list of cities, see Appendix A.

There is no uniform and comprehensive national data source that tracks solar energy capacity by municipality, so the data for this report come from a variety of sources: municipal and investor-owned utilities, city and state government agencies, operators of regional electric grids and non-profit organizations (see Methodology). This may lead to variation among cities in how solar capacity is quantified and in the comprehensiveness of the data. While we endeavored to correct for many of these inconsistencies, readers should be aware that some discrepancies may remain. In some cases, more precise methods were found for measuring solar capacity for this year's report, meaning that comparisons with data reported in previous reports may not be valid. Such cases are noted in Appendix B.

Leading cities continue to grow in solar capacity per capita

The cities ranked in this report vary in size, population and geography. Measuring solar PV capacity installed per city resident, in addition to total installed solar PV capacity, provides a metric for how successfully cities have tapped their solar power potential in relation to their size.

Cities with 100 watts or more of capacity per capita are termed "Solar Superstars." These cities have experienced dramatic growth in solar energy in recent years and are setting the pace nationally for solar energy development.

Honolulu ranks first among surveyed cities in solar power per capita, with over a kilowatt of solar capacity per person, the equivalent of more than three solar panels for each person within urban Honolulu. Las Vegas, San Diego, Albuquerque, N.M., and San Jose, Calif., round out the top five cities in solar per capita.

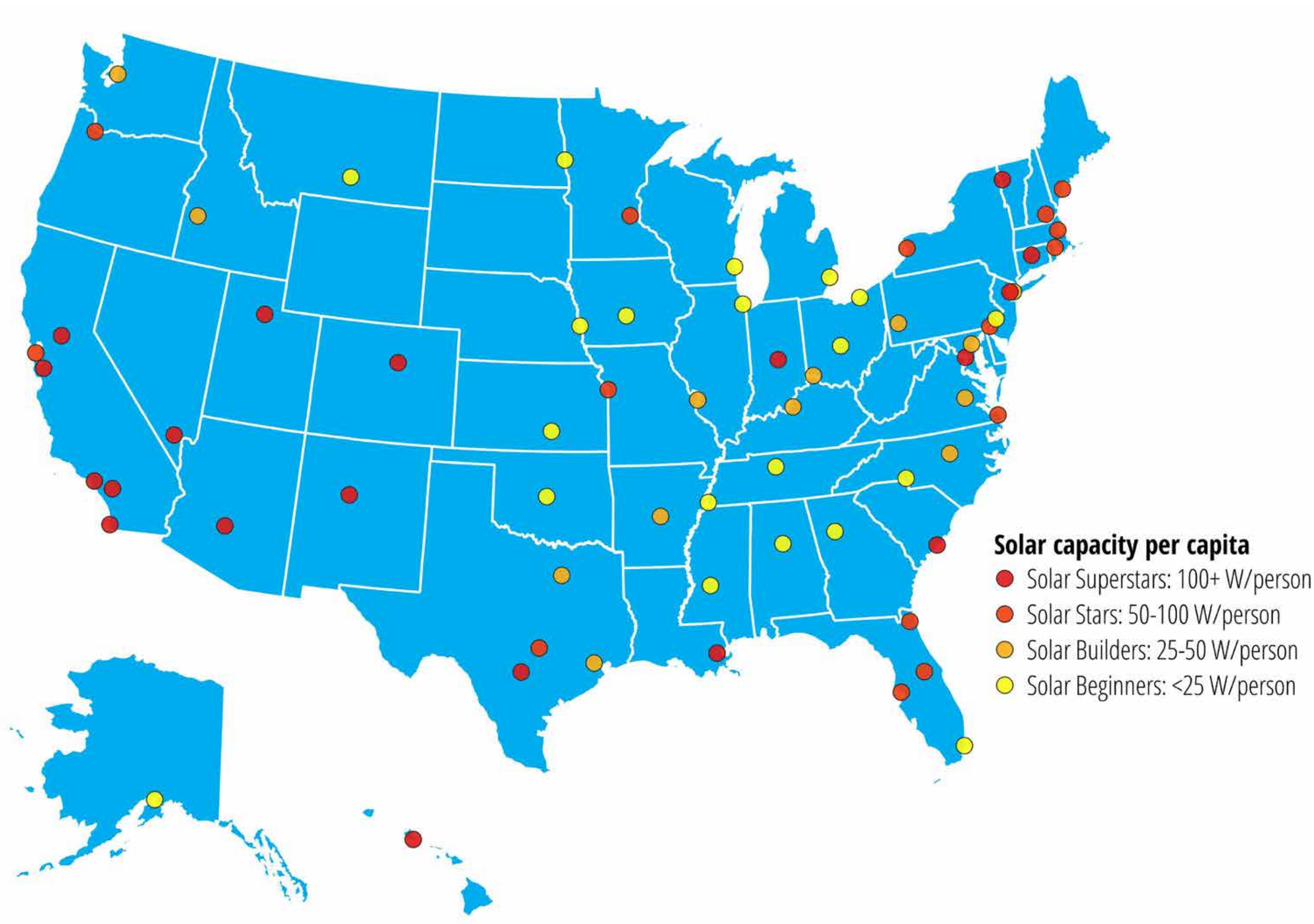

Figure 1. U.S. cities by installed solar PV capacity per capita, end of 2021 (watts per person)

Table 1. "Solar Superstars" (cities with 100 or more watts of solar power per person, end of 2021)

Per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar capacity (MW)	Total solar rank
1	Honolulu	HI	Pacific	1,133.5	397.8	4
2	Las Vegas*	NV	Mountain	689.9	442.8	3
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13	Salt Lake City	UT	Mountain	182.8	36.5	24
14	Los Angeles	CA	Pacific	166.7	649.9	1
15	Sacramento	CA	Pacific	159.8	83.9	14
16	Indianapolis	IN	North Central	142.1	126.1	12
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19	Charleston*	SC	South Atlantic	101.5	15.2	38

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

In 2014, only eight of the cities surveyed for this report exceeded the 50 watts per person threshold to be ranked as "Solar Stars," the previous top category in this report. Now, 34 cities have enough solar capacity to rank as "Solar Stars." Buffalo, N.Y., Minneapolis, Virginia Beach, Va., Providence, R.I., Manchester, N.H., Orlando, Fla., Kansas City, Mo., and Tampa, Fla., rose to make the "Solar Stars" list for the first time.

Table 2. The "Solar Stars" (cities with 50 to 100 watts of solar power per person, end of 2021)

Per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar capacity (MW)	Total solar rank
20	Austin	TX	South Central	96.0	92.3	13
21	Buffalo	NY	Northeast	85.8	23.9	31
22	Minneapolis*	MN	North Central	81.4	35.0	26
23	Virginia Beach*	VA	South Atlantic	78.1	35.9	25
24	Providence	RI	Northeast	74.8	14.3	40
25	Manchester	NH	Northeast	74.7	8.6	49
26	San Francisco*	CA	Pacific	71.9	62.8	18
27	Portland	OR	Pacific	71.1	46.4	23
28	Boston	MA	Northeast	70.4	47.6	21
29	Orlando	FL	South Atlantic	68.7	21.1	33
30	Jacksonville^	FL	South Atlantic	67.0	63.6	17
31	Wilmington*	DE	South Atlantic	65.1	4.6	59
32	Portland	ME	Northeast	62.1	4.2	61
33	Kansas City	MO	North Central	57.6	29.3	29
34	Tampa	FL	South Atlantic	56.9	21.9	32

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

^ Updated data not available. Capacity estimate is from Shining Cities 2020.

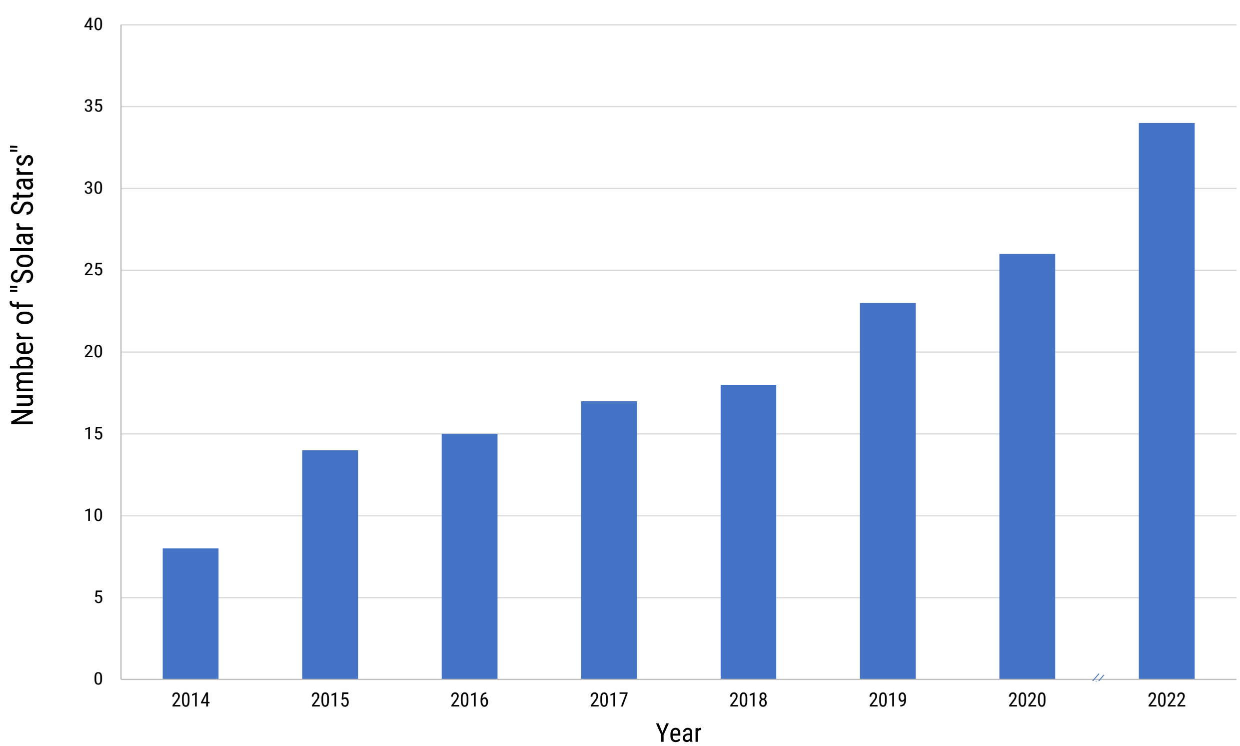

Figure 2: The number of cities with >50W of solar PV per capita ("Solar Stars" and "Solar Superstars") in each edition of Shining Cities

"Solar Builders" have between 25 and 50 watts of solar PV installed per person. Boise, Seattle, New York and Houston all showed strong improvement over the past years.

