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Title: Land-Use Screens: Process, Methods & Recommendations

Presenters: Erica Brand, Travis David, Saffia Hossainzadeh
Siting, Transmission, and Environmental Protection Division

Date: October 10, 2022



Consideration of land use in energy proceedings





History of Land-Use Screening



Renewable Energy
Transmission
Initiative (RETI)

2009

Land-Use Screens
added to CPUC's
RPS Calculator
(2015)

Land-Use Screens
for CPUC's
Integrated
Resource
Planning
(2016 to present)

Land-Use Screens
for Busbar
Mapping
(2018 to present)

Land-Use Screens
for SB 100
analysis and 2040
Starting Point
Scenario (2021)

Land-Use Screens
Update for IEPR
& California
Planning Library
(2023)



Summary of Proposed Updates

- Three proposed land-use screens to inform resource potential estimates for onshore wind and utility-scale solar.
- A proposed approach to land use evaluation and resource potential estimation for geothermal energy resources.
- For this first phase, CEC staff focused on updates to exclusion, biodiversity, cropland, and habitat datasets. The next phase of the project will evaluate how to incorporate additional important land use considerations.
- CEC staff did not address land-use evaluation for other energy technologies, but plan to explore in future updates.



Intended Use

The models and land-use screens presented today are for use in electric system planning, including SB 100 modeling, integrated resource planning, and busbar mapping. The geospatial land-use screens are intended to inform high-level estimates of technical renewable resource potential for electric system planning and should not be used, on their own, to guide siting of generation projects nor assess project-level impacts.



Geographic Information System Methods



Data Modeling and Screening

Data modeling and screening is a lot like cooking

Ingredients

- Tomatoes
- Pasta
- Mozzarella Cheese



Spatial Data

- Study Area
- Exclusion Areas
- Inclusion Areas



Source: CEC staff



Data Modeling and Screening

Data modeling and screening is a lot like cooking

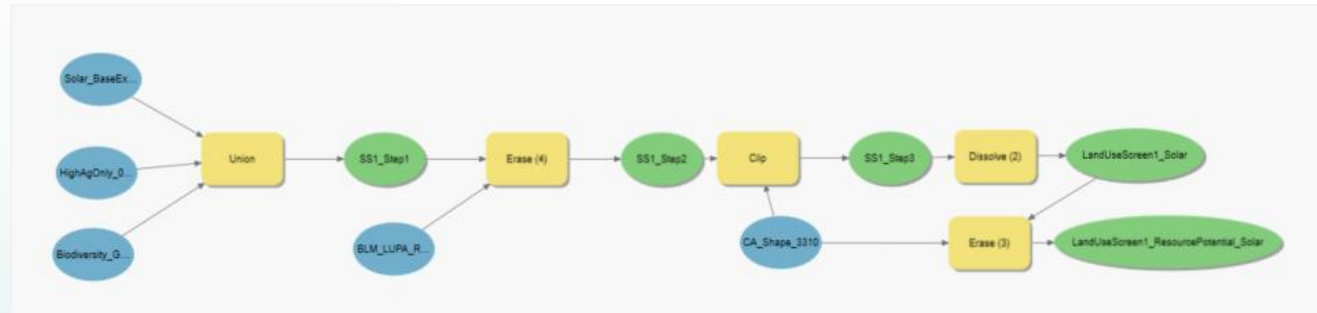
Preparations

- Chopping tomatoes
- Measuring salt
- Mixing the sauce
- Baking



Modeling/Screening

- Filter data to what is relevant
- Adjusting values measured in different scales to the same scale
- Removing exclusions





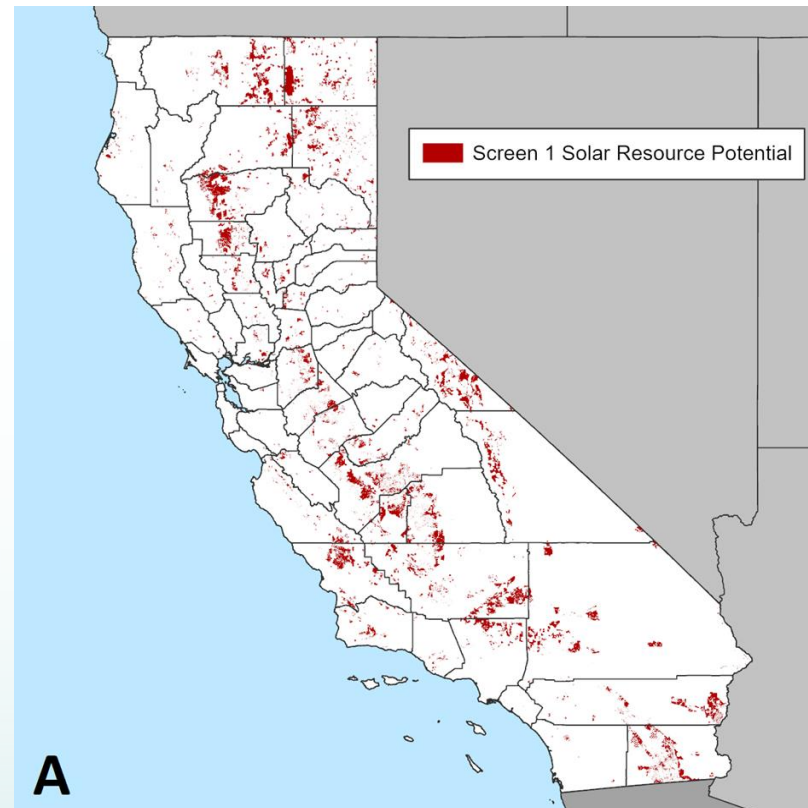
Data Modeling and Screening

Data modeling and screening is a lot like cooking

Lasagna



Results



Source: CEC staff

Solar

- Screen 1
- Screen 2
- Screen 3

Onshore Wind

- Screen 1
- Screen 2
- Screen 3

Geothermal



Land-Use Screens Update: Project Considerations

- Statewide scale planning
- Data changes over time
- Spatially explicit study
- Selected datasets primarily driven by previous land-use screens
- Time



Base Exclusions

Using conventions established in previous land-use screens, there are three categories of base exclusions:

- Techno-economic criteria
 - Population
 - Railroads
 - Water Features
 - Slope
 - Flood Zones
 - Airports
 - Military Installations
 - Active Mines
 - Modeled capacity factor from raw resource potential and technology specifications
- California Native American Tribes' tribal lands
- Legally protected areas



Source: CEC staff



Legally Protected Areas

USGS Protected Area Database (PAD)

