Clean Energy States Alliance Webinar

Solar Maps as Tools for Advancing Solar Energy

Hosted by
Warren Leon, Executive Director, CESA

March 5, 2014
Housekeeping

All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded.

You will find a recording of this webinar, as well as all previous CESA webcasts, archived on the CESA website at

http://www.cleanenergystates.org/webinars/
About CESA

Clean Energy States Alliance (CESA) is a national nonprofit organization working to implement smart clean energy policies, programs, technology innovation, and financing tools, primarily at the state level. At its core, CESA is a national network of public agencies that are individually and collectively working to advance clean energy.
Today’s Guest Speakers

Tria Case, University Director of Sustainability at the City University of New York

Emil King, Policy Analyst in the Energy Administration at the District of Columbia Department of the Environment
The NYC Solar Map
City University of New York
America’s Largest Urban University
24 Academic Institutions | 500,000 Students
Tria Case, Esq., University Director of Sustainability
Sustainable CUNY
America’s Largest Urban University
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CUNY Sustainability Project

Sustainable Energy

CUNY SustainableWorks

Modeling a CUNY transformation

Building the tools to move cleantech in to NYC and beyond

Building commercialization platforms
Building the Foundation of Change in NY

U.S. Department of Energy

2013  SunShot Rooftop Solar Challenge II *NYS, NYC*

2012  NYSolar Smart  Phase 1 a *NYS, NYC*

2011  SunShot Rooftop Solar Challenge I *NYC*

2010  ARRA ‘Special Projects’ *NYC*

2007  Solar America City *NYC*

2006  Million Solar Roof *NYC*
Sustainable CUNY
Solar Plan Implementation

Solar Coordinator/ Ombudsman
Solar Installers Roundtable
Agencies
Utilities

Human Capital
Technical

Sustainable CUNY

Policy Analysis
Market Facilitation

NYC Solar Map
Permit Tracking Portal
Data Acquisition Systems
Analytics tools & IT platform

Funding Partners
-Federal
-State
-City
-CUNY
-Utility
-Private

Net Metering
Property Tax Abatement
Zoning Amendment
Empowerment Zones

Permitting and Interconnection
Planning and Zoning
Net Metering and Interconnection Standards
Financing Options
NYC SOLAR MAP
• Showcases existing installations

TOOLS
• LiDAR based PV potential for every rooftop in NYC
• Marketing tool for industry, ie customer acquisition
• Planning tool for utility
• Calculator

Testimonial
The owners wanted to do something to lower their carbon footprint and to be an example of environmental stewardship in their community.
METHOD

• Create a 3-D model of New York City
  o LiDAR for creating a Digital Surface Model (DSM)

• Run a model to calculate solar insolation

• Calibrate model
  o Typical Meteorologic Year (Central Park)
  o Pyronameter (Hunter College Weather Station)
  o Other solar sites

• Develop Custom Web Map

The NYC Solar Map was built in the C.A.R.S.I. Center at CUNY’s Hunter College under the direction of Professor Sean Ahearn
LiDAR (Light Detection And Ranging)

LiDAR operating principles:
LiDAR (light detection and ranging) is a mapping technology through which a laser is fired at the ground from an airplane to measure distance to the ground. LiDAR was developed as a fast and effective method to gather digital elevation model (DEM) data. With state-of-the-art LiDAR sensors, and many thousands of square miles of data successfully acquired and processed, Sanborn sets the highest standard of accuracy and reliability for LiDAR technology.

Aerial GPS (Global Positioning System):
Based on GPS satellite triangulation, measures the location of the aircraft every 0.5 second.

IMU (Inertial Measurement Unit):
Measures attitude (pitch/yaw/roll) of aircraft every 0.002 second.

Ground GPS:
Measures the location of the aircraft every 0.5 second relative to a known ground position.
LiDAR Density of NYC

Point Density per Square Meter

- Yellow: 0.8 - 1.7
- Light Orange: 2.0 - 3.9
- Orange: 4.0 - 7.9
- Medium Brown: 8.0 - 11.9
- Dark Brown: 12.0 - 20.0

15 Billion Points!
LIDAR Data  Created a Digital Elevation Model for New York City
Radiation data was layered on top of LIDAR
Solar Model Calibration

Model parameters were adjusted, and output was corrected, to match an average of TMY3 and Redbook data, which results in a slight discrepancy from TMY3. TMY3 is a ‘typical meteorological year’ based on 30 years of observations in Central park. Model results are for flat unshaded areas within Manhattan:
Panel Tilt and Azimuth Angle Adjustment

This plot shows the estimated yearly output for a 1kW system in NYC based on the tilt and azimuth angles of the panels, from the NREL PVWatts system. Solar potential is the product of the monthly estimated output from PVWatts, the usable area, and the shading derate factor, which is the ration of modeled radiation (using LiDAR) to reference radiation for a flat unshaded surface.
Key Functionalities

Summary

Annual electricity bill savings up to: $44,151.

