APPLICATIONS OF RESOURCE ASSESSMENT FOR SOLAR ENERGY

May 19, 2010

American Solar Energy Society

Phoenix AZ

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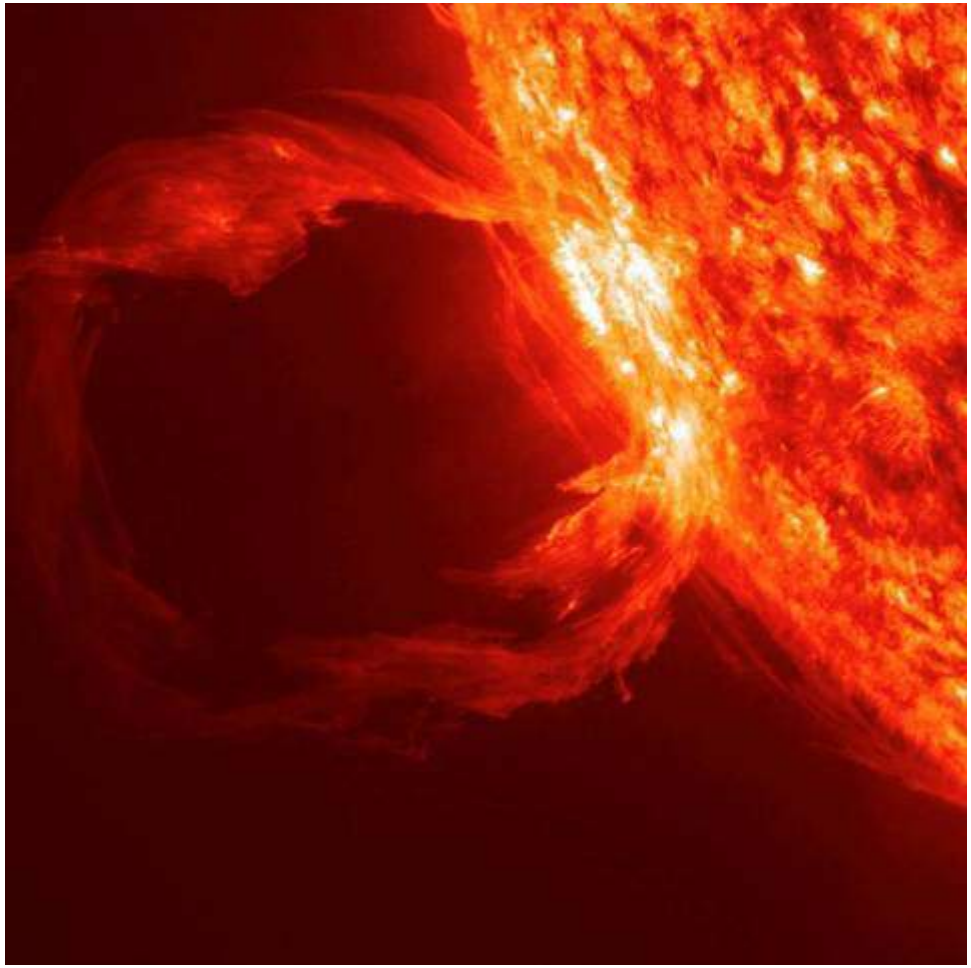
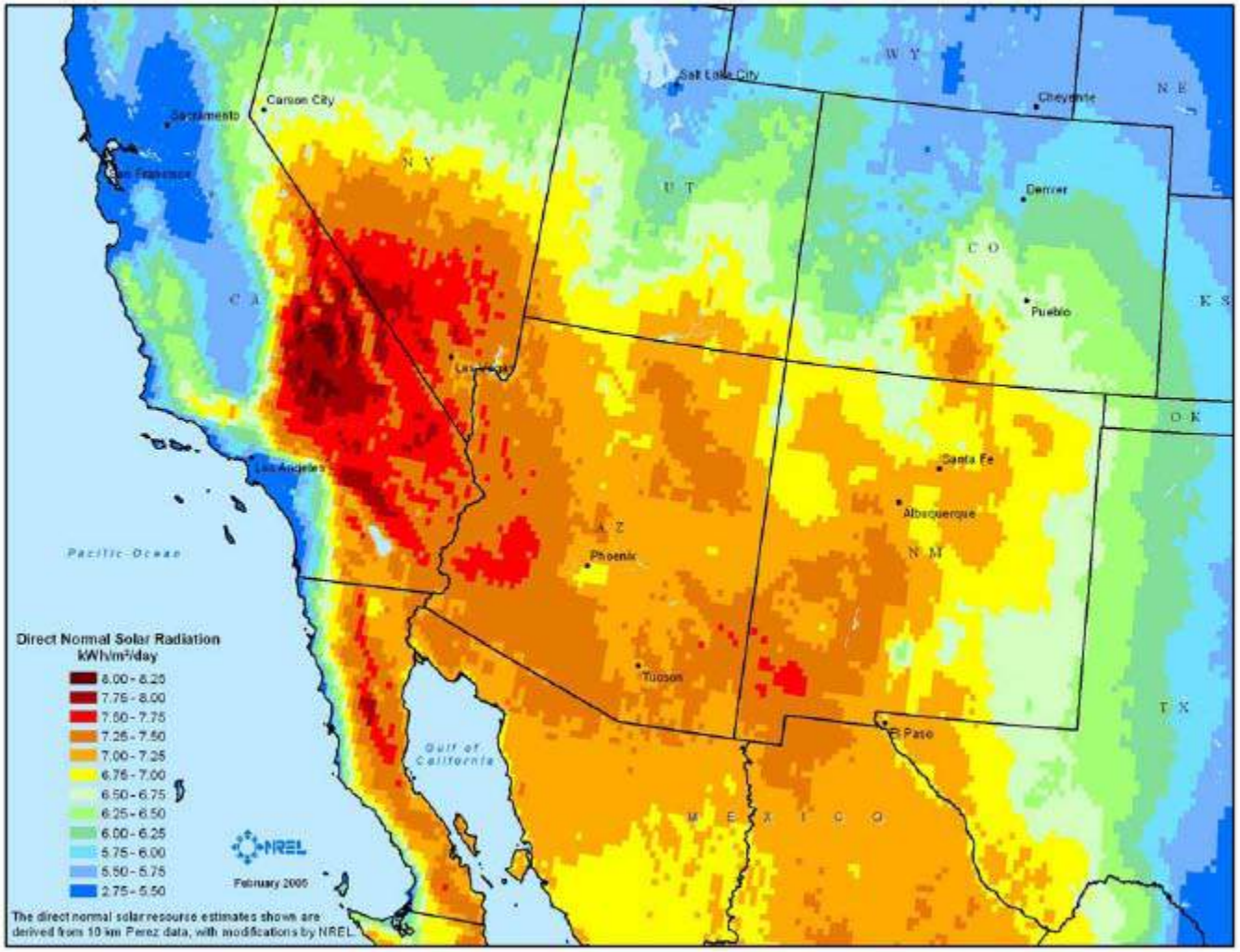
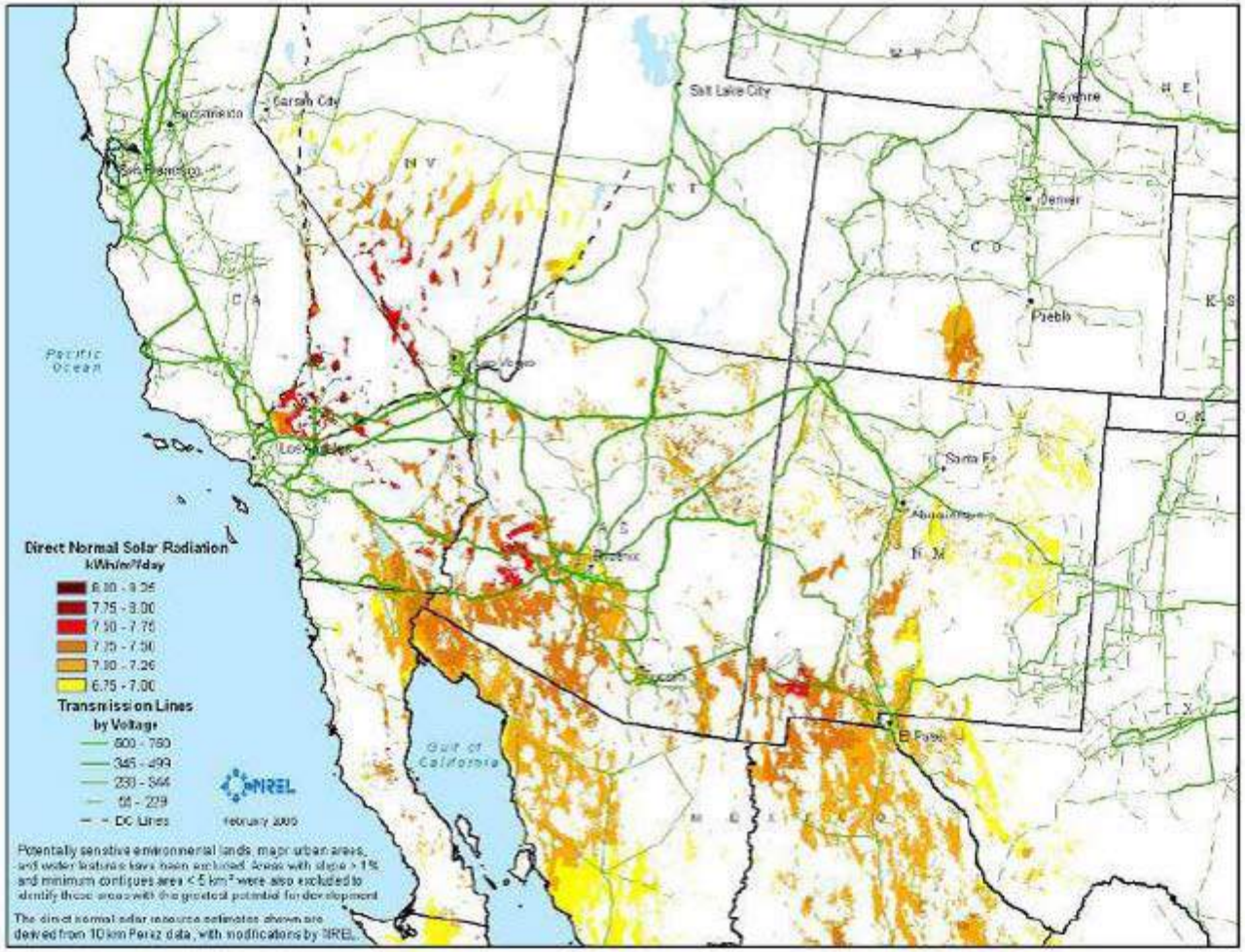


