# Community Solar Economic Value Proposition

West Monroe Partners

April 2017

# Report Contents

# Executive Summary

# Executive Summary

- The stated goal of Task 5.1 was to collect shared solar investment data from local community solar projects and analyze the value proposition to stakeholders by ownership and business model. Because little local data was available, a model was developed that aggregated the costs and benefits of a hypothetical community solar project to the various stakeholders
- Initially, the analysis only examined the impacts to the system owner and subscriber. The analysis was expanded to understand implications to the utility, electric customers, as well as electric generators and retail energy suppliers
- The Future Energy Jobs Act (SB2814) passed by the Illinois Legislature in December 2016 defined a community solar framework and provided incentives that are expected to enhance the IL market, including Cook County
- Our findings indicate that a positive business case for community solar is possible for the system owner and subscriber, but these financial metrics are not supported if certain conditions are not met
  - Owners must be able to take advantage of federal tax credits
  - Solar renewable energy credits (SRECs) and utility rebates must be available to developers or subscribers
- Commonwealth Edison, the local utility, operates as a transmission and distribution company and is not responsible for generation. Many of the community solar benefits traditionally thought to impact the utility were found to either be not applicable or have impacts to other stakeholders instead

# Background and Objectives

# SunShot Initiative Goals

- 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

SunShot
U.S. Department of Energy

- The SunShot Initiative's Solar Market Pathways Program is supporting 15 projects– including the **Cook County Community Solar Project** – that are advancing solar deployment across the United States during the period 2015-2017

- The objective of the Cook County Community Solar Project is to identify and establish models for community solar and ways to eliminate barriers to implementation

# Cook County Project Team and Scope Overview

**Core Team Members:** Cook County, City of Chicago, Elevate Energy, Commonwealth Edison, West Monroe Partners, Environmental Law and Policy Center

The National Renewable Energy Laboratory (NREL) provided technical support through DOE/SunShot on the value proposition phase of the project

**Task Areas:** The Cook County Solar Market Pathways Project is broken into 5 key task areas. This report details the findings of a Value Proposition Analysis (Task 5.1) carried out under Task 5

- **Task 1:** Opportunity Assessment
- **Task 2:** Stakeholder Engagement
- **Task 3:** Policy & Market Barriers
- **Task 4:** Pilot Demonstrations
- **Task 5:** Benefits Documentation

# Value Proposition Analysis Objectives

- The goal of Task 5.1 is to collect shared solar investment data from local projects, and analyze the value proposition to stakeholders, aggregating and modeling the project costs (investment) and ongoing costs/benefits (revenue/savings) by ownership and business model *(Source: DOE-FOA-0001071 Statement of Project Objectives)*

- Impacts and benefits of community solar were initially identified for the system owner and subscribers

- Additional analysis was conducted to analyze impacts to the transmission and distribution utility and its customers, retail energy suppliers, electric generators, and society as a whole

# Value Proposition Analysis Approach

- Because no community solar project has yet been developed within Cook County, cost and benefit data were analyzed for a hypothetical community solar project

- This analysis was conducted in 2 phases: first to analyze the costs and benefits that accrue to subscribers and developers, and then to additional stakeholders, including the transmission & distribution utility
  - Costs and benefits to subscribers and developers were represented using values from literature; values were vetted with the National Renewable Energy Laboratory, GTM Research, the National Community Solar Partnership, and a working group of regional stakeholders
  - Methodologies to quantify the impacts to the utility and other stakeholders were reviewed in literature and discussed in multiple working sessions with regional and national value of solar experts. The methodologies used and rationale are presented in subsequent slides

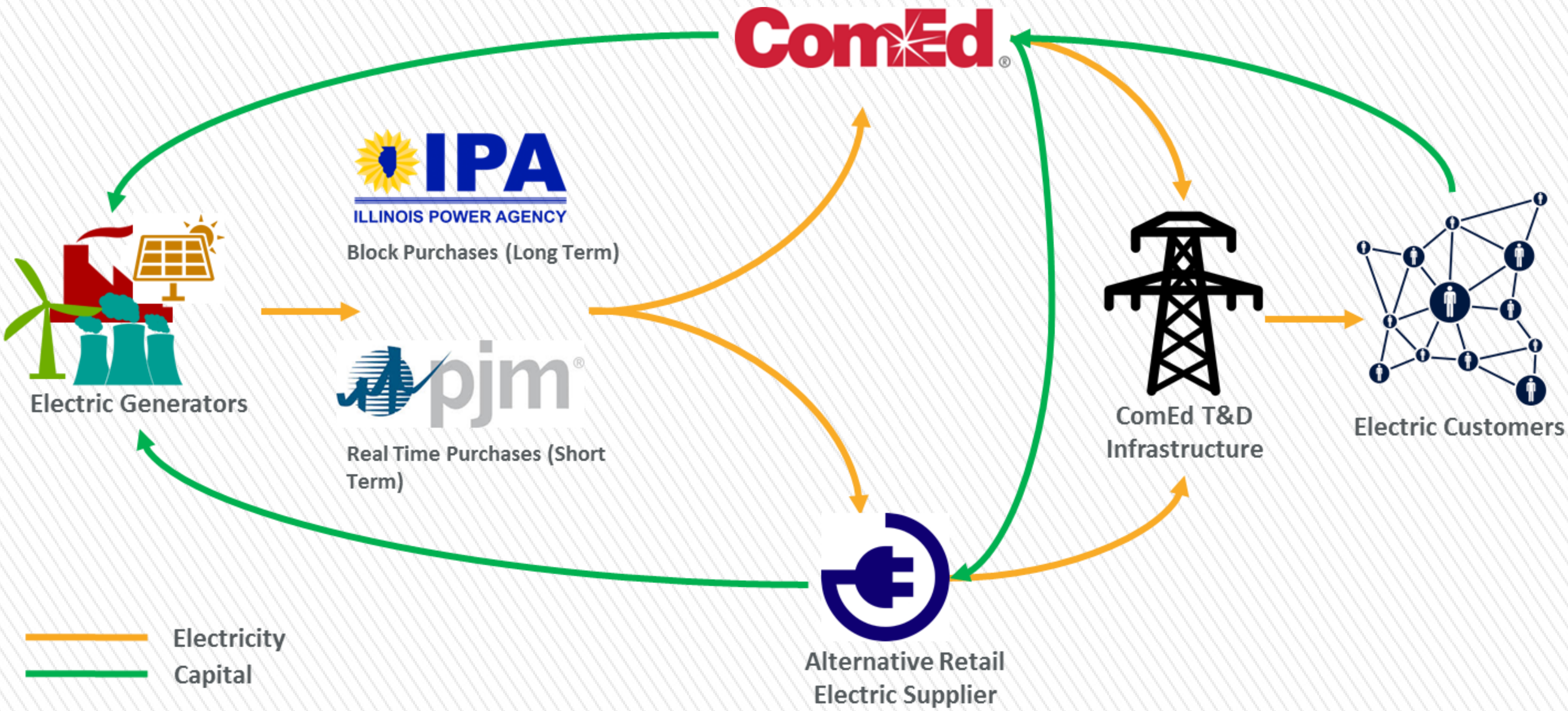
- A financial model was created to illustrate the costs and benefits of a community solar project over time and demonstrate the value proposition to each of the stakeholders

# Market and Regulatory Structure

# Illinois Market Structure Overview

- Many possible configurations and accompanying business models exist for community solar projects. In the simplest form, the community solar model involves a system owner, electric utility (if not the system owner), and subscribers
- Community solar is often enabled or inhibited by state-level policies or regulation; these policies can dictate how cost and benefits accrue to various stakeholders
- Cook County presents a unique scenario because Commonwealth Edison (ComEd), the local transmission and distribution utility, delivers electricity to local residents, but is not responsible for electricity generation
- The Illinois Power Agency procures bulk power from third-party generators that is then wheeled to Commonwealth Edison. Real time electric transactions are procured from PJM by ComEd or alternative retail electric suppliers
- These power and related capital flows are illustrated on the following slide

# Illinois Market Structure Diagram



# Legislation Impacting Community Solar in Illinois

- 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) was signed in December 2016. The bill is designed to strengthen and expand the Illinois Renewable Portfolio Standard, expand energy efficiency programs, and create jobs, while maintaining competitive rates for customers. The Act becomes effective in June 2017

- The Act has specific provisions to promote community solar, namely:
  - Investor-owned utilities are required to approve all community solar applications
  - The developer can define the appropriate structure of the subscription model
  - Energy produced by community solar will be credited at the energy service rate only, not the full retail rate
  - A $250/kW rebate will be provided to either the owner (developer) or subscribers of the system
    - The rebate is intended to compensate subscribers for the value that distributed energy resources (DER) provide to the grid
    - 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
  - New renewable energy targets are listed for construction of solar and wind, with a carve out for community solar
  - An adjustable Renewable Energy Credit (REC) block purchase program has been created with a specific allocation for community solar generated RECs. The IPA will propose the structure of this program by June 2017

# Stakeholder Overview

# Stakeholder Overview

- Community solar expands access to solar power to previously untapped market segments: renters, those with unsuitable roof space, and households facing financial barriers to rooftop installation

- The community solar value proposition for the developer and subscriber is well understood in literature
  - The subscriber benefits by receiving monthly bill credits for their share of solar generation
  - The developer receives subscriber payments, either in the form of an upfront purchase or ongoing lease payment. They are also often eligible for tax credits, and state or utility incentives
  - Developers or subscribers may be eligible for RECs

- Within a vertically integrated market, the utility can serve as the developer and can reap the benefits of adding solar to its generation portfolio

- Less analysis has been conducted on the benefits of utilities in deregulated markets, such as Illinois

# Key Market Players Defined

**SOLAR DEVELOPER**

Entity that designs and builds the community solar array. This entity often, but not always, owns and operates the assets

**SOLAR SUBSCRIBER**

A Residential, Commercial or Industrial ratepayer that subscribes to community solar through panel purchase, lease or PPA

**T&D UTILITY**

An energy delivery provider that manages power lines to deliver electricity to homes and business within its service territory. T&D utilities doe not generate electricity

**RETAIL ELECTRIC SUPPLIER**

A business that sells electricity to residential and/or commercial customers in a competitive market, including an energy reseller, aggregator, or power marketers

