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Description:	Presentation by Erica Brand, Travis David, and Saffia Hossainzadeh, CEC
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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

Input: Land-use screens

CPUC Integrated Resource Planning

Planning and Procurement Timeline (up to 10 years ahead)
- Procurement and policy compliance focused

Busbar Mapping

Input: Land-use screens

SB 100 Resource Build Activities

Climate Goals Timeline (10-25 years ahead)
- **Example: Starting Point Scenario + 20-Year Transmission Outlook**
- Explore longer term requirements and options for meeting long term policies

Input: Land-use screens

Joint Agency SB 100 Analysis

Climate Goals Timeline (10-25 years ahead)
- **Example: SB 100 modeling**
- Focused on planning to achieve long term policies and identifying long term solutions

Portfolio evaluation

History of Land-Use Screening

2009 — Renewable Energy Transmission Initiative (RETI)

- 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

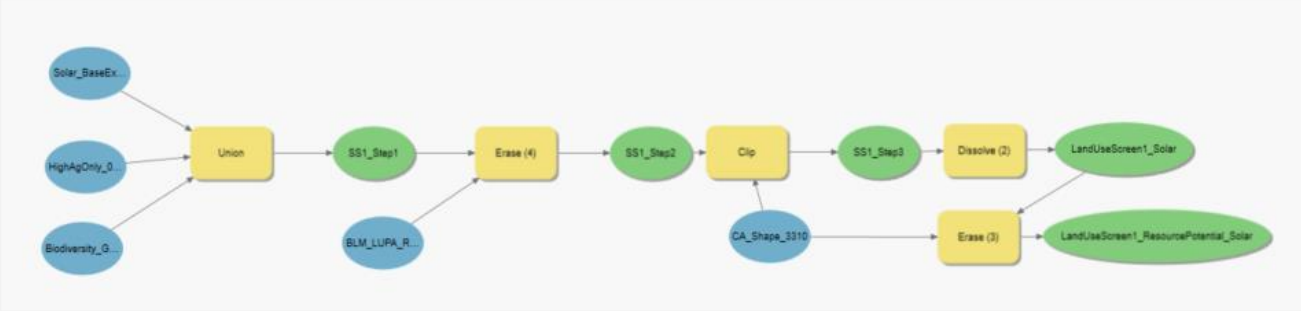
Preparations

- 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

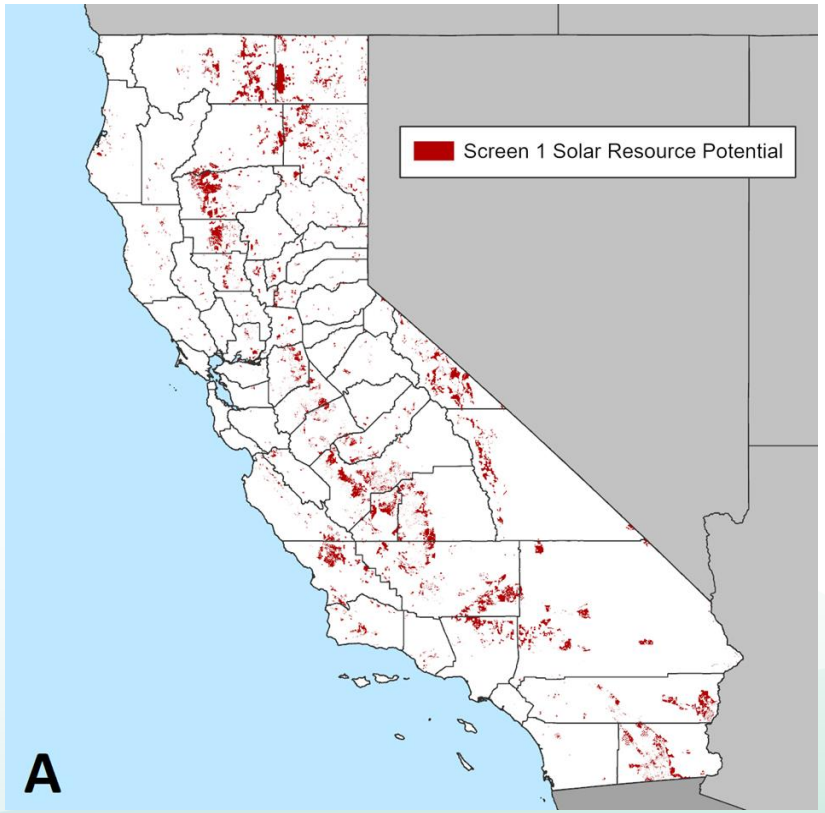


Data Modeling and Screening

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)

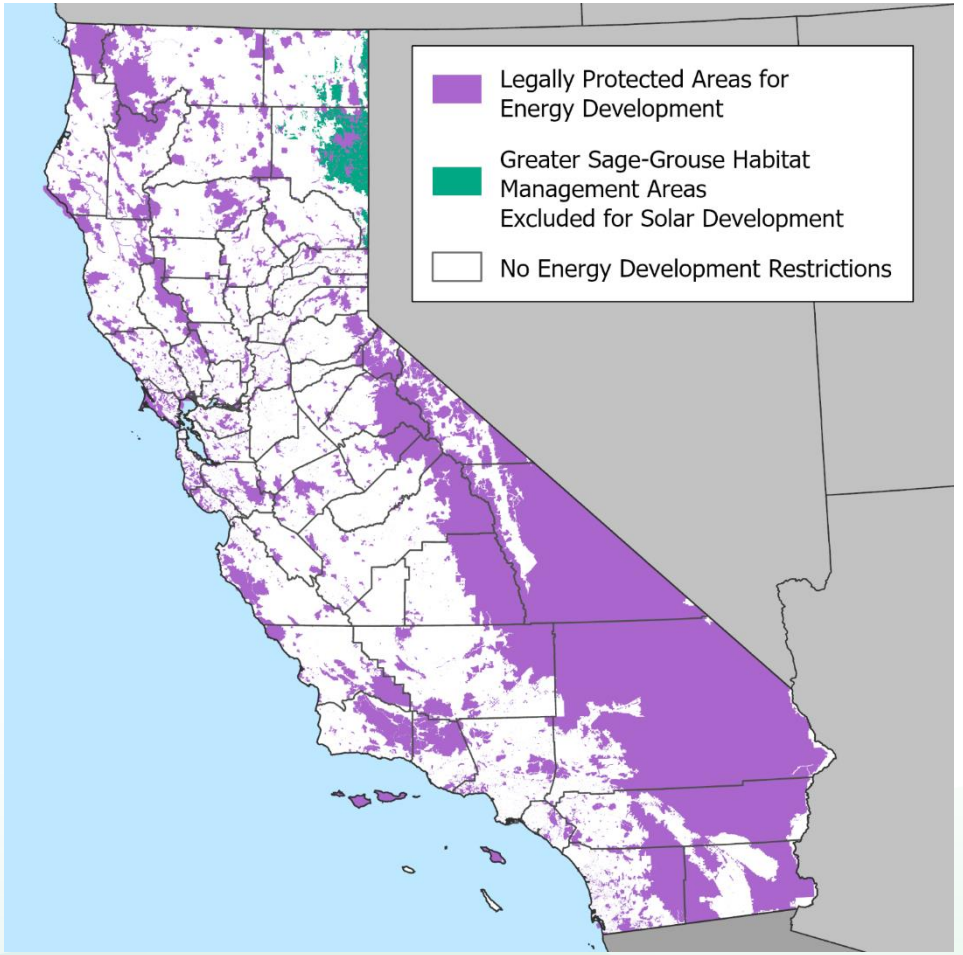
- National parks
- State parks/recreation areas
- Wildlife reserves
- Conservation areas
- Private conservation land
- Wilderness areas, studies, and research lands
- Gap status

