CUNY Players

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OBJECTIVE

- Create the next generation solar application

**Individual:**
- To enable all owners of the 1 million buildings in NYC to assess the value of their solar PV potential.

**Collective:**
- Reduce the strain on the NYC electric grid during peak periods, lower chances of blackouts.
- Reduce emissions and reliance on foreign oil.
- Create green jobs
METHOD

- Create a Digital Surface Model (DSM) of the City of New York from LiDAR data
- Run a model to calculate solar incidence
- Calibrate model
- Create application environment “NYC SOLAR MAP”
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 LiDAR scanner
Sends/receives up to four returns per pulse using a laser transceiver, receiver and scanner with variable frequency range

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 .002 second

Ground GPS
Measures the location of the aircraft every 0.5 second relative to a known ground position

Source: Sanborn
LiDAR Density of NYC

Point Density per Square Meter

- 0.8 - 1.7
- 2.0 - 3.9
- 4.0 - 7.9
- 8.0 - 11.9
- 12.0 - 20.0

Boroughs

15 Billion Points!
Vertical Accuracy of Lidar

$\pm 7.5 \text{ cm RMS}$

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LiDAR as input to Solar Insolation Model

- Create surface model for City
- Calculate “useable roof area”.
- Use ESRI tool to calculate insolation
- Calibrate with installation data
Points to Digital Surface Model (DSM)
Solar Insolation Calculation (ESRI tool)

One Day

Solar animation

one day
Usable Roof Area Estimates

Criteria

- Minimum insolation threshold
- Height difference < 2'
- Contiguous area of > 10 m²
- Slope sd < x
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:
But the aggregated yearly insolation is within the range of observed variability:

- 2008: 1,251 kWh
- 2009: 1,249 kWh
- 2010: 1,273 kWh
- Modeled: 1,254 kWh
Summary

Annual electricity bill savings up to: $25,174.
You can install up to 111.34 kilowatts of solar here.
Reduce your annual carbon emissions by up to 92,872 lbs/yr.
That's the same as planting 248 trees!

Note: estimates only, actual values may vary. Click here to learn how this building's solar potential was estimated.
### Solar Calculator

#### Calculator Output

**Cost**
- System Size: 111.34 kW-DC
- Total System Cost, Before Incentives: $640,205
- Cost After All Incentives and Taxes: $128,956

**Financial Metrics**
- Payback Period: 6 yrs
- Net Present Value: $28,546
- Internal Rate of Return: 12%
- Levelized Cost of Electricity w/Incentives: 0.17 $/kWh

**Electricity Bill Savings**
- Energy Production: 119,886 kWh/yr
- Savings: $25,176/yr

**Environmental Impact**
- CO2 Emissions Reductions: 82,542 lbs/yr
- Trees Planted Equivalent: 220 trees

#### Cumulative Net Cash Flow

**Incentives**
- NYSERDA/LIPA Incentives: $87,500
- Federal Tax Credit / Treasury Grant: $192,062
- NY State Tax Credit: $0
- NYC Property Tax Abatement: $110,541
- 100% Year One Bonus Depreciation: $190,461

**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.*
TOTAL USEABLE ROOF AREA

- Estimate of **615 million** sq ft of useable rooftop

SAVINGS

- Typical one family home savings $500 - $1,500 per year
- Return on investment 5-7 years

PEAK OUTPUT

- Could produce up to **5,800 MW** at peak output
- Over **40%** of NYC's peak demand
1. Obtaining, processing, and comparing real-time data (to incorporate factors like daily weather changes)

- Allowing Con Ed customers to access their individual account information while looking at their building’s solar energy potential, to help calculate energy & cost savings more precisely.