Modeling Rooftop Solar Energy Potential

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Demo Theater

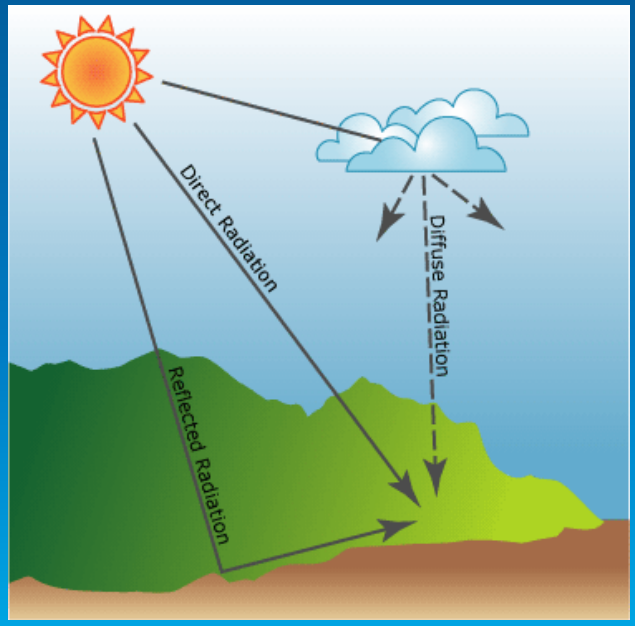
Outline

- Solar Radiation Analysis
- Understanding Solar Radiation Analysis Tools
- Applications of Solar Analysis

- Demo
  - Run solar radiation tools
  - Interactive rooftop analysis - PV potential

Solar Radiation Analysis

- Calculate amount of incoming solar radiation (insolation)
- Understanding key to broad range of earth system processes
- Highly variable
  - Spatial and temporal scales
- Influenced by factors
  - Atmosphere, Topography …
- Effects these processes



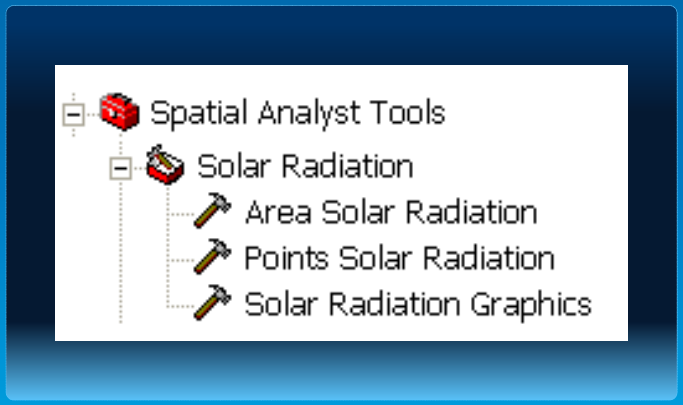
Solar Radiation Analysis

- Global Scale
- Landscape scale
  - Topography major factor
  - Strong local variation difficult to model
    - Monitoring stations
      - Need dense network
      - Interpolation not meaningful
    - GIS
      - Spatial radiation models
- Spatial models help to understand this variability and can easily be integrated in GIS

Solar Radiation Analysis Tools

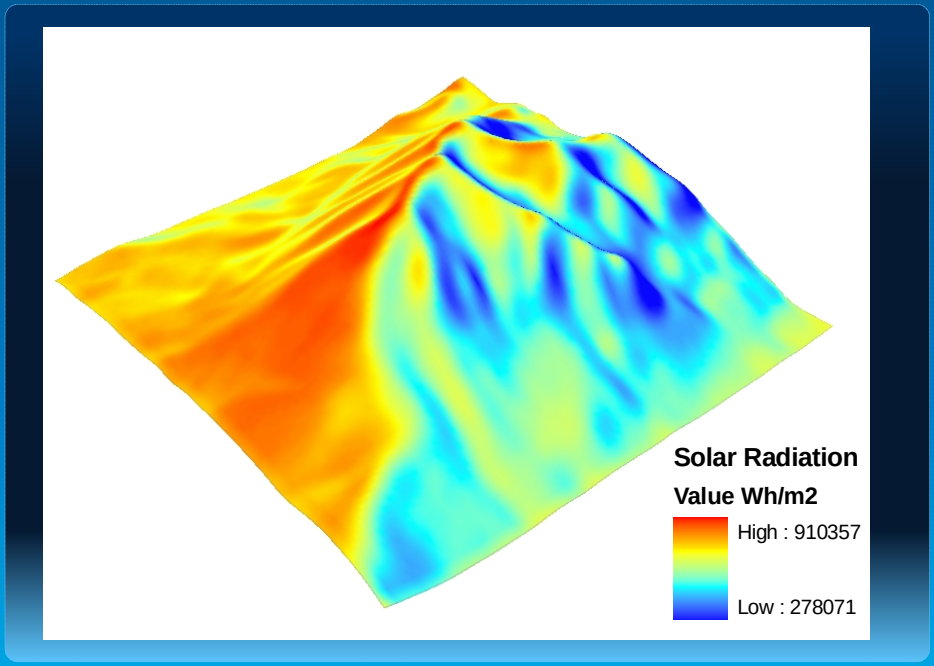
- 3 geoprocessing tools
  - Spatial Analyst Extension

