STAFF REPORT
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INFORMATIONAL REPORT PROVIDING A STATUS UPDATE ON RENEWABLE ENERGY EVALUATION OF LANDS UNDER THE JURISDICTION OF THE COMMISSION AND ITS PARTICIPATION IN RENEWABLE ENERGY TASK FORCES IN CALIFORNIA

INTRODUCTION:
The purpose of this report is to update the Commission on staff's work over the past 2 years in assessing the renewable energy potential of lands under the jurisdiction of the Commission. The report also provides an update on the Commission's participation in various renewable energy task forces in California. Staff also hopes this report elicits feedback and comments from various stakeholders about the resource potential analysis, including the methodology, screening criteria, and data sources so that staff can utilize this feedback to improve the analysis. The exhibits summarize the data sources and the references used in the resource potential analysis.

BACKGROUND:
Concerns related to climate change and sea-level rise have prompted California lawmakers to establish stringent laws and regulations related to sources of energy used for electricity generation. California's Renewable Portfolio Standard (RPS) establishes renewable energy procurement targets for the state's load-serving entities, requiring retail sellers and local publicly owned electric utilities to increase their procurement of eligible renewable energy resources to 33 percent of retail sales by 2020 and 50 percent by 2030. (*See* Pub. Util. Code, §§ 399.11, 9621). In addition, recent downward trends in California oil and gas operations, combined with maturing oil fields in California provide clear opportunities to expand and promote renewable energy to further diversify the State's energy and income portfolio.

Interagency Efforts
The Commission and its staff have been engaged in efforts to transition California to a lower carbon, renewable energy generation system for many years. In 2008, the Commission sought to include renewable energy generation in its management portfolio on school lands, adopting a *Resolution by the California State Lands Commission Supporting the Environmentally Responsible Development of School Lands Under the Commission's Jurisdiction for Renewable Energy Related Projects*. In 2011 and 2013, the Commission entered into two memoranda of understanding with state and federal agencies to participate in the Renewable Energy Action Team and planning activities

related to the Desert Renewable Energy Conservation Plan (DRECP), in recognition of the Commission's widespread landholdings in the DRECP area and the Commission's responsibilities to develop those lands to benefit the State Teachers Retirement System. As part of its DRECP activities, and consistent with a 2012 memorandum of agreement between the Commission and the Department of Interior, Commission staff are working with staff from the Bureau of Land Management (BLM) to pursue land exchanges with the federal government (pursuant to Public Resources Code section 8720, et seq.). The land exchanges are intended to consolidate school landholdings in the DRECP area to facilitate renewable energy development on school lands in return for releasing state-owned inholdings within federal wilderness and other protected areas to the federal government.

Staff has also been active in developing partnerships related to renewable energy research and development in the marine environment. The Commission, for example, has been a member of the Marine Renewable Energy Working Group, led by the Ocean Protection Council since 2011, and in 2013 staff developed an informational report entitled *Marine Renewable Energy and Environmental Impacts: Advancing California's Goals* that discusses the state of marine-based wind and wave energy technology development and what environmental impacts may result from deployment of those technologies. In 2015 and 2016, the Commission provided cost-matching support in the form of in-kind services for the CalWave study, a Department of Energy grant-funded exploration of the feasibility of siting a national wave energy test center off the coast of California. While the California site was not selected for the test center, the study yielded valuable information on which agencies and industry are building. For example, staff is a member of the Intergovernmental Renewable Energy Task Force (Task Force), a state-federal partnership established between the state and the Bureau of Ocean Energy Management (BOEM) that seeks to explore and facilitate offshore renewable energy development. The common goals and objectives of the respective state and federal agencies were memorialized in a December 12, 2016 memorandum of understanding signed by Governor Brown and former Secretary of the Interior Sally Jewell.

Strategic Plan

On December 18, 2015, the Commission adopted its 5-year Strategic Plan. Recognizing the need for more renewable energy, the Strategic Plan has laid the foundation for how the Commission should endeavor to build the bridge to a sustainable future. The Commission also recognizes that any new renewable energy project in California may have a positive impact on the State's economy, climate change efforts, water availability, and air quality.

The Strategic Plan, the culmination of robust stakeholder input and collaboration, guides the Commission's stewardship of public lands and resources, which includes addressing challenges such as adapting to sea-level rise and climate change, and

promoting public access. Several Key Actions in the Strategic Plan focus on identifying and promoting lands with potential for renewable energy, which enables the Commission to adapt to emerging challenges. For example, Key Action 2.1.3. states "Identify sovereign and school lands resources that have renewable energy or other development potential or are suitable for mitigation purposes." The Targeted Outcomes in the Workplan provide additional detail and guidance, including:

- Conduct a thorough inventory of lands with renewable resources potential (including solar, wind, wave, biomass, and geothermal), leveraging GIS, and in collaboration with recognized authoritative entities, to actively market and promote resource development potential.
- Develop science-based criteria to identify Commission lands suitable for developing renewable energy resources while protecting ecologically core land.

This report is in furtherance of these Targeted Outcomes.

DISCUSSION:
The 2016-2020 Strategic Plan provides a clear guidance for initiating the analysis of renewable resources potential on lands under the Commission Jurisdiction. Although the Commission has not received any applications for offshore wind or wave projects in recent years, it has responded to several pre-application inquiries and met on many occasions with interested developers and continues to participate on the Task Force. On school lands, the Commission is currently evaluating three solar development applications and has issued one lease for wind energy development. Geothermal energy exploration and leasing has occurred on lands under the Commission's jurisdiction for several decades. The Commission currently manages seven geothermal leases on school lands, one sovereign land geothermal lease, and two geothermal leases on proprietary lands owned by the California Department of Fish and Wildlife in Imperial County. In Inyo County, the Commission has issued one geothermal prospecting permit on a 640-acre parcel of school land.

Since 2016, the Commission has achieved considerable progress in understanding and evaluating the potential for various types of renewable energy development on lands under its jurisdiction. The primary goal is to gain a better understanding of the Commission's landholdings, and how they can be used within the framework of local, state, and national energy trends toward more renewable resources. Staff developed a plan to conduct a multiphase, multifaceted, and multiyear project designed to complete a comprehensive renewable resource assessment of state landholdings. Future evaluations will also address the impacts of such development on the environment, local economy and California's climate change goals. In addition to the potential for proactive management of these resources, this study can assist the State in achieving the goals established by California's RPS.

School Lands

Because of prior efforts like the DRECP, and the fact that land-based renewable technologies are more mature than marine-based technologies, staff began its evaluation by focusing on school lands. For all fee-owned school lands (where the State owns both the surface and mineral rights), staff identified the following resources for evaluation:

- Land-based wind
- Solar photovoltaic
- Geothermal
- Biomass

The Commission owns approximately 458,000 acres of school lands and manages 790,000 acres of 100 percent Reserved Mineral Interest (RMI) parcels where the Commission owns all the mineral interests but not the surface. For all 100 percent RMIs, staff is in the process of reviewing the geothermal potential associated with these parcels. Moreover, staff is compiling a list of the Commission's GIS inventory of 100 percent RMI lands. The inventory is an important and critical step in determining how geothermal resources can be developed on these parcels.

Staff began by conducting a comprehensive literature survey to become familiar with the technology and operational aspects of the various types of renewable energy. Subsequently, staff developed a series of screening criteria documents for each type of renewable energy resource. These screening criteria were then used to identify parcels with the highest potential for renewable energy development. Maps that indicate the resource potential for these parcels were developed in ArcGIS using data obtained from various federal and state agencies, such as the National Renewable Energy Laboratory and the U.S. Geological Survey.

By the end of 2017, staff had evaluated school land parcels in several counties (Imperial, San Bernardino, Kern, Los Angeles, and Riverside) for their potential to develop industrial scale solar photovoltaic (PV), wind, geothermal, and biomass resources. For these parcels, the characteristics and their associated potential have been compiled in a database that will eventually become a comprehensive list of lands and their respective renewable resource potentials. Moving into 2018, staff will continue to evaluate school land parcels in remaining counties such as Inyo, Mendocino, Monterey, San Diego, and San Benito.

Sovereign Land

Staff also evaluated the potential for renewable energy development on offshore areas under its jurisdiction. Staff has evaluated offshore wind and wave potential and is now reviewing tidal energy capabilities. So far, staff has preliminarily identified several offshore areas with high wind and wave potential within the Commission's jurisdiction.

Understanding that development opportunities offshore would need to be screened in further detail for potential compatibility with other uses and values like ecological productivity, fishing, shipping lanes, kelp forests, marine protected areas, environmental justice, military use, sand migration and many other factors, staff considers these areas a starting point for further refinement and filtering.