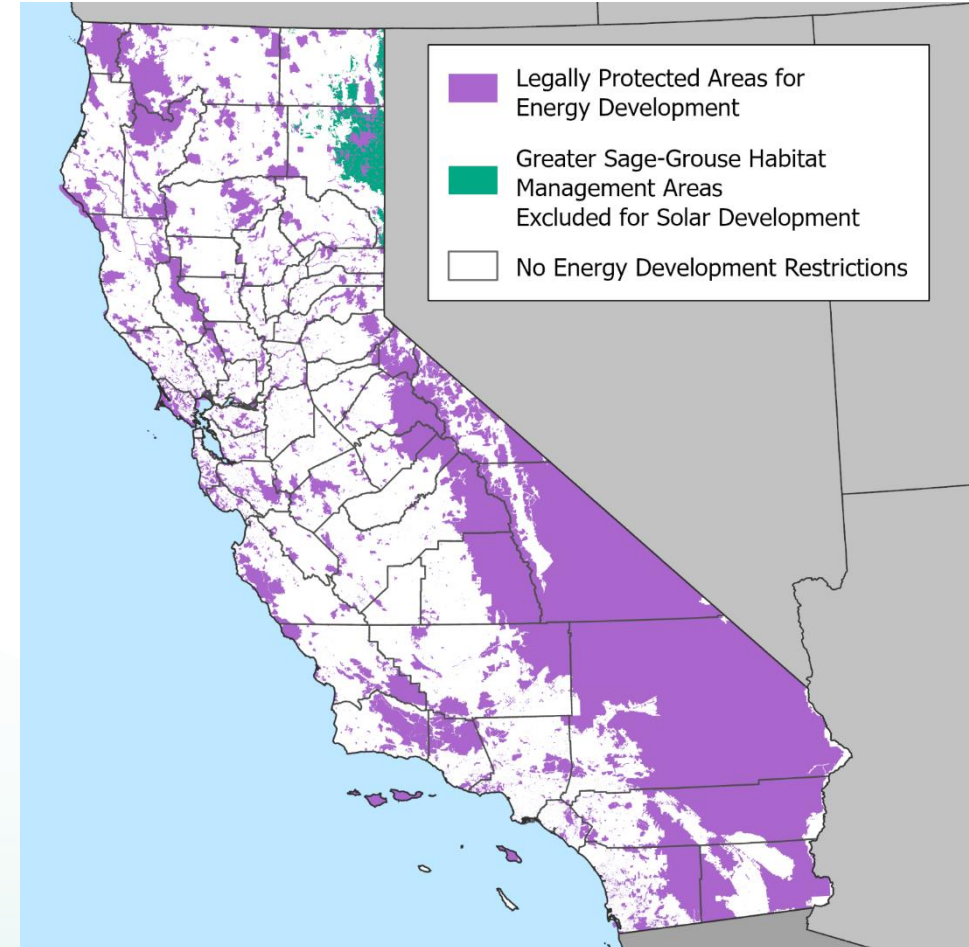
- National parks
- State parks/recreation areas
- Wildlife reserves
- Conservation areas
- Private conservation land
- Wilderness areas, studies, and research lands
- Gap status

State of California

- California Conservation Easements Database (CCED)
- 30x30 Terrestrial Conservation Areas

Other Protected Areas

- USFS Inventoried Roadless Areas
- National Conservation System
- Greater Sage Grouse Habitat



