Integrating Solar PV: Strategies and Case Studies

Jay Paidipati
Director
Navigant Consulting
Introduction and Agenda

- **Session Objectives:**
  - Provide update on the Better Buildings Alliance’s Renewables Integration Team
  - Present case studies and strategies from successful solar PV projects on commercial buildings

- **Agenda**
  - Introduction – Jay Paidipati
  - A Commercial Building Owner Perspective – Eugenia Gregorio
  - Solar PV Case Studies – Matt Lynn
  - Commercial Solar Case Study – Mark Manthy
Goals and Objectives

- Individual members often do not have the resources or expertise to address these very specialized issues, and vendors selling renewables projects have a vested interest in promoting their solutions.
- Provide unbiased advice and shared experience to help BBA members navigate complex regulations, business models, and utility policies associated with distributed renewable energy systems.
- Deliver projects based upon member interests and needs

Project Team Lead: Jay Paidipati, Navigant Consulting
Team Activities

Current Work

- Hospitality Solar Guide
- Healthcare Solar Guide
- Promoting Solar PV on Leased Buildings Guide
- Supporting Case Studies
- Request for Information

Upcoming Work

- Coordinate with SunShot Program
- Market Recent Work
- Team Meetings
Request for Information

- **Background:** DOE’s SunShot Initiative and BBA are exploring the best strategies to support, expand, and streamline efforts to deploy PV on and for commercial buildings in the U.S. real estate market.

- **Drivers:** Understanding the benefits and most prominent challenges for building owners, tenants and other stakeholders is essential for developing resources and solutions to promote solar installations in this market.

- **Purpose:** solicit feedback from building owners and building tenants, academia, research laboratories, government agencies, and other stakeholders on issues related to installing solar on commercial buildings.

- **Where:** [https://eere-exchange.energy.gov/](https://eere-exchange.energy.gov/)
Presentations

- Eugenia Gregorio, The Tower Companies
- Matt Lynn, Lend Lease
- Mark Manthy, Direct Energy Solar
Integrating Solar PV: Strategies and Case Studies

A Commercial Building Owner Perspective

Better Buildings Summit
Thursday May 28, 2015

Eugenia Gregorio
Director of Corporate Responsibility
The Tower Companies
Company Overview

- Family-Owned, Privately-Held Real Estate & PM Firm
- Locally-Focused
- Develops, Owns & Manages
- Over 5 million SF of commercial office, multi-family residential, and retail centers
- Leader in Green Building Industry
Sustainability Leadership

Lead by example on environmental responsibility, by developing and managing high performance properties, being a global voice on environmental stewardship, and sharing our sustainable and innovative practices.

[Logos and certifications]
Goal: 20% by 2020

**TOWER COMPANIES**
Energy and Water Performance

**ENERGY PERFORMANCE**
- Cumulative (vs. Baseline): 10%
- Annual (2013): 3%

**WATER PERFORMANCE**
- Cumulative (vs. Baseline): 14%
- Annual (2013): 4%

**PORTFOLIO ENERGY PERFORMANCE**

Better Buildings Challenge Partners strive to decrease portfolio-wide source energy use intensity (EUI) and to increase the percent improvement compared to a set baseline. Tower has committed 10 buildings that they both own and manage, which make up 3 million square feet of multi-tenant commercial office and multi-family high-rise residential properties. Compared to a 2010 baseline, Tower has improved energy performance by 10% due in large part to implementing a Real-Time Energy Management Program focused on low-cost ECMs and sustainable operations, LED lighting retrofits, BMS control upgrades, and equipment upgrades. There are other properties that The Tower Companies owns but that are not managed directly and therefore, aren’t being included in this program.

[https://www4.eere.energy.gov/challenge/partners/better-buildings/the-tower-companies](https://www4.eere.energy.gov/challenge/partners/better-buildings/the-tower-companies)
Energy Conservation Measure Best Practices

- Real-Time Energy Management
- Align Building Operations with Lease Hours
- Night Audits
- LED Lighting
- Green Lease Guidelines
- BMS & Equipment Upgrades
- Set-point modifications
- Green Teams & Engagement
- Renewable Energy
The Millennium Building
Sustainability Features

ENERGY
OFFSET 100% OF ENERGY CONSUMPTION
DCS FIRST PV SOLAR ARRAY FOR A CLASS A BUILDING

LEED
A PREMIER LEED GOLD BUILDING - WASHINGTON, DC'S FIRST LEED-EB OFFICE BUILDING
Clients automatically qualify for 25+ points, half the points needed for LEED Commercial interiors v2009

VISION STATEMENT
The Tower Companies envisions a world where buildings inspire and enrich the lives of their occupants, and create positive social change. In this world, people seek out buildings that better their health and well-being, connect them to thriving communities, and help to sustain the environment.

