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NASEO
National Association of State Energy Officials

State Summit on Energy Resilience Planning and Funding

July 28-29 & August 3-4, 2021

Hosted by the National Governors Association (NGA) and
National Association of State Energy Officials (NASEO)

Welcome Remarks and Overview

Presenters:

Kirsten Verclas, Senior Program Director, Electricity, NASEO
Dan Lauf, Energy Program Director, NGA Center for Best Practices

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Day 3: Making Energy Systems Resilient to Climate Change and Severe Hazards

Tuesday, August 3rd

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Preview of Today's Agenda

- 1:00 to 1:10 PM ET– Welcome, Introductions, and Overview of Day 3
- 1:10 to 2:00 PM ET – Resilience Planning: Severe Hazards & Long-Term Climate Shifts
- 2:00-2:45 PM ET – Breakout Sessions: Engaging Local Communities in Resilience
- 2:45 to 3:00 PM ET – Break
- 3:00-3:45 PM ET – Clean Energy Transition's Impact on Resilience
- 3:45-4:30 PM ET – Breakout Discussions: *The Role of Electricity Markets in Regional Planning and Achieving Climate Goals* and *Integrating Resilience for Mission-Critical Facilities and Defense Critical Electric Infrastructure*
- 4:30 PM ET – Key Takeaways and Closing Remarks

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Resilience Planning: Severe Hazards & Long-Term Climate Shifts

Speakers:

Dr. Michael Webber, Professor in Energy Resources, The University of Texas at Austin

Dr. C. Adam Schlosser, Senior Research Scientist, MIT Center for Global Change Science

Dr. Susan Wilhelm, Team Lead, Energy-Related Environmental Research, California Energy Commission

Moderator:

Kenya Stump, Executive Director, Office of Energy Policy, Kentucky Energy and Environment Cabinet

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Cal-Adapt and Resiliency Planning Efforts in California

NASEO/NGA State Summit on Energy Resilience & Funding

August 3, 2021

Susan Fischer Wilhelm
Team Lead, Energy and Environmental Research
California Energy Commission

Outline

- Early versions of Cal-Adapt: Uses and role in resilience policy & practice
- Critical needs to support energy sector resilience
- An expanded Cal-Adapt enterprise

Thanks to our research partners!

GEOSPATIAL INNOVATION FACILITY
Cutting-Edge Mapping Technology at UC Berkeley

Eagle Rock Analytics

UC San Diego | SCRIPPS INSTITUTION OF OCEANOGRAPHY

EARTH & ENVIRONMENTAL SCIENCES

Spatial Informatics Group

UCLA Center for Climate Science

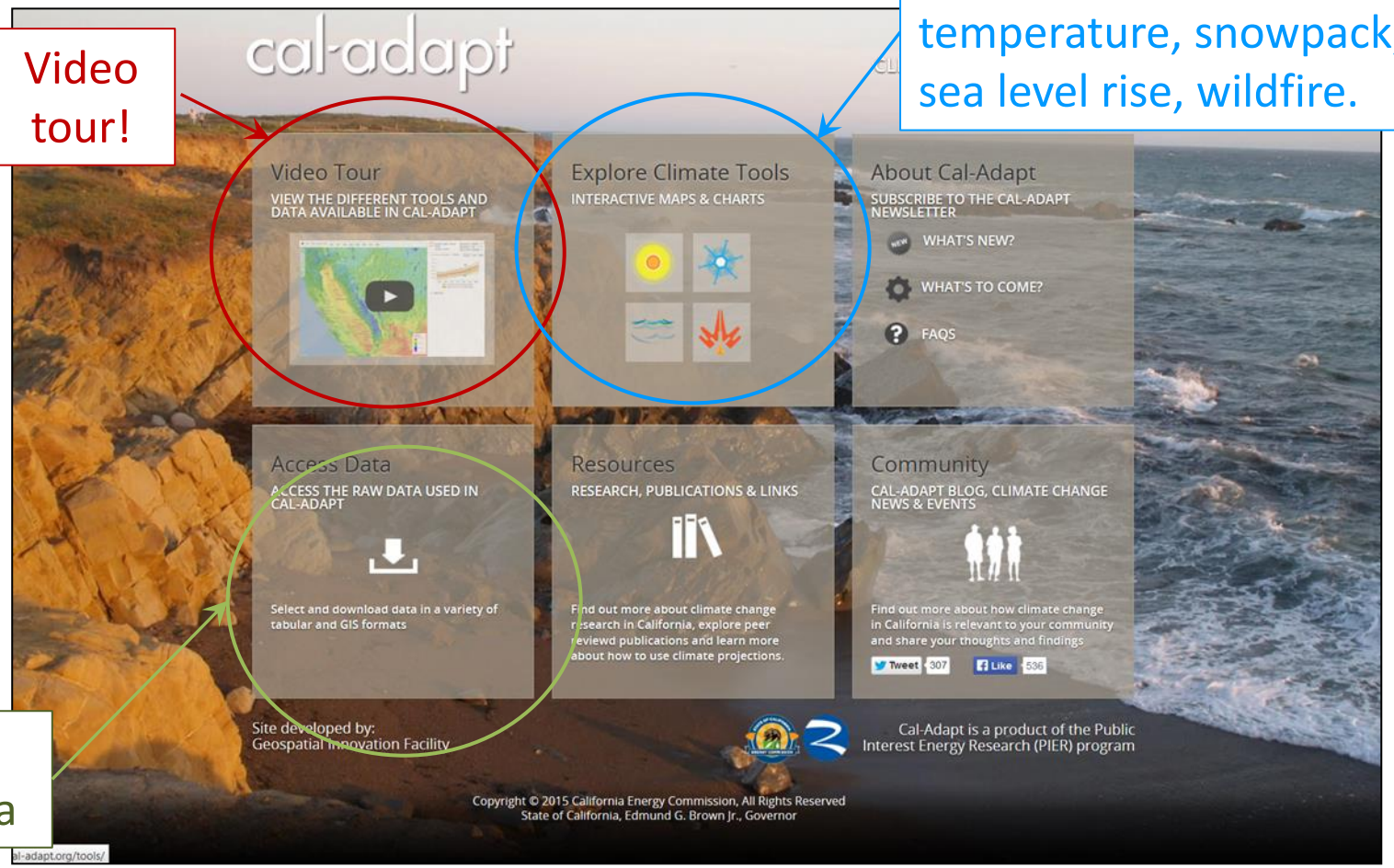
Cal-Adapt 1.0: Making regional climate projection data available