Federal Based Resource Assessments

Southwest Solar Resources
Unfiltered Data

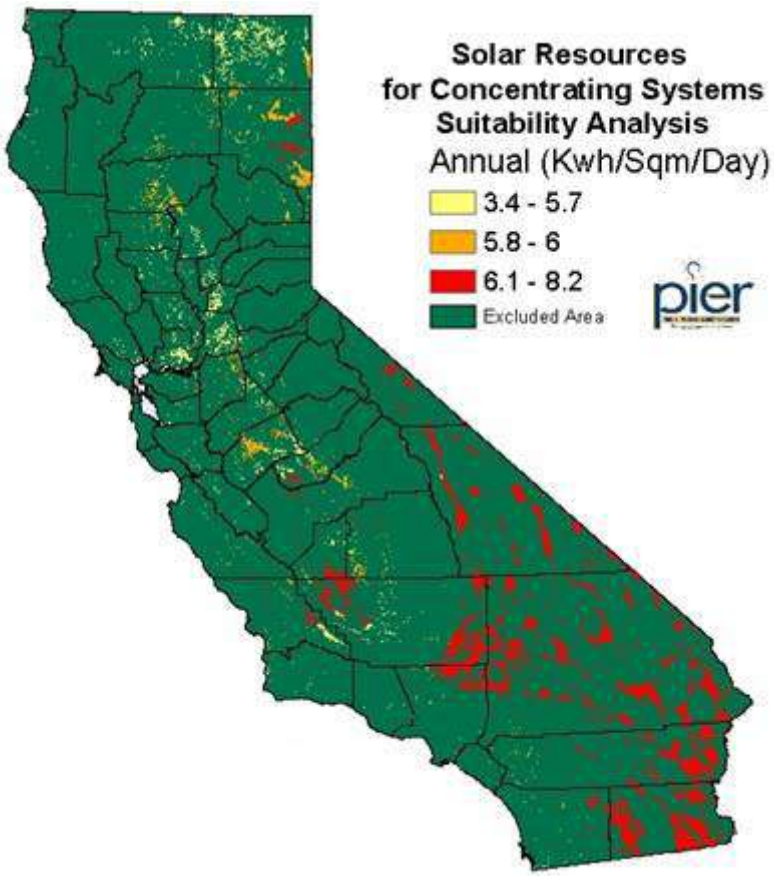


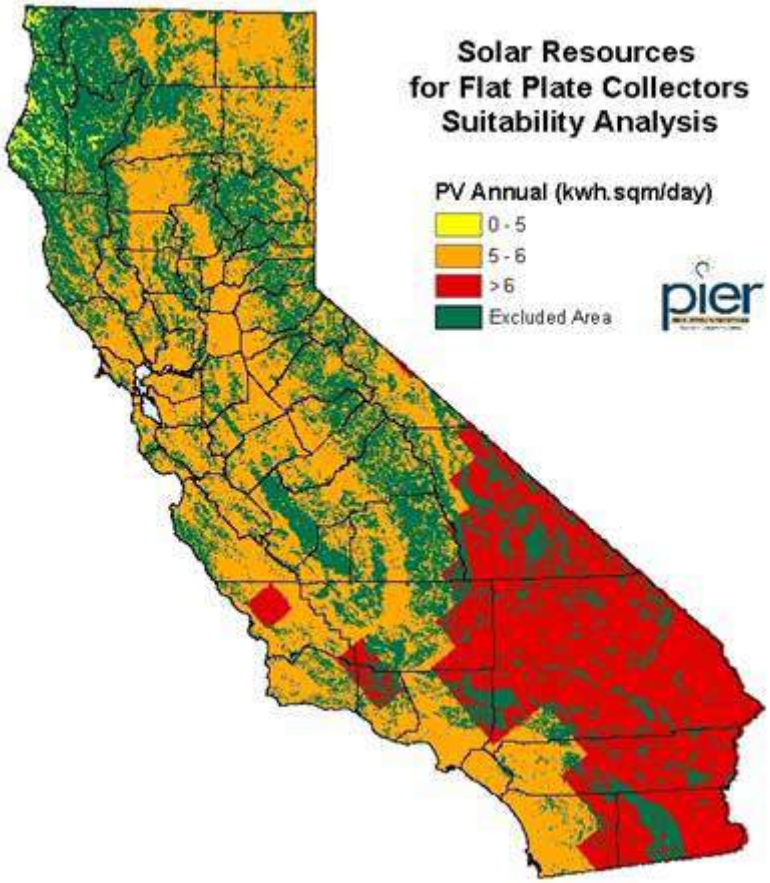
Southwest Solar Resources (With all Filters)
Result: 7,000 GW (7X U.S. capacity)!



Western Governors' Association study

State Based Resource Assessment

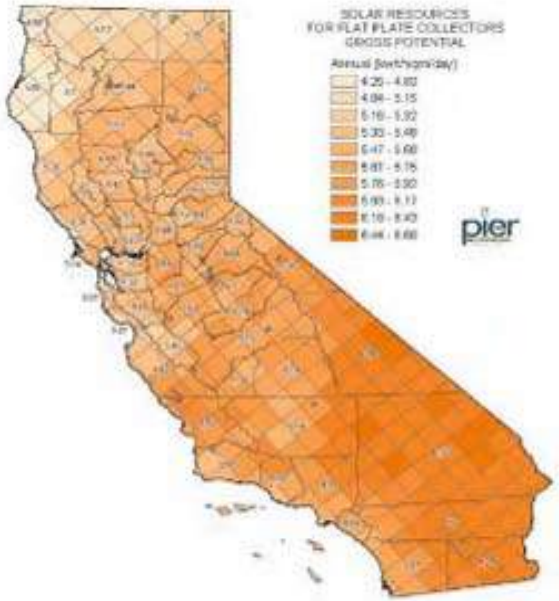




CSP, greater than 6 kWh / day annual average, less than 1% slope, no forest / water / roads or building lands.

Flat Plate Solar, exclude north sloping greater than 5%, exclude roads, forest areas, bodies of water and airports.

Gross and Technical Potential of PV in CA



The technical potential associated with installing PV systems on California's 15 million homes exceeds 38,000 MW.