**ELECTRIC CUSTOMERS**

All rate-paying electric customers

**ELECTRIC GENERATOR**

An entity that produces electricity for procurement by a utility or ARES

**IPA ILLINOIS POWER AGENCY PROCURE-MENT ADMIN.**

Develop electricity procurement plans and conduct competitive procurement processes to procure the supply resources identified in the plan(s)

**pjm REGIONAL TRANSMISS-ION ORG.**

An organization that is responsible for moving electricity over large interstate areas. An RTO coordinates, controls and monitors an electricity transmission grid

**SOCIETY**

All people living within the community

# Modeling Approach

# Value Proposition Model

## Developer Value Proposition

**Costs**
- System construction and program set up
- Ongoing administration and maintenance

**Benefits**
- Subscriber payments
- Tax credits (ITC and MACRS)
- Utility rebates
- SRECs

## Subscriber Value Proposition

**Costs**
- Panel purchase or lease costs

**Benefits**
- Bill credits (net metering)

## Utility Value Proposition

**Costs**
- Bill crediting costs
- Lost revenue

**Benefits**
- Possible grid benefits

*Note: many T&D utility costs/benefits will be passed through to electric customers

***+ costs and benefits for electric customers, electric generators, ARES, and society***

The model aggregates costs and benefits to each stakeholder group ***for a single community solar system***, and looks at the impact over the system life

# Community Solar Impact Categories

## Direct Costs

- Construction Costs
  - PV Modules
  - Inverters
  - Racking
  - BOC
  - Engineering and Design
  - Permitting and Interconnection
  - Installation Labor
  - Equipment rental and freight
  - Development overhead
- Site Costs
- O&M Costs
- Panel Purchase/Lease Payment
- Administrative Costs
- Billing System Costs
- SRECs
- Salvage Value

## Market Impacts

- Avoided Energy Generation
- System Losses
- Ancillary Services
  - Reactive supply and voltage control
  - Frequency regulation
  - Energy imbalance
  - Operating reserves
  - Scheduling/ forecasting
- Generation Capacity
- T&D Capacity
- Risk Reduction
- Reliability and Resiliency
- Environmental Compliance
- Environmental/Societal Benefits

# Flexible Model Inputs

- The model includes toggles that can be used to examine how various program components (see below) impact its financial metrics:

**Installation Type**
- Ground mount
- Rooftop
- Parking lot canopy

**Ownership Model**
- Tax Exempt
- Non-Tax Exempt

**Subscription Model**
- Panel Purchase
- Panel Lease

**Subscriber Acquisition Difficulty**
- Easy
- Moderate
- Difficult

- Additional flexible inputs allow users to enter any value to further examine impacts on these metrics. Flexible inputs include:
  - System Size
  - System Subscription Rate
  - Construction Costs
  - SREC Values
  - Financial Incentives

- The model also allows user to change net metering and rebate assumptions to analyze various regulatory scenarios

# Key Modeling Assumptions

The financial assessment was conducted for a single hypothetical system. A number of business-level and system-level assumptions were made in the model. These were stressed in the sensitivity analysis

- **Applicable Credit Rate:** Under the Future Energy Jobs Act, subscribers are credited at the electricity supply rate of $0.059/kWh. The annual energy cost increase was modeled to be 2.78% per year
- **Power Production:** Power production is assumed to be 1,150 kWh/kW, which decreases at 0.5% annually
- **Construction Costs**: Total installed PV system costs were modeled to range from $2.31/Watt to $3.06/Watt, depending on installation type
- **O&M Costs:** O&M costs are assumed to be $15/kW/year
- **Subscriber Participation:** The average panel size was assumed to be 300 W, and the average subscriber was assumed to lease/purchase 10 panels
- **Incentives:** Under the Future Energy Jobs Act, developers or subscribers are eligible for rebates of $250/kW for installed solar, depending on how the developer structures the project. The investment tax credit and MACRs depreciation were represented. A range of SREC values were modeled
- **Bill crediting:** Bill crediting was assumed to be performed manually. The costs associated with manual bill crediting were examined in another project workstream (see Task 3.1: Bill Crediting Analysis)

# Model Outputs

Model outputs used to assess the financial viability of the project include:

- **Net Present Value (NPV):** the difference between the present value of cash inflows and the present value of cash outflows. NPV is used to analyze the profitability of a projected investment or project. Generally, an investment with a positive NPV will be a profitable one and one with a negative NPV will result in a net loss

- **Internal Rate of Return (IRR):** a metric used to measure the profitability of potential investments. Internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project

- **Return on Investment (ROI):** a performance measure used to evaluate the efficiency of an investment. ROI measures the amount of return on an investment relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio

- **Simple Payback Period:** the length of time required to recover the cost of an investment

# Market Impact Categories and Quantification Methods

# Stakeholder Engagement Approach

- Many studies, including individual utility studies, state and local Value of Solar (VOS) studies, and national rate design studies, have attempted to determine the value of solar

- Two specific reports aggregate multiple utility VOS studies and their methods of cost/benefit quantification. These have been heavily drawn upon for our analysis
  - Rocky Mountain Institute's A Review of Solar PV Benefit & Cost Studies
  - National Renewable Energy Laboratory's Methods for Analyzing the Benefits and Costs of Distributed Photovoltaic Generation to the U.S. Electric Utility System

- While VOS studies were leveraged for the analysis, this effort was not intended to serve as a VOS study to quantify the overarching value of solar. A more precise term is a stakeholder value proposition analysis, where the value stack is being investigated for each impacted party

- However, little market research has been done on markets similar to that in Illinois (deregulated, wires-only), where the value streams are very different

- To ensure the viewpoints of all stakeholders were considered, multiple working sessions with local and regional subject matter experts were held to discuss the approach for assigning value to the market impacts of community solar

# Impact Categories

- Many market impacts were investigated as part of this analysis:
  - Avoided Energy Generation
  - System Losses
  - Ancillary Services
  - Generation Capacity
  - Transmission Capacity
  - Distribution Capacity
  - Reliability and Resiliency
  - Air Pollutants
  - Renewable Energy Credits
  - Utility Rebates
  - Financial Risk
- The following slides detail:
  1. The definition of each category
  2. A diagram of the market structure
  3. Impact of community solar on flow of capital
  4. Summary of methodology used for quantification
- Where possible, these impacts were quantified and incorporated into the financial model

# Avoided Energy Generation

Definition: The cost of energy that would have otherwise been generated to meet customer needs, largely driven by the variable costs of the marginal resource that is displaced

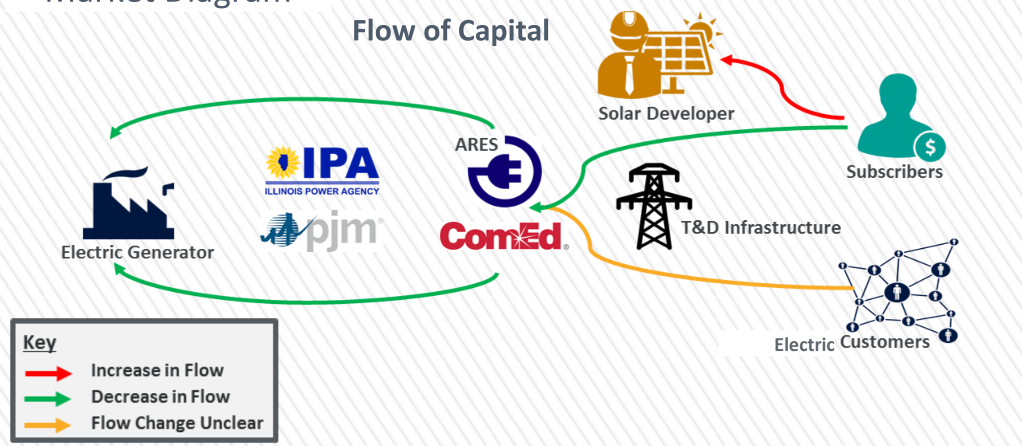
Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

The PJM Interconnection operates a competitive wholesale electricity market and manages the reliability of its transmission grid. Every year, the Illinois Power Agency (IPA) releases Requests For Proposals for electricity and procures block contracts for ComEd based on ComEd forecasts. Near-term adjustments are made through PJM's Real-Time Energy Market and Day-Ahead Market.

## Market Diagram




## Quantification Approach

- The market price method was used for this analysis.
- The market price method correlates historic locational marginal prices correlated with PV output for a specified time interval.
- PJM uses locational marginal pricing to set prices for energy purchases and sales.
- Hourly energy locational marginal prices were matched with hourly PV output to determine the cost of avoided energy during that hour.
- An annual escalator was applied using the consumer price index.

## Impacted Stakeholders

- **Electric Generator:** "Marginal" units may be called to generate less or not to generate, potentially losing some profit
- **ARES**: ARES earn a percent margin on the electricity they supply. If fewer customers are purchasing electricity through an ARES, they are losing some profit as well
- **Electric Customer:** Impact to customers will depend on locational marginal price of power
- **Solar Subscriber:** Subscriber bill credits include a cost for energy. This is captured via net metering

# System Losses

Definition: The compounded value of the additional energy generated by central plants that would otherwise be lost due to inherent inefficiencies (electrical resistance) in delivering energy to the customer via the transmission and distribution system

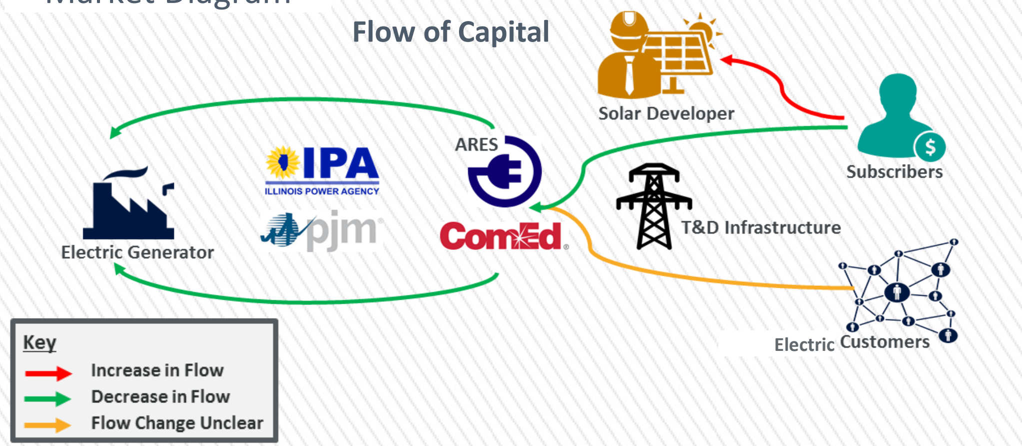
## Impact Category

- Avoided Energy Generation
- **System Losses**
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

When customers install solar on their homes, electricity is generated at the premise, so system losses are avoided. Electricity generated through community solar does not directly offset subscriber use and travels over the T&D infrastructure. It may be, however, located closer sources of energy demand, than a typical generating plant. Within the system, this may be accounted for as a reduction in accounted for energy.

