Clean Coalition

Making Clean Local Energy Accessible Now

# Peninsula Advanced Energy Community (PAEC)

# Solar Siting Survey


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- Questions will be answered during the Q&A portion of the webinar
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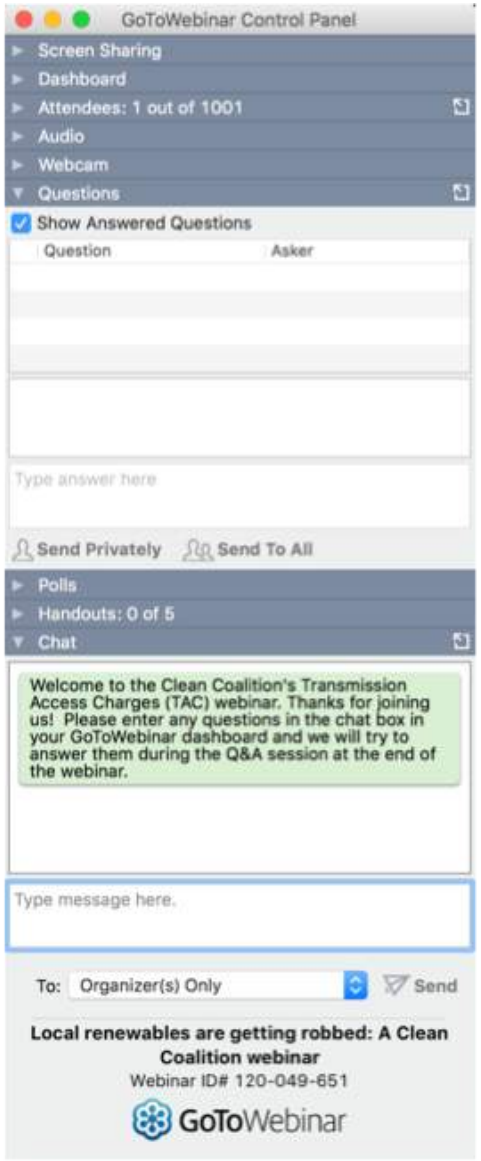

# Today's presenter

Bob O'Hagan
Program Engineer

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# Solar Siting Survey: Purpose

- Who is the Clean Coalition
  - Why do a Solar Siting Survey?
- What does a Solar Siting Survey consist of?
  - How is it done?
- What did we find?
- What does the report/map look like?
- What is the Integration Capacity Analysis?

# Clean Coalition mission

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise

# Clean Coalition overarching objectives

- From 2025 onward, at least 80% of all electricity from newly added generation capacity in the United States will be from renewable energy sources.
- From 2025 onward, at least 25% of all electricity from newly added generation capacity in the United States will be from local renewable energy sources.
  - Locally generated electricity does not travel over the transmission grid to get from the location it is generated to where it is consumed.
- By 2025, policies and programs are well established for ensuring successful fulfillment of the 80% & 25% objectives.
  - Policies reflect the full value of local renewable energy.
  - Programs prove the superiority of local energy systems in terms of economics, environment, and resilience; and in terms of timeliness.

# Clean Coalition vision = Community Microgrid future


Grid Energy Storage


Distributed Generation


Switches &
Power Electronics


Distributed Generation

Monitoring,
Communications
& Control (MC²)


Energy Storage


Biopower Generation


Microturbine


Distributed Generation


Electric Vehicles (EV)


Home Energy System


Fuel Cells


Distributed Generation

# FITs address the wholesale DG market segment

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*Project Size*

50+ MW

500 kW

5 kW

**Wholesale DG**

**Serves Local Loads**

Central Generation

Serves Remote Loads

Retail DG

Serves Onsite Loads

*Behind the Meter*

*Distribution Grid*

*Transmission Grid*

# WDG unleashed solar in Germany

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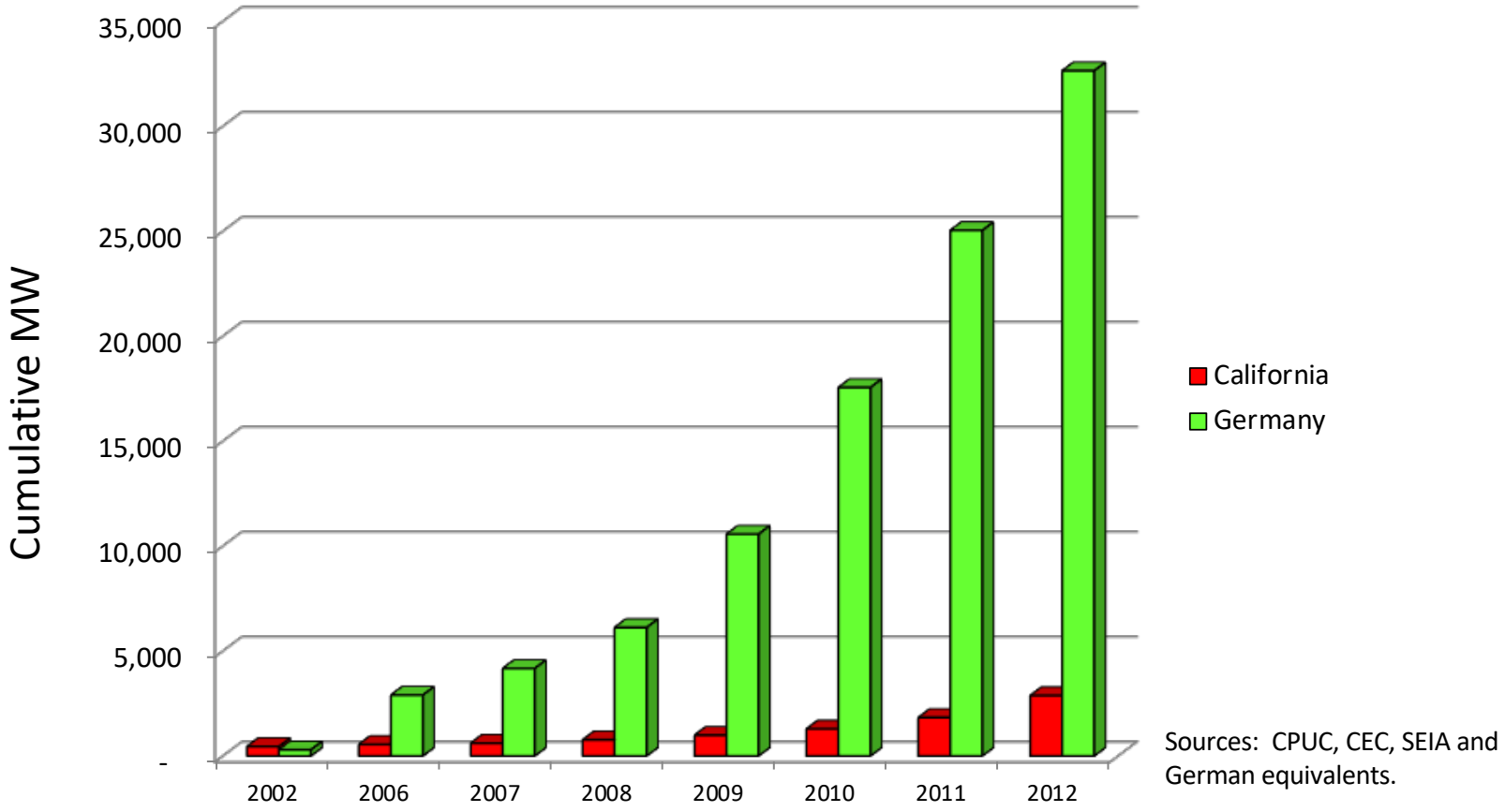
## Solar Markets: Germany vs California (RPS + CSI + other)




Sources: CPUC, CEC, SEIA and German equivalents.