You can install up to 183.93 kilowatts of solar here.

Reduce your annual carbon emissions by up to 162,880 lbs/yr.

That's the same as planting 435 trees!

Note: estimates only, actual values may vary. Click here to learn how this building's solar potential was estimated.
PV Potential for Every Rooftop

1558 PITKIN AVENUE

Energy Generation

- Building Footprint: 12,562 sq ft
- Usable Area for Solar: 6,921 sq ft
- Solar PV System Size: 55.37 kW-DC
- FDNY setbacks apply?: Yes
- All Zoning: C4-3
- Solar Empowerment Zone?: Yes

NYC Solar Calculator >
Cost Estimates - Incentives, payback

**Calculator Output**

**Cost**
- System Size: 45.38 kW-DC
- Total System Cost, Before Incentives: $272,280
- Cost After All Incentives and Taxes: $38,800

**Financial Metrics**
- Payback Period: 5 yrs
- Net Present Value: $15,953
- Internal Rate of Return: 12%
- Levelized Cost of Electricity w/Incentives: 0.16 $/kWh

**Electricity Bill Savings**
- Energy Production: 46,642 kWh/yr
- Savings: $9,795/yr

**Environmental Impact**
- CO2 Emissions Reductions: 32,113 lbs/yr
- Trees Planted Equivalent: 86 trees

**Cumulative Net Cash Flow**
![Cumulative Net Cash Flow Graph]

**Incentives**
- NYSERDA/LIPA Incentives: $68,070
- Federal Tax Credit: $81,684
- NY State Tax Credit: $0
- NYC Property Tax Abatement: $40,842
- MACRS + 50% Bonus Depreciation in Year 1: $81,003

**Steps for Installing Solar in NYC**

*Note: A solar lease or power purchase agreement can reduce your upfront cost to zero! Ask your installer for details.*

**GO TO MAP**
Summary

Annual electricity bill savings up to: $252,355.
You can install up to 4,602.37 kilowatts of solar here.
Reduce your annual carbon emissions by up to 931,011 lbs/yr.
That's the same as planting 2,484 trees!

Note: All results are estimates and may change depending on building-specific information. Enter your information by clicking below.
Solar Market Growth

1MW in NYC in 2007 represented $8,330,000

The growth to 22.4 MW by November of 2013 represents $162.6 Million
U.S./ NYS/ NYC Annual Growth

Percent (%) Growth Over Previous Year

- NYS
- NYC
- US

2011

2012

March 5, 2014
Agenda

1. Energy Sustainability in DC
2. Primary Solar Policy Drivers
3. Solar Mapping Overview and Details
1st in per capita ENERGY STAR rated buildings (US EPA)
1st in per capita LEED certified projects among large cities
(US Green Building Council)
1st among US communities in citywide green power usage

(US EPA)
1st in solar density among states
(Green Source Magazine)
Solar Policy Drivers

Numerous Legislative Supports:

- Renewable Portfolio Standards Act
- Green Building Act
- Clean and Affordable Energy Act
- Sustainable DC Act
- Distributed Generation Amendment Act
- Community Renewables Energy Act
Vision for a Sustainable DC

In just one generation—20 years—the District of Columbia will be the healthiest, greenest, and most livable city in the United States.

An international destination for people and investment, the District will be a model of innovative policies and practices that improve quality of life and economic opportunity.

We will demonstrate how enhancing our natural and built environments, investing in a diverse clean economy, and reducing disparities among residents can create an educated, equitable and prosperous society.
## Sustainable DC Plan Structure

- 32 Goals, 31 Targets, 143 Actions
- 4 Challenges, 7 Solutions

<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>SOLUTIONS</th>
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<tbody>
<tr>
<td>• Jobs and the Economy</td>
<td>• Built Environment</td>
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<td>• Health and Wellness</td>
<td>• Energy</td>
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<td>• Equity and Diversity</td>
<td>• Food</td>
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<td>• Climate and Environment</td>
<td>• Nature</td>
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<td>• Transportation</td>
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<td>• Waste</td>
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<td>• Water</td>
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Highlight: Energy

Goal: Increase the proportion of energy sourced from clean and renewable supplies

Target: By 2032, increase the use of renewable energy to make up 50% of the District’s energy supply

Actions:

- ID opportunities for neighborhood scale renewable energy systems (ST)
- Build 1,000 new renewable energy projects (MT)
- Introduce legislation to reduce fuel-based power use (LT)
Highlight: Built Environment

Goal: Ensure highest standard of green building design for new construction

Target: By 2032, meet net-zero energy use standards in all new construction projects.