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

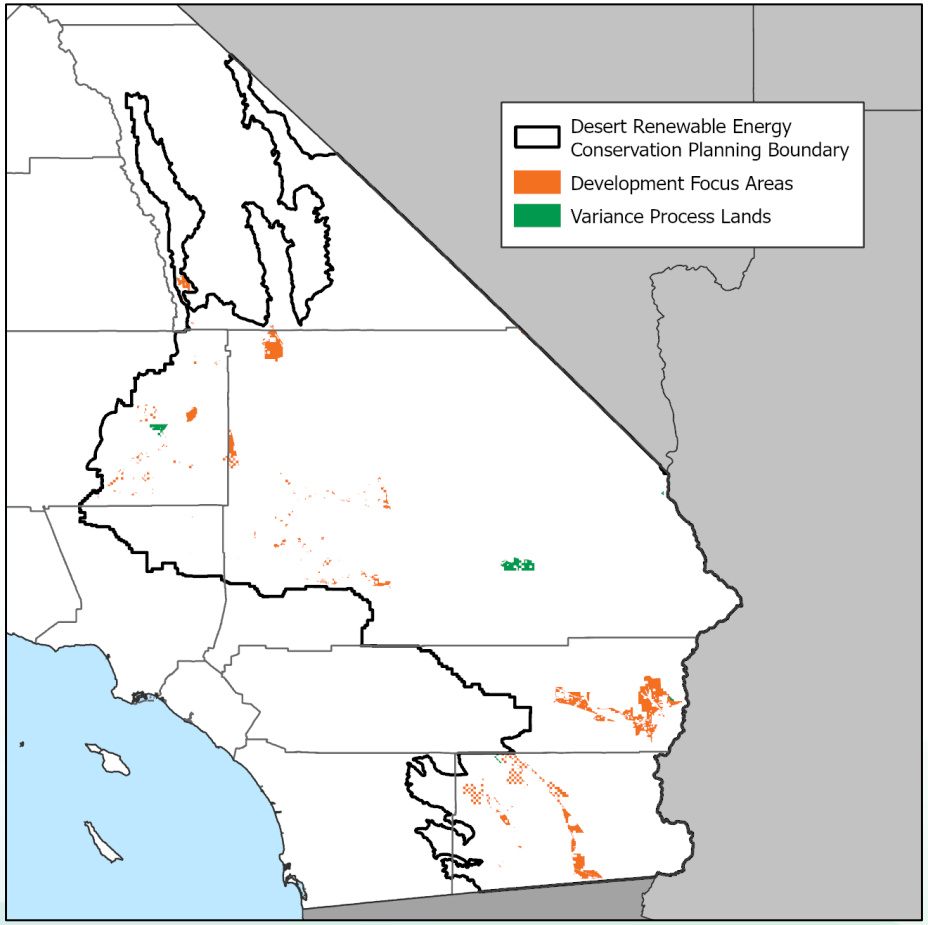


Source: CEC staff

Inclusion Data

Desert Renewable Energy Conservation Plan

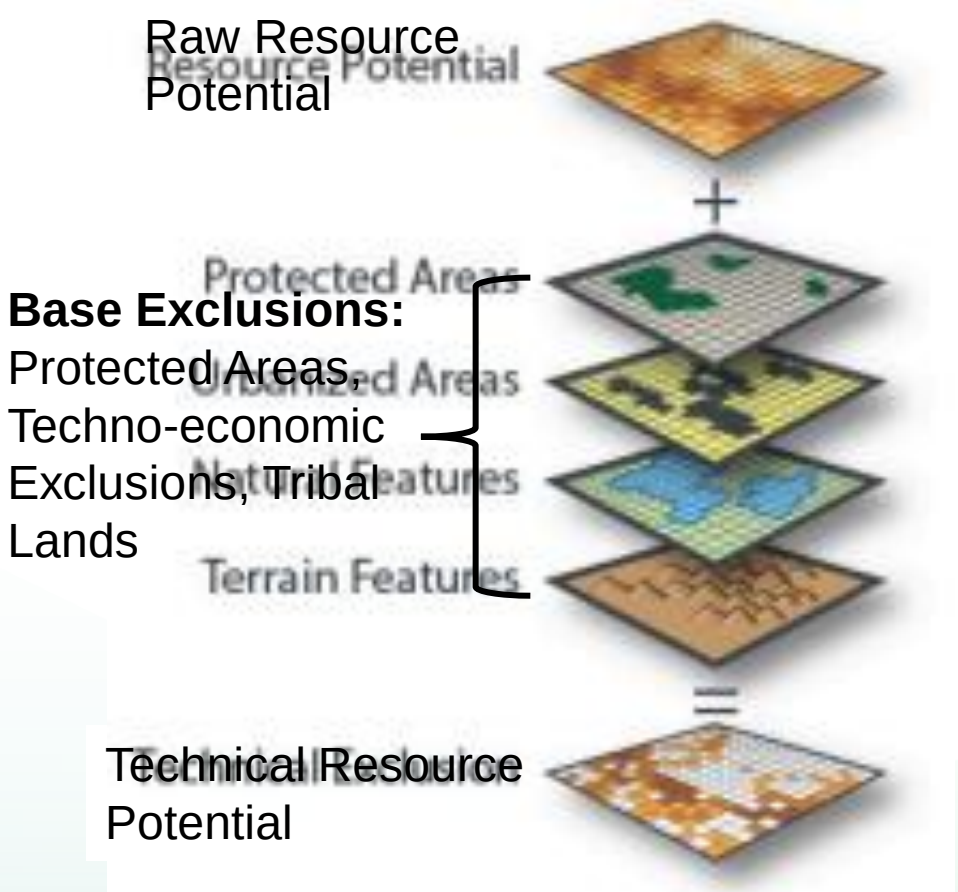
- Development Focus Areas
- Variance Process Lands



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)



Modified from Maclaurin et al. 2019

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)

