Community Solar in Cook County: Opportunity Assessment

June 2015
About the SunShot Initiative

The U.S. Department of Energy SunShot Initiative is a collaborative national effort that aggressively drives innovation to make solar energy fully cost-competitive with traditional energy sources before the end of the decade. Through SunShot, the Department of Energy supports efforts by private companies, universities, and national laboratories to drive down the cost of solar electricity to $0.06 per kilowatt-hour. Learn more at energy.gov/eere/sunshot.
“Cook County should be a world-class model of sustainability. We are working not only to boost sustainability practices throughout County government, but also to join forces with local governments, nonprofits and business, to accomplish more than we could separately in making each of Cook County’s communities sustainable.”

– Toni Preckwinkle, President, Cook County Board of Commissioners

This project to advance community solar in Cook County is undertaken cooperatively by Cook County, the City of Chicago, ComEd, Elevate Energy, Environmental Law and Policy Center, and West Monroe Partners.
Overview

- Goals of Opportunity Assessment
- Cook County Housing Demographics
- Opportunity Assessment
- Conclusions and Next Steps
SunShot Initiative Seeks to Make Solar Energy Cost-Competitive

- U.S. Department of Energy SunShot Initiative is a national collaborative effort to make solar energy cost-competitive with other forms of electricity by the end of the decade.

- The SunShot Initiative’s Solar Market Pathways Program will support 15 projects, including the Cook County Community Solar Project, over the next two years that are advancing solar deployment across the United States.

The Cook County Community Solar Project will identify and establish models for community solar and ways to eliminate barriers to implementation.
Goals of Opportunity Assessment
Goals of This Opportunity Assessment

- Quantify community solar customer potential by analyzing Cook County housing demographics
- Assess and quantify market potential for community solar installations by analyzing physical characteristics of vacant land and buildings in Cook County
- Identify the number of sites suitable for community solar installations and potential combined solar energy capacity for these sites
- Identify most suitable vacant land and buildings to streamline community solar development
- Help inform the project’s pilot site selection process in Fall/Winter of 2015
Cook County Housing Demographics
Cook County Overview

- 5.2 million people - second most populated county in the U.S.
- 1.933 million households
- 1,635 square miles
- 132 municipalities

Source: U.S. Census. Available at: [http://quickfacts.census.gov/qfd/states/17/17031.html](http://quickfacts.census.gov/qfd/states/17/17031.html)

Cook County Housing Characteristics

42% of Cook County households cannot invest directly in solar photovoltaic systems due to lack of roof ownership; of the owner-occupied units, over one-quarter cannot install solar photovoltaic systems due to shared roof ownership.

- 1.933 million occupied housing units in Cook County
  - 1,128,000 owner-occupied households
  - 800,000 renter occupied

Source: 2013 American Communities Survey 5-Year Estimates
Cook County Overview

- Majority of Cook County residents cannot invest in, install, and benefit from solar photovoltaic systems because:
  - They do not own their roof (renters)
  - They co-own their roof (condo owners)
  - Home/roof is not structurally sound
  - Shading on roof
  - Financial barriers and up-front costs of installation

- Community solar has potential to allow nearly all Cook County utility customers to invest in and benefit from solar photovoltaic energy
Opportunity Assessment
Opportunity Assessment Overview

- Data Utilized
- Data Limitations
- Data Aggregation
- Electrical Grid Data
- Site Screening Criteria

**Objective:** Quantify the community (shared) solar market potential in Cook County
Data Utilized for Opportunity Assessment

- Acquired local and national data:
  - Cook County/local property assessor
    - Building characteristics and land use type
    - Light Detection and Ranging (LiDAR) data
    - Geographic Information System (GIS) data
  - Cook County Land Bank Authority
    - Property list/tax delinquent
  - National Housing Preservation Database
    - Public and subsidized multifamily properties
  - U.S. Environmental Protection Agency (U.S. EPA)
    - Brownfields, landfills, superfund, and Resource Conservation and Recovery Act (RCRA) sites
  - National Renewable Energy Laboratory (NREL)
    - Best practices for solar site development, solar radiation potential
Data Limitations

- Geographical Information System (GIS) data, including vector polygons representative of building footprints, is essential for the analysis of available rooftop space
  - Building footprint data is required to calculate the area and boundary of the rooftop surface
  - This data is not available for suburban Cook County
  - Without the area and boundary of the rooftop surface analysis of the rooftop slope, orientation, and total usable area (minus obstructions) cannot be performed

- As a result, no suburban rooftops were included in this analysis

- The analysis presented in this document will be updated when the data for suburban Cook County becomes available

Source: Cook County Assessor
Data Limitations, cont.

