# Proposed Business Case: Employee Benefits Model

Community Solar for United Airlines Data Center


System Owner:
***Developer***

Installation Type:
***Rooftop***

Subscriber Model:
***Panel Lease Model***

Host Site Owner:
***Commercial***

System Size:
***1,410 kW***

Subscribers
***137***

**September, 2017**

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# Contents

# Case Study

## Overview

The United Airlines Data Center, main campus building is LEED Silver certified and ideal for solar. It has the capacity to accommodate a rooftop system of more than 1.4 MW. This proposed model is unique in allowing United Airlines to partner with a solar developer to offer direct benefits to their employees and the surrounding community. This model allows employees to lease panels with no upfront costs and save 20 percent on the cost of their electricity, starting the first year. United Airlines would be able to subscribe to 40 percent of the energy produced and would see additional revenue from site lease payments. They would also be able to extend benefits to the surrounding community if they choose, with the ability to serve nearly 200 subscribers.

## Business Case Assumptions

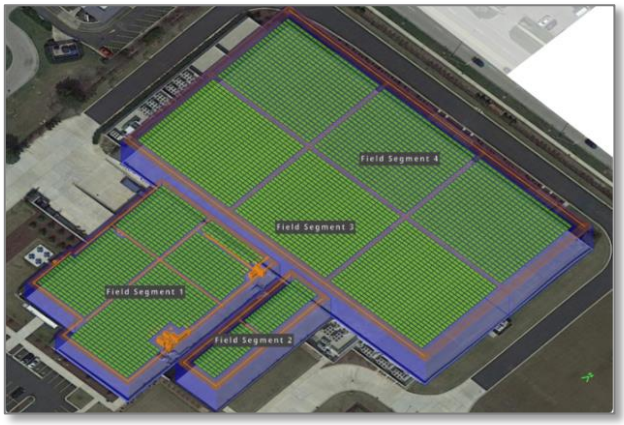
The intent of this proposed business case is to provide a high-level assessment of installing solar at this location and providing a rationale and proposed model for operating a community solar program. While system designs, assumptions and costs are provided in this report, they are not intended to serve as construction ready drawings or designs, financial pro forma or commitments. It is assumed that each site, stakeholder or solar developer will pursue design, engineering, interconnection and business planning separately and specifically. Neither Cook County nor any person acting on their behalf (a) makes any warranty, express or implied, with respect to the use of any information or methods disclosed in this report or (b) assumes any liability with respect to the use of any information or methods disclosed in this report.

# Site Assessment

The new, LEED certified, United Airlines Data Center in Des Plaines, has more than 200,000 safe of available roof space. The roof is a perfect, flat roof with 30 years remaining on the warranty. While the roof has several different levels and some obstructions from rooftop equipment, it is ideal for solar and is anticipated to be able to house a 1.4 MW system. This 30 acre campus is open and easy to access. The tree coverage surrounding the building is at a height that will not shade modules. All in all, this is an ideal structure for ballasted rooftop solar.

## Shading Analysis

An analysis was conducted to determine the impact of shading on the kWh output of the proposed system design. The HelioScope software program was used to determine the amount of shading and corresponding reduction in kWh output. The results of the shading analysis indicate that annual rated kWh output will be reduced by 0.8% due to shading between rows and from the parapets and equipment on the building roofs.




## Mounting Structures

The proposed design uses a ballasted racking system for mounting modules instead of an attached system. A ballasted system avoids penetrating the roof membrane to attach the solar panels. Instead the modules are attached to trays with ballast weights to hold the structurs in place and to counteract the effects of wind uplift. By not piercing the roof membrane, the warranty will remain intact, which is critical for a newly installed roof. Wind deflectors can be attached to the modules to decrease the required ballast weight, resulting in a system with a total superposed uniform load of less than 5 pounds per square feet (psf). Applications are limited to low slope roofs with a pitch of 10 degrees or less, which works perfectly for this roof.