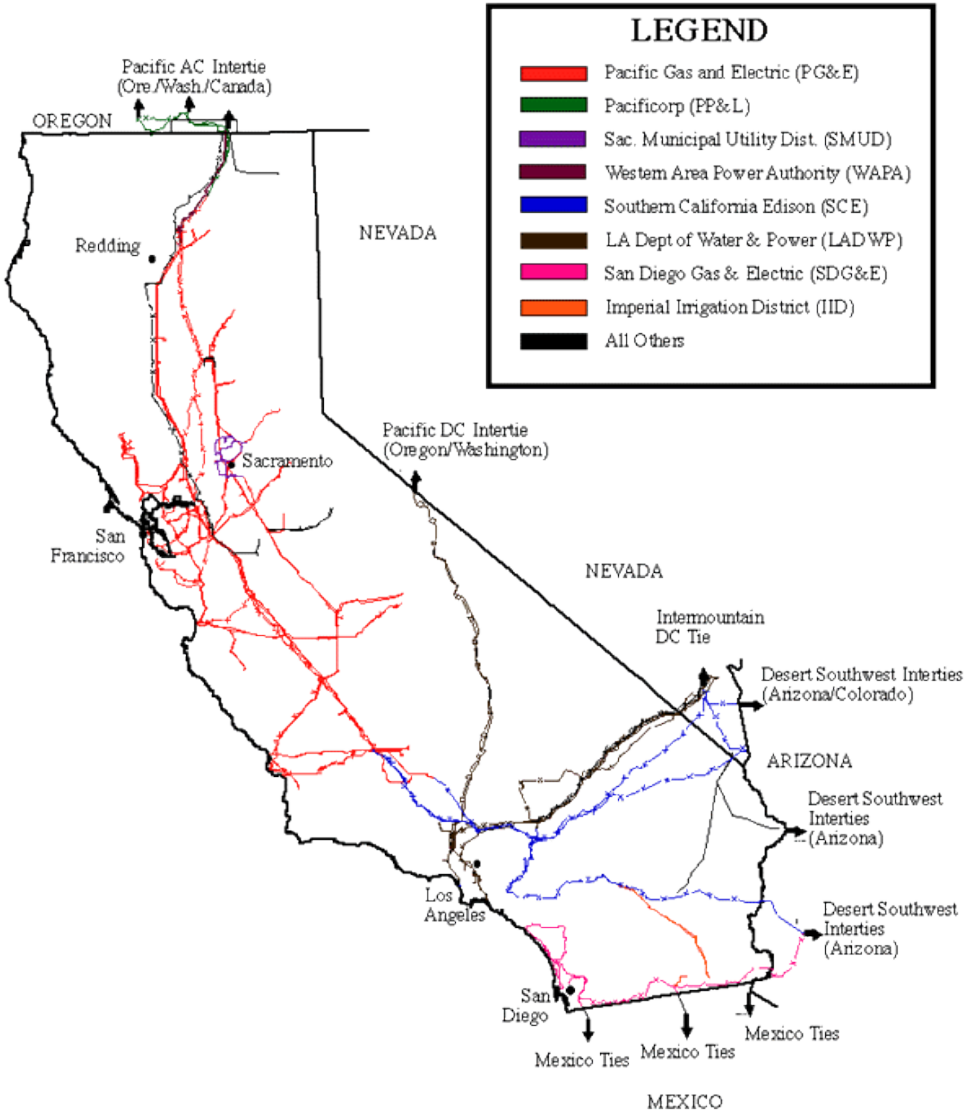
The potential for locating PV systems on commercial buildings using 2005 building numbers indicates the state wide potential at 37,000 MW.

California's Grid

California's transmission and distribution system is made up of more than 124,000 square miles of power lines, and over 2000 substations.

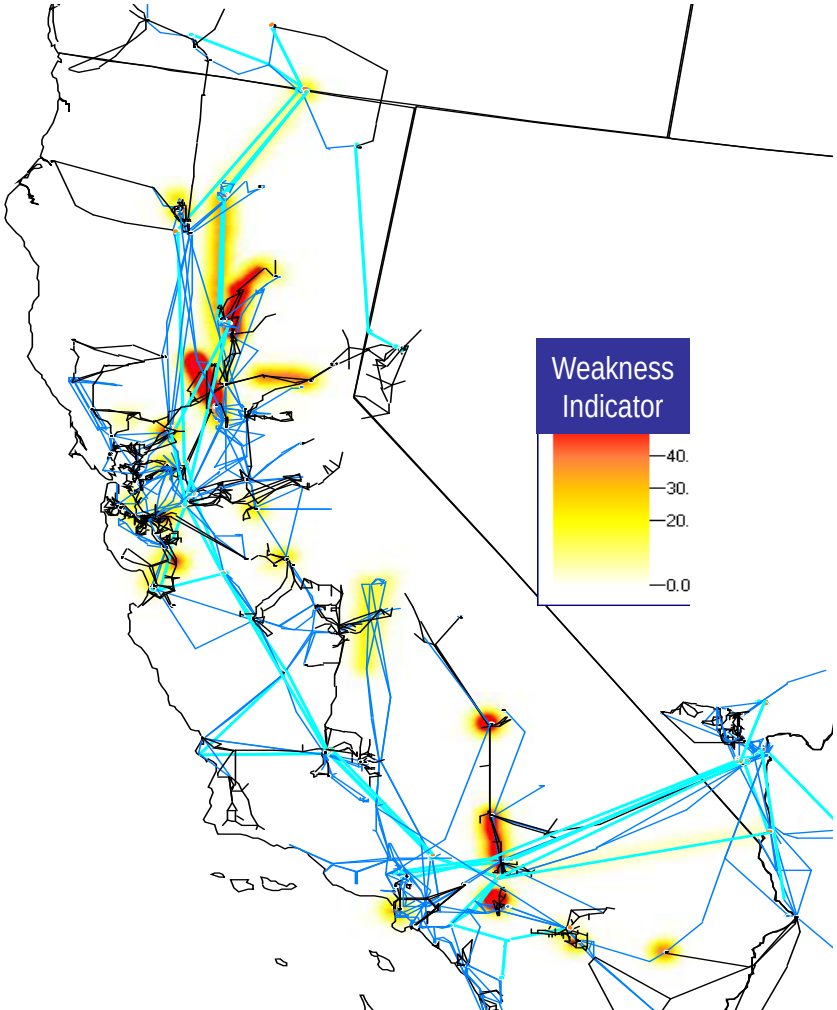
The grid supplies over 164 billion kilowatt-hours per year to 33 million Californians.

Electricity generation of over 53,000 megawatts supply electricity into California's grid.



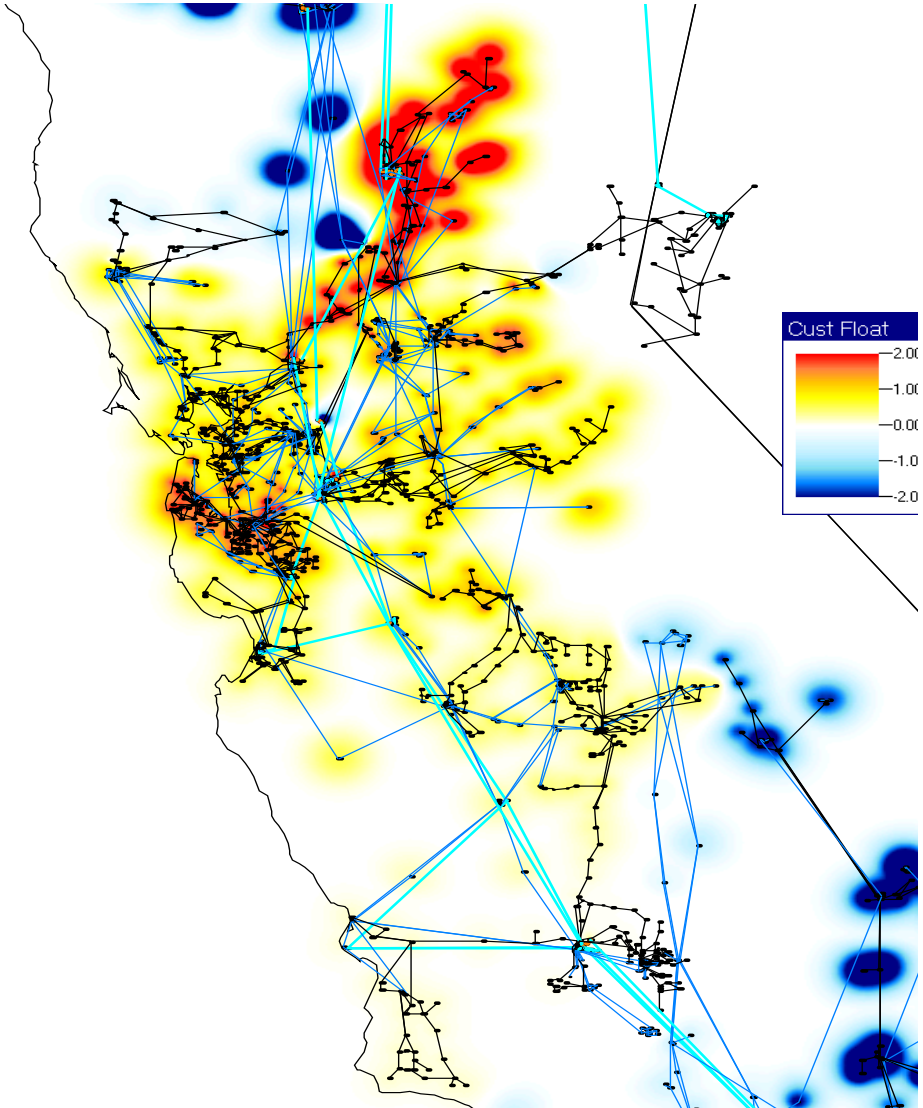
“Weak” Transmission Elements in California (Hot Spots)

