Notes regarding submitting comments on this Draft Work Product:

Comments are Due February 7, 2018.

Comments shall be no longer than 5 pages.

Comments should be submitted to LDBPcomments@ebce.org

East Bay Community Energy

Locational Value Factors

Prepared for
East Bay Community Energy

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Introduction

Local development of distributed energy resources (DER) will result in benefits realized across multiple scales and categories.
Generating energy close to the point of consumption:

- Avoids the use of transmission system capacity, reducing the need for new capacity investment, reducing congestion and losses within the CASIO operational area, and enabling CAISO to increase dispatch and reliance on the most economical resources participating in its markets, especially in the northern half of the state.
- Reductions in transmission usage within the PG&E service territory will result in lower transmission capacity charges for all customers within this service territory.
- Improves reliability and resiliency by enabling uninterrupted or more rapidly restored service in local areas in the event of local, regional, or system-wide grid outages.
- Shifting to renewable resources also has both local, regional, and broader environmental benefits, reducing emissions related costs and potentially lower priced energy.

For example, operating an additional 25 MW of distributed local PV for 20 years is estimated to have the following average impacts compared to reliance on conventional Combined Cycle Natural Gas generation:

- $12 Million in PG&E ratepayer peak capacity savings
- $6 Million in ratepayer savings statewide from avoided transmission losses
- $9 Million in ratepayer savings statewide from avoided transmission proportional capacity related costs over 20 years[1]
- 39,000,000 lbs. GHG reduction annually,[2] equivalent to 850 homes
- 7,000,000 gals water saved annually[3]
- 160 acres land preserved (when relying on secondary use of roof and parking lot areas)[4]

[1] CAISO 2013 TAC schedule and infrastructure projections
[2] NREL Emissions Health Calculator, PG&E service territory
[3] DOE 2009
[4] Civil Society Institute – "Hidden Costs of Electricity" (Sep 2012)

In addition to utility and ratepayer factors, within the EBCE service territory there are critical facilities that would benefit from resilience against the risk of prolonged electric outages, and local variations in community factors captured in CalEnviroScreen which are potentially subject to mitigation through targeted DER deployment to reduce emissions.

Countywide Average Utility Locational Values

Distributed Energy Resources (DER) include Energy Efficiency, Demand Response, Energy Storage, and Generation interconnected within the electric distribution system both in front of the meter (wholesale resources) and behind the meter (customer resources).

The Distributed Energy Resource Avoided Cost calculator (DERAC) has been adopted by the CPUC to estimate the value of energy, capacity, and services provided by DER.
The avoided costs components included in DERAC are Energy, Generation Capacity, Transmission Capacity, Distribution Capacity, Losses, Ancillary Services, reduced RPS procurement, and Environmental Savings (GHG, criteria pollutants, and water).

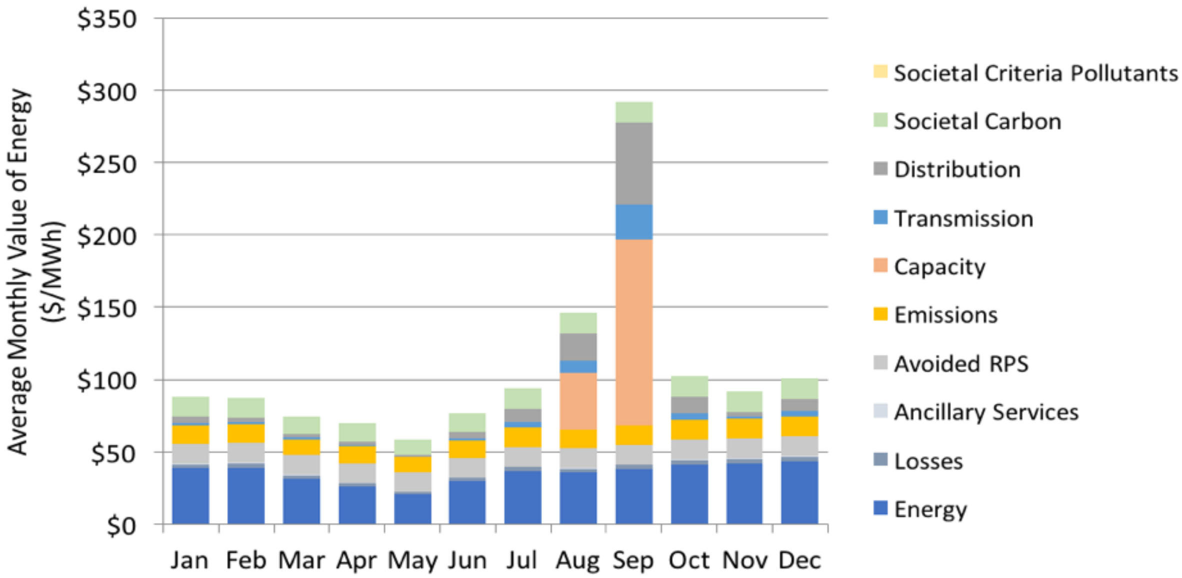
DERAC forecasts long-term marginal costs to evaluate the cost-effectiveness of distributed energy resources (DERs) and provides robust area- and time-specific cost estimates suitable for regulatory local integrated resource planning, cost-effectiveness evaluations, building energy code design, and rate design. Values vary substantially by climate zone and DERAC captures these regional differences in locational value.

Avoided Costs by Climate Zone

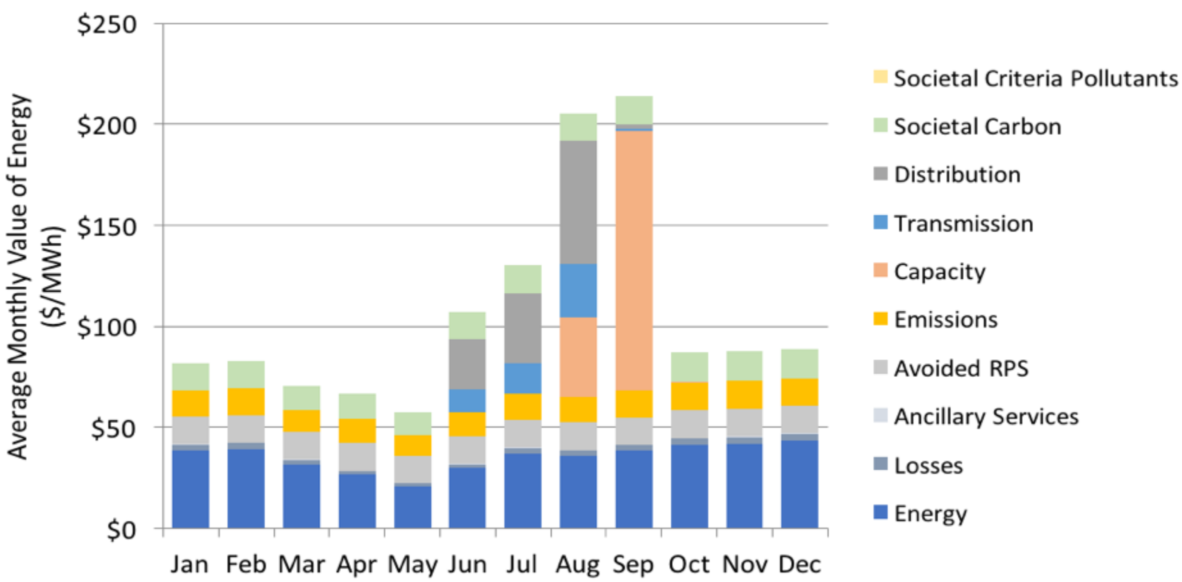
DERAC establishes the following 20 year levelized values for each value category for 2018 deployment for the two distinct climate zones found in Alameda County (Climate Zone CZ 3A: East Bay; CZ 12: Eastern Alameda County):