## Market Diagram




## Quantification Approach

- Historically, ComEd has not experienced much fluctuation in unaccounted for energy throughout the year, which led us to believe an averaged approach was appropriate for this analysis.
- The average combined loss rate assumes PV avoids an average combined loss rate for T&D infrastructure.
- ComEd's 2015 ComEd Distribution System Loss Study contains a combined loss rate between 6%-7% that was used in the analysis.
- Transmission losses are embedded in customer supply rates.

## Impacted Stakeholders

- **Electric Generator:** "Marginal" units may be called to generate less or not to generate, potentially losing some profit
- **Electric Customer:** Electric customers may benefit from a reduction of unaccounted for energy
- **Solar Subscriber:** Subscribers are credited for electricity produced by their portion of the solar array, which includes a cost for energy grossed up for system losses. This is captured as part of their bill credit via net metering

# Ancillary Services

Definition: Ancillary services are required to enable the reliable operation of interconnected electric grid systems, including operating reserves, reactive supply and voltage control; frequency regulation; energy imbalance; and scheduling

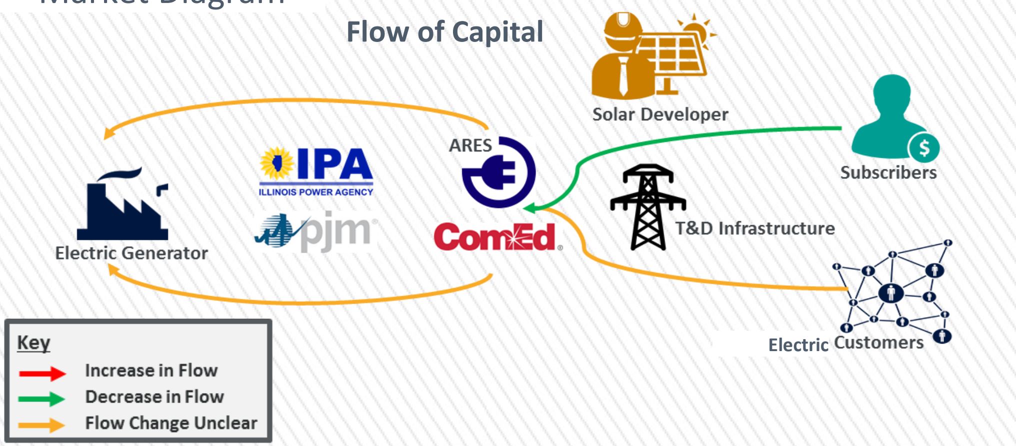
## Impact Category

- Avoided Energy Generation
- System Losses
- **Ancillary Services**
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Solar can increase the variability and uncertainty of the system net load, which can increase operating reserves (regulation and flexibility reserves) required by the system. Alternatively, PV can potentially decrease certain reserve services by reducing net load, while advanced inverter technologies can provide voltage control, providing a net benefit.

## Market Diagram




## Quantification Approach

- Ancillary services are diverse and the categories that fall under this umbrella are not directly related to each other: each would need to be analyzed individually to understand the impact.
- More renewables in the market are likely to require more regulation reserves to maintain reliability, although these impacts would not be seen for a single project.
- Because impacts will not be seen for a single project, ancillary services impacts have not been quantified.

## Impacted Stakeholders

- **Electric Generator:** A requirement for more regulation reserves would create additional opportunity in the market for electric generators providing ancillary services. However, if the need for ancillary services declines as a result of community solar, the market opportunity for providers of ancillary services will decline
- **Electric Customer:** Additional or avoided funds to procure ancillary services would be passed on to ComEd customers
- **Solar Subscriber:** Subscriber bill credits include a cost for ancillary services. This is captured via net metering

# Generation Capacity: Short Term

Definition: The cost of central generation capacity that can be deferred or avoided due to the addition of the solar. Short term refers to next three years

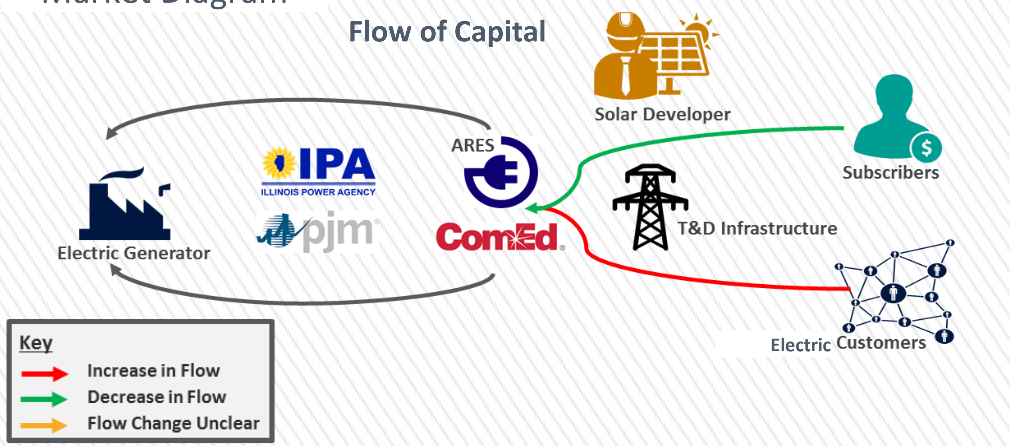
## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

The IPA procures capacity contracts for ComEd through PJM's capacity market. PJM's capacity market, called the Reliability Pricing Model, ensures long-term grid reliability by procuring the appropriate amount of power supply resources needed to meet predicted energy demand three years in the future. These capacity costs are passed through to ComEd customers based on their peak load contribution.

## Market Diagram




## Quantification Approach

- Capacity contracts for the next 3 years have already been purchased and therefore will not be impacted by community solar.
- Because subscribers are receiving bill credits for the community solar generation, less net dollars are flowing from subscribers to ComEd. Some costs associated with capacity will be transferred from solar subscribers to the remaining electric customers, to make up for this difference. This has been accounted for in our analysis.

## Impacted Stakeholders

- **Electric Customer:** Some costs associated with capacity will be transferred from subscribers to the other electric customers, as the utility is no longer collecting peak load contribution charges from community solar subscribers
- **Solar Subscriber:** Subscribers are credited for electricity produced by their portion of the solar array, which includes a cost for capacity. This is captured as part of their bill credit via virtual net metering

# Generation Capacity: Long Term

Definition: The cost of central generation capacity that can be deferred or avoided due to the addition of the solar. Long term refers to 4+ years into the future

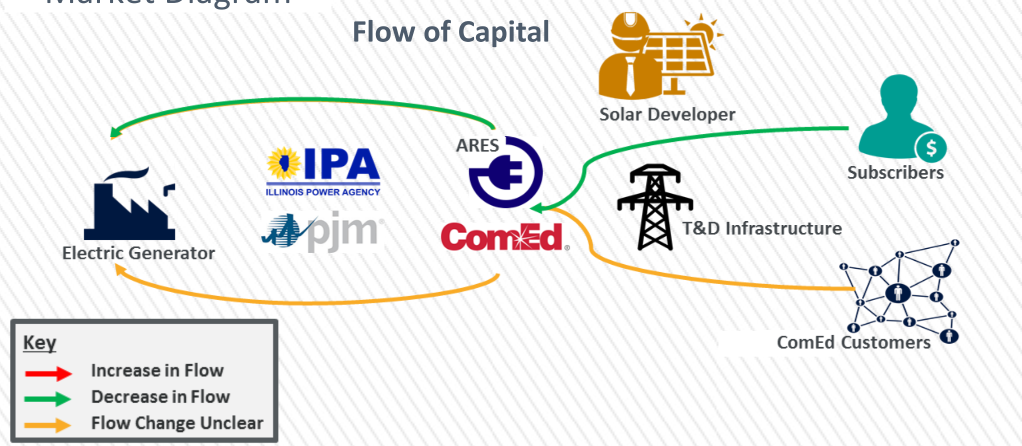
## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

The IPA procures capacity contracts for ComEd through PJM's capacity market. PJM's capacity market, called the Reliability Pricing Model, ensures long-term grid reliability by procuring the appropriate amount of power supply resources needed to meet predicted energy demand three years in the future. These capacity costs are passed through to ComEd customers based on their peak load contribution. Community solar may result in a reduction in purchased capacity and a shift in capacity prices, but prices are expected to return to market equilibrium over time.

## Market Diagram




## Quantification Approach

- Two key components must be considered when determining the avoided capacity associated with solar: the **capacity credit** that's given to solar and the **type of generation** that is assumed to be avoided.
- PJM developed a method of estimating the capacity credit for solar which was leveraged in this study.
- Because IL is a restructured market, historic capacity market prices were used to estimate the cost of generation capacity avoided by community solar.
- Escalators were applied to account for reserves.