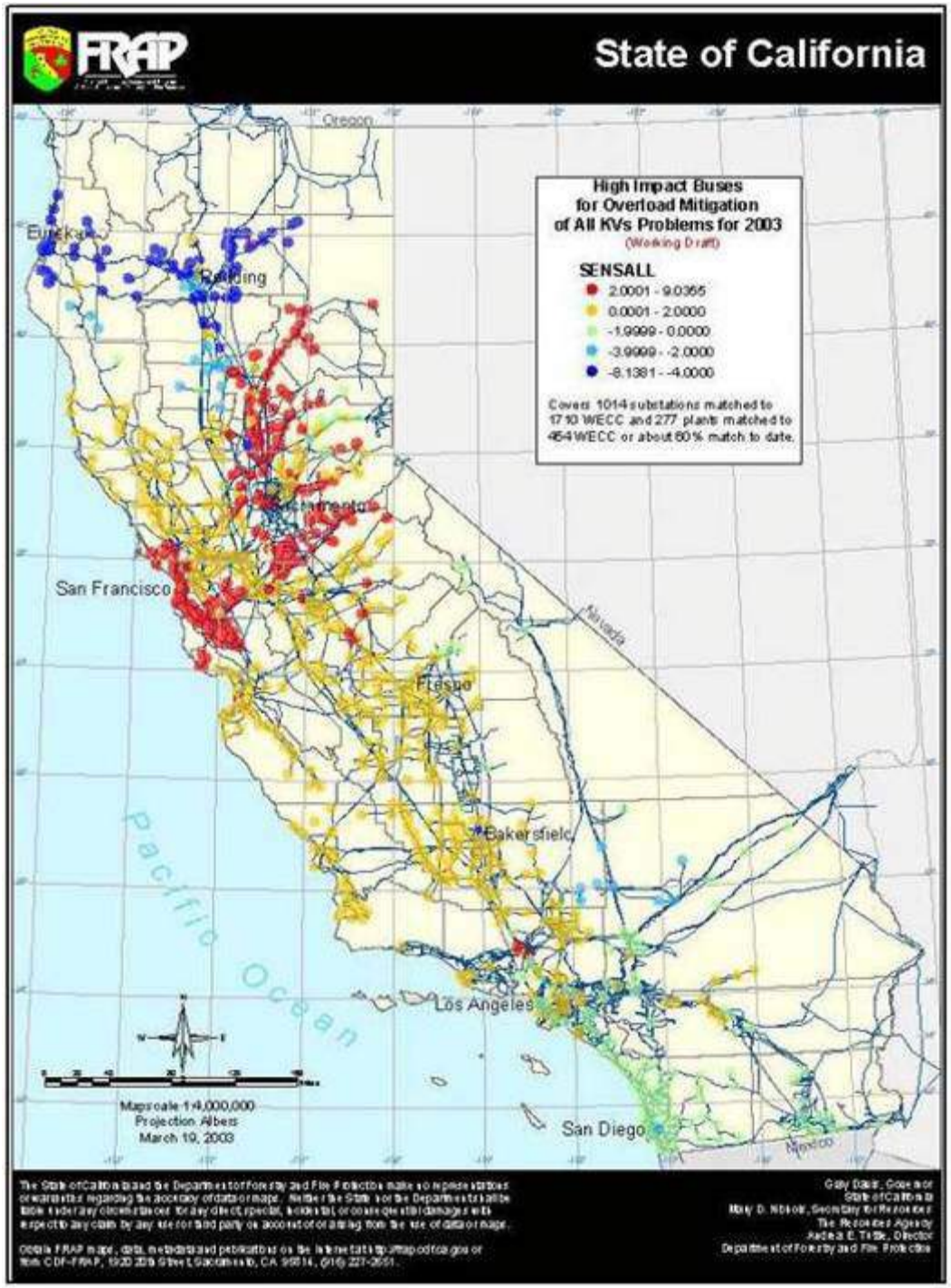
- Hot spot are NOT mitigated with generation located at the hot spot.
- Need to find high impact buses in the system based on Transmission Loading Relief Sensitivities



High Impact Buses in California for Overload Mitigation

- New generation at the red locations will tend to reduce the overloads. We should build more generation here.
- New generation at blue locations will tend to increase the overloads.
- Note: High imports are bad for reliability





Hot Spot Analysis

Power flow simulation data on capacity and voltage to help identify projected energy deficits (“hot spots”).

Renewable Resource GIS Assessment

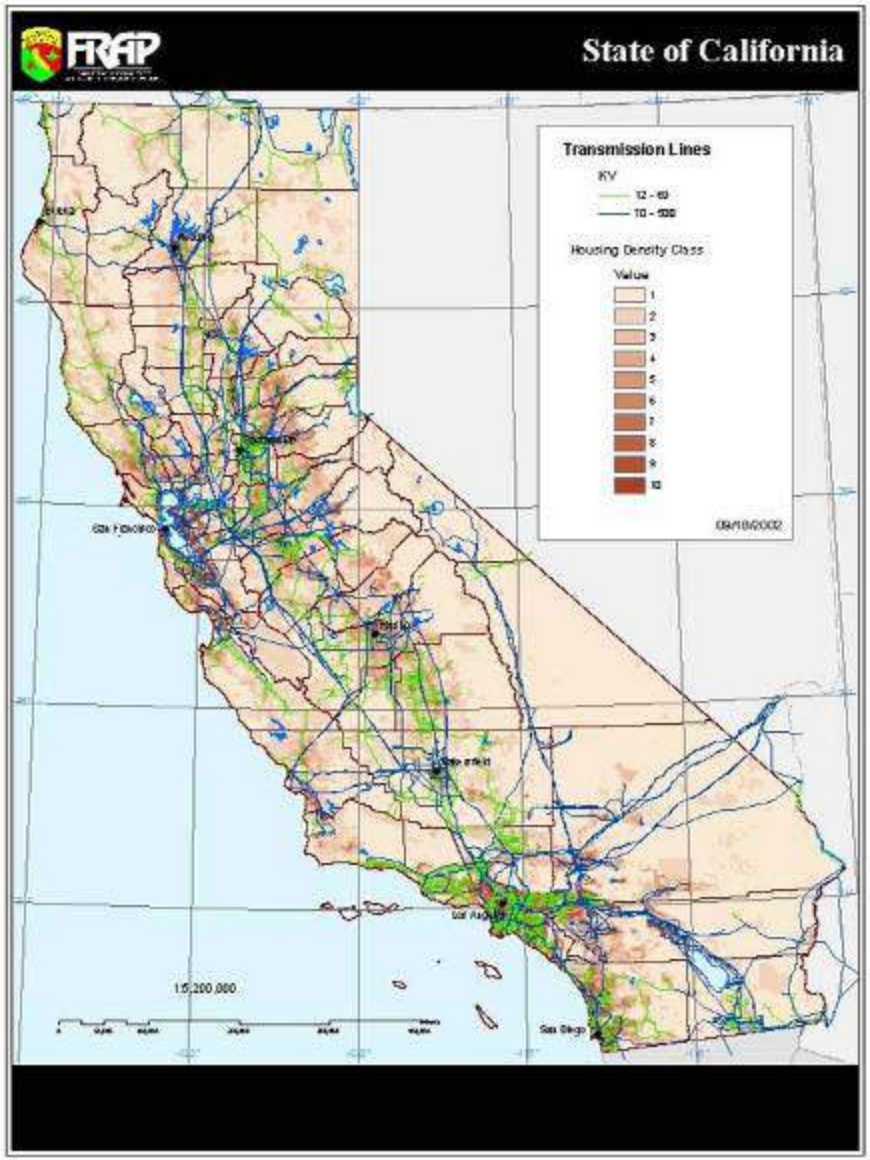
- Create thematic layers on renewable resources within California, layers on detailed demographic, environmental and energy use information by Geographic Information System (GIS) mapping to assess renewable energy potential
- Public benefit analysis
- Conduct GIS analysis to overlay hot spots, renewable resource potential and areas of high public benefits