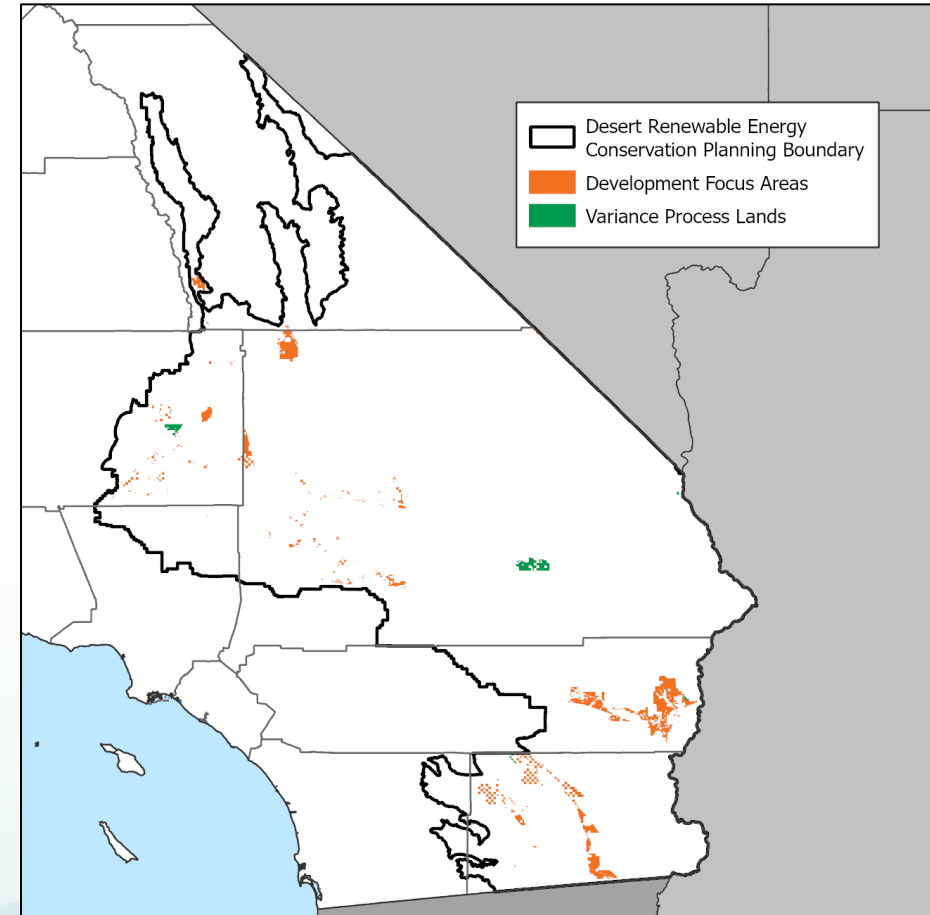
Source: CEC staff



Inclusion Data

Desert Renewable Energy Conservation Plan

- Development Focus Areas
- Variance Process Lands

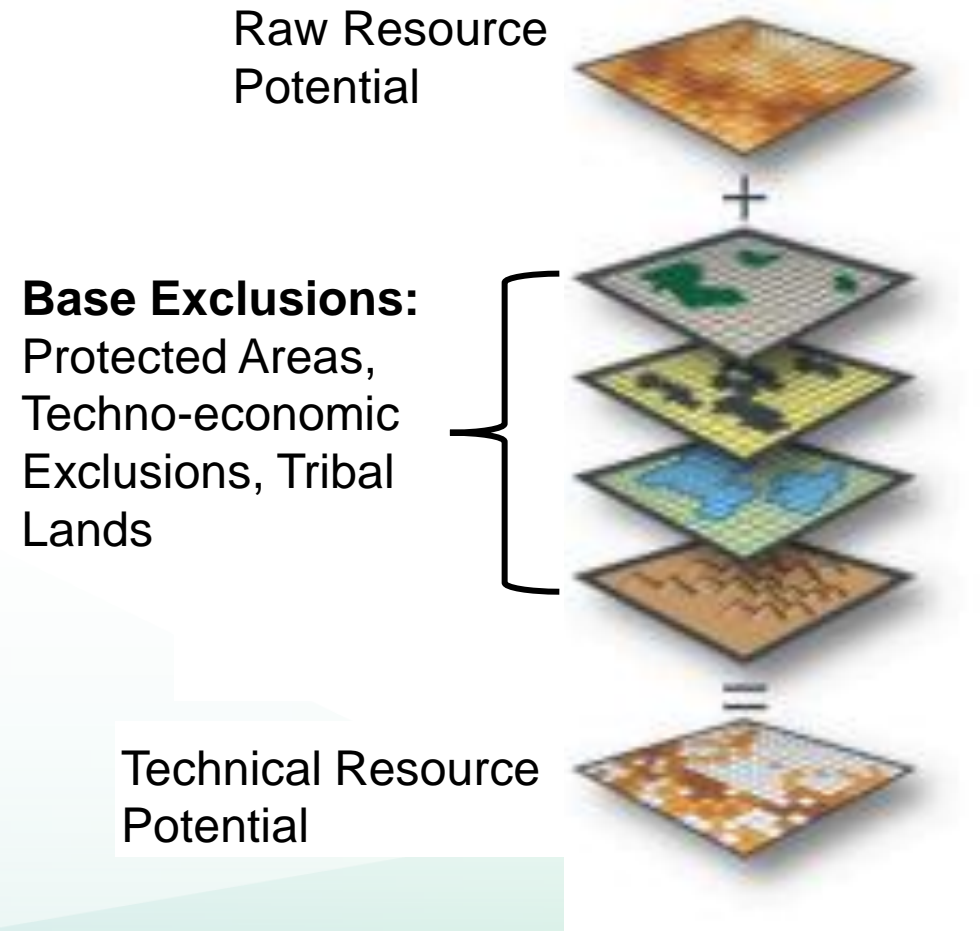


Source: CEC staff



Resource Potential Basemaps

- Area remaining in California after removal of the base exclusions
- Maximum technical potential for each resource
- Starting point for other land-use screens to be applied
- Reduces the resource potential further (next section)





Suitability Modeling



Biodiversity Model



SOURCE DATA

ACE Biodiversity

ACE Connectivity



MODELING

Transformed Biodiversity

Connectivity

- Equal Weights
- Combined Based on Location
- 1 km Resolution Raster
- Suitability Scale (1-5)

SCREEN INPUT DATA

**Classified Biodiversity
Index Results**

1. Manual 2 Class Classification
With a Threshold of 2.75
2. Manual 2 Class Classification
With a Threshold of 2.5

BIODIVERSITY INDEX RESULTS





Cropland Model



SOURCE DATA

Soil Survey Geographic Database

- Revised Storie Index
- Electrical Conductivity
- Sodium Adsorption Ratio

California Important Farmland

Crop Mapping

MODELING

Transformed Storie Index Weight = $3/8$

Transformed Electrical Conductivity Weight = $1/8$

Transformed Sodium Adsorption Ratio Weight = $1/8$

Transformed California Important Farmland Weight = $3/8$

Mask

- Combined Based on Location
- 30m Resolution Raster
- Suitability Scale (1-10)
- Clipped to Mask

CROPLAND INDEX RESULTS

SCREEN INPUT DATA

Classified Cropland Index Results

Natural Breaks (Jenks)
Classification 2 Classes



Landscape Intactness and Proximity to Protected Areas Model



SOURCE DATA

Legally Protected Areas

Landscape Intactness

MODELING

Transformed Distance to Legally Protected Areas

Transformed Intactness

- Equal Weights
- Combined Based on Location
- Suitability Scale (1-5)

SCREEN INPUT DATA

Classified Intactness
Index Results
Manual 2 Class
Classification With
a Threshold of 3

