Community Solar Local Benefits Analysis

August 2017

Powered by SunShot U.S. Department of Energy

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Cook County Community Solar Project

The U.S Department of Energy SunShot Initiative is a national effort to drive down the cost of solar electricity and support solar adaptation. SunShot aims to make solar energy a low-cost electricity source for all Americans through research and development efforts in collaboration with public and private partners. Learn more at energy.gov/sushot.

Cook County SunShot Project Partners:

Project Objectives Include:

- Inventory existing community solar market
- Identify the potential market for community solar
- Analyze the economics of different ownership structures
- Identify structural and policy barriers to community solar and propose approaches to address them
- Select 5-7 pilot sites and conduct technical and economic feasibility analysis
- Disseminate lessons learned so other projects can succeed

Local Benefits Analysis: Background and Objectives

- The goal of the Local Benefits Analysis is to scale up the simulated costs/benefits at a hypothetical community solar site to derive the total local net benefits of increased deployment of community solar projects within Cook County

- The analysis is intended to include an assessment of the local benefits associated with the construction and maintenance of the community solar installations

- To-date, community solar has seen limited levels of adoption in Illinois because no regulatory framework to support program development existed. The Future Energy Jobs Act (SB2814) signed in 2016 contains specific provisions to promote community solar, including new renewable energy targets for construction of community solar sites

- This report highlights the anticipated local impacts of community solar, provided these new state targets (defined in SB2814) are met, including local spending and job creation, and avoided energy generation and associated regional emissions

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Factors Influencing Community Solar Deployment

- Community Solar Enabling Legislation
- Factors Influencing Regional Community Solar Growth
- Characteristics Influencing Project Siting: Cook County Compared to State
- Characteristics Influencing Subscriber Acquisition: Cook County Compared to State

Community Solar Enabling Legislation

- The Future Energy Jobs Act (SB2814), enacted in December 2016, is a major energy bill intended to strengthen and expand the Illinois Renewable Portfolio Standard (RPS). It creates an adjustable Renewable Energy Credit (REC) block purchase program with a specific allocation for community solar generated RECs
- The structure of this program has yet to be defined by the Illinois Power Agency (IPA), but REC prices are anticipated to create market conditions that allow the new renewable energy targets for construction of community solar sites to be met
- The RPS is structured to front-load the new build solar targets to align with the sun setting investment tax credit (ITC), meaning more solar growth is expected in 2018, 2019, and 2020 than the subsequent years
- While the state-wide goals for community solar under the Future Energy Jobs Act are understood, the legislation does not prescribe solar deployment goals across individual regions or counties
- The construction of community solar projects in an area can employ local residents and result in increased economic activity. Residents who participate in a community solar program are likely to experience savings on their electric bill, which may then be reinvested in the economy

Factors Influencing Regional Community Solar Growth

Many factors may influence a developer's decision on where to site their community solar project and target subscribers. Some key considerations include:

- **Population or population density:** while land may be more readily available in areas with lower population densities, marketing and customer acquisition may be more difficult in areas with geographically dispersed populations
- **Gross domestic product (GDP):** GDP is one of the primary indicators used to gauge the health of a country or region's economy. Regions with higher GDPs will likely contain more customers that have the financial means to participate in community solar
- **Per Capita Personal Income (PCPI):** PCPI, like GDP, is an indicator of a county or region's financial well-being. PCPI calculates the average annual personal income of a person in a given region. Higher PCPI levels indicate greater spending potential and a more probable ability to partake in community solar initiatives
- **Land or real estate costs:** developers are likely to avoid locations with higher land purchase or lease costs
- **Labor costs:** developers are likely to avoid locations with higher labor rates for installers, contactors, and electricians
- **Permitting and zoning rules:** developers may avoid building in areas with more cumbersome permitting and zoning rules and favor areas with streamlined processes
- **Access to community institutions**: partnerships with local community groups, churches and other community institutions may improve a developer's interactions with potential customers and reduce subscriber acquisition costs
- **Grid value**: Once net metering equals 5% of the utility supplied peak demand, the Illinois Commerce Commission will examine and determine if an alternative rebate value is appropriate. The rebate is intended to compensate subscribers for the value that distributed energy resources (DER) provide to the grid. Once the net metering cap is reached, developers may choose to site projects at locations with higher rebate values
- **Utility load**: utilities may be required to procure community solar consistent with their percentage of the overall state load

Characteristics Influencing Project Siting: Cook County Compared to State

Cook County's land, labor and permitting characteristics present mixed incentives for developers seeking to site projects compared to the rest of the state

CATEGORY	COOK COUNTY COMPARISON TO STATE	DIRECTIONAL IMPACT
Utility Load Higher Load than Other Utilities	• Cook County makes up more than 50% of Illinois' total electric load[4] • Depending on the structure of the IPA procurement process, high utility load percentages may indicate the necessity for larger renewable loading procurement in the area	Positive
Labor Costs Higher Labor Costs than State Average	» Cook County construction laborers earn an average weekly wage of $1,625; higher than the average weekly wage for construction workers in IL of $1,451[1] » High comparative wages may cause developers to design projects in other parts of the state	Negative
Land Costs Higher Land Costs than State Average	» Cook County encompasses the City of Chicago, a major metropolitan hub, increasing property costs compared to the rest of the state » Cook County is the only county in IL that evaluates commercial and industrial property at a higher market value % than residential property, yielding a higher property tax burden on businesses[2] » Higher taxes may cause developers to site projects elsewhere	Negative
Permitting Rules Fewer Permitting Hurdles than Surrounding Counties	» Chicago established streamlined solar permitting in concurrence with SunShot initiatives[3] » Ease of permitting may incentivize developers to design their projects in Cook County	Positive
Grid Value Unknown Relative Grid Value	» Since the rebate quantity and highest value-providing site locations are unknown, Cook County cannot be compared to the surrounding area in this category	Unknown

[1] Department of Labor
[2] Chicago Metropolitan Agency for Planning
[3] Department of Energy
[4] Chicago Regional Energy Shot

Characteristics Influencing Subscriber Acquisition: Cook County Compared to State

Cook County's demographic and economic characteristics are expected to create an attractive market for developers seeking to acquire community solar subscribers, compared to the rest of the state

CATEGORY	COOK COUNTY COMPARISON TO STATE	DIRECTIONAL IMPACT
Population **Higher Population than Surrounding Counties**	» 5.2 million people (41% of the state's population) reside in Cook County [1] » Developers are likely to market their community solar programs in areas with large populations	**Positive**
Population Density **Higher Population Density than Surrounding Counties**	» Cook County has a population density of 5,539 people per square mile, over 20 times the state average of 232 per square mile [2] » A high population density indicates that developers can market to a larger number of customers within a specific areas	**Positive**
Per Capita Personal Income **Higher PCPI than State Average**	» Cook County's Per Capita Personal Income[3] (PCPI) is $54,714; this exceeds the state average of $50,288 [1] » Cook County makes up ~44.3% of the total IL personal income ~$646 billion [1] » With an above average PCPI, Cook County residents are likely less risk adverse and more likely to participate in community solar programs	**Positive**

[1] Bureau of Economic Analysis 2015
[2] Census Bureau 2016

State and Local Deployment Forecasts

- Illinois Community Solar Deployment Projections
- Cook County Community Solar Deployment Projections
- Community Solar Deployment Projections: 2018 – 2030
- Community Solar Deployment Snapshot

Illinois Community Solar Deployment Projections

- The Future Energy Jobs Act created an Adjustable Block Program consisting of three buckets: small DG, large DG and community solar. Twenty-five percent of the total RECs are allocated to each bucket, with another 25% unallocated

- The Future Energy Jobs Act has frontloaded the mandated solar new build targets to correspond with the sun-setting federal investment tax credit. Estimated solar capacity required by the new build targets include[1]:
  - 2020: 1,500 MW
  - 2025: 2,250 MW
  - 2030: 3,000 MW

- The Adjustable Block Program mandates that 400 MW of community solar is be built in Illinois by 2030. For the purposes of this analysis, it has been assumed that 25% of the unallocated RECs would come from small DG, and the remaining (~38%, representing 200 MW) would be split evenly between large DG and community solar

- For scenario modeling, an Illinois projection of 600 MW of community solar (400 MW mandate and 200 MW from the unallocated block) between 2018 and 2030 was assumed. The annual capacity installation levels were assumed to correspond with the frontloaded new build targets
  - 2018 – 2020 annual capacity additions: 99 MW
  - 2021 – 2030 annual capacity additions: 30 MW

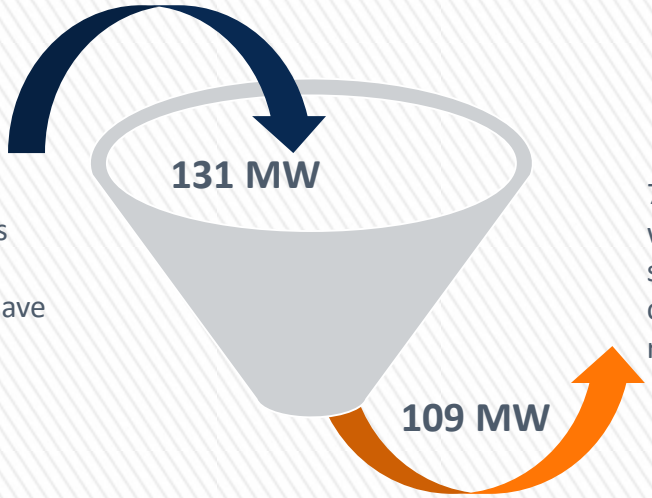
[1]Environmental Law and Policy Center "Overview: Improved & Modernized Illinois Renewable Portfolio Standard"

Cook County Community Solar Deployment Projections

- Because the relative impact of these characteristics is unknown, various scenarios were created to represent possible deployment levels in Cook County

109 sites were submitted for consideration as pilot locations

These sites are estimated to have capacity for 131 MW of solar



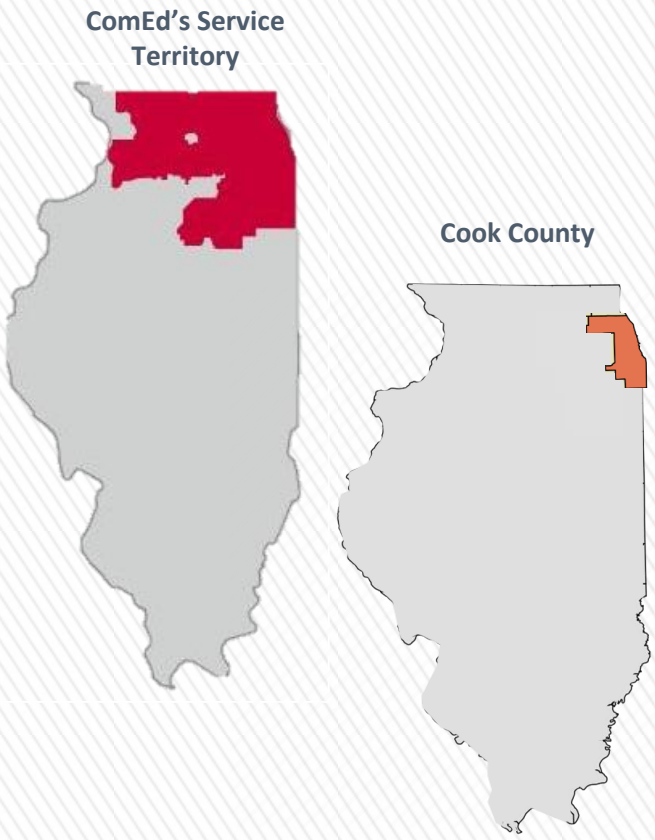
75 of these sites, totaling 109 MW, were screened as being suitable for solar given sun exposure and site conditions (>100 kW and >10 year roof life)

- The “expression of interest (EOI)” scenario analyzed for Cook County assumes that community solar is built at each of the suitable properties submitted as pilot site projects for the Cook County Community Solar Project. This was compared to the state projection, which was estimated to be 600 MW of installed capacity by 2030

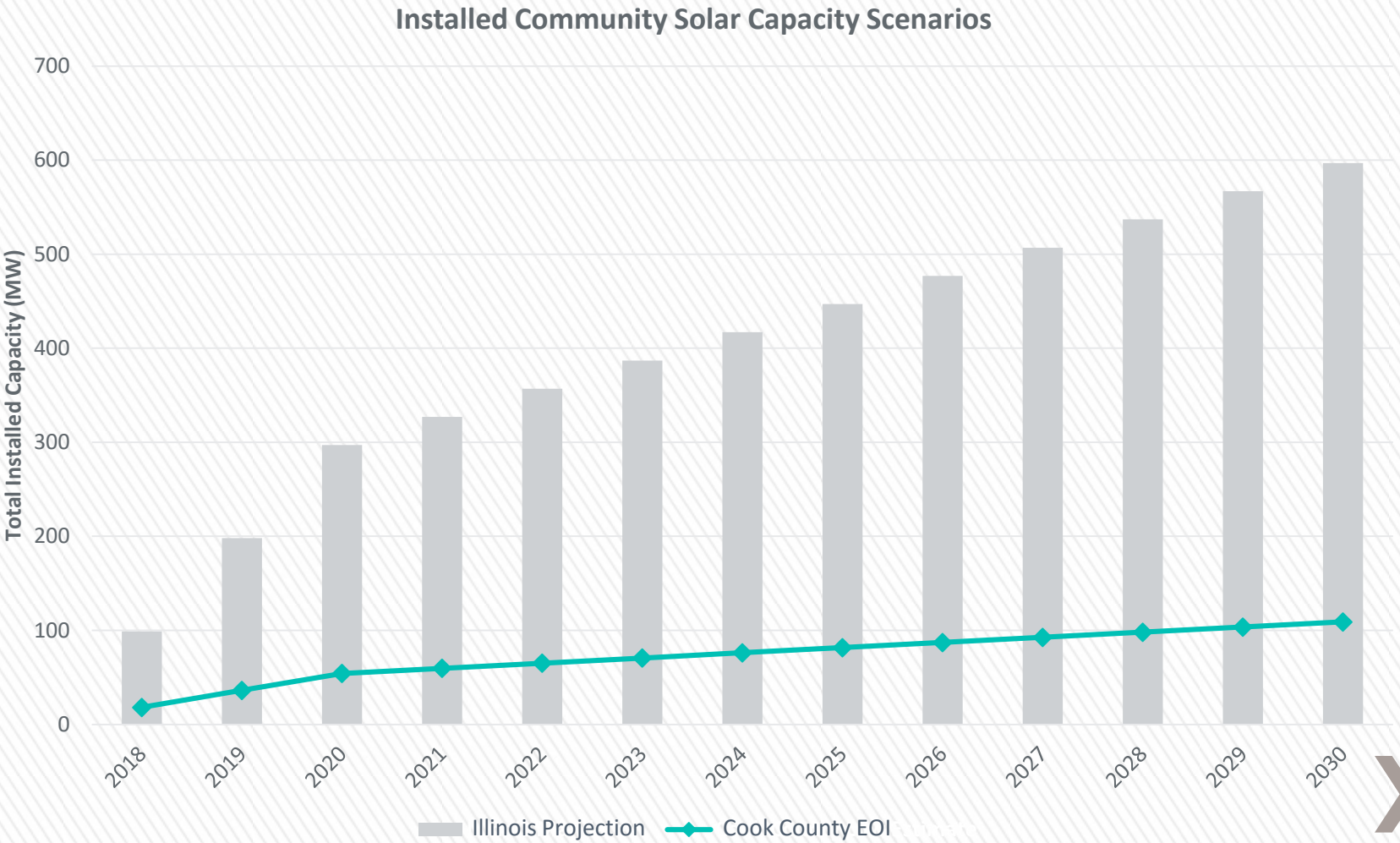
- The deployment timeline for the Cook County scenario was modeled to mirror the trend created from the state-wide mandate

Cook County Community Solar Deployment Projections (Continued)

- The Future Energy Jobs Act requires that community solar subscribers are located in the same utility service territory as the project they subscribe to; there are no limits on the distance between the subscriber and project
- Cook County is urbanized with a high population density; these characteristics may make siting projects more difficult than in other parts of the state, but are ideal for attracting subscribers
- Cook County is likely to experience a disproportionate number of subscribers to projects, as its residents will be subscribing to projects built in more rural parts of the state, but within ComEd's service territory
- For modeling purposes, the Cook County expression of interest (EOI) scenario assumes 41% of total Illinois subscribers are located in Cook County (based on population)



Community Solar Deployment Projections: 2018 – 2030



Community Solar Deployment Snapshot

These deployment estimates can be translated to number of projects, investment in construction, and developer profit

	Forecasted Megawatts	Projects	Construction Investment *(Actual 2016 $)*	Developer Profit *(Actual 2016 $)*
Cook County EOI	109	75	$253 Million	$24.6 Million
Illinois Projection	600	412	$1.39 Billion	$133 Million

Calculation Assumptions

Number of Projects Calculations: Assumes each project is ~1.45 MW, the average size of projects submitted as potential pilots for the Cook County project

Construction Investment Calculations: Assumes a total installed cost of $2.32/W for construction[1] and land acquisition and preparation; does not include incentives or rebates

Developer Profit Calculations: Assumes developer overhead of $0.41/W and profit consisting 54% of overhead[1]

[1] Community Solar Business Case Tool; Elevate Energy & West Monroe Partners

Community Solar Deployment Snapshot (Continued)

The scenarios assume an disproportionate number of subscribers are located in Cook County (compared to the number of projects), given its high population density and concentration of community groups

	Forecasted Megawatts	Residential Subscribers	Electricity Bill Savings (Over Project Life, *Actual 2016 $*)
Cook County EOI	109	49,200	$414 Million
Illinois Projection	600	120,000	$1.01 Billion

Calculation Assumptions

Subscriber Calculations: Assumes each project receives 60% residential subscription, and each subscriber receives credit for generation from 10 300-MW panels. Assumes all 41% of total Illinois subscribers are located in Cook County (based on population).