Germany deployed over 10 times more solar capacity than California, almost entirely on built-environments, in the decade starting 2002, despite California having 70% better solar resource

# German solar is mostly local (on rooftops)

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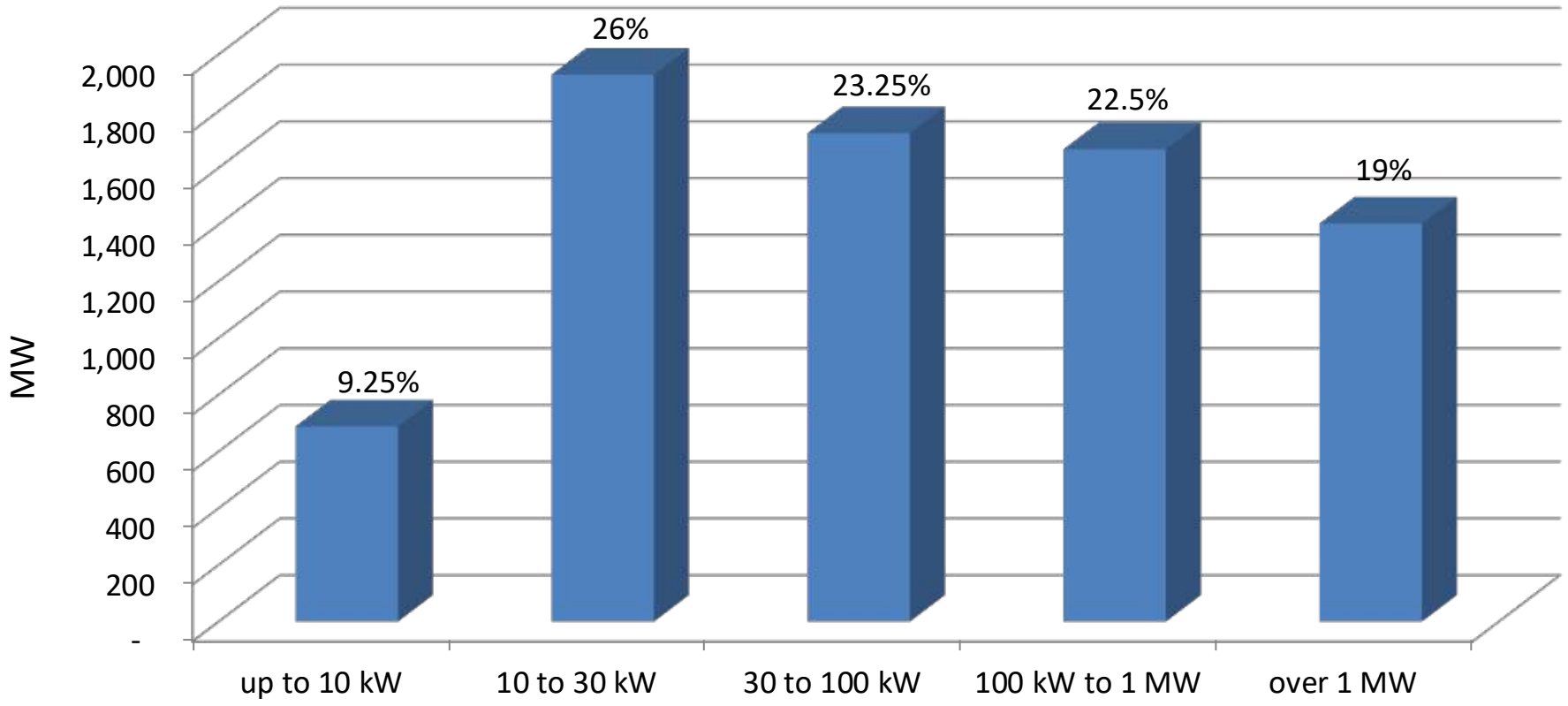
## German Solar Capacity Installed through 2012




Source: Paul Gipe, March 2011

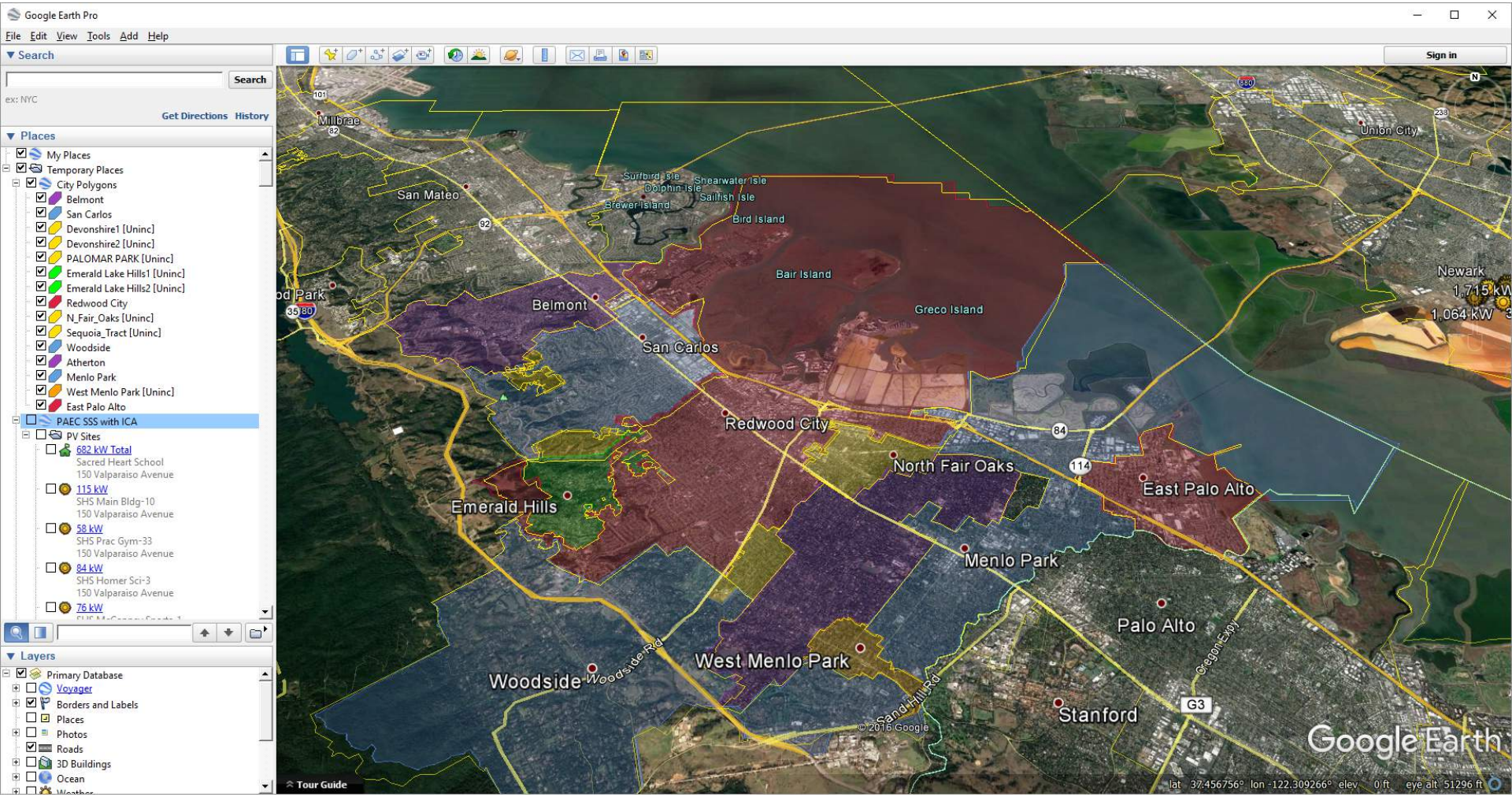
Germany's solar deployments are almost entirely sub-2 MW projects on built-environments and interconnected to the distribution grid (not behind-the-meter)

# Solar Siting Survey: Components

- What is it?
  - Survey of potential PV siting opportunities performed over a well-defined area
  - Includes primarily large rooftops and aggregations of closely related smaller rooftops
  - Also includes parking lots and parking garages
  - Has a lower limit generation size of 100 KW AC

- Tools used to site the potential opportunities
  - Survey and coordinates: Google Earth
  - Database and KML generation: Excel
  - Addresses and site names: Google Maps, Bing Maps, Mapquest
  - Alternate display app: Google Maps