## Impacted Stakeholders

- **Electric Generator:** "Marginal" units may be called to provide less capacity, potentially losing some profit
- **Electric Customer:** A reduction in purchased capacity will be passed on to customers as a bill savings; any change in capacity price (increase or decrease) due to the addition of community solar will be passed to customers as well
- **Solar Subscriber:** Subscribers are credited for electricity produced by their portion of the solar array, which includes a cost for capacity. This is captured as part of their bill credit via virtual net metering

# Transmission Capacity: Short Term

Definition: Benefits to the transmission system occur when rising demand can be met locally, relieving capacity constraints upstream and deferring or avoiding transmission upgrades. Short term refers impacts that occur over the next year

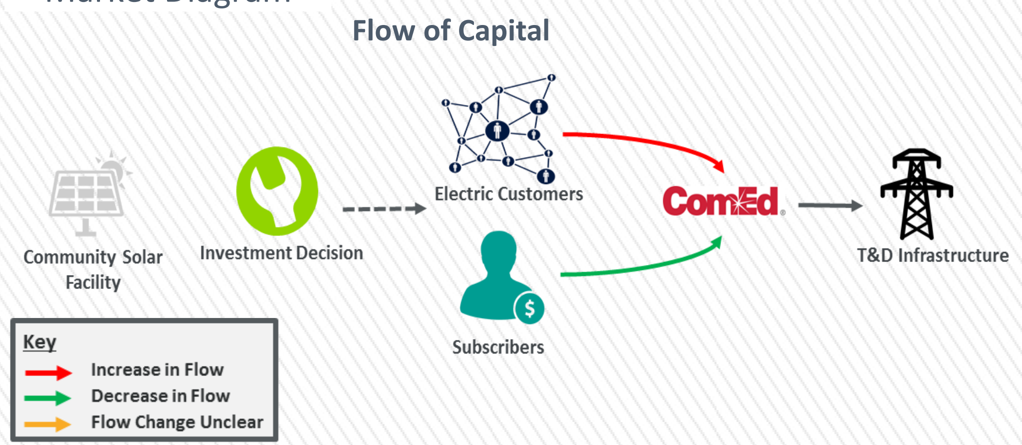
## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Transmission investment decisions are made one-year ahead. ComEd's formula rate determines the how the costs required to maintain or build new transmission capacity are shared amongst electric customers. In the short term, if less revenue is collected from ComEd customers than anticipated, a "true up" occurs from the customer base to collect remaining funds.

## Market Diagram




## Quantification Approach

- Investment decisions for the next year have already been determined and therefore will not be impacted by community solar.
- Because subscribers are receiving bill credits for the community solar generation, less net dollars are flowing from subscribers to ComEd. Some costs associated with transmission will be transferred from solar subscribers to the remaining electric customers, to make up for this difference. This has been accounted for in our analysis.

## Impacted Stakeholders

- **Electric Customer:** Some costs associated with transmission will be transferred from subscribers to the other electric customers, as the utility is no longer collecting transmission charges from community solar subscribers
- **Solar Subscriber:** Subscribers are credited for electricity produced by their portion of the solar array, which includes a cost for transmission. This is captured as part of their bill credit via virtual net metering

# Transmission Capacity: Long Term

Definition: Benefits to the transmission system occur when rising demand can be met locally, relieving capacity constraints upstream and deferring or avoiding transmission upgrades. Short term refers to 2+ years into future

## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
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## Market Overview

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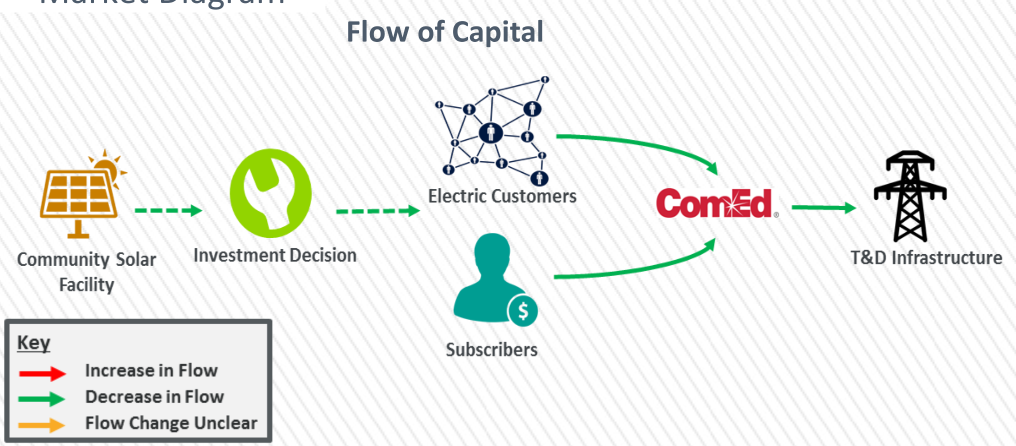



## Quantification Approach

- Community solar is not expected to extend the life of ComEd's transmission equipment, as it does not tend to wear out based on loading.
- If solar was added to a loaded circuit, it could defer the investment in additional capacity. However, ComEd is currently near a zero growth environment, making this unlikely.
- Long-term avoided transmission capacity was not quantified for a single system due to community solar's inability to extend equipment life and ComEd's zero growth market.

## Impacted Stakeholders

- **T&D Utility:** ComEd earns a rate of return on capital projects. Because no capital is put at risk for these investments, it was assumed avoiding or deferring capital investment does not result in a loss of revenue
- **Electric Customer:** Avoiding additional system upgrades would result in bill savings for electric customers
- **Solar Subscriber:** Subscribers are credited for electricity produced by their portion of the solar array, which includes a cost for transmission. This is captured as part of their bill credit via virtual net metering

# Distribution Capacity

Definition: The presence of solar could decrease or increase distribution system capacity investments necessary to maintain reliability, accommodate growth, and/or provide operating flexibility

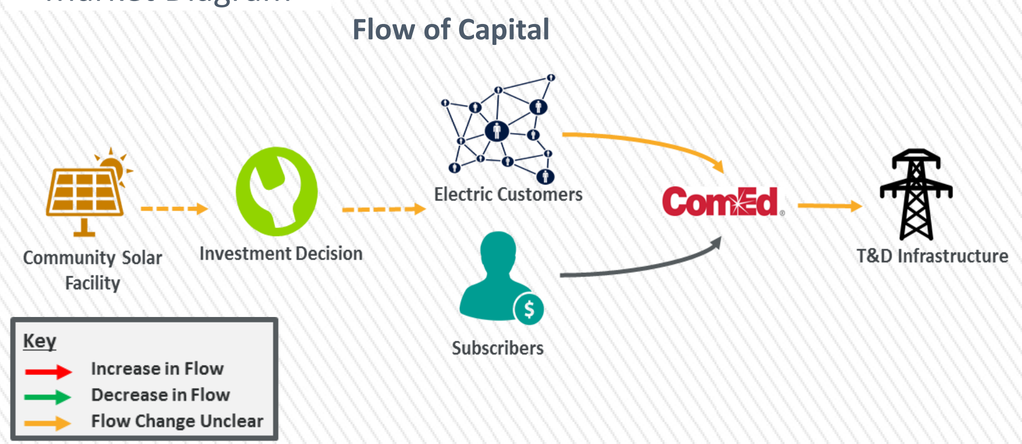
## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Community Solar may have a positive impact on the distribution system if it helps reduce the system peak. Like transmission capacity, distribution investment decisions are made one year in advance and costs and incorporated into customer rates. Community solar subscribers are credited at the at the supply rate only, meaning no transfer of costs occurs between subscribers and electric customers.

## Market Diagram




## Quantification Approach

- A single community solar project is not expected to significantly extend the life of distribution equipment.
- Adjustment factors would need to be established to adjust the capacity value for actual output and the probability of overlap with the system peak.
- Distribution capacity impacts were not quantified for this analysis due to the small scale and lack of knowledge about the system's location or peak load.

## Impacted Stakeholders

- **T&D Utility:** ComEd earns a rate of return on capital projects. Because no capital is put at risk for these investments, it was assumed avoiding or deferring capital investment does not result in a loss of revenue
- **Electric Customer:** Avoiding additional system upgrades would result in bill savings for electric customers

# Reliability & Resiliency

Definition: The increased grid reliability and resiliency provided by solar by reducing congestion along the T&D network, reducing large-scale outages by increasing the diversity of the generation portfolio, and providing back-up power sources available during outages

Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- **Reliability & Resiliency**
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Benefits to grid reliability are typically based on the total cost of power outages to the U.S. each year, and the perceived ability of solar to decrease the incidence of outages. The grid security value that distributed generation could provide is attributable to three primary factors, the last of which would require coupling solar with other technologies to achieve the benefit:

- The potential to reduce outages by reducing congestion along the T&D network. Power outages and rolling blackouts are more likely when demand is high and the T&D system is stressed.
- The ability to reduce large-scale outages by increasing the diversity of the electricity system's generation portfolio with smaller generators that are geographically dispersed.
- The benefit to customers to provide back-up power sources available during outages through the combination of PV, control technologies, inverters and storage.

Without the addition of storage, community solar is unlikely to have an impact on grid reliability.

## Quantification Approach

- While there is general agreement across studies that integrating solar near the point of use will decrease stress on the broader T&D system, most studies do not calculate a benefit due to the difficulty of quantification.
- Our analysis has assumed that, because solar typically generates electricity during good weather conditions, no benefits associated with reliability would be realized.

## Impacted Stakeholders

No impacted parties have been identified. It has been assumed that solar will have minimal impact on impact on grid reliability as it produces electricity during relatively good weather conditions.

# Air Pollutants

Definition: The value from reducing carbon emissions and criteria air pollutant emissions is driven by the emission intensity of displaced marginal resource and the market price of emissions, and/or the cost of human health damages

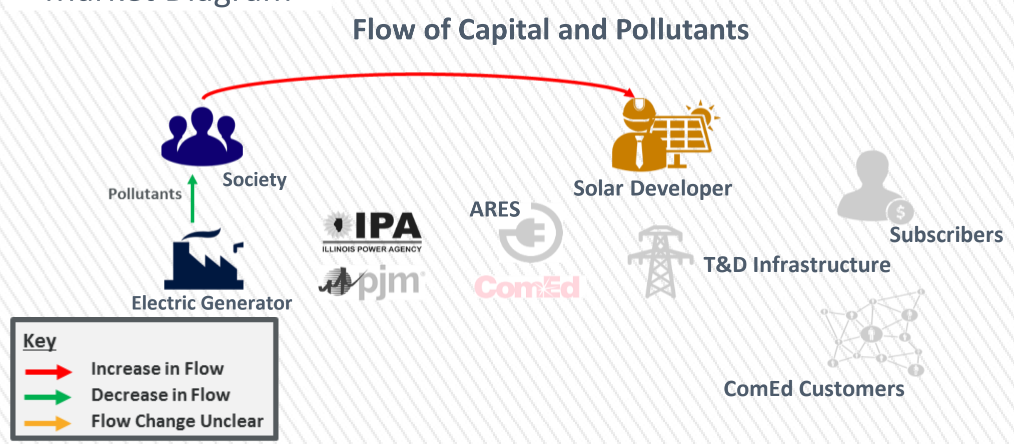
Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Solar, like other renewables, offsets electricity generation from another source that may be emitting greenhouses gasses or other emissions.