INTACTNESS INDEX RESULTS

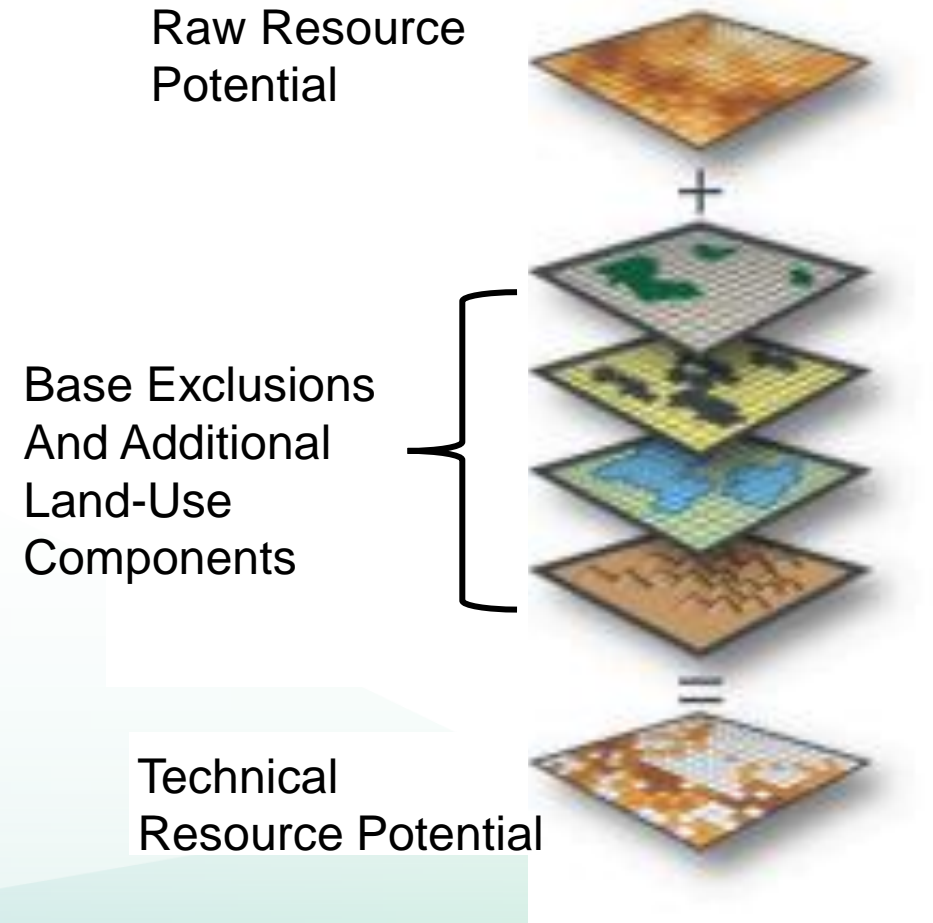


Screening



Screens

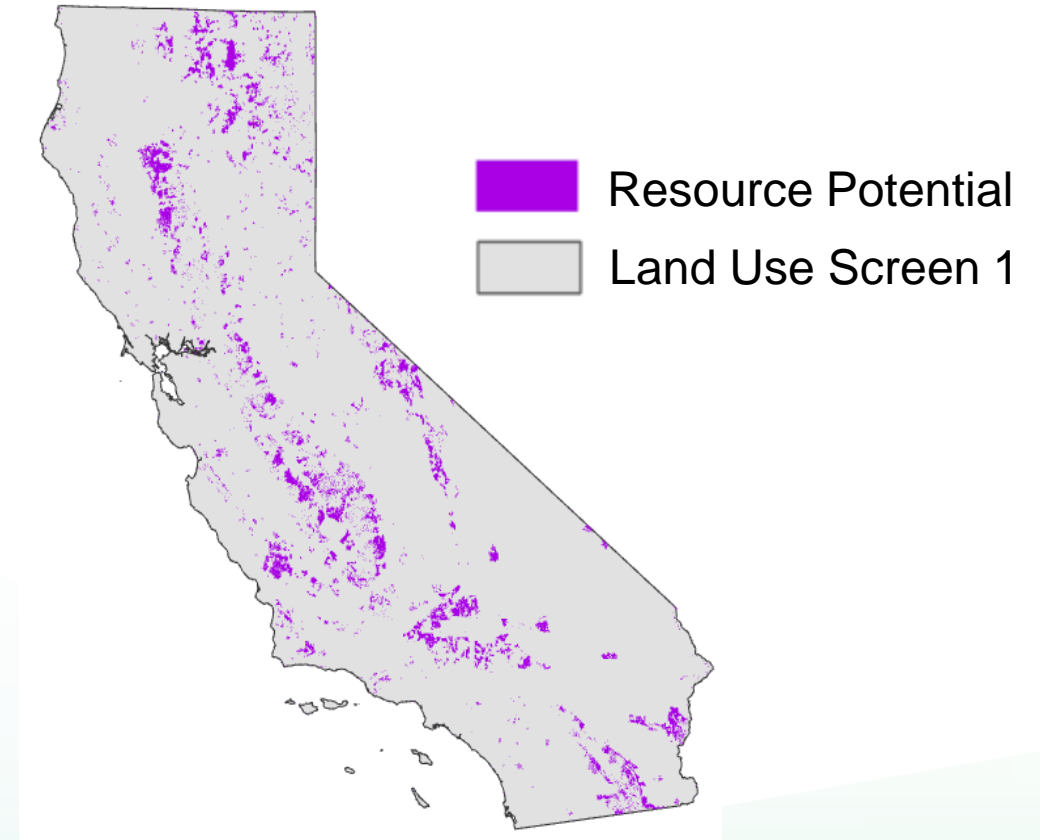
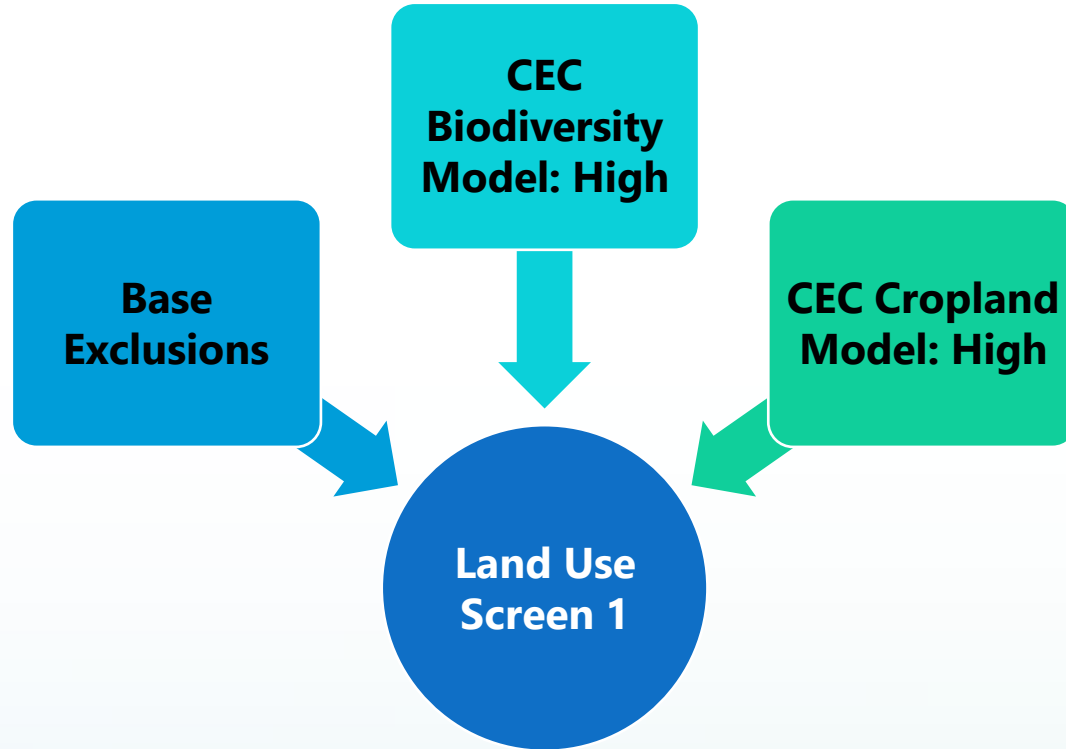
- Base Exclusions (for solar or onshore wind)
- High Categories of Model Results
 1. CEC Biodiversity Model
 2. CEC Cropland Model
 3. CEC Intactness/Proximity to Protected Area Model
 4. ACE Climate Change Resilience



Modified from Maclaurin et al. 2019



Components of Land-Use Screen 1

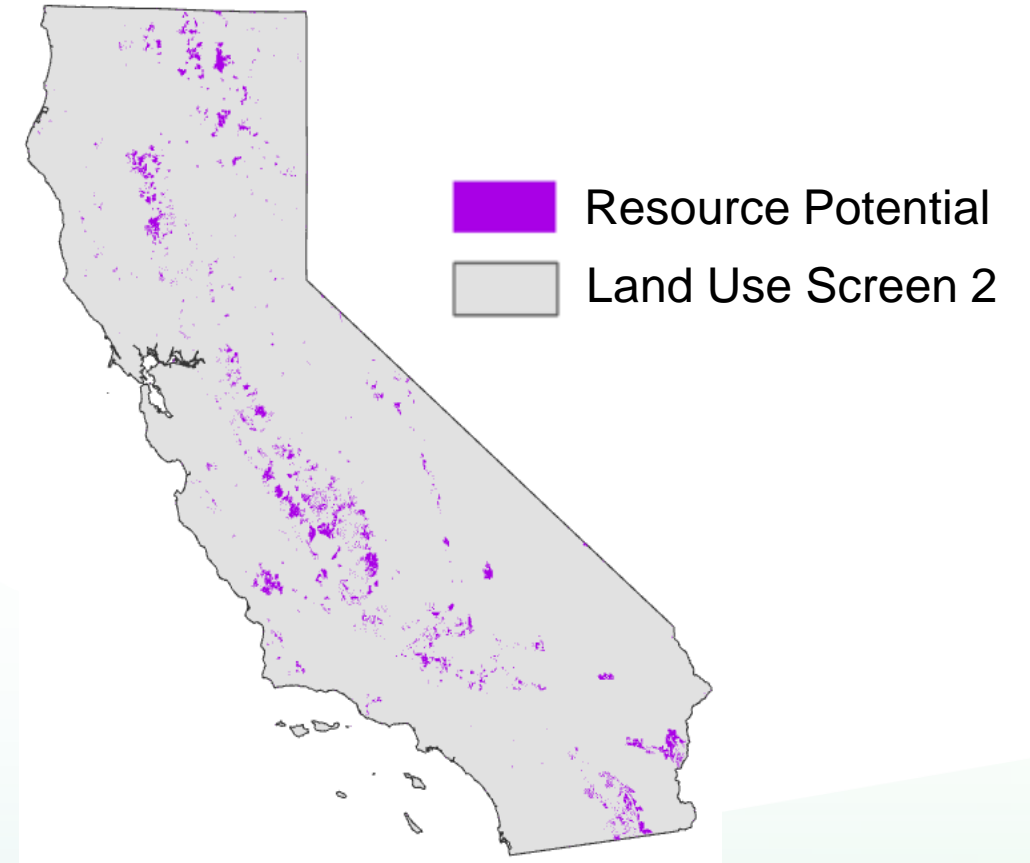
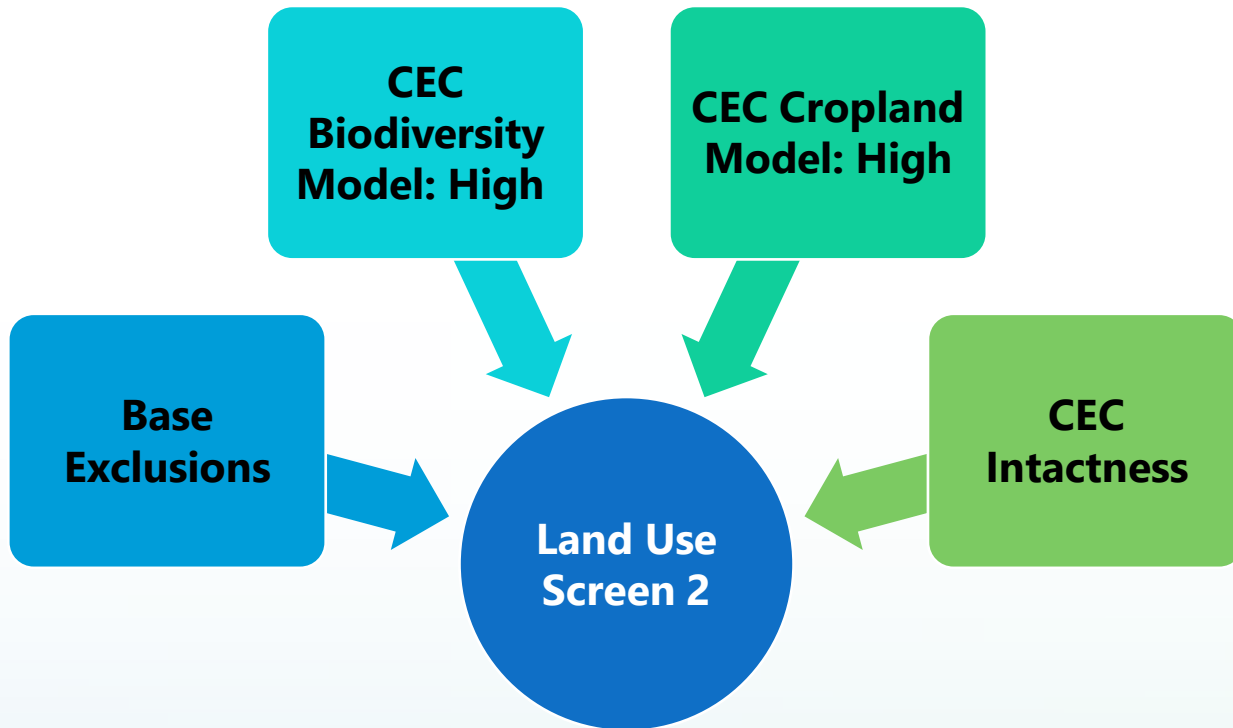


