



Cincinnati's Clean Energy Commitment:

- **100% Renewable Energy by 2035**
- **Phase 1: 25 Megawatts of Solar**



The Mayor's Commitment

Mayor Cranley has committed the City of Cincinnati to shift to 100% renewable energy by 2035, and to develop 25 megawatts (MW) of solar as the first phase of fulfilling that commitment. The 25 MW of solar will:

- cover approximately 125-150 acres of land;
- be largest onsite municipal solar array in the country;
- be the largest solar array in Ohio or any adjacent state currently installed;
- be one of the largest solar arrays at an airport in the U.S.;
- produce enough energy to power all non-utility City Facilities including all Parks, Recreation, Parking, Police, Fire, Health and Administrative buildings such as City Hall or 80% of GCWW's largest plant, the Richard Miller Treatment Plant; and
- reduce the City's dependence on fossil fuel generated electricity by approximately 20%.



Mayor Cranley Commits to 100% Renewable Energy by 2035

Going big on the use of renewable energy in Cincinnati will decrease carbon emissions, provide fiscal savings and grow the green economy.

This solar commitment sends a clear message: Cincinnati takes climate change seriously and we will do our part.

"In the past year, climate change has cost the City of Cincinnati more than \$50 million dollars responding to floods and landslides. Today, we are pledging to invest a similar amount to reduce climate change, move to energy independence, and achieve a financial return on investment" said Mayor John Cranley.

The 25 MW solar arrays will produce approximately 33 million KWH¹, enough electricity to power 3,400 homes. This will reduce the City's carbon emissions by 25,000 tons annually which is the equivalent of removing 5,000 cars from the road, planting 600,000 trees or keeping 24 million pounds of coal in the ground per year².

Project Economics

This project will deliver power for less than the current price the City pays for electricity at its facilities. The City currently pays, on average, 9.5 cents for each kilowatt hour (KWH) of electricity consumed by general fund City facilities. On-site generated solar is anticipated to cost 5 to 7 cents/KWH. The City currently pays 5.1 cents/KWH for just the "generation" portion of its electricity bills. Large scale off-site solar can provide this generation at 4 to 5 cents/KWH.

¹ "PVWatts." NREL National Renewable Energy Laboratories, <http://pvwatts.nrel.gov/pvwatts.php> Accessed 8/31/2017

² "Greenhouse Gas Equivalencies Calculator." EPA, Environmental Protection Agency, 24 Jan. 2017, www.epa.gov/energy/greenhouse-gas-equivalencies-calculator Accessed 8/31/2017.

A 25 MW solar project is anticipated to cost \$40-\$45 million dollars before federal incentives are applied³. Financing for the 25 MW solar installations may be accomplished through a variety of financing options or ownership structures. If owned by a private entity, the solar array will be eligible for a 30% federal tax credit and other tax benefits, substantially reducing the price⁴. This contractual relationship may be structured a number of ways and will be thoroughly analyzed to ensure the City receives the greatest benefit. This project may be completed without the City taking on any debt however; the City may choose to do so if it is in the City's financial best interest. It is important to note that any approach pursued would be subject to City procurement requirements.

Whatever ownership structure is ultimately selected, it will not increase the cost of electricity to the City.

Climate Change as a Backdrop

The Earth's climate has changed, and will continue to change.⁵ Climate change is primarily caused by the release of carbon dioxide and other greenhouse gasses through the burning of fossil fuels.⁶ 16 of the 17 warmest years on record have occurred since 2001. 2016 was the warmest year on record. This was the third consecutive year this record was set.⁷

As the Earth warms, scientific consensus projects an increase in extreme weather, sea level rise caused by melting polar ice caps, and potentially mass extinction.⁸ We are seeing this already beginning to happen. For example, the earth's coral reefs serve as a canary in the coal mine. They are dying as a result of warming seawater. Aided by El Niño, 2016 was the worst year recorded for coral reef die-offs.⁹ Coral reefs are important because they provide food for 1 billion people, serve as the nurseries and homes of countless organisms, and protect coasts from storm surges limiting property damage, coastal erosion and loss of life.