# PAEC survey area in Google Earth



# PAEC survey overview

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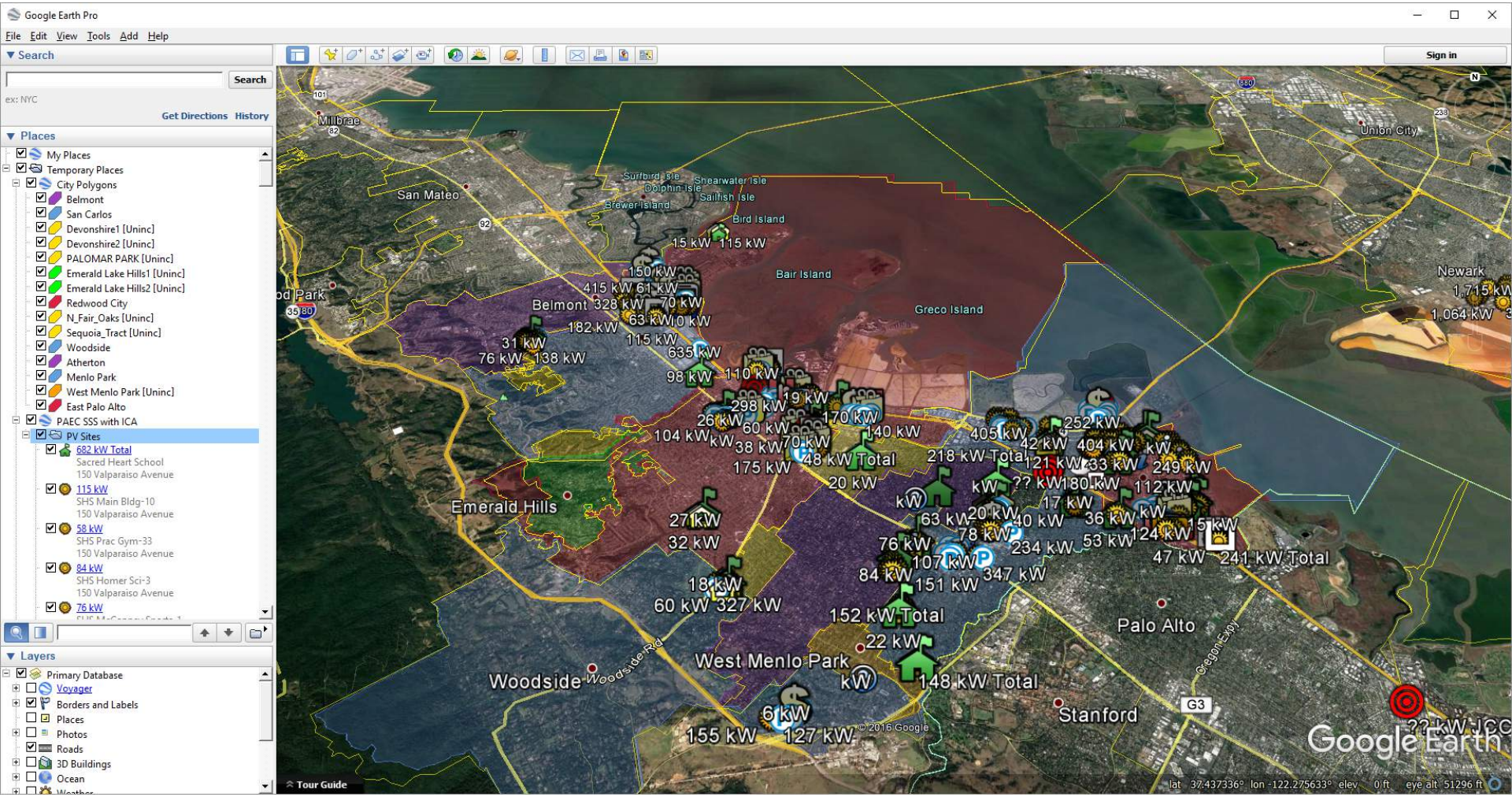

# Solar Siting Survey summary

- Key findings
  - Over 65 MW of PV potential can be easily found at the 100 kW minimum level
- Key takeaways
  - Parking lots and garages are very underutilized, comprising over 40% of the total
- Tie-in to overall objectives
  - The capacity to site PV on commercial, industrial, and civic rooftops is waiting to be utilized

# Deliverables

- Spreadsheet database
- Summary report
- Google Earth map derived from the database
  - Includes ICA data
- Google Maps readable version of Google Earth file

# PAEC Solar Siting Survey summary by PV size

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## Summary by Structure PV Size

| | Num_Sites | kW_Total | PV W_AC >= 500 kW | | > and >= 250 kW | | Less than 250 kW | |
|---|---|---|---|---|---|---|---|---|
| **Totals:** | **484** | **66,228 kW** | **24** | **17,073 kW** | **56** | **18,840 kW** | **404** | **30,315 kW** |
| Atherton, CA 94027 | 33 | 1,502 kW | - | - kW | - | - kW | 33 | 1,502 kW |
| Menlo Park, CA 94025 | 102 | 18,909 kW | 7 | 5,786 kW | 17 | 5,544 kW | 78 | 7,579 kW |
| East Palo Alto, CA 94303 | 91 | 8,134 kW | 4 | 2,499 kW | 2 | 575 kW | 85 | 5,060 kW |
| Redwood City, CA 94061 | 14 | 1,190 kW | - | - kW | 1 | 445 kW | 13 | 745 kW |
| Redwood City, CA 94062 | 18 | 740 kW | - | - kW | - | - kW | 18 | 740 kW |
| Redwood City, CA 94063 | 90 | 17,532 kW | 9 | 6,466 kW | 13 | 4,349 kW | 68 | 6,717 kW |
| Redwood City, CA 94065 | 53 | 10,049 kW | 1 | 532 kW | 17 | 5,968 kW | 35 | 3,550 kW |
| San Carlos, CA 94070 | 42 | 5,618 kW | 2 | 1,258 kW | 5 | 1,633 kW | 35 | 2,727 kW |
| Belmont, CA 94002 | 27 | 1,403 kW | 1 | 532 kW | - | - kW | 26 | 871 kW |
| Woodside, CA 94062 | 14 | 1,151 kW | - | - kW | 1 | 327 kW | 13 | 824 kW |

# Summary of aggregations by type

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| | Apartments | | Biz | | Edu | | Shopping | | Storage | | Hospital | | Bus | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Num_Sites | kW_Total | Num_Sites | kW_Total | Num_Sites | kW_Total | Num_Sites | kW_Total | Num_Sites | kW_Total | Num_Sites | kW_Total | Num_Sites | kW_Total |
| Atherton, CA 94027 | - | - kW | - | - kW | 5 | 1,502 kW | - | - kW | - | - kW | - | - kW | - | - kW |
| Menlo Park, CA 94025 | - | - kW | 3 | 4,954 kW | 5 | 865 kW | - | - kW | - | - kW | - | - kW | - | - kW |
| East Palo Alto, CA 94303 | 2 | 763 kW | - | - kW | 8 | 1,726 kW | 2 | 3,440 kW | 3 | 582 kW | - | - kW | - | - kW |
| Redwood City, CA 94061 | - | - kW | - | - kW | 1 | 195 kW | 1 | 996 kW | - | - kW | - | - kW | - | - kW |
| Redwood City, CA 94062 | - | - kW | - | - kW | 1 | 740 kW | - | - kW | - | - kW | - | - kW | - | - kW |
| Redwood City, CA 94063 | 1 | 369 kW | - | - kW | 4 | 587 kW | 7 | 7,904 kW | 5 | 1,940 kW | 2 | 3,309 kW | - | - kW |
| Redwood City, CA 94065 | - | - kW | 6 | 5,869 kW | 1 | 115 kW | 2 | 1,550 kW | - | - kW | - | - kW | - | - kW |
| San Carlos, CA 94070 | - | - kW | 1 | 1,208 kW | - | - kW | 1 | 544 kW | 4 | 1,617 kW | - | - kW | 1 | 278 kW |
| Belmont, CA 94002 | - | - kW | - | - kW | 1 | 871 kW | - | - kW | - | - kW | - | - kW | - | - kW |
| Woodside, CA 94062 | - | - kW | - | - kW | 1 | 1,151 kW | - | - kW | - | - kW | - | - kW | - | - kW |
| **Totals:** | **3** | **1,132 kW** | **10** | **12,031 kW** | **27** | **7,752 kW** | **13** | **14,433 kW** | **12** | **4,139 kW** | **2** | **3,309 kW** | **1** | **278 kW** |