- Inconsistencies between property data sets due to different data collection years
  - City of Chicago building footprint data is from 2010
  - Cook County Assessor data is from 2013
  - Cook County LiDAR and topographic data is from 2008

- Lack of comprehensive building characteristics data
  - Roof age
  - Building modifications including demolition and new development
# Data Summary

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Geography</th>
</tr>
</thead>
</table>
| LiDAR – Digital surface model of land and roof topography | Chicago: Yes  
Suburban Cook County: Yes |
| Source: Cook County 2008 LiDAR and Topographic Data Services |
| Building Footprint – GIS vector file to identify rooftop surface and area | Chicago: Yes  
Suburban Cook County: No |
| Source: City of Chicago Data Portal 2010 |
| Parcel – GIS vector file used to identify vacant land surface and area | Chicago: Yes  
Suburban Cook County: Yes |
| Source: Cook County GIS 2015 |
| Property Assessor – Building Characteristics and Use | Chicago: Yes  
Suburban Cook County: Yes |
| Source: Cook County Property Assessor 2013 |
In order to create a master list of potential sites and buildings, all of the data was aggregated into a single database. Building characteristics and use type joined with physical characteristics that were modeled from LiDAR data and then analyzed using ESRI ArcGIS software. Different date ranges in datasets required manual manipulation. Time needed for QA/QC, data cleaning, and verification of results.

The team then filtered all of the vacant land and buildings through the site selection criteria to find the list of suitable sites and buildings in Cook County.

This list is incomplete because building footprint data is not available in suburban Cook County.
Transparent Electrical Grid Information Is Critical for Pilot Site Selection

- Solar photovoltaic systems generate electricity that is distributed to the electrical grid and are required to go through an “interconnection” process with ComEd to ensure that each system can be integrated safely into the existing infrastructure.

- Community solar energy developers and other organizations interested in developing solar energy projects in their communities need to know where the best locations are in relation to the electrical grid.

- Detailed grid data is not currently available, but the project team is working to incorporate electrical grid information into the opportunity assessment analysis.

Photo source: http://www.elp.com/articles/2013/03/comed-switches-on-smart-substation-in-chicago.html
Utilized national best practices for solar photovoltaic site screening

- Additional criteria not yet applied
  - Grid infrastructure data, site sensitivity, energy usage, building longevity, zoning, prioritized use, site ownership, and other qualitative criteria

Cook County Land Parcels, Built and Vacant

Cook County Properties
1.9 Million

Chicago Properties
880 K

Suburban Cook County Properties
980 K

Built Properties
846 K

Vacant Land
34 K

Built Properties
947 K

Vacant Land
33 K

Source: 2013 Cook County Assessor
Cook County Vacant Land Site Screening
Vacant Land Site Screening Guidelines

- System Size ≥ 300kW

- Suitable sites must meeting the following criteria:
  - Land size ≥ ½ acre
  - Distance to roads < 1 mile
  - Distance to power infrastructure < ½ mile
  - Shade – not in shade and in sunlight for ≥ 3.7 hours per day
  - Obstructions – no major visible obstructions that cannot be moved
  - Land Slope <6 Degrees

- Community solar installations are on average significantly larger than minimum criteria metrics

Total Vacant Properties in Cook County: 67,122

With adequate area of available space: 6,679

Close to necessary infrastructure (roads and transmission): 6,162

With adequate solar potential (not in shade): 4,977

Properties with adequate surface (topography and obstructions): 3,038

Source: Cook County Assessor 2010, Cook County GIS 2013 Parcels 2015; Cook County 2008 LiDAR and Topographic Data Services (Contract No. 08-41-342). Published 2010
Vacant Properties with Adequate Surface

Solar Array Size
- >= 10 MW
- >= 5 MW
- >= 1 MW
- >= 500 kW
- >= 300 kW
Landfills are one type of parcel classified as vacant. 13 Cook County landfill sites appear to be good candidates for community solar.

There are 6 landfill sites that could house a solar array over 1 MW.

The majority of suitable landfills would be good-sized hosts for projects between 300 and 500 kW.
City of Chicago Rooftop Site Screening
Building Site Screening Guidelines; Rooftop Data Not Available for Suburban Cook County

- System Size ≥ 25kW
- Suitable sites must meeting the following criteria:
  - Rooftop size ≥ 1794 Square Feet
  - Distance to roads < 1 mile
  - Distance to power infrastructure < ½ mile
  - Shade – not in shade and rooftop in sunlight for ≥ 3.7 hours per day
  - Obstructions – no major visible obstructions that cannot be moved
  - Rooftop Slope - flat or pitched <60-degrees and facing south, southwest, or southeast
- Community solar installations are on average significantly larger than minimum criteria metrics

The following data only represents building rooftop for City of Chicago due to data limitations for suburban Cook County
Rooftops in City of Chicago Screening: Sites ≥ 25 kW

Total Rooftops in Chicago: 820,152

With adequate area of available space: 417,241

Close to necessary infrastructure: 417,241

Adequate solar potential (not in shade): 65,632

Suitable surface (topography and obstructions): 44,996

Number of suitable rooftops will be larger once analysis for rooftops in Suburban Cook County is added.


