

NZSEDI

Process for Net Zero Site Energy Design and Incentives

Select a state

MARIONYT TYRONE MARSHALL

Net Zero Site Energy Design and Incentives (NZSEDI)

Code

```
1 // NZSEDI | Net Zero Source Energy Design and Incentives
2 // Version One
3 // Tyrone Marshall
4 // Active: Phase One:
5 // .....Done!..Connection: State Incentives
6 // .....Done!.....Input: Search Parameter (State)
7 // .....Done!..Connection: Photovoltaic System Design
8 // .....Done!..Connection: Utility Prices for Commercial and Residential Specific Data
9 // ....._TBD_ End Phase One Development
10
11// GLOBAL GENERAL VARIABLES
12 var windowPadW1;
13 var windowPadH1;
14 var count = 0;
15 var pvcount = 1;
16 var countnone = 0;
17 var img;
18
19 var fedincentive = 0;
20
21 var gridlines = false;
22
23 var update;
24
25 var time;
26 var wait = 30; //for secs add three extra zeros as this is in milliseconds
27
28 // dsire search data variablesj
29
30 //dsire input data;
31
32 var search;
33 var address;
34
35 //dsire output data;
36
37 var sources;
38 var lat=0;
39 var lon=0;
40 var refcity;
41 var refzip;
42
```

Design | Simulation

NZSEDI
Net Zero Site Energy Design and Incentives

Showing Incentives for the State of New York
Incentives Resource: Ventyx Research (2012)
Data based on reference city of New York, New York 10007
Utility Contact: Consolidated Edison Co of New York Inc

1 | PV Incentive DSIRE ID: NY10F
Program Name: PV Incentive Program
State Sector: Residential & Commercial Incentive

2 | PV Incentive DSIRE ID: US37F5
Program Name: Residential Renewable Energy Tax Credit
Federal Sector: Residential & Commercial Incentive

3 | PV Incentive DSIRE ID: NY03F1
Program Name: Residential Solar Tax Credit
State Sector: Residential & Commercial Incentive

Minimum Commercial PV Size undefined kW
Maximum Commercial Tax Credit in undefined Dollars
Commercial PV Pre-Tax Credit in undefined Dollars per kWh
PV Pre-Tax Credit Duration in undefined Years
PV Residential Max Rebate in undefined Dollars
PV Residential Pre-Tax Credit in undefined Dollars Per kWh
PV Rating Basis in DC Power
PV Maximum Rebate from Federal in 70000 Dollars

Notes: 08/17/10 Slight revision to remove indication that CEC listing is required for modules and inverters. Manual references CEC but only because Power Clerk pulls from CEC list of equipment, others conceivably eligible. JB 08/16/10 New PON issued. Terms mostly the same, but no more bonus incentives, everything at \$1.75/W. Created and updated by JRM

Notes: 3/14/11 Removed dead links to SEIA fact sheet. 2/3/11 Updated record based on review of current statute and notes in L/N. No changes. JRH 2/18/10 Updated record based on review of current statute and notes in L/N. No changes. JRH 6/5/09 Added info about carryforward provisions - unused credit can be carried forward...

Minimum Commercial PV Size undefined kW
Maximum Commercial Tax Credit in undefined Dollars

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Incentives Resource: Ventyx Research (2012)
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1625.36
PV Roof Area in sq.ft.

16
PV Module Efficiency (%)

322.94
Solar Thermal Roof Area in sq.ft.

16
Solar Thermal Module Efficiency (%)

24
Calculated PV DC kW Size

4
Calculated Solar Thermal PV DC kW Size

40,396
Simulated Annual Output in kW AC

113,311 USD
Installed PV Cost Based on Roof Area

22,513 USD
Installed Solar Thermal PV Cost Based on Roof Area

Photovoltaic System Simple Payback Calculation

1731.65
Actual Monthly Consumption in kWh
Monthly bill estimate is 200.00 USD
PV system reduces monthly bill by 406.95 USD
Calculation Simulation Uses 4% Energy Inflation Rate Per Year
PV System Initial Cost Without Incentives is 135,824.64 USD
PV System Payback With Federal Solar Rebate and Credit in 6 Years