Electricity Bill Savings: Assumes production of 1,262.6 MWh per MW; assumes electricity prices escalate by 2.26% per year while panel lease prices remain constant at 1.68 per panel per month (see Task 5.1 Value Proposition Report).

Local Economic Benefits

- Local Economic Benefits Overview
- Analysis Approach
- Job Creation Overview
- Illinois Economic Benefits
- Cook County Economic Benefits
- Value of Incremental Community Solar Installations

Local Economic Benefits Overview

- Renewable energy growth has risen dramatically in recent years and now comprises the largest source of new electric capacity installed each year. Solar in particular has experienced an uptick in deployments year over year due to falling manufacturing and installation costs

- Concurrent with the rise in solar installations is a rise in solar industry jobs
  - > 769,000 renewable energy sector jobs were recorded during the 2015 U.S. census; 208,000 of these were in solar-related fields
  - > Solar and wind jobs have grown at rates of about 20% annually in recent years and are each creating jobs at a rate 12 times faster than that of the rest of the U.S. economy
  - > Renewable energy jobs have gained steady traction, unlike those in the fossil fuel extraction industry which are subject to boom and bust cycles

- In the solar energy sector, 80% of jobs are demand-side services (e.g. installation, sales, etc.), most of which are inherently local jobs that cannot be outsourced

- Different types of solar energy jobs include: component manufacturing, project development, construction and installation, financing, engineering, sales and distribution, systems analysis, and operations and maintenance

- Community solar provides additional job opportunities related to subscriber acquisition and ongoing management of subscribers and their bill credits

[1]Environmental Defense Fund. "Now Hiring: the Growth of America's Clean Energy & Sustainability Jobs."

Analysis Approach

The National Renewable Energy Laboratory (NREL) **Jobs and Economic Development Impact** (JEDI) Solar PV model was used to estimate the jobs that would be created from building community solar projects, according to the deployment schedules created. The JEDI model also computed the earnings received by workers and the anticipated local economic activity in the region. More information about the JEDI outputs can be found on the subsequent slide.

Additional analysis was conducted to estimate economic output unique to community solar, including jobs created from subscriber acquisition and management, and savings from customer electric bills that could be reinvested in the local economy.

Key metrics were calculated across three categories:

- **Project Development & Onsite Labor Impacts** – Labor from companies engaged in development and on-site construction and operation of power generation and transmission.
- **Module & Supply Chain Impacts** – Impacts that occur in supporting industries. These results are driven by the increase in demand for goods and services from direct on-site project spending.
- **Induced Impacts** – Impacts that occur from the reinvestment and spending of earnings by direct and indirect beneficiaries.

Key Metrics

Jobs

Refers to full-time equivalent employment for a full year

Earnings

Refers to the wage and salary compensation paid to workers

Economic Activity

Refers to the economic activity or the value of production in the state or local economy

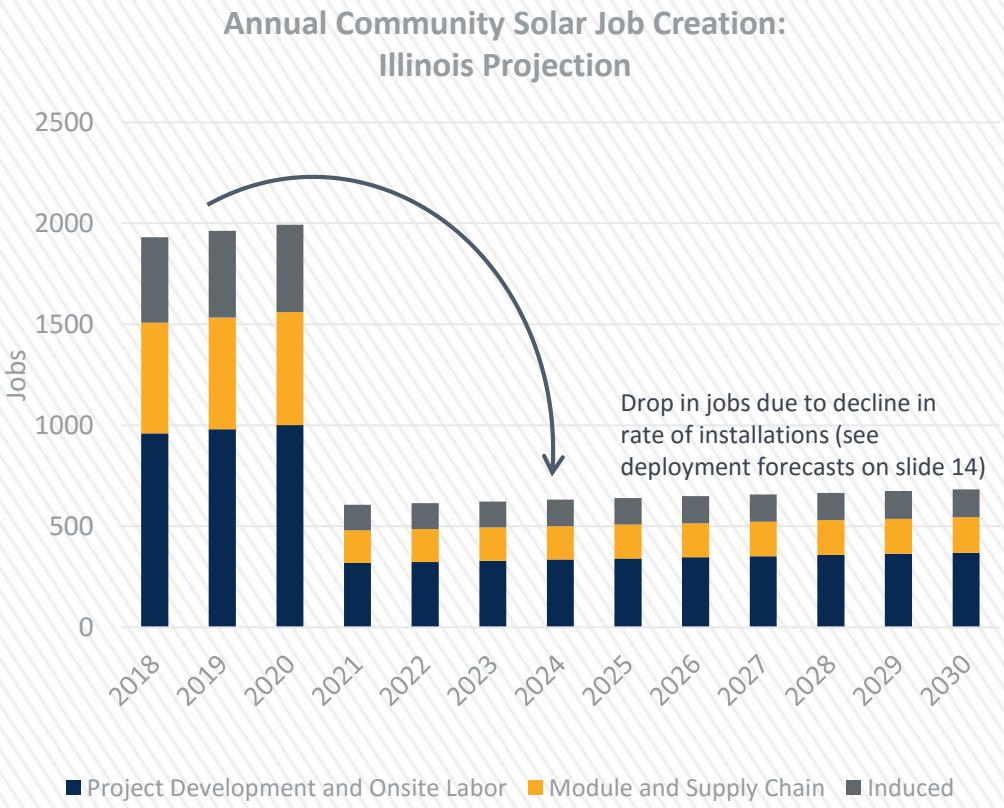
Job Creation Overview

Examples of jobs created by community solar development include:

	Project Development & Onsite Labor Impacts	*Local Revenue & Supply Chain Impacts*	*Induced (Indirect) Impacts*
Construction-Period	• **Construction and Installation Labor:** Crane operators, road contractors, construction managers, electricians, excavation workers, backhoe operators, foundation workers, installation workers, etc. • **Construction and Installation Related Services**: Civil and electrical engineers, attorneys, permitting specialists, etc. • **Subscriber Acquisition Services:** Marketing and communications, customer acquisition, sales, contract management, etc.	• **Supply Chain Jobs from Project Construction:** Manufactoring, wholesale, retail, distribution sales, warehousing and delivery for materials and equipment necessary for constructing the solar project	• **Induced Jobs from Project Development:** Jobs associated with increased business at local restaurants, hotels, and retail establishments and with increased service at child care providers and any other entity affected by increased economic activity and spending associated with project construction
Post-Construction Period	• **Onsite Labor from O&M:** Clerical and bookkeeping support, site managers, field technicians, other O&M workers • **Subscriber Management Services:** Marketing and communications, customer acquisition, sales, contract management, etc.	• **Supply Chain Jobs from Project Maintenance:** Manufactoring, wholesale, retail, distribution sales, warehousing and delivery for materials and equipment necessary for ongoing maintenance the solar project; also includes ongoing needs such as insurance and permitting	• **Induced Jobs from Project Development:** Jobs associated with increased business at local restaurants, hotels, and retail establishments and with increased service at child care providers and any other entity affected by increased economic activity and spending associated with project construction

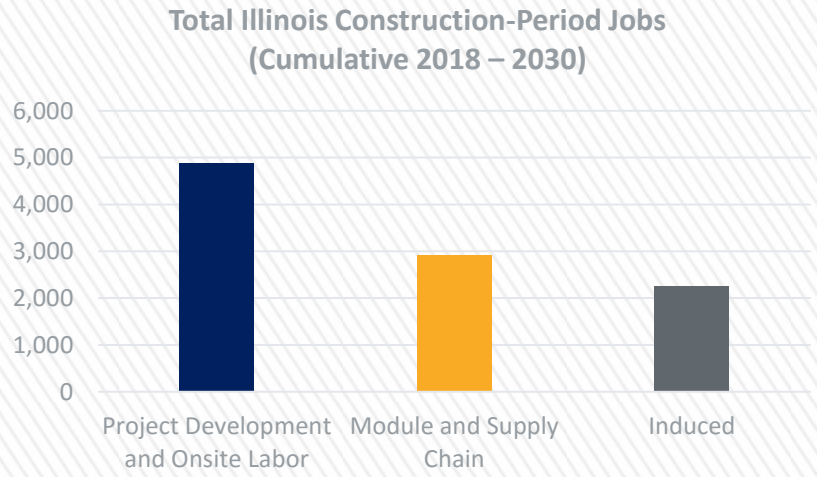
Illinois Economic Benefits

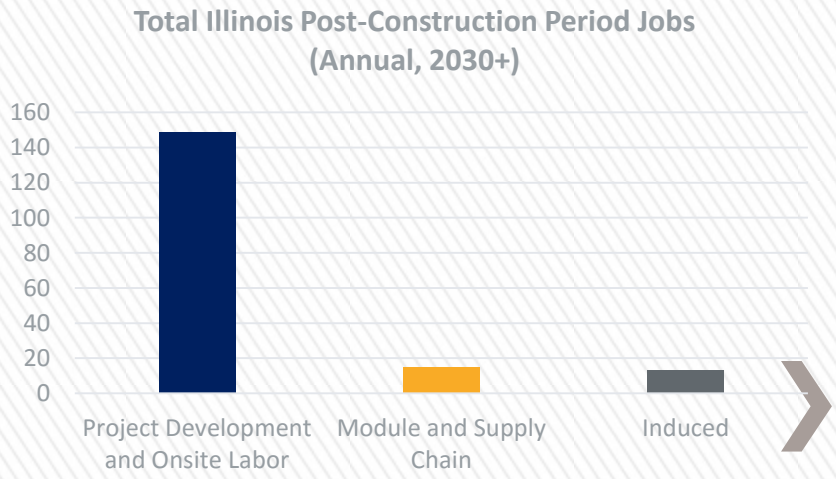
- Community solar installations in Illinois are expected to create hundreds of direct and indirect jobs annually between 2018 and 2030
- Over this time period, an expected **11,363 cumulative total jobs** will be created from community solar
- These jobs will produce an **estimated $655MM in cumulative total earnings** for local workers between 2018 and 2030
- The spending from these workers will spur **$1.50B in local economic activity** between 2018 and 2030
- For a more detailed results breakdown, please refer to the Appendix



Illinois Economic Benefits (Continued)

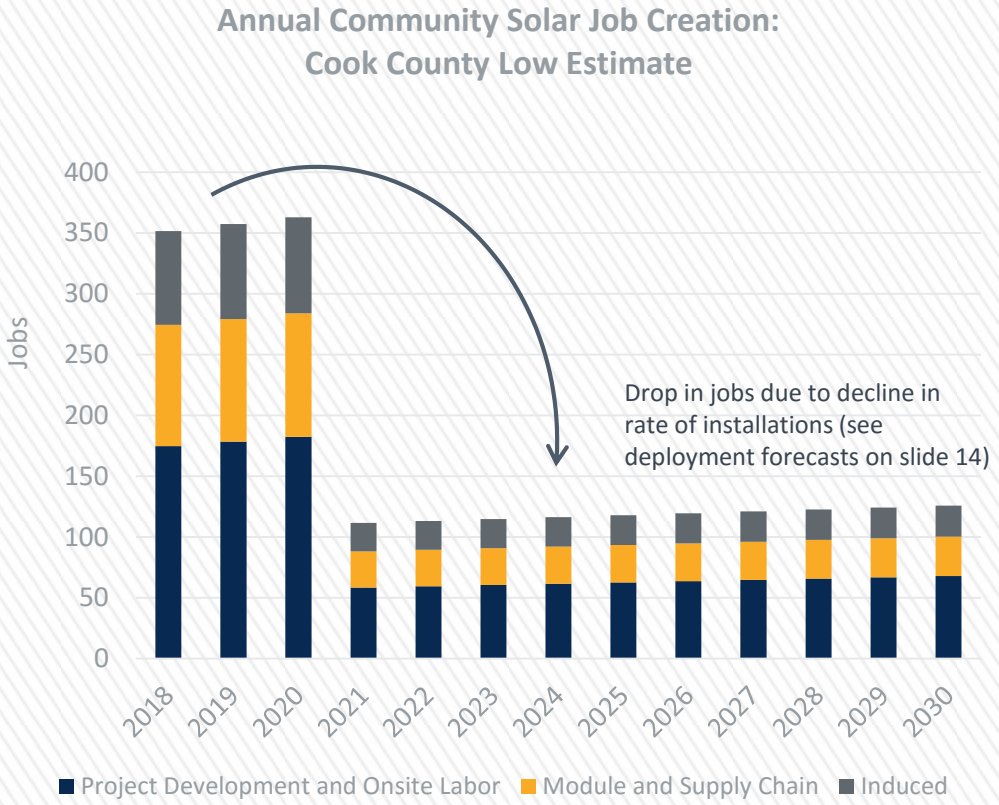
- Community solar installations will produce temporary jobs during the construction period, and permanent jobs to support ongoing maintenance of the projects
- Nearly 50% the construction-period jobs will be in the areas of project development and onsite labor; 29% of jobs created are projected to be related to supply chain impacts, and 22% related to induced impacts (refer to job descriptions on slide 20)
- Community solar is expected to create **177 permanent post-construction period jobs in Illinois**, based on JEDI-modeled projections. These will be comprised primarily of onsite project maintenance jobs related to equipment upkeep and replacement, and ongoing management of subscribers