- Electric Market Forward Price: $34.89/MWh
- Carbon Price: $14.14/ton
- Transmission Capacity $34.86/PCAF-kW-yr (CAISO system wide average)
- Primary Distribution Capacity: $60.29/PCAF-kW-yr (CZ 3A); $52.57 (CZ 12)
- Secondary Distribution Capacity: $1.44/PCAF-kW-yr (CZ 3A); $4.01 (CZ 12)
- Marginal Transmission Capacity $33.41/PCAF-kW-yr (CZ 3A); $31.13 (CZ 12)
- Marginal Primary Distribution Capacity: $78.54/PCAF-kW-yr (CZ 3A); $85.34 (CZ 12)
- Marginal Secondary Distribution Capacity: $3.87/PCAF-kW-yr (CZ 3A); $5.84 (CZ 12)

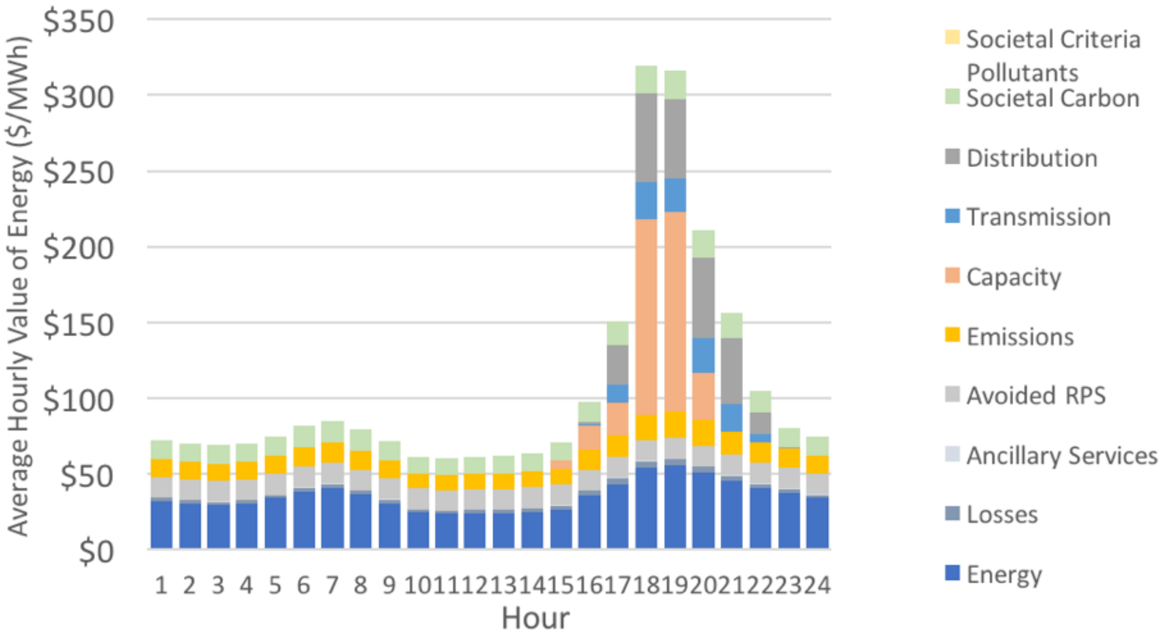
East Bay region, Climate Zone (CZ) 3A, Western Alameda County



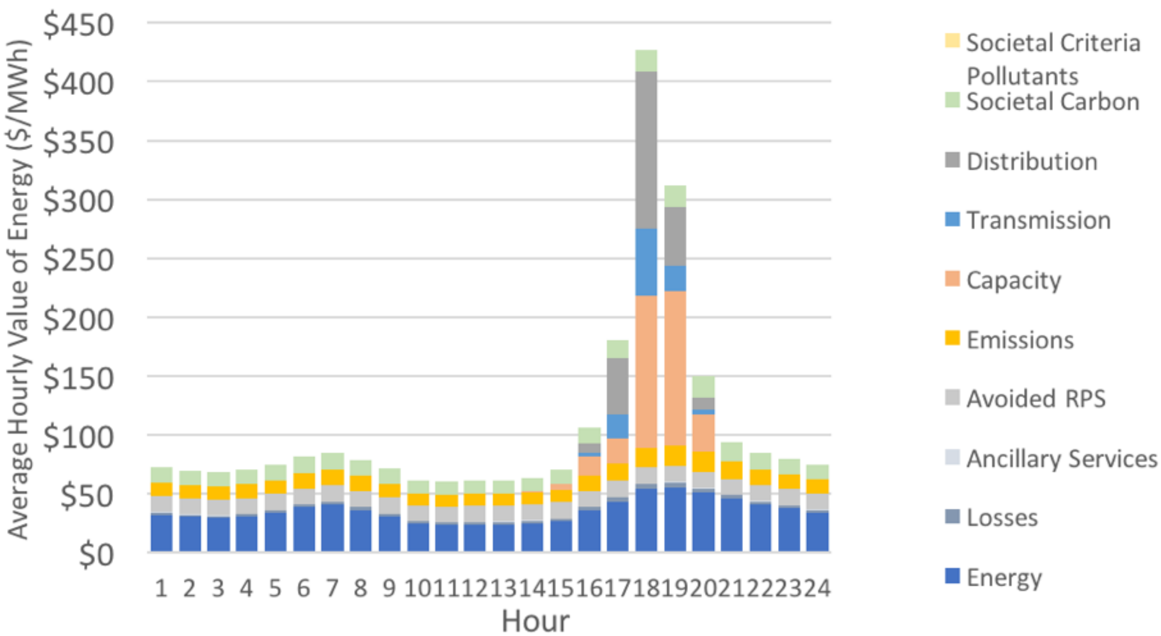
Climate Zone (CZ) 12, Eastern Alameda County



East Bay region, Climate Zone (CZ) 3A, Western Alameda County



Climate Zone (CZ) 12, Eastern Alameda County



As is evident from these figures, the value of DER varies substantially by time of day and time of year, and significantly between eastern and western Alameda County climate zones.

The value at any point in time is agnostic to the DER technology deployed. However, various DER will offer different performance profiles best able to realize avoided cost values specific to each location and period.

Transmission Access Charges

Transmission Access Charges (TAC) are usage fees applied to each unit of metered energy downflow from the grid. TAC are currently 1.8¢/kWh throughout the PG&E service territory, and add nearly 3¢/kWh to the levelized cost of energy over a typical 20-year renewable energy contract, increasing the wholesale price of energy in California by 30%.

TAC are currently applied based on energy downflow at the customer meter, including local energy that does not actually use the transmission grid to reach customers. This creates a distortion in the apparent cost to ratepayers and procurement agencies. This issue has active legislative attention[5] and CAISO is currently reviewing the TAC billing determinant and structure,[6] which may result in distributed generation avoiding these charges wherever it serves local loads or otherwise reduces demand for additional transmission investment.