MISSION STATEMENT
The Tower Companies owns, develops, and manages commercial, retail and multi-family residential properties in the DC metro area, while being mindful of our global impact. Our buildings are among the most sustainable in the world, blending sophisticated design, smart growth principles, unparalleled amenities and unrivaled service in a way that transforms expectations about real estate and improves the way people live, work, and play.

WASTE
INDUSTRY-LEADING COMPOSTING PROGRAM
WASTE MANAGEMENT OVER 50% LANDFILL DIVERSION RATE ABOVE NATIONAL AVERAGE

WATER
EFFECTIVE BUILDING COOLING TOWER
EFFICIENT RAIN BARREL FOR IRRIGATION
LOW FLOW FIXTURES
15% REDUCTION IN WATER USE

INDOOR AIR QUALITY
100% building-wide exchange of fresh air every 25 minutes
Air is double scrubbed - removing 80% of the airborne toxins from the "fresh" outside air
Biannual Air Quality Assurance inspection to ensure healthy and productive environments for clients

HEALTH & WELLNESS
WELLNESS ROOM
LACTATION ROOM
YOGA ROOM
MASSAGE ROOM
SEASONAL HERB GARDEN FOR CLIENTS
ROOFTOP TERRACE 360° VIEWS OF DC
CSA PROGRAM OFFERED TO CLIENTS
CLIENT ONLY FITNESS FACILITY WITH TOWEL SERVICE

TRANSPORTATION
SECURED & CONDITIONED CLIENT BIKE ROOM
2 EV CHARGING STATIONS IN GARAGE
PREFERRED PARKING FOR HYBRID CARS & EXPECTING MOTHERS
2 BLOCKS METRO ENTRANCE ACROSS THE STREET
Motivations & Financing

- Long-Term Perspective
- Environmental Leader
- Financial Incentives
- Electricity Avoidance
- SREC Sales
- 30% Federal Tax Credit
- Accelerated Depreciation
- 40% Upfront Credit
Challenges & Solutions

✓ Industry Experience
✓ New Process for Government Agencies
✓ Financial Incentives
✓ Design Modifications
✓ Education for Clients
Learn How Our Solar Panels Work

1. In this photovoltaic (PV) system, solar panels capture sunlight and produce direct current (DC) electricity.
2. The PV system converts this clean power into the alternating current (AC) electricity that our building needs.
3. Once converted, AC electricity flows through our building’s electrical system to reduce the need to purchase energy as well as our carbon footprint.

The Millennium Building’s solar PV installation in 2014 was the first ever on a Class A commercial office building in Washington, D.C. The 30kW solar PV array consists of 109 American-made panels.
THANK YOU!

Eugenia Gregorio
Director of Corporate Responsibility
Eugenia.Gregorio@towercompanies.com
301.692.1463
LEND LEASE ENERGY DEVELOPMENT GROUP

DELIVERING CLEAN, RELIABLE AND AFFORDABLE ENERGY SOLUTIONS

OUR VISION

CREATE THE BEST ENERGY SOLUTIONS
Lend Lease

THE DOD’S LARGEST PRIVATE SECTOR PARTNER
FOR THE DEVELOPMENT OF COMMUNITIES & HOTELS

MORE THAN 40,792 HOMES
NEARLY 12,000 PRIVATIZED HOTEL ROOMS

Experience gained providing energy solutions & security for facilities – DOD facilities across the US
Lend Lease accepted President Obama’s Better Buildings Challenge and committed to achieving a 20% reduction in energy consumption for our entire military housing and hotel portfolio by 2020.

We are proud to announce we hit our goal early, achieving a 25% reduction as of December 31, 2014.
OUR DELIVERY

68 MEGAWATTS

Lend Lease Military Housing locations are currently generating or in development of
68 megawatts of on-site solar electricity.

SOARING HEIGHTS COMMUNITIES

At Davis Monthan AFB, 3.4MW of ground mounted solar arrays and 2.7MW of rooftop solar arrays, totaling more than 80,000 solar array panels.

At Holloman AFB, over 600 solar photovoltaic rooftop arrays atop duplex and single-home residences, totaling approximately 3.1MW of solar power.
OUR DELIVERY

ISLAND PALMS COMMUNITIES

18MW rooftop solar power that will provide approximately 30% of its community’s energy needs. Upon completion it will be one of the largest solar-powered communities in the world.

HICKAM COMMUNITIES

3.4MW of rooftop solar power generated will offset more than 185 million pounds of CO2 emissions over the next 20 years.