## Roof Load Capacity

While the engineering team was not able to visit the roof, drawings were analyzed to determine construction type and load capacity. The roof on this structure includes a steel roof deck with a ballasted slab. Due to the existence of the cast-in-place ballast slab and the relatively low incremental increase in load created by the proposed ballast system, structural reinforcement will most likely not be required for this building. The roof is designed for a minimum of 40 pounds per square foot (psf) hanging live load with a capacity of 50 psf for the majority of the roof. The roof is design to handle an additional snow load of 25 psf. The additional weight due to typical solar panels and the ballast system is in the order of 4.5 psf, less than 5% of the total design load. As such no structural reinforcements are likely necessary.

## Permitting

All panels are proposed to be roof mounted for this site. Thus, only building permits are anticipated to be required.

## Interconnection

The United Airlines Data Center site is fed from a 3-phase 34kV line supplying power underground to customer-owned transformers located in the middle of the complex. The interconnection will require the installation of a power transformer, fused disconnect, relaying, and metering equipment at the interconnect point. The ComEd distribution system may require a relay upgrade for the feeder based on the pre-screen interconnection report completed by ComEd. These anticipated costs have been factored into our site preparation budget and financial models. But, a formal ComEd interconnection study will need to be performed to determine actual interconnection requirements and costs.

### The Customer Side of the Meter

The upgrades required on the customer's side of the meter include a relay protection device, a distribution panel, as well as cabling and connection equipment to bring the power from the system to the grid. These costs are all incurred by the system owner. The system owner also incurs the cost for all construction, engineering and the interconnection application. Total interconnection costs are equivalent to about $.11 per installed watt, slightly higher than the industry average of $.09.

| Customer Side Materials Costs | |
|---|---|
| Relay for DER Protection | $1,000 |
| Distribution Panelboard | $6,000 |
| Cabling / Conduit | $9,600 |
| **Total** | **$16,600** |
| **Utility Side Materials Costs** | |
| Potential Transformer | $400* |
| 1,500 kVA Power Transformer | $50,000* |
| Fused Disconnect Switch | $5,000* |
| Meter | $300* |
| **Total** | **$24,700*** |

**Rider NS, Not in upfront total*

### ComEd Side of the Meter

At the ComEd distribution station, the feeder is presently protected at the substation. ComEd will need to perform some minor off-property work such as replacing a fuse, based on ComEd's Pre-screen report. ComEd will incur the costs of upgrading the transformers, switch and meter. The customer will pay a monthly fee for these upgrades via the Nonstandard Rider (Rider NS), typically $200 to $400 per month.

| Total Customer Interconnection Costs | |
|---|---|
| Engineering | $20,000 |
| Construction | $100,000 |
| Materials | $16,600 |
| Interconnection Application | $1,500 |
| **Total** | **$147,100** |

# System Design

## Panel Layout

The proposed design for the United Airlines Data Center includes module arrays using fixed ballasted racking systems over several rooftop areas. This simple, yet large design includes the installation of 4,345 total modules. Shading is minimal for these locations and has a small impact on system losses and output. Our design has rated an output of 1.41 MW capable of producing approximately 1.789 GWh annually. This PV system design has an estimated cost of $1.78 per installed watt.