21
FT CO2 Emissions Saved

3,254
Miles Driven Annually

107
Trees Planted Annually

4

Incentives Available

70,000 USD
Total Federal PV Rebate Dollars Available

0 USD
Total Commercial PV Pre-Tax Credit Dollars Available

0 USD
Total Residential PV Pre-Tax Credit Dollars Available

0 USD
Max Commercial PV Tax Credit Dollars Available

5,000 USD
Max Residential PV Rebate Dollars Available

40,747 USD
Federal 30% Solar Investment Tax Credit Available

Net Zero Site Energy Design and Incentives (NZSEDI)

Code ————— Design | Simulation

Project Description

Goals

Net Zero Site Energy Design and Incentives (NZSEDI) is a design performance modeling process for achieving net zero site energy projects using photovoltaic and solar thermal water heating systems with financial incentives. The system serves to inspire interest in early net-zero building design for architects. NZSEDI will collect data for renewables in the United States for federal and state incentive programs. The computational algorithms will calculate the solar array size, payback period, and cost based on simple building design parameters.

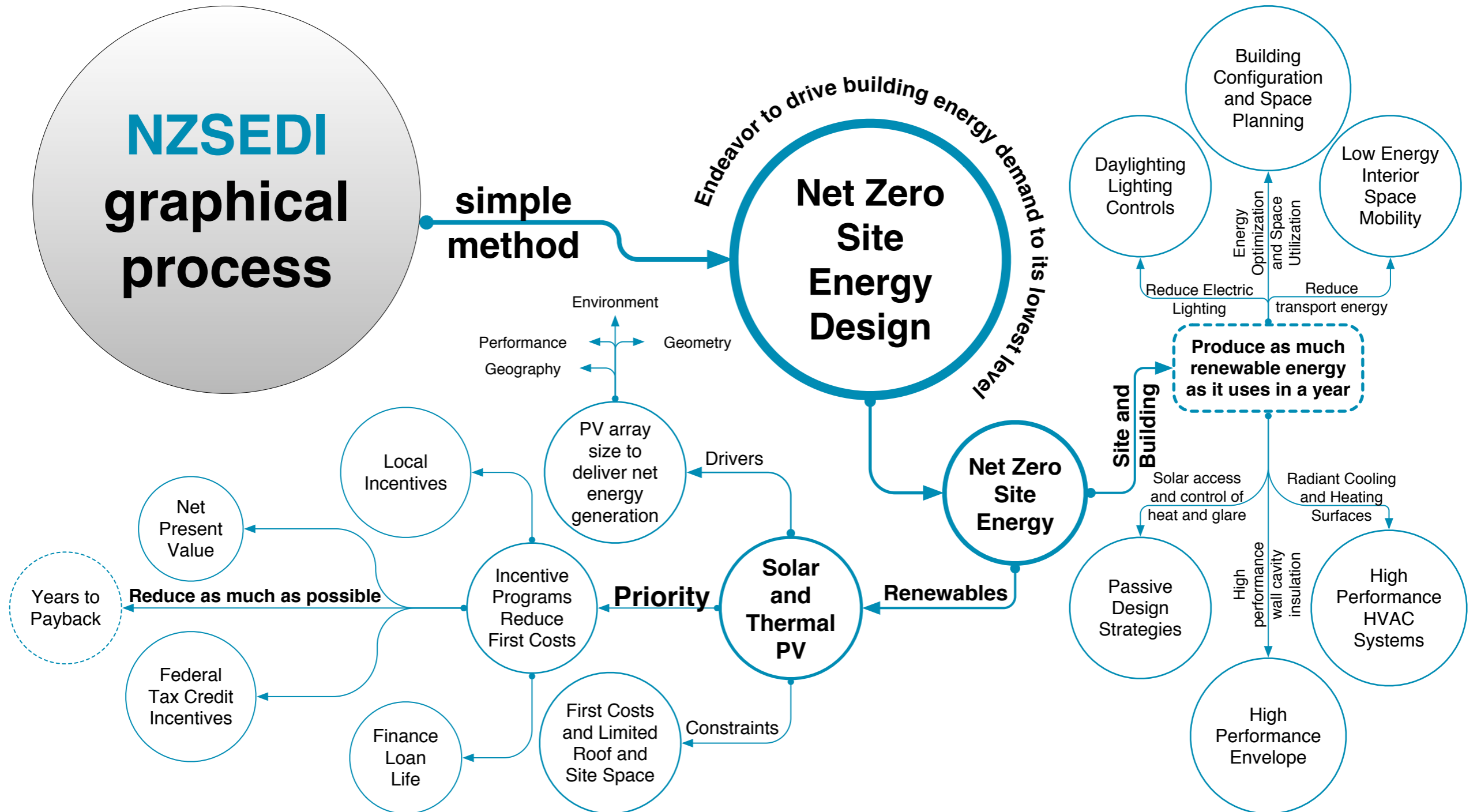
Methods

NZSEDI will collect data for renewables in the United States for federal and state incentive programs. The computational algorithms will calculate the solar array size, payback period, and cost based on simple building design parameters. A research phase will graphically discuss process for simple net zero site energy design.

Deliverables

NZSEDI will provide a process for achieving net zero site energy design and web-based calculation engine for solar array sizing, incentive aggregation engine, and simple design input parameters for solar thermal design. The results can be useful in conjunction with design performance modeling.

Net Zero Site Energy Design and Incentives (NZSEDI)



Net Zero Site Energy Design and Incentives (NZSEDI)

NZSEDI

NZSEDI/index.html

NZSEDI
Net Zero Site Energy Design and Incentives

New York

Set PV Azimuth in Degrees: 180