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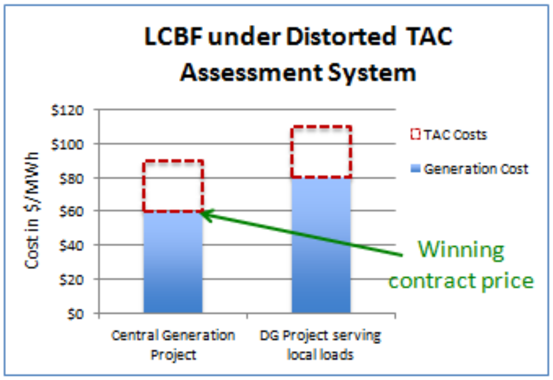
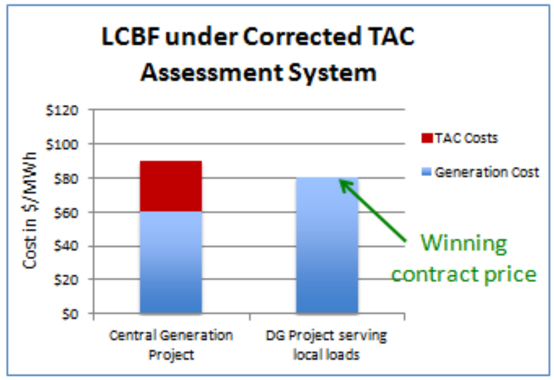
[5] SB 692

[6] http://www.caiso.com/informed/Pages/StakeholderProcesses/ReviewTransmissionAccessChargeStructure.aspx

If implemented, this change would allow local renewables to compete on a level playing field. Evaluating project bids through the Least Cost Best Fit (LCBF) methodology should consider the total delivered cost of energy, and recognize that local renewables do not use transmission to deliver energy. As shown in the example below, a local renewable or distributed generation (DG) project may have higher energy generation costs but lower total delivered cost.





Emission Reduction

Displacing Combined Cycle Natural Gas (CCNG) generation with 10 MW of PV will yield approximately 16,000 MWh of clean generation per year, depending on location and installation, reducing annual emissions equivalent to that achieved by removing 1,567 cars from the road.
Annual Emission Reductions
(Per 25 MW PV Deployment)
CO_2: 39,000,000 lbs (17690 Metric tons)
NO_X: 76,650 lbs
Mercury (Hg): 0.04 lbs

As Qualifying Facilities contributing to California's Renewable Portfolio Standard (RPS), at a base price of $10/Mt for avoided CO_2 the annual market value of emission reduction is $176,900, however the market rate is liable to substantially exceed $10/Mt in future years.

Transmission & Distribution Line Loss Savings

Based on PG&E Bay Area reported loss rates, combined transmission and distribution avoided losses from DG average 5%, or 789 MWh per year for each 10 MW of PV DG installed. At an average current retail value of 15¢/kWh the value of these avoided losses is $118,350 per year, totaling $2,367,000 over 20 years. The use of average loss values is conservative as the marginal rate of line loss is twice the average rate of loss[7], and any reduction will actually realize the marginal rate, and is highest during peak demand periods which can coincide with DER production profiles.

Losses are greater on longer circuits. While not reflected in the scale of resolution provided by DERAC or CAISO loss rates, it should be noted that distribution line losses are greater on longer circuits, which are typically in rural and suburban areas. As such, the deployment of DER to serve local loads in these areas of the county will realize 1-2% greater energy value and can avoid alternative infrastructure investments designed for loss reduction; however, DER siting must be aligned with load locations on each circuit to realize these benefits.

Land Impact

Land use varies by installation and siting. For example, 10 MW of local PV installed on built environments in the county will avoid impacting 75 acres of land in contrast to citing this same renewable capacity on pristine or arable lands, although some grazing and agricultural uses are not necessarily incompatible with PV or wind facilities. DG avoids impact when it is deployed as a secondary use on existing structures, parking lots or otherwise already disturbed land, and provides added value to such spaces through beneficial shading.

While conventional CCNG facilities require relatively little land for the generating facility itself, the land impacts resulting from the extraction and delivery of fuel to these facilities is comparable.[8] Additionally, the figure of 75 acres does not include the local land impacts associated with transmission lines from large or remote resources, which can impact wild lands, farms, parks, view sheds and residential zones.

Planned Avoided Cost Valuation Updates and Refinements

The CPUC issued Resolution E-4801 September 29, 2016 updating the DERAC model, and subsequent to this the Commission has approved updated GHG valuation; however, these updates will not be reflected in the model until the scheduled May 2018 revision. The Commission is also considering the adoption and application of Societal Costs and values

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[7] Source: Dr. David Patton, Phd expert witness in transmission costs for NY PUD
[8] Fthenakis, V., Kim, H.C., Land use and electricity generation: A life-cycle analysis. Renew Sustain Energy Rev (2008)

which may be incorporated in future valuation. Each of these factors are likely to increase the valuation relative to those developed from the current version of the model (v20160801), while updated natural gas price forecasts may reduce the energy value component.

A Locational Net Benefits Analysis (LNBA) methodology is being developed under the CPUC's Distribution Resources Plan R. 14-08-13 to further refine and assess locational variation in values. The LNBA methodology has been demonstrated with regard to the value of DER in relation to their ability to provide energy, capacity and services that would otherwise require conventional capital investment in distribution infrastructure, however this assessment only applies where specific investments have been planned, and where these investments are deemed deferrable. PG&E is in the process of implementing refinements in the methodology and developing the databases of deferrable planned investments. Under CPUC proposed schedules pending final approval, LNBA values will be mapped for all locations by the Summer of 2018.

Further development of the LNBA to also reflect the value of DER in avoiding or deferring the growth of the need for additional ratepayer funded energy, services or capacity is also being developed. These values are very significant because if the growth in DER deployment delays or avoids approaching the limits of the existing energy infrastructure, new investments to mitigate these needs will not be needed and will never enter into the planning cycle. These avoided costs would not be captured if only considering planned capital investments.

Identified Local Grid Needs & Planned Projects

2017 Transmission Planning Process (TPP) Report

Locational values are associated with identified local grid needs & potentially deferrable planned projects. As illustrated below, the East Bay, including Alameda County, primarily relies on internal generation to serve customers, rather than electricity delivered from other areas. The addition of local renewable generation and other DER can reduce the use of existing local conventional generation or future expansion, proportionately reducing emissions from these facilities.

CAISO conducts an annual transmission planning process (TPP) to assess the need for new transmission investment based on load forecasts and current and planned generation and transmission infrastructure.[9] This includes identification of defined areas of local reliability constraint. Major transmission pathways pass through Alameda County, and county boundaries incorporate multiple local reliability areas, allowing resources in those sectors of the county to contribute in meeting the needs of each associated reliability area.