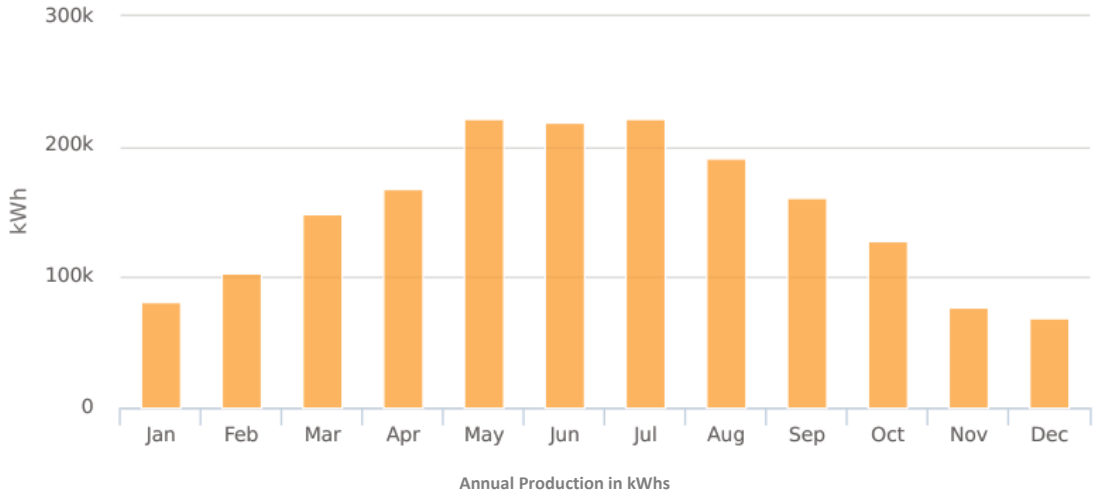
## System Components and Costs

The proposed system includes (4,345) 325-watt panels over three roof segments. The system design uses 20 small inverters. for cost effectiveness and to minimize the effect of inverter down time. With a number of small inverters, only a small part of the system will be taken out of service if there is a failure. Utilizing 1,000VDC strings allows a larger number of PV modules per string and reduces cost. Using 480AC three-phase for power distribution is recommended to minimize voltage drop.

| System Parameters | |
|---|---|
| System Size (Capacity)(kWDc) | 1,410 |
| Anticipated Number of Panels | 4,345 |
| Nameplate Module Efficiency (%) | 16.72 |
| Module Type: | CS6U-325 |
| Module Mass: | 22.4 kg |
| Installation Type | Fixed |
| Rooftop, Ground-Mount, Canopy | Rooftop |
| Mounting Approach (tilt, ) | 8, 10 and 17° Tilt |
| Array Azimuth | 179° |
| System Losses | 18.3% |
| Inverter Efficiency | 99% |
| DC to AC Size Ratio | 1.19 |

## System Performance

HelioScope software was used to analyze the anticipated power generation performance of the system based on the proposed design. HelioScope uses solar irradiance data from the closest possible set of typical meteorological data (TMY). In this case, the nearest set of TMY for this site is from O'Hare Airport. Based on this analysis, the system is anticipated to generate 1,789 megawatt hours per year. This is enough to power 224 typical Cook County homes.




## Operations and Maintenance

A robust maintenance plan can ensure optimal system performance. The U.S. Dept. of Energy suggests that an optimal operations and maintenance (O&M) plan for solar arrays can increase typical performance from 91% to 95%. The components of O&M include site maintenance, electrical inspections and panel maintenance. By far, the single biggest expense for maintaining solar arrays is inverter maintenance and replacement. Most inverters have a planned mechanical life of about 10 years, which this model assumes.

| O&M Costs $/kW | |
|---|---|
| General Site Maintenance | $1.40 |
| Electrical Inspection | $2.49 |
| Panel Washing | $0.82 |
| Inverter Maintenance | $4.08 |
| Inverter Replacement | $6.22 |
| **Total** | **$15.00** |

# Business Model

## Ownership Structure

The proposed model allows a developer to design, build and maintain the system. The developer benefits from SRECs, tax benefits and the $250 per kW capacity incentive. Subscribers lease panels and receive savings immediately, with savings increasing over the life of the system. The host site is the anchor subscriber, taking 40 percent of the power. Host site earnings from leasing and energy savings would be $10,353 in the first year and increase each subsequent year. The developer sees an Internal Rate of Return of 16.1 percent and a simple payback of 3.3 years. The economies of scale, ease of installation and maximizing of incentives makes this is very profitable project and provides good value for all stakeholders.