Cook County Economic Benefits

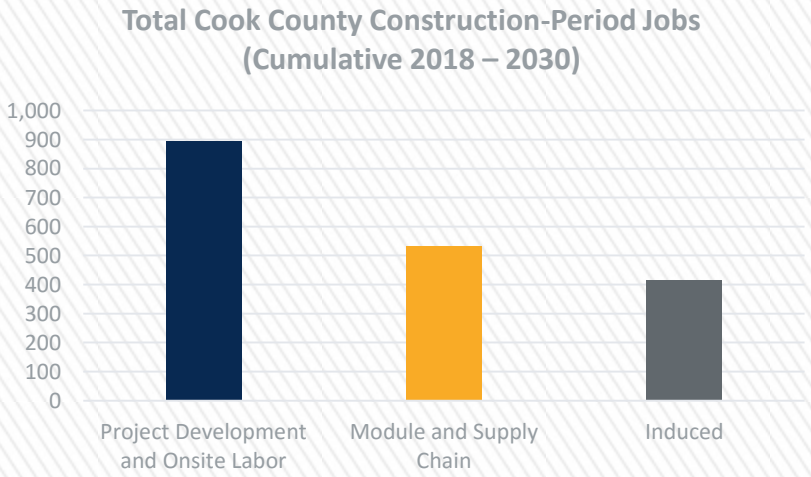
- If the Cook County projections are met, community solar installations are expected to produce **2,031 cumulative total jobs** between 2018 and 2030
- These jobs will produce **an estimated $119MM in cumulative total earnings** for local workers between 2018 and 2030
- The spending from these workers will spur **$283MM in economic activity** between 2018 and 2030
- For a more detailed results breakdown, please refer to the Appendix

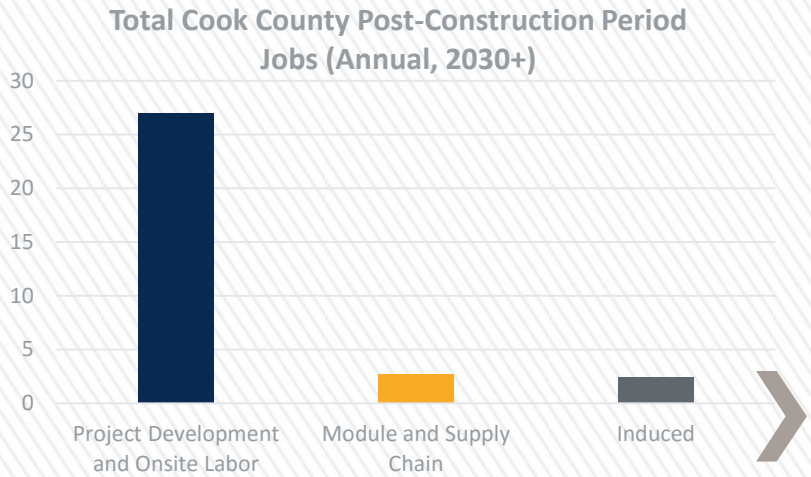


Cook County Economic Benefits (Continued)

- Like the Illinois proportion, a majority of the construction-period jobs will be in the areas of project development and onsite labor; with the remaining split between supply chain and induced jobs (refer to job descriptions on slide 20)

- Community solar is expected to produce **32 permanent post-construction period jobs in Cook County**, based on the modeled projections. Twenty-seven of these will be direct jobs related to the onsite project maintenance jobs related to equipment upkeep and replacement, and ongoing management of subscribers; the remaining will be related to supply chain or induced impacts

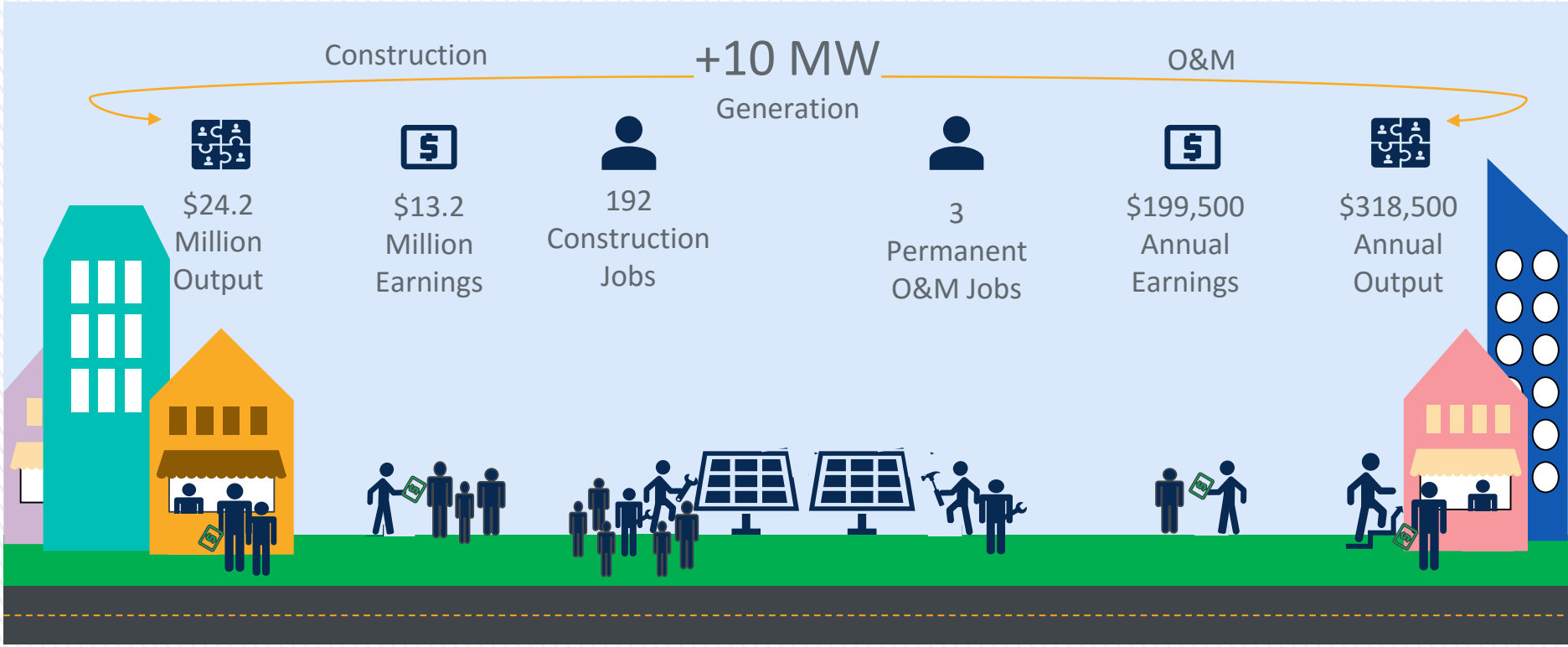




Value of Incremental Community Solar Installations

- The modeled scenarios for both Cook County and Illinois represent the projected community solar deployment levels

- Each incremental 10 MW of installed community solar capacity is expected to result in:[1]



[1] Note: values are based on assumed 2018 cost data (listed in Appendix); full analysis tied deployment year to cost data projections for that year

Local Energy & Environmental Benefits

- Local Energy & Environmental Benefits Overview
- Analysis Approach
- Greenhouse Gas Emissions Reduction
- Other Pollutants Emissions Reduction
- Emissions Equivalencies
- Avoided Emissions Equivalencies: 2018 – 2030
- Value of Incremental Community Solar Installations

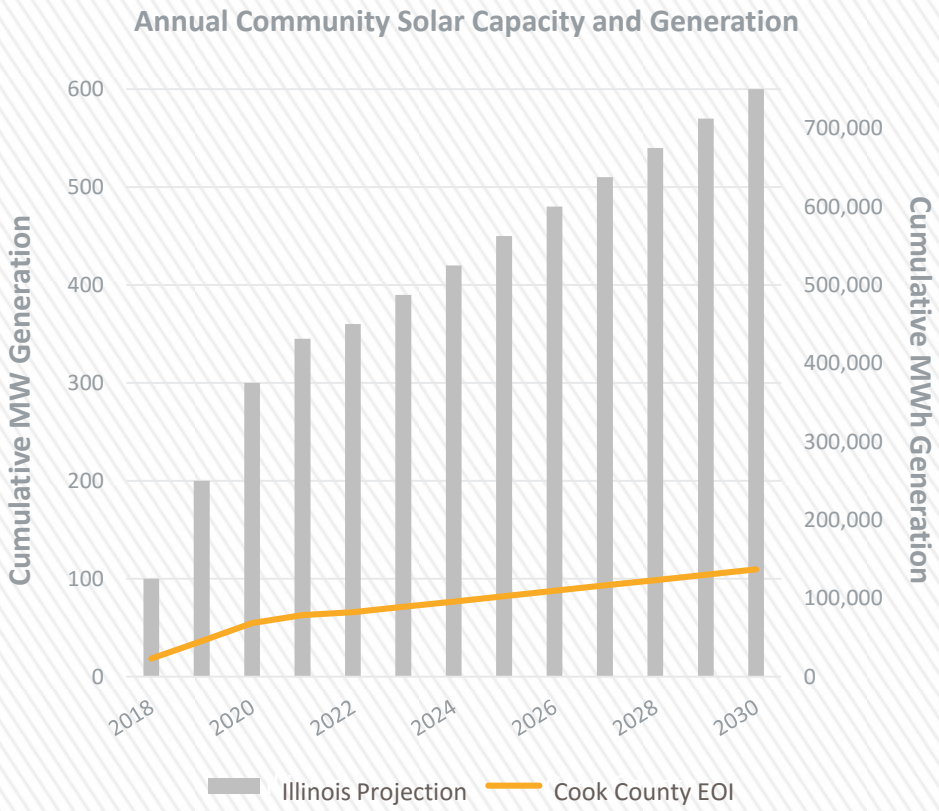
Local Energy & Environmental Benefits Overview

- Between 2018 and 2030, **an estimated 600 MW of community solar** capacity will be brought online in Illinois. During this timeframe, these projects will produce nearly **6,000 GWh of generation**

- Capacity refers to the electric output an electricity generator can produce, and generation refers to amount of electricity a generator produces over a specific period of time

- The electricity provided by community solar will reduce the need to procure electricity from traditional generating sources, which may lead to a reduction in air emissions

- Additionally, both sulfur dioxide and nitrogen oxides are highly harmful to humans, posing respiratory threats, and contribute to acid rain, deforestation and corrosion



Analysis Approach

The United States Environmental Protection Agency (EPA) has developed a public **Emissions and Generation Resource Integrated Database (eGRID)** that characterizes almost all electric power generation within the US regarding air emission content, emission rates, net generation, and resource mix. Each of these characteristics are divided by state and sub-region for further analysis

This comprehensive database supports various studies including:

- Carbon footprint studies
- Greenhouse gas registries and inventories
- Consumer information disclosures
- Emission inventories and standards
- Power market changes
- Avoided emission estimates

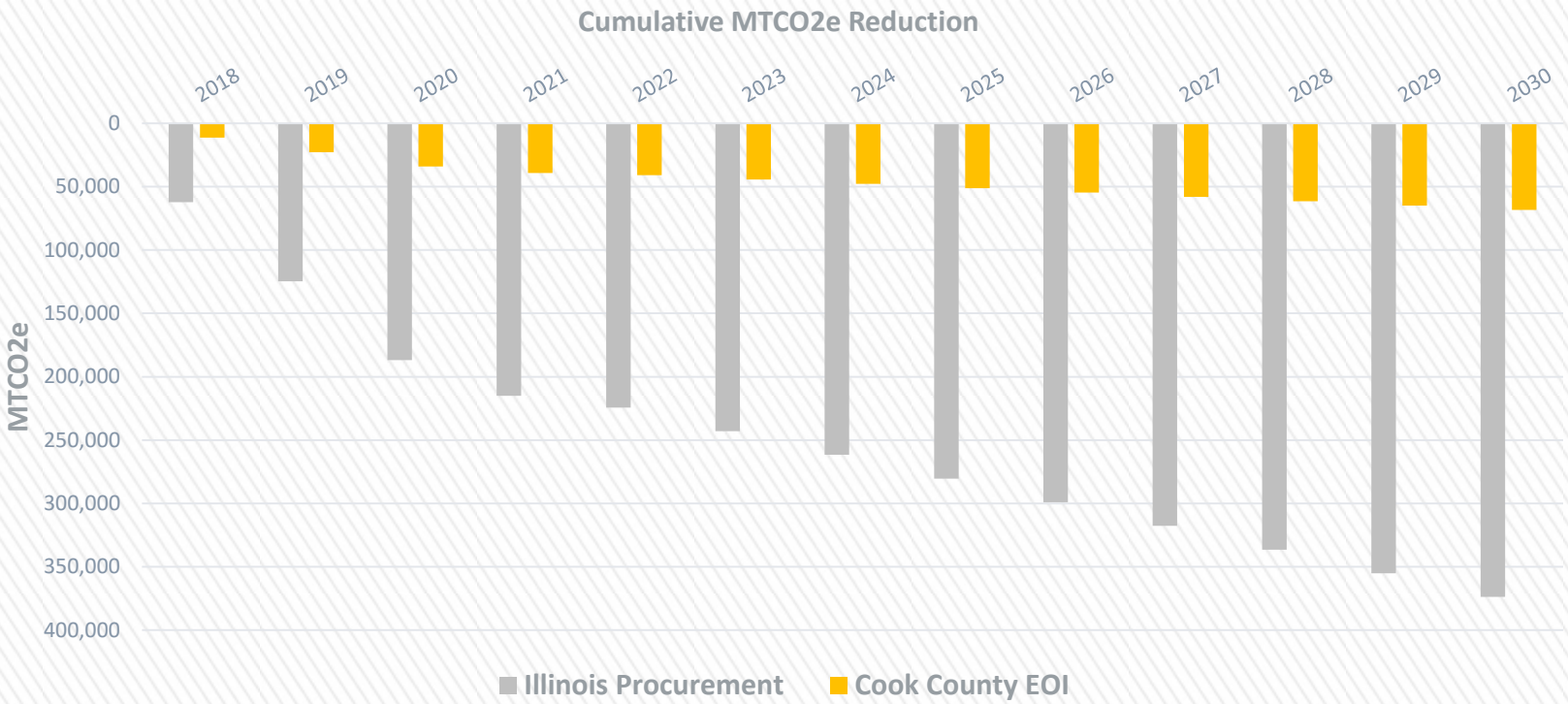
In this project, eGrid data was used to convert community solar generation estimates to reductions in greenhouse gas and other emissions

Illinois Key Metrics

- **Annual State Emission Rates**
  - **Sulfur Dioxide (SO_2) – 1.5 (lb/MWh)**
  - **Nitrogen Oxides (NO_2) – 0.5 (lb/MWh)**
  - **Carbon Dioxide Equivalent (CO_2e) – 0.4984 (MTCO2e/MWh) [1]**

[1] Calculated using total CO2e emissions (tons) and total MWh generation in Illinois