Example of GIS Information

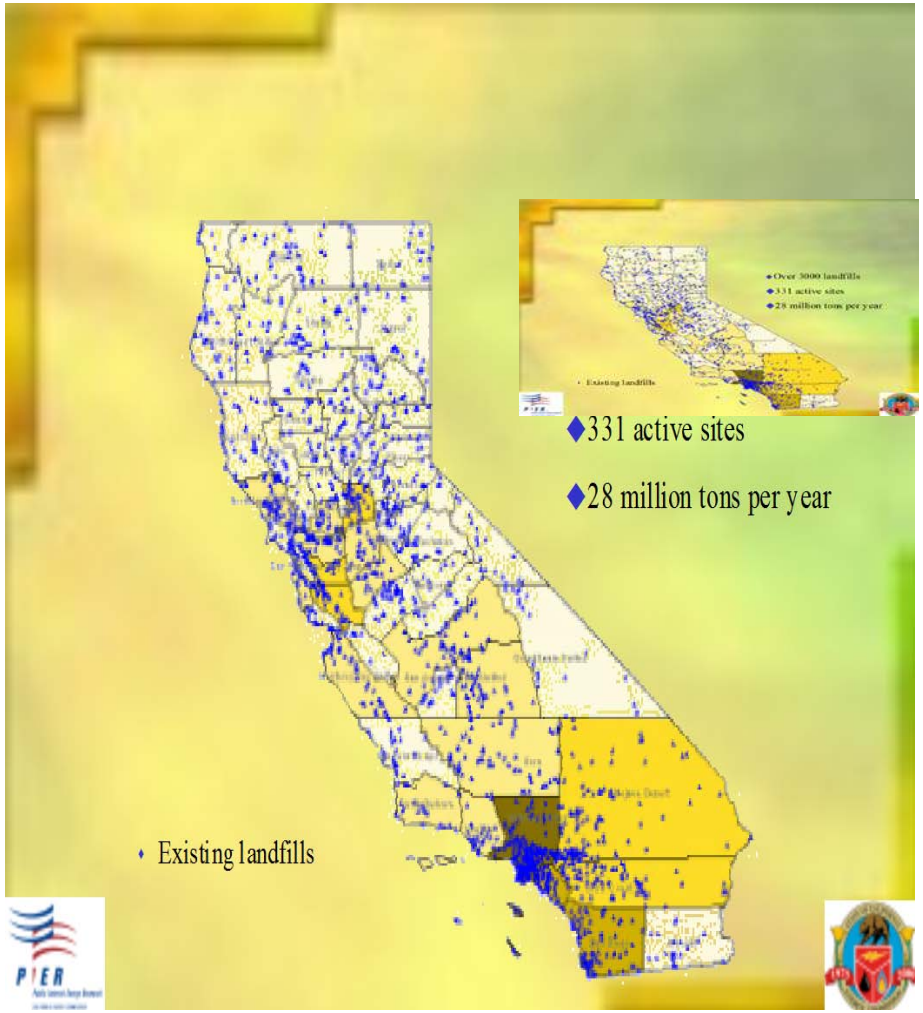
- **Biomass Resources**
- **Agricultural Residues**
- **Forestry Residues**
- **Biomass LFG and MSW**
- **Urban Wood Waste**
- **Landfill Gas Resources**
- **Livestock Residues**
- **Small Hydroelectric Resources**
- **Geothermal Resources**
- **Wind Resources**
- **Solar Resources**
- **Congestion Zone Information**
- **Demographics**

- **Environmental Information**
- **Employment**
- **Small Businesses**
- **Air Quality Conditions**
- **Water Quality Conditions**
- **Landfill Capacities**
- **Wildfire Assessments**
- **Water Quality Conditions**
- **Power Flow Simulation Data**
- **Substation Data**
- **Large Energy User Data**
- **T&D Lines and Capacities**
- **Generation Facilities (by type)**
- **Hot Spot Locations**