- Two methods
  - Area based
  - Point specific



rea Solar Radiation Tool

- Calculate the insolation across a entire landscape
- Repeated for each location.



Point Solar Radiation Tool

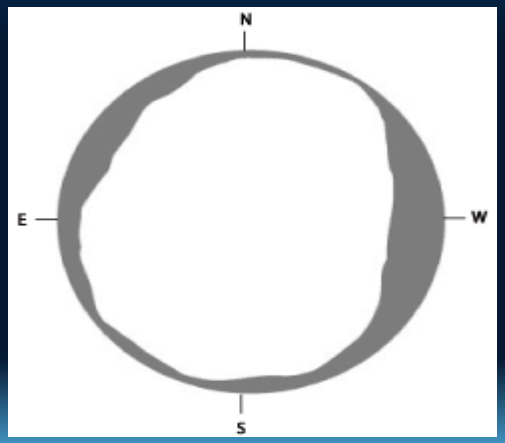
- Calculate the amount of radiant energy for a given location only
- Locations can be stored as point features
- Or (x,y) coordinates in a location table

Solar Radiation Graphics Tool

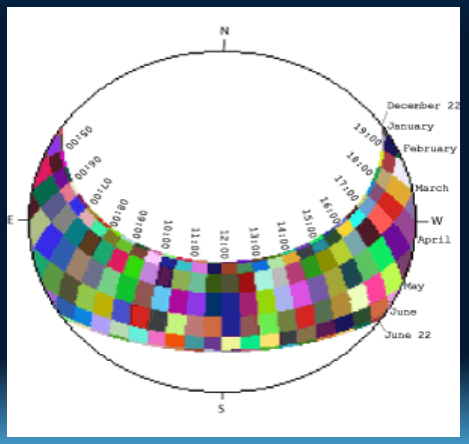
- Hemispherical views (Planetarium style)
- Diagnostic raster “maps” of sky,
  - used in the analysis.