# Survey data excerpt

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| Site name, identifier, occupant or description of structure if known | Street address | City and ZIP code | Gmap Addr Lat_Lon | Latitude of structure | Longitude of structure | Marker Symbol on Map | Scale Factor for Symbol in Display. Blank = 1 | Color attribute for Symbol | Short Add'l Text for G-Earth Symbol Label | Scale Factor for Label. Blank = 1 | Color attribute for Label. | Flags 1st use of an address in group | Surface area in sqft | Structure type | PV power density assesment | Estimated PV potential [W, AC] | Total PV potential at this address [W, AC] | Comments re area or assessment | Flag for PRP site |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site_Desc** | **Address** | **City_ZIP** | **G-Map Coord** | **Lati** | **Longi** | **Map_Sym** | **Sym_Scl** | **Sym_Clr** | **Label_Text** | **Label_Scl** | **Label_Clr** | **Site_Seq** | **Area_ft2** | **PV_Type** | **PV_Rating** | **Struc_W** | **Site_Sum_W** | **Comments** | **PRP_24** |
| Sacred Heart School | 150 Valparaiso Ave | Atherton, CA 940 | 37.4487523,-122.1 | 37.449911 | -122.196095 | Edu | 1.75 | | | | | 1 | | | | - | 681,600 | | |
| SHS Main Bldg-10 | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.448557 | -122.196755 | Roof_Flat | | | | | | - | 19,200 | Roof_Flat | Medium | 115,200 | - | | |
| SHS Prac Gym-33 | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.447628 | -122.197487 | Roof_Flat | | | | | | - | 9,700 | Roof_Flat | Medium | 58,200 | - | | |
| SHS Homer Sci-3 | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.447548 | -122.196827 | Roof_Flat | | | | | | - | 14,000 | Roof_Flat | Medium | 84,000 | - | | |
| SHS McGanney Sports | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.447824 | -122.195852 | Roof_Flat | | | | | | - | 12,700 | Roof_Flat | Medium | 76,200 | - | S Slope Roof, too | |
| SHS Campbell Perf Ar | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.449224 | -122.196675 | Roof_Flat | | | | | | - | 8,900 | Roof_Flat | High | 62,300 | - | | |
| SHS Unk Bldg PV Exist | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.447774 | -122.197007 | Roof_Example | | | | | | - | 5,000 | Existing | Medium | - | - | Existing | |
| SHS Bergeron Lower S | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.451246 | -122.195207 | Roof_Flat | | | | | | - | 9,700 | Roof_Flat | High | 67,900 | - | | |
| SHS Stevens Library | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.451622 | -122.195960 | Roof_Example | | | | | | - | 6,600 | Existing | Medium | - | - | Existing | |
| SHS Johnson Perform | 150 Valparaiso Ave | Atherton, CA 940 | 37.4515316,-122.1 | 37.451527 | -122.196621 | Roof_Flat | | | | | | - | 11,100 | Roof_Flat | Medium | 66,600 | - | BingBird missing newer bldg | |
| SHS Murphy Administ | 150 Valparaiso Ave | Atherton, CA 940 | 37.4511111,-122.1 | 37.451102 | -122.196022 | Roof_Flat | | | | | | - | 6,200 | Roof_Flat | High | 43,400 | - | BingBird missing newer bldg | |
| SHS Xie Middle Schoo | 150 Valparaiso Ave | Atherton, CA 940 | 37.4507507,-122.1 | 37.450579 | -122.195388 | Roof_Flat | | | | | | - | 9,300 | Roof_Flat | High | 65,100 | - | BingBird missing newer bldg | |
| SHS Spieker Pavilion | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.450823 | -122.194686 | Roof_Flat | | | | | | - | 4,000 | Roof_Flat | High | 28,000 | - | | |
| SHS Unkown Bldg | 150 Valparaiso Ave | Atherton, CA 94027 | | 37.450692 | -122.194197 | Roof_Flat | | | | | | - | 2,100 | Roof_Flat | High | 14,700 | - | | |
| Menlo Atherton HS | 555 Middlefield Rd | Atherton, CA 940 | 37.4615008,-122.1 | 37.461196 | -122.175029 | Edu | 1.75 | | | | | 1 | | | | - | 352,100 | | |
| Perf Arts Ctr | 555 Middlefield Rd | Atherton, CA 94027 | | 37.460935 | -122.175132 | Roof_Flat | | | | | | - | 1,200 | Roof_Flat | High | 8,400 | - | BingBird missing newer bldg | |
| B_Wing-1-5 | 555 Middlefield Rd | Atherton, CA 940 | 37.461632, -122.1 | 37.461432 | -122.176671 | Roof_Angled | | | | | | - | 2,000 | Roof_Angled | High | 14,000 | - | | |
| B_Wing-9-12 | 555 Middlefield Rd | Atherton, CA 940 | 37.461632, -122.1 | 37.461421 | -122.176030 | Roof_Angled | | | | | | - | 2,900 | Roof_Angled | High | 20,300 | - | | |
| B_Wing-2-23 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.461390 | -122.175294 | Roof_Angled | | | | | | - | 3,000 | Roof_Angled | High | 21,000 | - | | |
| C_Wing-0-5 | 555 Middlefield Rd | Atherton, CA 940 | 37.461658,-122.17 | 37.461661 | -122.176896 | Roof_Angled | | | | | | - | 3,100 | Roof_Angled | High | 21,700 | - | | |
| C_Wing-10-15 | 555 Middlefield Rd | Atherton, CA 940 | 37.461632, -122.1 | 37.461608 | -122.176049 | Roof_Angled | | | | | | - | 1,900 | Roof_Angled | High | 13,300 | - | | |
| D_Wing-1-9 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.461882 | -122.176834 | Roof_Angled | | | | | | - | 9,000 | Roof_Angled | High | 63,000 | - | | |
| D_Wing-12-17 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.461832 | -122.176030 | Roof_Angled | | | | | | - | 2,000 | Roof_Angled | High | 14,000 | - | | |
| D_Wing-22-24 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.461801 | -122.175242 | Roof_Angled | | | | | | - | 1,800 | Roof_Angled | High | 12,600 | - | | |
| E_Wing-12-16 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.462018 | -122.176009 | Roof_Angled | | | | | | - | 900 | Roof_Angled | High | 6,300 | - | | |
| E_Wing-19-26 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.462001 | -122.175320 | Roof_Angled | | | | | | - | 2,200 | Roof_Angled | High | 15,400 | - | | |
| M-1-3 | 555 Middlefield Rd | Atherton, CA 940 | 37.461153, -122.1 | 37.461171 | -122.174314 | Roof_Angled | | | | | | - | 3,500 | Roof_Angled | High | 24,500 | - | | |
| S-1-2 | 555 Middlefield Rd | Atherton, CA 94027 | | 37.461136 | -122.174049 | Roof_Angled | | | | | | - | 5,300 | Roof_Angled | High | 37,100 | - | | |
| New Gym | 555 Middlefield Rd | Atherton, CA 94027 | | 37.462031 | -122.173043 | Roof_Angled | | | | | | - | 11,500 | Roof_Angled | High | 80,500 | - | | |
| Menlo School | 50 Valparaiso Aver | Atherton, CA 940 | 37.4532637,-122.1 | 37.453597 | -122.192068 | Edu | 1.75 | | | | | 1 | | | | - | 165,900 | | |
| MS Stent-26 | 50 Valparaiso Aver | Atherton, CA 94027 | | 37.453414 | -122.191790 | Roof_Flat | | | | | | - | 5,300 | Roof_Flat | High | 37,100 | - | | |
| MS Ath Ctr-30 | 50 Valparaiso Aver | Atherton, CA 94027 | | 37.453358 | -122.192739 | Roof_Example | | | | | | - | 8,000 | Existing | High | - | - | | |
| MS Ath Ctr S-30 | 50 Valparaiso Aver | Atherton, CA 94027 | | 37.453499 | -122.192578 | Roof_Angled | | | | | | - | 1,500 | Roof_Angled | High | 10,500 | - | | |
| MS Ops Off-40 | 50 Valparaiso Aver | Atherton, CA 94027 | | 37.452994 | -122.193013 | Roof_Angled | | | | | | - | 6,100 | Roof_Angled | High | 42,700 | - | | |