Housing Density and Transmission and Distribution lines

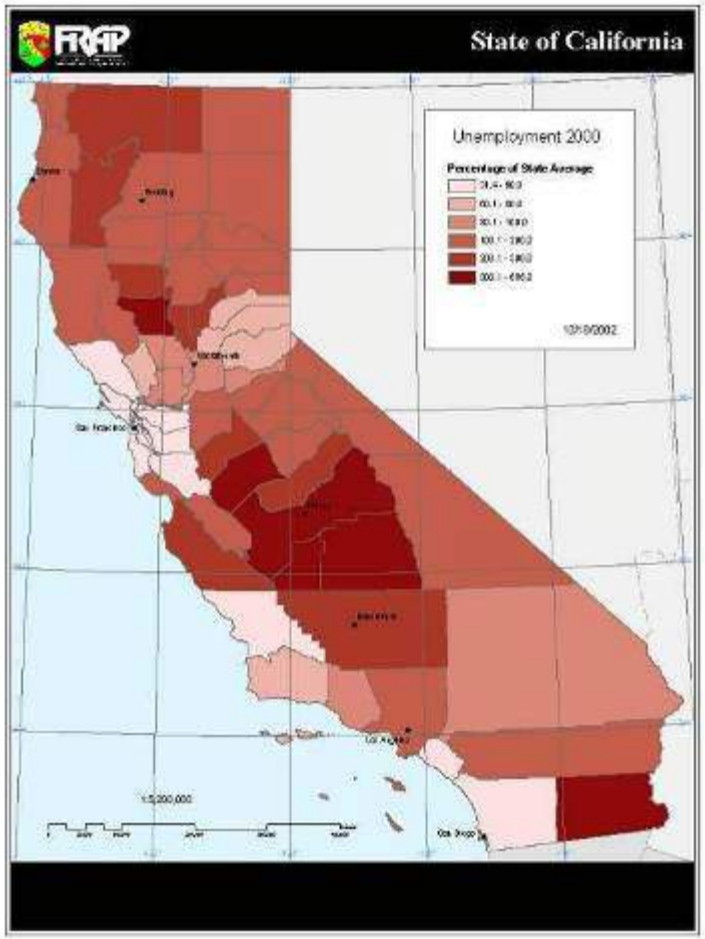


California's Landfills



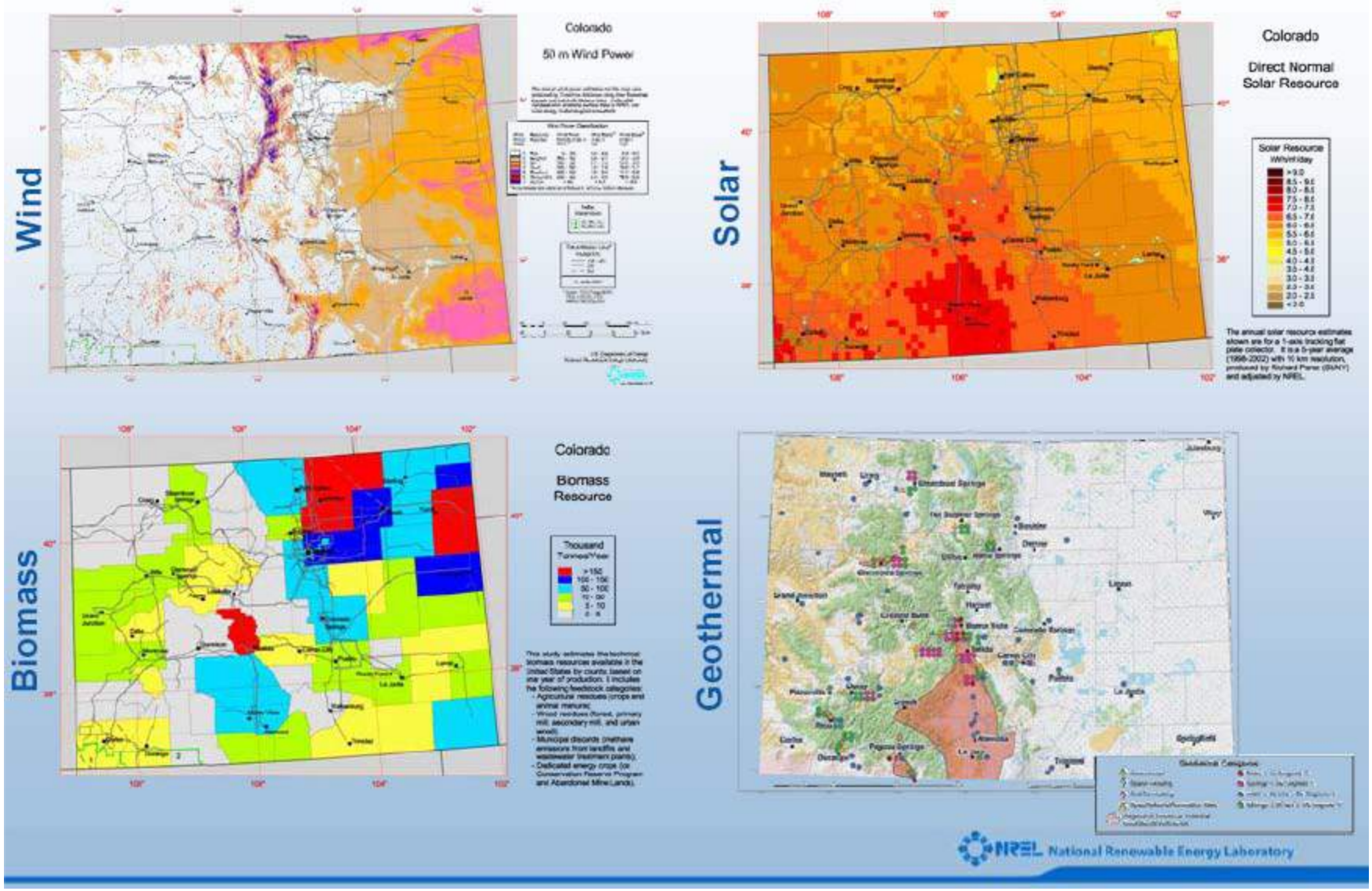
Public Benefits

Wildfire Hazard



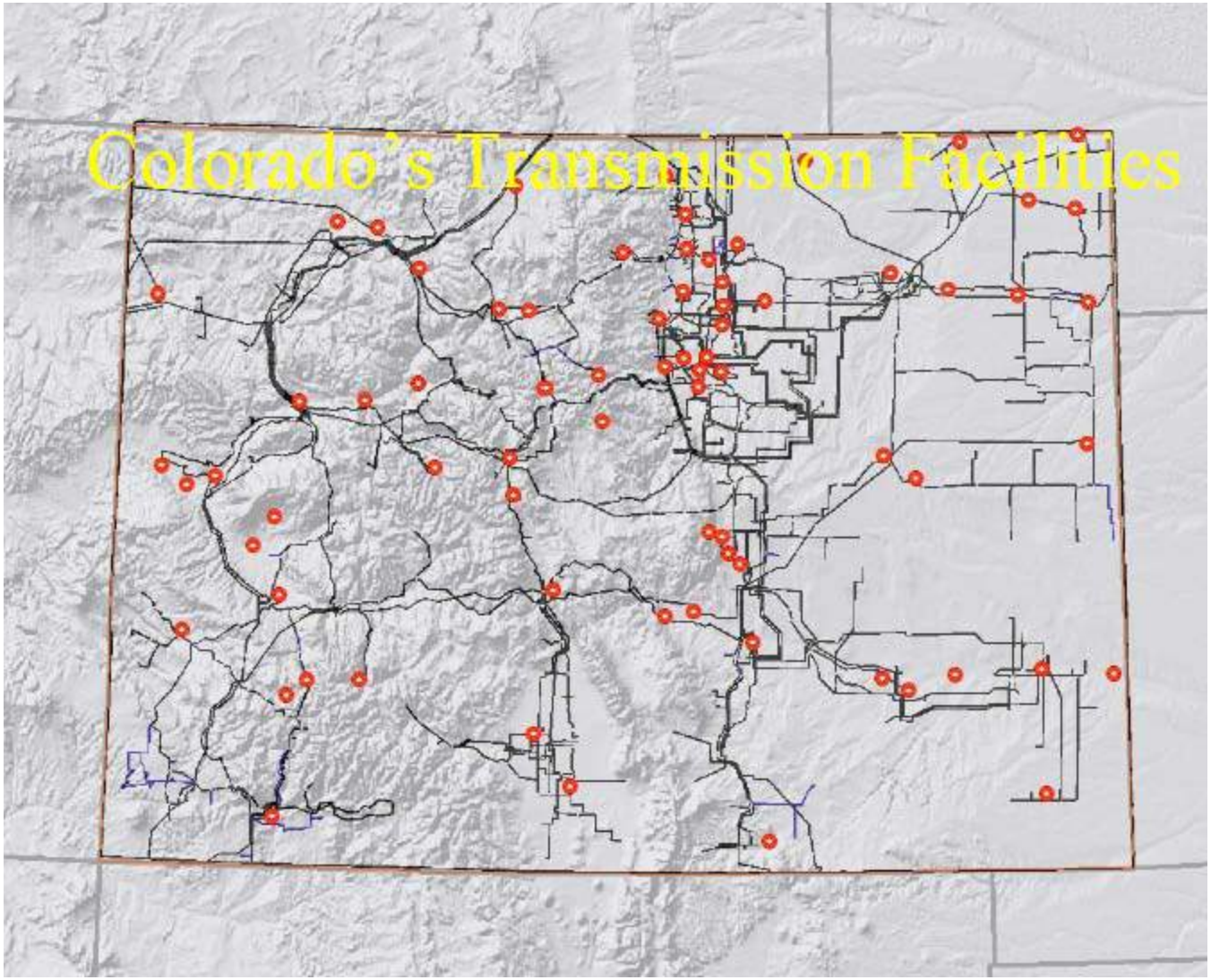
Unemployment

Colorado Resources

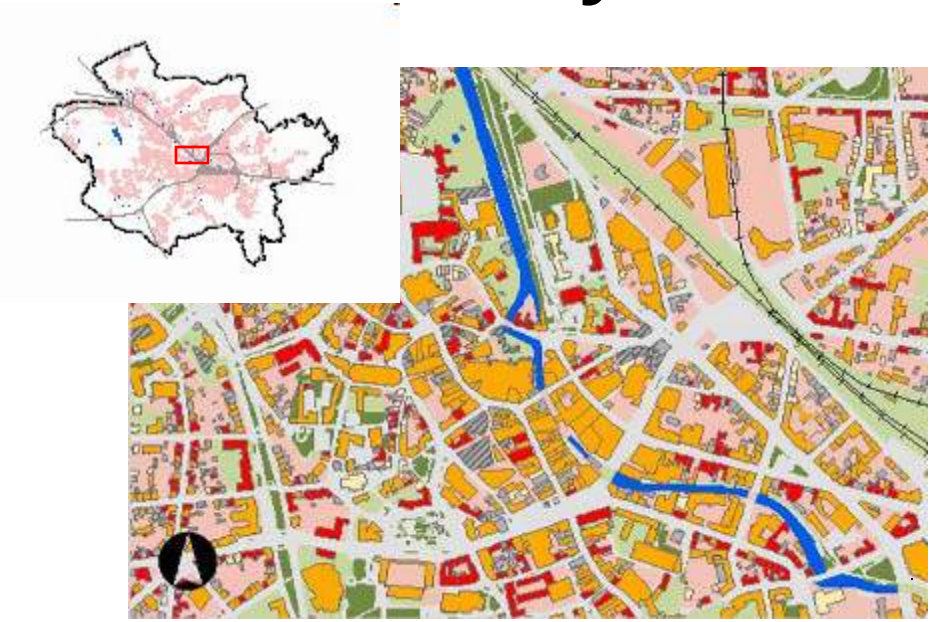


Slides from Chuck Kutscher

Colorado Transmission Facilities

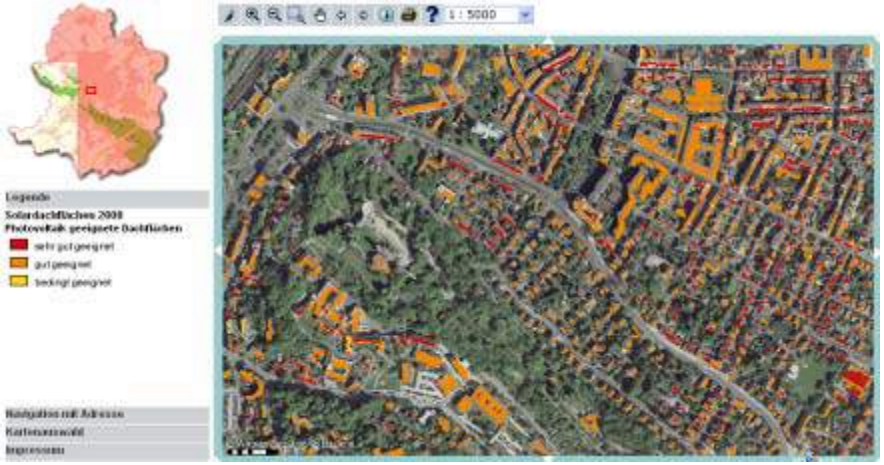


Community Resource Assessment



Osnabrück Germany Building by Building PV Suitability