American coastal cities are under threat from rising water and increased storm activity as well. Scientists have found a sharp jump in nuisance flooding along Florida and the south eastern coasts which are particularly vulnerable. They have seen a rise in sea level six times the global average due to climate change and natural variations.¹⁰ Millions of dollars are being invested to protect property and

³ Ran Fu, Chung, Donald, Travis Lowder, David Feldman, Kristen Ardani, Robert Margolis. 2016. US Solar Photovoltaic System Cost Benchmark: Q1 Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-66532 <https://www.nrel.gov/docs/fy16osti/66532.pdf> Accessed 8/31/2017

⁴ DSIRE (Database of State Incentives for Renewables & Efficiency). 2016. Accessed 8/31. <http://www.dsireusa.org/>

⁵ IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland,

⁶ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

⁷ NASA, NOAA Data Show 2016 Warmest Year on Record Globally, RELEASE 17-006, <https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally> Accessed 8/31/2017

⁸ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

⁹ Hughes, Terry. "Global Warming and Recurrent Mass Bleaching of Corals." *Nature*, vol. 543, no. 7645, 16 Mar. 2017, pp. 373–377., doi:8/28/2017.

¹⁰ Valle-Levinson, A., A. Dutton, and J. B. Martin (2017), *Spatial and temporal variability of sea level rise hot spots over the eastern United States*, *Geophys. Res. Lett.*, 44, 7876–7882, doi:10.1002/2017GL073926.

infrastructure from the rising sea. Miami Beach recently increased local fees to finance a \$400 million dollar infrastructure plan which will raise seawalls, elevate roadways and increase pumping in an attempt to protect the City from the rising sea.¹¹ The federal government predicts that within 80 years, Baltimore and San Francisco will each experience flooding on about 350 days each year.¹² While extreme storms naturally occur, the recent Hurricane Harvey intensity in Houston was estimated to have been increased as much as 30% due to climate change warming the gulf waters which grew the size and strength of the storm¹³. The overall costs of this terrible storm and the others that followed are not yet known.

Climate Change in Cincinnati

The climate in Cincinnati has changed, and will continue to change. Weather data and climate models show that Cincinnati has gotten hotter and wetter over time, and the pattern of intensifying storms and heat waves will worsen.¹⁴ By 2050, the hottest day of the year in Cincinnati will be, on average, 6.7 degrees Fahrenheit hotter than it is now.¹⁵ This is of special concern because large heat waves can be deadly; in 2003, a heat wave in Europe killed 70,000 people.¹⁶



Flooded cars along Vine Street near East Mitchell Ave
Photo: Carla Owsley, Cincinnati Enquirer 8/28/2016

In the past year, Cincinnati has experienced three 100-year rain events, flooding streets, damaging property, and causing sewer overflows in our homes and businesses. Reimbursing residents for sewage filled basements and addressing flooding has cost MSD rate payers over \$30 million dollars in the past year alone. Heavy rain events are destabilizing our hill sides as well. Large hill slides are occurring, damaging property and causing significant delays to our transportation system. The recent slide on Riverside Drive requires a

¹¹ Gillis, Justin. "Flooding of Coast, Caused by Global Warming, Has Already Begun." *The New York Times*, The New York Times, 3 Sept. 2016, www.nytimes.com/2016/09/04/science/flooding-of-coast-caused-by-global-warming-has-already-begun.html Accessed 8/31/2017

¹² USGCRP, 2017: *Climate Science Special Report: A Sustained Assessment Activity of the U.S. Global Change Research Program* [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 669 pp.