Source: CEC staff

Solar: ~ 650,000 MW
Wind: ~ 25,000 MW



Components of Land-Use Screen 2

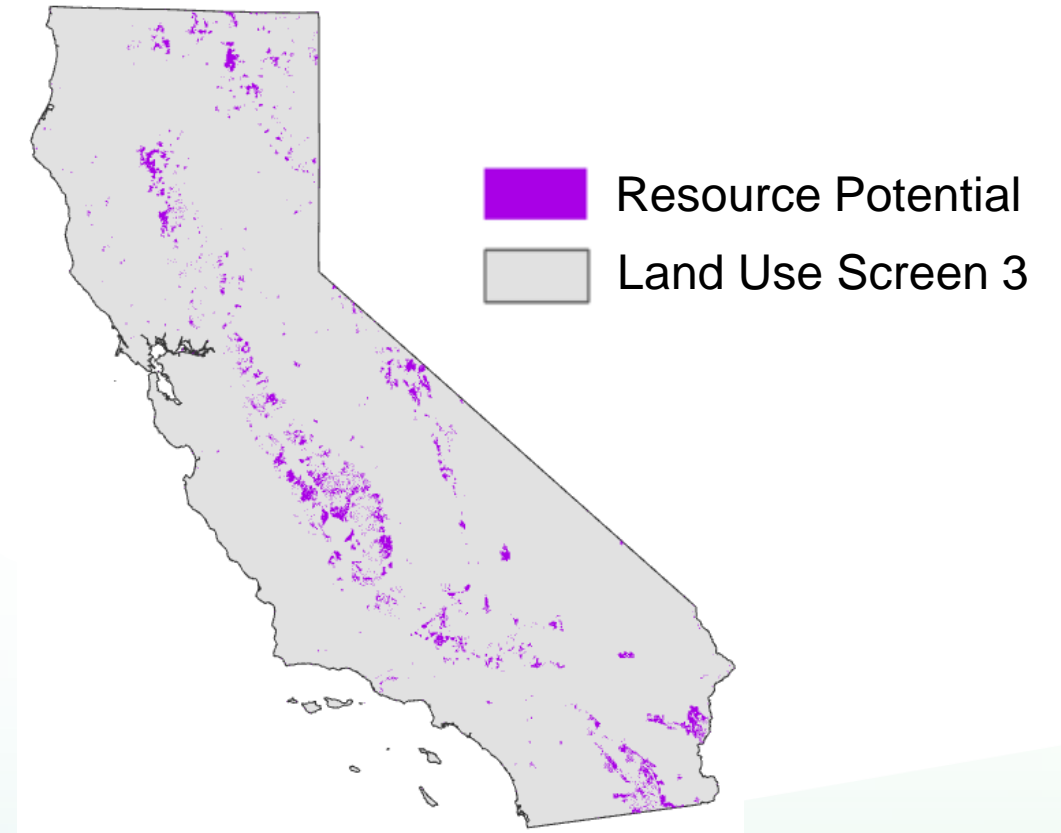
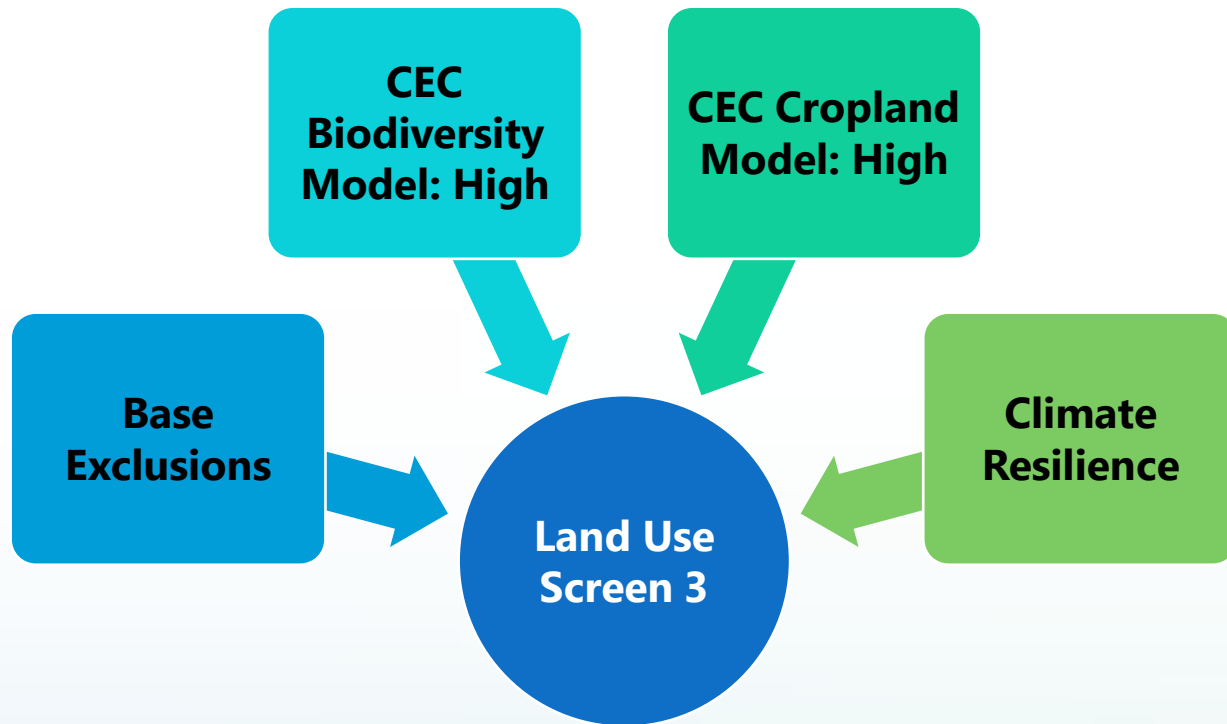