## Market Diagram




## Quantification Approach

- Two key components need to be considered when determining the value of avoided emissions: 1. The amount of emissions that are avoided; and 2. The cost of various types of avoided emissions.
- PJM has developed the average emissions rates for electric generators in the region using its Generation Attribute Tracking System. Emission factors for CO2, NOX and SOX are calculated yearly.
- Monetary values were calculated using assumed emissions costs from published scientific report[1].

## Impacted Stakeholders

**Society:** Society benefits from additional renewable energy as a reduction in greenhouse gasses and other criteria air pollutants results in potential heath benefits and avoided environmental damage. Tax payers help subsidize renewable energy through funding the federal investment tax credit, which helps offset the capital costs of solar.

[1]Schindell, Drew T. "The Social Cost of Atmospheric Release." *Climate Change*. Jan. 2015.

# Renewable Energy Credits

Definition: Tradable credits that represent all the clean energy benefits of electricity generated from a solar energy system. Each time a solar energy system generates 1 MWh of electricity, an SREC is issued which can then be sold or traded separately from the power

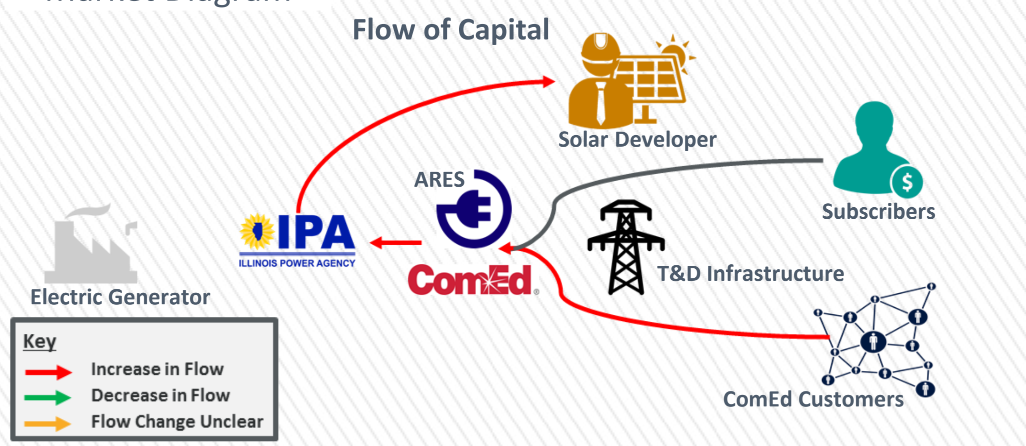
**Impact Category**

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

In Illinois, the Illinois Power Agency manages the Illinois Supplemental PV Procurement Program. Under the Future Energy Jobs Bill, the state will be creating an adjustable block program that procures RECs from distributed generation with a carve out for community solar.

## Market Diagram




## Quantification Approach

- Because the SREC market created under the Future Energy Jobs Bill has not yet been created, market prices can only be speculated.
- A range of SREC price projections were modeled to test the impact on solar developer and subscriber financials.
- RECs are funded through the Illinois Renewable Portfolio Standard, collected as a charge to Illinoisans on their electricity bill

## Impacted Stakeholders

- **Solar Developer:** Solar developers in Illinois will be eligible to participate in the IPA's SREC market, receiving payment for renewable energy credits from their community solar systems
- **Solar Subscriber:** Subscribers of community solar system will benefit indirectly from the SREC market. Developers will be able to offer lower subscription prices to subscribers if costs are being offset by SRECs or other incentives
- **ComEd Customers:** ComEd customers support funding for RECs through the RPS, collected through their electricity bill

# Utility Rebates

Definition: Cash incentives provided by the local electric utility for customers planning to install new solar PV systems

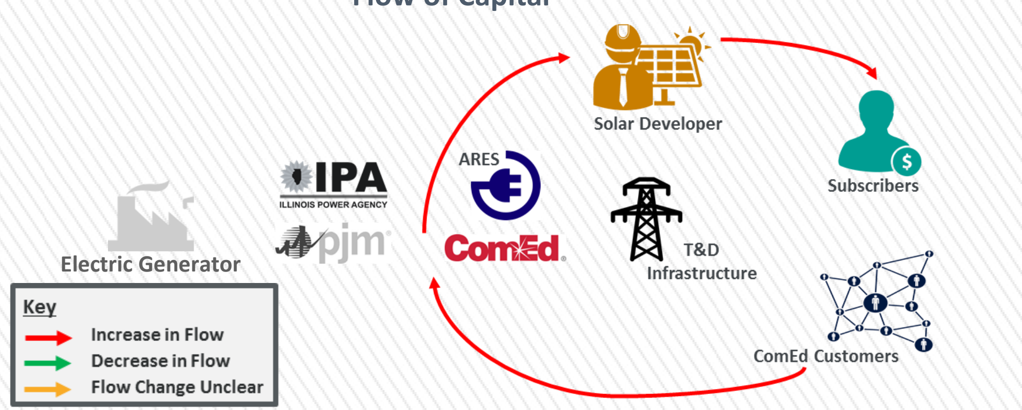
## Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- **Utility Rebates**
- Financial Risk

## Market Overview

Under the Future Energy Jobs Bill, ComEd has been directed to offer solar rebates in the amount of $250/kW for community solar developers or subscribers. Once 5% of utility supplied peak demand is utilizing net metering, the Illinois Commerce Commission will determine the value of the rebate for DER (related to the capacity on the circuit); the energy value will continue to be dependent on market prices.

## Market Diagram




## Quantification Approach

- Rebates were assigned to the developer in the amount of $250/kW.
- ComEd was modeled to earn a regulated rate of return on the rebates.
- The amount of the rebates plus the rate of return was assumed to be funded by ComEd customers.

## Impacted Stakeholders

- **T&D Utility:** ComEd will earn a rate of return on the rebates
- **Solar Developer:** Solar developers within ComEd's service territory will be eligible for the $250/kW rebates
- **Electric Customer:** Rebates for community solar will be funded through customer rates
- **Solar Subscriber:** Subscribers of community solar will benefit indirectly from the utility rebates. Developers will be able to offer lower panel purchase or lease prices to subscribers if costs are offset by utility rebates or other incentives

# Financial Risk

Definition: The reduction in financial risk or overall market price due to the addition of solar. Two components typically considered are fuel price hedge and market price suppression

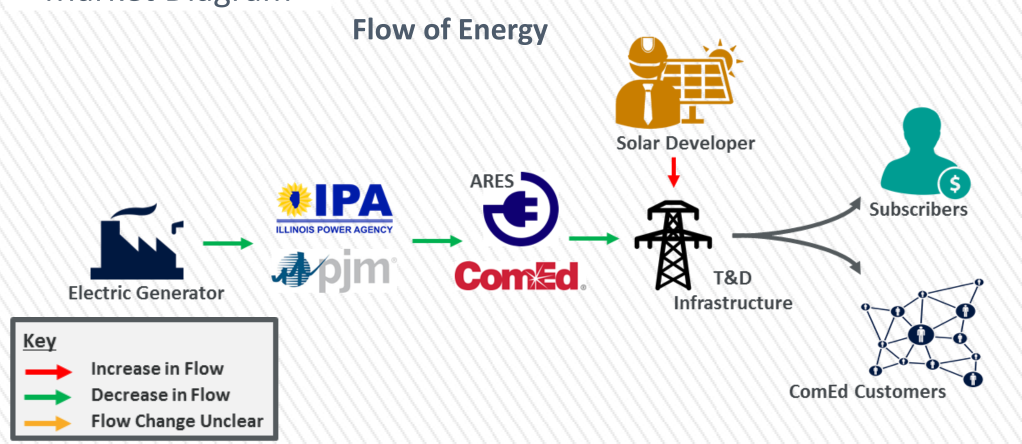
Impact Category

- Avoided Energy Generation
- System Losses
- Ancillary Services
- Generation Capacity
- Transmission Capacity
- Distribution Capacity
- Reliability & Resiliency
- Air Pollutants
- Renewable Energy Credits
- Utility Rebates
- Financial Risk

## Market Overview

Energy and capacity are procured competitively in the PJM market. The addition of community solar to an could result in diversity-related benefits, which include providing a physical hedge against uncertain future fuel prices and insurance against the impact of higher future fuel prices or changes in emissions policy.

## Market Diagram




## Quantification Approach

- Two potential market-price benefits to consumers might result from adding solar to the generation system: reducing wholesale electricity prices and reducing natural gas (and other fossil fuel).
- Price suppression impacts would likely only be seen at very high penetrations of solar and be temporary due to other higher cost generators exiting the market.
- Due to the penetration levels of solar required to see a price suppression effect in the market, financial risk was not quantified as part of this analysis.

## Impacted Stakeholders

- **Electric Generator:** Electric generators may be impacted by the introduction of community solar in the market. They will likely experience a loss in profit if market prices are suppressed
- **Electric Customer:** Electric customers may benefit if community solar provides a hedge against rising fuel prices or market price suppression. This will be realized as a reduction in the supply component of their electricity bill

# Scenarios and Sensitivities

# Base Case Modeling Scenarios

- Different scenarios can be analyzed using the model to determine how these inputs impact the financial metrics for each stakeholder group

- A "Base Case" configuration was developed given current business models and practices
  - A panel lease and panel purchase model were both examined as representative subscriber models; the lease model assumes all costs are spread out over the life of the project while the purchase model assumes all costs are paid upfront
  - Alternative configurations may be implemented by developers. Examples of hybrid models include short-term leases or paying the panel costs upfront and a small ongoing administration fee over time

# Base Case Modeling Scenarios (Continued)

- To determine the relative impacts of different variables, a sensitivity analysis was run modeling alternative scenarios:

| Variable | Base Case | Alternative Scenarios |
|---|---|---|
| System Type: | Ground Mount | Rooftop; Canopy |
| System Size: | 1,000 kW | 500 kW; 2,000 kW |
| Ownership Entity: | Tax-Exempt Entity | Non Tax-Exempt Entity |
| Subscription Model: | Panel Lease | Panel Purchase |
| Acquisition Costs: | Moderate ($0.33/Watt) | Easy ($0.26/Watt), Difficult ($0.42/Watt) |
| Years to Full Subscription: | 3 | 0; 5 |
| SREC Values: | $45 (See Subsequent Slides) | $0; $100 |
| Financial Incentives: | $250/kW | $0; $500/kW |
| Installed Costs: | $2.31/Watt (Ground Mount) | 50% Increase, Decrease in Costs |
| Panel Purchase Price: | $230 (See Subsequent Slides) | $175, $300 |
| Panel Lease Price: | $1.68 (See Subsequent Slides) | $1.50, $2.00 |