Set PV Tilt in Degrees: 41

Set PV System Capacity in kW: 28

Set Type of PV Array: 1

Set PV AModule Type: 1

Set System Losses in Percent: 10

Showing Incentives for the State of New York

Incentives Resource: Ventyx Research (2012)
Data based on reference city of New York, New York 10007
Utility Contact: Consolidated Edison Co of New York Inc

Incentive Specific Data

1 | PV Incentive DSIRE ID: NY10F
Program Name: PV Incentive Program
State Sector | Residential& Commercial Incentive

Minimum Commercial PV Size undefined kW
Maximum Commercial Tax Credit in undefined Dollars
Commercial PV Pre-Tax Credit in undefined Dollars per kWh
PV Pre-Tax Credit Duration in undefined Years
PV Residential Max Rebate in undefined Dollars
PV Residential Pre-Tax Credit in undefined Dollars Per kWh
PV Rating Basis in DC Power
PV Maximum Rebate from Federal in 70000 Dollars

Notes: 08/17/10 Slight revision to remove indication that CEC listing is required for modules and inverters. Manual references CEC but only because Power Clerk pulls from CEC list of equipment, others conceivably eligible. JB 08/16/10 New PON issued. Terms mostly the same, but no more bonus incentives, everything at \$1.75/W ...

2 | PV Incentive DSIRE ID: US37F
Program Name: Residential Renewable Energy Tax Credit
Federal Sector | Residential& Commercial Incentive

Minimum Commercial PV Size undefined kW
Maximum Commercial Tax Credit in undefined Dollars
Commercial PV Pre-Tax Credit in undefined Dollars per kWh
PV Pre-Tax Credit Duration in undefined Years
PV Residential Max Rebate in undefined Dollars
PV Residential Pre-Tax Credit in undefined Dollars Per kWh
PV Rating Basis in undefined Power
PV Maximum Rebate from Federal in undefined Dollars

Notes: 3/14/11 Removed dead links to SEIA fact sheet. 2/3/11 Updated record based on review of current statute and notes in L/N. No changes. JRH 2/18/10 Updated record based on review of current statute and notes in L/N. No changes. JRH 6/5/09 Added info about carryforward provisions - unused credit can be carried forward...