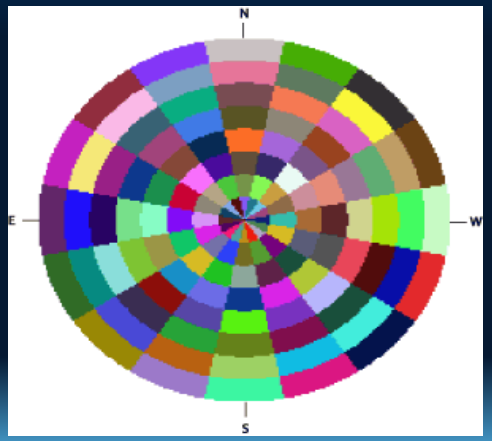
Viewshed

Sunmap



SkyMap





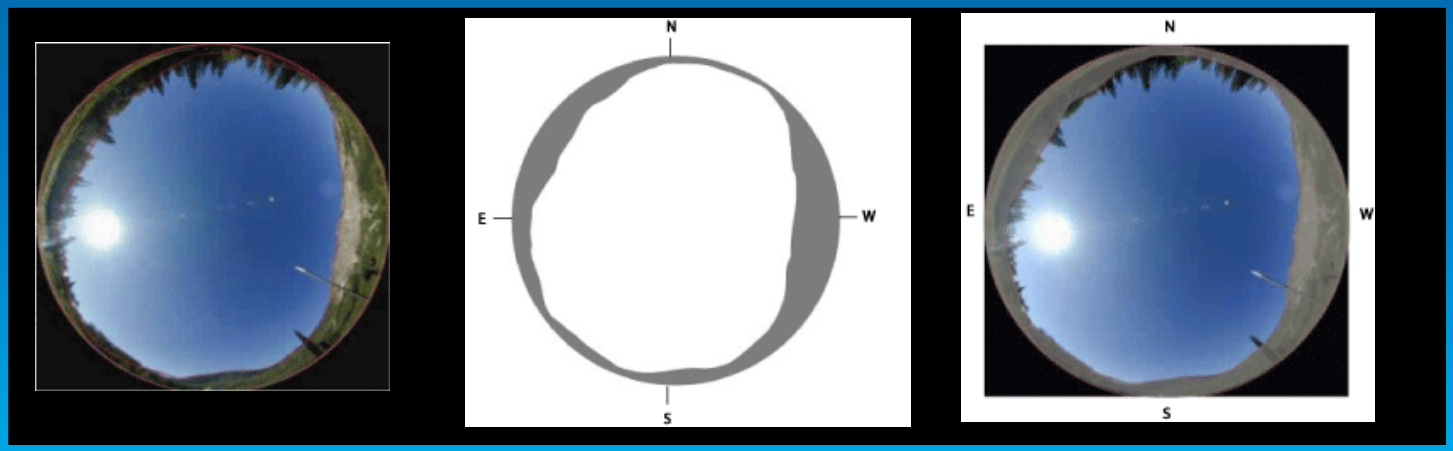
Understanding Solar Radiation Analysis Tools

- Designed for landscape scale only
  - Small geographic area (1° latitude or ~ 100 km x 100 km)
  - Accounts for effects of topography
    - Slope, Aspect, Visibility (shadows)

- Maps the effects of the sun for any time period
- Accounts for
  - Atmospheric effects
  - Elevation, Slope, Aspect,
  - Shadows

Understanding Solar Radiation Analysis Tools

- Generates an upward looking hemispherical viewshed
- Calculate amount of visible sky for every location
- Overlay with sun and sky maps
- Estimate amount of direct and diffuse radiation from all sky directions



Understanding Solar Radiation Analysis Tools

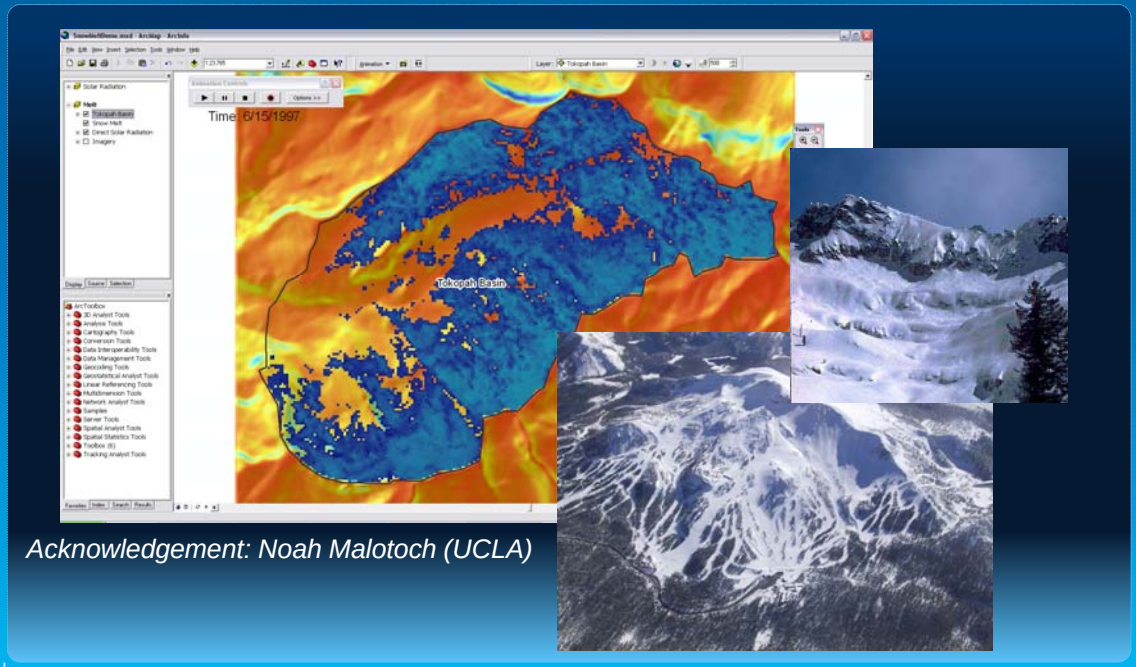
- Requires input surface raster
  - Include locations for point analysis
- Size (resolution) of input affects analysis time
  - Area analysis
    - calculates viewshed for every cell in raster (slower)
- Spatial Reference to calculate proper latitude.