# PAEC Solar Siting Survey example of information

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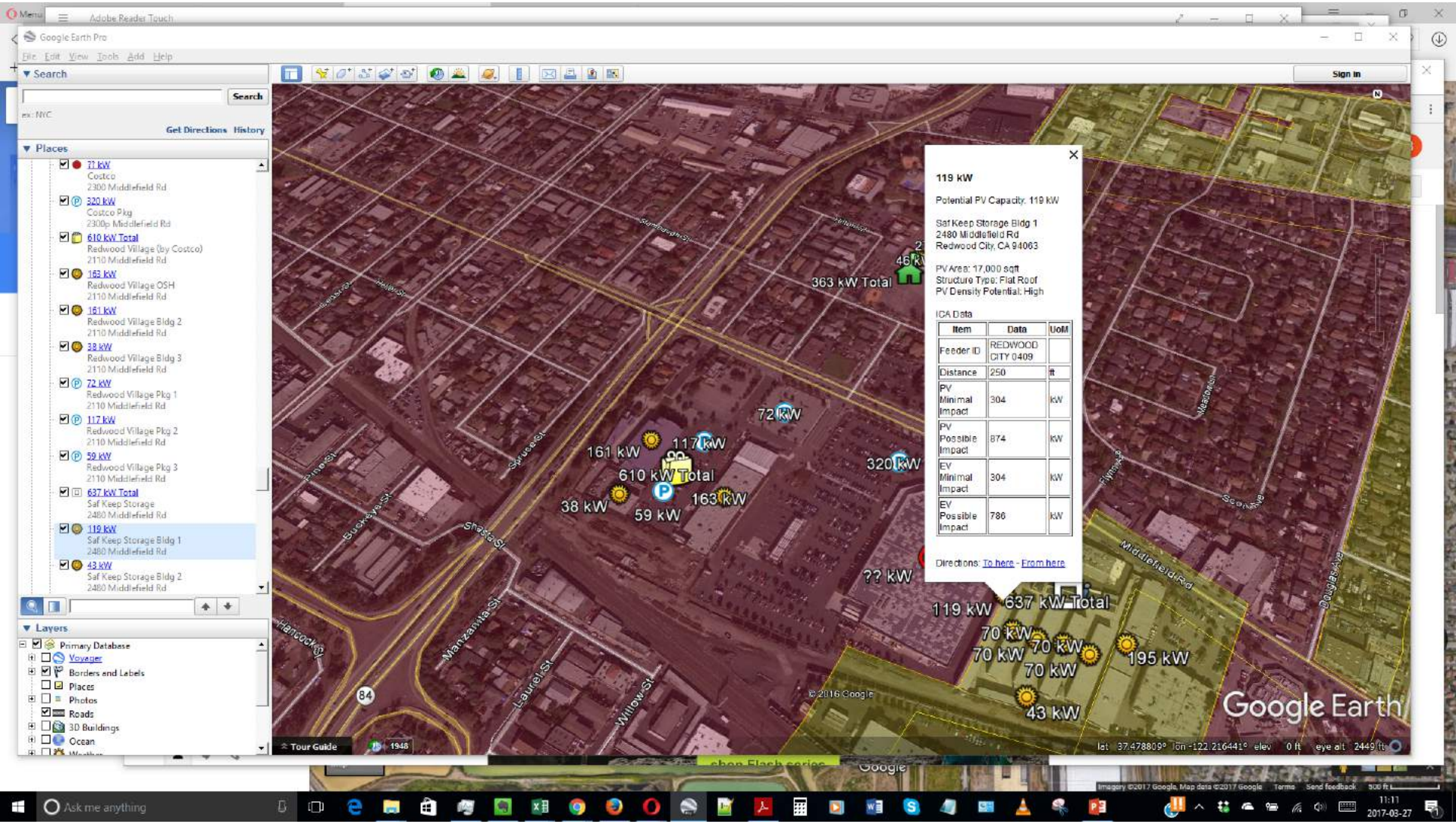
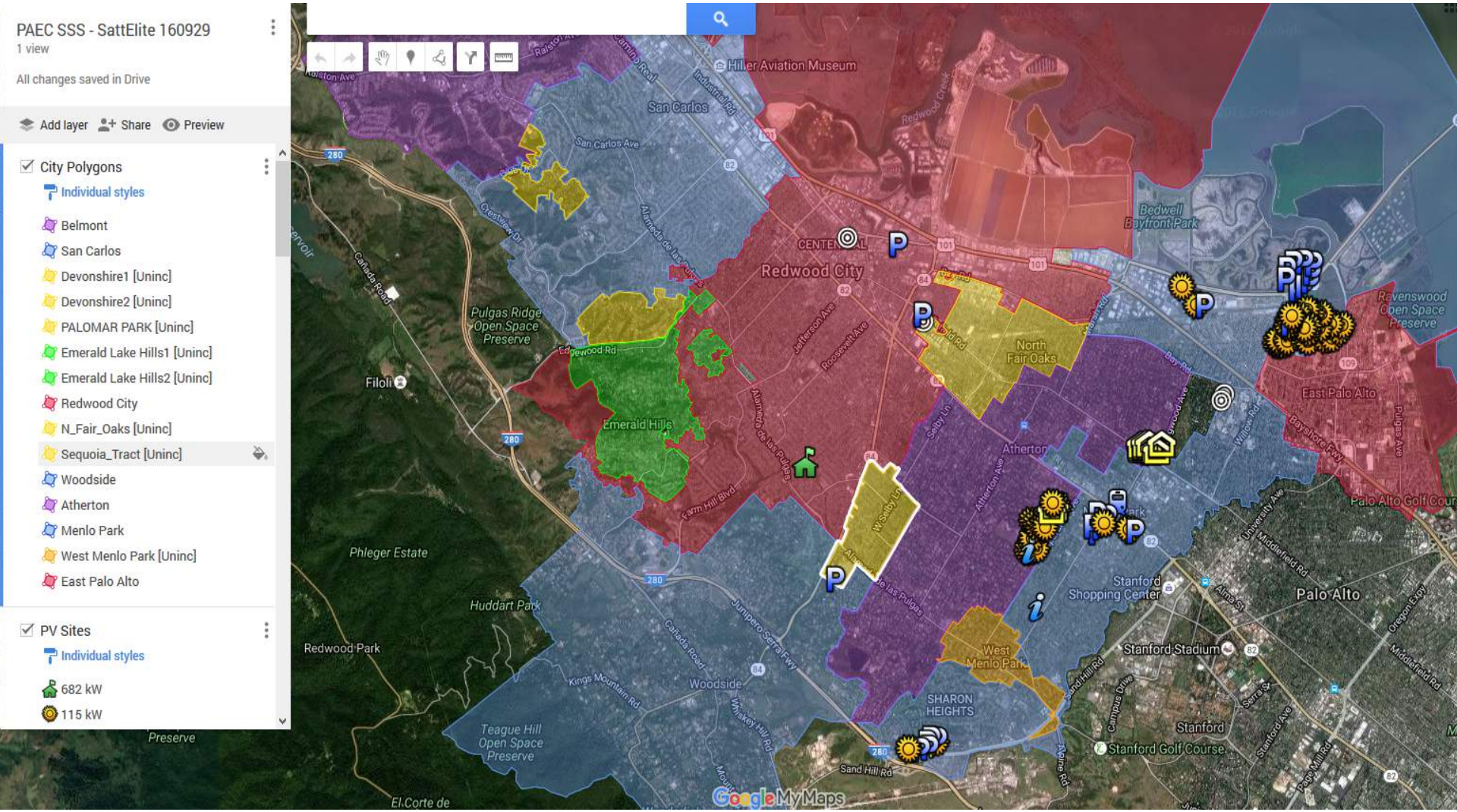