Table 3. The "Solar Builders" (cities with 25 to 50 watts of solar power per person, end of 2021)

Per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar capacity (MW)	Total solar rank
35	Boise	ID	Mountain	48.8	11.5	43
36	Seattle*	WA	Pacific	45.7	33.7	28
37	Richmond	VA	South Atlantic	45.7	10.4	44
38	New York	NY	Northeast	40.3	354.4	6
39	St. Louis	MO	North Central	39.7	12.0	42
40	Dallas	TX	South Central	36.3	47.4	22
41	Houston	TX	South Central	35.3	81.4	16
42	Raleigh*	NC	South Atlantic	33.8	15.8	37
43	Baltimore	MD	South Atlantic	27.7	16.2	36
44	Cincinnati	OH	North Central	26.6	8.2	50
45	Pittsburgh	PA	Northeast	26.5	8.0	51
46	Louisville*	KY	South Central	25.3	6.2	53
47	Little Rock	AR	South Central	25.2	5.1	56

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

The “Solar Beginners” are cities that have installed under 25 watts of solar PV capacity per person. Oklahoma City, Columbus, Ohio, and Memphis, Tenn., have all worked their way up in the rankings considerably over the past two years.

Table 4. The “Solar Beginners” (cities with <25 watts of solar power per person, end of 2021)

Per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar capacity (MW)	Total solar rank
48	Oklahoma City	OK	South Central	21.3	14.5	39
49	Charlotte*	NC	South Atlantic	20.3	17.8	34
50	Columbus	OH	North Central	19.0	17.2	35
51	Chicago	IL	North Central	18.9	51.8	20
52	Jackson	MS	South Central	18.1	2.8	63
53	Milwaukee	WI	North Central	17.8	10.3	45
54	Cleveland*	OH	North Central	16.7	6.2	54
55	Anchorage	AK	Pacific	16.5	4.8	57
56	Des Moines	IA	North Central	15.7	3.4	62
57	Memphis	TN	South Central	15.5	9.8	47
58	Philadelphia	PA	Northeast	15.3	24.5	30
59	Atlanta^	GA	South Atlantic	14.9	7.4	52
60	Detroit	MI	North Central	13.9	8.9	48
61	Wichita	KS	North Central	11.3	4.5	60
62	Miami^	FL	South Atlantic	10.6	4.7	58
63	Billings	MT	Mountain	10.3	1.2	65
64	Nashville	TN	South Central	8.9	6.1	55
65	Omaha	NE	North Central	4.2	2.0	64
66	Birmingham^	AL	South Central	3.7	0.7	66
67	Fargo	ND	North Central	2.0	0.3	67

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

^ Updated data not available. Capacity estimate is from Shining Cities 2020.

The top nine shining cities have more solar power than the entire U.S. 10 years ago

Cities that lead the nation in total installed solar PV capacity come from all regions of the U.S. The top nine cities in our report host more solar capacity than the entire country had installed a decade ago.[37]

Of the 56 cities surveyed in all eight editions of this report, 52 more than doubled their total installed solar PV capacity between 2014 and 2022. There were 15 cities that increased their capacities tenfold. **Ten cities have more solar PV capacity installed than the top city, Los Angeles, did back in 2014**. In total, the cities in this report added 1,545 megawatts (MW) of solar capacity over just the past two years.

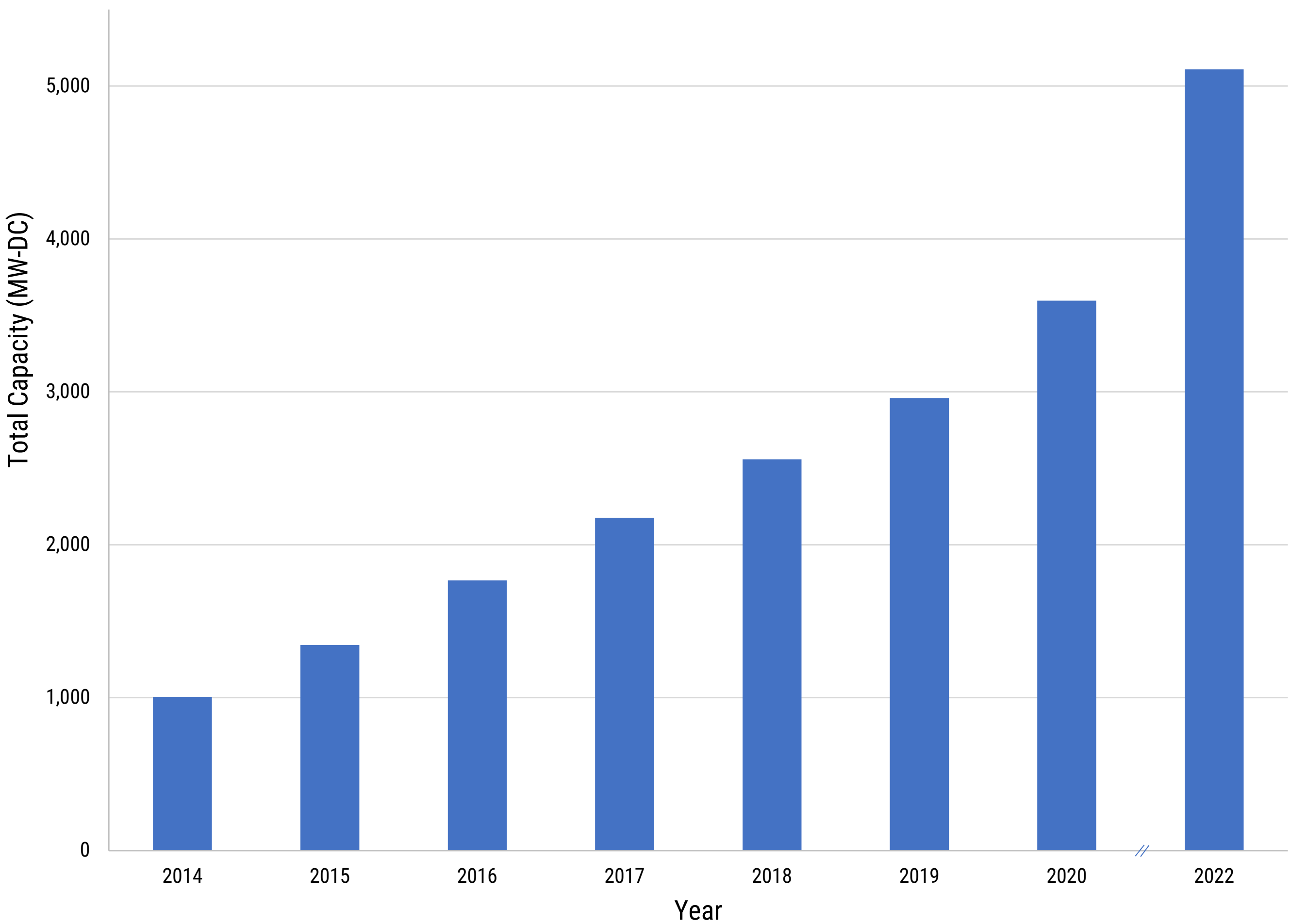

Figure 3: Total solar capacity of the 56 cities included in all eight editions of Shining Cities

In 2022, Los Angeles defended its title as the leading city for total installed solar PV capacity – a title the city has held from 2014 to 2016 and from 2018 to 2020, after briefly being topped by San Diego in 2017.