Applications for Solar Radiation

- **Broad range of Applications**
  - **Ecology**
  - **Hydrology**
  - **Agriculture**
  - **Fire modeling**
  - **Renewable Energy**

Snow Melt Analysis

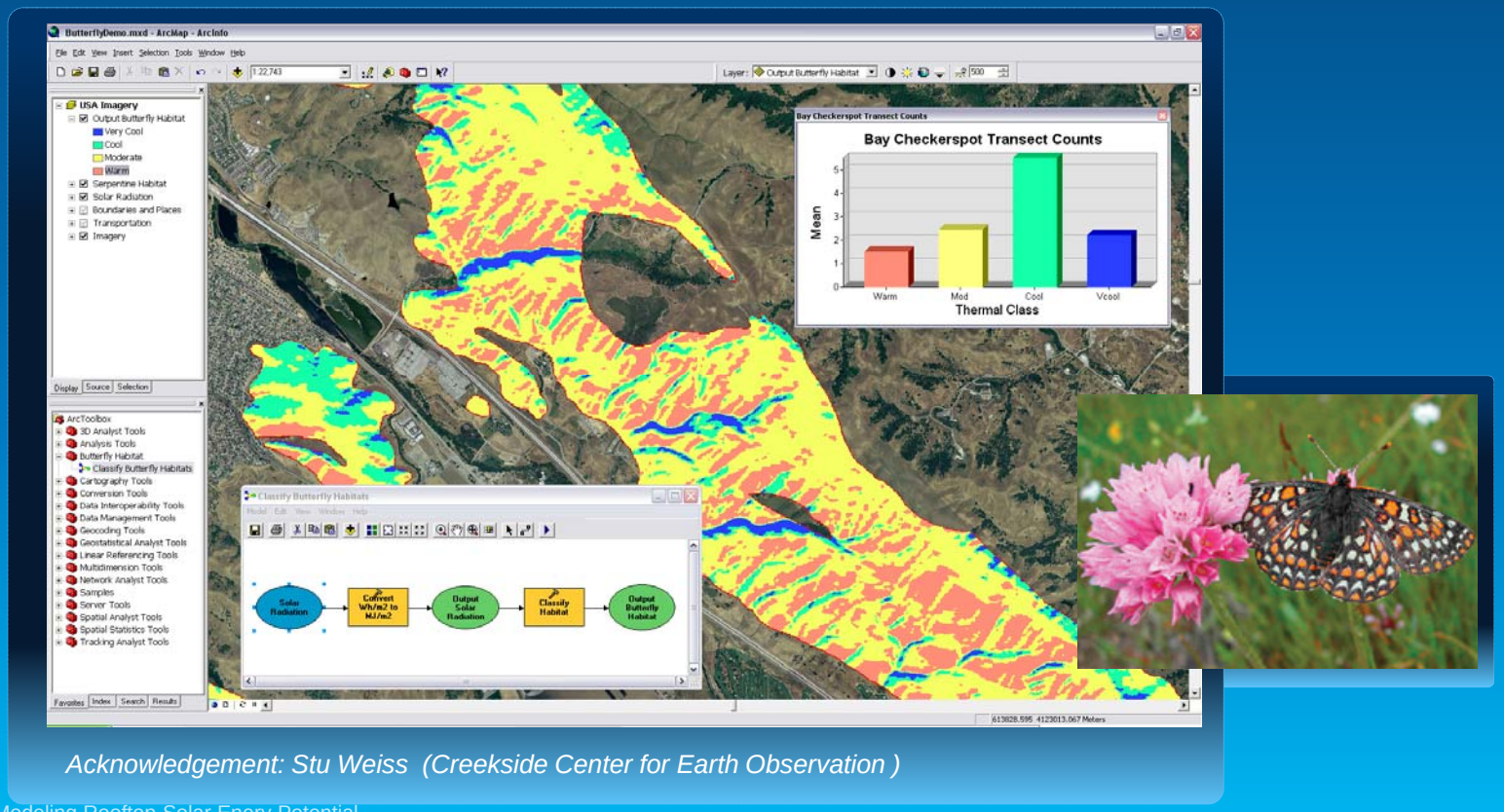
- **Solar Radiation is a direct input to calculating snowmelt**
  - **75% of snow melt energy**
- **Important for hydrological processes**
  - **Ground water recharge**



Acknowledgement: Noah Malotoch (UCLA)