3 | PV Incentive DSIRE ID: NY03F
Program Name: Residential Solar Tax Credit
State Sector | Residential& Commercial Incentive

Minimum Commercial PV Size undefined kW
Maximum Commercial Tax Credit in undefined Dollars

Utility Rates for New York

Commercial Cents/kWh: **0.11**

Residential Cents/kWh: **0.23**

21 FT CO2 Emissions Saved

3,254 Miles Driven Annually

107 Trees Planted Annually

4

Incentives Available

70,000 USD
Total Federal PV Rebate Dollars Available

0 USD
Total Commercial PV Pre-Tax Credit Dollars Available

0 USD
Total Residential PV Pre-Tax Credit Dollars Available

0 USD
Max Commercial PV Tax Credit Dollars Available

5,000 USD
Max Residential PV Rebate Dollars Available

40,747 USD
Federal 30% Solar Investment Tax Credit Available

Station Data

Longitude -73.96700286865234 | Latitude 40.78300094604492
Elevation +40 | Solar Data Reference 725033.csv
Location in "NEW YORK CENTRAL PRK OBS BELV" | State NY

Graphical Direct Current Output of PV Design

Month	Mega Watts DC
Jan	2.64
Feb	3.06
Mar	4.00
Apr	3.89
May	3.90
Jun	4.20
Jul	4.30
Aug	4.12
Sep	3.71
Oct	3.51
Nov	2.58
Dec	2.32

Set Graph Scale: 0.028

1625.36
PV Roof Area in sq.ft.

16
PV Module Efficiency (%)

322.94
Solar Thermal Roof Area in sq.ft.

16
Solar Thermal Module Efficiency (%)

24
Calculated PV DC kW Size

4
Calculated Solar Thermal PV DC kW Size

40,396
Simulated Annual Output in kW AC

113,311 USD
Installed PV Cost Based on Roof Area

22,513 USD
Installed Solar Thermal PV Cost Based on Roof Area

Photovoltaic System Simple Payback Calculation

1731.65 Actual Monthly Consumption in kWh
Monthly bill estimate is 200.00 USD
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Calculation Simulation Uses 4% Energy Inflation Rate Per Year
PV System Initial Cost Without Incentives is 135,824.64 USD
PV System Payback With Federal Solar Rebate and Credit in 6 Years

Net Zero Site Energy Design and Incentives (NZSEDI) Map

② Search by State of Database of State Incentives for Renewable and Efficiency Use Web Data Application Programming Interface (NREL and NC Solar Center)