Other Activities

Additionally, staff initiated the following efforts:

- Compiled a comprehensive database for many solar and wind plants and operators in California. The database has information on the capacity and technical aspects of the plants as well as general operating company's information. This data was collected with the purpose of using it in the future to initiate contacts to promote and market the Commission's landholdings to companies with existing operational plants in California. This database includes comprehensive information for more than 130 wind facilities and contractors in California for prospective leasing. The database also includes information on solar developers and facilities in California.
- Developed a simple economic model for preliminary assessment of state revenue forecasts under different scenarios of royalty and rent.
- Initiated contacts with California renewable energy operators. Staff visited the Desert View biomass power plant in Riverside County in November 2017 to discuss issues including operational and environmental concerns, maintenance costs, initial capital cost, price of the feedstock, future opportunities for biomass, and competition and incentives. This discussion led to a better understanding of the biomass-generated electricity in California. Staff plans on conducting similar site visits to solar and wind facilities in 2018.
- Conducted research and gathered information from Nevada Division of State Lands and Arizona State Land Department as well as BOEM and BLM to help with the development of the framework for marketing the Commission's landholdings.

Staff recommends the following next steps to demonstrate the Commission's commitment to including these additional factors for the criteria:

- Consider land-use zoning.
- Consider conservation and protected areas, as well as their regulatory restrictions and resource management plans.
- Consider endangered and threatened species and critical habitats.
- Consider environmental justice communities – equitable distribution of impacts and benefits, legacy effects of energy development.
- Consult with Native American Tribes to ensure consideration of their perspective, interests, and concerns.
- Consider ecological constraints and opportunities.

- Conduct outreach to local communities, local and regional governments, environmental organizations, and renewable energy developers.
- Consider local versus export demand.

RESOURCE EVALUATION:

Assumptions and Data Sources:
Staff's primary source of data is the National Renewable Energy Laboratory (NREL), which has GIS maps and data on renewable energy resource potential from reputable sources such as universities, U.S. Geologic Survey, U.S. Forest Service, and the California Energy Commission. Established in 1974 and located in Colorado, NREL specializes in renewable energy and energy efficiency research and development. NREL is a government-owned, contractor-operated facility, and is funded through the U.S. Department of Energy (DOE).

Commission staff lacks the research capabilities to conduct and evaluate resource potential on its own and therefore must rely on publicly available data from reputable organizations. It is important to note that staff has used the data compiled by NREL with the assumption that the corresponding agencies have vetted the data and have verified their accuracy. A list of the data used and the agencies who provided it, is listed in Exhibit A. Use of this data is strictly for staff's evaluation and is not meant to replace the due diligence required by any potential developer in conducting their own resource evaluation.

Land-Based Wind Evaluation:
Wind power has been an area of considerable activity for many years. California was the first State to develop large wind farms, beginning in the early 1980's when the State provided tax rebates for wind power. These rebates funded the first major use of wind power for electric utility.

By 1995, California produced 30 percent of the world's wind-generated electricity. Texas; however, is the current leader in wind power development in the United States. According to NREL's estimate, the estimated potential for land-based wind power in California is 303,000 megawatts (MW) at a height of 80 meters. During 2016, electricity generated from wind in California totaled 13,500 gigawatt hours (equivalent to 4,403 megawatts).

Historically, most of California's wind power output has been in three primary regions: Altamont Pass Wind Farm (east of San Francisco), Tehachapi Pass Wind Farm (south east of Bakersfield), and San Gorgonio Pass Wind Farm (near Palm Springs, east of Los Angeles). The Alta Wind Energy Center, which is the largest US wind farm, is in Tehachapi Pass in Kern County.

In October 2016, the Commission authorized issuance of a General Lease – Industrial Use to Pacific Wind Development, LLC, beginning October 13, 2016, for a term of 40 years, for the construction, operation, maintenance, and decommissioning of a wind energy facility consisting of seven wind turbines of up to 3.0 MW each on 609 acres of school lands located in San Diego County. The project is proposed to supply electricity to about 6,000 homes and has the potential to generate millions of dollars in revenues for the State Teachers' Retirement System.

Land screening for site selection

To develop science-based screening criteria, staff studied many reports published from reputable scientific organizations in the sustainable energy field. These include the U.S. Energy Information Administration (EIA), American Wind Energy Association (AWEA), DOE, NREL, U.S. Forest Service, and universities. The NREL map showing the Nationwide Wind Energy Information is included in Figure 1. Staff determined that to be successful, a wind energy project must have:

1. Logistical compatibility
   - Strong wind resource (Wind speed ≥ 5.5 m/s)
   - Transmission access (Distance to transmission lines ≤ 10 miles)
   - Road access (Distance to roads ≤ 10 miles)
   - Suitable acreage (≥ 100 acres)
   - Appropriate site topography characteristics (Land slope ≤ 14 degree (PL) & ≤ 20 degree (NFS) & Elevation ≤ 7,000 ft.
   - Distance to urban areas > 2 desirable

2. Environmental Compatibility
   - Located outside designated wilderness areas, national conservation lands designations, critical habitat, or other protected lands
   - Screening for other potentially significant environmental conflicts (using existing knowledge/data or project-specific evaluations)

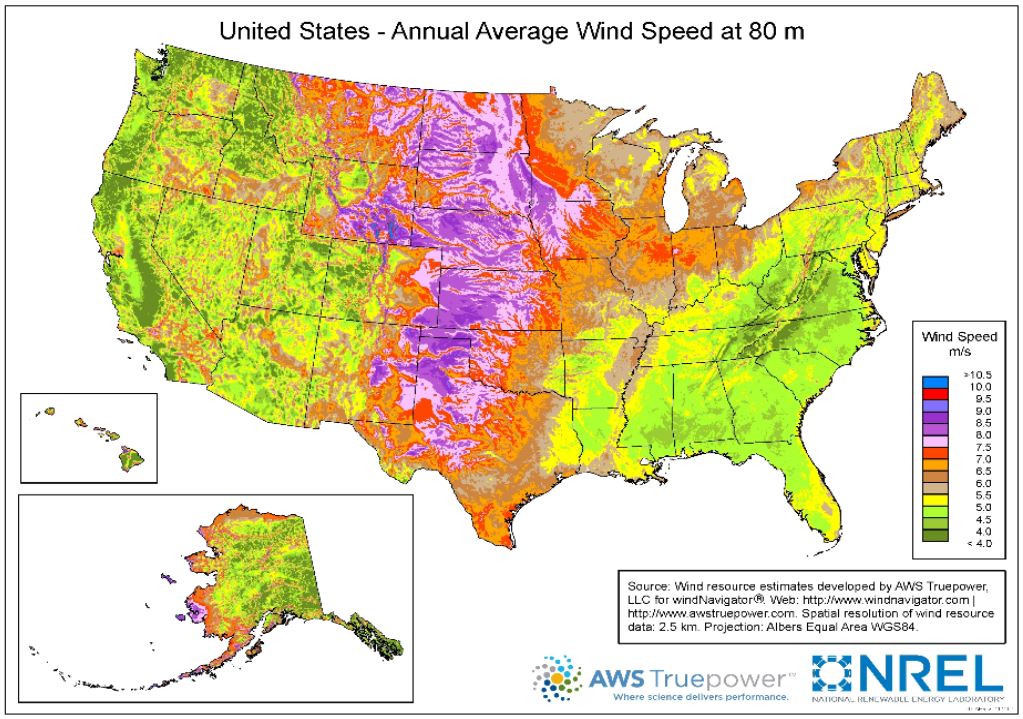


Figure 1 - Nationwide Wind Energy Information

Identification of Parcels with Potential for Wind Energy Development

Originally, a high-level review of all counties with school lands under the Commission's jurisdiction was conducted, and screening criteria were applied to identify parcels with potential for wind power development. The results are summarized below. An example of identified high wind potential areas in Kern County is included in Figure 2.

- Total number of counties with potential for wind energy development: 17 (Imperial, Inyo, Kern, Lake, Los Angeles, Mendocino, Modoc, Monterey, Napa, Plumas, Riverside, San Benito, San Bernardino, San Diego, Shasta, Sonoma, and Tehama)
- Total number of parcels in above counties: 1,112
- Number of parcels identified with potential wind energy development: 163
- Analysis completed for: four counties (Imperial, Inyo, Kern, and Riverside). Review of San Bernardino County is currently underway.