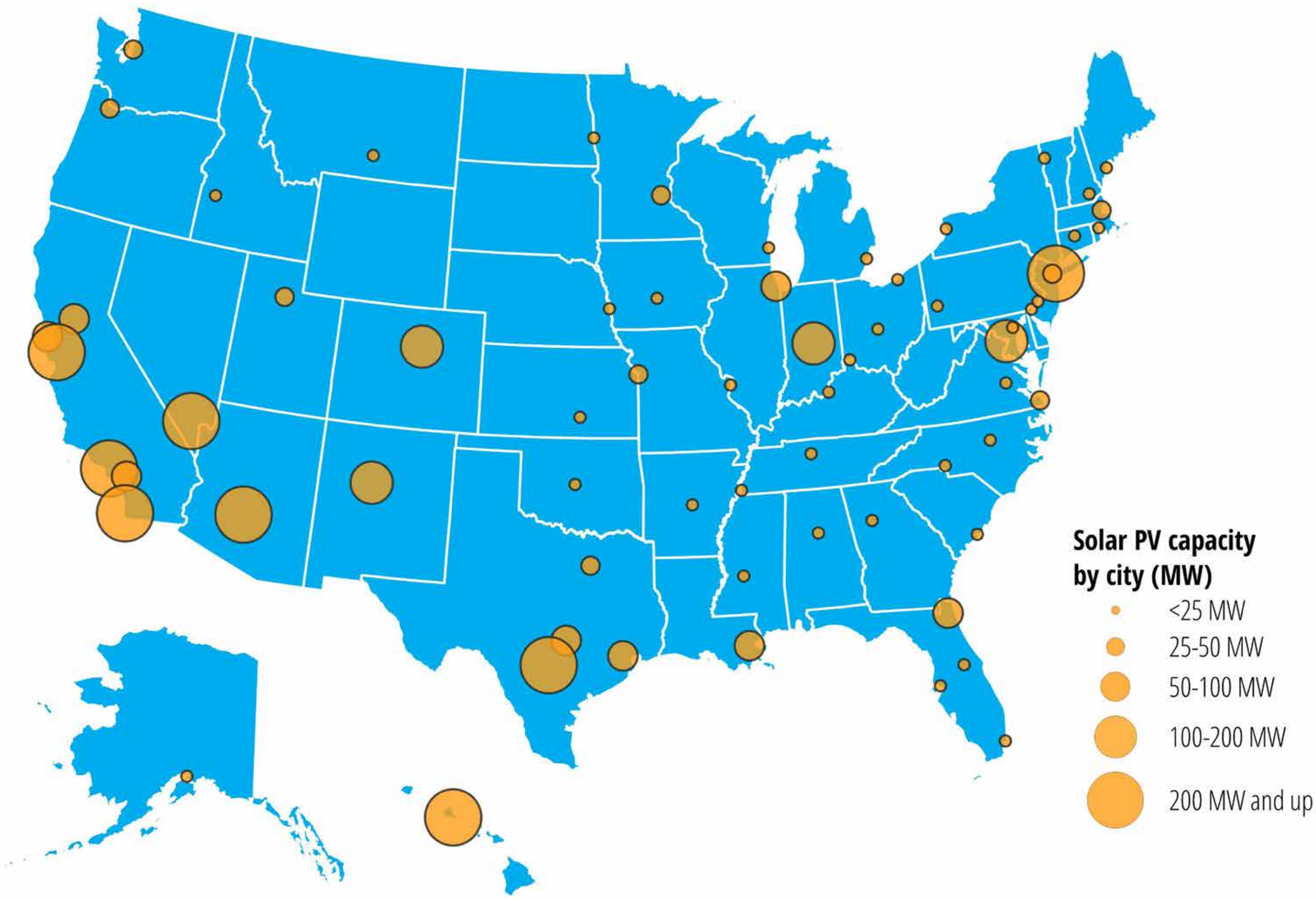

Figure 4. U.S. cities by total installed solar PV capacity, end of 2021 (MW)

Table 5. Top 20 solar cities by total installed solar capacity, end of 2021

Total solar rank	City	State	Region	Total solar capacity (MW)	Per capita solar (watts per person)	Per capita rank
1	Los Angeles	CA	Pacific	649.9	166.7	14
2	San Diego	CA	Pacific	468.0	337.4	3
3	Las Vegas*	NV	Mountain	442.8	689.9	2
4	Honolulu	HI	Pacific	397.8	1133.5	1
5	San Antonio	TX	South Central	354.9	247.4	6
6	New York	NY	Northeast	354.4	40.3	38
7	Phoenix	AZ	Mountain	342.0	212.7	9
8	San Jose	CA	Pacific	290.9	287.1	5
9	Albuquerque	NM	Mountain	166.8	295.5	4
10	Washington*	DC	South Atlantic	140.2	203.3	10
11	Denver	CO	Mountain	135.3	189.0	12
12	Indianapolis	IN	North Central	126.1	142.1	16
13	Austin	TX	South Central	92.3	96.0	20
14	Sacramento	CA	Pacific	83.9	159.8	15
15	New Orleans	LA	South Central	83.7	218.0	8
16	Houston	TX	South Central	81.4	35.3	41
17	Jacksonville^	FL	South Atlantic	63.6	67.0	30
18	San Francisco*	CA	Pacific	62.8	71.9	26
19	Riverside	CA	Pacific	61.4	195.0	11
20	Chicago	IL	North Central	51.8	18.9	51

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with city totals in previous editions of this report. See Appendix B for details on specific cities.

^ Updated data not available. Capacity estimate is from Shining Cities 2020.

Every region of the United States has leading solar cities

Every region of the country has solar energy leaders. Table 6 lists the top two cities in each region with the most installed solar PV capacity per city resident. For this analysis, we used regional designations from the U.S. Census, grouping some regions together for more logical comparisons.[38] We compared cities in the following regions: Pacific, Mountain, South Central, North Central, South Atlantic and Northeast.

In the Pacific region, **Honolulu** leads with 1,133 watts of solar PV capacity installed per person. Other regional leaders include **Las Vegas** for the Mountain region (690 watts/person), **San Antonio** for the South Central region (247 watts/person), **Burlington, Ver.,** for the Northeast region (223 watts/person), **Washington, D.C.,** for the South Atlantic region (203 watts/person), and **Indianapolis** for the North Central region (142 watts/person).

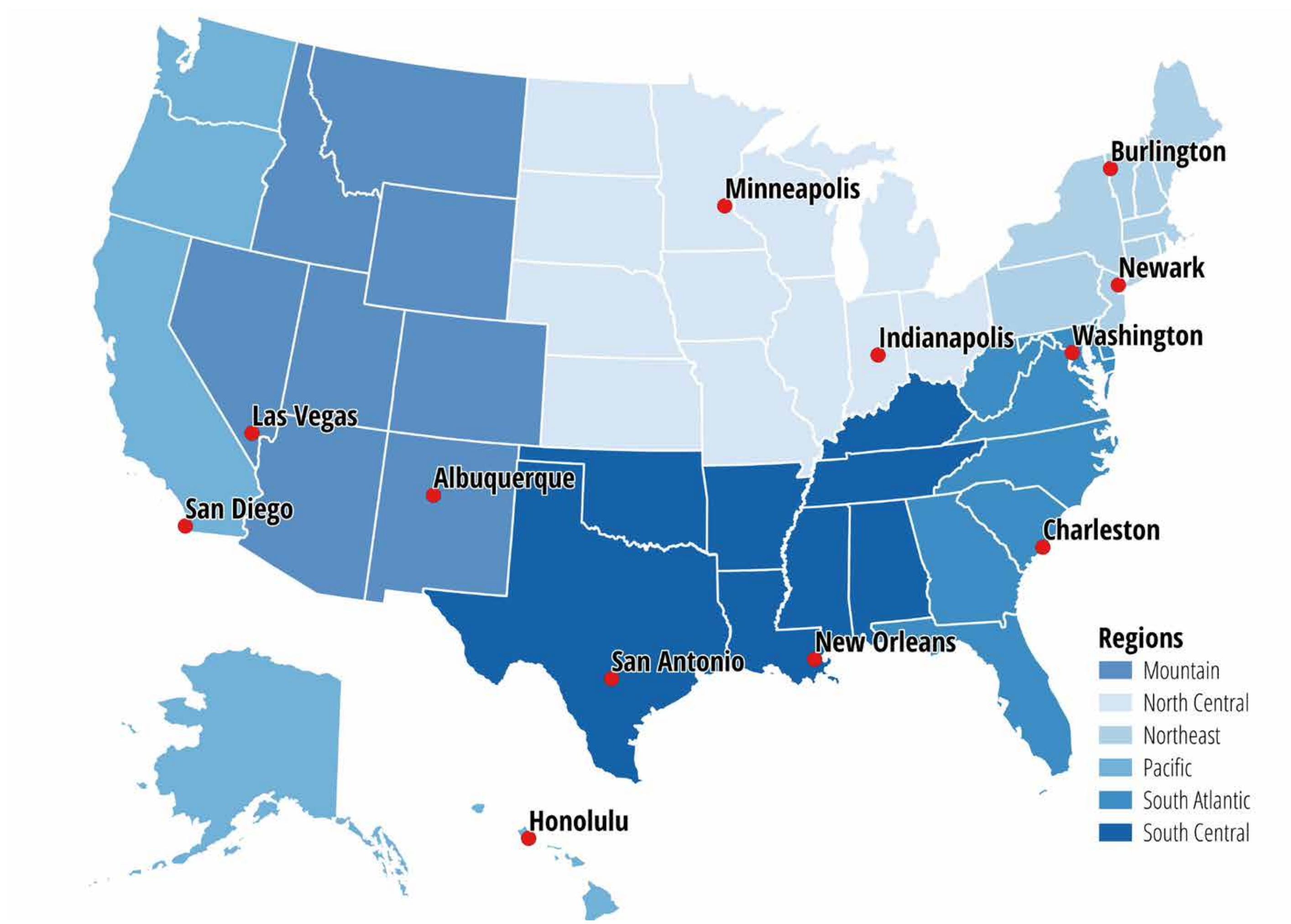

Figure 5. Top two cities in each region ranked by solar PV capacity installed per person, end of 2021

Table 6. Top two cities in each region ranked by solar PV capacity installed per person, end of 2021

Regional per capita rank	City	State	Region	Per capita solar (watts per person)	Total solar (MW)
1	Honolulu	HI	Pacific	1,133.5	397.8
2	San Diego	CA	Pacific	337.4	468.0
1	Las Vegas*	NV	Mountain	689.9	442.8
2	Albuquerque	NM	Mountain	295.5	166.8
1	San Antonio	TX	South Central	247.4	354.9
2	New Orleans	LA	South Central	218.0	83.7
1	Indianapolis	IN	North Central	142.1	126.1
2	Minneapolis*	MN	North Central	82.1	35.3
1	Washington*	DC	South Atlantic	203.3	140.2
2	Charleston	SC	South Atlantic	101.5	15.2
1	Burlington	VT	Northeast	222.9	10.0
2	Newark	NJ	Northeast	112.0	34.9

* Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

Solar energy has enormous potential in U.S. cities

While the exponential growth of solar power has already delivered enormous benefits to communities across the U.S., America is still far from tapping its full solar energy potential. A National Renewable Energy Laboratory (NREL) study estimated that building rooftops alone are technically capable of hosting 1,118 GW of solar PV capacity, 34 times the amount of small-scale PV capacity installed across the country.[39] That is enough solar energy to cover the annual electricity needs of more than 133 million homes, or nine out of every 10 American homes, and solar panel efficiency has increased 25% since that study was published.[40] Cities also have the potential to develop utility-scale solar installations on open land or above parking lots – adding significantly to the clean energy they can provide to the grid.