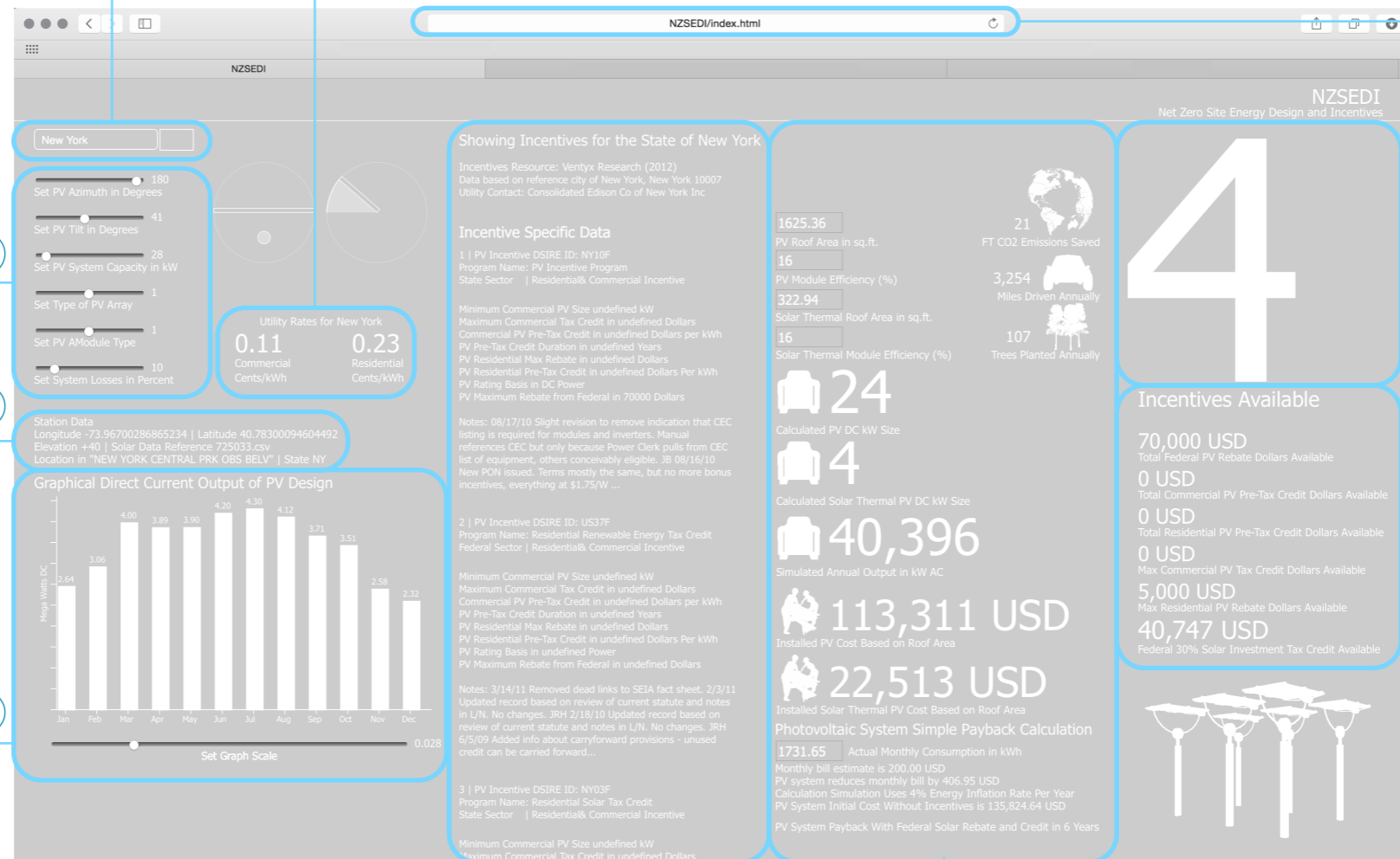
⑦ Display of State Utility Rates Service Data for Commercial and Residential Use Web Data Application Programming Interface (NREL, Ventyx Research Inc and The Energy Information Agency)

① Web based solar thermal design calculation and incentive aggregation engine.

PV Module System Simulation Design Parameters for PV Watts Calculator Version 5 Use Web Data Application Programming Interface (NREL)

PV Watts Version 5 Station Data Use Web Data Application Programming Interface

PV Module System Simulation Design Parameters for PV Watts Calculator Version 5 Use Web Data Application Programming Interface (NREL)



Data Display of State Incentives for Renewable and Efficiency Use Web Data Application Programming Interface (NREL and NC Solar Center)

Custom Data Calculation Engine Based on Simple Design Parameters Including PV System Cost, Payback in Years, Calculated and Simulated PV and Solar Thermal Output

Large Infographic Display of Available US State Incentives

Display of Incentives, Credits and Rebates Totals Including Federal 30% Solar Investment Tax Credit

⑤

⑧

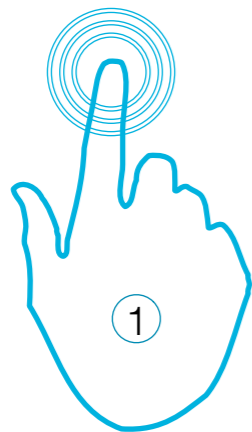
⑥

③

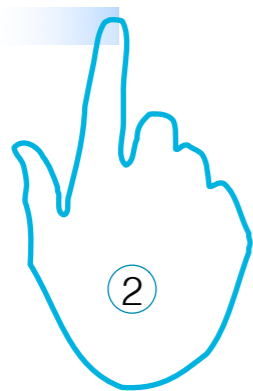
④

Net Zero Site Energy Design and Incentives (NZSEDI) Interface

Select, Enter Data, Activate



Parametric Sliding Values Input



The screenshot shows the NZSEDI web interface with the following elements:

- Callout 1:** Points to the state selection dropdown menu (currently set to 'New York') and the parametric sliding input controls for PV Azimuth (180), PV Tilt (41), PV System Capacity (28), PV Array Type (1), PV Module Type (1), and System Losses (10).
- Callout 2:** Points to the 'Set Graph Scale' slider at the bottom of the 'Graphical Direct Current Output of PV Design' chart.