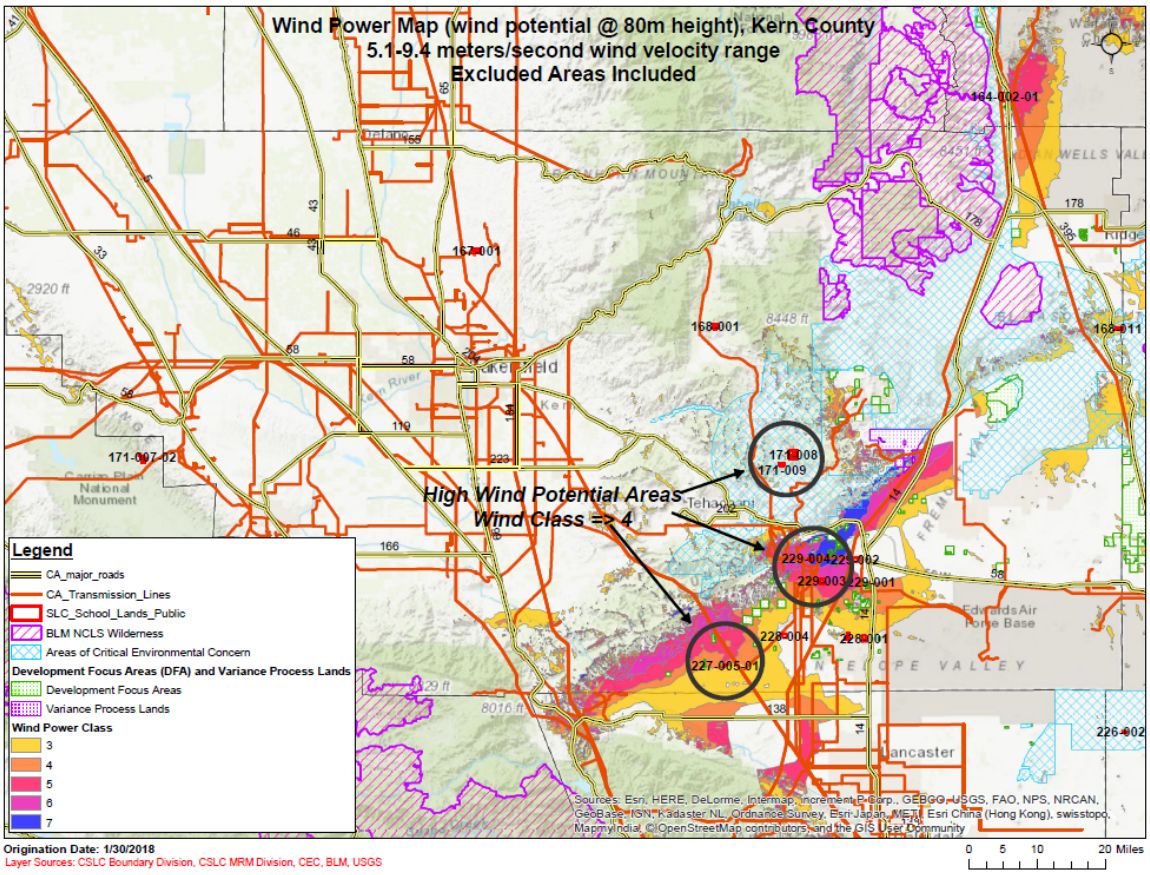


Figure 2 - An example of identified high wind potential areas in Kern County

Utility-Scale Solar Photovoltaic (PV) Evaluation:

In recent years, a dramatic drop in the cost of solar energy production has been achieved in the United States market. As a result, a rapid increase in PV solar power generation has occurred in the State. The California Energy Commission reported that in 2016, solar PV facilities in California generated 17,235 GWh of electricity, approximately 8.7 percent of the total electricity generated in the State. By comparison, in 2006, the State's share of solar PV was only 2 GWh. Staff initially focused on evaluating lands for using flat-plate, non-concentrating PV modules technology. Staff's objective was to identify parcels with high potential to garner interest from the renewable energy industry in pursuing solar resource development on State lands in an environmentally-sound manner consistent with future CEQA requirements and identified environmental restrictions which are currently known to staff. Figure 3 highlights the high potential for solar development in central and southern California.

The first step in staff's evaluation was to develop a summary of the key factors affecting utility-scale PV solar development. These factors were then considered for screening to identify parcels viable for solar PV deployment. Staff also generated a high-level

estimate of the potential of these suitable lands for electricity generation, using a simplified method derived from the actual performance of operational solar PV plants in the southwestern Unites States.

Land Screening for Site Selection

To define the appropriate screening criteria, staff conducted a thorough literature review. The focus was on better understanding the technical, economic, environmental, and social limiting factors affecting solar PV development. Preliminary terrain and proximity siting requires the consideration of existing infrastructure that affect the direct cost of utility-scale PV solar power development as well as potential solar irradiance that directly impacts the efficiency of an operating site. Vehicle access to a site is essential for construction and maintenance. Due to the high cost of road construction, proximity to existing roads is essential during preliminary siting. Proximity to national grid transmission lines also affects construction and development costs. Flat terrain is essential for both solar exposure and constructability while a high daily annual solar irradiance is needed for plant efficiency and stability.

In this assessment, the five key criteria considered for evaluating lands for solar PV development are:

- At least 10 acres in size.
- An annual average direct normal irradiance (DNI) level greater than 6.5 kWh/m2-day.
- Land slope less than 4 degrees.
- Road proximity of 2 miles.
- Substation proximity of 20 miles.

Identification of Parcels with Potential for Solar PV Energy Development

So far, staff has evaluated school land parcels in Imperial, Riverside, and Los Angeles counties, applying the above screening criteria, using solar potential GIS data provided by NREL. In Riverside County**,** out of 109 parcels, 35 met the criteria stated above, resulting in a net land size of 10,000 acres. Los Angeles County does not have any parcels suitable for solar PV development. In Imperial County**,** 28 parcels have high solar development potential with the net land size of 11,500 acres.

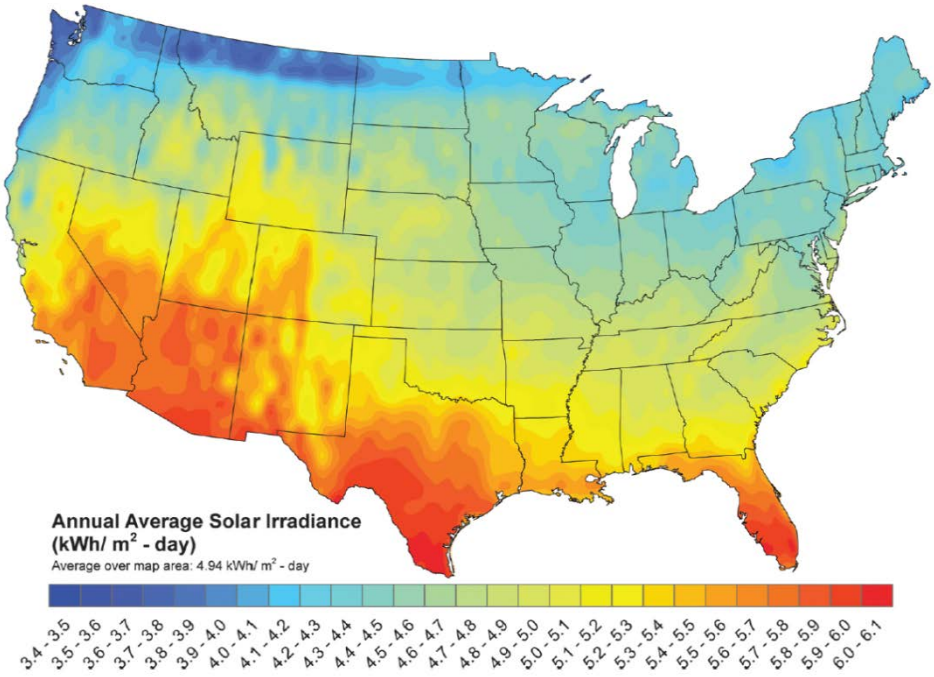


Figure 3 - Annual Average Solar Direct Normal Irradiance (kWh/m^2-day) across U.S. (M. Jacobson et al., 2014)

To estimate the electricity generation, the following assumptions were made:

- Install 0.13 MW per acre of solar PV module capacity; which represents the average system size per acre of a group of 20 operational utility-scale solar PV plants Southwest of the United States (California, Nevada and Arizona), constructed in the past few years.
- A System Capacity Factor (CF) of 25 percent is assumed for the solar PV modules. CF is defined as the ratio of actual electricity output over potential output based on the nameplate capacity. Similar CF values are reported for the existing utility-scale PV plants.
- A system loss of 10 percent was applied.

Considering the above assumptions, staff forecasted the electricity that could potentially be generated on school land parcels in Imperial and Riverside counties. The 35 suitable parcels identified in Riverside County for solar PV (10,000 net acres), have the potential to generate approximately 2,500 GWh of AC power annually. This is equivalent to the electricity consumed by 357,000 homes in California. In the 28 suitable parcels observed in Imperial County (11,500 net acres), the potential annual electric current output is 3,000 GWh AC, equivalent to the electricity consumption of 428,500 households. As with all of staff's evaluations for this project, however, additional screening for environmental sensitivity, environmental justice concerns, and other site-specific factors will refine these numbers.