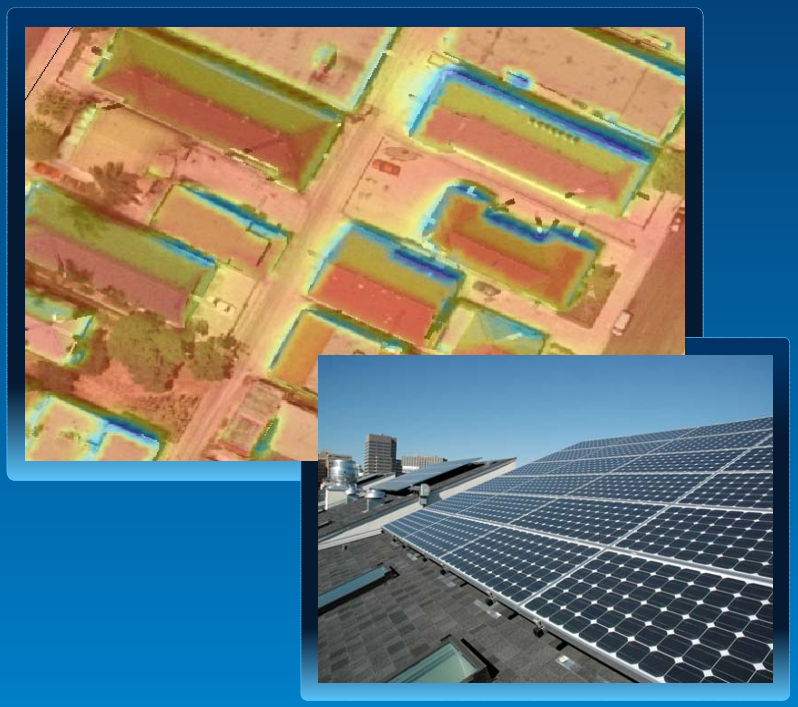
Suitable Butterfly Habitat

- **Threatened Bay Checkerpot Butterfly (San Jose, CA)**
- **Prefers specific soil and cool areas**



Acknowledgement: Stu Weiss (Creekside Center for Earth Observation)