Even the nation's leading solar cities have immense untapped solar energy potential. San Francisco could support 1,800 MW of solar PV capacity on its city rooftops, Philadelphia 4,300 MW, and San Antonio could accommodate more than 6,200 MW of solar PV capacity on all of the rooftops in the city.[41]

Photo: Marc Kollar, Sun Light & Power

Student housing at the California College of the Arts, San Francisco.

Public policy has a major impact on solar development

Many state governments and utility commissions recognize the environmental, public health and resiliency benefits of solar power, and are enacting policy changes that support these benefits. But fossil fuel interests and some utilities are threatened by the advancement of solar power, and seek to roll back support for solar power.

In some cases, those interests have won changes in solar policies that have meaningfully changed the trajectory of solar deployment in cities featured in this report.

Indianapolis was an early success story in solar deployment. At the end of 2017, Indianapolis had 117 MW of solar capacity, ranking in the top 10 shining cities overall and fourth in solar per capita. For many years, the state of Indiana had retail rate net metering, where rooftop solar owners got the same value for the energy they sent to the grid as the energy they bought from it. In 2017, however, a state law was passed that significantly slashed net metering benefits by up to 80% for customers of investor-owned utilities, like the one serving Indianapolis.[42] Four years later, the city has added less than 10 MW of solar capacity since 2017 and has fallen to 16th per capita in this year's rankings. Instead of planning for how to restart the state's rooftop solar industry, Indianapolis' utility proposed a further cut to the value of solar, which was overturned by the state Court of Appeals.[43]

Las Vegas was another early adopter of solar power whose leadership was threatened by statewide policy changes. Rooftop solar owners in Nevada enjoyed full net metering until 2015, when the Public Utilities Commission of Nevada slashed net metering for new and existing customers. After public opposition, the commission allowed existing customers to maintain their previous rates, but the industry suffered as developers and new buyers struggled to make new installations profitable.[44] In the two years after the decision, Nevada's solar installation market dropped from seventh nationwide to 17th.[45] In 2017, the governor restored net metering, at rates of between 75-95% of the retail electric rate, which are locked in for 20 years.[46] Nevadans were quick to respond, installing more residential solar in the first half of 2018 than in all of 2017.[47] Las Vegas now ranks second in the country for per capita solar capacity and third for total solar capacity among cities included in this report.

Good policies accelerate solar deployment

Good policies that support solar power can be as important as abundant sunshine in determining how quickly cities and states develop their solar resources. The best policies ensure a fair value for the energy that rooftop solar feeds back into the grid. They also expand access to solar energy for people who don't have viable rooftops or may not own their homes.

South Carolina: Collaborative negotiations between Duke Energy and several solar and environmental groups arrived at an agreement that was approved by the state's Public Service Commission in May 2021. Although the new rate structure includes a minimum monthly bill, it preserves the full retail electric rate for the value of solar that net metering customers supply the grid. The new time-variable tariff more accurately values energy by changing during the day based on energy demand and solar supply. When the sun is shining, rooftop solar customers receive a smaller credit for their solar, but also pay less for the energy they buy from the grid, and vice versa during times of peak demand. The Southern Environmental Law Center said they hope to use this tariff as a model for other states.[48] The policy should help Charleston, a new Solar Superstar, continue its solar growth.

Virginia: Prior to 2020, net metering was capped in Virginia at 1% of each utility's generating capacity – too low for any meaningful growth, according to rooftop solar developers. With the April 2020 passage of the Virginia Clean Economy Act (VCEA), the net metering cap was raised from 1% to 6%, greatly improving conditions for solar.[49] In 2020, Virginia Beach added nearly 5.5 MW of net metered solar, a 164% increase over its capacity at the end of 2019. In 2021, the city again more than doubled its capacity, adding an additional 9 MW of net metered solar.

The VCEA also increased size limits on both residential and commercial solar installations and raised the caps on power purchase agreements for nonprofits and public entities, increasing the value they could receive for solar power.[50] Another "solar freedom" provision opened the door for community solar, which provides valuable access to solar for renters and people in apartment buildings. However, Dominion Energy is threatening that solar access by proposing a minimum monthly bill of $75 for shared solar customers – an excessive and prohibitive charge, especially given that Dominion customers in South Carolina with rooftop solar pay a minimum monthly bill of $13.50.[51] The State Corporation Commission will likely decide in 2022 whether the $75 charge is a "fair share" of the utility's cost.

Fossil fuel interests and some utilities are dimming the promise of solar energy

The fossil fuel industry sees the rapid growth of solar energy as a threat. Fossil fuel interests and some utilities are pushing to slow solar energy's growth across the country through various measures, such as slashing compensation for the additional power solar consumers supply to the grid (i.e., net metering) and implementing solar-specific charges on electric bills. The following are just a few examples of cities and states whose solar energy markets are threatened by recent or proposed policy changes:

- **California:** In December 2021, the California Public Utilities Commission (CPUC) released a proposed update to its net energy metering (NEM) rules, known as NEM 3.0. The proposed rules would create a "grid participation charge" based on the capacity of residential solar systems, adding about $48 per month to solar owners' bills. They would also slash the compensation that net metering customers receive for the additional power they supply to the grid by 88%, replacing market-rate compensation with a less lucrative, more complex formula.[52] Furthermore, the proposal would end existing net metering arrangements after 15 years, breaking the promise of 20 years of stable compensation offered by previous versions of NEM.[53] Solar energy analysts and advocates warned that the costs and uncertainty of the new rules could set the industry back years. After extensive public outcry and demonstrations, in February 2022 the CPUC announced it would not be voting on the proposal until further notice.[54]
- **Florida:** In March 2022, a bill passed the Florida Legislature that would make solar a dramatically

worse investment in the Sunshine State. The bill, SB 1024, would cut the solar compensation rate by 75% and allow utilities to charge solar customers minimum monthly fees.[55] The *Orlando Sentinel* has reported that consultants for the state's biggest utility, Florida Power and Light, funded a think tank that produced reports critical of net metering, and a subcontractor for the think tank has lobbied for SB 1024.[56] Although 84% of Florida voters support net metering, the governor is expected to sign the bill.[57]

- **Louisiana:** In 2019, the Louisiana Public Service Commission commissioned a report on net metering, authored by a renewable energy critic and member of the National Petroleum Council. The report assigned a high cost to net metering, but made several glaring errors, including basing its calculations on an expired tax credit.[58] Nevertheless, Louisiana commissioners voted to roll back net metering. As of 2020, customers are compensated by utilities for the avoided cost of the power they supply to the grid, less than half the retail value they had previously been receiving for their rooftop solar.[59] However, New Orleans, where the city council regulates electricity service, has kept its net metering program intact, and more than doubled its solar capacity in the past two years.[60]

Municipal utilities are advancing solar in their service territories

Every city can implement policies to promote solar energy, but cities with municipal utilities have a unique opportunity to drive the adoption of solar energy. Cities that own and operate their own utilities can set ambitious goals for solar energy and work to meet them by supporting the growth of solar power within their city boundaries, building their own solar power plants outside city limits, or purchasing solar power from facilities owned by others.

We examined municipal utilities in the 67 cities examined in the Shining Cities report to identify the total solar PV capacity installed in the utility's service territory, as well as capacity the utility may own, or have a long-term contract with, located outside of their service territory. We also calculated a per capita solar PV capacity value based on each utility's total electric customers. Researchers attempted to contact all municipal utilities serving cities covered by this report. Data presented here include only those utilities that responded.

Serving its ratepayers with over 2,000 MW of solar power, the Los Angeles Department of Water and Power leads the pack of municipal utilities, making great use of the southern California sun. Austin Energy, the municipal utility serving Austin, Texas, and nearby towns, is also a pacesetter, supplying more than 3,000 watts per person of solar energy to its customers. Its goal is to reach 100% carbon-free electricity generation by 2035.[61]

Other municipal utilities boasting over a kilowatt of solar power per customer include Riverside Public Utilities, owned by its southern California customers since 1895; the Sacramento Municipal Utility District (SMUD); CPS Energy of San Antonio, one of the nation's largest municipally owned energy companies; and the Orlando Utilities Commission, which added 200 MW of solar in the past two years.

Table 7. Top municipal utilities by solar PV capacity installed, end of 2021

City	Municipal utility	State	Service territory capacity (MW DC)	Solar owned* outside of service territory	Total capacity (MW DC)	Number of electric customers	Per capita solar installed (watts per person)
Austin	Austin Energy	TX	124.6	1,459.2	1,583.8	507,660	3,119.8
Riverside	Riverside Public Utilities	CA	61.4	108.2	169.6	111,711	1,518.1
Sacramento	Sacramento Municipal Utility District	CA	681.9	192.0	873.9	644,723	1,355.4
Los Angeles	Los Angeles Department of Water and Power	CA	649.9	1,358.5	2,008.5	1,500,000	1,339.0
San Antonio	CPS Energy	TX	428.3	541.4	969.7	884,811	1,096.0
Orlando	Orlando Utilities Commission	FL	77.2	167.4	244.6	231,206	1,057.9
Burlington	Burlington Electric Department	VT	10.6	0	10.6	21,452	492.8
Memphis	Memphis Light, Gas and Water	TN	79.2	0	79.2	436,644	181.5
Seattle	Seattle City Light	WA	43.9	0	43.9	461,496	95.2
Omaha	Omaha Public Power District	NE	11.1	0	11.1	390,334	28.4
Nashville	Nashville Electric Service	TN	10.2	0	10.2	411,643	24.9

*Includes long-term power purchase agreements.