Staff will further develop this evaluation to assess the potential of parcels located in the southern and central counties with highest solar PV potential. An example of GIS maps showing an overlay of solar potential and school lands parcels is included in Figure 4.

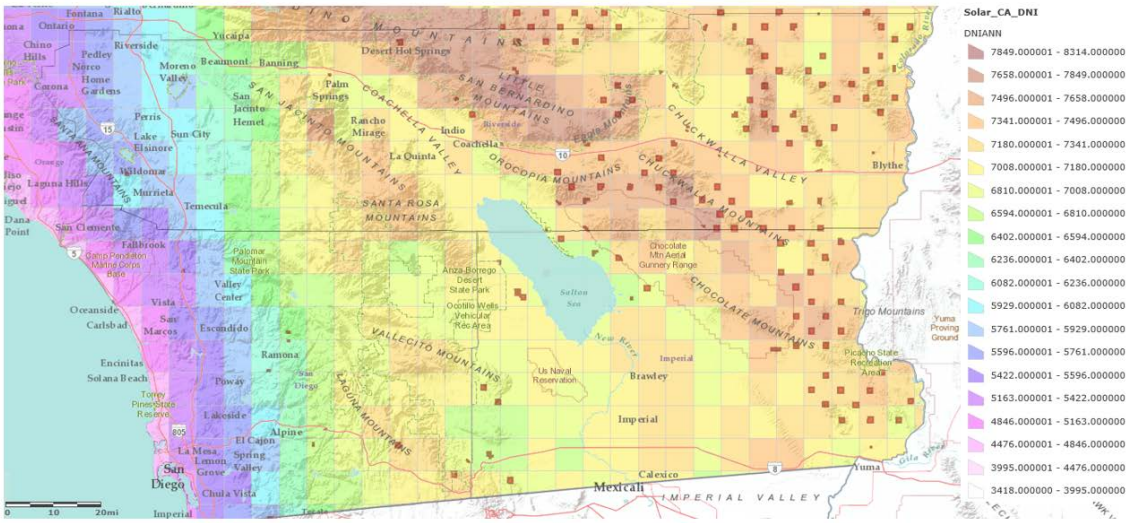


Figure 4 - Riverside and Imperial counties with NREL's annual solar irradiance map. School Land parcels are represented with red blocks.

Geothermal Energy Evaluation

Geothermal energy development on school lands has been part of the Commission's routine prospecting and leasing activities since the 1970s. The Commission manages land with geothermal potential and has leases for geothermal production in the Geysers area of Sonoma and Lake counties and is exploring production options in the Truckhaven area by the Salton Sea in Imperial County.

Current geothermal production in the State is approximately 2,700 MW, more than all the other states combined. However, another 1,800 or more MW of potential may exist in the southern Salton Sea area (Douglas Gagne, 2015). These numbers can rapidly change because of technology improvements and advancements in unconventional geothermal systems.

The outlook for geothermal energy development in California is positive primarily due to the State's requirements to increase the use of renewable resources in electricity generation. Additionally, the value of the uninterrupted and consistent baseline power provided by geothermal production will always keep this resource valuable, despite losing in some short-term competition from other cheaper energy sources, such as solar. In fact, the electricity generated by geothermal power in 2015 and 2016 remained constant at 2,716 MW for both years, indicating the consistent reliability inherent in

geothermal energy (California Energy Commission, 2018).

Staff has been studying geothermal energy potential in the State's landholdings for the past several years, long before initiating a review of the other renewable resources. Staff's research into the State's geothermal potential is characterized by a county-level, relatively broad analysis of the surface favorability for conventional geothermal production, as well as an analysis of unconventional systems. Staff analyzed the deep underground heat gradient suitable for enhanced geothermal systems (EGS), with information from Southern Methodist University's Geothermal Laboratory (SMU). EGS could become more prevalent as the technology and economics of geothermal projects continue to improve. Staff also compiled a proximity analysis of previously drilled geothermal wells occurring within several miles of school lands and earmarked them, in part, to supplement the Commission's geothermal GIS data with real-world wellhead history.

In 2015, staff created a comprehensive database of school lands with potential for commercial geothermal development. This task was separated into stages, starting with a compilation and correction of the State's 100 percent RMI lands within any of the 21 Known Geothermal Resources Areas (KGRAs) established by the U.S. Geological Survey during the 1980s. The amended land ownership coverage was then used to determine other important observations, such as the presence of previously producing geothermal wells, and their limited distances to power plants. This initial study resulted in a better understanding of the KGRA definition in practical terms and added a better perspective on the State's ownership of geothermal resources in these areas.

The next phase of the study was to increase the use of GIS data to determine overall resource potential for school lands on a broad scale. The two primary datasets used for this effort are:

- Surface Geothermal Favorability, U.S. Geological Survey, 2008. Indicates electricity potential in megawatts per square kilometer (MW/km^2) that ranges from 1 – 15 or more. This dataset relies on conventional heat sources found at the surface that are related to conventional geothermal and direct-use applications (Figure 5).
- Enhanced Geothermal Systems Favorability Index, Southern Methodist University's Geothermal Laboratory, 2009. Indicates a potential class for enhanced geothermal systems production within the depth zone of 3-10 km, based on borehole temperature data (Figure 6).

In addition, RMI and fee-owned school lands were examined for their proximity to existing transmission infrastructure and previously drilled geothermal wells. The study is being conducted county by county and the results are currently under development. The compilation of lands exhibiting high potential for geothermal development will be further

examined as more tools become available. Staff hopes to market these lands for possible development in the future as California's energy sources move toward more renewable resources.

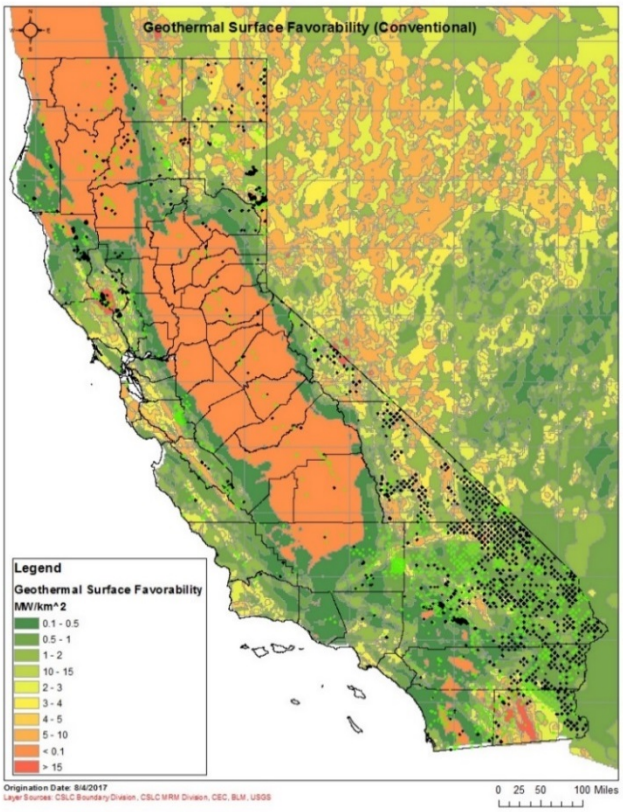


Figure 5 - NREL's Surface Geothermal Potential

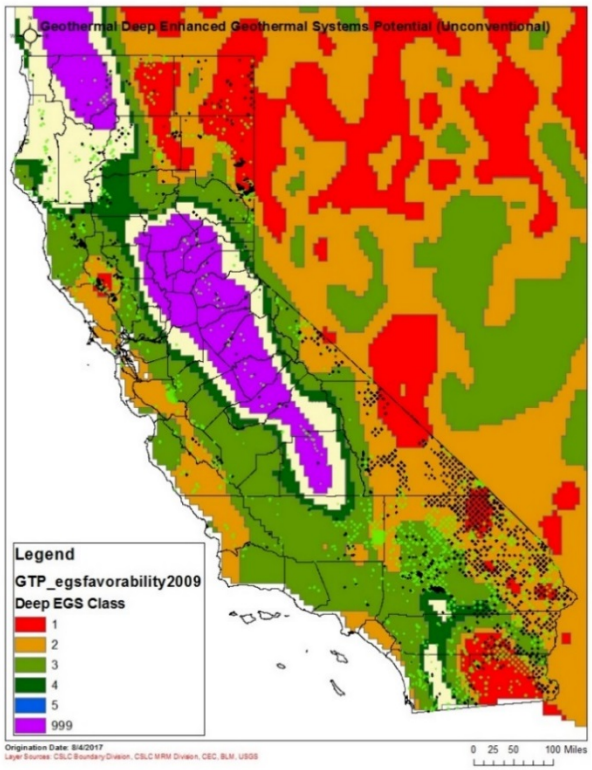


Figure 6 - SMU's Deep Geothermal Potential

Land Screening for Site Selection

The datasets used for the primary resource assessment of school lands utilized the record of temperature values reported at locations at the surface of the earth, as well as temperature data reported from borehole records in the subsurface. It is important to note that the presence of heat is the single most important characteristic of a geothermal system. This heat source can be near the surface, or down tens of thousands of feet deep depending on the location. The locations associated with higher temperatures in the deep subsurface can only be used for creating enhanced geothermal systems, which could become more prevalent as the technology improves.