BIODIVERSITY INDEX RESULTS

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

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

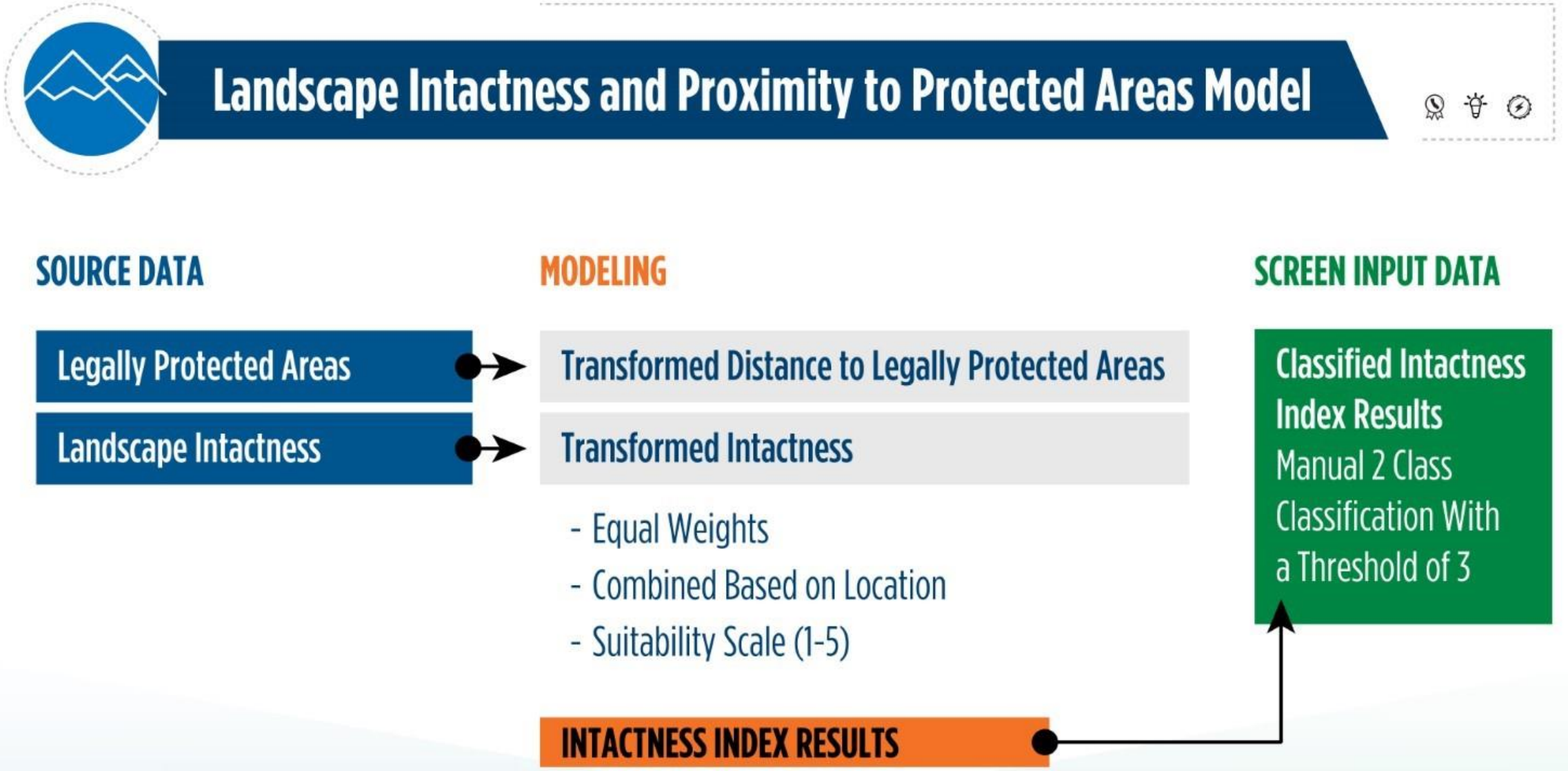
Mask
- Combined Based on Location
- 30m Resolution Raster
- Suitability Scale (1-10)
- Clipped to Mask

CROPLAND INDEX RESULTS

SCREEN INPUT DATA

Classified Cropland Index Results
Natural Breaks (Jenks) Classification 2 Classes

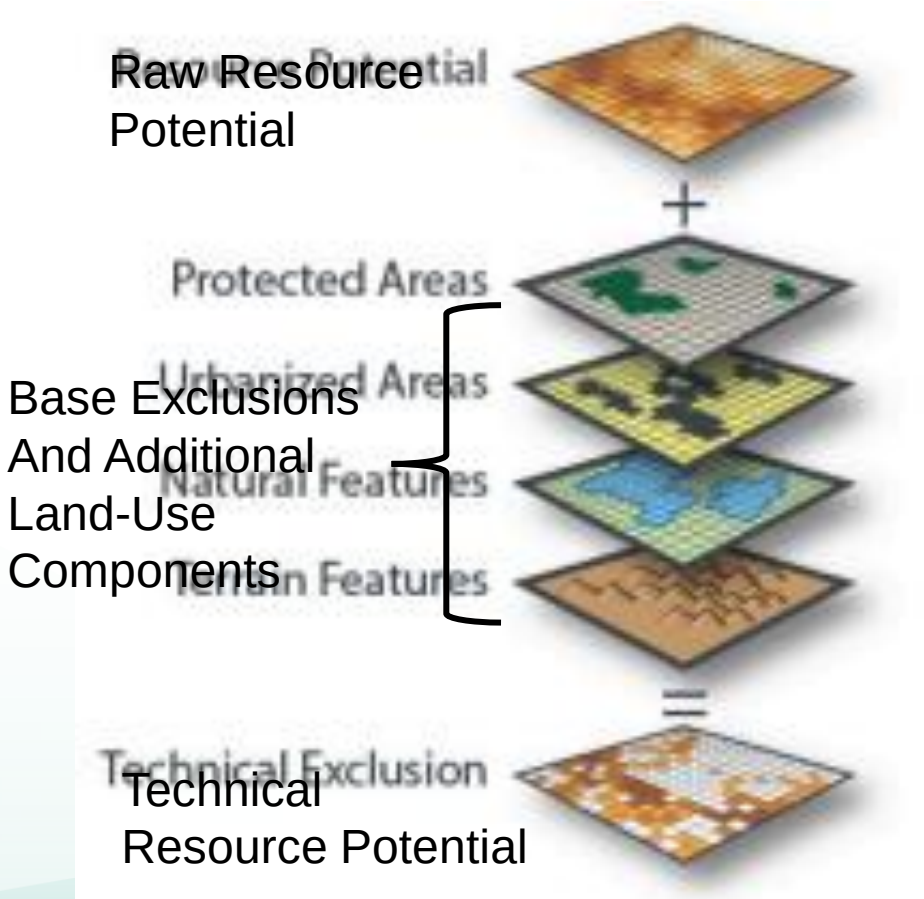
Landscape Intactness and Proximity to Protected Areas Model