Key Data Points from Interface:

- Utility Rates for New York:** Commercial Cents/kWh: 0.11, Residential Cents/kWh: 0.23
- Incentive Specific Data (1):**
 - 1 | PV Incentive DSIRE ID: NY10F
 - Program Name: PV Incentive Program
 - State Sector: Residential & Commercial Incentive
- Incentive Specific Data (2):**
 - 2 | PV Incentive DSIRE ID: US37F
 - Program Name: Residential Renewable Energy Tax Credit
 - Federal Sector: Residential & Commercial Incentive
- Photovoltaic System Simple Payback Calculation:**
 - 1731.65 Actual Monthly Consumption in kWh
 - Monthly bill estimate is 200.00 USD
 - PV system reduces monthly bill by 406.95 USD
 - Calculation Simulation Uses 4% Energy Inflation Rate Per Year
 - PV System Initial Cost Without Incentives is 135,824.64 USD
 - PV System Payback With Federal Solar Rebate and Credit in 6 Years
- Summary Metrics:**
 - 1625.36 PV Roof Area in sq.ft.
 - 16 PV Module Efficiency (%)
 - 322.94 Solar Thermal Roof Area in sq.ft.
 - 16 Solar Thermal Module Efficiency (%)
 - 24 Calculated PV DC KW Size
 - 4 Calculated Solar Thermal PV DC KW Size
 - 40,396 Simulated Annual Output in kW AC
 - 113,311 USD Installed PV Cost Based on Roof Area
 - 22,513 USD Installed Solar Thermal PV Cost Based on Roof Area
- Incentives Available:**
 - 70,000 USD Total Federal PV Rebate Dollars Available
 - 0 USD Total Commercial PV Pre-Tax Credit Dollars Available
 - 0 USD Total Residential PV Pre-Tax Credit Dollars Available
 - 0 USD Max Commercial PV Tax Credit Dollars Available
 - 5,000 USD Max Residential PV Rebate Dollars Available
 - 40,747 USD Federal 30% Solar Investment Tax Credit Available

Photovoltaic and Solar Thermal System Design Parameters

System Size

- Based on Calculated kW(DC) and Available Roof Area

Module Type

Standard

- Default
- Glass
- Poly or Mono-crystalline silicon Modules with Efficiencies in range of 14-17%
- Typical option for preliminary analysis
- Temperature coefficient of $-0.47\%/^{\circ}\text{C}$

Premium

- High Efficiency Mono-crystalline Silicon Modules with Efficiencies in the Range of 18-20%
- Anti-reflective coatings and lower temperature coefficients
- Temperature coefficient of $-0.35\%/^{\circ}\text{C}$
- Thin Film
- Low Efficiency with significantly lower temperature coefficient
- Uses representative model found in most installed thin film modules as of 2013
- Glass
- Temperature coefficient of $-0.20\%/^{\circ}\text{C}$

System Losses

- Default 14%

Array Type

- Fixed Open Rack
- Default
- Fixed Roof Mount
- Single Axis
- Backtracked Single Axis
- Double Axis

Tilt Angle

- Degrees
- Site Latitude

Azimuth Angle

- Degrees
- North Hemisphere is 180
- South Hemisphere is 0

Showing Incentives for the State of New York

Incentive Specific Data

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Program Name: PV Incentive Program
State Sector: Residential & Commercial Incentive

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Program Name: Federal Energy Tax Credit
Federal Sector: Residential & Commercial Incentive

3 | PV Incentive DSIRE ID: NY03F
Program Name: Residential Solar Tax Credit
State Sector: Residential & Commercial Incentive

