Solar Roadmap Market Potential Methodology & Assumptions

As part of the Solar Roadmap platform, local solar market potential is assessed for each participating jurisdiction. These statistics highlight the benefits and opportunities available to be captured via the solar market development and are customized for each municipality. Specific methods and assumptions that were used to calculate these numbers are shown below:

Population

Population was determined using the 2010 Census Demographic profile: http://www.census.gov/popfinder/

Land Area

Land area was determined using Census' State and County QuickFacts:
http://quickfacts.census.gov/qfd/index.html

Solar Energy Yield

Solar Energy production data was generated using the latest version of the National Renewable Energy Laboratory's System Advisor Model (SAM), which uses system design, technology, geographic location, DC to AC derate factor, performance ratios and over 30 years of weather data to predict solar energy production for a specific location. The yield calculation assumes a 180° azimuth and 15° system tilt using the agency zip code.

Total Market Size

In assessing the potential for solar PV, the Solar Roadmap team used Energy Information Administration (EIA) data to estimate the total electric usage within a community. The electric usage by state was obtained at http://www.eia.gov/electricity/data/state/revenue_annual.xls. From there, average per capita usage is derived by using population sources noted above, and multiplied by the jurisdictional population to obtain an estimate of usage within the community. Note that this approach assumes that per capita usage within a community is similar to the statewide average.

After total electricity usage is determined, a 5% offset goal is set for the community to demonstrate the potential solar market size and the associated benefits of reaching this target. 5% is an aggressive yet obtainable number that aligns with some current state-level renewable portfolio standard goals as detailed here: http://www.dsireusa.org/documents/summarymaps/Solar_DG_RPS_map.pdf. Some utilities are already nearing this penetration level as can be seen in the Solar Electric Power Association's annual report: http://www.solarelectricpower.org/media/8186/final-2012-top-10-report-v2.pdf. The quantity of PV required to offset 5% of local electricity usage is determined using the Solar Energy Yield figure described above.

Job and Economic Impact

The Job and Economic Impact was estimated using National Renewable Energy Laboratory's Job and Economic Development Impact Photovoltaic Model: http://www.nrel.gov/analysis/jedi/about_jedi_pv.html
The following assumptions were used within the model:

- Installation Year: 2013

- Installed Cost: $3.50/Watt
- No local manufacturing of modules, racking and inverters
- No induced economic impact

Environmental Benefit

The Environmental Benefit was calculated using tools and statistics developed by the U.S. Environmental Protection Agency (EPA). The greenhouse gas emissions of utility provided power (carbon dioxide equivalent per kWh) is provided within Electric Coordinating Council regions:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2012V1_0_year09_SummaryTables.pdf

The total kWh offset by solar power is described in the Total Market Size section. The carbon dioxide equivalent of this quantity can be determined using the figures provided by the EPA at the link above. The equivalent environmental metrics are determined using the EPA's greenhouse gas equivalencies calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html

The Solar Roadmap platform expresses the equivalent CO2 offset of providing 5% of electricity via solar power by two metrics: CO2 sequestered by acres of U.S. forest and cars off the road.

Cumulative Size (Residential) and Solar Viable Residences

In assessing the potential for residential rooftop solar, the latest housing stock data was used as acquired from Census American Fact Finder (http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml and after entering the community name click through to "Advanced Search" -> "Selected Housing Characteristics"). We chose to consider all single unit residences, both attached and detached, as solar viable for the starting point of our analysis. Factors were then applied to determine the fraction of these residences which can accommodate solar. These factors include estimated structural integrity of the roof, pitch and orientation of the roof surface, and potential shading concerns, further described below.

For structural integrity, the team followed methodology used in City of Austin's report: A Solar Rooftop Assessment for Austin (http://imaginesolar.com/wp-content/uploads/2012/01/A-Solar-Rooftop-Assessment-for-Austin.pdf). The report concluded that 99% of all residential rooftops were structurally capable of supporting solar. Roof age and replacement were also considered, but for this long-term market evaluation, timing concerns would not have a material impact.

In regard to roof pitch and orientation, the Solar Roadmap team utilized National Renewable Energy Laboratory's report, "The Solar Deployment System (SolarDS) Model: Documentation and Sample Results" (http://www.nrel.gov/docs/fy10osti/45832.pdf) to determine the fraction of homes that have an appropriate roof surface for solar. Following the building assumptions in Table 1 in Appendix C, the team disregarded sloped roofs with orientation greater than 60deg off true south due to decreased solar production, eliminating orientations 2 and 8 in Table C-1 from consideration. For detached homes, the split between flat (10%) 4-sided (45%) and 2-sided (45%) as stated in the table was assumed to hold. For attached homes, a split of flat (50%) and 2-sided (50%) was assumed. This results in 87.1% of detached homes and 85.7% of attached homes having a roof surface with viable orientation and tilt.

For shading, the same NREL report noted above "The Solar Deployment System (SolarDS) Model: Documentation and Sample Results" was used. The report provides estimates of the percentage of shaded rooftops by state in Table C-2 of Appendix C. This number varies from a low of 35% shaded in California, Florida, and Texas to a high of 60% in New England where there is more vegetation.

These three factors are applied in series to determine the overall fraction of residential structures which can support solar as follows:

$$solar\ viability = structural\ integrity\ \times\ roof\ pitch\ and\ orientation\ \times\ shading$$

$$solar\ viability\ detached = 0.99\ \times\ 0.871\ \times\ \frac{(0.65\ for\ CA, FL, TX)}{(0.40\ for\ New\ England)} = \frac{56\%\ for\ CA, FL, TX}{34\%\ for\ New\ England}$$

$$solar\ viability\ attached = 0.99\ \times\ 0.857\ \times\ \frac{(0.65\ for\ CA, FL, TX)}{(0.40\ for\ New\ England)} = \frac{55\%\ for\ CA, FL, TX}{34\%\ for\ New\ England}$$

The two shade factor extremes are shown in the line calculations above; other states will fall within this range as determined by their local shade factor.

Once the total number of viable residences has been determined, cumulative size (kW) is determined by applying the average residential system size to each residence. The average residential system size is calculated from the California Solar Initiative (CSI) database for all residential projects installed in CA during the first 6 months of 2012. The average system capacity is 5.1 kW. Other states do not have data on installed systems as readily available, however as California represents about half the total national volume, 5.1 kW is assumed to be representative.