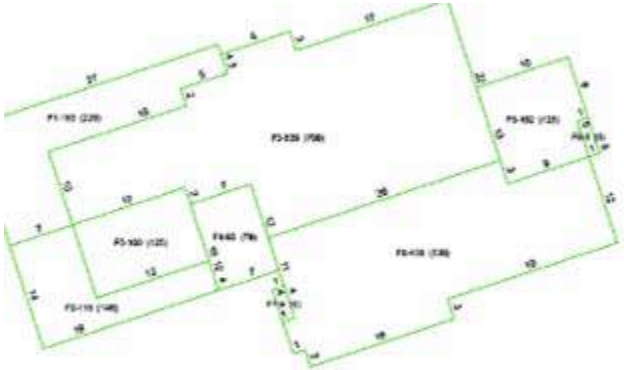
Close up of Braunschweig Germany

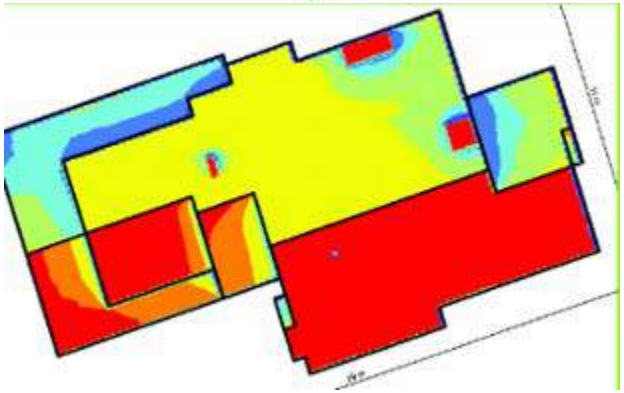


Kartendienst der Stadt Bielefeld Germany

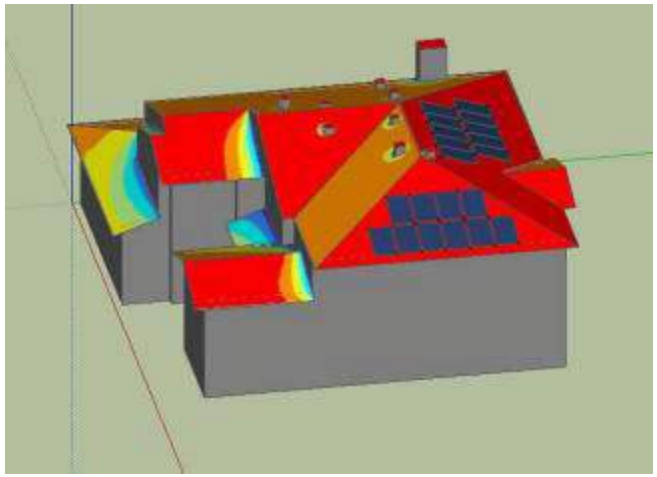
(More than 100 municipalities about SUN-AREA. Images courtesy of SUN-AREA).

Individual House PV Customization

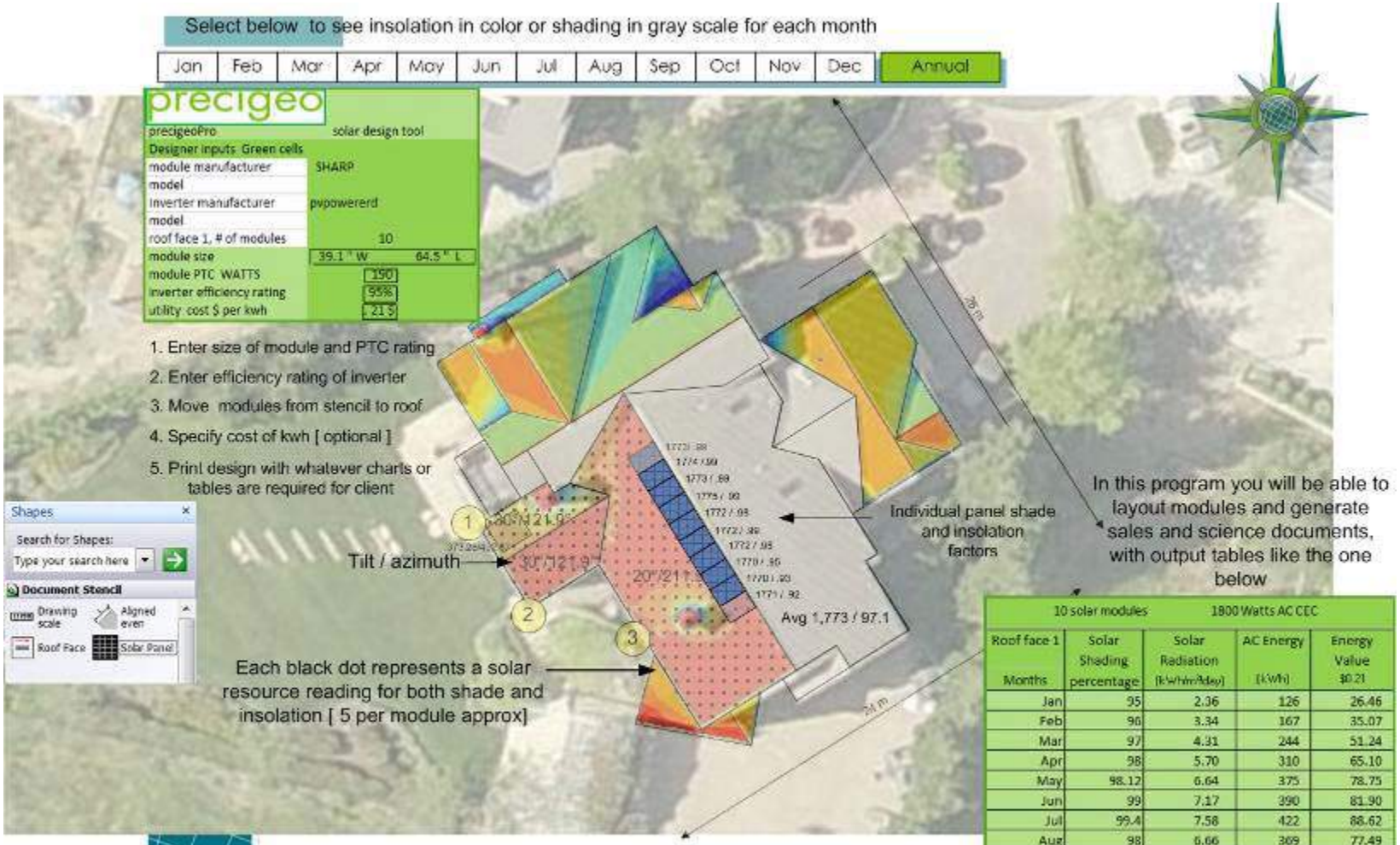




precigeoSolar™, provides individual building and PV system analysis; solar modules are placed to scale on a satellite image of the actual building for visualization purposes.