Policy recommendations

U.S. cities, as centers of population growth and energy consumption, must lead the way in building a grid powered by 100% clean, renewable energy. Many cities have already experienced the havoc that global warming can cause through severe weather, drought, increased heavy precipitation and intense heat waves. Increasing solar energy capacity will be critical to reduce greenhouse gas emissions and create a more resilient and reliable energy system.

The geographic diversity of our "Solar Superstars" shows that policies can be as important as the availability of sunshine in dictating which states are succeeding in adopting solar energy and which are

Photo: City of Albuquerque

Rooftop solar panels on the Albuquerque Museum.

not. The most effective policies facilitate the wide adoption of small-scale solar energy systems on homes, businesses and other institutions, while also speeding up the deployment of utility-scale solar energy projects. Policymakers at every level of government – federal, state and local – have an important role to play in making sure solar energy continues to thrive.

Local governments should:

- Set a goal for 100% renewable energy – The cities that are leading in solar energy adoption are not doing so by chance. The second highest-ranked city for total installed solar PV capacity, San Diego, has set the ambitious goal of generating 100% of its electricity from renewable sources by 2035.[62] Over 180 cities in the United States have adopted ambitious 100% renewable electricity goals, including Atlanta, Boise, Idaho, Des Moines, Iowa, and Kansas City, Mo.[63] Burlington, Ver., one of the top-ranked cities for solar capacity per capita, is one of six communities in the U.S. to have already achieved this goal.[64]
- Implement solar access ordinances – These critical protections guard a homeowner's right to generate electricity from the sunlight that hits their property, regardless of the actions of their neighbors or homeowners' associations. Local governments should also offer clear zoning regulations that allow solar energy installations on residential and commercial rooftops by right, which will help streamline solar installations.
- Encourage or require new homes to install solar panels and/or be zero net-energy – Solar energy is most efficient and cost-effective when it is designed into new construction from the start. State and local governments have adopted policies to require new homes or commercial buildings to have solar power or to be designed so that solar energy can be easily installed. In 2020, new building codes took effect in California requiring new single-family homes and multi-family homes of up to three stories to install solar PV panels, and a 2023 update will require solar power and battery storage on many new high-rise residential projects.[65] Tucson, Ariz., requires that new single-family homes or duplexes either include a solar energy system or be pre-outfitted so that future solar PV and hot water systems can be easily installed.[66] By pairing solar energy with highly efficient construction, rooftop solar panels can meet a higher percentage of home energy needs.
- Use automated permitting to make solar approvals easy, quick and affordable – The "soft" costs of solar energy, such as costs related to zoning and permitting, can be up to two-thirds of the total cost of residential solar energy systems.[67] Automated online permitting allows eligible rooftop solar applications to get instantly approved for building permits, allowing permitting departments to focus on more complex applications. Solar Automated Permit Processing (SolarAPP+) is an online permitting platform developed by the Department of Energy and free for local governments to use. Integrating SolarAPP+ automated permitting to approve standardized rooftop solar projects allows cities to process 5-14 times more applications than traditional permitting.[68]
- Expand access to solar energy – Statewide and citywide financing programs can make solar energy available to all residents, including low-income households, nonprofits, small businesses and apartment dwellers. Community solar programs allow groups of residents to purchase electricity from the same larger solar installation and share in the net metering or other financial benefits. Similarly, "solarize" bulk purchasing programs lower the costs of solar energy so that more residents can participate.[69] Power purchase agreements (PPAs) are widely utilized and allow apartment occupants and others who cannot install their own solar systems to purchase and benefit from solar energy. Commercial Property Assessed Clean Energy (C-PACE) programs allow local and state governments to loan money to business owners for energy improvements. This program includes an option to tie a loan for a solar installation to the property itself so that it is transferred to the new owner if the property is sold.

This program has been key for property owners who are concerned that they may move before they recoup their investment in a solar installation.[70]

- Create community choice aggregation in communities where investor-owned utilities are unwilling to cooperate to promote solar power – Cities served by less supportive utilities, and in areas of the country where the option is available, should consider creating community choice aggregations – also known as community bulk power – that allow cities and towns to combine the purchasing power of their residents to negotiate for cleaner and more affordable power. Under community choice aggregation, the city, rather than the utility, is responsible for purchasing power for its residents, but unlike a municipal utility, the private utility still maintains the power lines and provides customer service.[71]
- Install solar panels on public buildings – Local governments can promote solar energy by installing solar panels and signing solar PPAs for public buildings. A 2020 report found that 9.4% of K-12 students attend one of 7,332 schools across the country that have installed solar energy systems, which have a combined capacity of 1,337 MW.[72] The city government of Albuquerque, N.M., is on track to power 80% of its city operations with renewable energy by 2022, and has 10.4 MW installed on or planned for its city buildings.[73] Not only do solar installations on public buildings save governments money on their electricity bills, but they also serve as a public example of a smart clean energy investment.
- Implement policies that support energy storage, electric vehicle charging and microgrids – Technological advances are enabling solar energy to be used in new ways, including to charge electric vehicles (EVs) and to be integrated with energy storage technologies and other energy resources in microgrids. Local governments should alter their ordinances to allow these technologies to be easily adopted. See the Environment America Research & Policy Center reports Making Sense of Energy Storage and An Electric Vehicle Toolkit for Local Governments for guidance on making policies friendly to energy storage and EV adoption.[74]

State governments should:

- Set a statewide 100% renewable energy goal – States should adopt or increase mandatory renewable electricity standards (RES) that move toward 100% renewable energy as soon as possible. States should also encourage utilities to set goals of providing 100% renewable energy, and to update their long-term resource plans to lock in a major buildout of solar. In 2020, Virginia passed the Virginia Clean Economy Act, which helped protect net metering and established a mandatory target for utilities to reach 100% clean electricity by 2045.[75] In 2021, Oregon passed a law committing to 100% clean power by 2040, becoming the eighth state to commit to 100% renewable power.[76]
- Adopt and preserve strong statewide interconnection and net metering policies – Strong interconnection policies ensure that individuals and businesses can easily connect their solar PV systems to the electric grid and move seamlessly between producing their own electricity and using electricity from the grid. It is critical that states ensure that their interconnection process is straightforward and efficient in order to make it easy to "go solar."[77] Net metering policies ensure that solar panel owners are appropriately credited for the electricity that they export to the grid. In states without strong net metering programs, carefully implemented CLEAN contracts (also known as feed-in tariffs) and value-of-solar payments can play an important role in ensuring that consumers receive fair crediting for solar energy, so long as the payments fully account for the benefits of solar energy and are sufficient to spur participation in the market.
- Reject punitive rate designs for solar customers – Many utilities are now adding or increasing charges on electric bills that can cause solar customers to pay steep fees for generating their own electricity, such as high minimum monthly bills specifically

for solar customers.[78] State governments and utility regulators should reject punitive proposals designed to discourage customers from switching to solar energy.

- Establish policies that expand solar energy access to all residents – According to NREL, 49% of Americans either don't own a home or have insufficient space on their rooftops for even a small solar installation.[79] Policies such as virtual or aggregate net metering and community solar allow low-income households, renters and apartment dwellers to collectively own solar energy systems and share in the net metering credits they generate. Enabling C-PACE financing can also expand access to solar power for commercial customers.

- Enable third-party sales of electricity – Financing rooftop solar energy systems through third-party electricity sales significantly lowers the up-front cost of installing solar PV systems for commercial and residential consumers. States should allow companies that install solar panels to sell electricity to their customers without subjecting them to the same regulations as large utilities.

- Implement, maintain or increase tax credits, rebates and grants for solar energy installations – Tax credits, rebates and grants are powerful incentives that have made solar energy a financial option for many more Americans.

- Implement policies that support energy storage, electric vehicle charging and microgrids – State governments should design policies that facilitate the transition from an electric grid reliant on large, centralized power plants to a "smart" grid where electricity is produced at thousands of locations and shared across an increasingly nimble and sophisticated infrastructure. Such state policies should support the expansion of energy storage technologies, electric vehicle charging and microgrids. Most states still use distributed solar interconnection standards from 2003 –only a few states, including Minnesota, Maryland and Hawaii, have adopted the latest interconnection standards for "smart inverters," which allow distributed energy devices to interact with the grid more reliably.[80]

Strong and thoughtful federal policies can promote solar power, make it more accessible, and lay an important foundation on which state and local policy initiatives can be built. Among the key policy approaches that the federal government should take are the following:

- Continue and expand financial support for solar energy – The solar Investment Tax Credit (ITC), a key incentive program for solar energy, currently stands at 26% of the value of a solar investment (down from the previous 30%). The ITC is slated to fall to 22% for projects that begin construction in 2023, and disappear entirely for residential systems in 2024, though commercial and utility-scale systems would remain at 10%.[81] The Build Back Better Act, which the House of Representatives passed in December 2021, would extend the ITC for a decade, restore tax credits to 30% of solar costs and expand them to cover energy storage.[82] The federal government should maintain strong federal tax credits for solar energy, but also add provisions as necessary to enable nonprofit organizations, housing authorities and others who are not eligible for tax credits to benefit from those incentives.