Actions:

- Adopt latest green building code for all new construction/major renovations (ST)
- Update Green Building Act to require higher level of LEED certification (MT)
- Require all new buildings to be net-zero or net-positive (LT)
# RPS Annual Increase

<table>
<thead>
<tr>
<th>Year</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Solar</th>
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<tbody>
<tr>
<td>2011</td>
<td>4%</td>
<td>2.5%</td>
<td>0.40%</td>
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<tr>
<td>2012</td>
<td>5%</td>
<td>2.5%</td>
<td>0.50%</td>
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<tr>
<td>2013</td>
<td>6.5%</td>
<td>2.5%</td>
<td>0.50%</td>
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<tr>
<td>2014</td>
<td>8%</td>
<td>2.5%</td>
<td>0.60%</td>
</tr>
<tr>
<td>2015</td>
<td>9.5%</td>
<td>2.5%</td>
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<tr>
<td>2016</td>
<td>11.5%</td>
<td>2%</td>
<td>0.825%</td>
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<tr>
<td>2017</td>
<td>13.5%</td>
<td>1.5%</td>
<td>0.98%</td>
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<tr>
<td>2018</td>
<td>15.5%</td>
<td>1%</td>
<td>1.15%</td>
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<tr>
<td>2019</td>
<td>17.5%</td>
<td>0.5%</td>
<td>1.35%</td>
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<td>2020</td>
<td>20%</td>
<td>0%</td>
<td>1.58%</td>
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<td>2023</td>
<td>20%</td>
<td>0%</td>
<td>2.50%</td>
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Source: DC Public Service Commission
DC RPS – Solar Carve Out

976 solar PV and 65 solar thermal systems within the District eligible for the RPS program
Additional 2,239 solar energy systems outside of the District are eligible
Total reported capacity of~29.6 MW, of which ~10.3 MW is located within the District. Current SREC price ~$480 (Flett Exchange, 2/3/14)

*As of February 1, 2013
Solar Capacity Needed for RPS

Source: DC Public Service Commission
Citywide Photovoltaic Distribution
Mapping Project Goals

- Support Mayor Gray’s Sustainable DC goals
- Comprehensively map the District’s PV installations
- Provide a resource to analyze citywide solar potential on a lot-by-lot basis
- Showcase Solar System where national energy policy is debated and created
- Demonstrate viability of community action driven by a powerful and engaging information tool
- Accelerate deployment and adoption of other open energy mapping and analysis tools elsewhere
Project Planning

Areas for Consideration

- **Sponsor's Customization**
  - Logos, program content, installed PV system info, optional inputs, installer info

- **Local Intelligence**
  - Financial incentives (installation, generation), restrictions by building type, system installed prices

- **Launch and Outreach**
  - Press materials, social media plan

- **Administrative**
  - Contractual agreements, payment terms
Partner Roles

Mapdwell
• Developed solar potential data as delivered and visualized through Solar System
• Developed cost/benefit analysis modules

District of Columbia
Provided underlying input datasets, content, and imagery

*As of February 1, 2013
Map Stats

High Yield PV Capacity - 2.693 GW
Total PV Production Potential - 2,669 GWh/yr
Total Listed Systems – 6.97 MW
Number of Buildings - 156,195
Average Footprint - 1,418 sq ft
High Potential Area - 6.5 sq mi
Total City Area - 68.34 sq mi
Population - 632,323
Selected Map Features

Installed System

- Building Use: Residential
- Installation Year: 2011
- System Size: 4 kW
- Annual Output: 4,428 kWh
- Yearly Savings: $576
- Installer: Solar Solutions, LLC

1414 Hopkins St. NW
Washington, DC 20036

Cost to Owner: $21,337
Yearly Revenue: $4,157

Money
- Cost to Owner: $21,337
- Total System Cost: $30,482
- Federal Tax Credit: $9,145
- Other Deductions: -$0
- Revenue per Month: $345
- Total Revenue per Year: $4,147

SUSTAINABILITY
DC
Contact Information

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Today’s Guest Speakers

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Thank you for attending our webinar

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