Screening

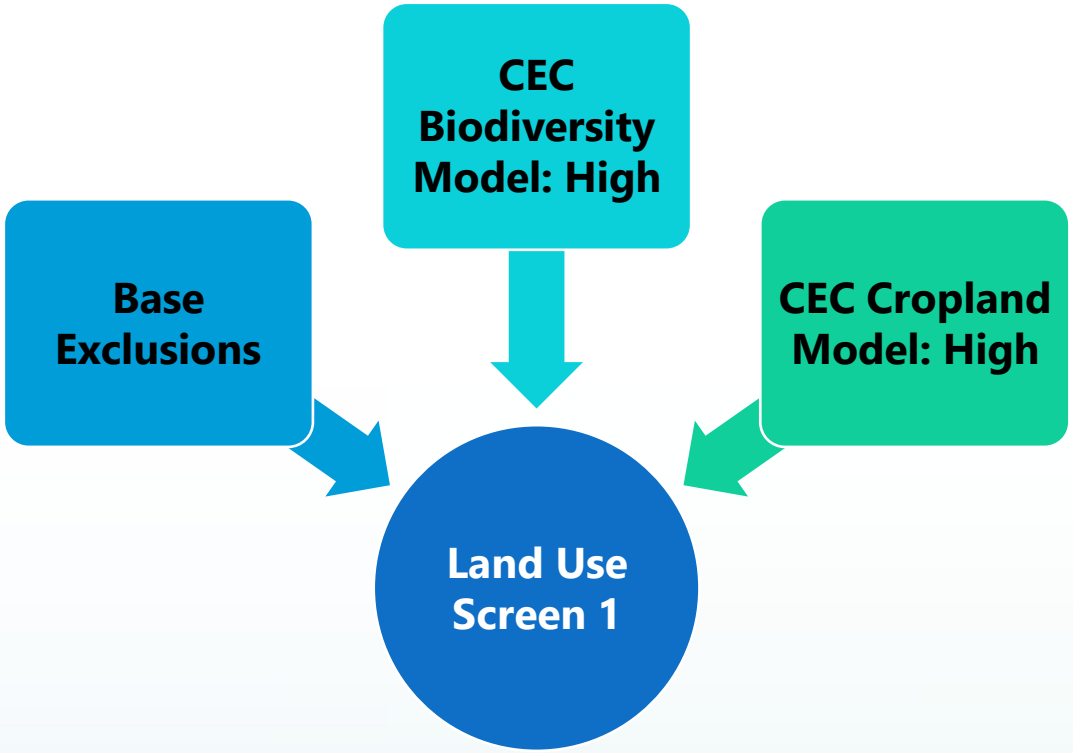
Screens

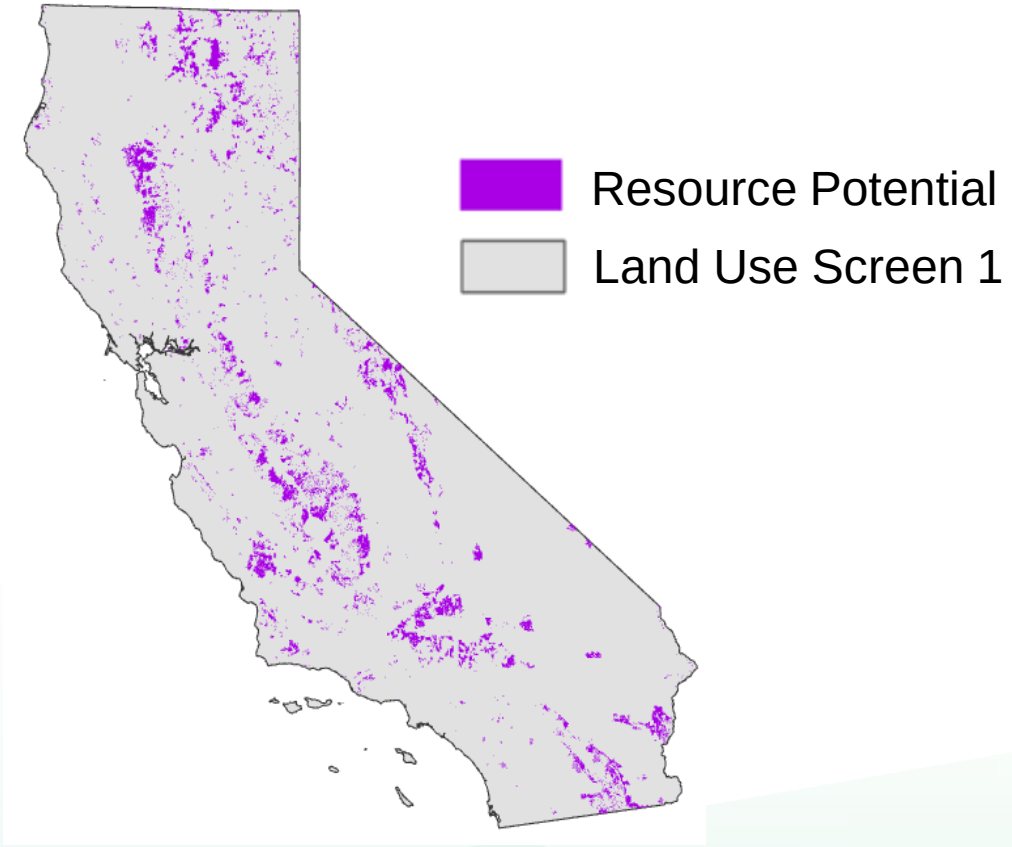
- Base Exclusions (for solar or onshore wind)
- High Categories of Model Results
  1. CEC Biodiversity Model
  2. CEC Cropland Model
  3. CEC Intactness/Proximity to Protected Area Model
  4. ACE Climate Change Resilience