In addition to utilizing GIS layers to determine resource potential for fee lands, previous geothermal well histories have been referenced where active (or previously active) geothermal wells are presently producing. A buffer area of several miles was applied to the RMI school lands to help determine where more resources could be discovered.

Identification of Parcels with Potential for Geothermal Energy Development
Currently, geothermal energy potential on school lands (fee and 100 percent RMI) for Imperial and Riverside counties has been evaluated. The results of this broad resource assessment were generated primarily by using the overlay of surface and subsurface geothermal potential on school lands. The surface potential data was used to determine State parcels that exhibited at least 5MW/km^2 of potential. The subsurface EGS potential was used to determine parcels that exhibited a potential class of 1 or 2 (maximum of 5). Parcels that exhibited high potential for both criteria were cross-referenced with any known geothermal well history.

Riverside County	High Potential = 11 Fee, 8 RMI	TOTAL = 109 Fee, 98 RMI
Imperial County	High Potential = 12 Fee, 40 RMI	TOTAL = 55 Fee, 90 RMI

The resource study will continue for each of the counties with school land parcels. All applicable resource designations will be compiled into one master spreadsheet that will eventually be used to create an overview of the renewable resources characteristics of all school lands.

Biomass Energy Evaluation:
Staff focused the first phase of their study on “woody” biomass, which is a renewable and sustainable source of energy used to create electricity. According to a 2009 report prepared by Conservation Biology Institute for Natural Resources Defense Council, California has roughly 33 million acres of forest (approximately one-third of the State). Approximately 19.5 million acres are considered productive timberland, of which only half undergoes regular harvest, or is managed to reduce fire risk. Harvest of public forests has decreased 90 percent in the last 25 years. Figure 7 shows the dispersion of biomass resources in California. Biomass is faced with strong competition from solar and wind energy in California. Without additional incentives, the biomass industry will have a hard time competing and surviving.

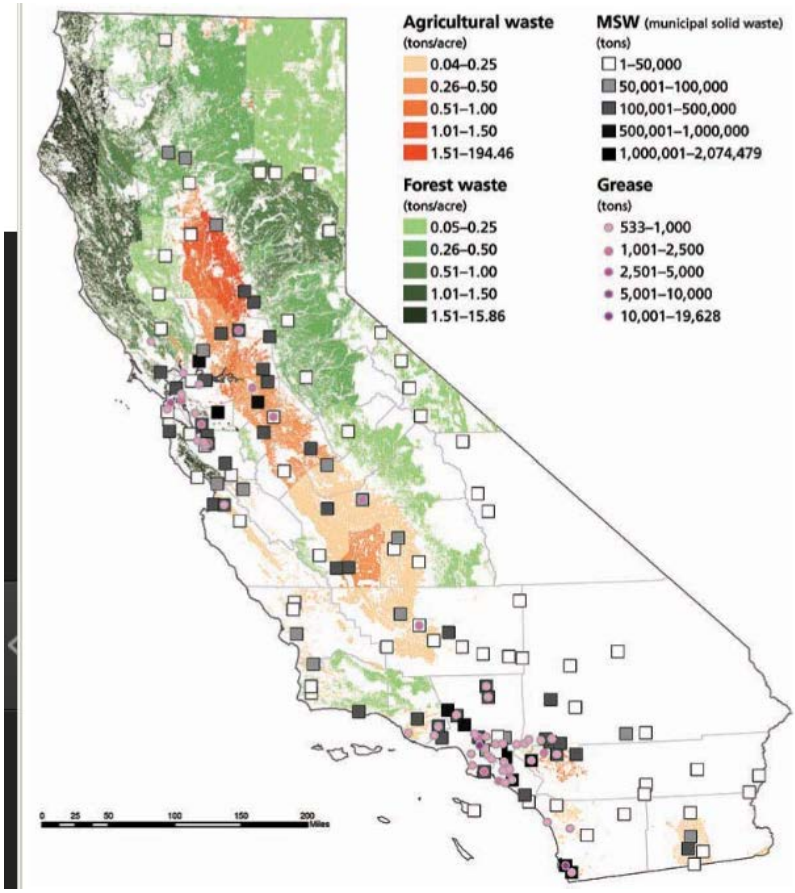
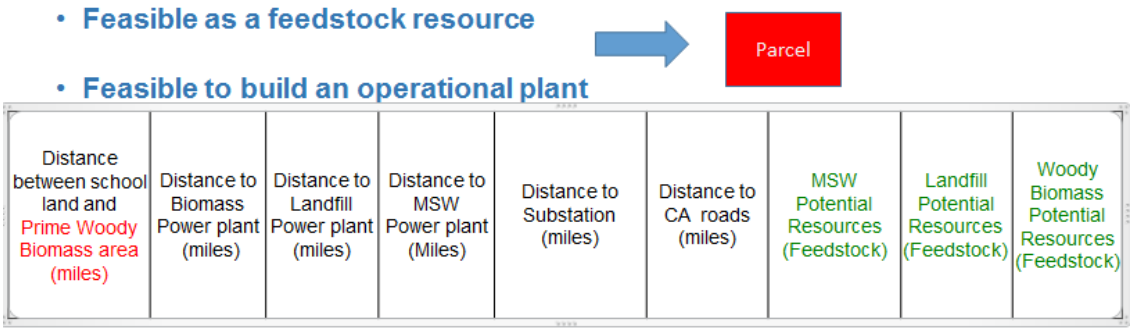


Figure 7 -NREL's map of distribution of Biomass in California

Staff's focus in this report is on forest waste that is shown in Figure 7. The northern California area has the highest potential for biomass resource development.

Land Screening for Site Selection

Each school land parcel has been reviewed and assessed for whether it is an appropriate candidate for feedstock or for an operational plant. The criteria below are used to evaluate the candidacy of each parcel. The estimates are based on county-level statistics and point-source data gathered from the U.S. Department of Agriculture, U.S. Forest Service, the U.S. Environmental Protection Agency, and other organizations including California Department of Fish and Wildlife, and California Department of Forestry and Fire protection.

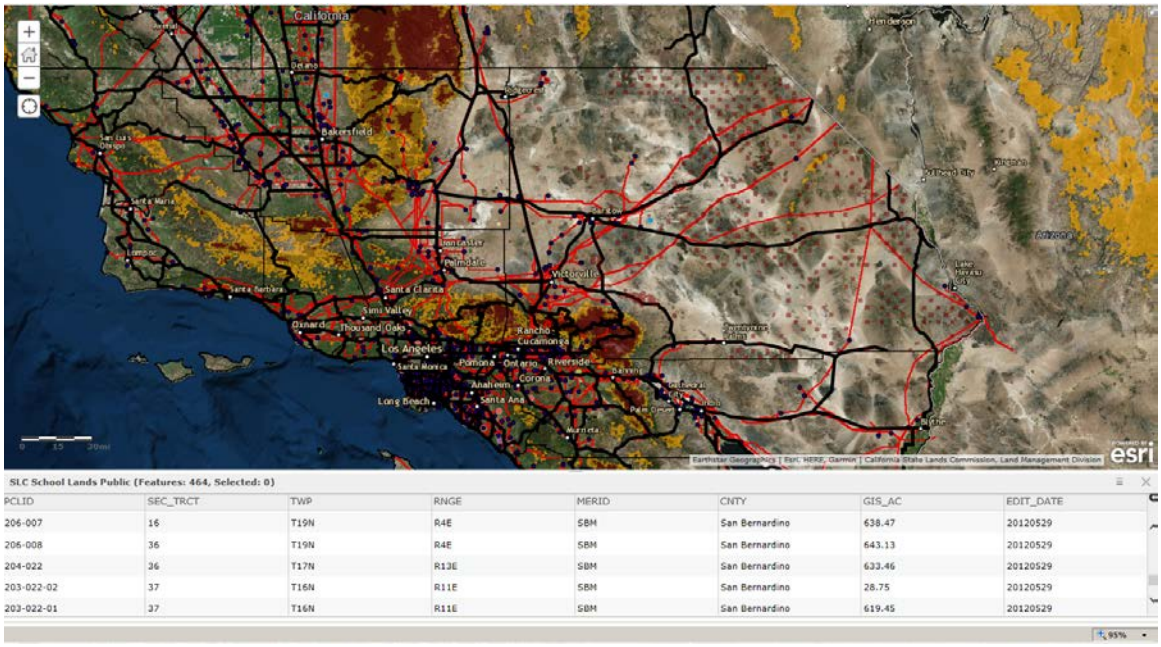


Identification of Parcels with Potential for Biomass Energy Development

State lands parcels in Imperial, Inyo, Kern, Riverside, and San Bernardino counties have been evaluated, and the potential parcels have been identified and are listed below.