[9] https://www.caiso.com/planning/Pages/TransmissionPlanning/2017-2018TransmissionPlanningProcess.aspx

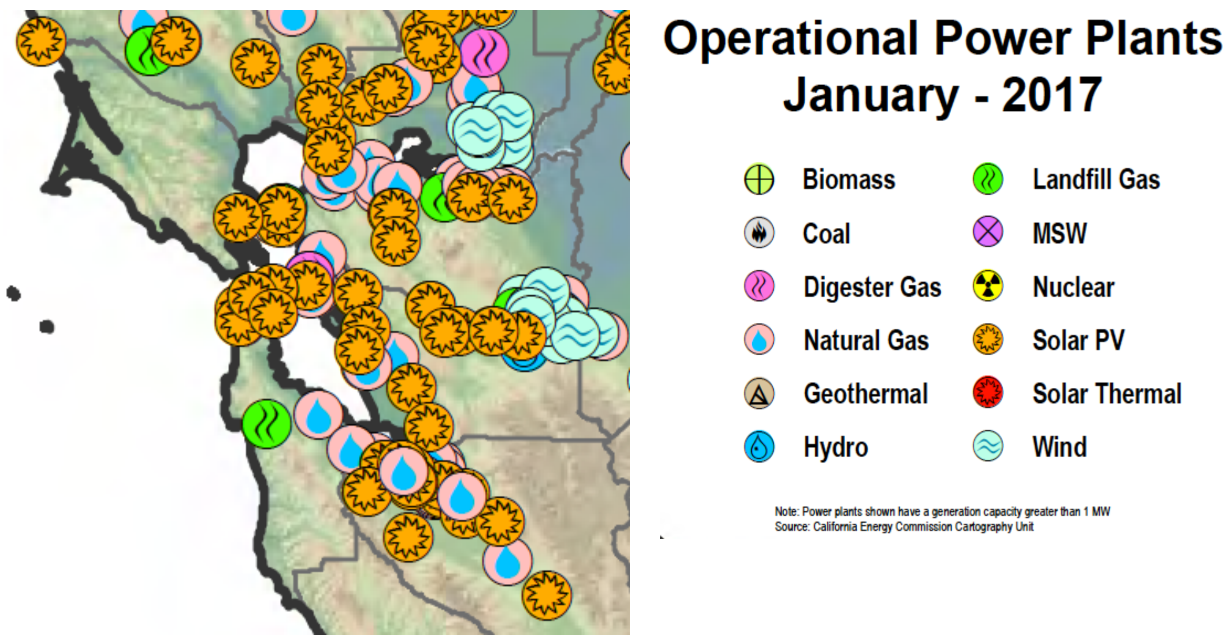
Bay Area Local Reliability Areas & Transmission System

Bay Area Local Reliability Areas

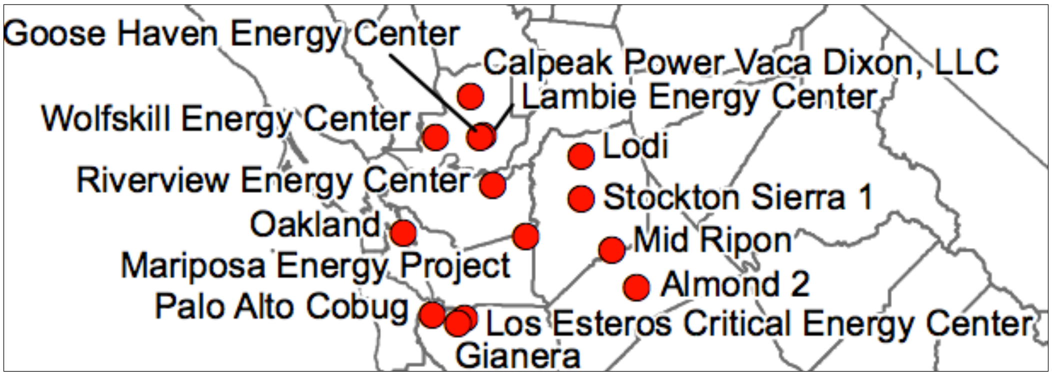
San Francisco Bay Area 3790 MW (B), 4349 MW (C with 131 MW deficiency)

- Oakland Sub-Area 92 MW (C)
- Pittsburg & Oakland Sub-Area 1188 MW (B), 2001 MW (C)
- Contra Costa Sub-Area (including Eastern Alameda County) 930 MW (B or C)
- Ames Sub-Area 596 MW (C)
- San Jose Sub-Area 265MW (B) 687 MW (C with 131 MW deficiency)

These Local Reliability Areas, overlapping or adjacent to Alameda County, are supported by regional large generation facilities connected to the transmission system, as illustrated in the following maps and the table of conventional generating plants in or near Alameda County.



Regional Emergency Conventional Peaker Power Plants



Conventional Power Plants in or Near Alameda County[10]

Alameda County **CCNG Generation Facilities**	**Location**	**MW**
Russell City Energy Center	Hayward	691
Peak Generation Facilities		
Dynegy Oakland Power Plant	Oakland	225
Peak Generation Facilities Bordering Alameda County		
Los Esteros Critical Energy Facility	Milpitas - San Jose	309
Mariposa Energy Project	Byron	200
Gianera Power Plant	Milpitas - San Jose	64
CCNG Generation Facilities Bordering Alameda County		
Donald Von Raesfeld Power Plant	Santa Clara	147
Tracy Power Plant	Tracy	341
Marsh Landing Power Plant	Antioch	720
Gateway Generating Station	Antioch	581

[10] See also: http://www.energy.ca.gov/maps/

Delta Energy Center	Pittsburg	860
Los Medanos Energy Center	Pittsburg	594
Pittsburg Power Gas Power Plant	Pittsburg	1,029

East bay Area Sensitivity Study

ISO forecast of summer peak load in East Bay area is for no increase (actually a small decrease) over the next 10 years, from 921 MW to 890 MW. The load forecast decreased by about 4% from last year's 2025 case study to this year's 2026 case study due to projected increases in behind-the-meter distributed generation (DG) and energy efficiency. As such, no new projects were identified in the 2017 TPP based on reliability, policy driven or economic factors, and the extent of reliability issues reduced slightly compared to last year's assessment without some of the local generation being available in the East Bay area.

Although no new capital reliability projects are added in the 2017 TPP, some contingency thermal overloads in the larger Bay Area are being addressed by prior year TPP projects. PG&E has a number of planned and approved projects below $50M each, some of which may be in the Alameda County area; however, projects of this size are not addressed in the TPP. A substantial number of these projects have been cancelled after approval due to reduced demand, largely driven by DG. Additional projects in this category are likely deferrable.

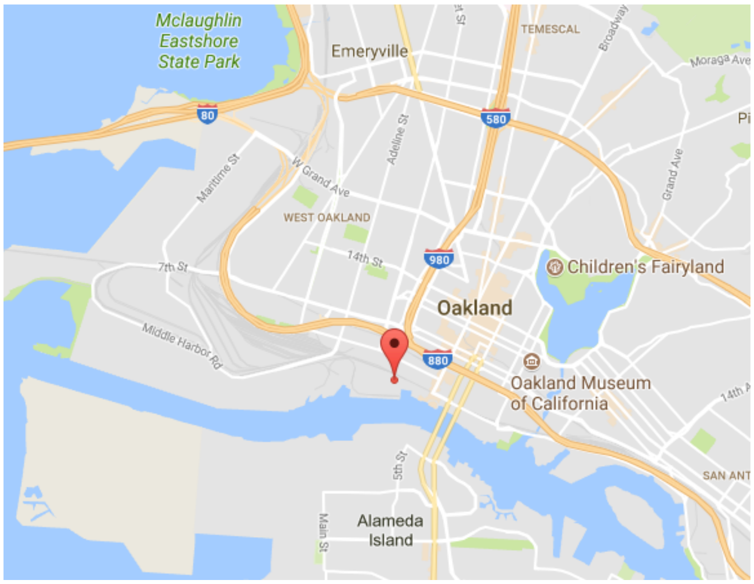
With the reliance on aging generation in the area, the ISO is continuing to assess the transmission needs in the East Bay in the event of local generation being unavailable. CAISO's scenario sensitivity analysis shows thermal overloads on the Grant-Oakland 115 kV line. The identified P2 and P6 contingencies are mitigated by the existing Oakland natural gas generator facility,[11] whose future is uncertain.