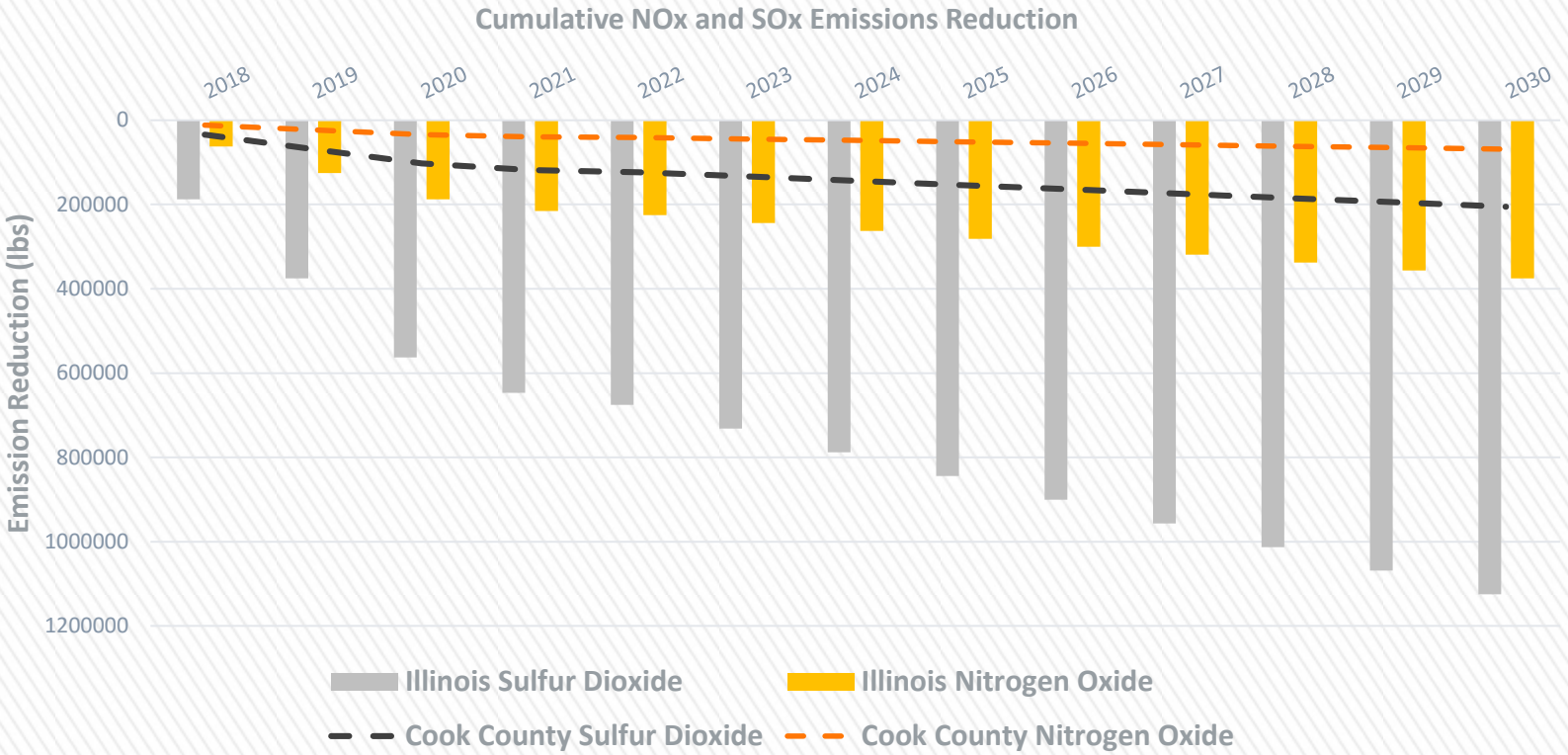
Greenhouse Gas Emissions Reduction



- In 2018, community solar will reduce greenhouse gas emissions by an estimated 62,300 $MTCO_2e$ in Illinois and an estimated 11,375 $MTCO_2e$ in Cook County
- By 2030, community solar will reduce emissions by an estimated 373,800 $MTCO_2e$ in Illinois and an estimated 68,248 $MTCO_2e$ in Cook County
- All calculations were made using forecasted project MWhs and an eGRID conversion rate[1] of 0.4984 (MTCO2e/MWh) for IL

[1] eGRID data sheet

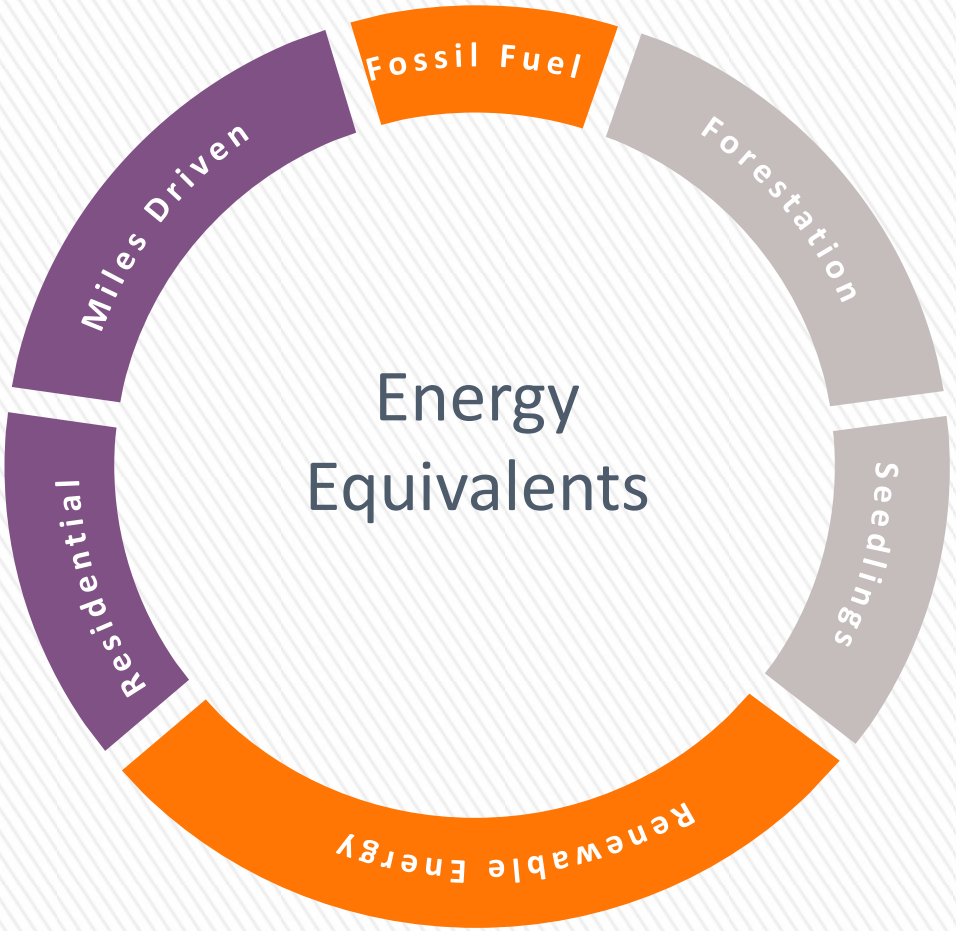
Other Pollutants Emissions Reduction



- In 2018, community solar is expected to reduce sulfur dioxide emissions by an estimated 187,500 lbs. and nitrogen oxide emissions by 62,500 lbs. in Illinois
- Community solar will reduce sulfur dioxide emissions by an estimated 34,234 lbs. in Cook County and nitrogen oxide by 11,411lbs in Cook County in 2018
- By 2030, community solar will reduce sulfur dioxide emissions by an estimated 1,125,000 lbs. and 205,402 lbs. and nitrogen oxide by 375,000 lbs. and 68,467 lbs. in Illinois and Cook County respectively

[1] eGRID data sheet

Emission Equivalencies



Fossil Fuel

1 How do emission reductions compare to burning X amount less of fossil fuels (gas, oil, etc)

Forestation

2 How many acres of forestation would need to be planted to achieve the same emission reduction

Seedlings

3 How many seedlings grown for 10 years would be required to reduce the same amount of MTCO2e

Renewable Energy

4 How many windmills, LEDs, etc would need to be installed to achieve the same reduction

Residential

5 How do emission reductions compare to X amount of houses using 100% clean energy

Miles Driven

6 How do emission reductions compare to driving X miles less per year

[1] eGRID equivalency calculator tool

Avoided Emissions Equivalencies: 2018 – 2030

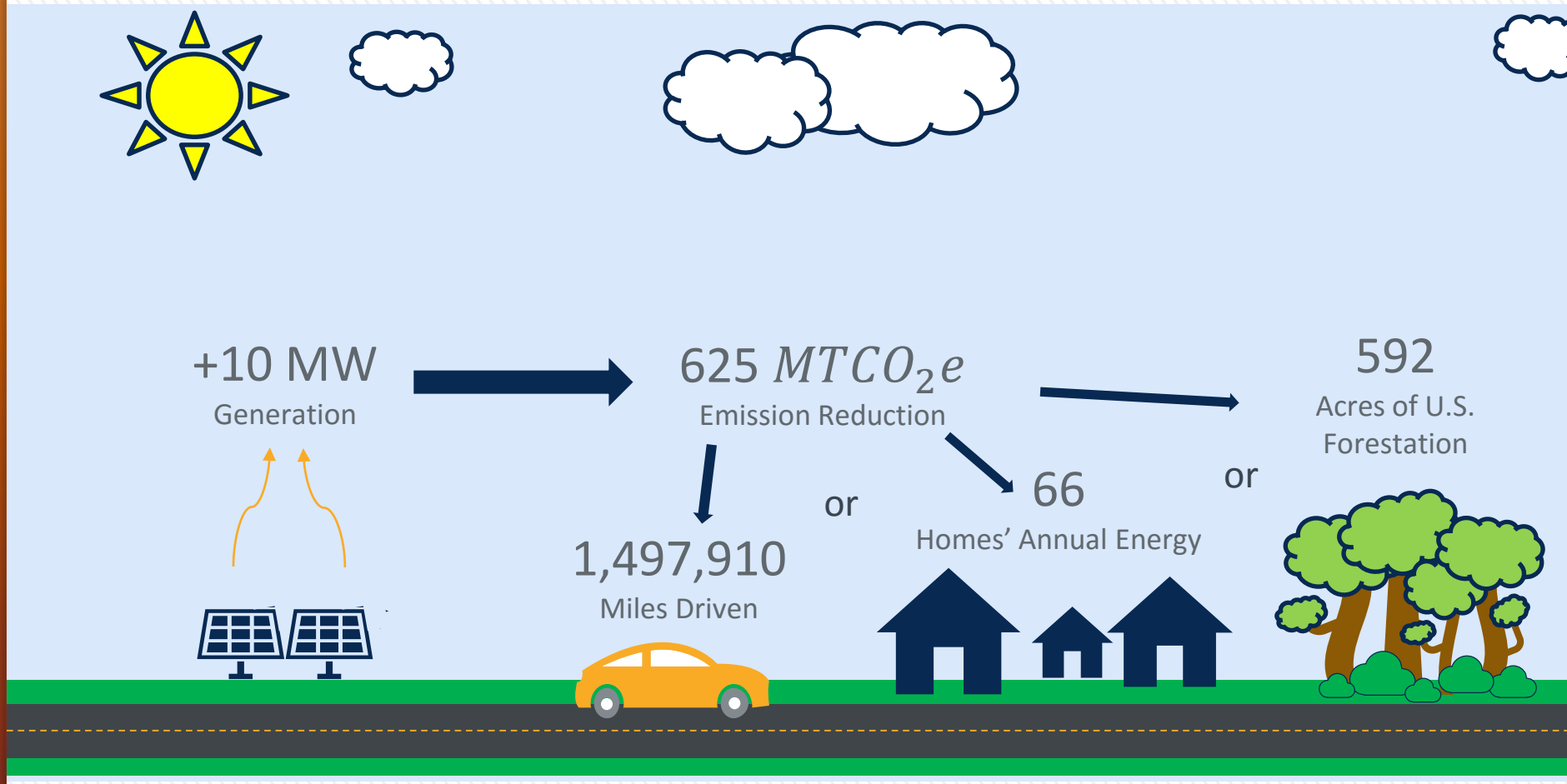
- Between 2018 and 2030, the mandated community solar deployment levels in Illinois are expected to reduce emissions by 3,280,095 MT of CO_2e
- During the same period, the EOI deployment scenario modeled for Cook County is expected to reduce emissions by 598,878 MT of CO_2e. This is equivalent to:

Illinois Mandate	7,861,258,086 passenger miles	346,367 homes' energy use for one year	3,104,952 acres of US forests in one year
Cook County EOI	1,435,304,319 passenger miles	63,239 homes' energy use for one year	566,900 acres of US forests in one year

[1] Data derived from eGRID equivalency calculator tool

Value of Incremental Community Solar Installations

- Each incremental 10 MW of installed community solar capacity is expected to result in:



Comparison of Community Solar Output to Regional Climate Goals

- Overview of Regional Climate Goals
- Illinois
  - Renewable Portfolio Standard Overview
  - Expected Impact of Community Solar on the Renewable Portfolio Standard
- Cook County
  - Cook County Sustainability Report Overview
  - Comparison of Community Solar Output to Sustainability Report Goals
- City of Chicago
  - Chicago Climate Action Plan and Other Initiatives Overview
  - Comparison of Community Solar Output to Climate Action Plan Goals

Overview of Regional Climate Goals

- The analysis is intended to provide relevant City, County and State planning bodies further insight regarding solar deployment and how community solar can help meet their renewable energy and greenhouse gas reduction goals

- Specific initiatives and goals examined include:

Illinois Renewable Portfolio Standard

- Statewide initiative
- Sets goals related to loading standards
- Advanced by Future Energy Jobs Act

Cook County Sustainability Report

- Sets emissions reduction goals for County buildings and operations
- Sets sustainability goals for residential planning and programs

Chicago Climate Action Plan

- City wide emission reduction plan
- Provides recommendations for organizations and individuals
- Complimented by additional city goals

Illinois: Renewable Portfolio Standard Overview

The Future Energy Jobs Act is expected to improve and modernize the Renewable Portfolio Standard (RPS) by ensuring long-term, reliable funding sources for the purchase of renewable resources into the foreseeable future

Utility Load Goals

Outline total renewable energy load standards

- 13% of all eligible customers' loading must be procured from renewable sources by the end of 2017
- Each subsequent year should yield a 1.5% increase in renewable energy loading until the end of 2025
  - > 14.5% by 2018
  - > 16% by 2019
  - > Etc.
- Must maintain at least 25% loading following 2025

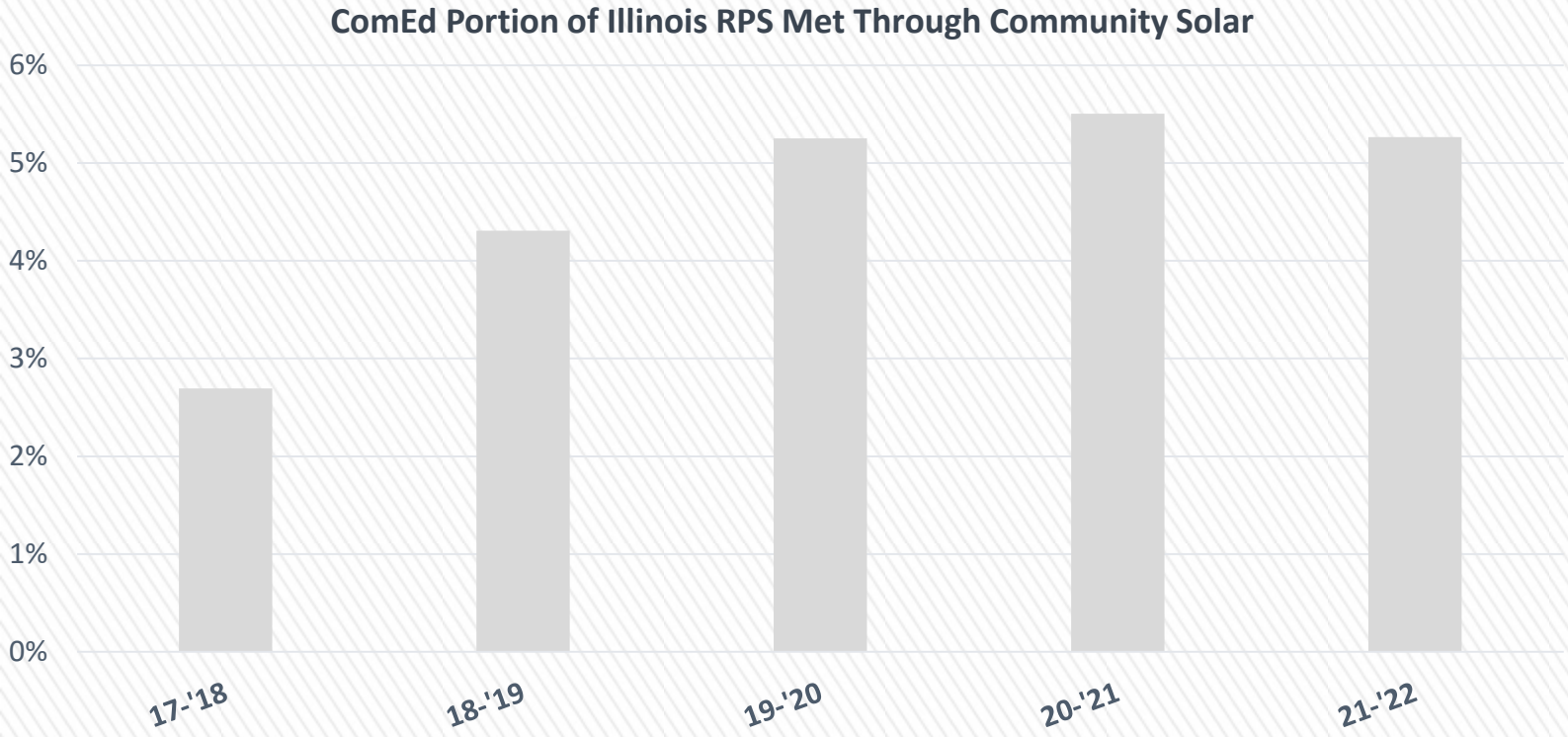
Renewable Energy Credit (REC) Requirements