# Solar Renewable Energy Credit Assumptions

- Because the Illinois Power Agency (IPA) solar renewable energy credit (SREC) market described in the Future Energy Jobs Bill has not yet been created, future SREC values are unknown

- To determine base case SREC values for modeling purposes, an analysis was conducted to examine the tradeoffs to a system owner between SREC prices and the price they charge a customer to subscribe (expressed as a panel lease, panel purchase, or power subscription)

- This analysis was done for the panel lease scenario, as this is expected to be the most common subscriber model

# SREC Assumptions (Continued)

- It was assumed that a subscriber should realize savings each year, or at a minimum break even. The panel lease was therefore determined to have a maximum threshold price equal to the bill credit rate, as calculated below:
  - **Average panel size: 300 W**
  - **Average monthly panel generation (year 1): 28.7 kWh**
  - **Subscriber supply credit rate (year 1): $0.0587/kWh**
  - **Average monthly bill credit per panel = $0.0587/kWh * 28.7 kWh**
  - **Average monthly bill credit per panel = $1.68/panel**
- A lease price of $1.68 per panel per month was considered to be the “threshold” price at which a subscriber would be willing to participate in a community solar program, as the average bill credit would be $1.68 per panel in year 1
- Because the panel price is assumed to be held constant while electricity prices escalate year over year, subscribers will realize greater savings over time
- With all other parameters held constant, alternative SREC values and monthly panel prices were simulated to determine their impact on the developer IRR with the intent of identifying those values where the IRR was 10% or above (see table on following slide)

# SREC Assumptions (Continued)

SREC Values

Monthly Panel Lease Price

| | $0 | $5 | $10 | $15 | $20 | $25 | $30 | $35 | $40 | $45 | $50 | $55 | $60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $1.54 | -0.1% | 0.6% | 1.4% | 2.3% | 3.2% | 4.2% | 5.3% | 6.4% | 7.7% | 9.1% | 10.5% | 12.0% | 13.7% |
| $1.56 | 0.1% | 0.8% | 1.6% | 2.4% | 3.4% | 4.3% | 5.4% | 6.6% | 7.9% | 9.2% | 10.7% | 12.2% | 13.8% |
| $1.58 | 0.2% | 1.0% | 1.7% | 2.6% | 3.5% | 4.5% | 5.6% | 6.7% | 8.0% | 9.4% | 10.8% | 12.3% | 13.9% |
| $1.60 | 0.4% | 1.1% | 1.9% | 2.7% | 3.7% | 4.7% | 5.7% | 6.9% | 8.2% | 9.5% | 10.9% | 12.5% | 14.1% |
| $1.62 | 0.6% | 1.3% | 2.1% | 2.9% | 3.8% | 4.8% | 5.9% | 7.0% | 8.3% | 9.6% | 11.1% | 12.6% | 14.2% |
| $1.64 | 0.7% | 1.4% | 2.2% | 3.1% | 4.0% | 5.0% | 6.0% | 7.2% | 8.4% | 9.8% | 11.2% | 12.7% | 14.3% |
| $1.66 | 0.9% | 1.6% | 2.4% | 3.2% | 4.1% | 5.1% | 6.2% | 7.3% | 8.6% | 9.9% | 11.4% | 12.9% | 14.5% |
| $1.68 | 1.0% | 1.7% | 2.5% | 3.4% | 4.3% | 5.3% | 6.3% | 7.5% | 8.7% | 10.1% | 11.5% | 13.0% | 14.6% |

- At $45/REC, a developer could charge $1.68/panel/month to obtain the target IRR (10%). Because this also produced a positive business case for subscribers, $45/REC was used as the baseline REC value

- If RECs are offered at higher prices, developers can charge less to subscribers and still earn the target IRR

# SREC Assumptions (Continued)

- To determine the baseline panel price for the Panel Purchase scenario, SREC values were held at $45/REC
- For a developer to achieve the same NPV as the panel lease scenario, the panel price would need to be set to $230/panel

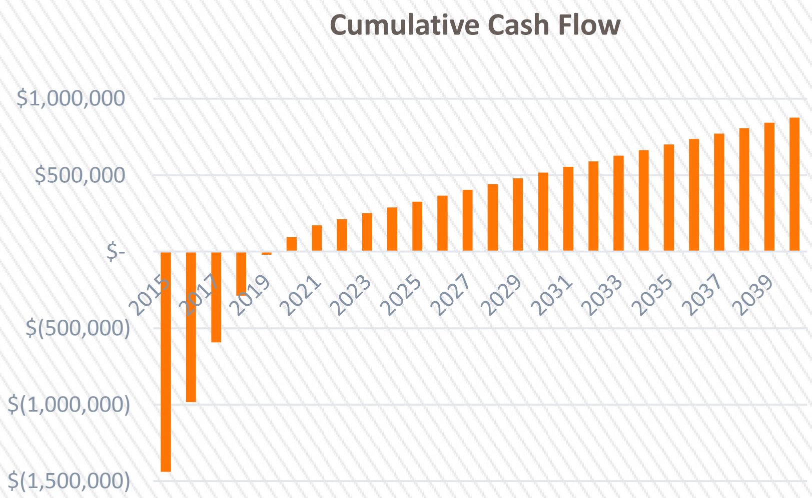
# Representation of Market Impacts

| Impact Category | Quantified in Model | Model Output Value Range |
|---|---|---|
| Avoided Energy Generation | ✓ | ▪ Electric Generator Lost Profit: $1.404/watt<br>▪ ARES Lost Profit: $0.098/watt |
| System Losses | ✓ | ▪ Electric Customer Benefit: $2.48/MWh<br>▪ Electric Generator Lost Profit: $0.098/watt |
| Ancillary Services | | ▪ N/A |
| Generation Capacity – Short Term | ✓ | ▪ Short-Term Electric Customer Cost Transfer: $0.013/watt |
| Generation Capacity – Long Term | ✓ | ▪ Long-Term Electric Customer Benefit: $0.535/watt<br>▪ Electric Generator Lost Profit: $0.535/watt |
| Transmission Capacity – Short Term | ✓ | ▪ Short-Term Electric Customer Cost Transfer: $0.057/watt |
| Transmission Capacity – Long Term | | ▪ N/A |
| Distribution Capacity | | ▪ N/A |
| Reliability and Resiliency | | ▪ N/A |
| Air Pollutants | ✓ | ▪ Social Benefits: $3.328/watt<br>▪ Social ITC Payments: $0.675/watt - $0.900/watt |
| Renewable Energy Credits | ✓ | ▪ Developer Benefits: $0.749/watt<br>▪ Electric Customer Cost Transfer: $0.749/watt |
| Utility Rebates | ✓ | ▪ T&D Utility Revenue: $0.012/watt<br>▪ Developer Benefits: $0.250/watt<br>▪ Electric Customer Cost Transfer: $0.262/watt |
| Financial Risk | | ▪ N/A |

# Community Solar Project Economics

## Base Case Panel Lease Analysis: Developer

### Project Financial Analysis




**Key Financial Metrics**

- **25-Year Costs:** $3,395,735
- **25-Year Revenues:** $4,018,209
- **25-Year Net Benefits:** $622,474
- **25-Year Net Present Value (NPV):** $111,389
- **Internal Rate of Return:** 10.0%
- **Return on Investment (ROI):** 18.3%
- **Payback Period:** 4.2 years

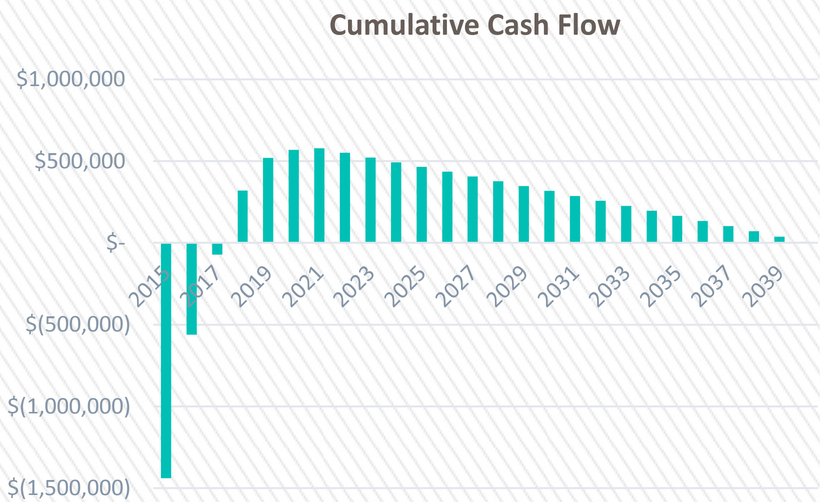
### Results Interpretation

- Using the base case assumptions, a developer is expected to achieve positive economic results over time
- Assuming the system owner takes on no debt to finance the system, they can expect to see a payback of just 4.2 years and an NPV of ~$110,000 over the system life
- Relative to a panel purchase, a lease has a lower IRR and payback, but higher net benefits since the system owner collects payments over time to help offset O&M