Although the existing generation and previously approved projects mitigate the issues in the area, the ISO is working with the Oakland generator owner and assess potential near term retirement prior to recommending any alterative developments. The Oakland

[11] Dynegy Oakland Power Plant, 50 Martin Luther King Jr. Way, Oakland, CA 94607. Operating since 1978 with 3x 75 MW Kerosene (Jet fuel) powered turbines. Maximum annual generation 21,248 MWh in 2000, average 10,934 MWh generation in 2011 and onward.

generating facility is located within and upwind of populations highly impacted by air pollution.

Dynegy Oakland Power Plant



PG&E's Oakland Reliability Proposal[12] includes substation upgrades combined with the procurement of preferred resources, including DR, EE, DG and ES in the event of Oakland closure as an alternative to a new 230 kV transmission line into the area, and preliminary PG&E analysis shows the potential for multimillion dollar savings for ratepayers compared to conventional transmission or generation alternatives.

This proposal, described below, includes the installation of two additional bus sectionalizing breakers and a new bus tie breaker at an estimated cost of $21M-$24M. After accounting for proposed grid upgrades, a DER portfolio of approximately 20 MW is required to mitigate the identified P6 needs from 7am to 9pm, and an additional 20 MW to meet P2 needs from 8am to 6pm. Energy Efficiency, Solar, Storage, and Demand Response can each contribute to the portfolio to achieve the required capacity and duration.

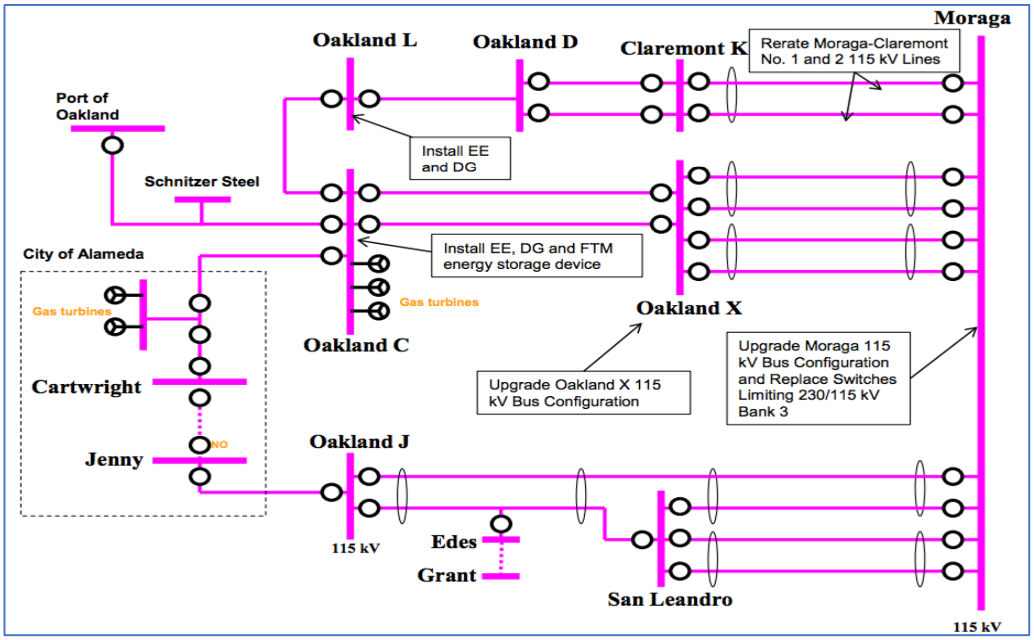
While PG&E includes some DER mitigations, additional DER alternatives to both the generation replacement and substation investments may be available at lower net cost to ratepayers after consideration of the additional energy, capacity, and load mitigation values offered.

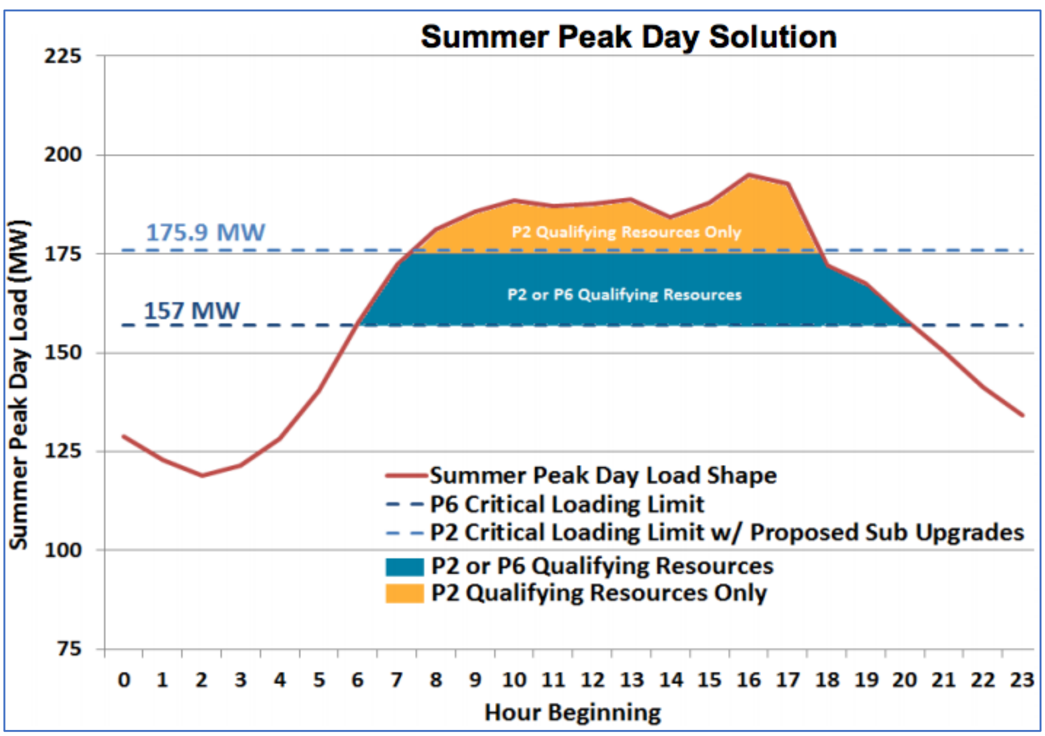
[12] See Oakland Reliability Proposal at https://www.caiso.com/Documents/Day2_PG_E-Presentation_2017-2018TransmissionPlanningProcess_PreliminaryReliabilityResults.pdf

Making Clean Local Energy Accessible Now

Grid Schematic:

PG&E proposed locations substation upgrades and DER deployment





Pacific Gas and Electric Company

Multiple Event Concerns after Substation Upgrades

NERC	Facility Name	Contingency Name	Base	Full2022	Mitigation
P6	MORAGA-CLAREMONT #1 115kV [2700]	P6: MORAGA-CLAREMONT #2 115kV [2710] & SOBRANTE-MORAGA 115kV [3742]	108%	82%	Re-rate
P6	MORAGA-CLAREMONT #2 115kV [2710]	P6: MORAGA-CLAREMONT #1 115kV [2700] & SOBRANTE-MORAGA 115kV [3742]	108%	82%	Re-rate
P6	C-X #2 [9962]	P6: K-D #1 115kV [9966] & K-D #2 115kV [9967]	106%	89%	Portfolio
P6	MORAGA 230/115 kV TRANSFORMER NO. 2	P6: MORAGA 230/115kV TB 3 & MORAGA 230/115kV TB 1	101%	99%	Portfolio
P6	MORAGA 230/115kV TRANSFORMER NO. 2	P6: MORAGA 230/115kV TB 3 & MORAGA 230/115kV TB 1	103%	99%	Portfolio
P6	MORAGA 230/115kV TRANSFORMER NO. 1	P6: MORAGA 230/115kV TB 3 & MORAGA 230/115kV TB 2	103%	99%	Portfolio
P6	MORAGA 230/115kV TRANSFORMER NO. 1	P6: MORAGA 230/115kV TB 3 & MORAGA 230/115kV TB 2	101%	99%	Portfolio
P6	MORAGA 230/115 kV TRANSFORMER NO. 3	P6: MORAGA 230/115kV TB 1 & MORAGA 230/115kV TB 2	114%	99%	Moraga Transformer No. 3 Upgrade + Portfolio
P6	MORAGA 230/115 kV TRANSFORMER NO. 3	P6: MORAGA 230/115kV TB 1 & MORAGA 230/115kV TB 2	114%	99%	
P6	MORAGA-CLAREMONT #2 115kV [2710]	P6: C-X #2 115kV [9962] & C-X #3 115kV [9925]	116%	86%	Re-rate
P6	D-L #1 [9963]	P6: C-X #2 115kV [9962] & C-X #3 115kV [9925]	120%	93%	Portfolio
P6	MORAGA-CLAREMONT #1 115kV [2700]	P6: C-X #2 115kV [9962] & C-X #3 115kV [9925]	116%	86%	Re-rate
P6	C-X #2 [9962]	P6: D-L #1 115kV [9963] & C-X #3 115kV [9925]	121%	93%	Portfolio
P6	MORAGA-CLAREMONT #2 115kV [2710]	P6: C-L #1 115kV [9961] & MORAGA-CLAREMONT #1 115kV [2700]	106%	88%	Re-rate
P6	MORAGA-CLAREMONT #1 115kV [2700]	P6: C-L #1 115kV [9961] & MORAGA-CLAREMONT #2 115kV [2710]	106%	88%	Re-rate

The table above indicates the mitigation requirements met by DER in the PG&E proposed DER portfolio after accounting for substation upgrades. These upgrades increase the P2 Critical Loading Limit by nearly 50 MW, from the existing 128 MW to 176 MW. Higher DER growth in this area may reduce the need for these upgrades, and consideration should be given to the DER mitigation provided at a cost comparable or lower than the proposed $35M for upgrades alone.

Additional Locational Value Factors

Co-location

As indicated in the separate Solar Siting Survey, large commercial and public rooftops and parking areas are prime siting opportunities for solar generation at commercial scale. Concentrations of these sites are clearly visible in the satellite image. Power flow analysis demonstrates good alignment of PV generation and load at similar commercial locations, mitigating stress on the electrical grid. Commercial customers at such locations are also subject to demand charges tariffs and can benefit from energy storage.

Co-location of energy storage with renewable resources, combined with primary charging from those resources, allows the storage to qualify for the Federal Investment Tax Credit (ITC), reducing the capital cost by 30%. Under existing rules, ITC value will decline over the next five years to 10%.

Energy storage facilities are highly capable of mitigating the grid impacts of both excess load and excess generation, thereby supporting increased grid hosting capacity both co-located with the storage and across all electrically related line sections and circuits in equal capacity to the battery's capabilities utilized for this purpose. While any portion of storage capacity dedicated to hosting capacity or other grid mitigation must prioritize that function, the entire capacity remains available to provide secondary services when not actively utilized or reserved for the primary function in any time period.

With appropriate tariff options, energy storage capacity can be applied to multi-use applications, providing services both the individual customers and to the community grid, locally balancing higher penetrations of distributed generation while supporting daily and emergency grid operation.

Critical Facilities

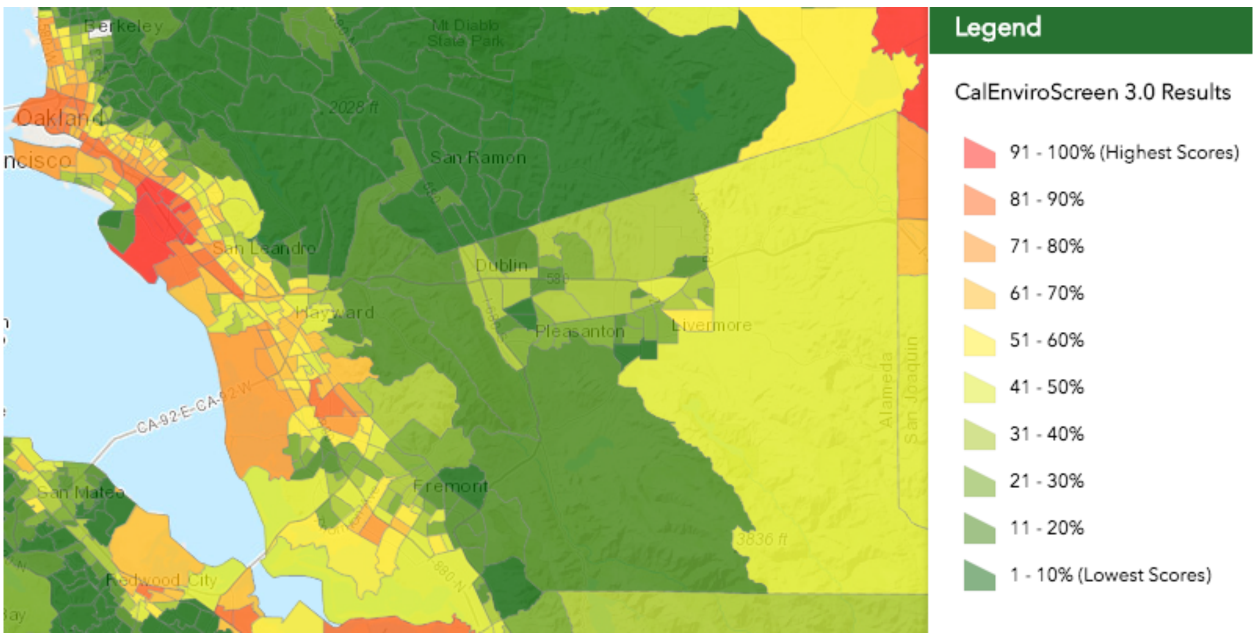
Critical public facilities are located throughout the county, and concentrated in population centers. Critical facilities provide services to the population during local and regional emergencies to support rescue, relief, and recovery operations. Major disasters, including earthquakes and large fires, can disable regional power supplies for extended periods due to disruptions in both the electric transmission system and the gas pipelines used from electrical generation. The development of local distributed generation and storage resources in appropriate locations can provide ongoing reliable backup power onsite or through local microgrids connecting these resources to maintain power for nearby hospitals, fire and police facilities, water supply, and schools or other buildings used as temporary shelters. While diesel backup generators may be available at some locations, fuel supplies are limited and resupply is subject to availability and delivery constraints following disruptions to transportation and refining or storage infrastructure. The satellite image below illustrates mapped examples of facility locations at or near which distributed generation and storage development may also provide support for critical services.