- Support research to drive solar power innovations – The U.S. DOE Solar Energy Technologies Office and similar initiatives facilitate solar energy adoption by investigating the best ways to integrate solar energy into the grid, deliver solar energy more efficiently and cost-effectively, and lower market barriers to solar energy. The federal government should also invest in research and development of energy storage, including through ARPA-E, to ease the integration of renewable energy into the grid, to strengthen cities' grids in the face of extreme weather, and to unlock the other benefits of energy storage.[83]

- Lead by example – The federal government consumes vast amounts of energy and manages thousands of buildings. If the federal government were to put solar installations on every possible rooftop, it would set a strong example for what can be done to harness the limitless and pollution-free energy of the sun. The U.S. Army aims to obtain carbon-free electricity for its installations by 2030, and to install microgrids on all Army posts by 2035.[84] One utility has already installed more than 400 MW of solar energy capacity on military bases across the Southeast.[85]

- Expand access to solar energy – Federal agencies such as the Department of Housing and Urban Development and the Department of Education should work to expand access to solar energy for subsidized housing units and schools by encouraging installation of solar power on those facilities or enabling community solar projects. Programs designed to provide fuel assistance to low-income customers, such as the Low-Income Home Energy Assistance Program, should be expanded to include solar energy.

Methodology

There is no uniform national data source that tracks solar energy by municipality. As a result, the data for this report come from a variety of sources: municipal and investor-owned utilities, city and state government agencies, operators of regional electric grids and non-profit organizations. These data sources have varying levels of comprehensiveness, with varying levels of geographic precision, and often use different methods of quantifying solar PV capacity (e.g., AC versus DC capacity).

We have worked to obtain data that are as comprehensive as possible, resolve discrepancies in various methods of estimating solar PV capacity, limit the solar facilities included to only those within the city limits of the municipalities studied, and, where precise geographic information could not be obtained, use reasonable methods to estimate the proportion of a given area's solar energy capacity that exists within a particular city. Much of the data is provided by utilities, the majority of which only track grid-tied solar energy systems, so most cities lack data for non-grid-tied installations (which are likely small in number across the country). The data are sufficiently accurate to provide an overall picture of a city's adoption of solar power and to enable comparisons with its peers. Readers should note, however, that inconsistencies in the data can affect individual cities' rankings. The full list of sources of data for each city is provided in Appendix B, along with the details of any data analyses performed.

For some cities, our most recent solar capacity estimates are not directly comparable to previous estimates listed in earlier editions of Shining Cities. In some cases, this is because some solar energy systems installed toward the end of the year were not reported by the time we collected data. Also, for some cities, we were able to obtain more precise and complete data this year. In a few cases, our current estimate is lower than previous estimates for the same city, due either to inconsistencies in the data reported to us by the cities or improved precision in assigning solar installations to cities. For an explanation of individual discrepancies, see Appendix B.

Selecting the cities

The cities evaluated in this report consist of the principal cities in the top 50 most populous Metropolitan Statistical Areas in the United States according to the U.S. Census Bureau, and the most populous cities in each state not represented on that list.[86] In South Carolina, Charleston now has a larger population than Columbia, which is no longer represented in this report. We were unable to identify solar power capacity installed in the city limits of Sioux Falls, S.D., Cheyenne, Wyo., and Charleston, W. Va. For a complete list of cities, see Appendix A.

Converting from AC watts to DC watts

Jurisdictions and agencies differ in their use of alternating current (AC) or direct current (DC) to quantify solar PV capacity. Solar PV panels produce energy in DC, which is then converted to AC in order to power a home or enter the electric grid. Solar capacity reported in AC watts accounts for the loss of energy that occurs when DC is converted to AC.[87]

We converted all data to DC watts for the sake of accurate comparison across cities. When we could not determine whether the data were reported in AC watts or DC watts, we made the conservative estimate that the data were in DC watts. To convert the estimate of solar capacity from AC to DC megawatts, we used the default residential DC to AC ratio of 1.2-to-1 found in NREL's PV Watts Calculator.[88] A different conversion factor was used in the 2014 to 2017 versions of this reports, which affects year to year comparisons for some cities.

Using data on solar PV installations by zip code to estimate capacity within city limits

In some cases, we were only able to find data on solar PV capacity installed by zip code in an urban area. Zip codes do not necessarily conform to city boundaries; in many cases, a zip code will fall partially inside and partially outside of a city's boundaries. For these cities (with one exception as described in Appendix B), we used QGIS software and U.S. Census Bureau cartographic boundary files for Zip Code Tabulation Areas and city boundaries to determine the share of the area in each zip code that fell within municipal boundaries. We then multiplied the total solar PV capacity within each zip code by that percentage to approximate solar capacity installed within city limits. Details of calculations for cities for which a geospatial analysis was performed are given in Appendix B. Calculations using installation address latitude and longitude were also used where such data were available.

For municipal utility analyses, we relied on data provided by the utility for solar PV capacity in their area of coverage, and any additional capacity owned or under long-term contract by the utility.

Appendix A – Solar energy in major U.S. cities

City	State	Population	Per capita rank	Per capita solar (watts per person)	Total solar rank	Total solar capacity (MW)
Albuquerque	NM	564,559	4	295.5	9	166.8
Anchorage	AK	291,247	55	16.5	57	4.8
Atlanta^	GA	498,715	59	14.9	52	7.4
Austin*	TX	961,855	20	96.0	13	92.3
Baltimore	MD	585,708	43	27.7	36	16.2
Billings	MT	117,116	63	10.3	65	1.2
Birmingham^	AL	200,733	66	3.7	66	0.7
Boise	ID	235,684	35	48.8	43	11.5
Boston	MA	675,647	28	70.4	21	47.6
Buffalo	NY	278,349	21	85.8	31	23.9
Burlington	VT	44,743	7	222.9	46	10.0
Charleston*	SC	150,227	19	101.5	38	15.2
Charlotte*	NC	874,579	49	20.3	34	17.8
Chicago	IL	2,746,388	51	18.9	20	51.8
Cincinnati	OH	309,317	44	26.6	50	8.2
Cleveland*	OH	372,624	54	16.7	54	6.2
Columbus	OH	905,748	50	19.0	35	17.2
Dallas	TX	1,304,379	40	36.3	22	47.4
Denver	CO	715,522	12	189.0	11	135.3
Des Moines	IA	214,133	56	15.7	62	3.4
Detroit	MI	639,111	60	13.9	48	8.9

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City	State	Population	Per capita rank	Per capita solar (watts per person)	Total solar rank	Total solar capacity (MW)
Fargo	ND	125,990	67	2.0	67	0.3
Hartford	CT	121,054	18	102.1	41	12.4
Honolulu	HI	350,964	1	1,133.5	4	397.8
Houston	TX	2,304,580	41	35.3	16	81.4
Indianapolis	IN	887,642	16	142.1	12	126.1
Jackson	MS	153,701	52	18.1	63	2.8
Jacksonville^	FL	949,611	30	67.0	17	63.6
Kansas City	MO	508,090	33	57.6	29	29.3
Las Vegas*	NV	641,903	2	689.9	3	442.8
Little Rock	AR	202,591	47	25.2	56	5.1
Los Angeles	CA	3,898,747	14	166.7	1	649.9
Louisville*	KY	246,161	46	25.3	53	6.2
Manchester	NH	115,644	25	74.7	49	8.6
Memphis	TN	633,104	57	15.5	47	9.8
Miami^	FL	442,241	62	10.6	58	4.7
Milwaukee	WI	577,222	53	17.8	45	10.3
Minneapolis*	MN	429,954	22	81.4	26	35.0
Nashville	TN	689,447	64	8.9	55	6.1
New Orleans	LA	383,997	8	218.0	15	83.7
New York	NY	8,804,190	38	40.3	6	354.4
Newark	NJ	311,549	17	112.0	27	34.9
Oklahoma City	OK	681,054	48	21.3	39	14.5
Omaha	NE	486,051	65	4.2	64	2.0
Orlando	FL	307,573	29	68.7	33	21.1
Philadelphia	PA	1,603,797	58	15.3	30	24.5
Phoenix	AZ	1,608,139	9	212.7	7	342.0
Pittsburgh	PA	302,971	45	26.5	51	8.0
Portland	OR	652,503	27	71.1	23	46.4
Portland	ME	68,408	32	62.1	61	4.2

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City	State	Population	Per capita rank	Per capita solar (watts per person)	Total solar rank	Total solar capacity (MW)
Providence	RI	190,934	24	74.8	40	14.3
Raleigh*	NC	467,665	42	33.8	37	15.8
Richmond	VA	226,610	37	45.7	44	10.4
Riverside	CA	314,998	11	195.0	19	61.4
Sacramento	CA	524,943	15	159.8	14	83.9
Salt Lake City	UT	199,723	13	182.8	24	36.5
San Antonio	TX	1,434,625	6	247.4	5	354.9
San Diego	CA	1,386,932	3	337.4	2	468.0
San Francisco*	CA	873,965	26	71.9	18	62.8
San Jose	CA	1,013,240	5	287.1	8	290.9
Seattle*	WA	737,015	36	45.7	28	33.7
St. Louis	MO	301,578	39	39.7	42	12.0
Tampa	FL	384,959	34	56.9	32	21.9
Virginia Beach*	VA	459,470	23	78.1	25	35.9
Washington*	DC	689,545	10	203.3	10	140.2
Wichita	KS	397,532	61	11.3	60	4.5
Wilmington*	DE	70,898	31	65.1	59	4.6

*Due to a change in methodology or data source for this city, total and per capita solar PV capacity reported in this table may not be directly comparable with estimates for this city in previous editions of this report. See Appendix B for details on specific cities.

^ Updated data not available. Capacity estimate is from Shining Cities 2020.