¹³ Meyer, Robinson. "Did Climate Change Intensify Hurricane Harvey?" *The Atlantic*, Atlantic Media Company, 27 Aug. 2017, www.theatlantic.com/science/archive/2017/08/did-climate-change-intensify-hurricane-harvey/538158/ Accessed 8/31/2017

¹⁴ Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

¹⁵ USGCRP, 2017: *Climate Science Special Report: A Sustained Assessment Activity of the U.S. Global Change Research Program* [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 669 pp.

¹⁶ Robine, Jean-Marie; Cheung, Siu Lan K.; Le Roy, Sophie; Van Oyen, Herman; Griffiths, Clare; Michel, Jean-Pierre; Herrmann, François Richard (2008). "Death toll exceeded 70,000 in Europe during the summer of 2003". <https://www.ncbi.nlm.nih.gov/pubmed/18241810> *Comptes Rendus Biologies*. **331** (2): 171–178. ISSN 1631-0691. PMID 18241810. doi:10.1016/j.crv.2007.12.001. Accessed 8/31/2017

\$20 million dollar retaining wall to stabilize the hillside. These costs will continue to rise as our climate changes.

“We Are Still In”

In the largest official consensus in human history, the world rose to meet the vast challenges of climate change by signing the Paris Accords in 2015. In a framework of voluntary compliance and reporting, countries agreed to set emission reduction goals and report their progress. 195 countries were signatories to this agreement. Only two countries, Syria and Nicaragua, did not sign the Paris Accords.¹⁷ The world finally has a plan to begin addressing climate change.

On June 1st 2017, the United States announced it would withdraw from the Paris Accords. The United States represents 15% of the world’s carbon emissions and is the world’s second largest emitter of greenhouse gases.¹⁸ No alternative to the Paris Accords or greenhouse gas reduction strategy has been put in place by the federal government.

To fill a leadership void at the national level, local communities across the country are stepping up to shoulder the work of the Paris Accords. The City of Cincinnati is aggressively embracing a leadership role in the creation of a clean energy future. The City recognizes that these issues will impact us all and if the federal government chooses to abdicate its responsibility, we will step up. Cincinnati is committed to the goals of the Paris Accords and has pledged that “We Are Still In.” To highlight the City’s obligation to protecting our planet, in June, Mayor Cranley pledged that Cincinnati City Government would utilize 100% renewable electricity by 2035.



Cincinnati’s District 3 Police Station – The 1st Net Zero Energy Police Station in the Country and the Greenest Building in Ohio - 330 KW solar installed

Cincinnati’s Environmental Leadership

Cincinnati has a history of environmental leadership, stewardship and energy cost saving initiatives. The Green Cincinnati Plan (2008) set the goal to reduce greenhouse gases 2% per year. Cincinnati is meeting this goal. By 2015, Cincinnati, as a whole, had reduced its emissions by 18% while the Cincinnati City Government reduced its emissions by 36%.¹⁹ Many City departments have implemented energy efficiency upgrades such as upgrading to LED lights, improved HVAC equipment, and improvements to the facilities’ building envelope. To date, the City has invested in 1.7 MW of solar panels at 27 Cincinnati facilities. The recently constructed District 3 Police Station

¹⁷ “Paris Agreement” United Nations

https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtsg_no=XXVII-7-d&chapter=27&lang=en Accessed 8/31/2017

¹⁸ “Global Greenhouse Gas Emissions Data.” EPA, Environmental Protection Agency, 13 Apr. 2017, www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#Country. Accessed 8/31/2017

¹⁹ “2015 Cincinnati Green House Gas Inventory and Analysis” Cincinnati Office of Environment and Sustainability, <http://www.cincinnati-oh.gov/oes/citywide-efforts/climate-protection-green-cincinnati-plan/2015-greenhouse-gas-emissions-inventory-pdf/> Accessed 8/31/2017

is the first and only net-zero energy police station in the country. Cincinnati's Electric Aggregation program provided 86,000 households and small businesses with 100% renewable electricity and is expected to be the 4th largest green aggregation program in the country in 2017.²⁰ Cincinnati is the only city in the country that offers green natural gas and electricity through its aggregation program allowing resident's homes to use 100% carbon free energy.