County	Parcels w/ High Biomass Potential
Imperial	**5**
Inyo	**9**
Kern	**4**
Riverside	**7 to 10**
San Bernardino	**Under Review**

Figure 8 demonstrates an example of state biomass resource potential overlaid by school land parcels in San Bernardino County.



PCLID	SEC_TRCT	TWP	RNGE	MERID	CNTY	GIS_AC	EDIT_DATE
206-007	16	T19N	R4E	SBM	San Bernardino	638.47	20120529
206-008	36	T19N	R4E	SBM	San Bernardino	643.13	20120529
204-022	36	T17N	R13E	SBM	San Bernardino	633.46	20120529
203-022-02	37	T16N	R11E	SBM	San Bernardino	28.75	20120529
203-022-01	37	T16N	R11E	SBM	San Bernardino	619.45	20120529

Figure 8 - San Bernardino with the concentrated woody biomass is represented as a dark red color, and the less concentrated biomass area is represented as yellow color

Wave Energy Evaluation:

Wave energy can produce energy 24 hours a day, unlike solar and wind that may be hampered by the weather or daylight. Energy can be extracted directly from the surface waves or from pressure fluctuations below the surface through devices called Wave Energy Converters (WECs). Placement and type of the WECs is a key factor in designing a project.

According to a study (2007 California Ocean Wave Energy Assessment) prepared by Electric Power Research Institute for the California Energy Commission, the estimated wave energy potential in federal/state waters with the least amount of restrictions (the northern most California counties) is approximately 9,872 MW. The “raw” potential (i.e., without considering environmental concerns, shipping lanes, or any other factors) along California’s Coast is between 33,000 (California Marine Renewable Energy) and 37,000 MW (Electric Power Research Institute). There are no commercial-scale or pilot wave energy projects in operation in the Unites States, although test devices have been deployed in several states.

Screening Criteria for Site Selection

Like the other evaluations of sources of energy, staff gathered data from studies conducted by industry, academia, and government agencies. Staff used GIS to create maps using National Renewable Energy Laboratory’s/ Virginia Tech’s wave energy map (Figure 9) as the base map, and overlaid other GIS data (shipping lanes, marine protected areas, kelp forests, etc.) over the base map to exclude them. Once the

unencumbered areas of wave potential were identified, an in-depth review was conducted to verify the location's proximity to the shore and the existence of infrastructure. GIS maps were used to measure the distance from the resource to onshore transmission lines, substations, and power plants. The cost associated with distances to the nearest substation directly affects the project economics.

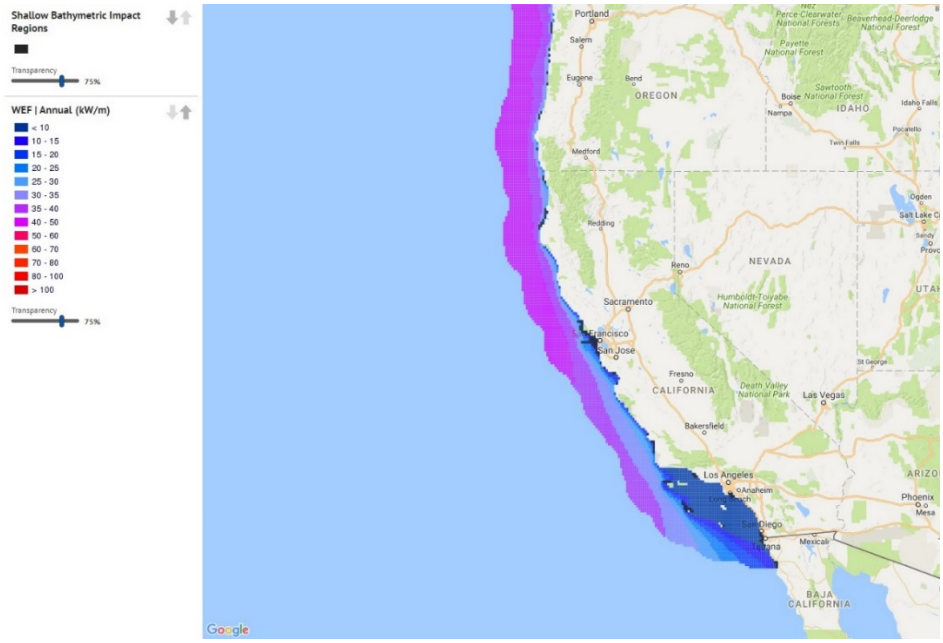


Figure 9 – NREL Map of CA Wave Potential

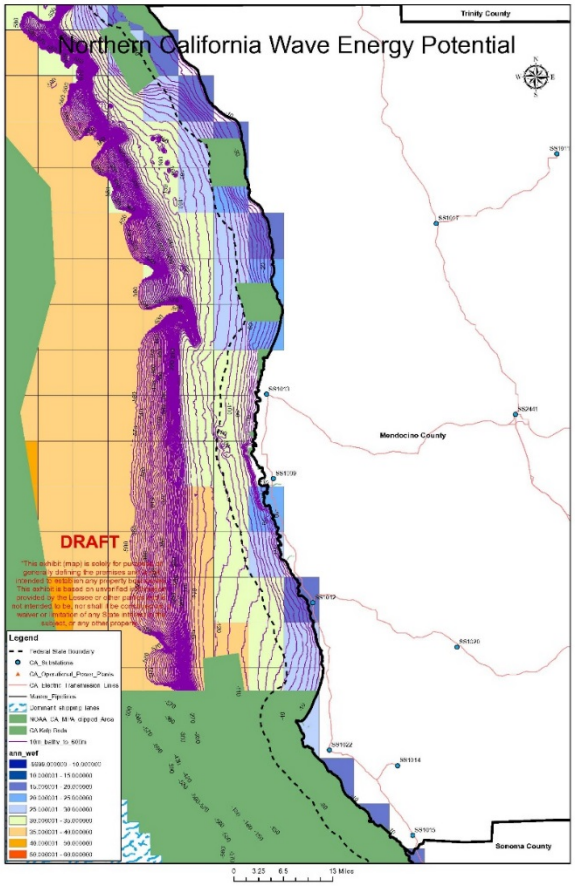


Figure 10 – Mendocino County Wave Energy Potential

Identification of Areas with Potential for Wave Energy Development

All 15 coastal counties (Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Francisco, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego) were reviewed and evaluated for wave energy potential. Special attention was directed to Del Norte, Humboldt, and Mendocino counties due to their geography's optimal wave energy characteristics as well as having less areas with restrictions. The study identified 15, 28, and 20 areas within State waters from Del Norte, Humboldt, and Mendocino counties. The table below shows the selected areas with wave energy potential and their distance to the nearest substation.

County	Distance to **Substation / Power Plant (miles)**	Nearest Substation	Nearest Power Plant
Del Norte	10.6	Substation 0172	No power plant in county
Del Norte	11.2	Substation 0169	
Del Norte	6.5	Substation 0169	
Humboldt	10.85	Substation 0324	Humboldt Bay Gen Station / Humboldt Bay Gen Station Repower
Humboldt	16.2	Substation 0324	Humboldt Bay Gen Station / Humboldt Bay Gen Station Repower
Humboldt	23.1	Substation 0329	No power plant in the vicinity
Mendocino	2.5	Substation 1013	Lake Mendocino / McFadden Farms
Mendocino	2.6	Substation 1013	All power plants in the county are on the east side approximately 45-50 miles away
Mendocino	3.3	Substation 1009	
Mendocino	4	Substation 1012	

Offshore Wind Energy Evaluation:
In 2015, the U.S. Department of Energy published a report titled, "Wind Vision." The report examines a scenario for the Unites States to generate 35 percent of its electricity from wind energy by 2050, using both land-based and offshore wind. The Wind Vision scenario estimates that 86 gigawatts (GW) of offshore wind power capacity could be deployed in the nation by 2050. Under this scenario, 20 percent of the nation's total offshore wind comes from the Pacific coastal states (DOE 2015). California has mandated that 50 percent of electricity in the State be from renewable sources by the end of 2030. With an estimated potential of 588 GW, California offshore wind energy could play an important role in reaching this goal. Offshore wind occurs with greater frequency and strength than onshore wind, and in some cases, is known to coincide with peak demand of electricity resources. Wind resource is typically characterized by wind velocity (meters per second) at a given height. Offshore areas can be categorized into low, medium, and high potential for development based on their wind power. Areas categorized as low potential are those in wind power classes 1 and 2, medium potential is indicated by classes 3 and 4, and high potential areas are those in classes 5 and higher. Wind resources in class 5 and higher are considered economically feasible for development with current technology. The majority of California's offshore wind energy occurs at wind speeds between 7.5 and 9.0 m/s at 90 m.