4

Incentives Available

- 70,000 USD Total Federal PV Rebate Dollars Available
- 0 USD Total Commercial PV Pre-Tax Credit Dollars Available
- 0 USD Total Residential PV Pre-Tax Credit Dollars Available
- 0 USD Max Commercial PV Tax Credit Dollars Available
- 5,000 USD Max Residential PV Rebate Dollars Available
- 40,747 USD Federal 30% Solar Investment Tax Credit Available

Photovoltaic System Simple Payback Calculation

1731.65 Actual Monthly Consumption in kWh
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Photovoltaic and Solar Thermal System Design Parameters

The screenshot displays the NZSEDI (Net Zero Site Energy Design and Incentives) web application. The interface is divided into several sections:

- Advanced Inputs:** Includes sliders for DC/AC Ratio (set to 1.1), PV Azimuth (180), PV Tilt (41), System Capacity (28 kW), PV Array Type, Module Type, and System Losses (10%).
- Inverter Efficiency %:** Set to 96%.
- Graphical Direct Current Output of PV Design:** A bar chart showing monthly PV Watts DC output from January to December. Values range from approximately 2.64 in January to 4.00 in March.
- Solar Resource Data:** A note stating that NZSEDI has preselected TMY3 for more recent solar resource data for the PVWatts calculation.
- Ground Coverage Ratio (GCR) Single Axis Only:** Set to 0.4. A diagram shows a solar panel tilted at an angle with a GCR of 0.4. Text explains that a GCR of 0.5 means half the area is covered when the tracker is horizontal, and lower values suggest wider spacing between rows.
- Photovoltaic System Simple Payback Calculation:** Shows an installed PV cost of 113,311 USD and a payback period of 6 years. It also displays a simulated annual output of 40,396 kWh AC.
- Incentives Available:** Lists available incentives such as a 70,000 USD Total Federal PV Rebate and a 40,747 USD Federal 30% Solar Investment Tax Credit.

Photovoltaic and Solar Thermal System Calculation Methods

PV Calculation Methods

- PV area required from energy demand calculations
- Calculated PV DC Power System Based on Available Roof Area
- Assumptions
 - Calculate PV and Solar Thermal Hot Water Heating Systems Separately
 - Results in more accurate system size with minimal adverse impacts for cost.
- Incentives
 - State and Federal incentives to reduce installation costs associated with PV or Solar Electric Systems up to 25 kW for residential customers and 200 kW for commercial customers.
 - Separate incentive programs specifically for PV and Solar Thermal
 - Installed PV Cost
 - This is not an exact process and it may be dependent on local market place conditions.

Graphical Direct Current Output (Mega Watts DC)

Month	Output (Mega Watts DC)
Jan	2.64
Feb	3.06
Mar	4.00
Apr	3.89
May	3.90
Jun	4.20
Jul	4.20
Aug	3.90
Sep	3.90
Oct	3.90
Nov	3.90
Dec	3.90

NZSEDI Calculation Engine

- System Cost Before Incentives
- Subtract Incentives (State)(Not Active)
- Subtract Incentives (Federal)
- Add Taxes (Federal and State) (Not Active)
- Arrive at Net System Cost After All Incentives (Not Fully Active)
- Electric bill cost per month for building
- Escalation (4% per year)
- Carbon dioxide emission reduction (TON per year)
- Electricity production supplied by system (100%)
- PV System Electricity Production (kWh/year)
- PV System 25 Year Loan Life and Loan Rate Calculations

Calculated PV DC kW: 1625.36

Calculated PV DC kW: 16

Calculated PV DC kW: 322.94

Calculated PV DC kW: 16

Calculated PV DC kW: 24

Calculated PV DC kW: 4

Calculated PV DC kW: 40,398

Calculated PV DC kW: 113,311 USD

Calculated PV DC kW: 22,513 USD

Calculated PV DC kW: 1731.65

NZSEDI Future Work

- The following will be required for more accurate calculation rate methods:
 - Operations and Maintenance cost (\$50 per year)
 - Loan Payment and Rate Calculations
 - Tax status of owner
 - Taxable income of owner
 - Loan rate
 - Payment (Loan)