## Subscriber Model

The proposed subscriber model allows for a panel lease option for all subscribers. The host site leases panels for $0.98 per panel per month and sees a 20% savings. They are proposed to take 40% of the shares of the system. Employees and subscribers from the surrounding community lease panels for $1.38 per panel per month and also see a 20% savings. The savings for all subscribers begins the first month and grows over time as energy prices increase. Subscribers can transfer or cancel their shares at any time. Households with incomes at 80% or less of Area Median Income may qualify for the Illinois Solar for All low-income community solar program, which we have assumed pays up to 50% of the cost of their subscription.

# Financial Model

## Inputs & Assumptions

Financial models were developed using the Community Solar Business Case Tool created by the Cook County Community Solar project team. Inputs were based on findings from the engineering assessment conducted by Primera, LLC on behalf of Cook County, solar designs from Elevate Energy and Microgrid Energy using Helioscope and PVsyst, interconnection pre-screening reports from ComEd, as well as industry data for some inputs identified in cooperation with the National Renewable Energy Laboratory[1] and Lawrence Berkeley National Laboratory[2]. The Community Solar Business Case Tool version used is the Illinois specific tool, based on an energy-only residential bill credit rate of $0.0587 per kWh and an average commercial and industrial bill credit rate of $0.035 per kWh. SREC values used were $45.00 per MWh, based on our assumption of increasing block values for system size ranges.

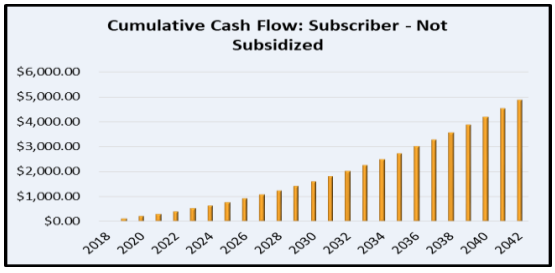
| Key Cost and Incentive Assumptions | |
|---|---|
| Installed cost for ground-tracking | $1.78 per watt |
| SREC base value | $45.00 |
| SREC Adder Values | $0 |
| Investment Tax Credit | 30% |
| MACRs | 35% over 6 years |
| Capacity rebate | $250 per kW |

***Business Case Tool Version:*** *The tool version used is a customized version of v1.21. All macros were removed and separate rate inputs were added for C&I/anchor subscribers. The PVWatts rate generator is disabled in this version. To adjust generation rate outputs, download the latest version here: https://www.elevateenergy.org/community-solar/communitysolarbusinesscasetool/*

## Subscriber Metrics

Employee and community subscribers gain value by leasing panels for $1.38 per month and receiving credits on their electricity bill at an effectively higher rate. The proposed subscriber model assumes a 20% savings for subscribers on their electricity rate. The proposed system requires about 130 to 140 residential subscribers leasing an average of 20 panels each. This model projects a typical subscriber to save at least $67 the first year and $195 on average annually over the life of the system. Low-income subscribers in households of 80% or less of Area Median Income may qualify for the Illinois Solar for All low-income community solar incentive, which our model has projected to pay for up to 50% of the cost of their monthly subscription.

| Subsidized Subscriber Metrics | |
|---|---|
| 25-Year Costs: | ($8,280.00) |
| 25-Year Revenues: | $13,154.69 |
| 25-Year Net Benefits: | $4,874.69 |
| Upfront costs | $0 |
| Year 1 Bill Savings: | $67 |




[1] *U.S. Solar PV System Cost Benchmark: http://www.nrel.gov/docs/fy16osti/66532.pdf*
[2] *Tracking the Sun quarterly solar price report: https://emp.lbl.gov/publications/tracking-sun-ix-installed-price*