Establish solar MWh requirements

- At least 1,000,000 RECs (1 REC=1MWh) must come from solar projects by the end of 2020
  - > 250,000 RECs must come from community solar
- At least 1,500,000 RECs must come from solar projects by the end of 2025
  - > 375,000 RECs must come from community solar
- At least 2,000,000 RECs must come from solar projects by the end of 2030
  - > 500,000 RECs must come from community solar

[1]Goals conveyed in the Renewable Portfolio Standard/ Future Energy Jobs Bill

Illinois: Expected Impact of Community Solar on the Renewable Portfolio Standard



- Based on Illinois RPS requirements, ComEd has published forecasted annual target RECs through 2022[1]
- If state mandate of 600MW of community solar is deployed in Illinois, and ComEd's community solar procurement is proportional to the statewide loading[2], community solar projects can expected to meet between 2% and 6% of annual ComEd RPS targets on any given year

[1] ComEd REC forecasts derive from ComEd's most recent loading forecast

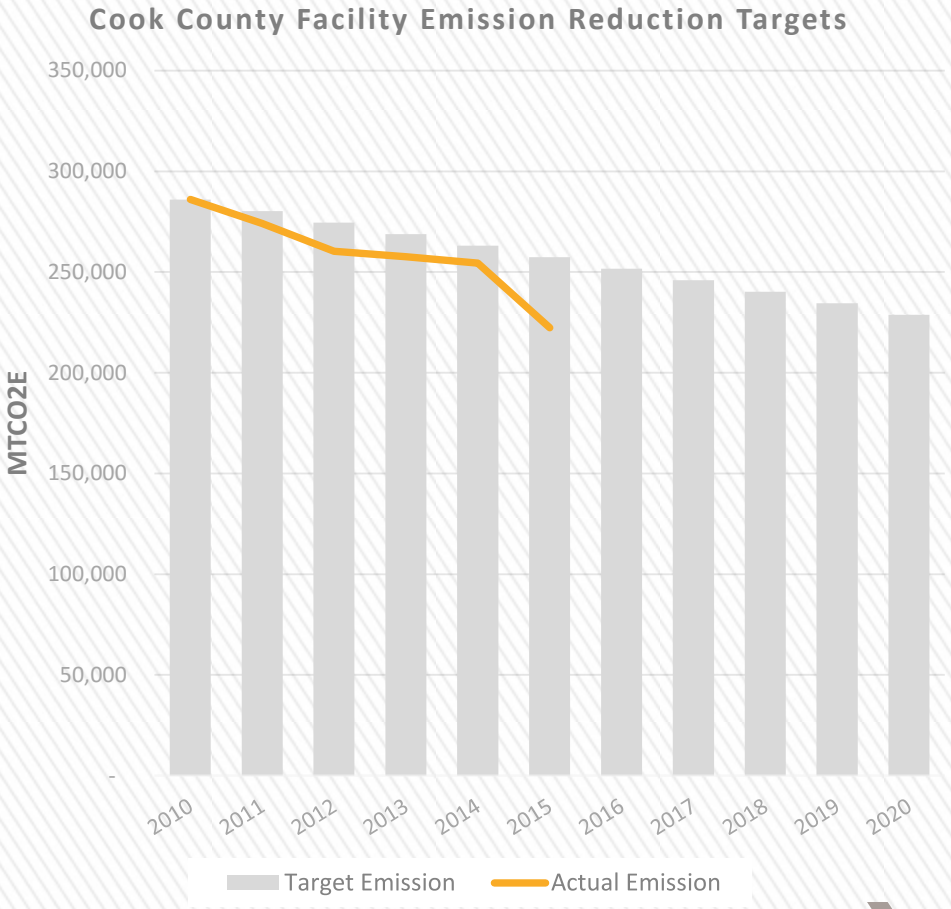
[2] MWh procurement was based on statewide community solar forecasts and ComEd statewide loading percentages derived from Illinois Commerce Commission Comparison of Electric Sales 2016-2015

Cook County: Sustainability Report Overview

- Cook County environmental initiatives are exceeding their targets

- The Cook County Green Leadership team set a long term goal of reducing the County's harmful GHG emissions by 80% by 2050
  - > The plan consists of an annual 2% reduction from 2010 levels
  - > The annual emissions reduction goal for all County buildings is approximately 5,700 $MTCO_2e$[1]

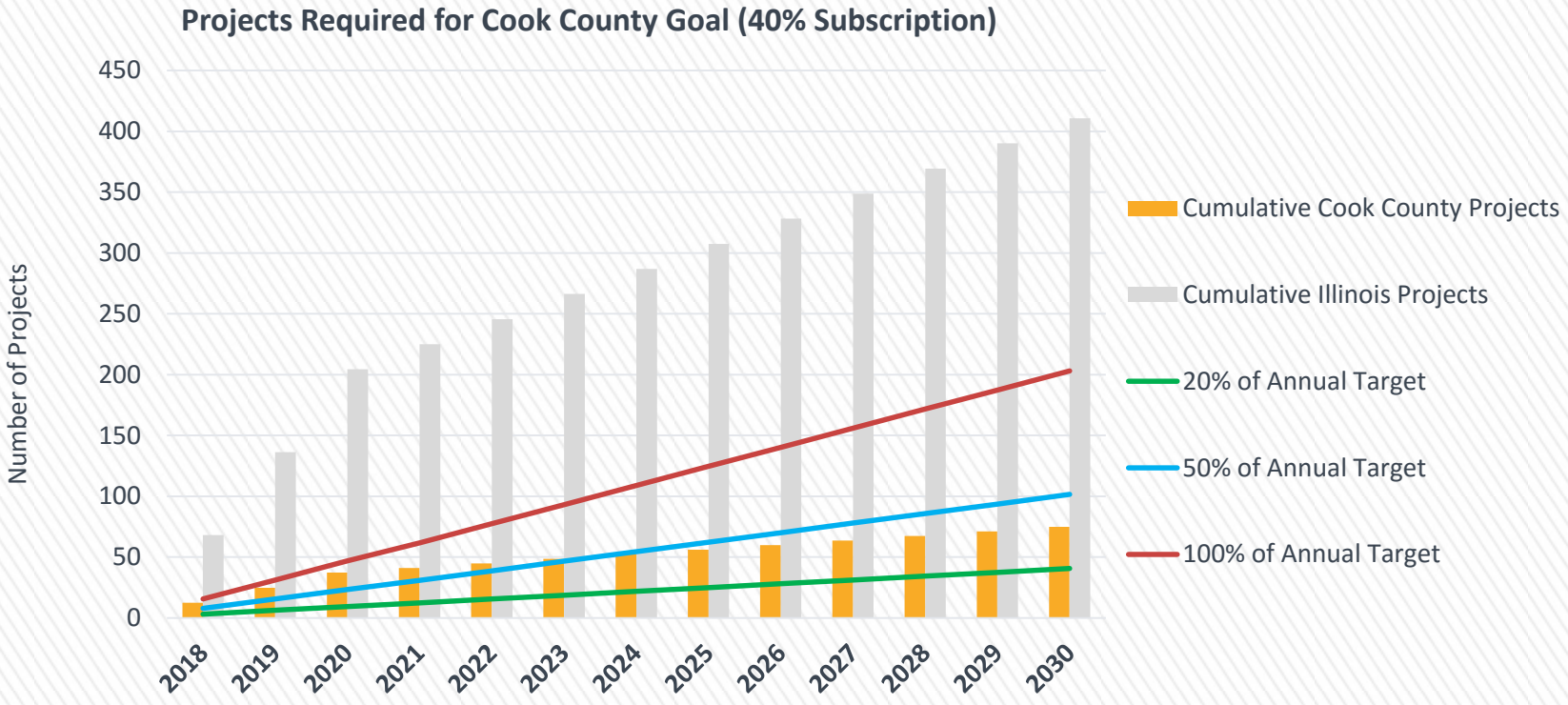
- According to the most recent County Sustainability Report, the County has surpassed its targets thus far
  - > Total emission reductions from 2010 baseline levels to 2015 levels totaled 22% [2]
  - > 2015 levels reached 222,252 $MTCO_2e$



[1] Annual reduction targets were calculated by taking 2% of the 2010 baseline emission from Cook County's Sustainability Report

[2] Historical emission reductions published in Cook County's 2016 Sustainability Report

Cook County: Comparison of Community Solar Output to Sustainability Report Goals



- By subscribing to projects around Illinois, at the maximum 40% subscription, the expected emissions reduction Cook County would exceed the emissions reduction target for county buildings ($5{,}700\ MTCO_2e$)
- Subscribing to Cook County sites exclusively (109 MW) would result in emissions reductions of 20% and 50% of the County's annual reduction target, depending on the year

City of Chicago: Chicago Climate Action Plan and Other Initiatives Overview

1	Cut total Chicago emissions by 25.8 $MMTCO_2e$ (80%) to a level of 6.5 $MMTCO_2e$ by 2050
2	Cut total Chicago emissions by 15.1 $MMTCO_2e$ (25%) to a level of 24.2 $MMTCO_2e$ by 2020
3	Cut electric based emissions by 3.0 $MMTCO_2e$ (20%) by 2020, using renewables
4	Install renewable technology in 5% of housing stock by 2020
5	Achieve 100% renewable energy use in CPS, CHA, CCC and Park District buildings (1.8 Mil MWh) by 2025

As of 2015, Chicago had reduced emissions to a level of 30.9 $MMTCO_2e$. An additional 6.7 $MMTCO_2e$ reduction is necessary to achieve Chicago's 2020 goal

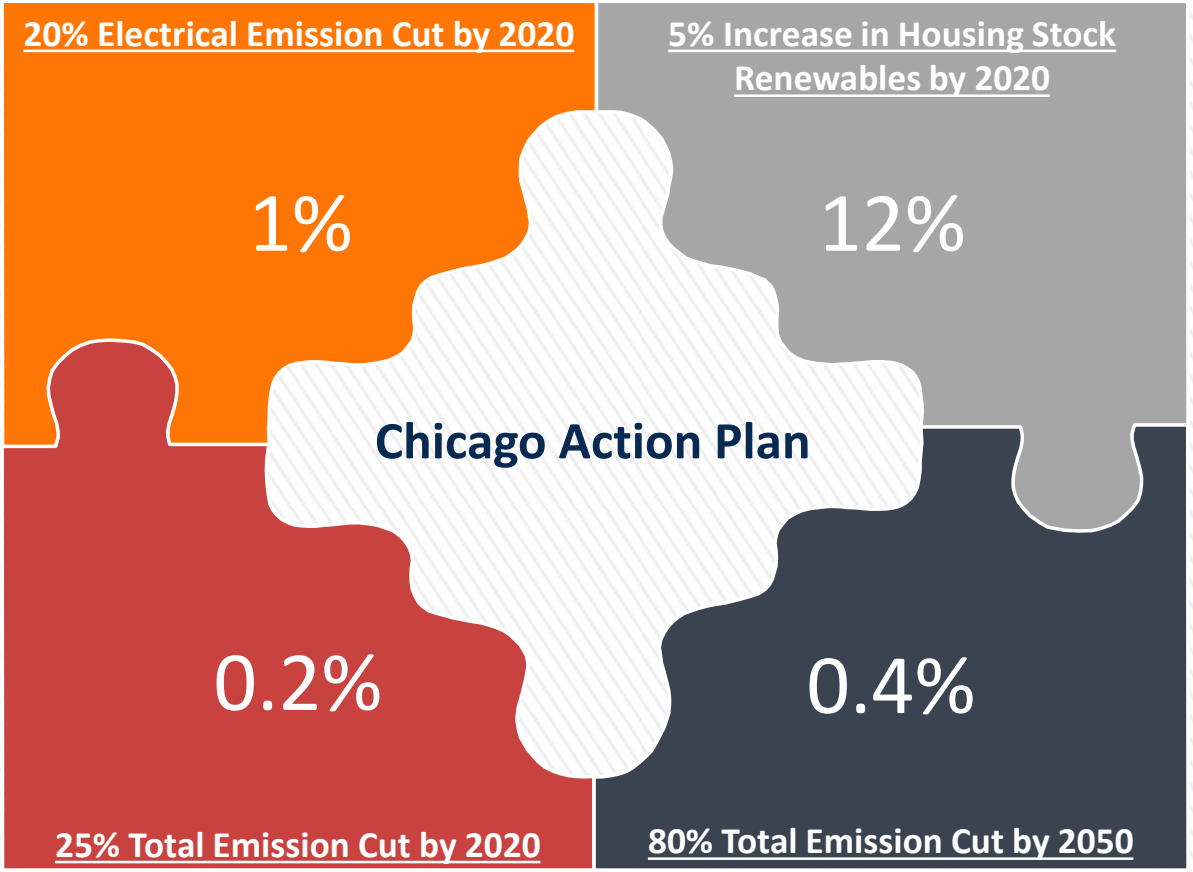
[1] Goals conveyed in Chicago Climate Action Plan

[2] Goal expressed by Mayor in recent press release

City of Chicago: Comparison of Community Solar Output to Climate Action Plan Goals

Goals: 1-4

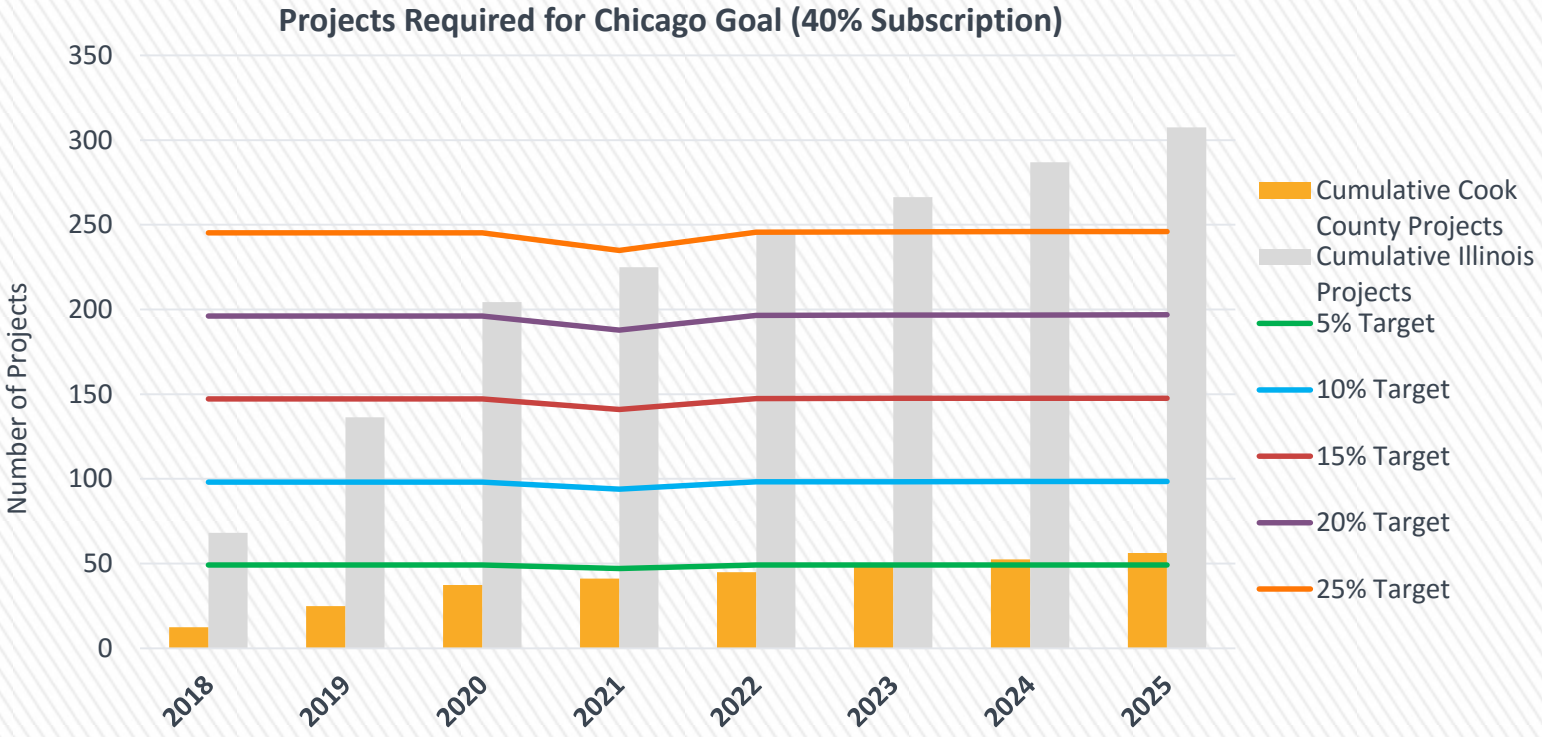
- The analysis assumes that all of the Cook County expressed interest of 109 MW is used to service Cook County-Chicago subscribers
- Chicago's Climate Action Plan is an inclusive plan that depends on all citizens to contribute to initiatives
- Any clean energy subscription within Chicago helps contribute to the city-wide emission reduction goals; however, community solar initiatives can only marginally compare to Chicago emission initiatives