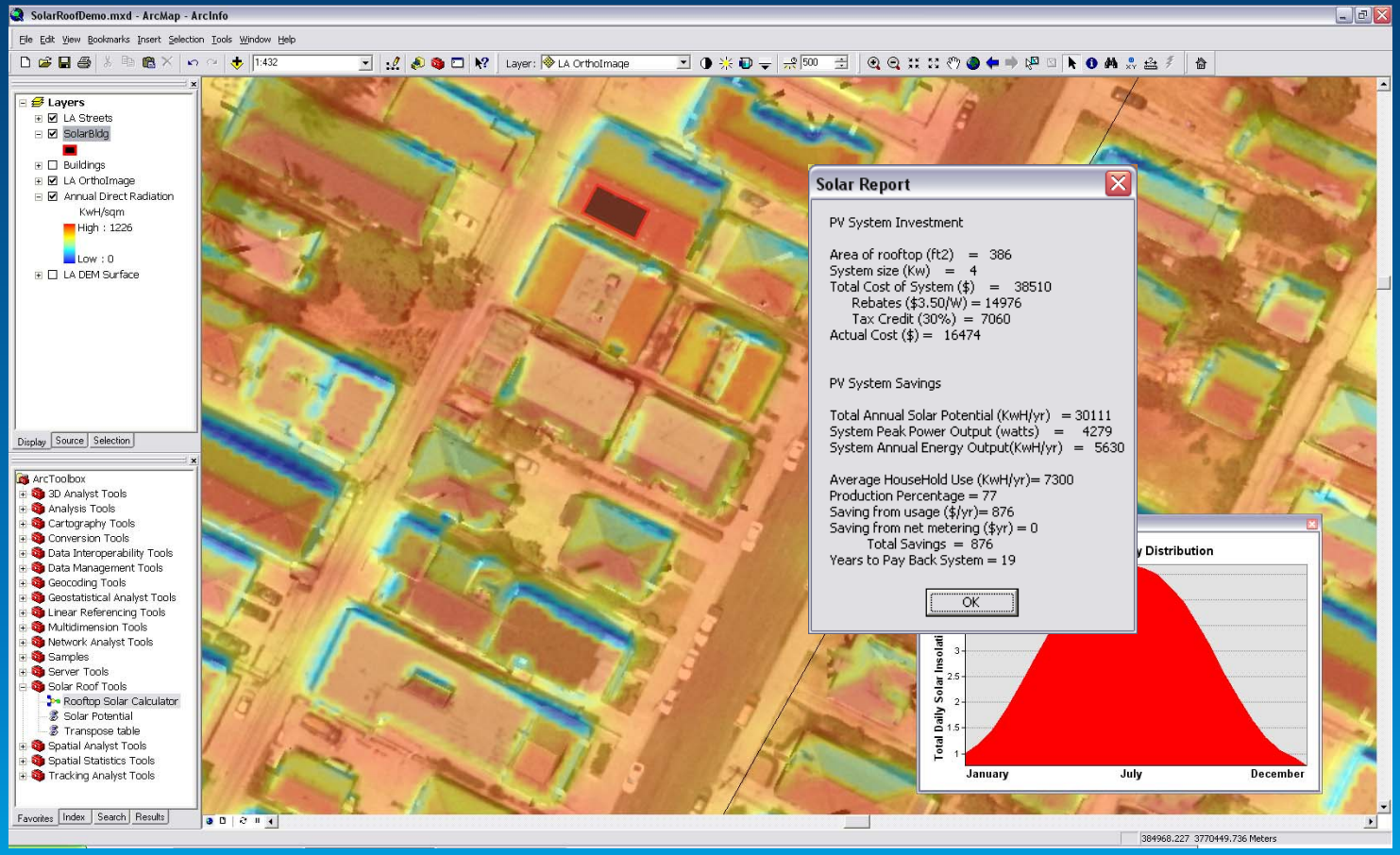
nteractive Solar Rooftop Analysis



Calculating energy potential for a photovoltaic system

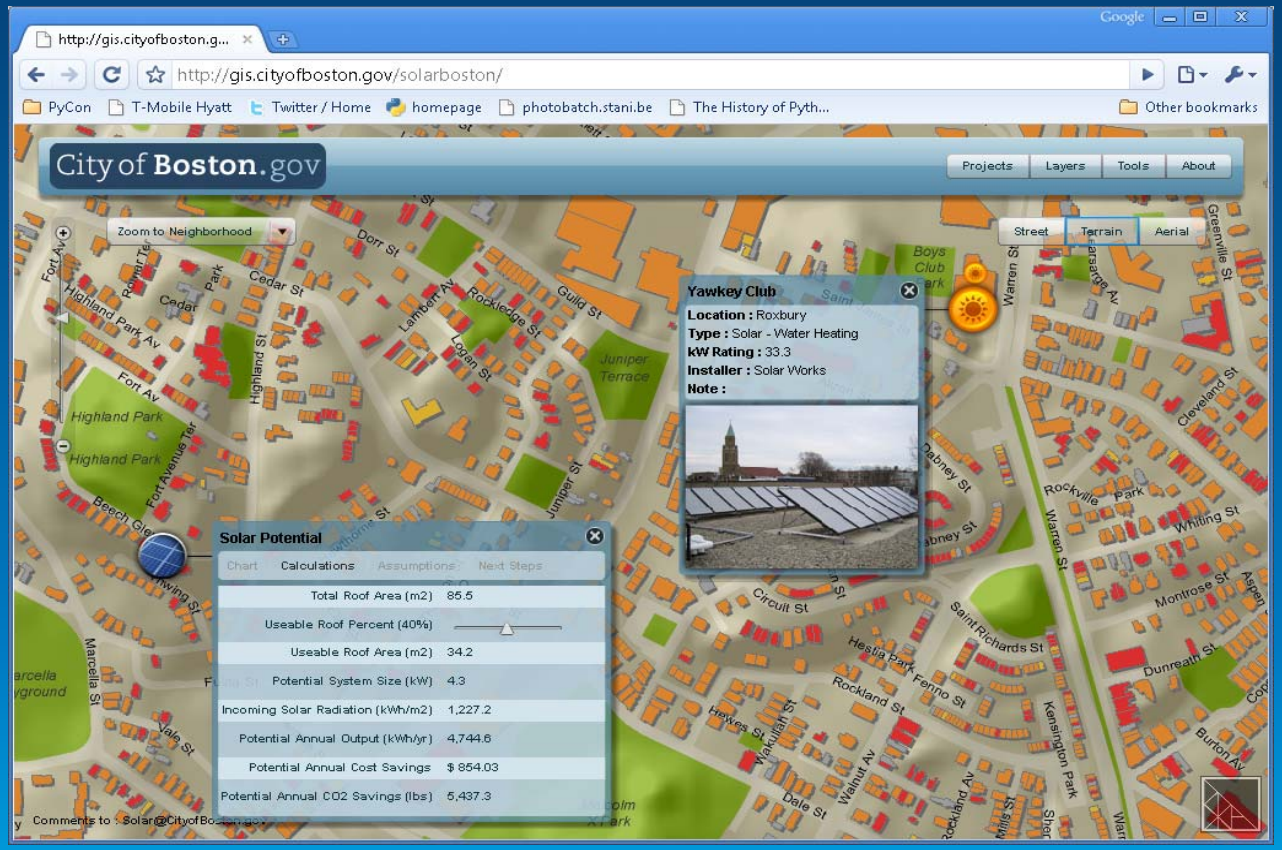
Demo data provided by CyberCity