# Community Solar Project Economics

## Base Case Panel Purchase Analysis: Developer

### Project Financial Analysis




**Key Financial Metrics**

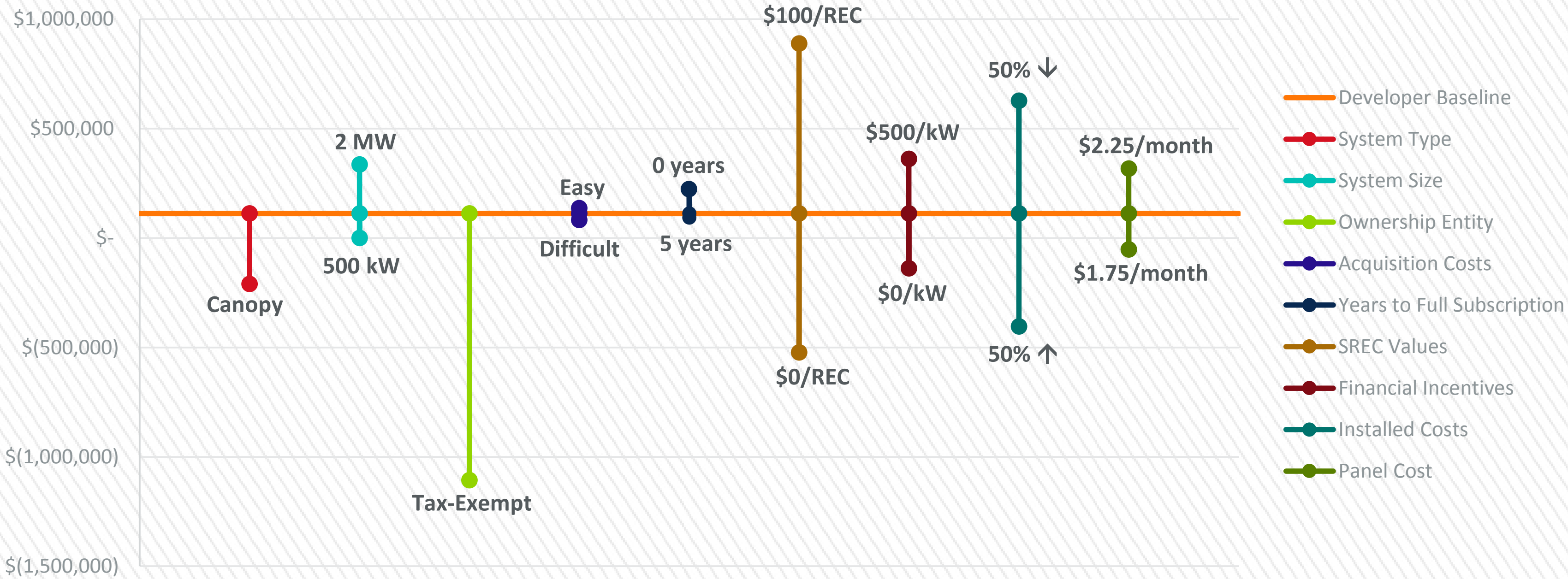
- **25-Year Costs:** $3,395,735
- **25-Year Revenues:** $3,147,259
- **25-Year Net Benefits:** ($248,476)
- **25-Year Net Present Value (NPV):** $111,389
- **Internal Rate of Return:** 16.0%
- **Return on Investment (ROI):** (7.3%)
- **Payback Period:** 2.2 years

### Results Interpretation

- Using the IRR as a metric of project health shows that a subscription model has a higher return than the panel lease model to the developer, but lower 25-year net revenues
- The panel purchase model produces a higher IRR and payback due to faster recovery of invested capital
- Net revenues under the panel lease model must be higher to than in the purchase model to obtain the same NPV because cash flows in the later years are discounted; in the purchase model the upfront payments are not discounted as heavily
- While costs are initially made back, economics worsen overtime as the system owner must continue to support the O&M costs of the project without revenue being collected from subscribers

# Community Solar Project Economics

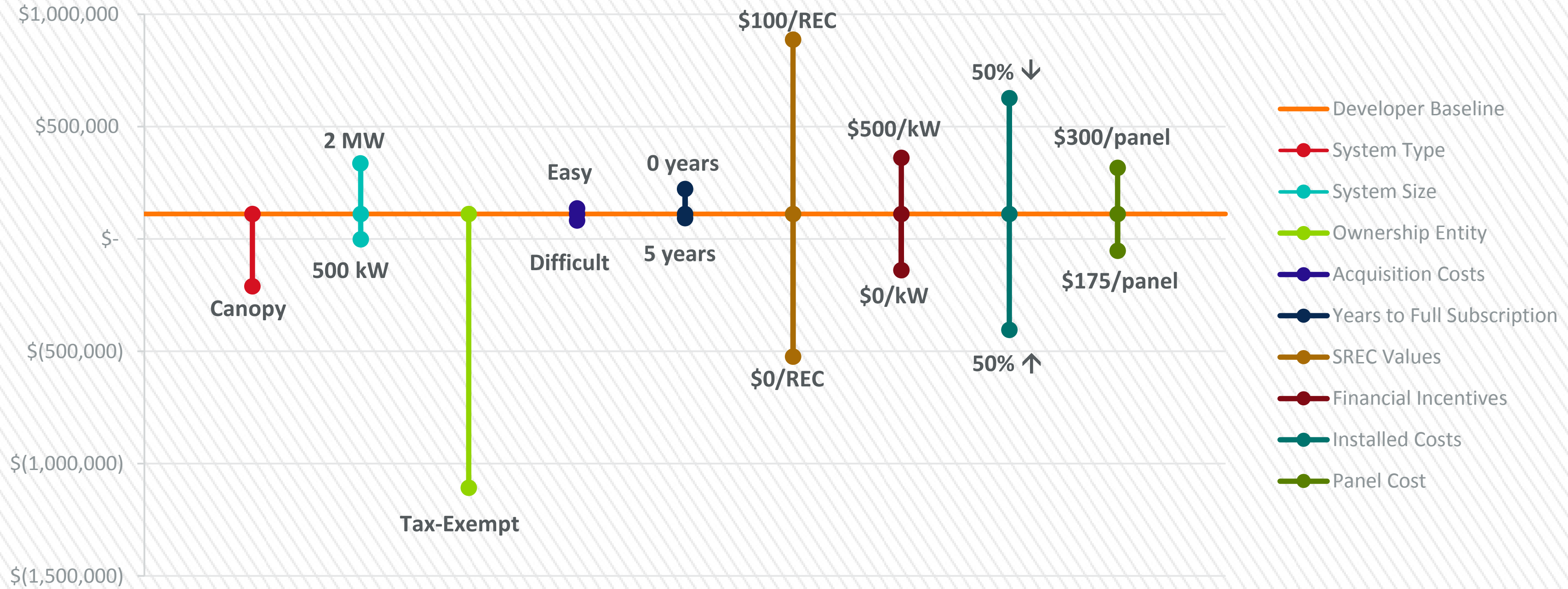
## Panel Lease Sensitivity Analysis: Developer




- The ownership model has the largest potential impact to subscriber costs. The loss of tax benefits causes the developer NPV to drop to below -$1,000,000
- The SREC market will be critical in determining the economic viability of community solar. Without SRECs and utility rebates, the community solar will not be viable in the IL market
- Larger systems and reduced costs for acquisition and construction will improve economics

# Community Solar Project Economics

## Panel Purchase Sensitivity Analysis: Developer

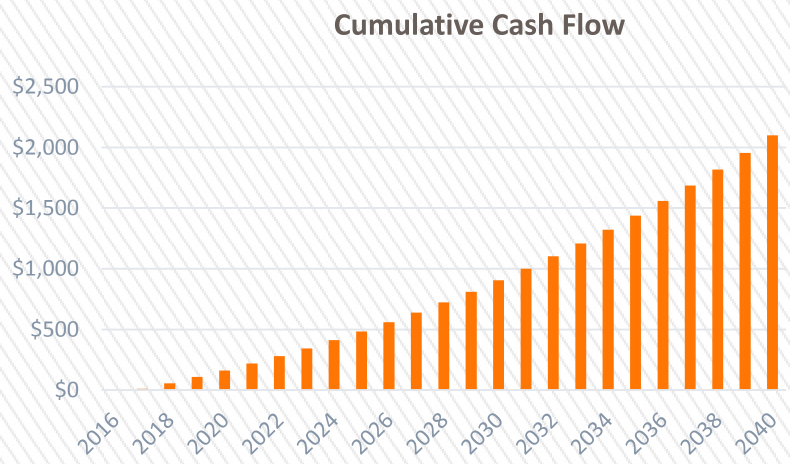



- The direction of each sensitivity remains the same between the panel purchase and lease models
- Like the panel lease model, tax exempt entities cannot own the generation and realize viable economics

# Subscriber Panel Economics

## Base Case Panel Lease Analysis: Subscriber

### Financial Analysis




**Key Financial Metrics**

- **25-Year Costs:** $5,040
- **25-Year Revenues:** $7,139
- **25-Year Net Benefits:** $2,098
- **25-Year Net Present Value (NPV):** $554
- **Internal Rate of Return:** N/A
- **Return on Investment (ROI):** 41.6%
- **Payback Period:** 0 years

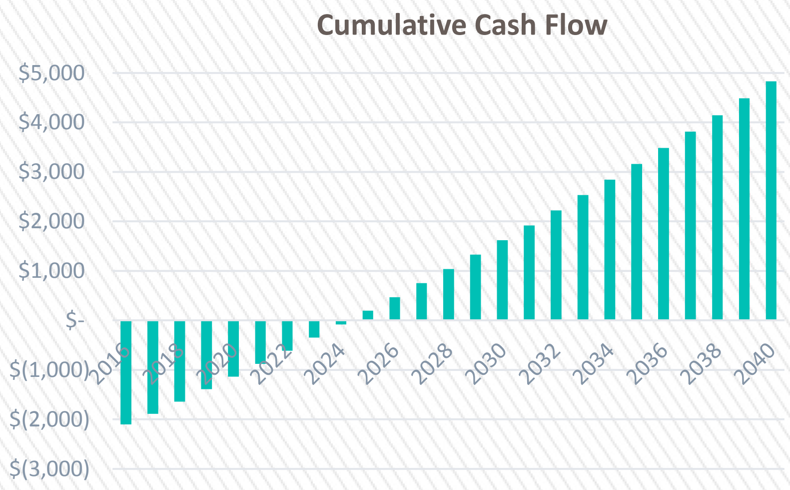
### Results Interpretation

- Under the lease model, subscribers break even in year 1 and begin to see positive returns in year 2
- Savings are expected to be greater in the later years because the price of electricity was modeled to increase at a rate of 2.78% annually, while the panel lease price remains the same and output decreases by just 0.5% annually

# Subscriber Panel Economics

## Base Case Panel Purchase Analysis: Subscriber

### Financial Analysis




**Key Financial Metrics**

- **25-Year Costs:** $2,206
- **25-Year Revenues:** $7,138
- **25-Year Net Benefits:** $4,832
- **25-Year Net Present Value (NPV):** $287
- **Internal Rate of Return:** 11.8%
- **Return on Investment (ROI):** 210%
- **Payback Period:** 9.0 years

### Results Interpretation

- Generally, financial metrics for subscribers vary under the purchase model
- While net benefits are higher, they will experience a ~9 year payback period to recoup their investment, instead of realizing benefits in year 1
- The NPV appears lower because the savings realized in the later years are discounted more heavily that savings made early in the project lifetime