Modified from Maclaurin et al. 2019

Components of Land-Use Screen 1

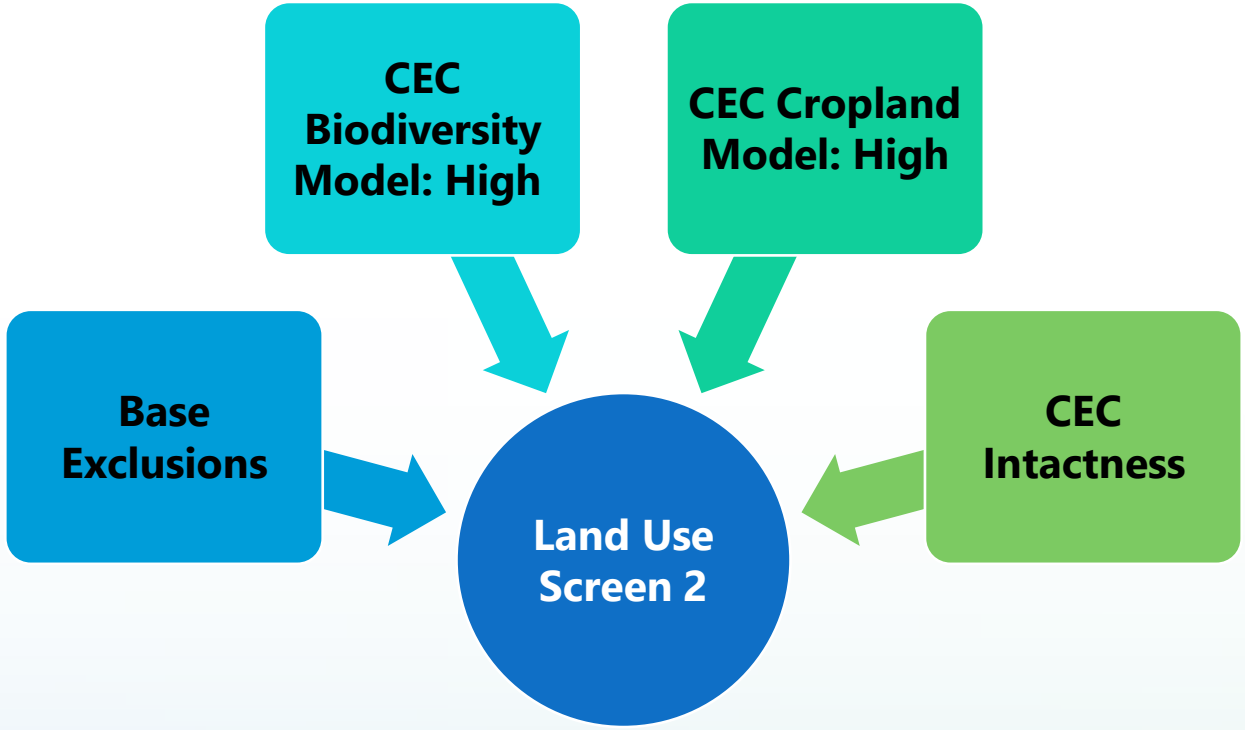


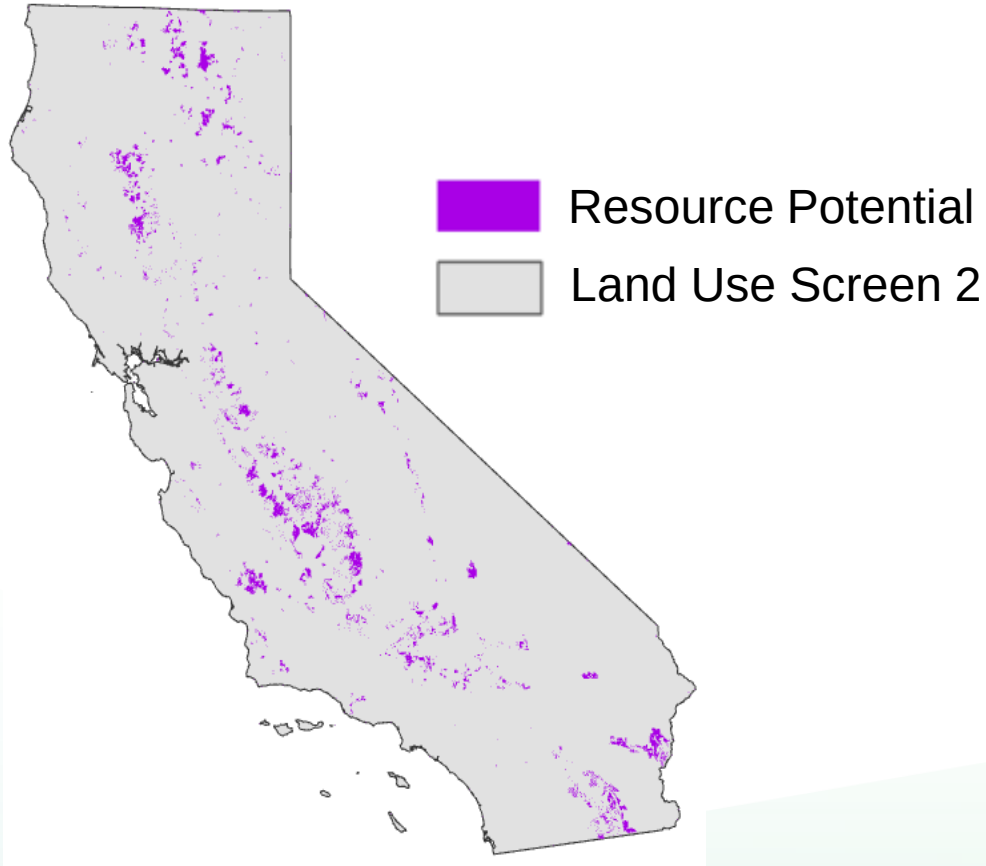


Source: CEC staff

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

Components of Land-Use Screen 2