TIERRA VISTA COMMUNITIES

## Project Overview

<table>
<thead>
<tr>
<th>Deal Structure</th>
<th>20 Year Power Purchase Agreement (PPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Project Capacity</td>
<td>795kWdc</td>
</tr>
<tr>
<td>Estimated 1st Year Production</td>
<td>938,100 kWh</td>
</tr>
<tr>
<td>Current Annual Usage at ST</td>
<td>2,300,000 kWh</td>
</tr>
<tr>
<td>Project Offset</td>
<td>40.8%</td>
</tr>
<tr>
<td>Current Electricity Rate</td>
<td>$0.1528/kWh</td>
</tr>
<tr>
<td>PPA Price</td>
<td>$0.1325/kWh with 1% escalator</td>
</tr>
<tr>
<td>20 Year Projected Savings (3% esc)</td>
<td>$1,182,178</td>
</tr>
<tr>
<td>30 Year Projected Savings (3% esc)</td>
<td>$3,936,302</td>
</tr>
</tbody>
</table>

### Keys to Success

1. **Offtaker with fairly high electricity rate**
2. **NYSERDA incentives**
3. **Utility Net Metering**
4. **Utility required to interconnect by law**

## Costs

- **Total Costs – Development, Financing and EPC**: $2,800,000
- **Federal Tax Credit – 30%**: -$750,000
- **NYSERDA State Incentives $1.00/watt**: -$795,000

**Total Costs to be financed**: $1,255,000

*Costs do not include fixed maintenance, insurances, state sales tax, inverter replacement, depreciation, etc.*
PRIVATE ARMY LODGING CASE STUDY
12,000 HOTEL ROOMS AT
40 ARMY INSTALLATIONS

$1 BILLION INVESTED OVER 8 YEARS

CANDLEWOOD SUITES
17 NEW

STAYBRIDGE SUITES
1 NEW

HOLIDAY INN EXPRESS
69 RENO
PHASE 1: 10 MW PROGRAM AT 12 SITES

- Analyzed over 70 separate sites
- 12 sites were selected for solar development where savings could be achieved through a Power Purchase Agreement (PPA)

SITE SELECTION CRITERIA
- Utility Rate
- Hotel(s) Electricity Load – can solar be deployed at scale?
- Available Land, Rooftops and Parking Areas
- Local Solar Resources
- EPC Costs including Interconnection
- Local Incentives/Rebates
- Billing and Regulatory Environment
SOLAR PPA DEVELOPMENT
LESSONS LEARNED

- Robust Stakeholder Engagement Plan – offtaker, utility, city officials, congressman, DOE, state sustainability associations, other influencers

- Understand all Federal and State incentives/rebates
  - Federal and State Investment Tax Credits
  - State Renewable Portfolio Standard (RPS)
  - State and Local Incentive Programs
    - SRECs, community solar, etc. utility rebates
  - Property and Sales Tax Exemptions

- Understand metering and billing structure at a very detailed level, how will each account number be affected by planned solar?

- Understand net metering laws in each state

- Obtain Detailed Consumption Data (load per meter), 15 minute data if possible

- Understand regulatory environment in each state – are 3rd party PPAs allowed by law?
  What is best financing option – PPA, Lease, Cash Purchase, ESPC, PACE financing, etc.?

- Does Customer have tax liability and appetite to invest in project?
OUR APPROACH

CORE CONCEPTS AND TECHNOLOGIES

CONSERVATION & EFFICIENCY
- LIGHTING
- HVAC
- BUILDING ENVELOPE

BUILDING ENERGY MANAGEMENT SYSTEMS
- SOFTWARE
- HARDWARE

DISTRIBUTED GENERATION & STORAGE
- GEOTHERMAL
- SOLAR
- STORAGE
- WIND
## Our Approach

### Energy Solutions & Security Strategic Objectives

**Our Approach and Rationale**

<table>
<thead>
<tr>
<th>Vision</th>
<th>Independence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>Project Company Free Cash Flow</td>
<td>Improve Project Co. NOI over time – reinvest savings into core facilities for residents</td>
</tr>
<tr>
<td>Long Term Hedge</td>
<td>Mitigate volatility of energy prices and future escalation</td>
</tr>
<tr>
<td><strong>Qualitative Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>Change Through Leadership</td>
<td>Showcase the DoD and Lend Lease as market leaders – a catalyst for change. Enable our client and utilities to achieve their energy goals</td>
</tr>
<tr>
<td>Environment</td>
<td>Benefit the environment through less energy consumption and more efficient and cleaner forms of energy generation</td>
</tr>
<tr>
<td><strong>Strategic Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>Base Portfolio Wide Energy Solutions</td>
<td>Create solutions for the overall base where we have a MHPI presence</td>
</tr>
<tr>
<td>Beyond DoD and Energy</td>
<td>Create a “Living Utilities” business in the Americas, inclusive of energy, to support our development pipeline and strategic clients</td>
</tr>
</tbody>
</table>
Thank you.