# Sample Customer Bill Breakdown

- As shown in the sample bills below, single family residential customers can expect to see savings of $25/month during the summer months, which may be greater than the lease price in Year 1

- Savings increase over time – by year 10, customers can expected to see a savings of $36/month

**Sample Customer* Monthly Bill: June, Year 1**
Without Community Solar Subscription

- Monthly Consumption: 985 kWh
- Monthly Bill: $104.43

**Sample Customer Monthly Bill: June, Year 1**
With Community Solar Subscription

- Panel Subscription: 10 300-Watt Panels
- Solar Generation: 442 kWh
- Solar Credit: $25.92
- Monthly Bill: $78.51

Estimated Monthly Lease Payment: $16.80

**Sample Customer* Monthly Bill: June, Year 10**
Without Community Solar Subscription

- Monthly Consumption: 985 kWh
- Monthly Bill: $142.51

**Sample Customer Monthly Bill: June, Year 10**
With Community Solar Subscription

- Panel Subscription: 10 300-Watt Panels
- Solar Generation: 431 kWh (reflects 0.5% annual derate)
- Solar Credit: $35.77
- Monthly Bill: $106.74

Estimated Monthly Lease Payment: $16.80



- Monthly savings will vary; more savings will be realized during months with more sunlight

*Average ComEd single family without space heat consumption

# T&D Utility Impacts

- Many of the benefits of community solar traditionally thought to impact the utility were found not to be applicable for a wires-only company. Because ComEd does not own generation, community solar will not result in a reduction in utility-generated electricity. Instead, ComEd will reduce the procurement of generation and capacity, which will be passed as savings to ComEd customers

- Similarly, possible impacts to the transmission and distribution infrastructure will be passed as additional costs or savings to ComEd's customers
  - If solar was added to a loaded circuit, it could defer the investment in additional transmission capacity
  - Community solar could help reduce the system peak and, in turn, defers distribution system upgrades
  - Community solar may also increase the need to for grid-related advancements to support community solar and create visibility to the grid (system control, data upgrades, digital relays)

- ComEd earns a rate of return on the rebates issued for community solar, providing a benefit

- ComEd will likely develop or purchase a new billing process to credit subscribers. While the process is planned to be manual initially, their customer relationship management system will be modified to process bill credits electronically. Going-forward costs and allocation of costs is indeterminate at this time



- A summary of the directional impacts of each of the market categories to the T&D utility can be found on the following slide

# T&D Utility Impacts (Continued)

- A majority of the considered market impacts were found to be not applicable or accrue to another stakeholder group

| Market Impact Category | Directional Impact to Utility | Utility Impact Description |
|---|---|---|
| Avoided Energy Generation | No Impact | N/A – benefits passed to customer |
| System Losses | No Impact | N/A – benefits passed to customer |
| Ancillary Services | No Impact | N/A – costs or benefits passed to customer |
| Generation Capacity – Short Term | No Impact | N/A – no realized short-term costs or benefits |
| Generation Capacity – Long Term | No Impact | N/A – benefits passed to customer |
| Transmission Capacity – Short Term | No Impact | N/A – no realized short-term costs or benefits |
| Transmission Capacity – Long Term | No Impact | N/A – benefits passed to customer |
| Distribution Capacity | No Impact | N/A – benefits passed to customer |
| Reliability and Resiliency | No Impact | N/A – no realized costs or benefits |
| Air Pollutants | No Impact | N/A – benefits accrue to society |
| Renewable Energy Credits | No Impact | N/A – benefits accrue to developer/subscriber |
| Utility Rebates | Positive Impact | T&D Utility Revenue: $0.012/watt from issued rebates |
| Financial Risk | No Impact | N/A – benefits passed to customer |

Positive Impact · Negative Impact · Direction of Impact Unknown · No Impact

# Impacts to Other Stakeholders

- The directional impact of community solar to the other considered stakeholders in shown in the table below
- Where values were quantified, the magnitude ranges have been documented

| Stakeholder | Community Solar Impact | Direction | Value Range |
|---|---|---|---|
| **Electric Customers** | ▪ Over the course of project, electric customers are expected to experience a positive impact from community solar<br>▪ A reduction in purchased capacity, purchased generation, and a reduction in unaccounted for energy from reduced system losses, will be passed through to customers<br>▪ In the near-term, customers may experience a cost shift from the generation capacity and transmission capacity charges that are no longer collected from subscribers<br>▪ The costs of the community solar rebates will also be funded by ComEd customers | ● (yellow) | ▪ Savings from reduced system losses: $0.098/watt<br>▪ Savings from reduced energy: $1.404/watt<br>▪ Savings from reduced generation capacity: $0.535/watt<br>▪ Bill increase from short-term capacity and transmission cost transfer: $0.070/watt<br>▪ Bill increase from community solar rebates: $0.262/watt |



● Positive Impact ● Negative Impact ● Direction of Impact Unknown ● No Impact

# Impacts to Other Stakeholders (Continued)

| Stakeholder | Community Solar Impact | Direction | Value Range |
|---|---|---|---|
| **Electric Generators** | ▪ If the market is made competitive for community solar through the availability of incentives, some electric generator will ultimately be displaced. Marginal units may be called upon to generate less or not generate at all<br>▪ Generators will experience losses from avoided energy generation, which will be amplified through a reduction in system losses<br>▪ Capacity contracts with generators may also not be renewed due to added capacity from community solar | Negative Impact (red) | ▪ Lost profit from avoided energy: $1.404/watt<br>▪ Lost profit from reduced system losses: $0.098/watt<br>▪ Lost profit from avoided generation capacity: $0.535/watt |
| **Alternative Retail Electric Suppliers** | ▪ ARES often earn percent mark up on the energy they supply<br>▪ If less energy is being purchased from an ARES because a customer is subscribing to community solar, they will experience a loss in profit | Negative Impact (red) | ▪ Lost profit from avoided energy: $0.021/watt |
| **Society** | ▪ Society will benefit from avoided emissions produced by traditional electric generators<br>▪ Society helps subsidize solar through the federal ITC | Direction of Impact Unknown (yellow) | ▪ Improved health impacts from reduced $CO_2$: $1.026/watt<br>▪ Improved health impacts from reduced $SO_2$: $1.807/watt<br>▪ Improved health impacts from reduced NOX: $0.485/watt<br>▪ ITC Payments: $0.675/watt - $0.900/watt |



Positive Impact · Negative Impact · Direction of Impact Unknown · No Impact

# Findings and Next Steps

# Key Findings: Market Viability

- The community solar program framework and incentives outlined in the Future Energy Jobs Act are anticipated to create a viable community solar market in Cook County, IL
- While the base case analysis indicates that a positive business case for community solar is possible for the system owner and subscriber, the financial metrics are not supported if certain conditions are not met
  - Owners must be able to take advantage of federal tax credits
  - SRECs and utility rebates must be available to developers
- Because receiving tax credits will be critical to ensuring positive economics, we expect to see interested non-profits and other tax-exempt entities participating as host-sites only or anchor subscribers instead of system owners. “Flip-structure” opportunities, where a third-party serves as the owner for the first 5 years of the project to receive the tax credits and then sells to a tax-exempt entity, may also be attractive to these parties
- SRECs and rebates must also be offered at sufficient prices to create a viable market for community solar. The SREC price in the base case scenario represents the estimated value that must be offered to support community solar today; actual SREC prices when the market opens in 2018 could be higher or lower, which could spur or hinder the market. When the 5% net metering cap is reached, rebates are also likely to change, which will also have market impacts

# Key Findings: Market Viability (Continued)

- An inverse relationship exists between SREC prices and the price that developers charge subscribers when financial metrics are held constant. Higher SREC values may have a trickle down effect to decrease panel lease/purchase prices and increase subscriber demand

- There are tradeoffs between a panel purchase and panel lease structure for both the system owner and subscriber
  - The panel purchase model allows developers to collect more dollars upfront, however they may run into an issue where, overtime, they must pay for annual system O&M without collecting subscriber fees to help offset such costs
  - Subscribers stand to spend less and have higher net benefits with the panel purchase model, but it takes them longer to recover their costs. The panel lease model is expected to allow subscribers to realize a payback over a shorter time period

- Other project factors that influence the business case include:
  - Project size – larger projects are able to realize economies of scale and improved project economics
  - System type – rooftop and ground mount systems are expected to be more economic than a carport canopy due to the avoided racking costs
  - Subscriber acquisition – reducing the out of pocket costs or level of effort required to acquire customers will have a positive impact on economics. Additionally, obtaining subscribers more quickly (ie, reducing the years to full subscription) will improve economics

# Key Findings: Stakeholder Implications

- Many of the benefits of community solar traditionally thought to impact the utility were found not to be applicable for a wires-only company
  - Because costs associated with energy generation and capacity are passed directly to customers, any savings from displacing a traditional generator would be realized by the electric customers, not the utility
  - Similarly, avoided investments in transmission and distribution infrastructure would be passed to customers. For this analysis, it was assumed no benefits would be realized for a single project
  - ComEd is expected to earn a rate of return on the rebates offered through the Future Energy Jobs Act, providing a benefit

- Electric Customers are anticipated to experience short term cost shifts but long-term benefits
  - In the near term, we expect cost shifting of some bill components between subscribers and electric customers. Costs associated with transmission and generation capacity have already been planned in the short-term, and will be spread over a smaller customer base when subscribers are credited for their community solar generation
  - Over time, as noted above, savings associated with energy generation and capacity would be passed directly to electric customers, producing positive net impacts to them

- Electric generators are expected to suffer some displacement with increased penetration of community solar
  - Retail electric suppliers earn a margin on the electricity they supply. If they supply less due to a customer's participation in a community solar, they are expected to realize a loss in profit

# Next Steps

- The financial model used in this analysis will feed into additional project areas:
  - > **Pilot Site Analysis (Task 5.1)** - conduct feasibility studies for the selected pilot sites and disseminate lessons learned
  - > **Local Impact Analysis (Task 5.2)** - use model to aggregate costs and benefits on a regional level to derive total local net benefits of increased shared solar systems
  - > **Regional Directives (Task 5.3)** - apply anticipated solar deployment levels against city, county and state renewable energy goals and the expected contributions from this initiative

- Projected Timeline:


March 2017 | May 2017 | May 2017 | June 2017

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