Appendix B – Detailed sources and methodology by city

Albuquerque, New Mexico

The Public Service Company of New Mexico (PNM), which serves the city of Albuquerque, provided us total solar PV capacity installed within Albuquerque as of 31 December 2021 in AC watts.[89]

Anchorage, Alaska

The electric utilities serving the city of Anchorage, Chugach Electric and Matanuska Electric Association, provided us with summary information on the solar PV capacity installed in Anchorage's city limits as of the end of 2021 in AC watts.[90]

Atlanta, Georgia

We were unable to obtain an updated estimate of Atlanta's solar capacity. The capacity estimate in this year's report was provided by Southface (www.southface.org) as of 31 December 2019.

Austin, Texas

Austin Energy, which serves the greater Austin metropolitan area, provided us with data on the solar PV installations within the City of Austin as of 31 December 2021 in AC watts. Pedernales Electric Cooperative and Bluebonnet Electric Cooperative also provided data in DC watts on solar PV installations in the small sections of their service territories that overlap with Austin, and those figures were summed. [91] This is a different methodology than in past reports, so this year's figure may not be directly comparable to previous reports.

Baltimore, Maryland

Data for solar PV installations in Baltimore as of December 2021 were downloaded in a spreadsheet called "Renewable Generators Registered in GATS" through the Generation Attribute Tracking System (GATS), an online database administered by the PJM regional transmission organization, in DC watts.[92] To focus on solar PV installations within Baltimore city limits, we filtered by primary fuel type "SUN" for the county of "Baltimore City."

Billings, Montana

Northwestern Energy, the utility serving Billings, provided the grid-tied solar PV capacity installed within Billings in AC watts as of 31 December 2021.[93] We used geographic analysis of city zip codes to limit our estimate to within the city limits of Billings. We included the full capacity of zip code 59101 due to its unique geography, which extends far beyond Billings' city limits.

Birmingham, Alabama

We were unable to update Birmingham's solar PV capacity, so we used the figure provided by Alabama

Power, the electric utility serving the city, for the end of 2019 in AC watts.[94]

Boise, Idaho

The City of Boise provided the total capacity of solar PV installations within Boise as of the end of 2021 in AC watts.[95]

Boston, Massachusetts

We downloaded the "Production Tracking System (PTS) Solar Photovoltaic Report" spreadsheet from the Massachusetts Clean Energy Center on 10 February 2022.[96] We filtered this list to installations in the city of Boston. This list may be incomplete because it is current only to 26 May 2021, and only includes systems that are fully registered with the Production Tracking System. The total solar PV capacity installed within Boston may, therefore, be higher than the reported figure.

Buffalo, New York

Data on solar PV installations in the city of Buffalo were obtained from the Open NY Database in the spreadsheet "Solar Electric Programs Reported by NYSERDA: Beginning 2000."[97] We summed the capacities, which are listed in DC watts, for installations completed before 31 December 2021 in the city of Buffalo. We then used geographic analysis of city zip codes to limit our capacity estimates to within city limits.

Burlington, Vermont

A list of solar PV installations in Burlington at the end of 2021 was provided by the City of Burlington's Electric Department.[98] Capacity figures were listed in AC watts.

Charleston, South Carolina

We estimated the amount of solar PV capacity in Charleston based on county-level data provided by the South Carolina Energy Office.[99] We used the ratio of households in Charleston County and City to estimate PV capacity within city limits, so results may not be directly comparable with last year's results.[100] Data were provided in AC watts. Data were only available through 30 September 2021, so it is likely that systems were added after that date and, thus, that solar PV capacity in Charleston was higher by 31 December 2021.

Charlotte, North Carolina

The North Carolina Sustainable Energy Association (NCSEA) provided us with the total solar PV capacity installed within Charlotte in DC watts.[101] Data provided for Charlotte were current as of 31 October 2021, so the capacity in Charlotte as of 31 December 2021 may be higher than the figure listed, and data may not be comparable to previous reports.

Chicago, Illinois

Commonwealth Edison, the electric utility serving the city of Chicago, provided us with the total solar PV capacity tied to their grid within Chicago as of 31 December 2021 in AC watts.[102]

Cincinnati, Ohio

The City of Cincinnati provided the total solar PV capacity installed within Cincinnati through the end of 2021 in AC watts.[103] Limited geographic analysis was performed to restrict capacity estimates to within Cincinnati city limits.

Cleveland, Ohio

We downloaded a spreadsheet of approved renewable energy generating facilities in Ohio from the Public Utilities Commission of Ohio's (PUCO) web page.[104] We filtered this spreadsheet for solar PV installations approved by 31 December 2021 in Cuyahoga County, Ohio. To determine which systems were installed in Cleveland, we multiplied the county PV capacity by the ratio of housing units within Cuyahoga County and the City of Cleveland.[105] This is a different methodology than in past reports, so this year's figure may not be directly comparable to previous reports.

Columbus, Ohio

The City of Columbus Department of Public Utilities provided solar PV capacity from solar permits issued in 2020 and 2021 in DC watts, which we added to the total capacity from our previous report.[106]

Dallas, Texas

Oncor Electric Delivery, the utility serving Dallas, provided solar PV capacity installed in Dallas as of 31 December 2021 in AC watts.[107]

Denver, Colorado

The City and County of Denver Community Planning and Development Department provided us with a spreadsheet of all permits issued in the city in 2020 and 2021 relating to solar PV systems, with capacities listed in DC watts.[108] We filtered these data for new solar PV installations. Some permits contained capacity information only in a descriptive note format, so for these installations we identified and included capacity values where clearly noted. We added the estimated total capacity of installations added during 2020 and 2021 to the cumulative capacity at the end of 2019 to estimate the total solar PV capacity installed within Denver as of 31 December 2021.

Des Moines, Iowa

MidAmerican Energy, the energy company that serves Des Moines, provided us with the solar PV capacity installed by Des Moines-area zip codes as of 31 December 2021 in AC watts.[109] We used geographic analysis of city zip codes to limit our capacity estimates to within city limits.

Detroit, Michigan

Total solar PV capacity for the city of Detroit was provided by DTE Energy, the electric utility serving the city.[110] Data were provided in AC watts.

Fargo, North Dakota

An estimate of solar PV capacity in Fargo as of 31 December 2021 was provided in DC watts by Cass County Electric Cooperative, which serves part of the city.[111] Xcel Energy, which serves the other part of Fargo, was unable to provide an updated estimate of solar PV capacity, so its estimate from 31 December 2019 was used.[112] The figures were then summed.

Hartford, Connecticut

The Connecticut Public Utilities Regulatory Authority provided a spreadsheet listing solar facilities approved under Connecticut's Renewable Portfolio Standard in both AC and DC watts.[113] We totaled all solar PV capacity installed in the city of Hartford through 31 December 2021 and converted all AC figures to DC watts.

Honolulu, Hawaii

We estimated the amount of solar PV capacity in Honolulu from county-level data as of 31 December 2021 provided by Hawaiian Electric, the company serving the island of O'ahu (which is coterminous with the county and city of Honolulu).[114] Within the city of Honolulu, we decided the Urban Honolulu census designated place is the area most comparable with other U.S. cities. We multiplied the total capacity of solar PV installations within Honolulu County by the ratio of housing units within the Urban Honolulu CDP and the county to estimate the solar PV capacity in urban Honolulu.[115] Solar PV capacity figures were provided in AC watts.

Houston, Texas

Total installed solar PV capacity within Houston city limits as of 31 December 2021 was provided by CenterPoint Energy, the electric utility serving the city, in AC watts.[116]

Indianapolis, Indiana

AES Indiana, the electric utility serving Indianapolis, provided us with the total installed solar PV capacity within Indianapolis as of 31 December 2021 in AC watts.[117]

Jackson, Mississippi

Entergy Mississippi, the electric utility serving Jackson, provided us with the total installed solar PV capacity in Jackson, Mississippi, as of 31 December 2021.[118]

Jacksonville, Florida

We were unable to update Jacksonville's solar capacity, so we used the figure provided by JEA as of 31 December 2019 in DC watts.[119]

Kansas City, Missouri

Evergy, the electric utility serving the city, provided total installed solar PV capacity for Kansas City at the end of 2021 in DC watts.[120] We then used geographic analysis of city zip codes to limit the capacity to within Kansas City limits.

Las Vegas, Nevada

The City of Las Vegas Office of Sustainability provided us with the total solar PV capacity within the city of Las Vegas through 31 December 2021 in AC watts.[121] Data provided did not include zip code capacities to facilitate geographic analysis, so values for this year may not be directly comparable with previous editions of this report.

Little Rock, Arkansas

Entergy, the utility serving Little Rock, provided solar PV capacity in Little Rock as of 31 December 2021 in DC watts.[122] A 1.8 MW-DC solar installation at a VA hospital not captured in Entergy's data was added to the total.[123]

Los Angeles, California

Total installed solar PV capacity in Los Angeles as of 31 December 2021 was provided by the Los Angeles Department of Water and Power, the city's municipal electric utility, in AC watts.[124]

Louisville, Kentucky

Louisville Gas & Electric, the electric utility serving Louisville, provided the total solar PV capacity connected to its system under an agreement with the company and installed in the Louisville-Jefferson County Metro city limits in DC watts as of 10 January 2022. [125] Louisville Gas & Electric used geographic analysis to limit the capacity estimates by excluding capacity installed in various independent municipalities within the boundaries of Louisville-Jefferson County Metro. We used further geographic zip code analysis to limit our capacity estimates to within Louisville Metro city limits. Previous versions of this report used the boundaries of Louisville prior to the creation of consolidated government with Jefferson County, so values for this year are not directly comparable with previous editions of this report.