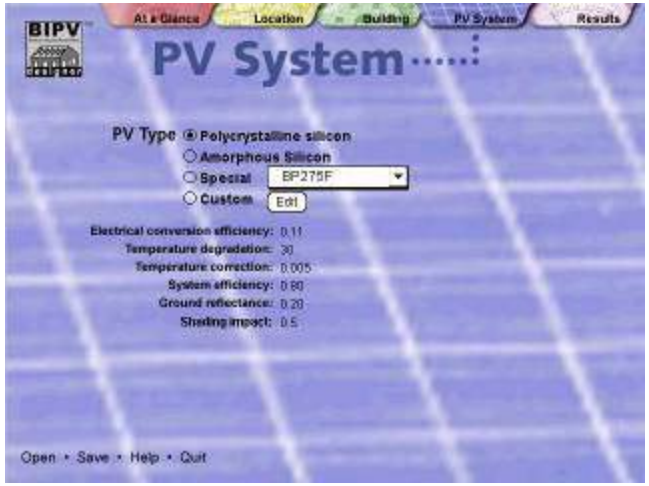


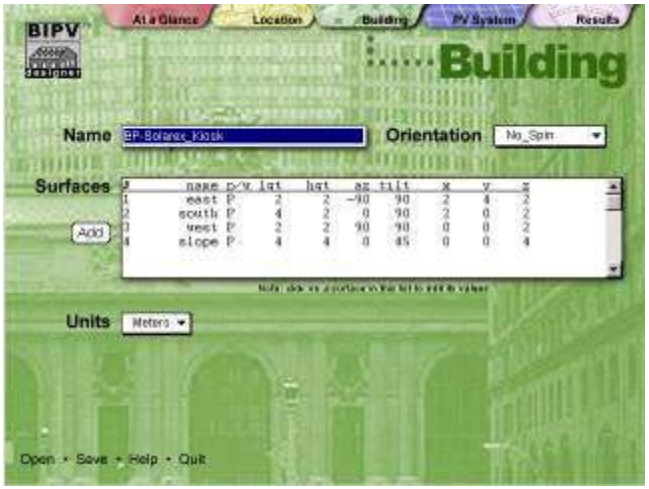
precigeoSolar™ GUI



10 solar modules		1800 Watts AC CEC		
Roof face 1 Months	Solar Shading percentage	Solar Radiation (kWhm/day)	AC Energy (kWh)	Energy Value $0.21
Jan	95	2.36	126	26.46
Feb	96	3.34	167	35.07
Mar	97	4.31	244	51.24
Apr	98	5.70	310	65.10
May	98.12	6.64	375	78.75
Jun	99	7.17	390	81.90
Jul	99.4	7.58	422	88.62
Aug	98	6.66	369	77.49
Sep	97.1	5.70	304	63.84
Oct	96.2	4.05	222	46.62
Nov	96	2.57	133	27.93
Dec	95.5	2.11	112	23.52
Year	97.1	4.86	3173	666.33

BIPV Designer

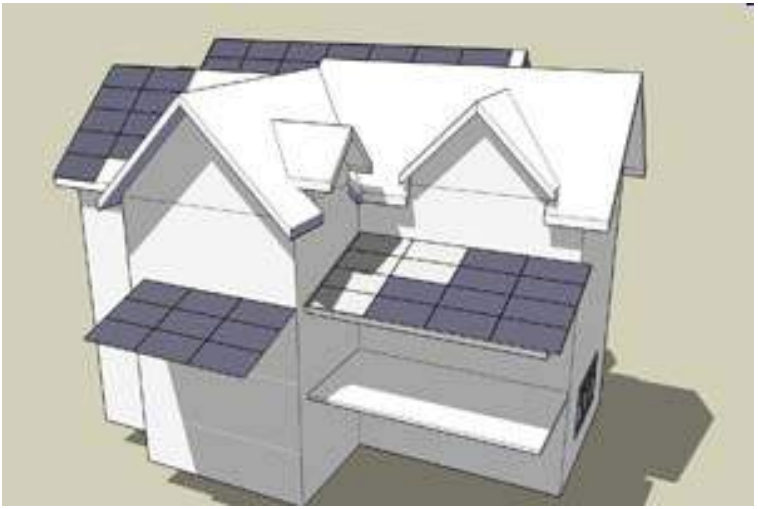


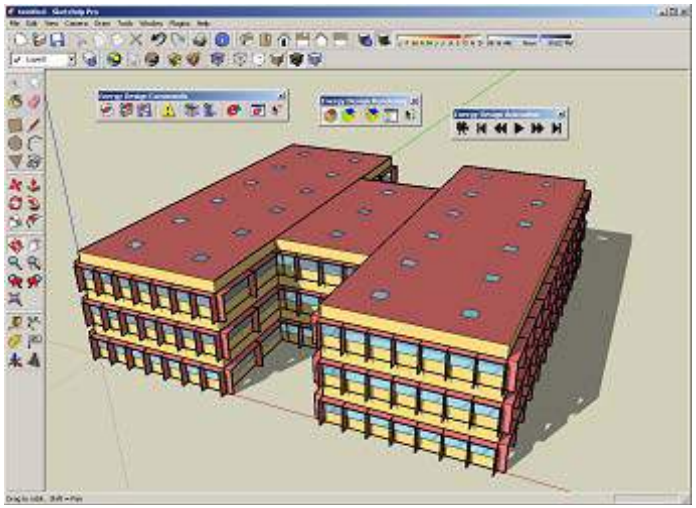


The software called "BIPV Designer" uses solar resource assessments to calculate the monthly performance of user defined surfaces around the world. BIPV Designer lets users interactively calculate how much energy can be produced by various building surfaces covered with BIPV.

Download The Interactive BIPV Designer Program freeware.zip at http://tinyurl.com/27kbmax

Google It!





Google SketchUp

http://apps1.eere.energy.gov/buildings/energyplus/openstudio.cfm

New buildings can benefit from solar energy predictions and economic calculations.

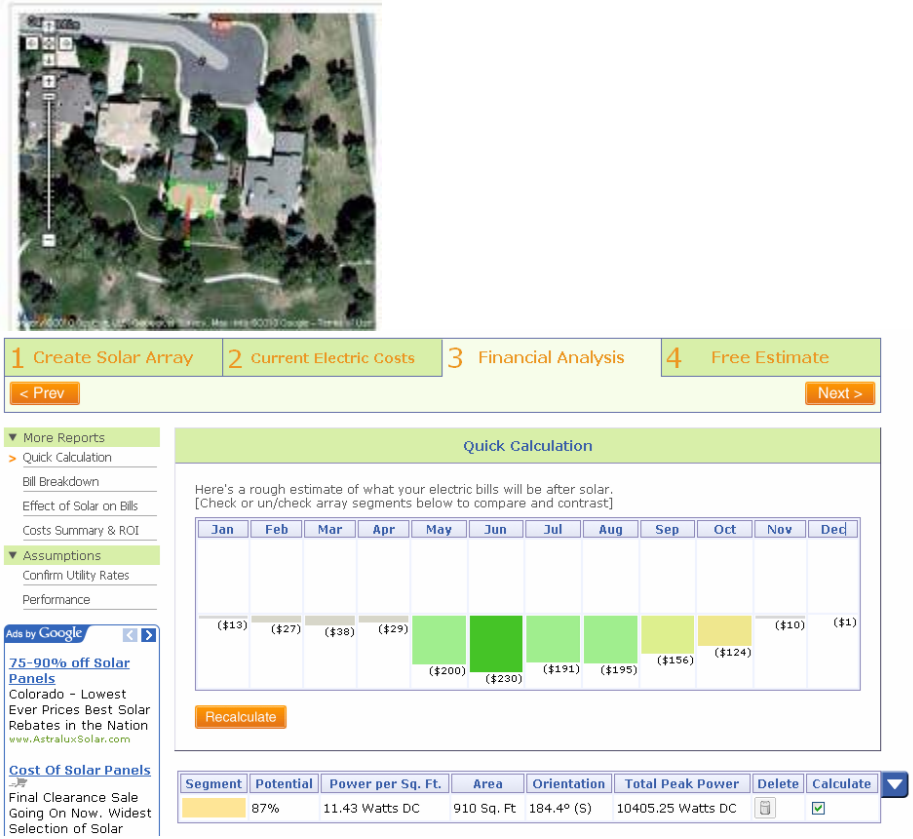
Vision is to enable Google SketchUp to incorporate a “Solar Button” that flashes most economical surfaces.

A Google Wave has been set up to try an implement this vision.

E-mail author if interested in being a part of The Wave.

Images courtesy of Google, OpenStudio and EnergyPlus

RoofRay and IMBY



RoofRay
http://www.roofray.com/calculators

In My Back Yard
http://mercator.nrel.gov/imby/

Excellent new Solar Advisor Model SAM Version 2010.4.12:
https://www.nrel.gov/analysis/sam/

CONCLUSIONS

- Resource assessment supports national security interests, electrical supply and transmission infrastructure planning for solar implementation.
- State governments can facilitate economic expansion, and new energy economic activity from solar energy due to targeted resource assessment visualization tools as seen with the CEC PIER analysis.
- Local governments can empower citizens with individualized solar resource assessment as seen with Sun-Area.
- Businesses can provide added value for “what-if” analysis to optimize solar systems performance as seen with precigeoSolarTM.
- Google can provide the world with CAD tools that create a paradigm shift in the way humanity designs buildings, capitalizing on solar resources in the built environment by integrating the visualization of solar resource assessment into their world wide distributed software offering SketchUp.

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We would like to thank Roy Clausen, Dorothea Ludwig, George Simons, Dr. Cynthia Erickson, John Bacus, Christopher Cronin, Jim Foltz, Robert Flottemesch, Christopher Gronbeck, NREL’s Christopher Helm & Dave Renne, and the excellent ASES Staff and volunteers.

Thanks

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