Source: CEC staff

Solar: ~ 320,000 MW
Wind: ~ 12,000 MW



Components of Land-Use Screen 3

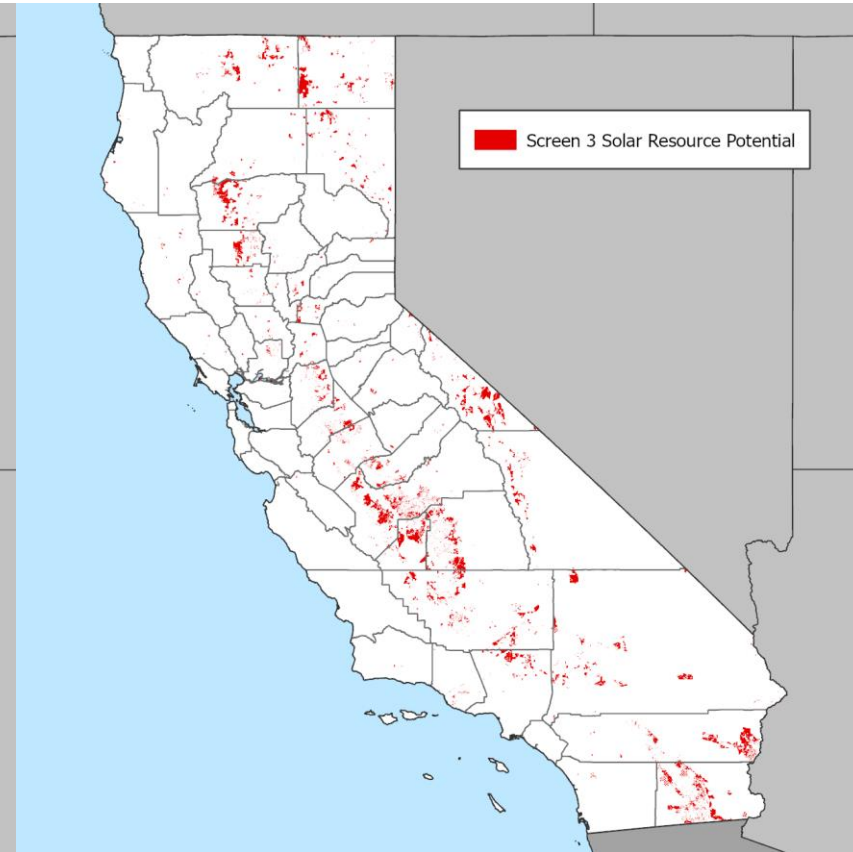
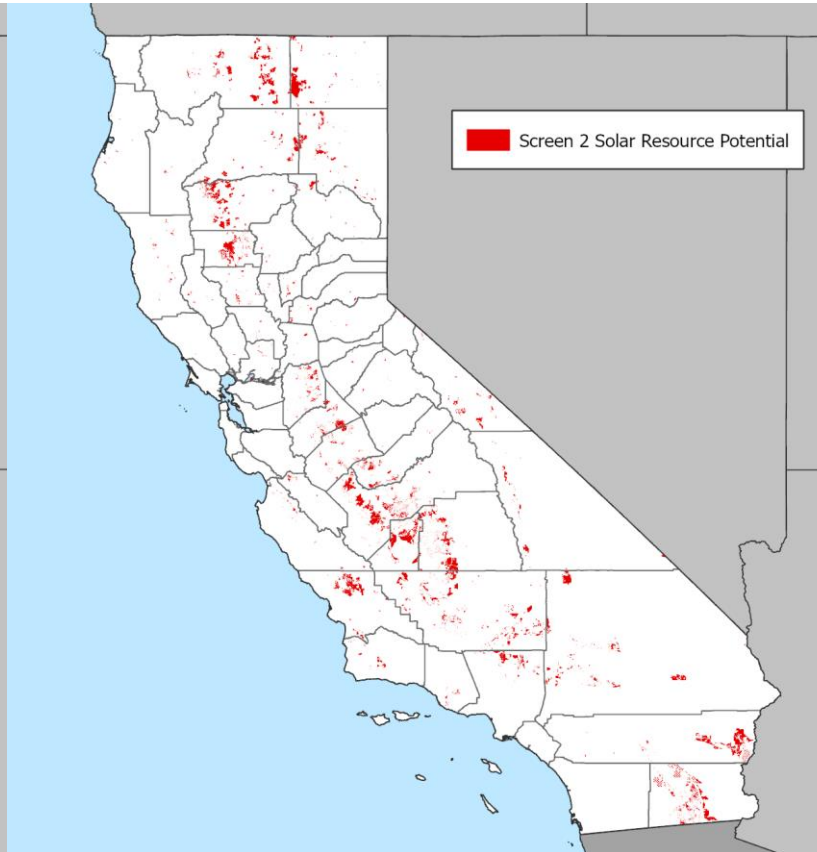