While globally many offshore wind facilities are operating or under construction, primarily in Europe, offshore wind power is still fairly underdeveloped in the United

States. The first U.S. facility, the five turbine, 30-megawatt Block Island Wind Farm, began operating in late 2016 offshore Rhode Island. On the West coast, significant progress is being made to facilitate siting, leasing, and construction of offshore wind power projects in both federal and state waters, in large part due to the activities of the Task Force. The focus of the Task Force was initially on the Central Coast area due to a January 2016 commercial lease request submitted by Trident Winds LLC, which proposed a commercial-scale floating foundation wind facility in federal waters offshore Morro Bay, San Luis Obispo County. Since this submittal, BOEM has initiated a competitive planning and leasing process, working with the State via the Task Force, to evaluate the feasibility of the site identified in the Trident Winds LLC proposal, as well as any other sites that should be considered (or that may be more desirable than the proposed site). Issues identified to date through the Task Force's data collection and mapping work include Department of Defense mission compatibility pertaining to training and operations activities, fishing compatibility, habitat sensitivity, and many others. Other issues that need to be resolved for offshore wind to be deployed include the timelines and investment required to develop new port facilities, heavy-lift construction vessels, and supply chains for major components. Additional concerns over coastal viewshed issues, understanding of offshore wind resources, and grid interconnection and integration issues, also require further investigation.

Screening for Site Selection

Determining the feasibility of offshore wind energy development in California requires a detailed analysis of regulatory frameworks, electrical infrastructure, economic viability, technological feasibility, and environmental constraints. The main siting concerns focus primarily on questions of competing use, environmental impacts, and constraints due to the availability of technology to meet challenging design conditions (e.g., water depth issues). When considering a location suitable for an offshore wind facility, there are many factors to consider. Physical aspects of the property, zoning regulations, transmission lines, environmental sensitivity, and stakeholder perception will also play a role in the success of a project. Finding practical locations for wind farms requires analyses of a wide range of spatial data types.

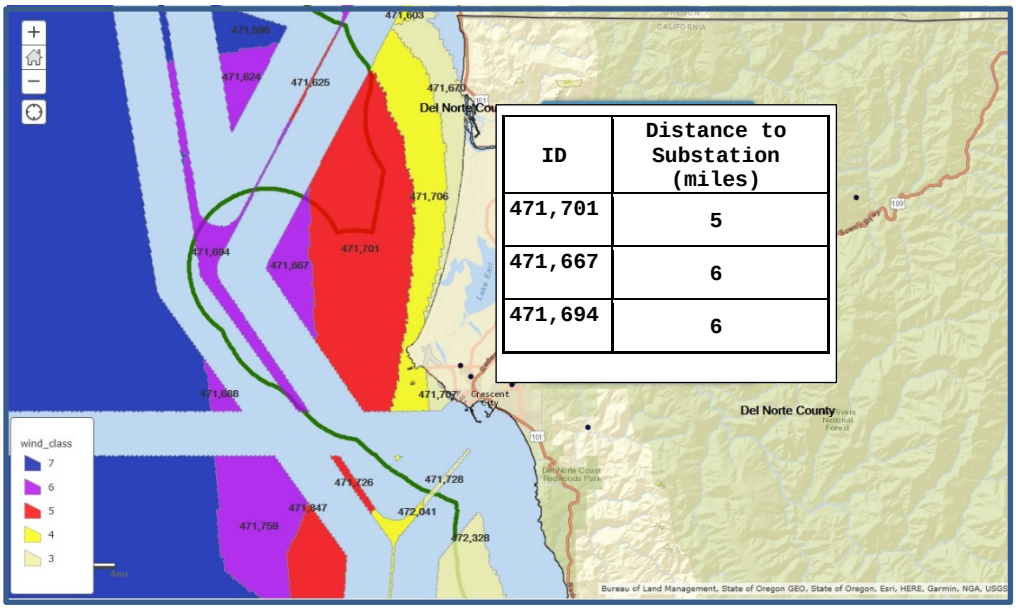
High-resolution wind resource maps facilitate efficient identification of promising offshore areas and realistic estimates of production potential. Proximity to transmission lines and the load-carrying capacity of existing lines are vital considerations. A large percentage of California's residents live close to the State's extensive coast line, and offshore wind could potentially reduce the required transmission distances. The depth of the water affects the type of technology used to develop a given offshore wind resource project. Several hard constraints (those which directly impact the technical and commercial feasibility of an offshore wind project such as average wind velocity and wind power density), and soft constraints (those which impact technical and commercial feasibility to a lesser extent such as visual impact) have been considered in this analysis as listed below for site selection.

- Wind power class 5 and higher
- Distance from shore (3 nautical mile limit)
- Access to transmission infrastructure on land
- Lowest use conflicts

Distance from shore is a critical siting parameter for offshore wind as it is generally considered desirable to site turbines far enough from shore, so they will not have a large visual impact. However, the required distance from shore is subjective and no minimum distance requirements have been assumed in this study.

Identification of Areas with Potential for Offshore Wind Energy Development
Figures 11 and 12 show the wind power class contours as well as the protected areas (light blue). The green line separates state and federal waters (3 nautical mile limit). Light blue areas identify protected areas: shipping lanes, marine protected areas, mammal migration zones, fishing grounds, recreational usage, kelp forest, and marine sanctuaries. The areas where wind power class contours are not covered by one of these conflicting zones were considered low conflict areas for this assessment, understanding that, like the other assessments presented in this report, finer scale siting considerations developed in coordination with local stakeholders could affect these preliminary results. These areas (one in red color and two in purple colors) are shown in both figures below which are suitable for installing a wind farm in Del Norte County. Approximate locations of the offshore wind reference sites are indicated with numerical labels. As indicated by the numerical labels (ID-471701, ID-471667, and ID-471694) on the map in Figure 11, three sites met the site-selection criteria to sustain a commercial offshore wind project.

Using publicly available information obtained from the GIS layer provided by the California Energy Commission on transmission lines and substations (California Energy Commission 2016), coastal interconnection points were identified and each reference area was assigned an interconnection point based on the closest viable electrical grid connections to the coast. The distance for each section ID from the substation is also given in Figure 11. These distances may be used later to assess the cost of the electrical infrastructure.



ID	Distance to Substation (miles)
471,701	5
471,667	6
471,694	6

Figure 11 - Region of interest based on wind power density class (class 5 and higher) – Del Norte County, protected areas are excluded (light blue)

In Humboldt County, there are 11 potental sites. Figure 12 depicts these potential areas with red, purple, and dark blue colors. Protected areas are shown in light blue color and are excluded. Table 1 shows the range of distances from substations for each of the eleven reference sites used in this analysis. Table 2 lists the number of regions of interest (potential sites) for all counties evaluated so far.