For more information, please contact:

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www.lendlease.com
Small Commercial Solar | A Case Study

Mark Manthy
Direct Energy Solar
202.643.0344
Objective

- Let’s analyze the real world numbers behind a commercial solar installation in Washington, DC, Maryland and Virginia.
- This will allow you to more clearly understand the huge differences that only a few miles can make in the economics of a solar installation.
Introduction

Who am I?
- I’ve been in ‘the business’ for over 5 years
- Live in Baltimore
- Boston College Undergrad
- UMD MBA
- 7.7 kW on my roof
Introduction

Who are we?

- **About Direct Energy**

  Direct Energy is one of North America's largest energy and energy-related services providers with over seven million residential and commercial customer relationships. Direct Energy provides customers with choice and support in managing their energy costs through a portfolio of innovative products and services. A subsidiary of Centrica plc (LSE: CNA), one of the world's leading integrated energy companies, Direct Energy operates in 46 states plus DC and 10 provinces in Canada. To learn more about Direct Energy, please visit [www.directenergy.com](http://www.directenergy.com).

- **About Astrum Solar**

  Astrum Solar is a leading national full-service residential solar provider, serving homeowners and small businesses in Connecticut, Delaware, New Hampshire, Maryland, Massachusetts, New Jersey, New York, Ohio, Pennsylvania, Virginia, Washington, DC, West Virginia, California, and Arizona. Astrum Solar's mission is to spread solar power to the rooftops of America and to ensure that its customers get the most out of their solar panels: the most energy generated, the most electricity savings, the most beneficial environmental impact, and the most joy each time they see a sunny day. Astrum Solar was on the Inc. 500 Fastest Growing Companies List in 2012 and 2013.
INTRODUCING DIRECT ENERGY SOLAR

Take control of your electricity bill. Go solar the right way. We make it easy.

LET'S SEE HOW MUCH YOU CAN SAVE
The DMV

For you out of towners:

District
Maryland
Virginia
The Project!

The Millennium Building
1909 K St, NW Washington, DC
Project Specs

109 Suniva 270 Watt Panels = 29.43 kW Solar
Edge Inverters with Optimizers
Flat Ballasted, no penetrations
Approximately 35,000 kWh generated per year
About 1% of total building usage
Project Specs

- Project owned and financed by the Tower Companies (Hi Eugenia!)
- Project is the first solar PV installation on a large, commercial, Class-A office building in Washington, DC.
Project Economics

1% of total building electricity offset by solar array!

WOW!

Seriously – what am I missing here?
Project Economics

Maryland

$100,000 cost
- $30,000 (Federal Tax Credit)
- $1,765 (State Solar Grant)
= $68,235

Annual PEPCO offset (at 35,000 kWh @ $.14/kWh) = $4,900
Annual SREC Production = 35 SREC * $120 = $4,200
Approximate annual income = $9,100

**Not taking into account any depreciation**
Project Economics

District of Columbia

$100,000 cost
- $30,000 (Federal Tax Credit)
= $70,000

Annual PEPCO offset (at 35,000 kWh @ $.14/kWh) = $4,900
Annual SREC Production = 35 SREC * $380 = $13,300
Approximate annual income = $18,200

**Not taking into account any depreciation**
Virginia

$100,000 cost
-$30,000 (Federal Tax Credit)
=$70,000

Annual Dominion offset (at 35,000 kWh @ $.10/kWh) = $3,500
Annual SREC Production = 35 SREC * $40 = $1,400
Approximate annual income = $4,900

**Not taking into account any depreciation**
Takeaways

- Location, location, location!
- EVERY SITUATION IS DIFFERENT!
  - Can you take the tax credit?
  - What are you paying for power?
  - Are you incurring a cost of capital?
  - What is an acceptable return?
  - Any depreciation concerns?

- Solar is GREAT and if you’re in the right situation could be very profitable.
Thank You!

Mark Manthy
mark.manthy@directenergysolar.com
202.643.0344
Closing and Next Steps

Thank You!

- Thank you to our speakers
- Thank you for attending

Getting Involved

- If you would like to join the BBA or the Renewables Integration team, contact me at jpaidipati@navigant.com
- We are currently looking for case studies of solar PV deployed at leased buildings.