[1] All goal percentage calculations were made using the IL eGRID conversion, C.A.P. emission goals and take in account 2015 status updates

City of Chicago: Comparison of Community Solar Output to Climate Action Plan Goals (Continued)

Goal: 5



- Subscribing to projects around Illinois, at the maximum 40% subscription, would equate to approximately 25% of the City's goal to use 100% renewable energy in CPS, CHA, CCC and Park District buildings by 2025
- Subscribing to Cook County sites exclusively (109 MW) would result in emissions reductions equivalent to 5% of the City's 2025 renewable energy goal

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Appendix

- Detailed JEDI Analysis Description and Inputs
- Detailed Annual Economic Benefits Results
- Detailed Construction Period and Post-Construction Period Economic Benefits Breakdown

JEDI Analysis Detailed Description and Inputs

- Detailed Economic Analysis Overview
- JEDI Input Assumptions
- JED Input Values

Detailed Economic Analysis Overview

Multiple analyses were conducted to estimate the jobs and associated local economic activity created by community solar

Jobs and Economic Development Model

National Renewable Energy Laboratory (NREL) Jobs and Economic Development Impact (JEDI) Solar PV model was used to estimate the jobs that would be created from building community solar projects, according to the deployment schedules created. The JEDI model also computed the earnings received by workers and the anticipated additional economic activity in the region. More information about the JEDI outputs can be found on the subsequent slide.

Subscriber Acquisition and Management Analysis

Unlike commercial or utility scale solar, community solar provides additional job opportunities related to subscriber acquisition and ongoing subscriber management. These types of jobs are not computed by the JEDI model. An additional analysis was conducted using assumptions in the Community Solar Business Case tool[1] to estimate the number of additional jobs related to subscriber acquisition and management created by community solar, in addition to the job estimates calculated by the JEDI model.

Electric Bill Savings Analysis

Over time, community solar subscribers are expected to realize savings from their community solar bill credits. When subscribers save on their electricity bills, they will have additional funds accessible to spend in the local economy. The JEDI model does not take these savings into account when calculating the economic local economic activity, created by solar. The Task 5.1 Value Proposition Report projected that under a panel leasing model, residential subscribers would pay $5,000 in fees to participate in the program over 20-years, but receive over $7,000 in energy bill savings. Multipliers were applied to convert energy bill savings to increased local economic activity.

JEDI Input Assumptions

- The JEDI model allows the user to specify key inputs, including cost data and information about whether labor and materials are assumed to be purchased and manufactured locally

- Annual construction and O&M costs were obtained from the National Renewable Energy Laboratory's (NREL's) Annual Technology Baseline and Standard Scenarios. NREL annually documents a realistic and timely set of input assumptions (e.g., technology cost, fuel costs), and a diverse set of potential futures (Standard Scenarios) to support and inform electric sector analysis in the United States. Their **Annual Technology Baseline (ATB) Spreadsheet** includes detailed cost and performance data (both current and projected) for renewable and conventional technologies

- Cost adders were applied to solar data to represent the additional activities required to acquire and manage subscribers, which is unique to community solar

- The model's default assumptions regarding the manufacture and purchase of materials were used in the analysis. This assumed that all materials were purchased locally (within Cook County) but none were manufactured locally. All labor was assumed to be sourced locally

JEDI Input Values

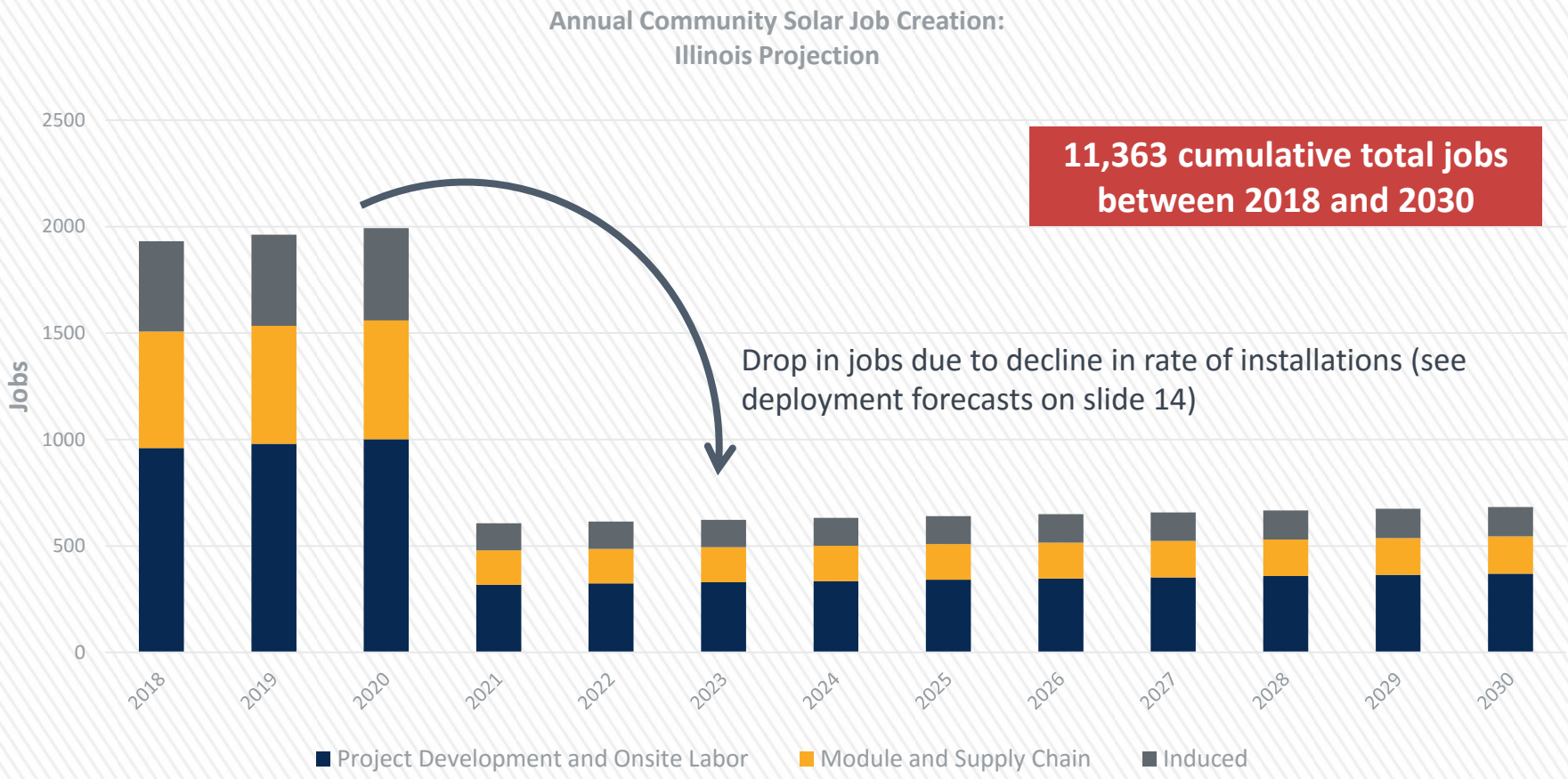
Project Cost Data	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mounting (rails, clamps, fittings)	$194.51	$186.77	$179.03	$170.87	$162.71	$154.56	$146.40	$138.24	$135.19	$132.14	$129.08	$126.03	$122.98
Modules	$592.80	$569.20	$545.60	$520.75	$495.89	$471.03	$446.17	$421.32	$412.01	$402.71	$393.40	$384.09	$374.79
Electrical (wire, connectors, breakers, etc.)	$166.73	$160.09	$153.45	$146.46	$139.47	$132.48	$125.49	$118.50	$115.88	$113.26	$110.64	$108.03	$105.41
Inverter	$120.41	$115.62	$110.83	$105.78	$100.73	$95.68	$90.63	$85.58	$83.69	$81.80	$79.91	$78.02	$76.13
Installation	$463.13	$444.69	$426.25	$406.83	$387.41	$367.99	$348.57	$329.15	$321.88	$314.61	$307.34	$300.07	$292.80
Permitting	$83.36	$80.04	$76.73	$73.23	$69.73	$66.24	$62.74	$59.25	$57.94	$56.63	$55.32	$54.01	$52.70
Other Costs	$83.36	$80.04	$76.73	$73.23	$69.73	$66.24	$62.74	$59.25	$57.94	$56.63	$55.32	$54.01	$52.70
Business Overhead	$379.76	$364.65	$349.53	$333.60	$317.68	$301.75	$285.83	$269.91	$263.94	$257.98	$252.02	$246.06	$240.10
O&M	$11.70	$11.10	$10.50	$9.90	$9.30	$8.70	$8.10	$7.50	$7.50	$7.50	$7.50	$7.50	$7.50

2016 data for all costs other than O&M derived Community Solar Business Case Tool; Elevate Energy & West Monroe Partners
O&M data from NREL's Annual Technology Baseline Spreadsheet – 2016
Escalators derived from NREL's Annual Technology Baseline Spreadsheet – 2016

Detailed Annual Economic Benefits Results

- Annual Illinois Jobs Analysis
- Annual Illinois Earnings Analysis
- Annual Illinois Economic Activity Analysis
- Annual Cook County Jobs Analysis
- Annual Cook County Earnings Analysis
- Annual Cook County Economic Activity Analysis

Community Solar Job Creation[1]: Annual Analysis Illinois



[1]Job refers to full-time equivalent employment for a full year

Note: results do not include job creation associated with induced impacts from energy savings, as it's unknown what job types this will enable

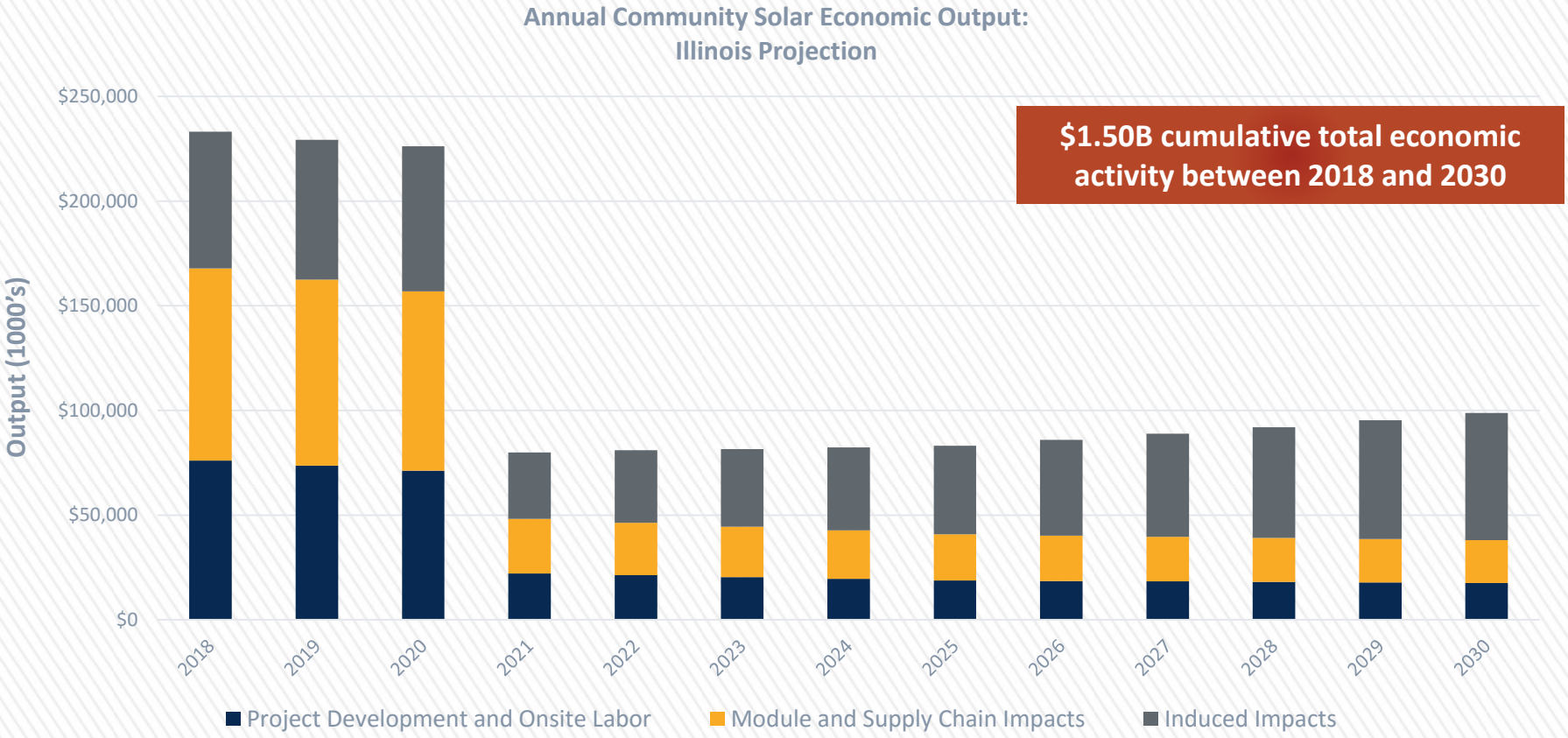
Community Solar Job Earnings[1]: Annual Analysis Illinois