All of Cincinnati's climate initiatives have been done in a way that yields multiple benefits: saving money, reducing overall usage, creating jobs, improving public health, and improving the quality of life for Cincinnatians.

Project Description

Options the City will assess for inclusion in this solar project include:

<u>Location</u>	<u>Solar Capacity Potential</u>	<u>Developable Land</u>
Lunken Airport	10-15 MW	60 Acres
Center Hill Landfill	10-15 MW	60 Acres
RMTP On-Site Generation	2-3 MW	10 Acres
City Facilities On-Site Generation	5-10 MW	50+ Acres
Other Off-Site Renewable Generation	25+ MW	125+ Acres

All City facilities would still be connected to the utility grid to provide power when the solar is not generating. During the day, the array(s) will produce more power than the City facilities use, and at night the City facilities will still rely on the electric grid to provide electricity. With this strategy, the City can still benefit from its energy management techniques, the electric grid reliability and successfully transition away from fossil fuels.

Lunken Airport

Lunken Airport represents an opportunity to deploy a large, utility scale solar array on City property. Airports are increasingly turning to solar due to their high energy needs and availability of large open areas. The Denver, Indianapolis, Minneapolis and Chattanooga airports all have large solar arrays offsetting their energy consumption. One of the largest solar arrays in Ohio is in Upper Sandusky located at the Wyandot County Airport. Panels line either side of the runway. Lunken has the land to potentially be one of the largest airport solar installations in the country. If these cities and airports can make solar happen, so can Cincinnati.



Denver Airport; Denver, Colorado
10 MW solar

²⁰ "Top Ten Utility Green Pricing Programs" National Renewable Energy Labs,
<https://www.nrel.gov/analysis/pdfs/utility-green-power-rankings.pdf> Accessed 8/31/2017

Center Hill Landfill

The former Center Hill Landfill, which closed in the early 1970s, is two parcels of land totaling 60 acres located on the corner of Estes Ave and Center Hill road. Center Hill Landfill represents an opportunity to place a large utility grade solar array within the City borders and to put to use an underutilized piece of property. Building on a landfill can be a challenge but preliminary analysis shows that Center Hill is a good fit for solar. The City has conducted settlement studies on the soil at Center Hill which showed the land to be relatively stable. The site has good access to both transmission and distribution level service. Finally, the site is flat with good access to the sun minimizing construction costs.

Richard Miller Treatment Plant



Solar panels currently at Richard Miller Treatment Plant -44KW

Richard Miller Treatment Plant is the City's largest consumer of electricity. Solar evaluations were completed at the RMTP in 2012 and 2015. Utilizing the roof of the clear wells, the roofs of several treatment facilities, and additional green space on the surrounding grounds, it is estimated that these locations can support an additional 2-3 MW of solar. Adding battery storage to the facility will reduce overall costs of the installation, improve dependability, and serve as a potential revenue stream for the

solar array. Additionally, GCWW will investigate enhancing or upgrading the existing hydro turbines with more efficient units that will recover energy on a more continuous basis.

Distributed Generation at City Facilities

Existing City facilities present great opportunity to expand solar deployment throughout Cincinnati. Cumulatively, they stand to make a large impact. Washington DC recently entered into an agreement with a third-party provider to provide roof upgrades and install solar at 34 DC City facilities. This resulted in the installation of 11.4 MW of solar, the creation of 140 jobs, all done at a cost savings to the tax payer²¹. We can replicate this in Cincinnati. Battery storage will be investigated for City facilities because they may improve the economics of the project. Further, battery storage adds a resiliency component allowing City facilities to act as cooling shelters should grid power go out during a



Beekman Garage- 229 KW solar array

²¹ "Mayor Bowser Announces Largest Municipal Onsite Solar Project in US", 1 Dec. 2015, <http://mayor.dc.gov/release/mayor-bowser-announces-largest-municipal-onsite-solar-project-us> . Accessed 8/31/2017

heat wave. Additional benefits could include completing necessary roof improvements, and providing shaded parking through the use of solar canopies similar to the Cincinnati Zoo.