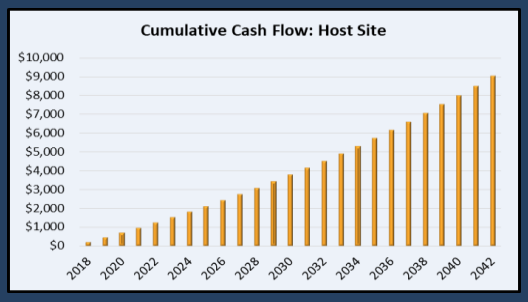
## Host Site Metrics

As the host site, the United Data Center earns value in two ways: first by leasing their site to the system owner at a proposed $6,000 annually. They also receive value through bill credits for their anchor share of the system. The host site will see a projected, combined earnings of $10,353 the first year, with an average combined earnings of $18,642 over the life of the system. The host has no upfront costs for this proposed model.

**Host Site Metrics / Site Lease & Energy Savings**

| | |
|---|---|
| 25-Year Revenues | $1,000,931 |
| 25-Year Net Benefits | $466,041 |
| Upfront Investment/Financing | $0 |
| Average Annual Earnings (25 years) | $18,642 |
| Average Monthly Earnings (25 years) | $1,553 |
| SREC Value (1MW-2MW Block) | $45.00/MWh |
| SREC Adder Value-Subscriber Type | $0 |
| SREC Adder Value-100% Low-Income | $0 |

**All SREC and SREC Adder values are assumptions. See Overview for more details.*



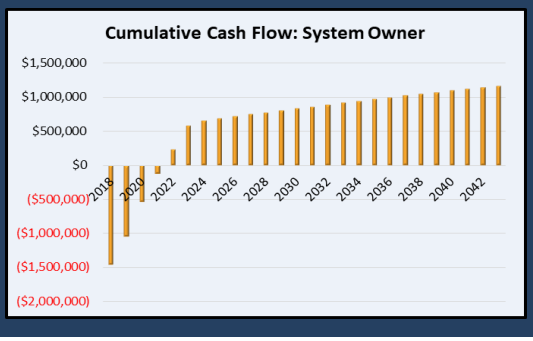

## System Owner Metrics

The proposed business case allows for a developer to build, own and maintain the system, taking advantage of federal and state incentives, including the federal Investment Tax Credit at 30%, the Modified Accelerated Cost Recovery System (MACRS) at 35% over six years, as well as the $250 per kW capacity rebate from the utility. The system owner benefits from United Airlines supporting subscriber acquisition through employee communications. They will see an Internal Rate of Return (IRR) of 16.1 percent, a Return On Investment (ROI) of 32.9 percent and a simple payback of 3.3 years.

**System Owner Metrics**

| | |
|---|---|
| 25-Year Costs | ($3,546,386) |
| 25-Year Revenues | $4,712,589 |
| 25-Year Net Benefits | $1,116,203 |
| 25-Year Net Present Value (NPV) | $404,122 |
| Return On Investment (ROI) | 32.9% |
| Payback Period | 3.3 years |
| Internal Rate f Return (IRR) | 16.1% |
| SREC Value (1MW-2MW Block) | $45.00/MWh |
| SREC Adder Value | $0 |

**All SREC and SREC Adder values are assumptions. See Overview for more details.*




# Subscriber Management

## Customer Acquisition

The proposed model calls for a customer acquisition plan that includes 137 residential subscribers in the first year. Employees and their families can be a primary focus, with United offering all employees within the ComEd territory the opportunity to join. While United has more than 10,000 employees in the area, outreach can include any households or business in the surrounding community. First year subscriber costs are budgeted at $63,115 or $463 per subscriber.

| Total Upfront Administrative Costs | Total ($) | $ per Subscriber |
|---|---|---|
| Marketing & Communications | $22,456 | $165 |
| Customer Acquisition Setup | $9,900 | $73 |
| Outreach Setup | $2,400 | $18 |
| Admin Setup | $1,400 | $10 |
| First Year Billing Management | $26,959 | $198 |
| **TOTAL UPFRONT SUBSCRIBER COSTS** | **$63,115** | **$463** |