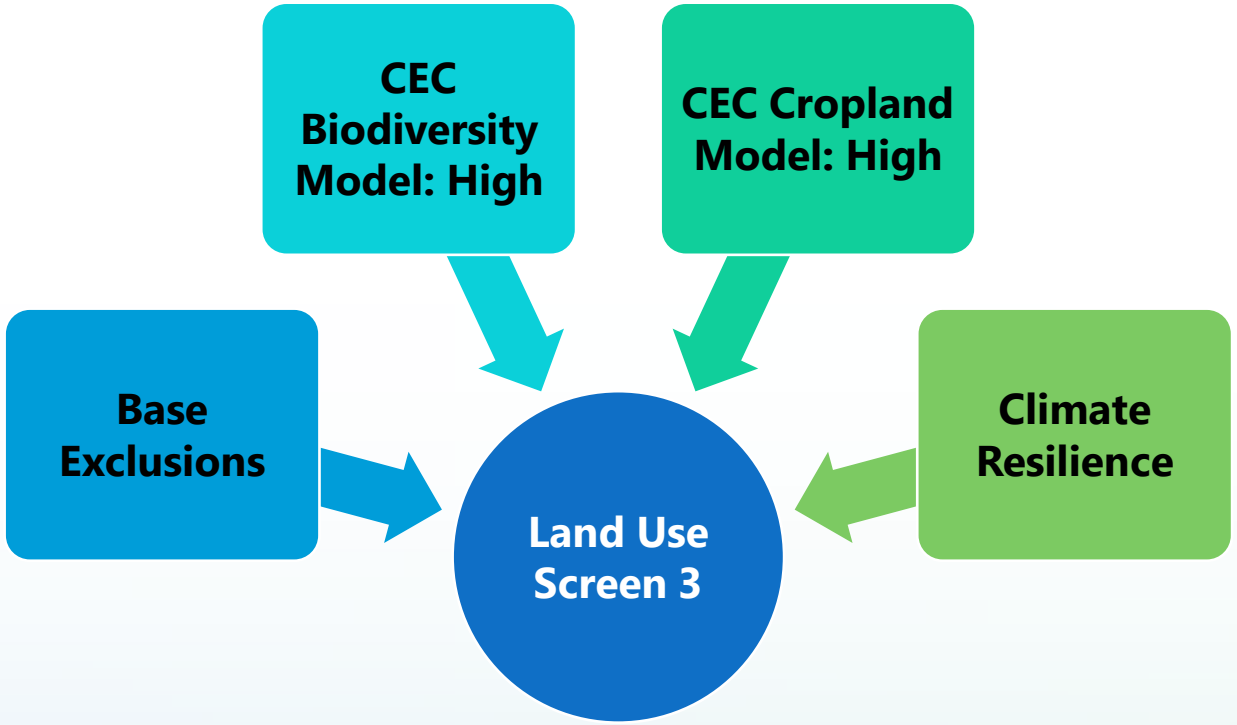


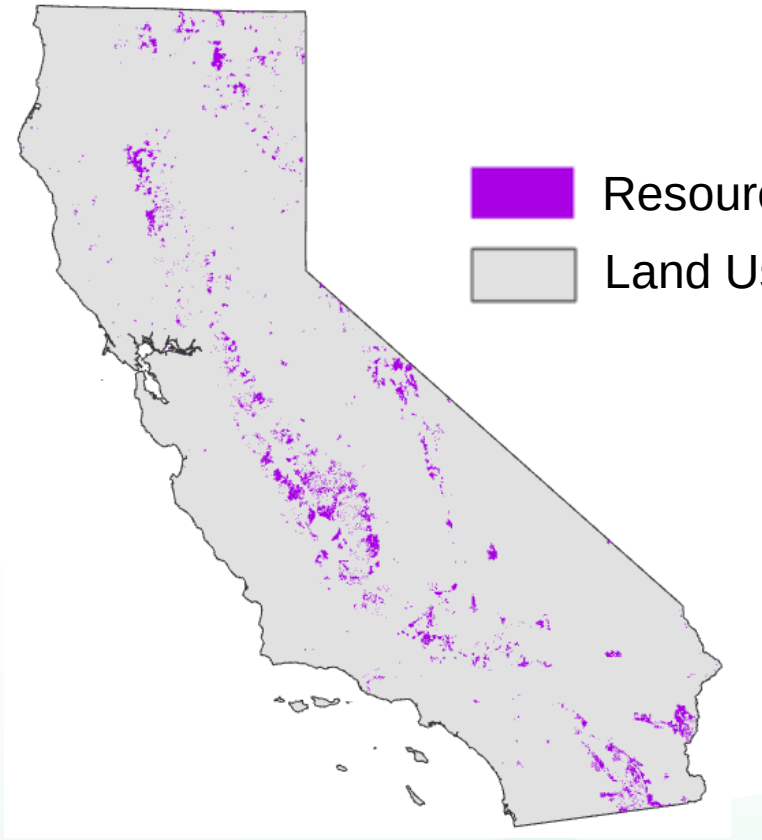


Source: CEC staff

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

Components of Land-Use Screen 3

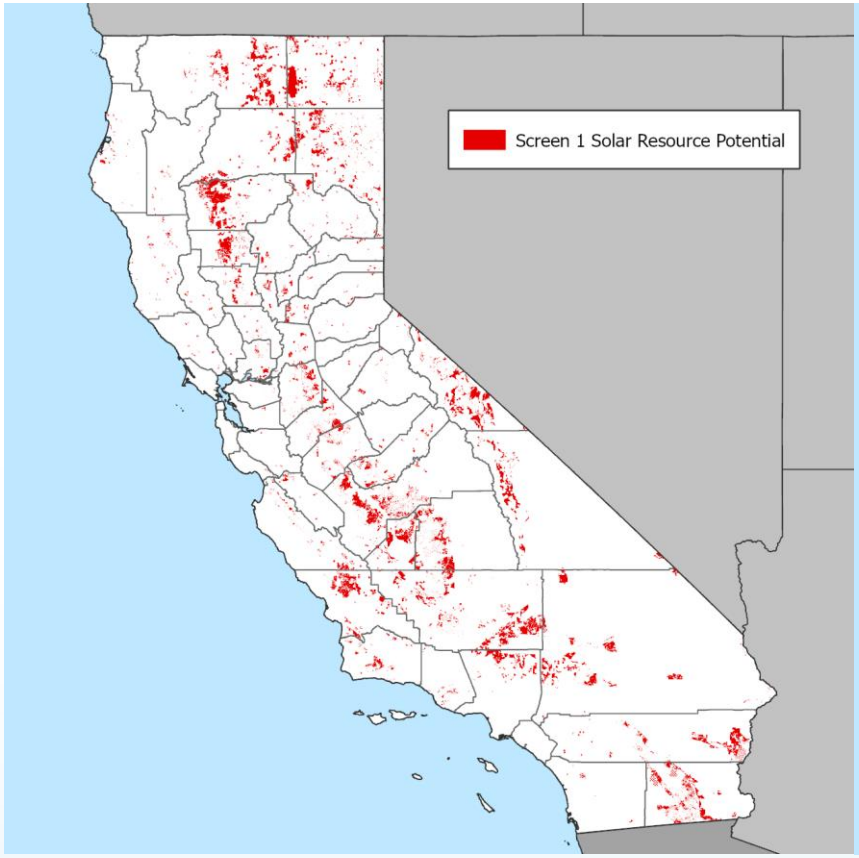


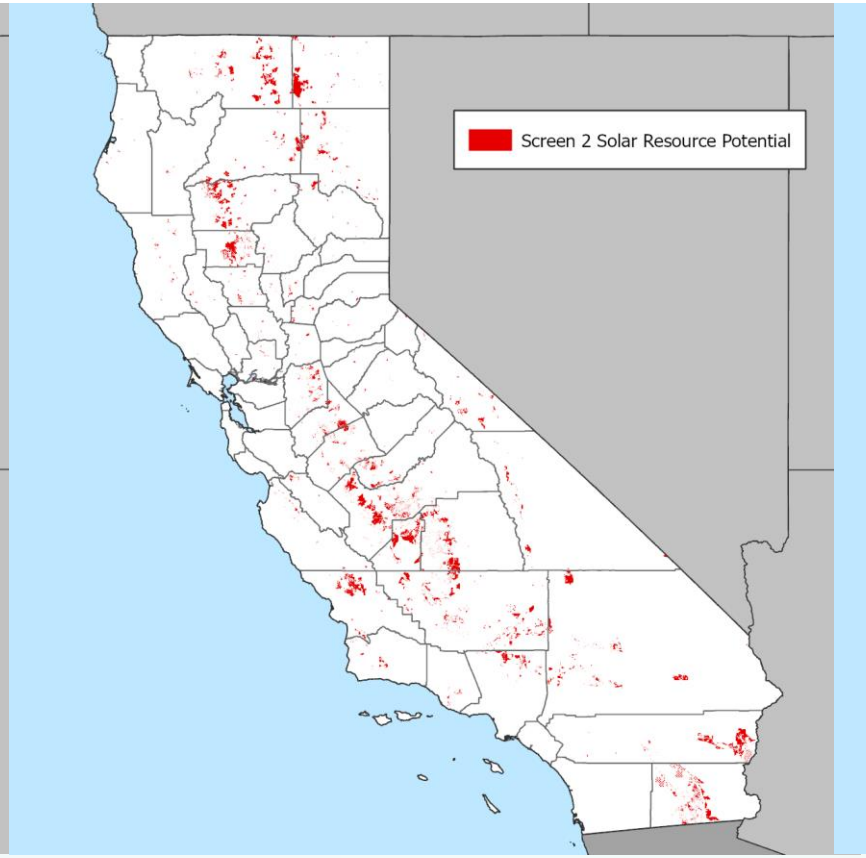