Solar: ~ 370,000 MW
Wind: ~ 14,000 MW

Source: CEC staff



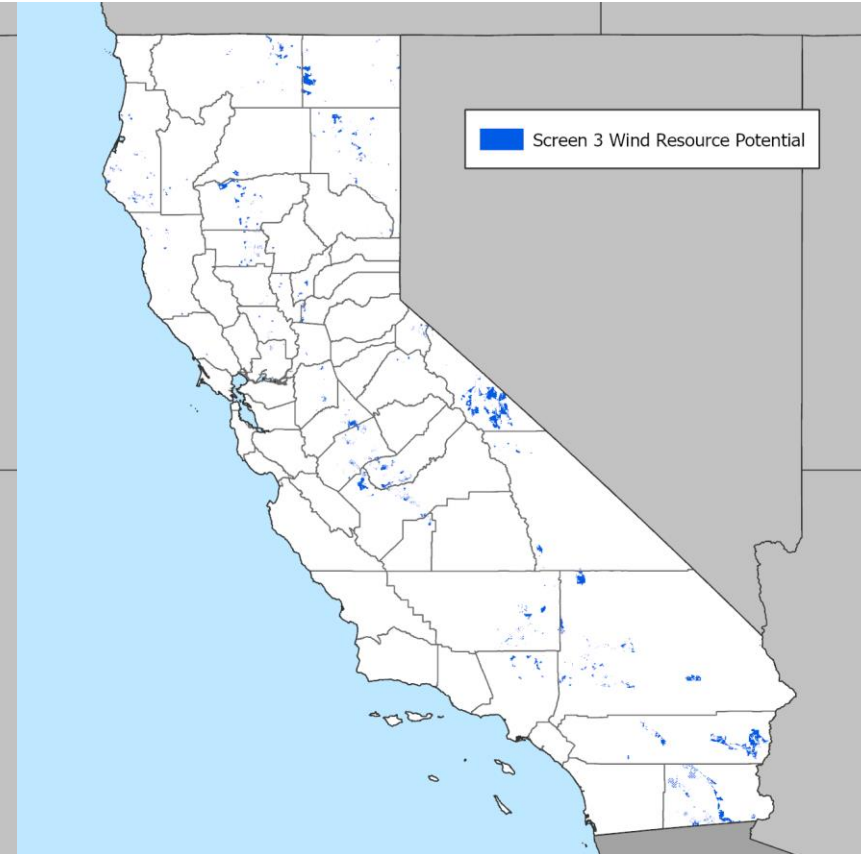
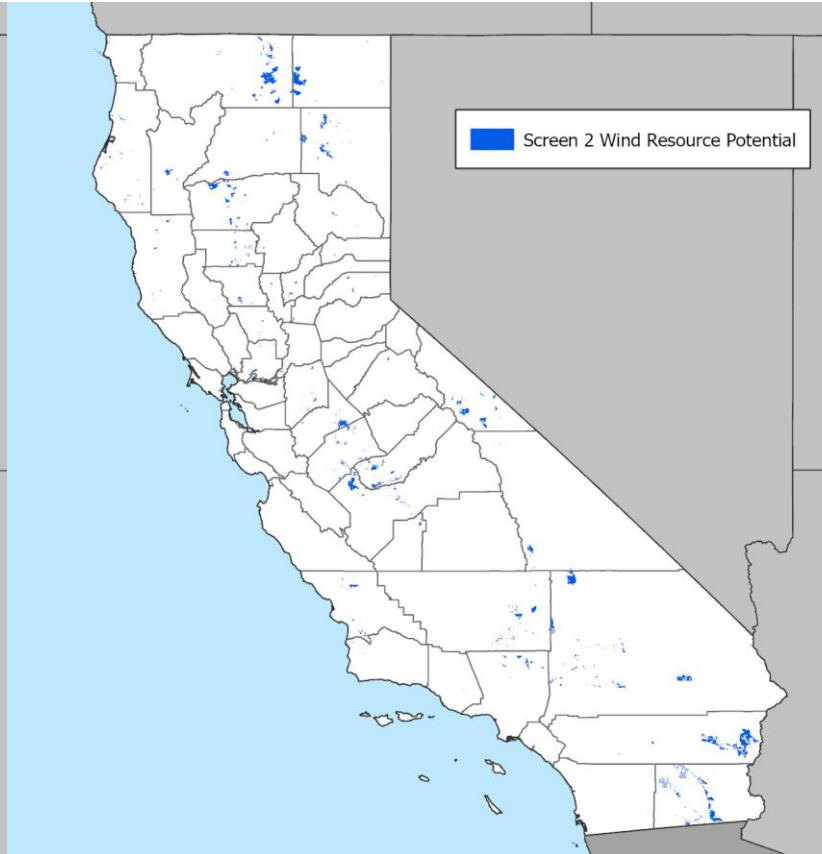
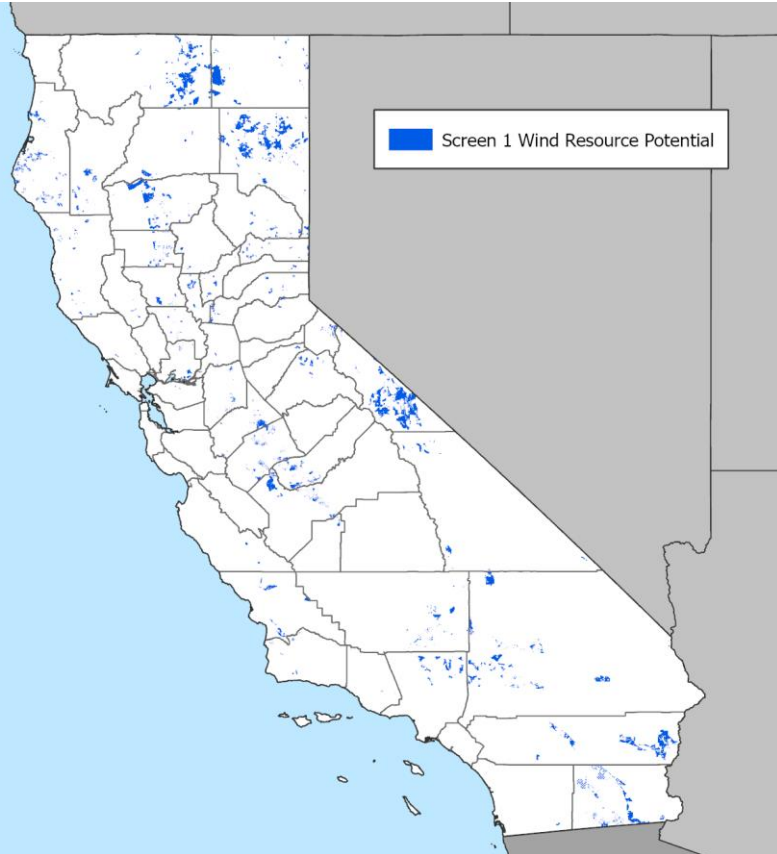
Screen Results - Solar