Impacted & Sensitive Populations

Air quality is important. It has clear effects on health for everyone, especially disadvantaged communities as these include higher concentrations of sensitive populations, reduced access to care, and greater exposure associated with increased pollutant levels and respiratory activities. In addition, air quality has multiple economic costs, both directly related to health, and more broadly to regional attractiveness, influencing attraction and retention of investment, employees, and visitors, and associated economic development.

This map shows CalEnviroScreen 3.0 scores for census tracts across the county. Consistent with SB 535 CalEPA defines Disadvantaged Communities as the 25% highest scoring census tracts.

Alameda County CalEnviroScreen 3.0

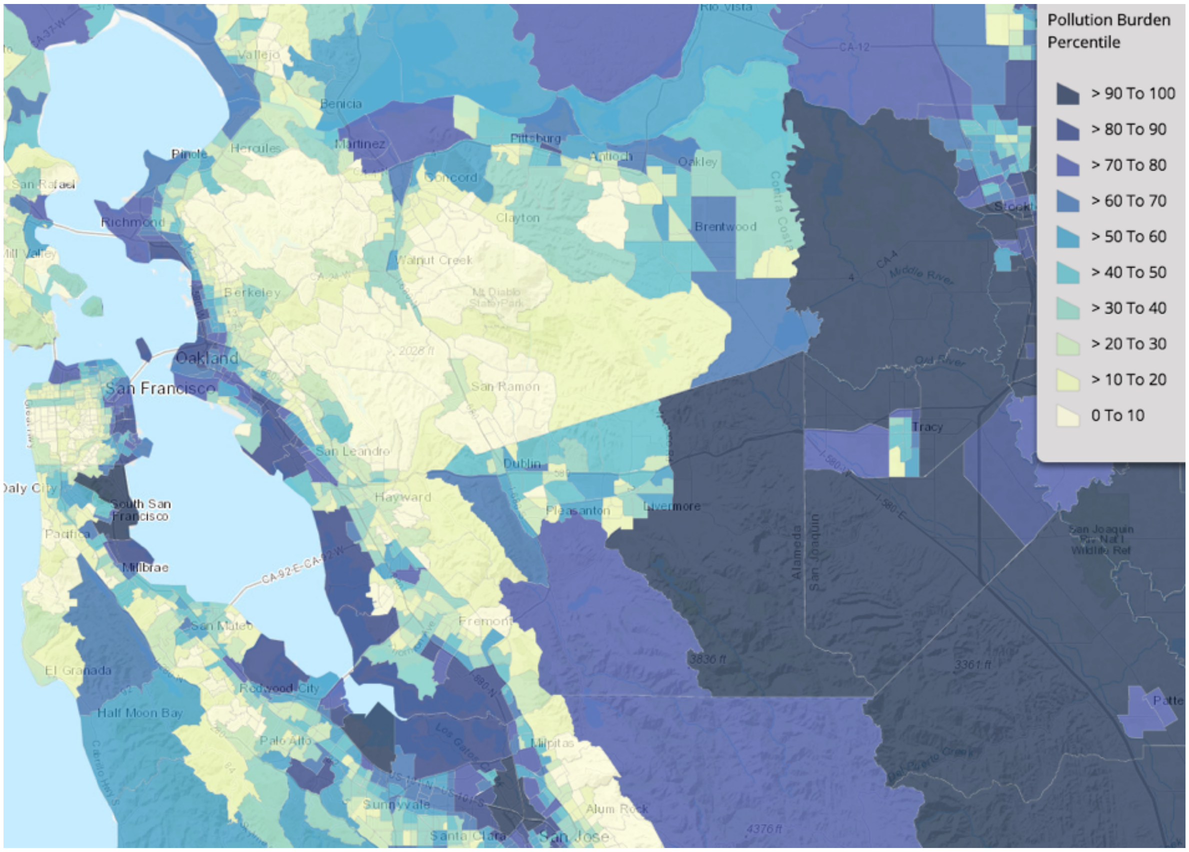


As can be seen, communities disproportionately burdened by pollution within Alameda Country are concentrated in the western urbanized regions, with multiple areas in the top 10% or 20% statewide.

Additionally, downwind communities bordering Alameda to the South and West are also highly impacted and will benefit from improvements in air quality achieved throughout Alameda County. This is evident when comparing the mapped air flow patterns and total pollution indices for the region

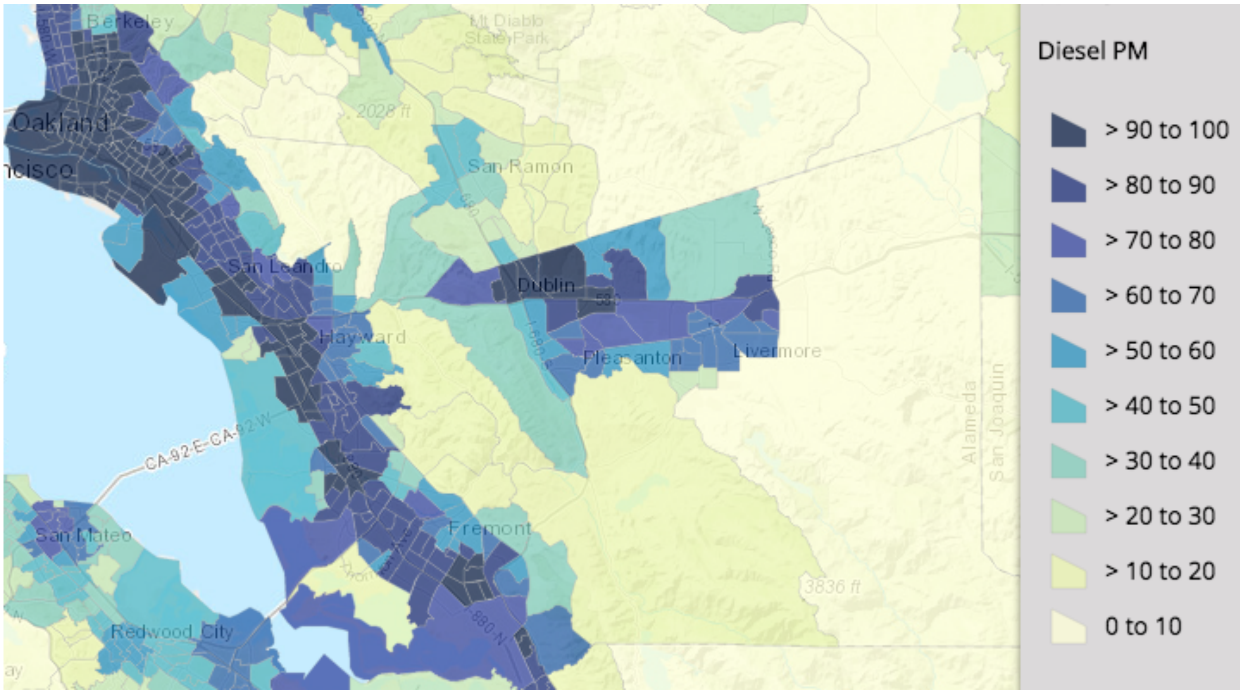
Regional Wind Patterns

Total Pollution Indicator: Greater Bay Area



As illustrated in the following maps, there is a high degree of correlation between areas of high pollution, high health impacts, and high unemployment. Targeting investment in these locations can effectively address multiple locational values and yield coordinated benefits, achieving improvements in public health, quality of life and economic opportunity for some of California's most burdened communities while at the same time reducing pollution that causes climate change.