# Survey map viewed in Google Maps

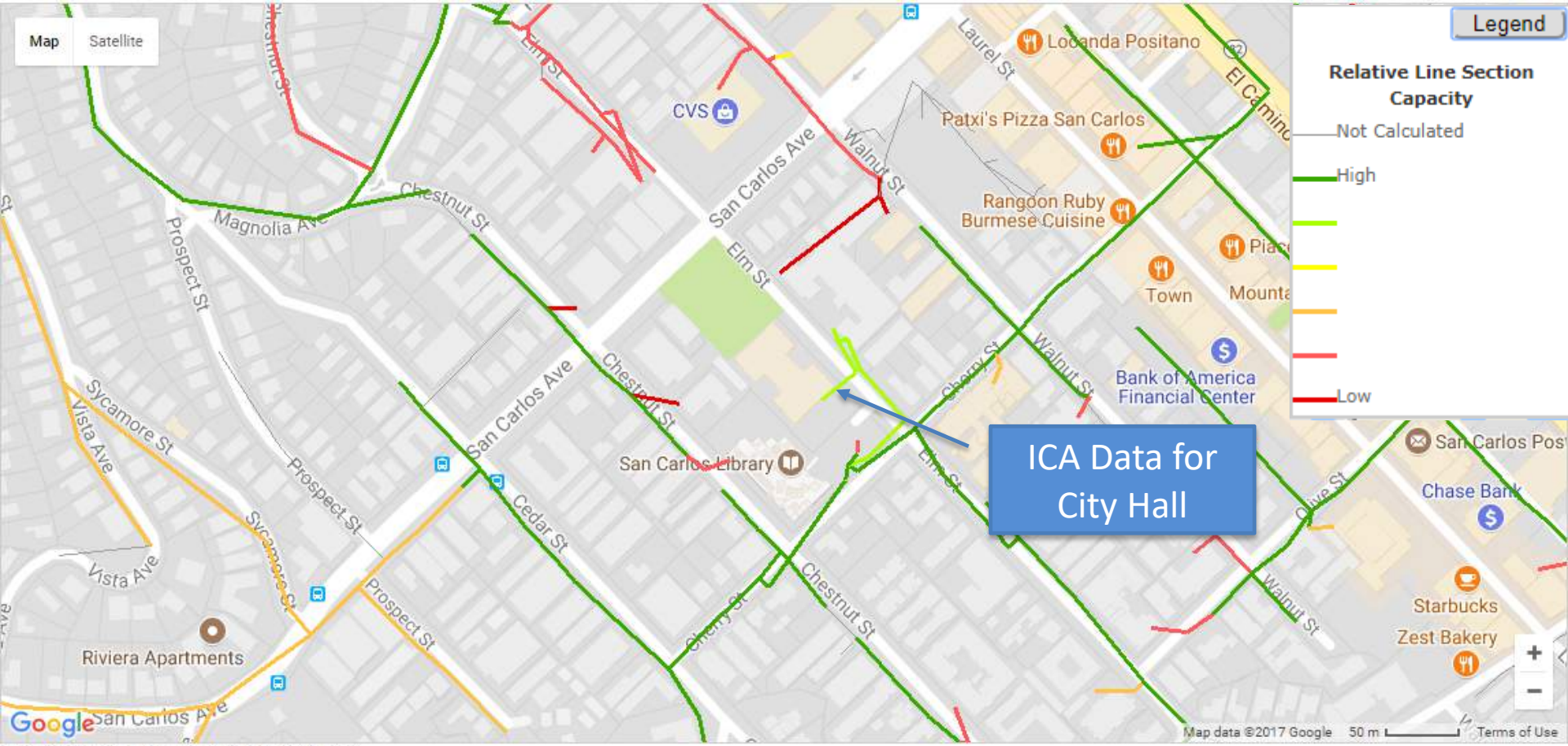


# Integration Capacity Analysis (ICA)

- Brief look at components
  - Feeder map
  - Analysis criteria
  - Sample of the types of generation and load profiles that are used in the analysis

