California Power Map: Methods and Data

PSE Healthy Energy
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The California Power Map tool aggregates public data from numerous resources and includes additional independent analysis. It is updated regularly based on ongoing data releases to reflect new emissions and operational data and power plant status.

I. California power plant database aggregation

The California Power Map includes all power plants larger than 10 megawatts burning fossil fuels or bioenergy resources (e.g. biomass, landfill gas) across the state. An initial list of power plants and capacities was downloaded from the California Energy Commission (CEC) [1]; this database includes capacity, location, start date, operational status, local reliability area and sub-area, utility territory, balancing authority, air district, air basin, and congressional districts. We supplemented this list with additional power plants and ownership information included in the U.S. Energy Information Administration (EIA) Forms 923 [2] and 860 [3], using the Power Plant ID Cross Reference Table from the California Energy Commission [4]. Some small plants, particularly cogeneration plants supplying industrial sources, may be missing from this compiled list. We incorporated proposed plants from EIA Form 860 and the California Energy Commission project list [5].

We verified power plant location when possible using Google Maps, and updated locations accordingly. We resolved discrepancies in power plant capacities between the CEC and EIA by checking power plant websites and proceedings when available. Certain database errors were updated, such as incorrect utility service territory classification. We classified plant types using a combination of data from the California Energy Commission [6] and forms EIA 860 [3] and 923 [2] as well as individual plant websites. We classified the status of each plant (e.g. operational, idle, pending retirement) using data from EIA Form 860 as well as media reports and the California Independent System Operator's announced retirement and mothball list [7] and some additional data on biomass plants from CalBiomass [8]. We supplemented information about capacity needs in local reliability areas using the California Independent System Operator (CAISO)'s 2019 local capacity requirement documentation [9].

II. Demographic analysis

While the impacts of power plants can be far-reaching, with criteria pollutant emission impacts reaching out-of-state, we analyzed populations living near power plants at different spatial scales to get a sense of who lives near different kinds of facilities. We analyzed some data by the census tract of the plant location, which aligns with certain state policies focused on identifying disadvantaged communities by census tract; and we integrated some population data at different distances from the plant to allow the user to have some control. We selected a 1-mile radius (this distance limits averaging over too large a population, which can cut off the high and low end of distributions); a 3-mile radius (which has precedent in the analysis performed by the U.S. Environmental Protection Agency in its environmental justice analysis of power plants for the Clean Power Plan); and a 6-mile radius (which is frequently used by the California Energy Commission to assess populations living near proposed plants).

We created radial geodesic buffers at 1, 3, and 6 miles around each power plant.
We obtained demographic information from the U.S. Census Bureau. We downloaded race and ethnicity data at the census block level from the 2010 decennial census [10] for the following variables: total population, white alone, black or African American alone, American Indian and Alaska Native alone, Asian alone, Native Hawaiian and Other Pacific Islander alone, some other race alone, two or more races, and Hispanic or Latino. We downloaded socioeconomic data from the American Community Survey (ACS) at the census block group level for the following variables: population living below the poverty line, and median income. Data at this granularity is only available from the ACS as a five-year aggregation, and we used the 2012-2016 data release [10] We also obtained environmental justice scores from CalEnviroScreen 3.0 [11]. These data are published at the census tract level.

We took population counts for variables at the block group level and allocated them to the block level based on the distribution of total population at the block level. This allowed us to estimate at a more detailed spatial scale and served to ensure that all counts are tabulated at the same spatial level. We overlaid the Census block polygons with each of the three buffer distances, and used areal apportionment to allocate block-level counts to areas within each buffer polygon by calculating the percentage of each census block residing within the buffered area, then summing population counts over each buffer distance for every power plant.
We brought all data to the same level of census tract by summing population counts over census tracts for the population count estimates at each buffer distance. We weighted CalEnviroScreen scores for each census tract by the population living with the buffered portion of the tract and summed them over each buffer distance for each power plant to calculate a population apportionment-based CalEnviroScreen score value for each facility over each buffer distance. We excluded all census tract with no CalEnviroScreen score value from this calculation.

Following the approach of the State of California, plants are designated as located in a disadvantaged community if the census tract score where it is located has an overall CalEnviroScreen score about the 75th percentile or, for tracts without a CalEnviroScreen score, an environmental score above the 95th percentile. In the histogram in the demographic map, plants without an overall percentile are plotted by their environmental percentile; this designation disproportionately affects plants located in the Los Angeles Department of Water & Power territory.

III. Operations, air quality and emissions

We aggregated generation, emission and air quality data from numerous sources, noting some discrepancies in data reporting between different databases. When available, we used the EPA's Air Markets Program Database for information on hourly, daily and annual generation (MWh), emissions of carbon dioxide (CO_2) and nitrogen oxides (NO_x), and fuel consumption (MMbtu) [12]. When this data was missing, we supplemented it with generation and fuel consumption data from the California Energy Commission annual generation database, although these data are only available through 2016 [6] and with emissions data from the California Air Resources Board, although these data are also only available through 2016 [13].