Table 1. Distance to substation, Humboldt County

ID	Wind Class	Distance to Substation (miles)
472,522	5	13
472,604	5	15
472,615	5	20
472,617	6	15
472,621	7	21
472,623	5	21
472,628	5	21
472,729	7	19
472,752	7	26
472,930	6	19
472,986	5	18

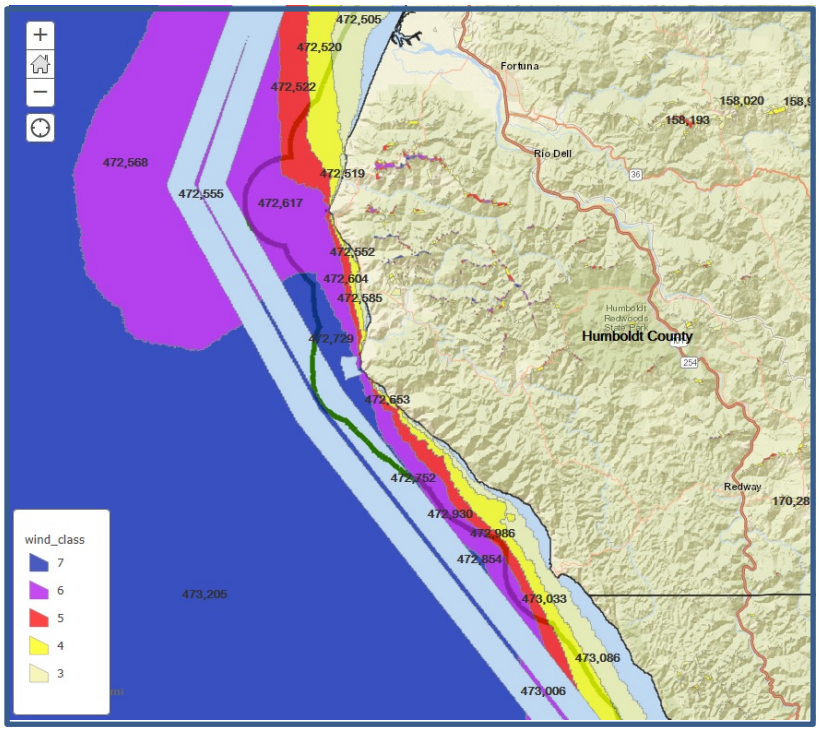


Figure 12 - Region of interest based on wind power density class (class 5 and higher) – Humboldt County, Protected areas are excluded (light blue)

Table 2. Number of potential offshore wind energy areas for each county

County	**Potential Offshore Wind Energy Sites**
Del Norte	3
Humboldt	11
Mendocino	2

Lessons Learned from Neighboring States and Federal Renewable Energy Leasing Activities:

Staff also conducted research to better understand the federal government's and neighboring states' approach toward bidding and leasing renewable resource lands. Under the Department of the Interior (DOI), the BLM manages 36 solar and 40 onshore wind projects. These projects are mostly concentrated in the southwest/midwestern states and, collectively, have the potential to generate around 100,000 MW of electricity over the life of the projects.

The federal mandate for the competitive bidding process is to first determine if a competitive interest exists. While there is no offshore wind development on the Pacific

OCS off the coast of California, BOEM received an unsolicited request from Trident LLC for a wind lease in an area off the coast of San Luis Obispo in January of 2016. This request prompted BOEM to post a “Call for Expressions of Interest” in the Federal Register. One Expression of Interest was received and in accordance with the federal mandate, if a competitive interest exists, then there must be a competitive award process.

Additionally, BLM has established robust and comprehensive competitive bidding and leasing processes through rules and procedures that took effect in January of 2017. BLM’s primary focus is to incentivize development in areas with the highest generation potential and fewest resource conflicts (areas known as “Designated Leasing Areas” or DLAs). Specific incentives include: financial incentives such as less frequent adjustments to rent, fixed-rate adjustments as opposed to market-based adjustments, streamlining the entire process by granting lessees site control earlier, and allowing standard bonds as opposed to bonds based on full reclamation costs. Most importantly, BLM is given more latitude when determining if a competitive interest exists. Instead of simply posting calls for expressions of interest in the Federal Register, BLM may now actively solicit EOI’s on the internet, in newspapers, professional journals, etc. This allows them to more accurately measure the level of competitive interest.

BLM has also introduced the concept of Variable Offsets to their competitive bidding process. Variable Offsets are specific factors announced in the bidding notice that will provide potential lessees a discount (up to 20 percent) if their proposal addresses the specified variable offset factors. Factors may include: addressing an environmental concern, using a preferred technology, adding a public benefit, and any other factors identified by BLM.

Lease terms for federal leases are mostly standardized. They are typically 30-year fixed term leases that extend with operations. Bond requirements are: $10,000 per wind turbine under a 1 MW potential, $20,000 per wind turbine equal to or greater than 1 MW, and $10,000 per solar acre. Acreage rent is based on National Agriculture Statistics Service (NASS) data and is due at the start of the lease. There is also a Lease Monitoring Fee which is used in a similar way to the Commission’s Lease Management fees. The lessee is also charged a Megawatt Capacity Fee which is like royalty and is based on the project megawatt capacity.

While nearly all of Nevada’s renewable energy potential is located on BLM-controlled lands, California and Arizona have the unique advantage of having renewable energy potential on clearly defined state land parcels. Arizona began to aggressively pursue its renewable energy program in 2012. In addition to advertising their available land parcels on their website, the Arizona State Land Department (ASLD) actively reaches out to solar industry leaders and is regularly invited to speak at industry events and conferences. The ASLD manages two operating solar leases, one solar lease that is

under construction, and two solar leases that are expected to begin construction in 2018. The first lease that is already operating includes 398 acres in Yuma County with 35 MW capacity. ASLD estimates that the lease will generate roughly $11 million from rent and the Megawatt Capacity Fee over the life of the lease. The second operational lease includes 150 acres in Maricopa County with 17 MW capacity. All produced energy from this lease has been sold with a 20-year commitment to the San Diego Gas & Electric Company. The revenue forecast for this lease is roughly $5.5 million over the life of the lease.

NEXT STEPS:

Over the remainder of 2018, staff will continue its county-by-county assessments of the various renewable potentials to identify parcels suitable for resource development consideration (i.e. viable for finer level screening). Additionally, staff will continue to initiate and advance coordination, outreach, and consultation with local and regional governments, environmental justice communities, Native American Tribes, and environmental organizations. This is to ensure that the next steps in the screening and mapping processes elevate environmental justice consideration, tribal consultation, and critical ecological, habitat, species, and other considerations for environmental protection to the forefront of the Commission's attention. Staff will also contact major California renewable resource developers to initiate discussions related to industry trends and marketing the State's renewable energy resources, in lands under the Commission's jurisdiction, for exploration and development. Staff will develop a marketing and prospecting framework as well as conduct research to better understand the development strategy of the major renewable resource developers in California. Staff will further incorporate "lessons learned" from other similar studies, such as "Utilizing the Energy Resource Potential for DOE lands" into its efforts to ensure suitability and attractiveness of the parcels.

EXHIBITS:

A. GIS Data Sources Used in Staff Analysis of Renewable Resource Potential on Lands Under the Commission's Jurisdiction.
B. References Used in Staff Analysis of Renewable Energy Resource Potential on Lands Under the Commission's Jurisdiction

EXHIBIT A

GIS DATA SOURCES USED IN STAFF ANALYSIS OF RENEWABLE REOURCE POTENTIAL ON LANDS UNDER THE COMMISSION'S JURISDICTION

Federal:

Bathymetry = National Oceanic and Atmospheric Administration

California Desert Tortoise Habitat = U.S. Fish and Wildlife Service

Critical Habitat Designations = National Oceanic and Atmospheric Administration - National Marine Fisheries Service and U.S. Fish & Wildlife Service

Deep Enhanced Geothermal Systems = Southern Methodist University's Geothermal Laboratory

Geothermal Surface Favorability = U.S. Geological Survey

Military Flight Corridors = U.S. Navy/Department of Defense

Military Radar RAIMORA = U.S. Navy/Department of Defense

Military Special Use Airspace = U.S. Navy/Department of Defense

National Security UAS Flight Restrictions = Federal Aviation Administration

Solar Irradiance data = National Renewable Energy Laboratory

Tribal Indian Lands = Bureau of Indian Affairs

U.S. Shipping Lanes = National Oceanic and Atmospheric Administration

US Woody Biomass = U.S. Forest Service

Wave Energy datasets = Virginia Tech University & National Renewable Energy Laboratory (NREL)*

Wind Energy datasets = National Renewable Energy Laboratory

State:

2010 Urban Adjusted Area = California Department of Transportation

Areas of Critical Environmental Concern (ACEC) = DRECP.org

California Kelp Beds = California Fish and Wildlife

California Known Geothermal Resources Areas (KGRA) = California Energy Commission

California Major Roads = California Department of Transportation

DRECP Development Focus Areas = DRECP.org

Electrical Substations = California Energy Commission

Electrical Transmission Lines = California Energy Commission

Geothermal Wells = California Department of Conservation, Division of Oil, Gas, and Geothermal Resources

Natural Gas Pipelines = California Energy Commission

Offshore Leases (State) = California State Lands Commission GIS Team

Operational Power Plants = California Energy Commission

SLC School Lands Public = California State Lands Commission GIS Team

* NREL- The National Renewable Energy Laboratory (NREL) is the U.S. Department of Energy's (DOE's) primary national laboratory for renewable energy and energy efficiency research. NREL has collected extensive geographic information system (GIS) data resources for a variety of renewable energy technologies and provides access to this repository of GIS data on its website.

EXHIBIT B

REFERENCES USED IN STAFF ANALYSIS OF RENEWABLE ENERGY RESOURCE POTENTIAL ON LANDS UNDER THE COMMISSION'S JURISDICTION

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