Analyzing solar potential for rooftop photovoltaic system



City of Boston solar initiative

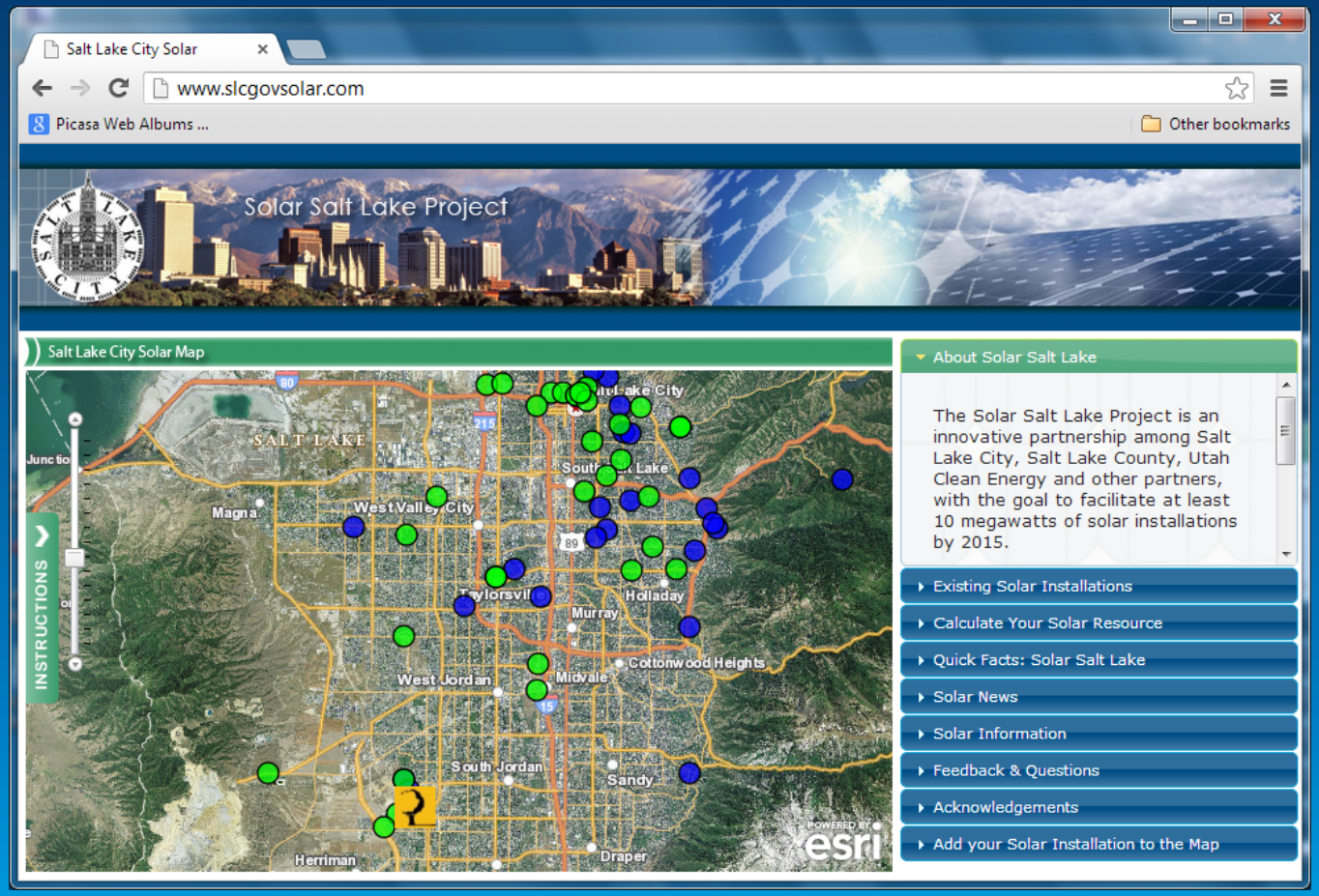
- Online map of solar energy in the city to track progress and identify solar potential