Other Offsite Renewable Generation Sources

It may be most economical to look at developing a large single solar field off site, outside the City. This would allow the project developer flexibility to secure the land and project design that provides the most value to the City. It would allow for economies of scale and a reduction in the soft costs associated with solar development such as the interconnection agreement, PJM agreements, and engineering costs.

The offsite generation model is used by many Fortune 500 companies, municipalities and colleges. They do not own the entire installation but instead own a significant portion of the production of the installation. For example, Ohio State owns 50 MW of wind energy from the Blue Creek Wind Farm²², located in Ohio's Van Wert and Paulding counties. Amazon has two wind farms in Paulding and Hardin County Ohio representing close to 300 MW of power²³. Washington DC owns wind energy at the South Chestnut 46 MW wind farm in southwestern Pennsylvania²⁴. All are done at a cost savings compared to utility rates. The guaranteed off-take from these investment grade entities helps finance the large renewable installation.

Recommendation:

The City will work to develop a procurement solicitation (e.g., invitation to bid, request for proposals, request for qualifications, etc.) to secure an owner's representative/developer. The procurement solicitation will focus on developing the 5 main areas listed above but allow for flexibility within allowing for creative solutions to meet the stated goal of 25 MW of solar.

The selected owner's representative will be a firm with expertise in large scale solar installations and energy management. They would serve as the City's agent and assist in preparing future information requests, evaluating proposals, verifying technical/fiscal engineering and negotiating legal contracts with vendors and/or utilities.

The owner's representative will also be responsible for working with City Staff to identify parcels, and do the required technical and fiscal engineering to ensure the project has cost savings to the City and provides the environmental benefits of renewable energy.

Next Steps and Tentative Project Timeline

1. October 2017: The Mayor will introduce to Council a motion that will direct the City Administration to issue a procurement solicitation to select an owner's representative.

²² Ohio State to Power Campus with Wind Energy from Ohio Wind Farm, *Ohio State*, <http://oe.osu.edu/ohio-state-to-power-campus-with-wind-energy.html>. Accessed 8/31/2017

²³ Mark Williams "Amazon to Build Second Wind Farm in Ohio." *The Columbus Dispatch*, 1 Nov. 2016, www.dispatch.com/content/stories/business/2016/11/01/amazon-to-build-second-wind-farm-in-ohio.html. Accessed 8/31/2017

²⁴ "Mayor Bowser Announces Groundbreaking Wind Power Purchase Agreement " 14 July 2015, <http://mayor.dc.gov/release/mayor-bowser-announces-groundbreaking-wind-power-purchase-agreement>. Accessed 8/31/2017

2. October 2017: The Mayor will introduce to Council an ordinance that will authorize the City to solicit proposals for development of a 25 MW solar project or to provide the City with energy from such a project, and to enter into a contract for the same, with the provision that the contract must be determined to be financially advantageous to the City
3. November 2017: OES, in partnership with the relevant City Departments will draft and publish a procurement solicitation. A multi departmental team selected by the City Manager will review submitted proposals and make a recommendation to the City Manager on which proposal(s) is/are most advantageous to the City.
4. December 2017: The selected owner's representative will be placed under contract and begin working with City Departments to assemble the bid package for the development and installation of 25 MW of solar at various City facilities
5. April 2018: OES, in partnership with the selected owner's representative, and the relevant City Departments will draft and publish a procurement solicitation for the installation of 25 MW of solar at City facilities. A multi departmental team selected by the City Manager will review submitted proposals and make a recommendation to the City Manager on which proposal(s) is/are most financially advantageous to the City.
6. June 2018: A solar developer will be selected.
7. July 2018-December 2018: Design, permitting and engineering will take place.
8. Spring 2019: Construction of the 25 MW of solar will begin.