We obtained air quality data from the EPA AirData database on a daily basis [14]. Using the CARB database of air monitors [15] we aggregated monitors in each Air Basin and determined the number of days ozone and particulate matter concentrations exceed federal standards (70 ppb ozone over an 8-hr period and 35 $\mu g/m^3$ $PM_{2.5}$ over a 24-hour period) somewhere in each basin [16]. For plants for which we have Air Markets Program Data, we then calculated the percentage of total electricity generation from each plant on days exceeding ozone or particulate matter standards somewhere within their air basin. These data are typically only available for larger plants.

By default, the data included in the California Power Map summarizes operational data for 2010-2017. Many of the tools include a filter to change the years, and changing these filters will update the data so that it is averaged over the selected timespan.

Data sources

1. **Data:** Power plant name, capacity, location, start date, operational status, local reliability area and sub-area, utility territory, balancing authority, air district, air basin, and congressional districts
   Source: California Energy Commission. Database of California power plants. 2018.
   Available at: www.energy.ca.gov/almanac/power_plant_data/Power_Plants.xlsx
   Most recent download: January 9, 2018

2. **Data:** Power plant ownership
   Source: U.S. Energy Information Administration. Form EIA-923 detailed data: 2017 Early Release. 2018.
   Available at: www.eia.gov/electricity/data/eia923
   Most recent download: July 1, 2018
   Data year: 2017

3. **Data:** Power plant ownership, capacity
   Source: U.S. Energy Information Administration. Form EIA-860 detailed data: 2017 Early Release. 2018.
   Available at: www.eia.gov/electricity/data/eia860
   Most recent download: July 1, 2018
   Data year: 2017

4. **Data:** Power plant ID cross-reference list
   Source: California Energy Commission. California Energy Commission power plant ID cross reference table. 2018.
   Available at:
   www.energy.ca.gov/almanac/electricity_data/web_qfer/Energy_Commission_Power_Plant_ID_Cross_Reference_Table.xls
   Most recent download: June 27, 2018

5. **Data:** Proposed power plants
   Source: California Energy Commission. Status of all projects. 2018.
   Available at: www.energy.ca.gov/sitingcases/all_projects.html
   Last checked: August 7, 2018

6. **Data:** Power plant capacity and generation
   Source: California Energy Commission. Annual generation – plant unit. 2018.
   Available at:
   www.energy.ca.gov/almanac/electricity_data/web_qfer/Annual_Generation-Plant_Unit.php
   Most recent download: July 3, 2018
   Data years: 2010-2017

7. **Data:** Power plant status
   Source: CALISO. Announced retirement and mothball list. 2018.
   Available at: www.caiso.com/Documents/AnnouncedRetirementAndMothballList.xlsx
   Most recent download: July 20, 2018

8. **Data:** Mothball status of biomass plants
   Source: Cal Biomass Energy Alliance. Biomass facilities. 2018
   Available at: www.calbiomass.org/facilities-map
   Most recent download: July 15, 2018

9. **Data:** Local capacity requirements
   Source: California Independent System Operator. 2019 local capacity technical analysis: final report and study results. 2018.
   Available at:
   www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleCapacityNeedsAssessmentProcess.aspx
   Most recent download: August 7, 2018

10. **Data:** Population and demographics
    Source: U.S. Census Bureau and the American Community Survey 2012-2016 5-year estimates.
    Available at: www.census.gov/geo/maps-data/data/tiger-data.html
    www2.census.gov/census_2010/04-Summary_File_1/
    Most recent download: April 30, 2018

11. **Data:** CalEnviroScreen 3.0
    Source: Office of Environmental Health Hazard Assessment. CalEnviroScreen 3.0. 2018.
    Available at: oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Most recent download: March 21, 2018
Data years: 2006-2016 (varies by indicator)

12. **Data**: Hourly power plant generation (MWh) and emissions (CO_2, NO_2, SO_x).
    Source: U.S. Environmental Protection Agency. Air Markets Program Data. 2018.
    Available at: ampd.epa.gov/ampd
    Most recent download: February 21, 2018
    Data years: 2010-2017

13. **Data:** Annual power plant criteria pollutant emissions
    Source: California Air Resources Board. CARB pollution mapping tool. 2018.
    Available at: www.arb.ca.gov/ei/tools/pollution_map
    Most recent download: July 9, 2018
    Data years: 2010-2016

14. **Data:** Daily ozone and particulate matter concentrations
    Source: U.S. Environmental Protection Agency. Pre-generated data files: tables of daily and daily summary data. 2018.
    Available at: aqs.epa.gov/aqsweb/airdata/download_files.html#Daily
    Most recent download: February 2, 2018
    Data years: 2010-2017

15. **Data:** Air monitor locations
    Source: California Air Resources Board. Air monitor site list generator. 2018.
    Available at: www.arb.ca.gov/qaweb/sitelist_create.php
    Most recent download: February 12, 2018

16. **Data:** California air basin geography
    Source: California Air Resources Board. California Air Basins. 2018.
    Available at: www.arb.ca.gov/knowzone/basin/basin.htm
    Last checked: August 7, 2018