# ICA map for 600 Elm St, San Carlos (50 m, closest)

Clean Coalition



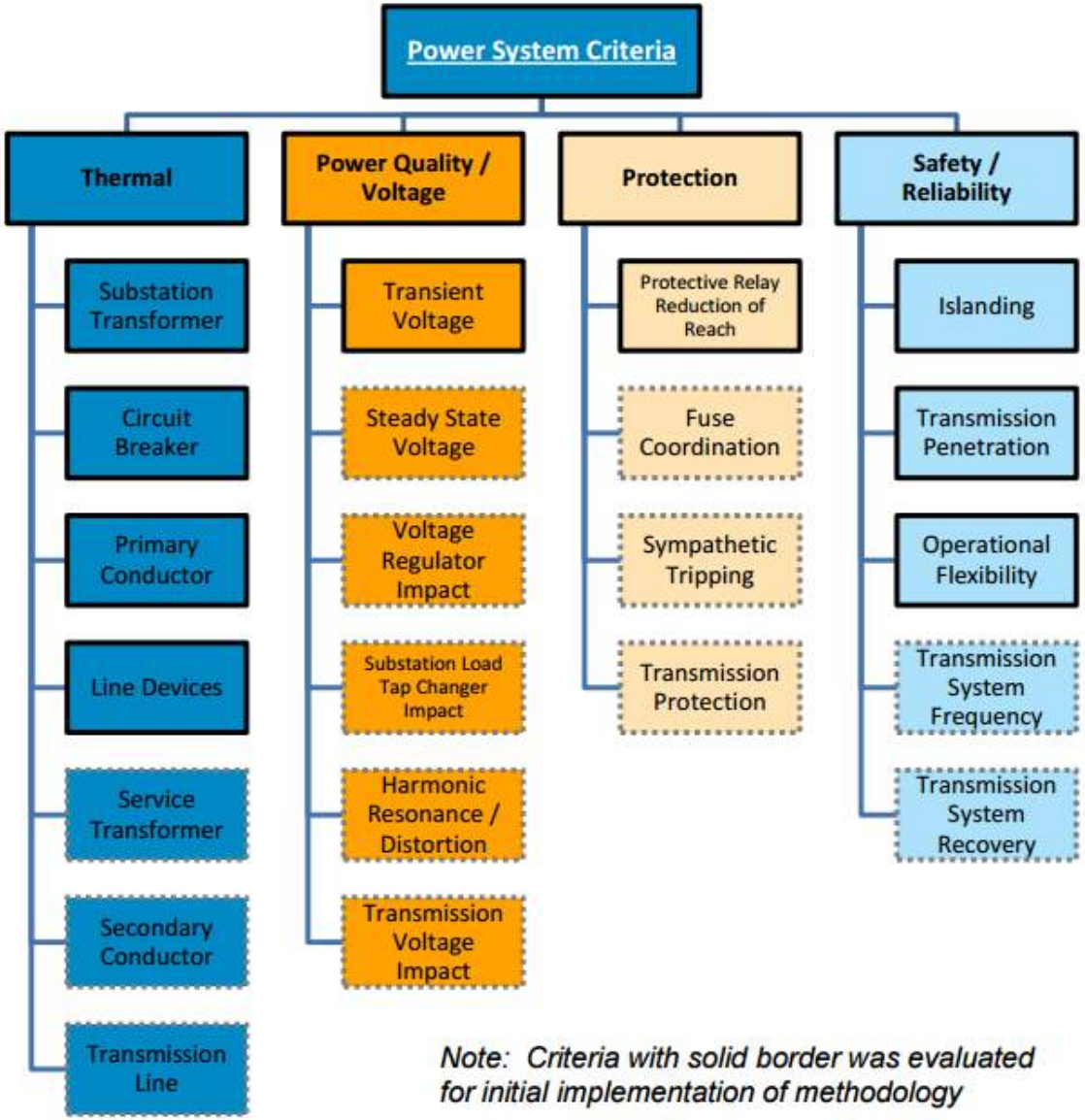

map width: 1.35 miles, map height: 0.64 miles

600 Elm St, San Carlos | Go

☑ Distribution Lines
☑ Substations
☑ Transmission Lines

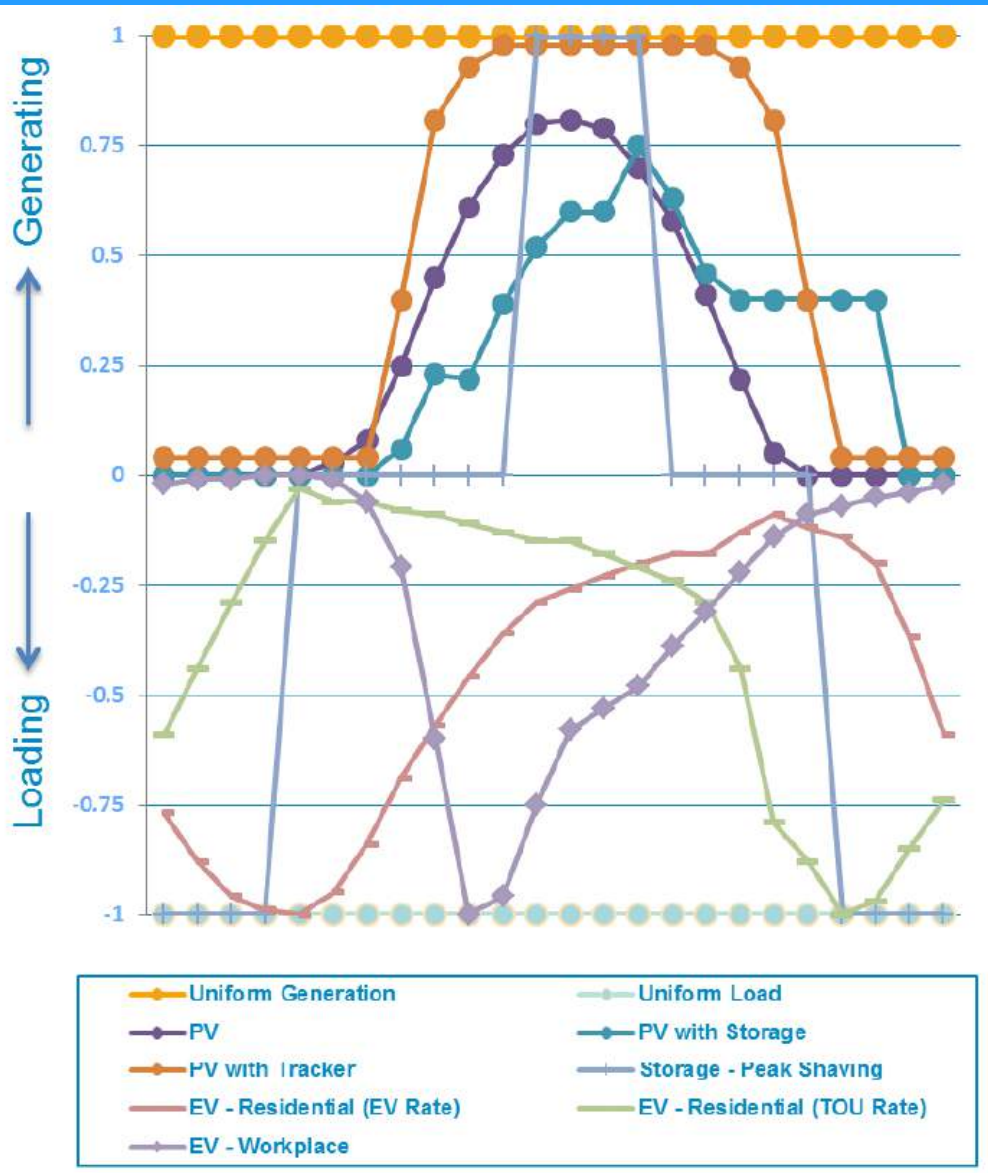
# Distribution Resources Planning (DRP): Integration Capacity Analysis criteria

Clean Coalition




Source: https://www.navigantresearch.com/blog/distribution-resource-plans-integrated-capacity-analysis

# ICA: DER generation and load profiles




Source: https://www.navigantresearch.com/blog/distribution-resource-plans-integrated-capacity-analysis

# Summary of Solar Siting Survey

- Purpose
- Elements
- How it helps a FIT program

# Thank you. Any questions?

**For questions and assistance, contact:**

Bob O'Hagan
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# Backup slides

# ICA data at feeder into San Carlos City Hall

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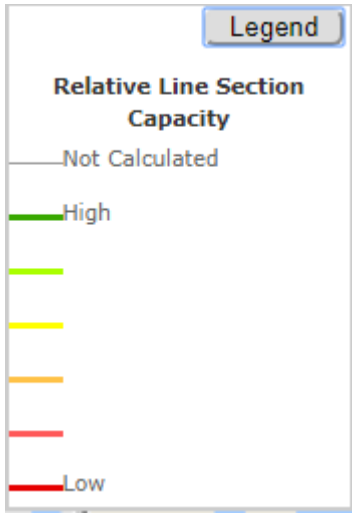
Asset Info | DER Capacity

| | |
|---|---|
| Shape | Polyline |
| Feeder Name | SAN CARLOS 0402 |
| Feeder Number | 24180402 |
| Nominal Circuit Voltage (kv) | 4 |
| Circuit Capacity (MW) | 2.48 |
| Circuit Projected Peak Load (MW) | 2.15 |
| Substation Bank | 1 |
| Substation Bank Capacity (MW) | 12.5 |
| Substation Bank Peak Load (MW) | 12.8 |
| Existing Distributed Generation (MW) | 0.102 |
| Queued Distributed Generation (MW) | 0 |
| Total Distributed Generation (MW) | 0.102 |
| ZoneId | 24180402.007 |




Asset Info | DER Capacity

**Feeder name: SAN CARLOS 0402** **Zone Id:24180402.007**

| DER | Zone DER Capacities (kW) | | Substation DER Capacities (kW) | |
|---|---|---|---|---|
| | Minimal Impacts | Possible Impacts | Feeder Limit | Substation Bank Limit |
| Uniform Generation (Inverter) | 551 | 594 | 610 | 3,402 |
| Uniform Generation (Machine) | 146 | 150 | 464 | 2,584 |
| Uniform Load | - | - | - | - |
| PV | 551 | 594 | 1,021 | 5,443 |
| PV with Storage | 551 | 594 | 1,132 | 6,025 |
| PV with Tracker | 551 | 594 | 787 | 4,268 |
| Storage - Peak Shaving | - | - | - | - |
| EV - Residential (EV Rate) | - | - | - | - |
| EV - Residential (TOU Rate) | - | - | - | - |
| EV - Workplace | - | - | - | - |

Notes:

- Integration Capacity Values last updated on July 1 2015

500 kW PV should be straightforward interconnection

# Quote from PG&E's ICA help page

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## Integration Capacity Data

The RAM map is now designed to display integration capacity values for DER. These values are intended to help users by indicating DER capacities that are expected to require Detailed Interconnection Studies. It is encouraged that customers apply using DER capacities that are less than the reported Integration Capacity value to have better chances of passing the interconnection Fast Track.

The distribution lines are colored based on a **Red** **Amber** **Green** coloring scale where green represents locations on each feeder that have higher integration capacity values then other locations on the feeder. Red is intended to display locations with lower capacity values, but does not necessarily mean a DER is not allowed to interconnect. The lower capacity values intended to show high chances of requiring detailed interconnection study. The coloring scheme is currently based on the PV Integration Capacity values.

# PG&E ICA URLs

- PG&E (login account needed)
  - ICA Map URL
    https://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/PVRFO/PVRAMMap/index.shtm
  - ICA Map Help URL
    https://www.pge.com/b2b/energysupply/wholesaleelectricsuppliersolicitation/PVRFO/PVRAMMap/help/