Source: CEC staff



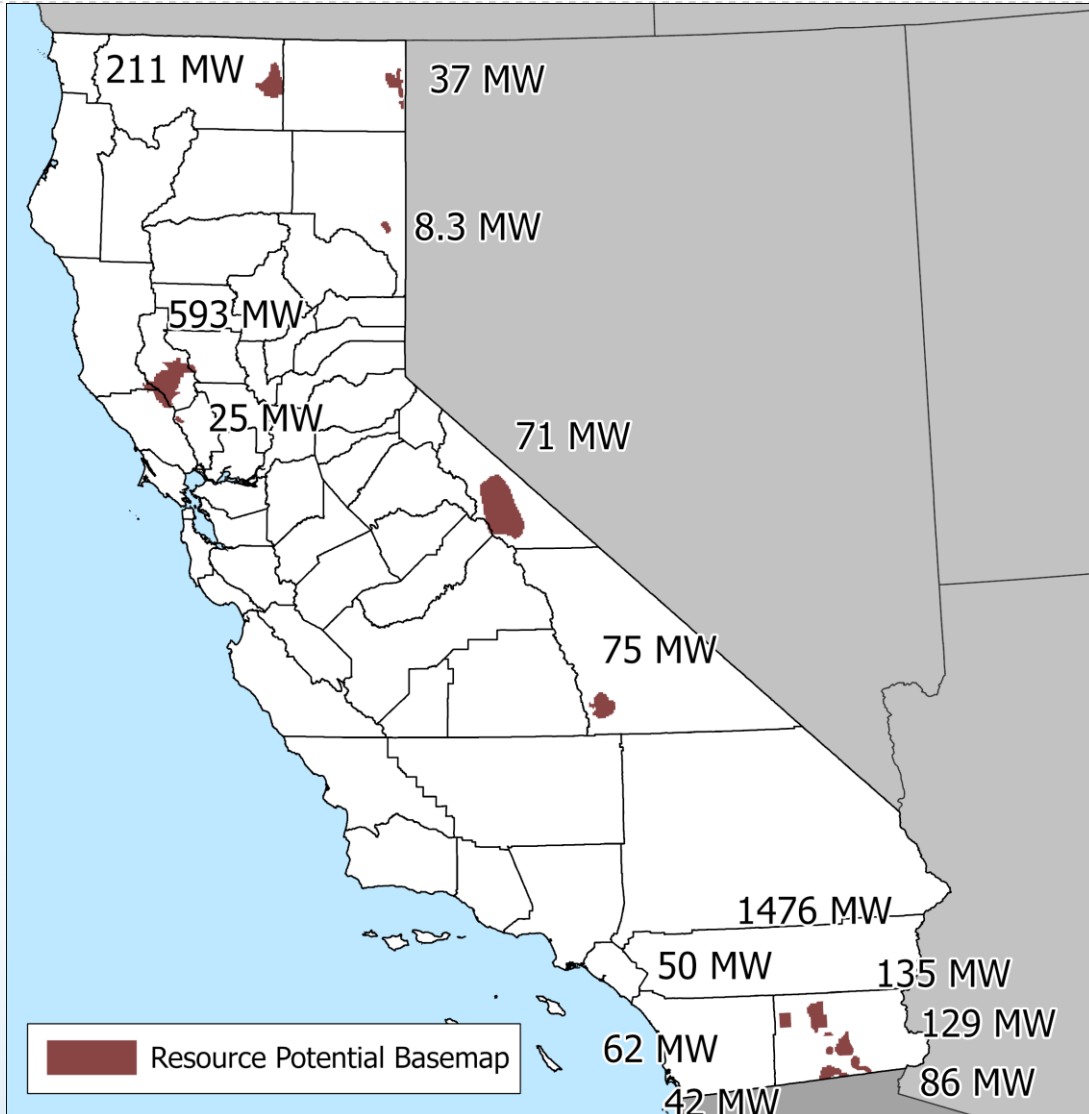
Screen Results – Onshore Wind



Source: CEC staff



Geothermal Resource Potential Estimate



- Began with known geothermal fields
 - KGRAs
 - BLM Leasing Areas
- Land evaluation methods:
 - Filtered by Legally Protected Areas
 - Partial overlaps with Legally Protected Areas allowed
- Generating capacity estimates provided by Lovekin et al. 2004
- Truckhaven estimate from BLM EIS
- Undeveloped Generating Capacity: ~3,000 MW



Recommendations and Next Steps



Recommendations for SB 100

- Land-Use Screen 1: CEC staff recommends this screen as the primary screen for estimating resource potential for onshore wind and solar.
- Land-Use Screens 2 and 3: CEC staff recommends using these screens as sensitivities in future SB 100 analysis. Further, the information from these screens can be a resource in evaluating projected land-use implications of scenarios.

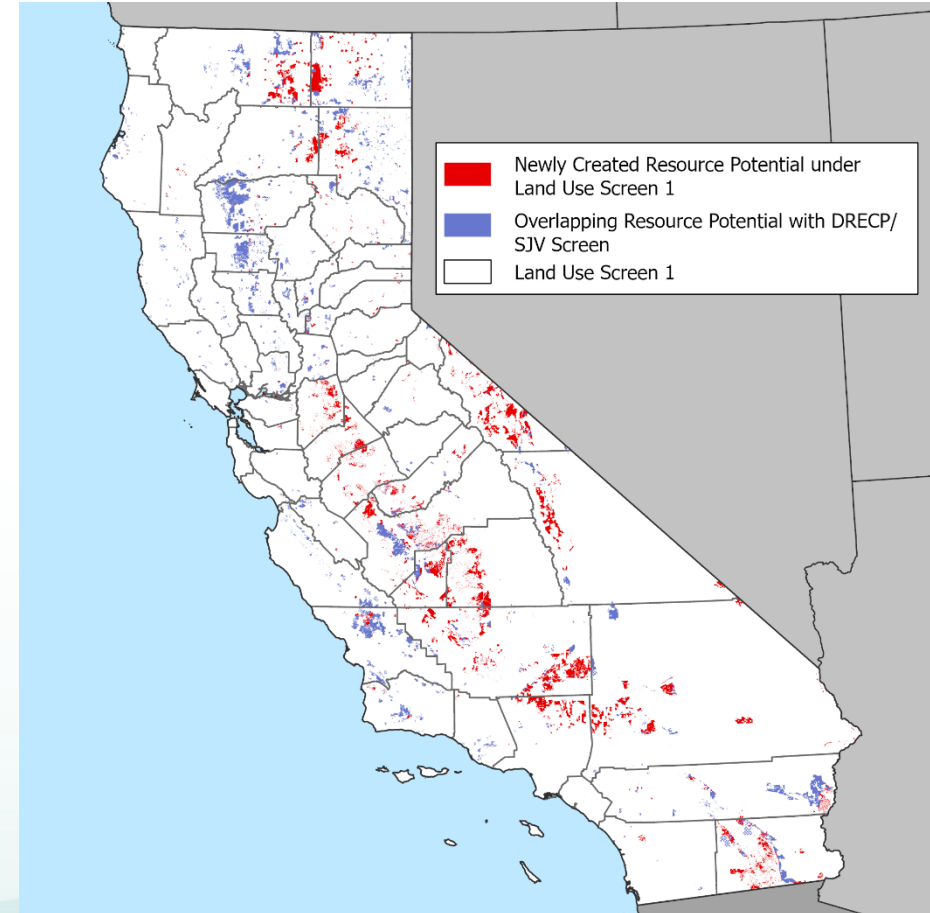


Source: Erica Brand



Comparing DRECP/SJV Screen to Land-Use Screen 1

Solar



Source: CEC staff



Comparing DRECP/SJV Screen to Land-Use Screen 1

Wind



Source: CEC staff



Timeline

- October 10, 2022 – workshop on draft staff report
- November 1, 2022 – public comment deadline
- January 2023 – release final staff report
- February 2023 – consideration at CEC business meeting



Next Steps in SB 100 Land Use Analysis

- Outreach and engagement
 - California Native American Tribes
 - Local Governments
- Upcoming methods development
 - “Analyze projected land-use impacts of scenarios and opportunities to reduce environmental impacts.”
 - “Define and include land-use impact social costs and non-energy benefits.”
 - Future groundwater availability
 - Energy equity and justice implications of renewable energy buildout patterns



Thank You



References

1. Maclaurin, Galen, Nick Grue, Anthony Lopez, Donna Heimiller, Michael Rossol, Grant Buster, and Travis Williams. 2019. The Renewable Energy Potential (reV) Model: A Geospatial Platform for Technical Potential and Supply Curve Modeling. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-73067. <https://www.nrel.gov/docs/fy19osti/73067.pdf>.
2. Lovekin, James W., Subir K. Sanyal, Christopher W. Klein. 2004. "New Geothermal Site Identification and Qualification." Richmond, California: California Energy Commission: Public Interest Energy Research Program. Accessed September 14, 2022.