Manchester, New Hampshire

Eversource Energy, the electric utility serving Manchester, provided the solar PV capacity installed within the city limits of Manchester through 31 December 2021 in AC watts.[126]

Memphis, Tennessee

Memphis Light, Gas and Water, the city's municipal electric utility, provided total solar PV capacity installed in Memphis as of 31 December 2021 in DC watts.[127]

Miami, Florida

We were unable to update Miami's solar capacity, so we used the figure provided by Florida Power & Light (FPL), the municipality serving the city, as of 31 December 2019 in AC watts.[128]

Milwaukee, Wisconsin

The City of Milwaukee's Environmental Collaboration Office provided us with total solar PV capacity within Milwaukee city limits as of 31 December 2021 in DC watts.[129]

Minneapolis, Minnesota

Xcel Energy, the electric utility serving the city of Minneapolis, provided us with total solar PV capacity by zip code installed within the city as 31 December 2021 in AC watts.[130] We were unable to receive capacity by zip code this year, so values for this year may not be directly comparable with previous versions of this report.

Nashville, Tennessee

Nashville Electric Service, the electric utility serving the city of Nashville, provided us with total solar PV capacity installed within the Urban Services District of Nashville as of the end of 2021 in DC watts.[131]

New Orleans, Louisiana

Entergy New Orleans, the electric utility serving the city of New Orleans, provided us with total installed solar PV capacity within New Orleans city limits as of 31 December 2021 in DC watts.[132]

New York, New York

Data on solar PV capacity installed within the city limits of New York as of 31 December 2021 were provided by Consolidated Edison, the utility serving the city, in AC watts.[133]

Newark, New Jersey

The solar PV installations supported by New Jersey's Clean Energy Program (NJCEP) are made available online in the NJCEP Solar Activity Report.[134] We downloaded the full Installation Data report updated through 31 December 2021. We summed the total solar capacity installed under the Transition Incentive Program and the Solar Registration Program, filtered for installations registered in the city names of "Newark," "Newark City," and various misspellings. We conservatively assumed capacities were in DC watts.

Oklahoma City, Oklahoma

The Oklahoma City Office of Sustainability provided us with the total solar PV capacity added in 2020 and 2021 in AC watts, which was added to the total capacity from the seventh edition of Shining Cities.[135]

Omaha, Nebraska

Omaha Public Power District (OPPD), the electric utility serving the city of Omaha, provided us with the total capacity of solar PV systems tied to their grid within Omaha city limits as of 31 December 2021 in AC watts.[136]

Orlando, Florida

Total solar PV capacity installed within the city limits of Orlando, as of 31 December 2021 and serviced by the Orlando Utilities Commission (OUC), was provided by OUC in DC watts.[137]

Philadelphia, Pennsylvania

Data were downloaded from the Solar Renewable Energy Certificates PJM-GATS registry, administered by regional electric transmission organization PJM.[138] These data include installations through 31 December 2021 and were filtered for Primary Fuel Type "SUN," State "PA" and County "Philadelphia," which is coterminous with the city of Philadelphia. Capacities were listed in DC watts.

Phoenix, Arizona

Phoenix is served by two electric utilities, Arizona Public Service (APS) and Salt River Project (SRP). Data from both service territories were provided by the City of Phoenix as of 31 December 2021.[139]

Pittsburgh, Pennsylvania

Data for solar PV installations in Allegheny County, Pennsylvania, as of 31 December 2021 were downloaded in DC watts from a spreadsheet called "Renewable Generators Registered in GATS" through the online GATS database administered by PJM.[140] To focus on solar PV installations, we filtered by primary fuel type "SUN." To estimate the capacity in the city of Pittsburgh, we multiplied the county total by the ratio of housing units in Pittsburgh and Allegheny County in the 2020 census.[141]

Portland, Maine

Avangrid, the utility company serving the central and southern areas of Maine, provided us with the total solar PV capacity connected to their grid within Portland city limits as of 31 December 2021 in AC watts.[142]

Portland, Oregon

The city of Portland is served in part by Portland General Electric and in part by Rocky Mountain Power, which operates as Pacific Power in the state of Oregon. Data on solar PV capacity installed by these utilities within Portland city limits through 31 December 2021 were provided by the City of Portland's Bureau of Planning and Sustainability in DC watts.[143]

Providence, Rhode Island

Total solar PV capacity within Providence city limits as of 31 December 2021 was provided by the Rhode Island Office of Energy Resources.[144] Figures were given in AC watts.

Raleigh, North Carolina

The North Carolina Sustainable Energy Association (NCSEA) provided us with the total solar PV capacity installed within Raleigh in DC watts.[145] Data provided for Raleigh were current as of 31 October 2021, so the capacity in Raleigh as of 31 December 2021 may be higher than the figure listed, and this year's figure may not be directly comparable to previous reports.

Richmond, Virginia

Dominion Energy provided a list of interconnected solar PV systems in the city of Richmond in AC watts through 31 December 2021. [146] We then used geographic analysis of installation address latitude and longitude to limit our capacity estimates to within city limits. We also included a 480 kW-DC system located on Dominion Energy's Tredegar Campus.

Riverside, California

The total installed solar PV capacity for Riverside as of 31 December 2021 was provided in DC watts by Riverside Public Utilities.[147]

Sacramento, California

The total installed solar PV capacity installed within Sacramento city limits as of 31 December 2021 was provided by Sacramento Municipal Utility District (SMUD) in AC watts.[148]

Salt Lake City, Utah

The total capacity of solar PV installations within Salt Lake City as of 31 December 2021 was provided by the Salt Lake City Department of Sustainability in DC watts.[149]

San Antonio, Texas

CPS Energy, the utility serving San Antonio, provided us with the total residential solar PV capacity as well as a sum of utility-scale solar PV installations in San Antonio as of 10 January 2022 in AC watts. [150]

San Diego, California

San Diego Gas & Electric, the electric utility serving the city, provided us with a figure of total solar PV capacity installed within San Diego as of 31 December 2021, which we assumed were in DC watts.[151]

San Francisco, California

Data on San Francisco's solar PV capacity as of 31 December 2021 were downloaded from the California Distributed Generation Statistics website for PG&E, the electric utility serving San Francisco.[152] Data for the County of San Francisco, which is coterminous with the city, were in DC watts and filtered for technology type "Solar PV" along with combinations of that technology with storage, wind and "other." Utility-scale capacity within the city was provided by the San Francisco Department of the Environment in AC watts.[153] This is a different methodology than in past reports, so this year's figure may not be directly comparable with previous reports.

San Jose, California

The City of San Jose provided us with total solar PV capacity installed within the city limits of San Jose as of 31 December 2021 in AC watts.[154] Due to the data format, a small share of capacity may be from systems that combine solar with another form of generation, including wind or fuel cells.

Seattle, Washington

Seattle City Light, the municipal utility serving the city, provided data on Seattle's total solar PV capacity as of 31 December 2021 in DC watts.[155] We then used geographic analysis of city zip codes to estimate the total capacity within Seattle city limits, so this year's figure may not be directly comparable to previous reports.

St. Louis, Missouri

Ameren Missouri, the utility serving the city of St. Louis, provided us with total solar PV capacity in zip codes entirely within St. Louis as of 31 December 2021 in DC watts.[156]

Tampa, Florida

TECO Energy, the electric utility serving the city of Tampa, provided us with the total installed solar PV capacity in Tampa as of 31 December 2021 in DC watts.[157]

Virginia Beach, Virginia

Dominion Energy, the utility serving Virginia Beach, provided us with the total installed solar PV capacity of all Virginia Beach zip codes as of 31 December 2021 in DC watts.[158] We then used geographic analysis of installation address latitude and longitude to limit our capacity estimates to within city limits, a different methodology than in past reports, so this year's figure may not be directly comparable to previous reports. We also included an 18 MW-DC solar farm located at Naval Air Station Oceana.

Washington, D.C.

We took the estimated total solar photovoltaic capacity in AC watts from utility and small-scale facilities in Washington, D.C., as of December 2021 found on the Energy Information Administration's Electric Power Monthly state data table.[159] This is a different data source than in past reports, so this year's figure may not be directly comparable with previous reports.

Wichita, Kansas

Evergy, the electric utility serving Wichita, provided us with the total solar PV capacity of systems interconnected to their grid within Wichita zip codes as of 31 December 2021 in DC watts.[160] We then used geographic analysis of city zip codes to limit our capacity estimates to within city limits.

Wilmington, Delaware

Data for solar PV installations in New Castle County, Delaware, were downloaded in a spreadsheet called "A List of Certified Eligible Energy Resources" through Delaware's online Renewable Portfolio Standard and Green Power Products database, in DC watts.[161] To focus on solar PV installations, we filtered by primary fuel type "SUN." We then used geographic zip code analysis to limit our capacity estimate to within the city limits of Wilmington. This is a different methodology than in previous reports, so this year's figure may not be directly comparable with previous reports.

Appendix C – Solar energy in selected California cities

Selected California cities ranked by installed solar PV capacity per capita as of December 31, 2021.

Total solar rank	City	Population	Total solar capacity (MW)	Per capita solar rank	Per capita solar (watts per person)
1	Los Angeles	3,898,747	649.9	6	166.7
2	San Diego	1,386,932	468.0	3	337.4
3	San Jose	1,013,240	290.9	4	287.1
4	Fresno	542,107	223.7	1	412.6
5	Bakersfield	403,455	156.2	2	387.1
6	Sacramento	524,943	83.9	7	159.8
7	San Francisco	873,965	62.8	11	71.9
8	Riverside	314,998	61.4	5	195.0
9	Long Beach	466,742	52.5	9	112.4
10	Oakland	440,646	49.5	10	112.4
11	Anaheim	346,824	47.1	8	135.8

Solar PV capacity for Anaheim was provided by the Anaheim Public Utilities Department in AC watts.[162] Data for Bakersfield, Fresno, Long Beach and Oakland came from the CA distributed generation database in DC watts.[163] Data sources for remaining cities can be found in Appendix B.

Notes

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13. World Health Organization, *Ambient (Outdoor) Air Quality and Health* (fact sheet), 22 September 2021, available at https://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health.

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