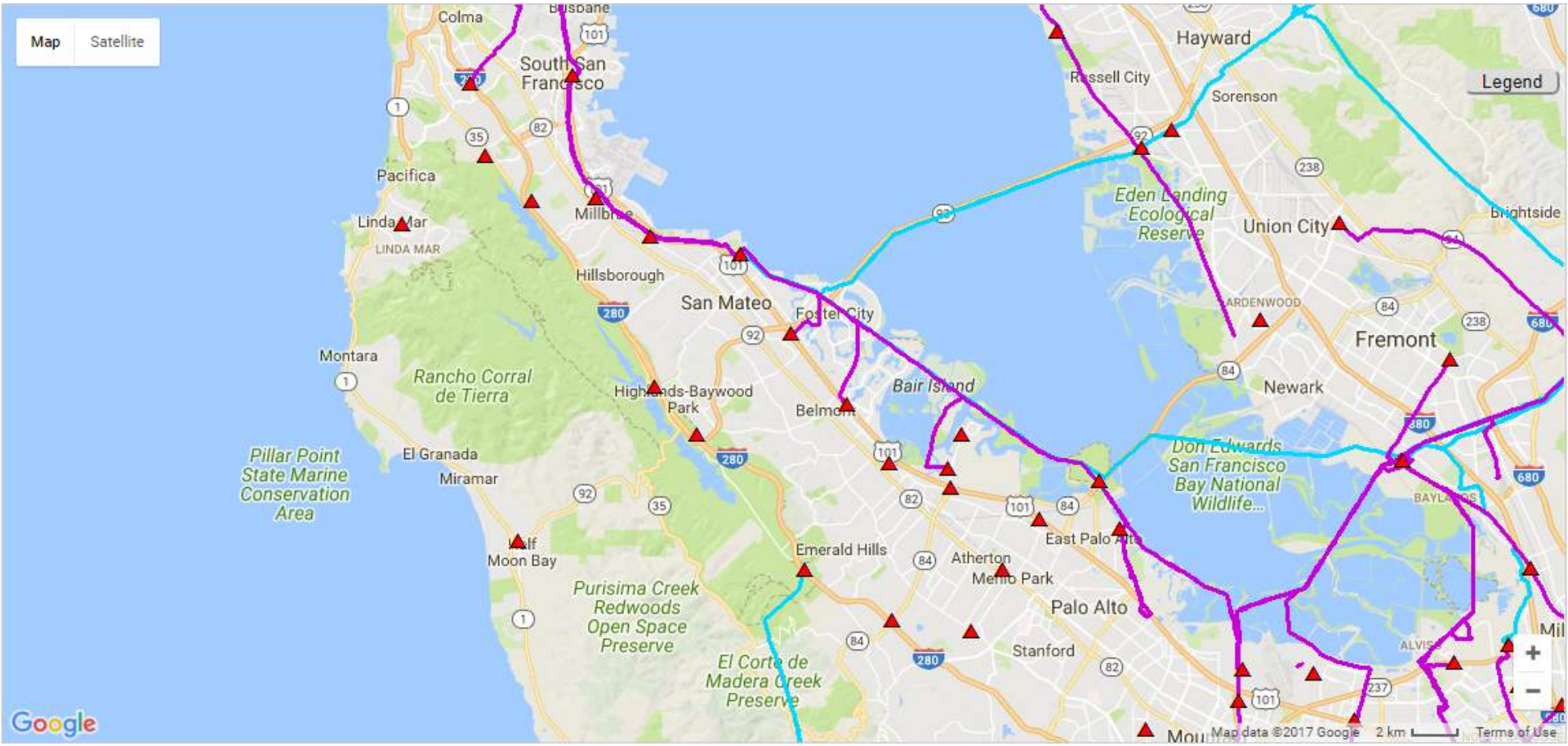
- SCE (no login needed)
  - https://www.arcgis.com/home/webmap/viewer.html?webmap=e62dfa24128b4329bfc8b27c4526f6b7
  - No login needed

- SDG&E (login account needed)
  - https://www.sdge.com/generation-interconnections/renewable-auction-mechanism-ram-map
  - Logins
  - https://sempra.maps.arcgis.com/home/signin.html?returnUrl=https%3A//sempra.maps.arcgis.com/apps/webappviewer/index.html%3Fid%3D8b11127abc7a47169de07eb77c2657c9

# ICA map of San Mateo County

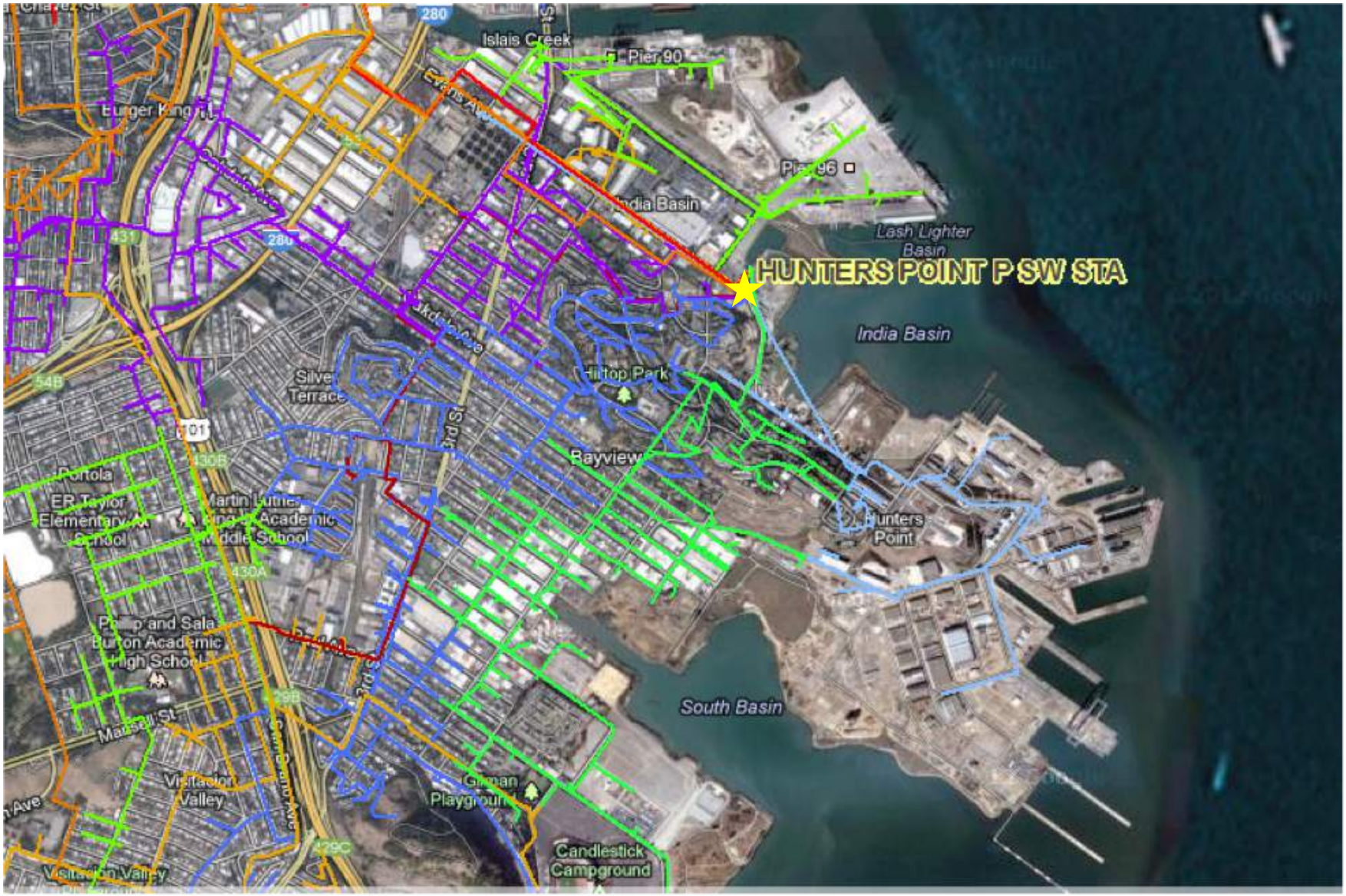
Clean Coalition

At high altitude, only transmission lines and substations are shown

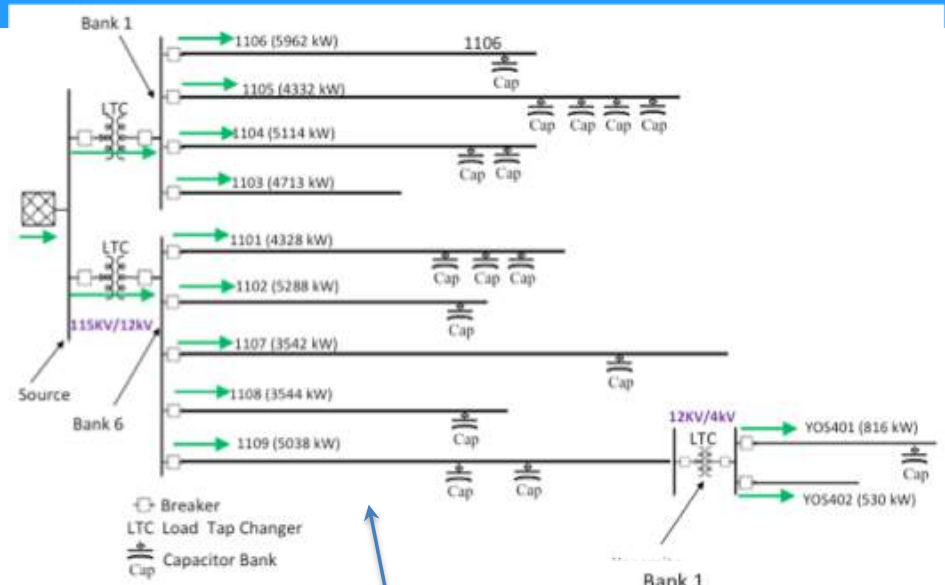


# Distribution Resources Planning history: Hunters Point Substation feeders

Clean Coalition



# Substation operation: Normal vs high-penetration PV




High-penetration PV: Power on some feeders flows back through substation

Normal: All power flows from transmission grid down to loads