http://gis.cityofboston.gov/solarboston

Salt Lake City Solar

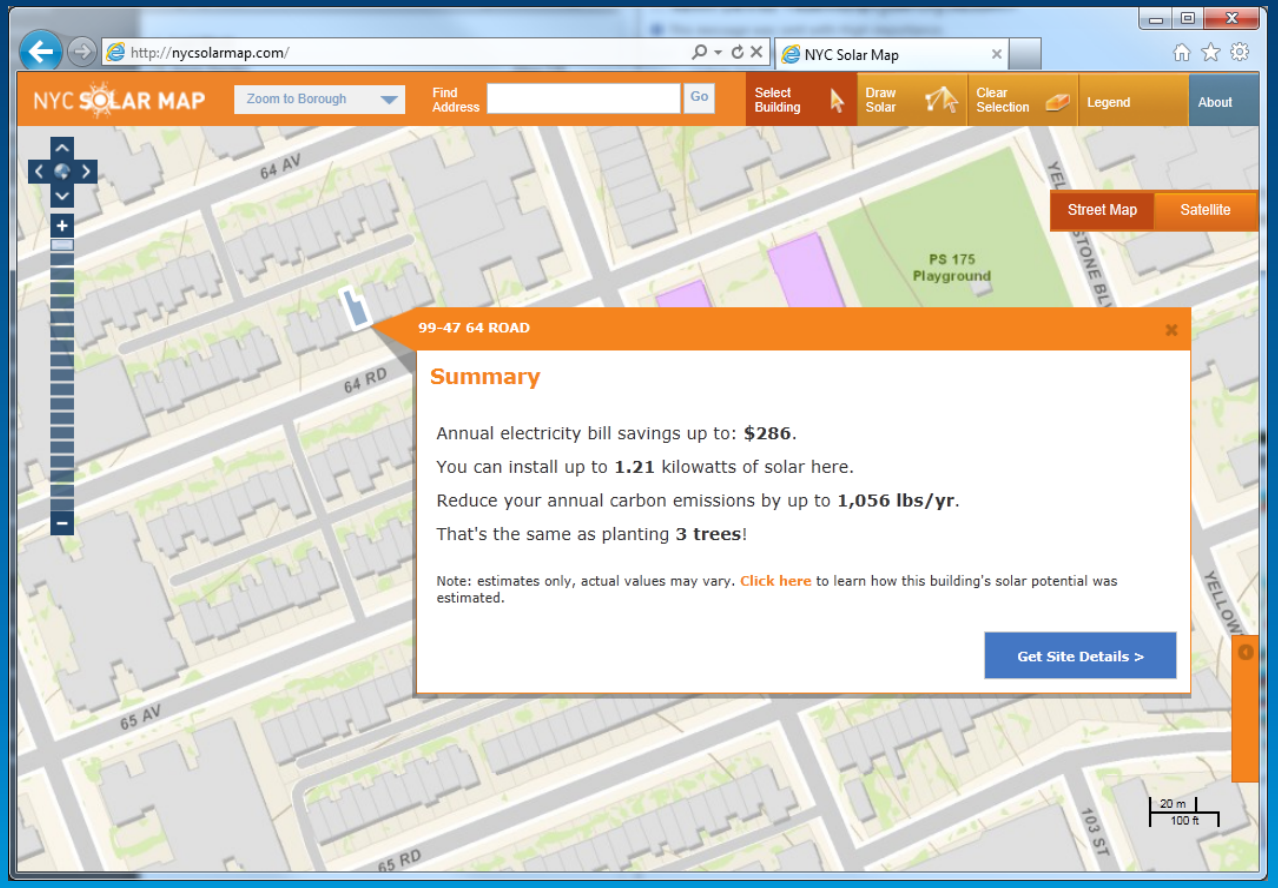
- Solar Initiative tracking includes solar calculator



http://www.slcgovsolar.com/

New York City Solar Map

- Online map of solar and system calculator



http://nycsolarmap.com

References

- ArcGIS Web Help
  - http://resources.arcgis.com/en/help/

- “Add Buildings into DEM”
  - 10.0x Custom tool to burn multi-patch features into raster dataset.
  - Resource Centre > Java code gallery
    - http://resources.arcgis.com/gallery/file/java
    - http://resources.arcgis.com/gallery/file/java/details?entryID=2929E846-1422-2418-A0DD-16627D87B471

Questions??

Thank you…

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