Diesel Pollution Indicator: Alameda County



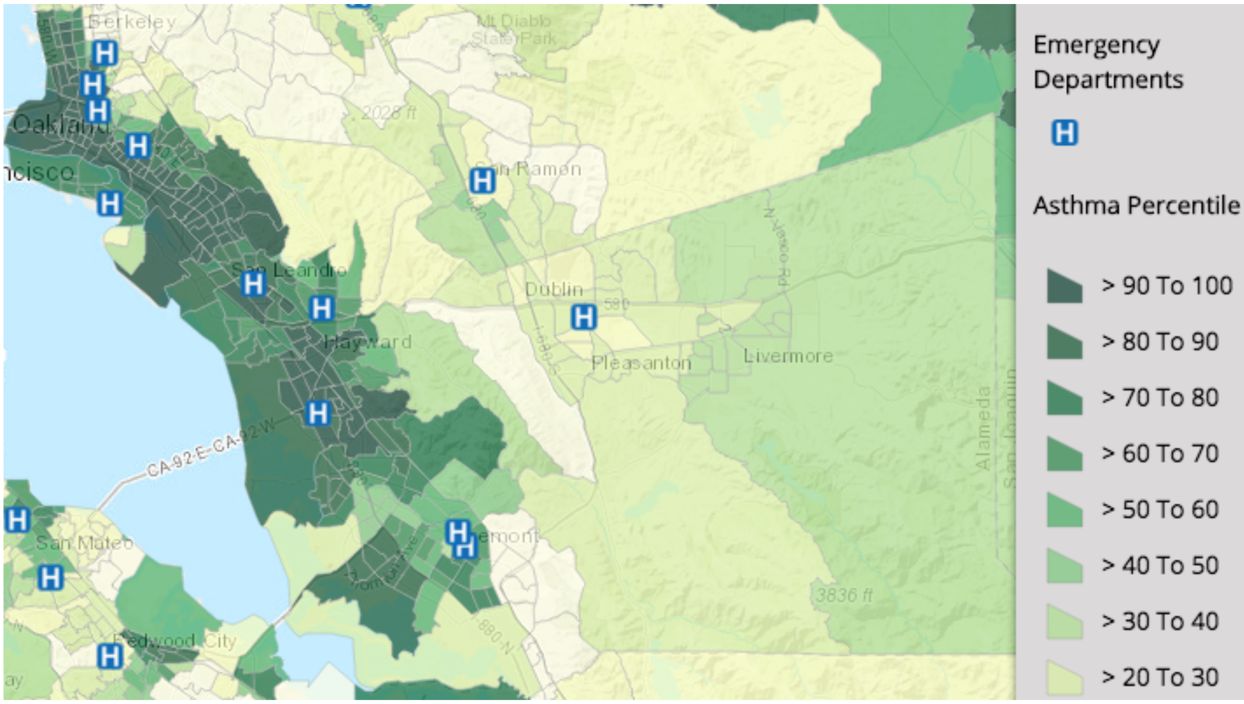
This indicator represents how much diesel particulate matter (PM) is emitted into the air within and nearby the populated parts of each census tract. The particles in diesel PM can reach deep into the lung, where they can contribute to health problems including eye, throat and nose irritation, asthma, heart and lung disease, and lung cancer. Children and the elderly are most sensitive to the effects of diesel PM.

The diesel PM percentile for the indicated dark areas is higher than 90% of the census tracts in California; West and central Oakland is most highly impacted, with indicators in the 99th percentile. Air pollution is a major causal factor in asthma. As indicated below, diesel emissions correlate closely with variations in asthma rates by location. Local nitrous oxide and ozone levels follow similar patterns.

Emission free power generation and increased electrification of transportation and building energy use directly reduce these three primary contributors to poor local air quality.

Air Pollution Impacts Indicator:

Alameda County Sensitive Populations – Asthma Rates

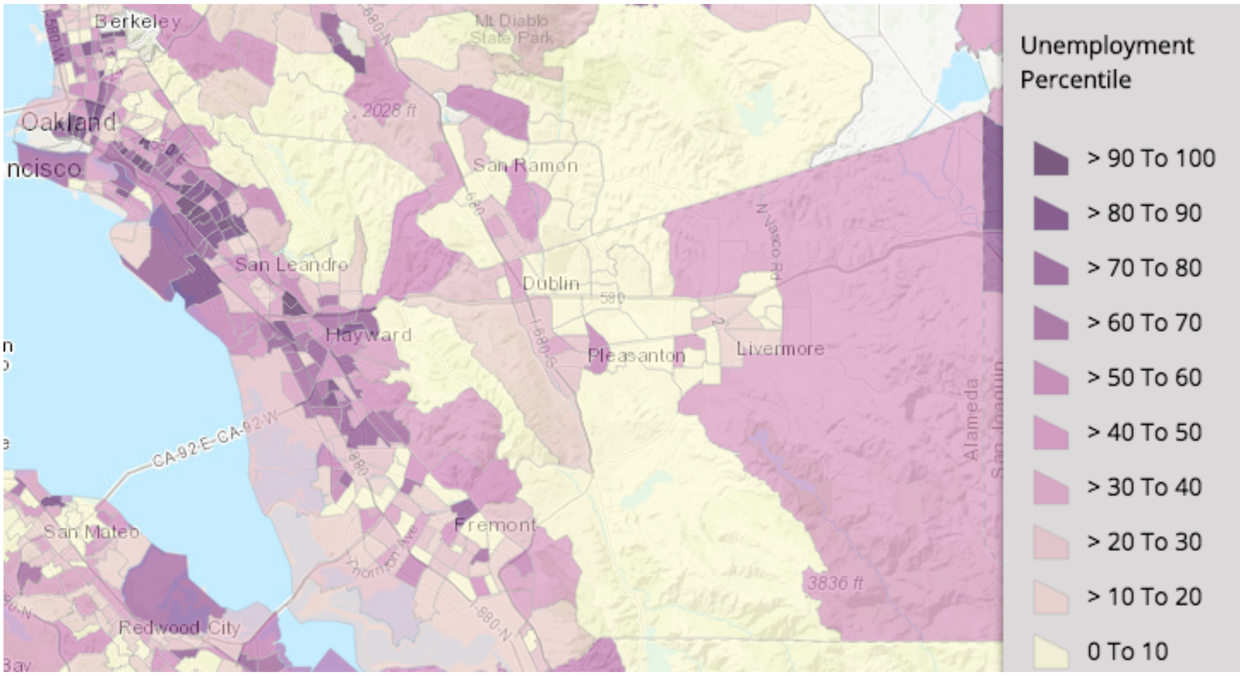


As previously noted under emission reduction figures, [13] and based on a PV avoided mortality rate of 0.004/MW, and 0.5/MW in health induced work loss days compared to emission impacts of conventional CCNG generation, each 25 MW of PV would avoid 0.1 deaths and 12.5 fewer work loss days.

Lastly, we note the high locational correlation of Disadvantaged Communities' health factors with unemployment levels indicated in the following map, and the broad correlation with local grid needs and opportunities to replace conventional generation in areas with local capacity requirements and transmission constraints.

[13] NREL Emissions Health Calculator, PG&E service territory

Unemployment Rates: Alameda County



Conclusion

The locational correlations between siting opportunities, grid needs, health impacts, customer value, and economic development investment indicate high value opportunities to address disadvantaged communities' environmental justice needs for clean air and employment while meeting the electrical needs of the service area. Weighted scoring of each factor can optimize procurement decisions to meet community goals.