Community solar deployments will result in paying jobs for local workers

[1]Refers to the wage and salary compensation paid to workers

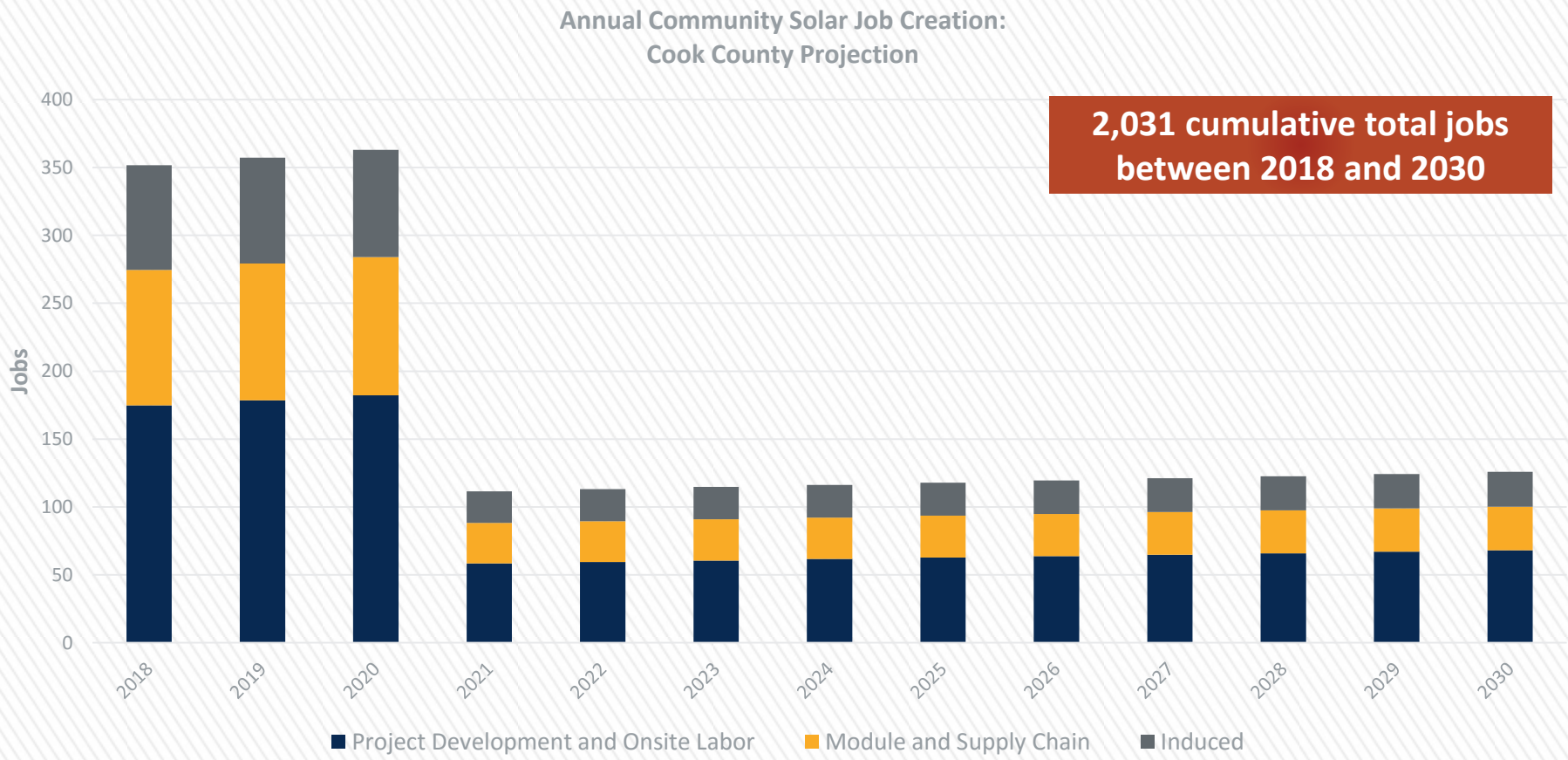
Note: results do not include job earnings associated with induced impacts from energy savings, as it's unknown what job types this will enable

Community Solar Economic Activity: Annual Analysis Illinois



The creation of additional jobs will spur hundreds of thousands of dollars of spending in the local economy

Community Solar Job Creation[1]: Annual Analysis Cook County



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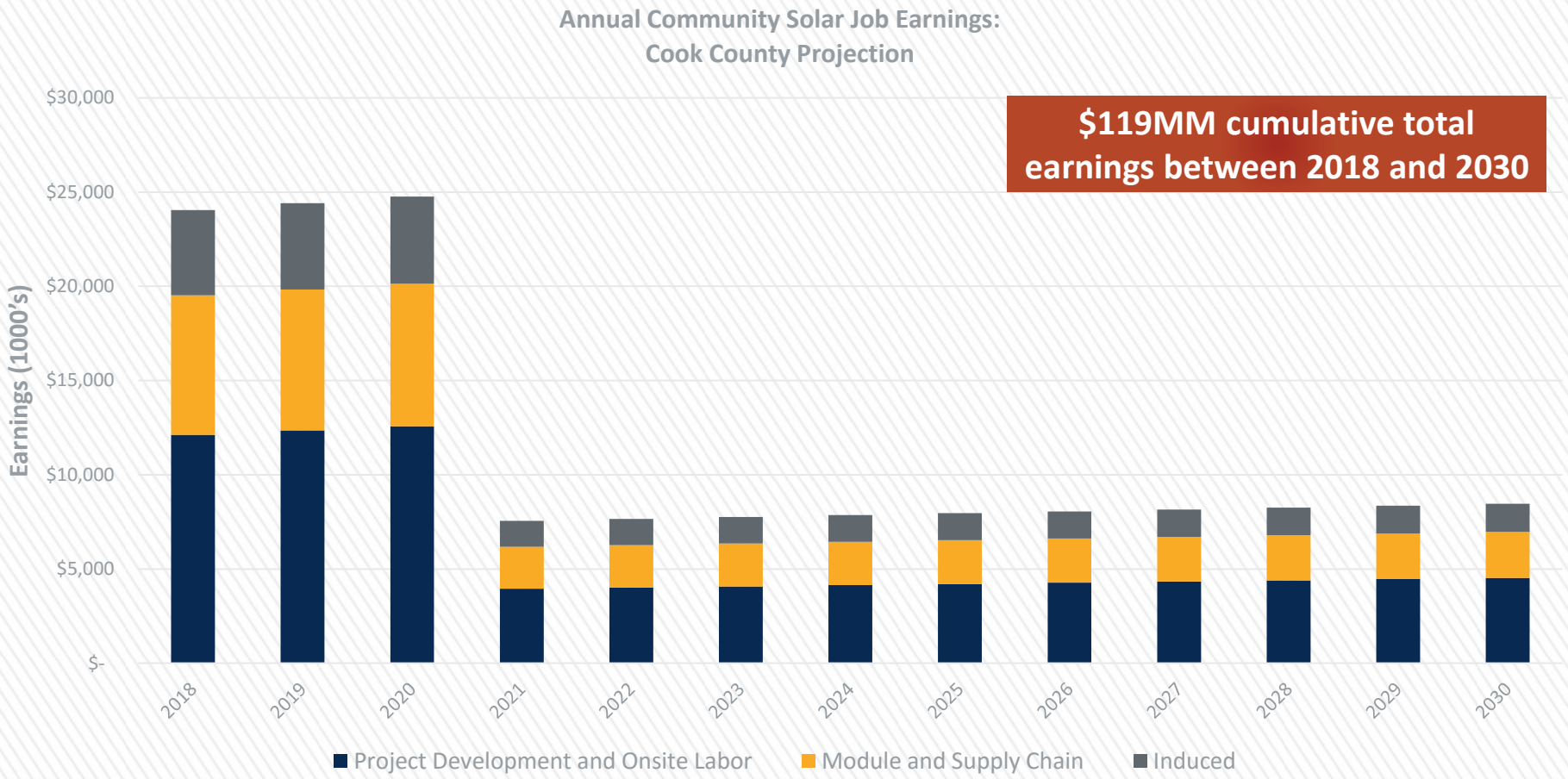
Note: results do not include job creation associated with induced impacts from energy savings, as it's unknown what job types this will enable

Community Solar Job Earnings[1]: Annual Analysis Cook County



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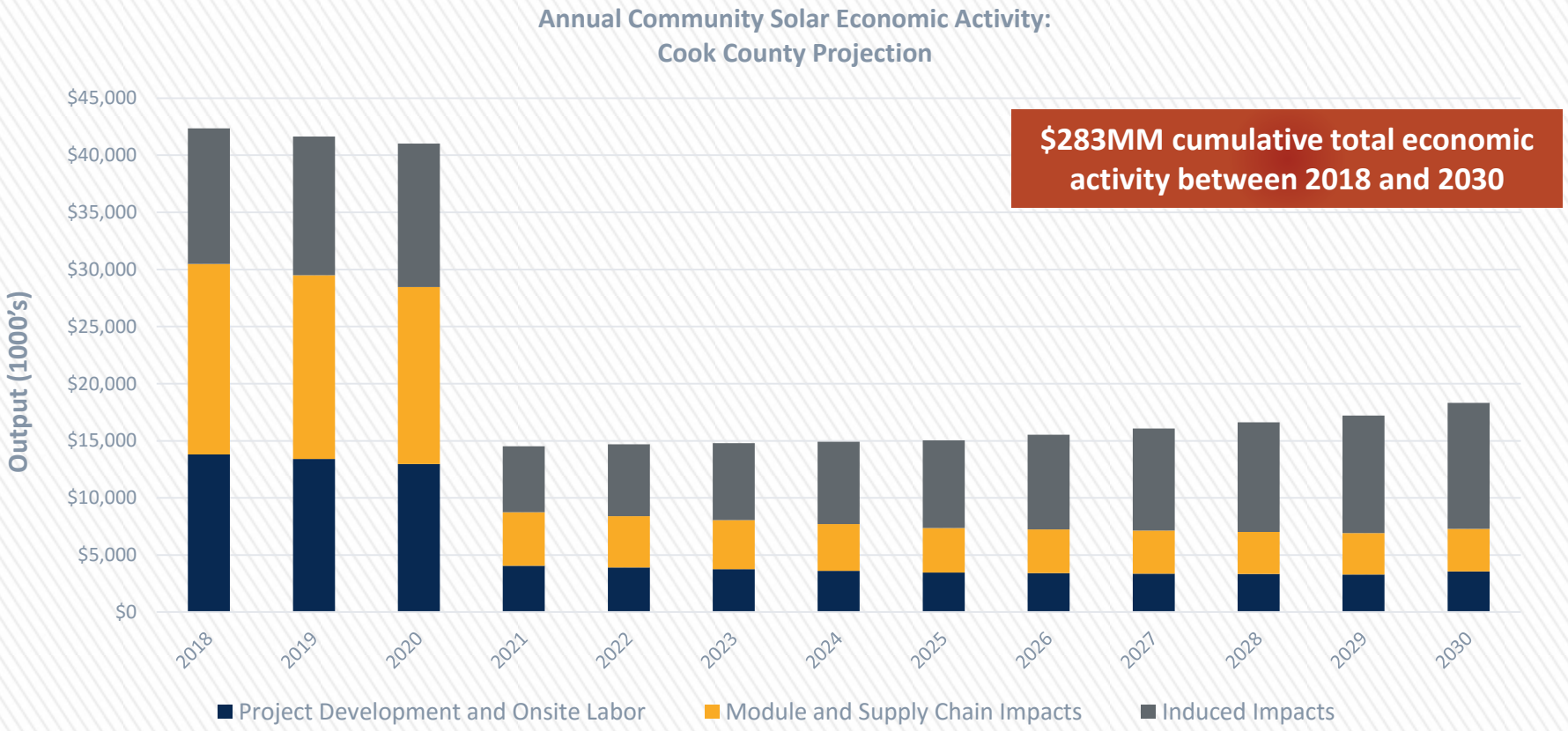
Community Solar Economic Activity: Annual Analysis Cook County



Detailed Construction Period and Post-Construction Period Economic Benefits Breakdown

- Detailed Construction Period Job Descriptions
- Detailed Post-Construction Period Job Descriptions
- Construction Period Job Type Analysis
- Post-Construction Period Job Type Analysis
- Construction Period Earnings Analysis
- Post-Construction Period Earnings Analysis
- Construction Period Economic Activity Analysis
- Post-Construction Period Economic Activity Analysis

Detailed Construction Period Job Descriptions

Job Type	Job Category	Job Examples
Construction Related Jobs	Construction and Installation Labor	Crane operators, road contractors, construction managers, electricians, excavation workers, backhoe operators, foundation workers, installation workers, etc.
	Construction and Installation Related Services	Civil and electrical engineers, attorneys, permitting specialists, etc.
	Subscriber Acquisition Services	Marketing and communications, customer acquisition, sales, contract management, etc.
Supply Chain	Supply Chain Demands from Construction	Manufactoring, wholesale, retail, distribution sales, warehousing and delivery for materials and equipment necessary for constructing the solar project
Induced	Induced from Project Development	Jobs associated with increased business at local restaurants, hotels, and retail establishments and with increased service at child care providers and any other entity affected by increased economic activity and spending associated with project construction

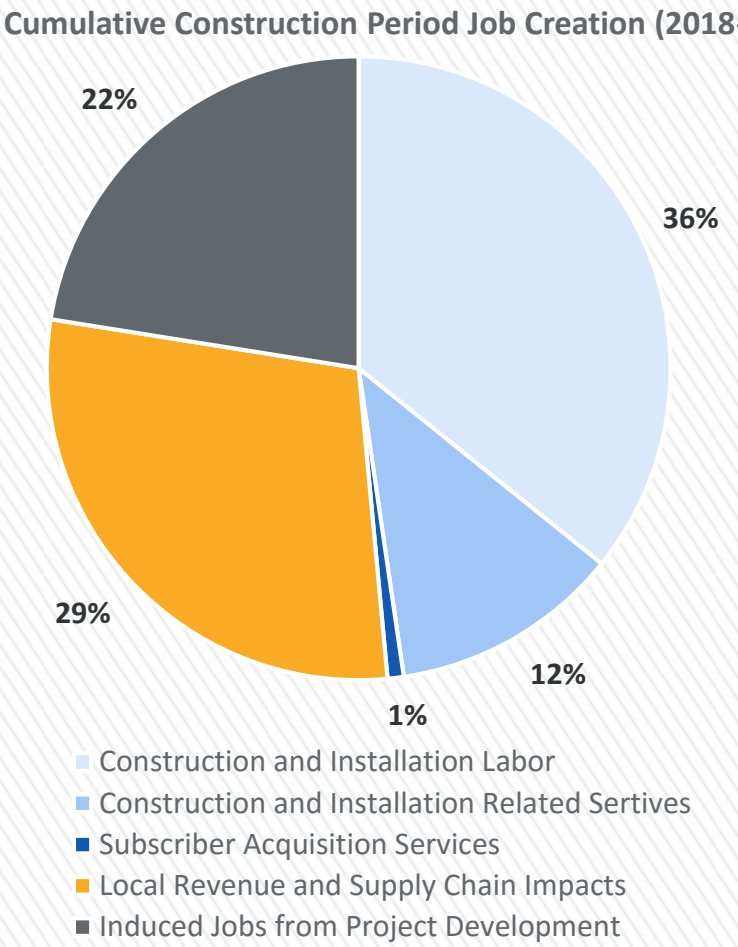
- During the period of construction, numerous **jobs** are created related to construction/installation labor and services, subscriber acquisition and supply chain demands
- Each of these new jobs and positions yield new wages, or **earnings**
- As workers earn new wages, they begin to spend money within the local economy. This spending yields induced jobs and subsequently induced earnings, thus beginning a cycle of continued induced earning/spending which ultimately yields a multiple of earnings called **economic activity**

Detailed Post-Construction Period Job Descriptions

Job Type	Job Category	Job Examples
Construction-Related Jobs	Onsite Labor from O&M	Clerical and bookkeeping support, site managers, field technicians, other O&M workers
	Subscriber Management Services	Marketing and communications, customer acquisition, sales, contract management, etc.
Supply Chain	Supply Chain Demands from O&M	Manufactoring, wholesale, retail, distribution sales, warehousing and delivery for materials and equipment necessary for ongoing maintenance the solar project; also includes ongoing needs such as insurance and permitting
Induced	Induced Work from O&M	Jobs associated with increased business at local restaurants, hotels, and retail establishments and with increased service at child care providers and any other entity affected by increased economic activity and spending associated with O&M work and energy bill savings
	Induced Work from Energy Bill Savings	