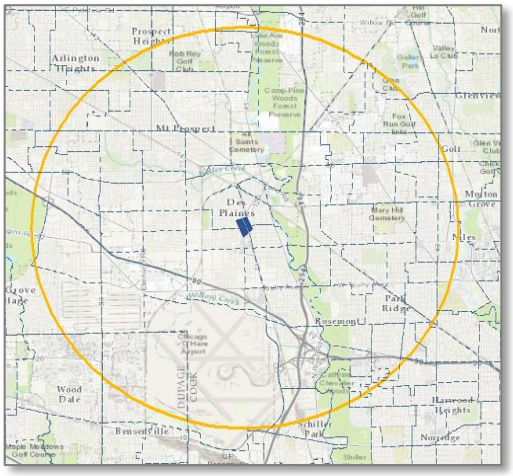
## Subscriber Management

Billing management is the largest ongoing subscriber management function. This will consist largely of managing share percentages monthly and providing breakdowns for the utility in a timely manner. Reconciling billing discrepancies can be an issue in the early stages of any community solar project. This, together with customer service and general program questions makes up the biggest share of subscriber management costs in the first two years after customer acquisition. After this time, it is anticipated that the billing function will become routine.

| Total Lifetime Subscriber Management Costs (year 2-25) | |
|---|---|
| Outreach | $3,780 |
| Sales | $696 |
| Sign-up Transaction | $497 |
| Customer Service | $4,619 |
| Billing Admin | $279,129 |
| **TOTAL TRANSACTIONAL COSTS** | $288,721 |

# Marketing & Outreach

United Airlines and United Holding Companies has more than 10,000 employees in the Chicago area. Any employee and their families that live in the ComEd territory can take advantage of this unique program and savings opportunity. In addition to employees, any household in the surrounding community can join this program. There are more than 120,000 households within just five miles of the site. So, there is a very wide universe of potential subscribers. Customer acquisition planning requires just 184 subscribers in the first year.




Subscribers can be market rate or may qualify for a subsidy to help pay for their monthly subscription. People can join the program because they want to save money, because they want solar but cannot install it on their own roof, or because they want to do something positive for the environment.

# The Cook County Community Solar Project

## Project Background

The Cook County Community Solar Project was launched in early 2015 with a grant from the Department of Energy's Solar Market Pathways Program. This two year project began on the premise that community solar was not only possible in our region, but has the potential to bring access and equity in renewables to the 80% of our population currently left out because of technical, structural or financial barriers. Community solar also has the potential to bring significant economic development to the region, with more than 600 MW of community solar development projected in Illinois through 2030 after the launch of the Future Energy Jobs Act in June of 2017.

Project Partners, including Cook County, Elevate Energy, the Environmental Law & Policy Center, The City of Chicago, ComEd and West Monroe Partners, have produced a series of reports, analyses and tools that are aimed at supporting stakeholders to grow the emerging community solar market in our region. Project deliverables include an opportunity assessment, policy analysis, best practices, value and impact analysis and a series of 15 site-specific project case studies, in which this document is one. More on the project and deliverables can be found here: https://www.cookcountyil.gov/service/solar-energy

## Key Project Contacts

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# About the SunShot Initiative

The U.S. Department of Energy SunShot Initiative is a collaborative national effort that aggressively drives innovation to make solar energy fully cost-competitive with traditional energy sources before the end of the decade. Through SunShot, the Energy Department supports efforts by private companies, universities, and national laboratories to drive down the cost of solar electricity to $0.06 per kilowatt-hour. Learn more at energy.gov/sunshot.

This material is based upon work supported by the U.S. Department of Energy under Award Number DE-EE0006916.




*All photos courtesy of the National Renewable Energy Laboratory's Image Gallery*