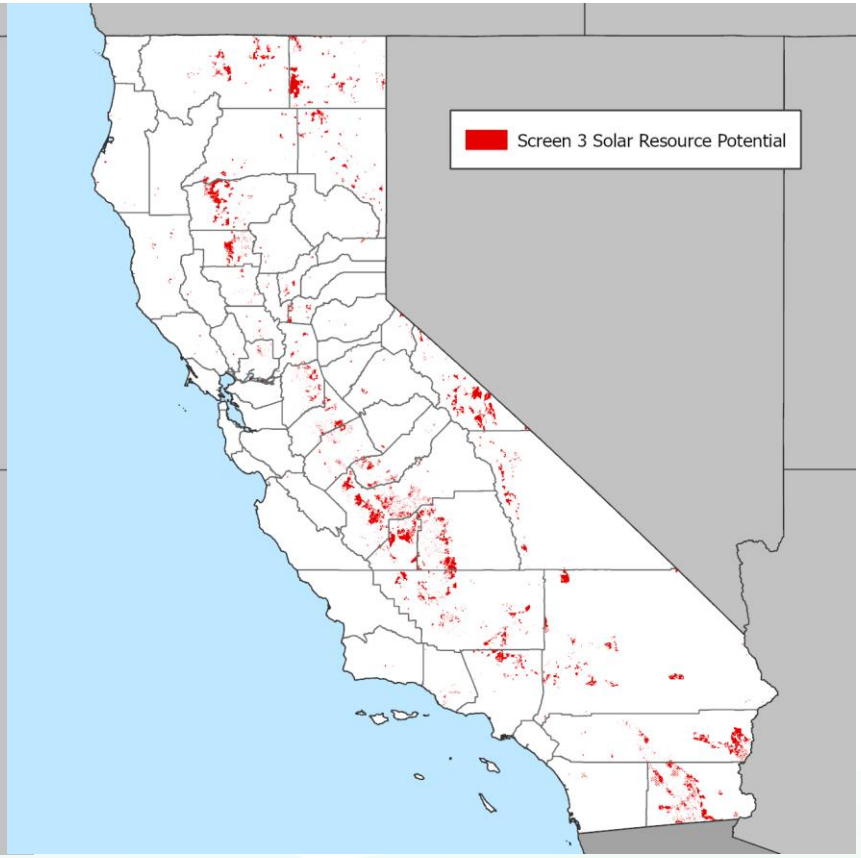
Source: CEC staff

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

Screen Results - Solar

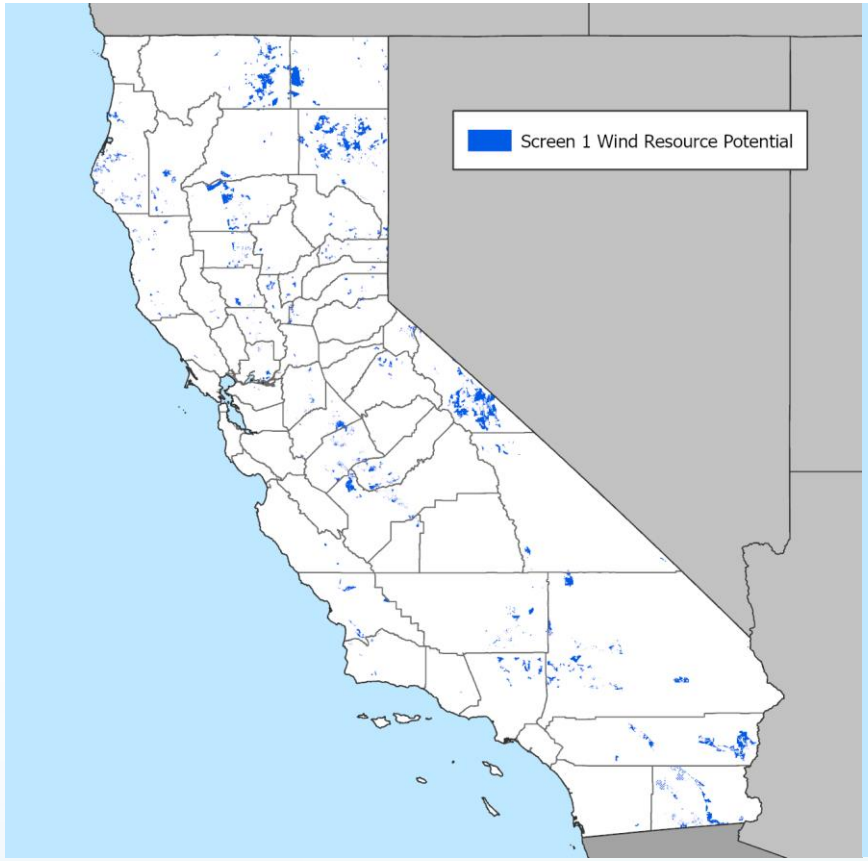


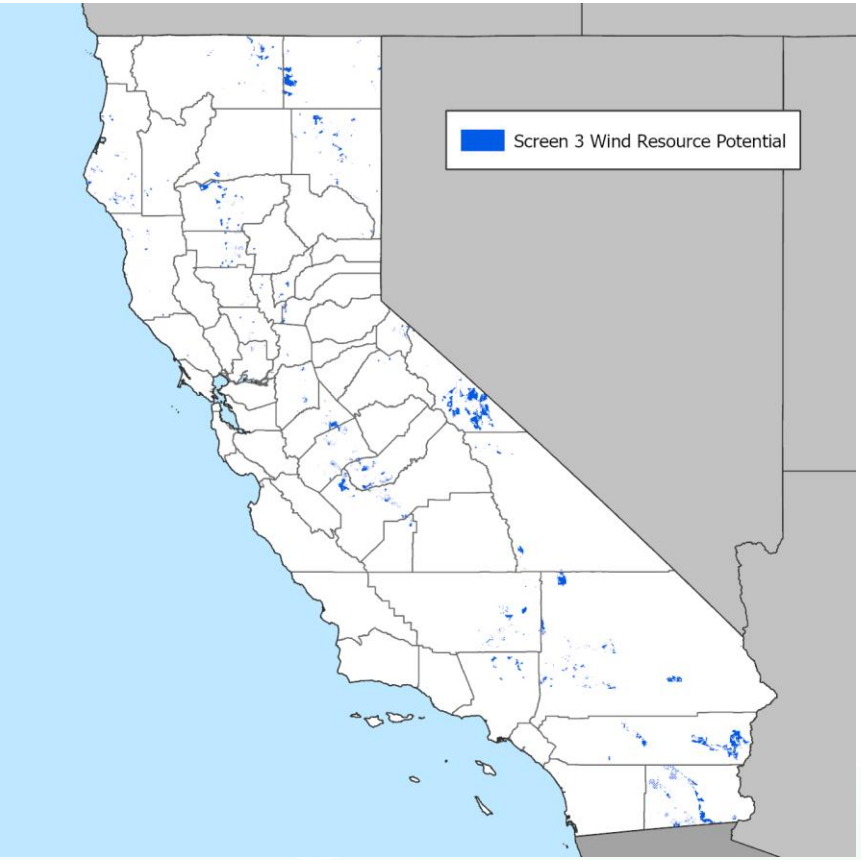




Source: CEC staff