- During the post- construction period, numerous **jobs** are created related to onsite labor, subscriber management and supply chain demands
- Each of these new jobs and positions yield new wages, or **earnings**
- As workers earn new wages, they begin to spend money within the local economy. This spending yields induced jobs and subsequently induced earnings, thus beginning a cycle of continued induced earning/spending which ultimately yields a multiple of earnings called **economic activity**
- A similar induced economic cycle stems from energy bill savings as subscribers begin to spend their savings

Community Solar Job Creation: Construction Period Job Type Analysis

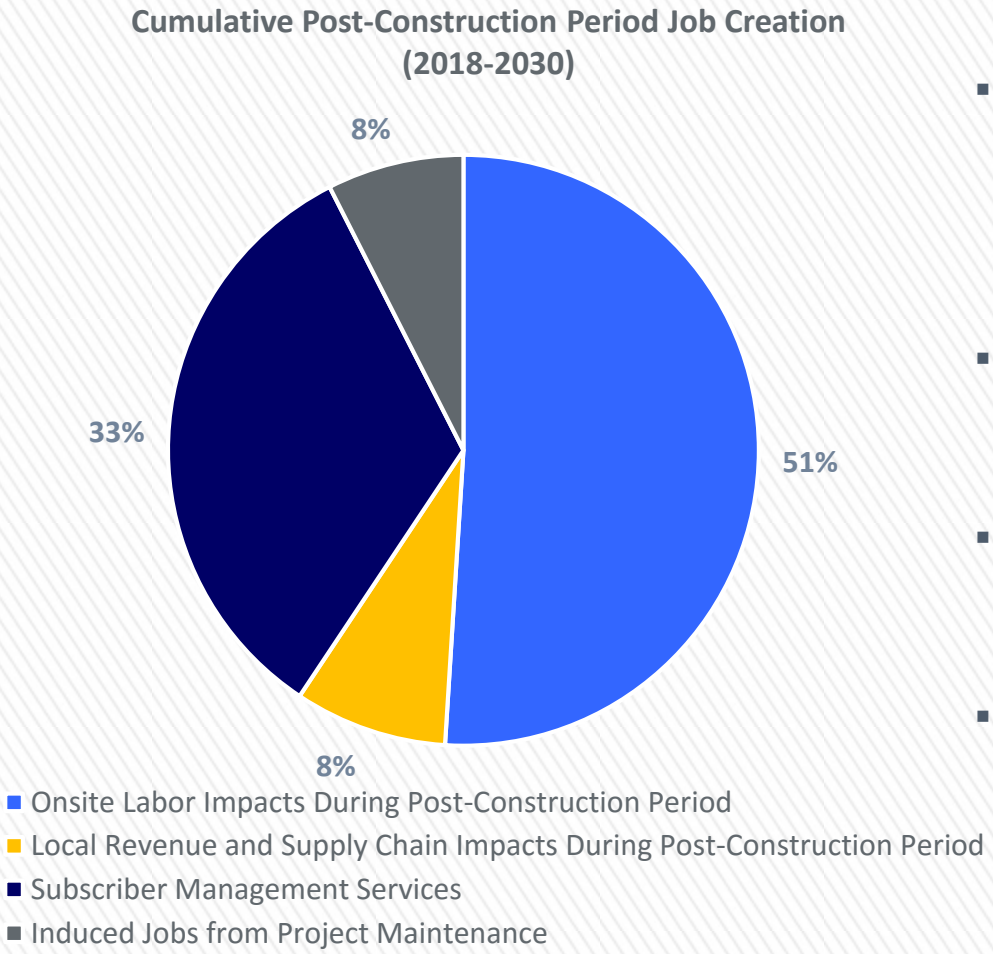


- If the new build mandates under the Future Energy Jobs Act are met, community solar is expected to create a cumulative 10,070 construction jobs1 between 2018 and 2030
- If the projected EOI of 109 MW is built in Cook County by 2030, this will result in an estimated job creation of 1,827
- Nearly 50% the these jobs will be in the areas of installation labor and supporting services
- 29% of jobs created are projected to be related to supply chain impacts, and 22% related to induced impacts

[1]Refers to full-time equivalent employment for a full year
Note: results do not include job creation associated with induced impacts from energy savings

[1]Job refers to full-time equivalent employment for a full year
Note: results do not include job creation associated with induced impacts from energy savings, as it's unknown what job types this will enable

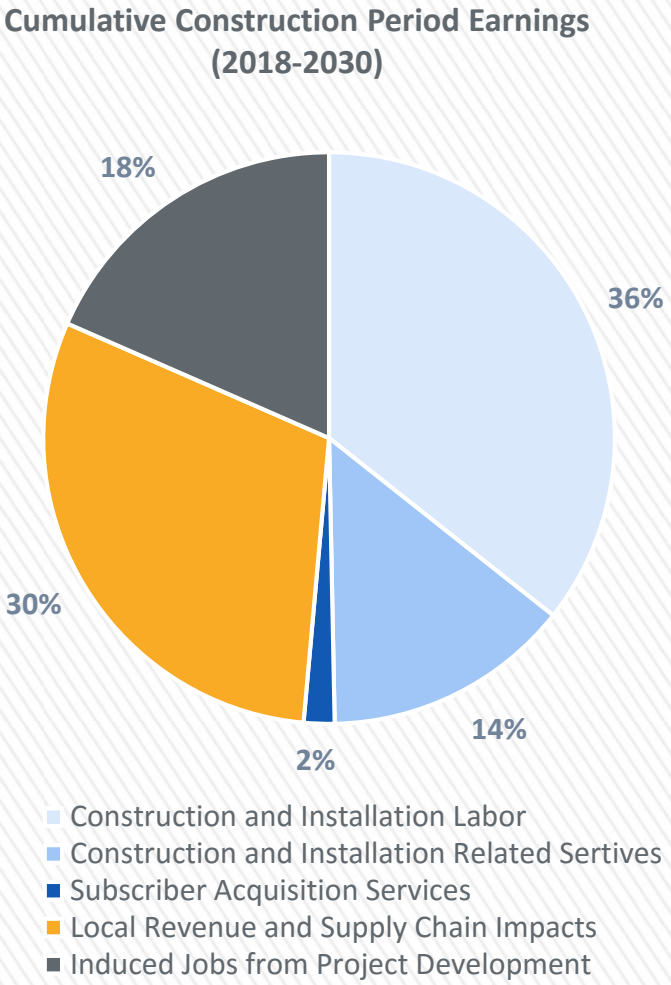
Community Solar Job Creation: Post-Construction Period Job Type Analysis



- 177 permanent O&M jobs will be created to support community solar project maintenance and subscriber maintenance if the new build mandates under the Future Energy Jobs Act are met
- If the EOI 109 MW build expected is met in Cook County, 32 permanent O&M jobs will be created in the county
- The ongoing jobs created will be comprised primarily of onsite project maintenance jobs related to equipment upkeep and replacement
- Approximately one-third of the jobs will be administrative jobs to support subscriber maintenance, such as marketing and communications, customer service, and billing administration

Note: results do not include job creation associated with induced impacts from energy savings, as it's unknown what job types this will enable

Community Solar Earnings: Construction Period Analysis

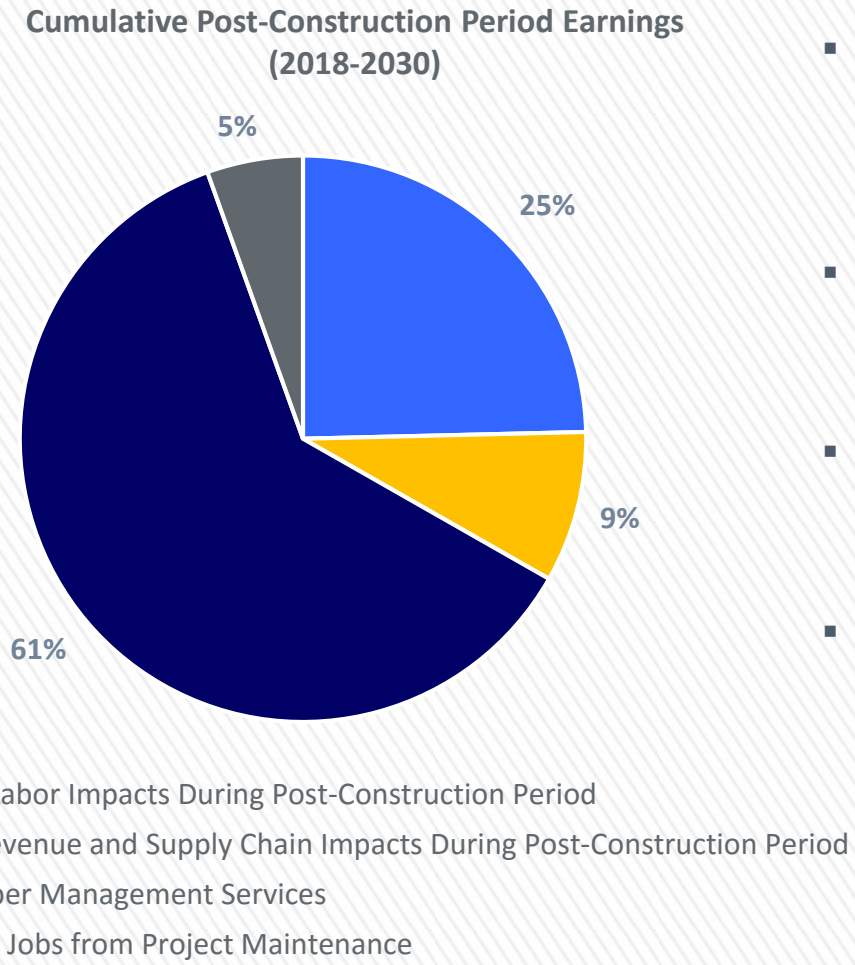


- If the new build mandates under the Future Energy Jobs Act are met, community solar is expected to produce a cumulative $655MM in earnings for construction jobs[1] between 2018 and 2013
- If the projected EOI of 109 MW is built in Cook County by 2030, this will result in earnings of $119MM for Cook County residents
- While jobs related to customer acquisition represent 1% of jobs, they represent 2% of total earnings; similarly, construction and installation related services (civil and electrical engineers, attorneys, permitting specialists) represent 12% of jobs but 14% of earnings, indicating that these jobs are higher paying than onsite construction jobs or jobs from induced impacts

[1]Refers to full-time equivalent employment for a full year

Note: results do not include job earnings associated with induced impacts from energy savings, as it's unknown what job types this will enable

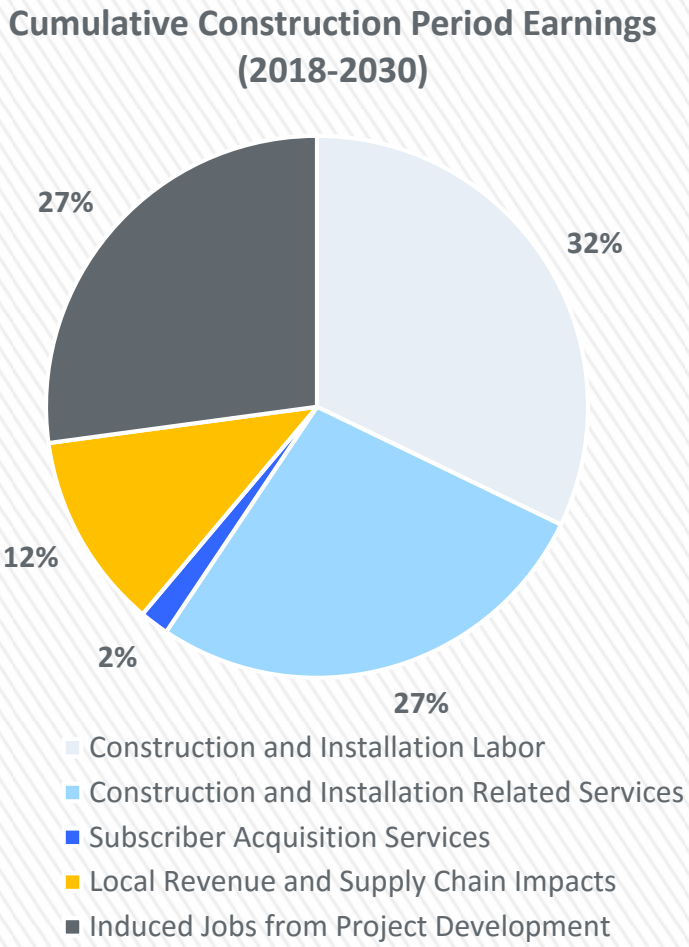
Community Solar Earnings: Post-Construction Period Analysis



- If the new build mandates under the Future Energy Jobs Act are met, local workers will earn $13.0MM annually in project support and maintenance
- If the EOI 109 MW build expected is met in Cook County, $2.4MM is expected be earned annually by local workers
- Over 60% of the ongoing earnings are expected to be related to subscriber management and 25% to onsite laborers
- As demonstrated in the construction analysis, subscriber management activities such as marketing and communications, customer turnover management, customer service, billing administration represent a higher percentage of earnings than jobs

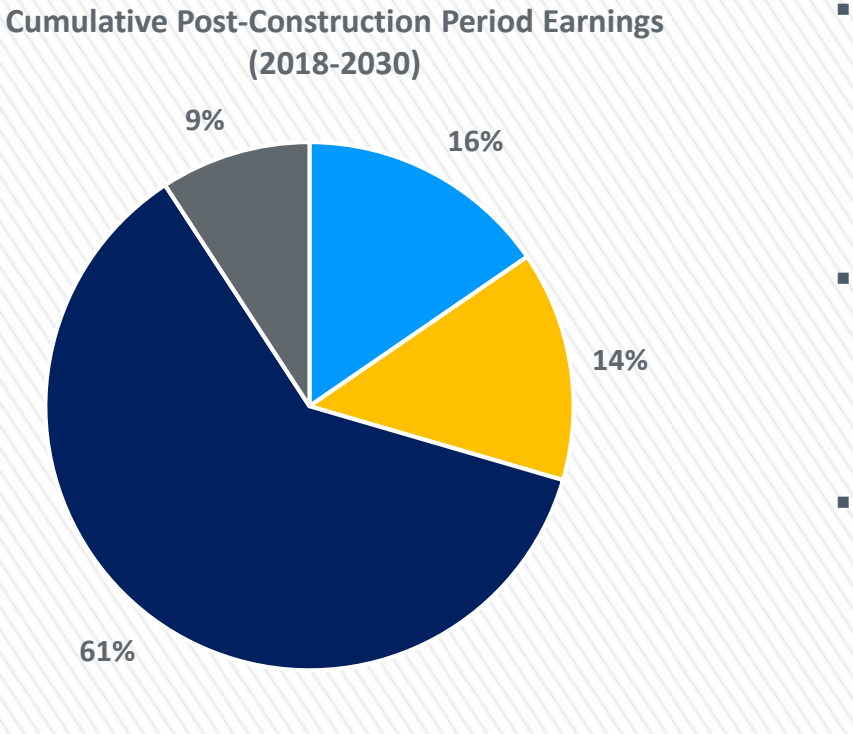
Note: results do not include job earnings associated with induced impacts from energy savings, as it's unknown what job types this will enable

Community Solar Output: Construction Period Analysis



- If the new build mandates under the Future Energy Jobs Act are met, community solar is expected to produce a cumulative $1.19B in local economic activity, for construction period activities in Illinois between 2018 and 2030
- If the projected EOI of 109 MW is built in Cook County by 2030, this will result in $119MM in increased economic activity for Cook County
- A majority of the increased economic activity will be related to increased local spending from construction and installation laborers, followed by those in construction and installation services and induced jobs that are supported by community solar workers, such as workers at local restaurants and daycare centers

Community Solar Economic Activity: Post-Construction Period Analysis



- If the new build mandates under the Future Energy Jobs Act are met, community solar is expected to produce a cumulative $20.7MM in local economic activity, for project maintenance activities between 2018 and 2030
- If the EOI 109 MW build expected is met in Cook County, $4.5MM in economic activity is expected to be generated in the county between 2018 and 2030
- Over 60% of the economic activity from post-construction activities are expected to be related to subscriber management