*Additional properties not listed include single-family detached and residential garages. Unclassified buildings include properties that are not classified by the Cook County Property Assessor.
Chicago Buildings with Adequate Surface

- School
- Municipal/Non-Profit/Church
- Public/Subsidized
- Condo
- Apartment
- Commercial
- Industrial
- Unclassified

Source: City of Chicago Building Footprints 2010, Cook County Assessor 2013, Cook County GIS 2013 Parcels 2015; School Boundaries 2014, National Housing Preservation Database 2013, Cook County 2008 LiDAR and Topographic Data Services (Contract No. 08-41-342). Published 2010, Elevate Energy Rooftop Suitability Analysis 2015

*Additional properties not listed include single-family detached and residential garages. Unclassified buildings include properties that are not classified by the Cook County Property Assessor
A total of 2,249 schools appear to be good candidates for community solar.

There are 62 school buildings that could house rooftop solar arrays over 1 MW.

The majority of suitable school rooftops would be good-sized hosts for 100-300 kW projects.

Sources: Cook County Assessor 2013, Cook County Data Portal Schools 2014, Elevate Energy Rooftop Suitability Analysis 2015
214 municipal buildings appear to be good candidates for community solar, based on our screening criteria.

31 buildings could house a rooftop solar arrays over 1 MW.

Source: CMAP 2015, Cook County 2015
452 public or subsidized housing buildings appear to be good candidates for community solar.

There are 102 buildings that could support rooftop solar arrays in the 100 - 300 kW range.

Source: National Housing Preservation Database 2013, Source: Cook County Assessor 2013
1,315 condominium/townhome buildings appear to be good candidates for community solar

13 buildings could support rooftop solar arrays between 300 kW to 1 MW

Source: Cook County Assessor 2013
A total of 15,424 rental apartments buildings appear to be good candidates for community solar.

2 apartment building could house a rooftop solar array over 1 MW.

The majority of suitable apartment rooftops would be good-sized hosts for 25 – 50 kW projects.

Source: Cook County Assessor 2013, Elevate Energy Rooftop Suitability Analysis 2015
A total of 9,998 commercial buildings appear to be good candidates for community solar.

121 buildings could house a rooftop solar array over 1 MW.

The majority of suitable commercial rooftops would be good-sized hosts for 25 - 100 kW projects.

Source: Cook County Assessor 2013, Elevate Energy Rooftop Suitability Analysis 2015
A total of 4,723 Industrial buildings appear to be good candidates for community solar.

348 industrial buildings could house a rooftop solar array over 1 MW.

The majority of suitable industrial rooftops would be good-sized hosts for 100 - 300 kW projects.

Source: Cook County Assessor 2013, Elevate Energy Rooftop Suitability Analysis 2015
There are 9,468 unclassified buildings that could house a rooftop solar array over 25 kW

38 of these sites could support an array above 1 MW
Cook County Criminal Courts

Located at 2650 S California Ave

22 buildings on this property have suitable rooftops for systems ≥ 25 kW (6 buildings shown in example)

Majority of the buildings at this site can hold a system between 300 kw to 1 MW
There is over 9,000 megawatts worth of site capacity available for community solar projects in Cook County, which is nearly enough to offset all of Cook County’s residential electricity use.
Conclusions and Next Steps
Opportunity Assessment Conclusions

- 45,000 rooftops in the City of Chicago are suitable to host at least a 25-kilowatt solar electric system
  > Properties that are not classified by the Cook County Property Assessor require further review to identify building use type
  > Number will be larger when suburban Cook rooftop data is analyzed.

- 3,000+ vacant land sites in Cook County that are suitable to host at least a 300 kilowatt solar electric system

- Total Cook County Community Solar Capacity is over 9,000 megawatts, enough to power 100% of the annual electricity consumption of:
  - Roughly 3,000,000 apartments in Cook County or
  - Roughly 1,400,000 single-family households in Cook County

Source: Chicago Data Portal 2013, Elevate Energy Analysis 2015, ACS 2013 5 Year Estimates
Next Steps

- Integrate additional electric grid site selection criteria into dataset as information becomes available

- Stakeholder working group sessions

- Research community solar best practices and business models

- Begin localized pilot site selection process
This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.