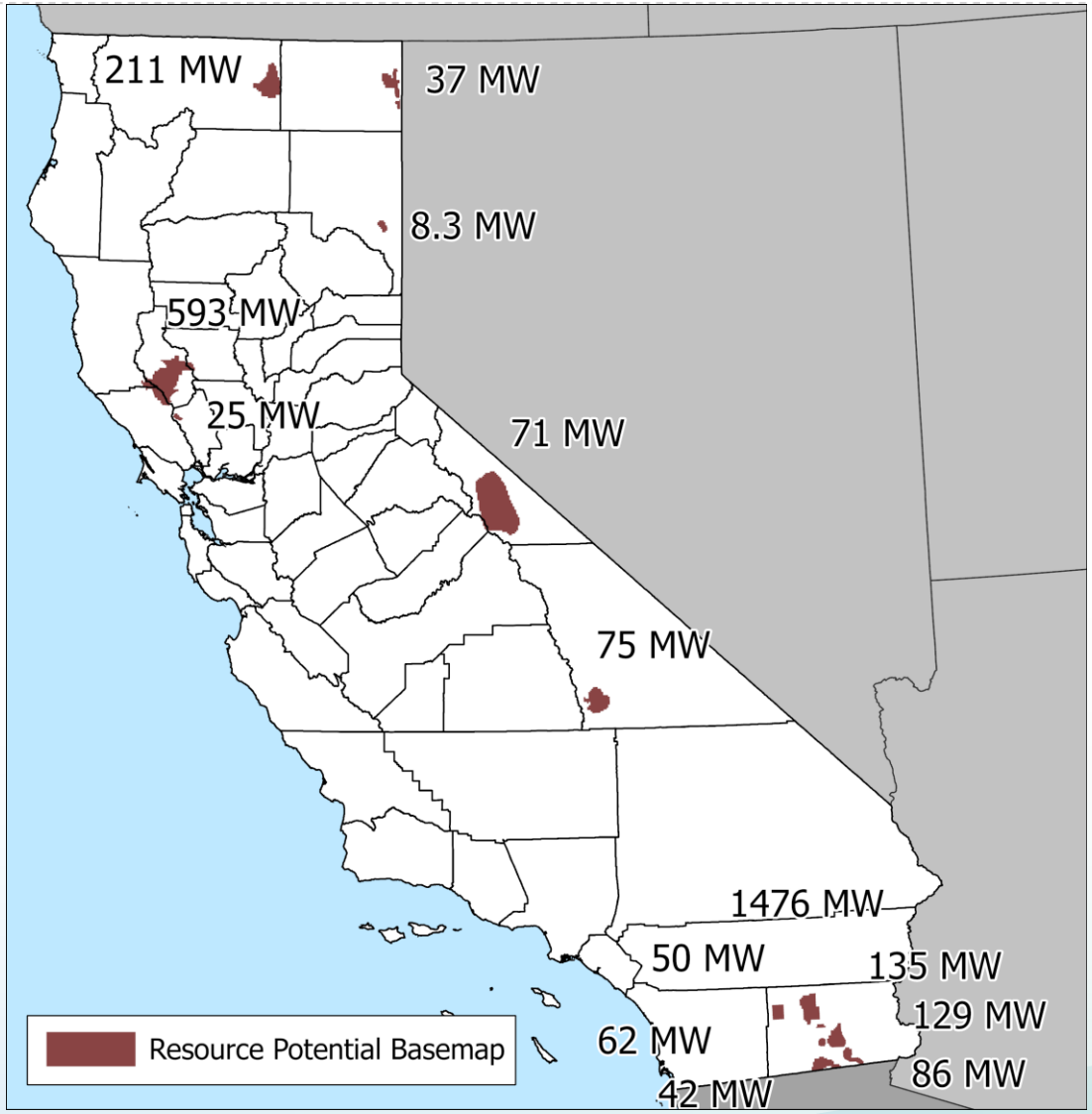
Screen Results – Onshore Wind





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

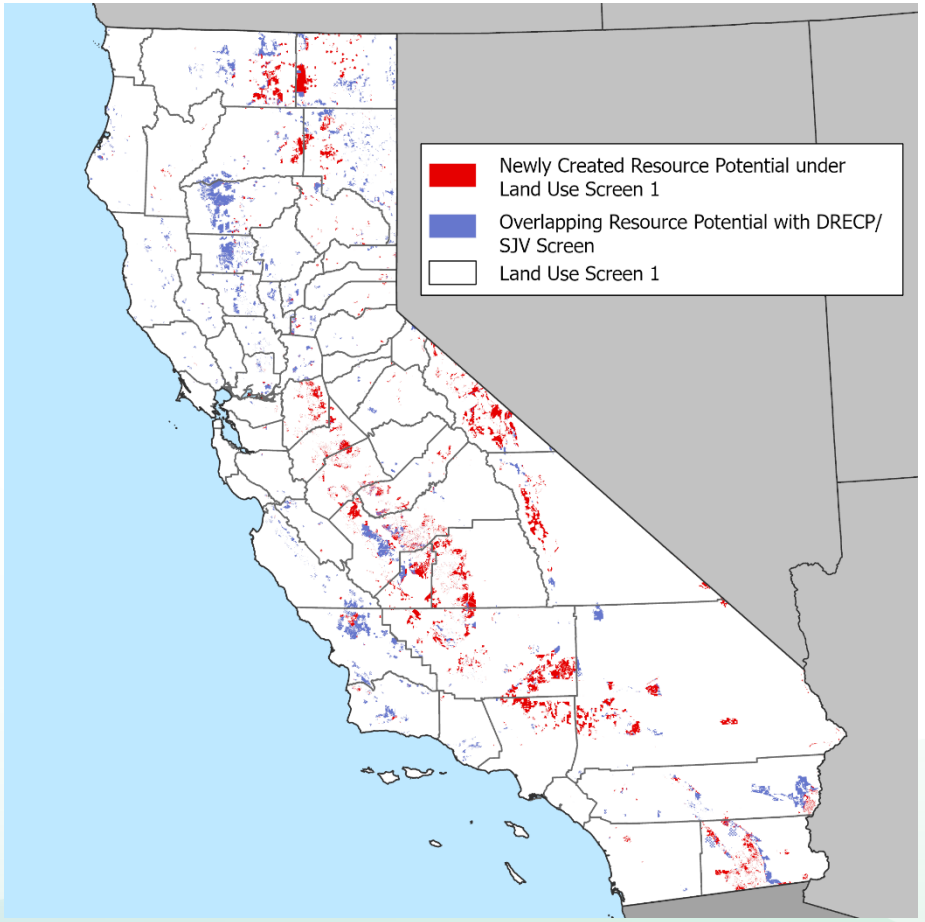
Recommendations for SB 100

- 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.