Released in 2011, as requested by then-Governor Schwarzenegger.

Three intended audiences:

- General public
- Practitioners of adaptation
- Scientific community

Cited by many adaptation plans.*



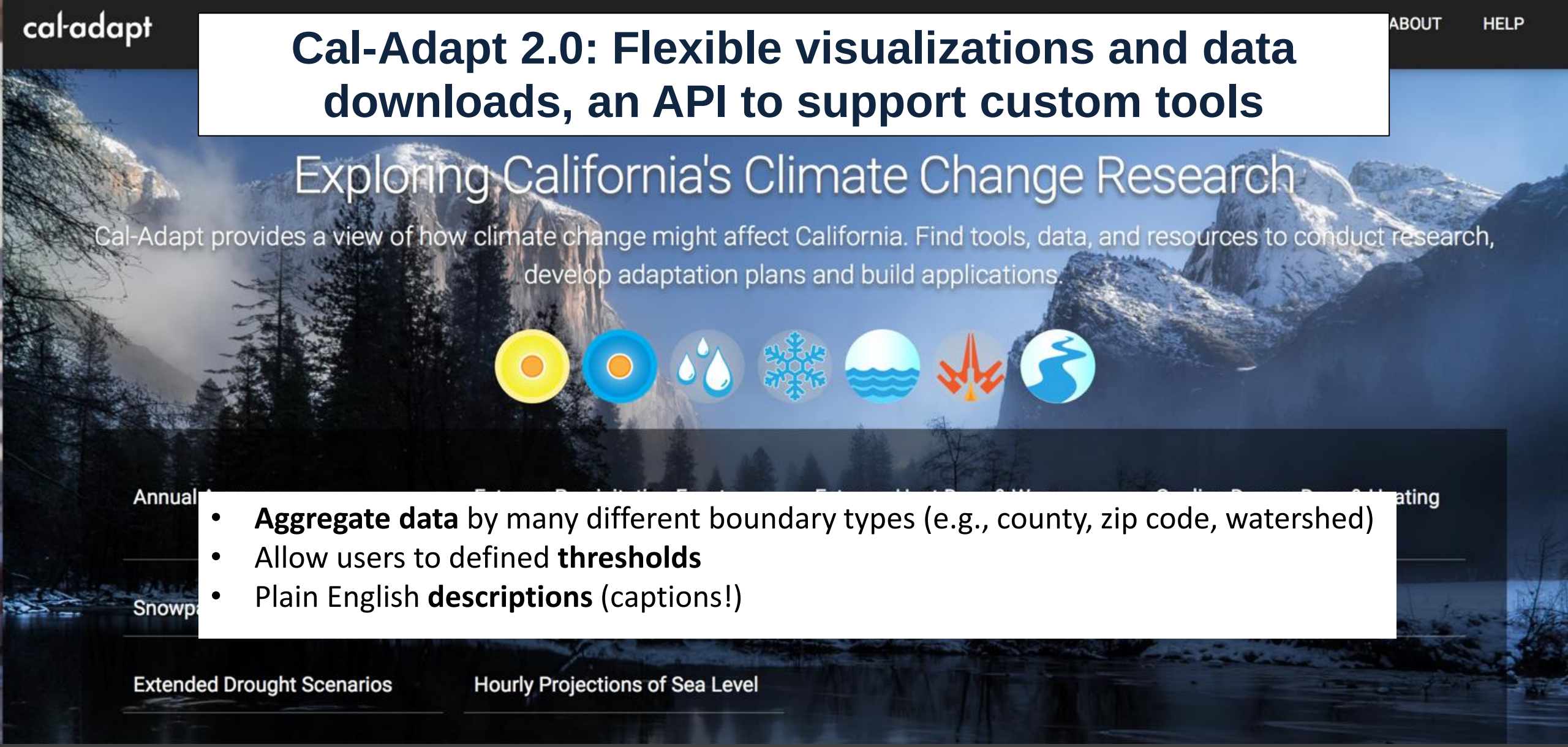
Video tour!

Tools for exploring temperature, snowpack, sea level rise, wildfire.

Access to primary data

* See, e.g., Santa Cruz Climate Adaptation Plan (2012), Sustainability Action Plan for Lake Tahoe (2012), Monterey Co. Hazard Mitigation Plan (2013).

Cal-Adapt 2.0: Flexible visualizations and data downloads, an API to support custom tools



- **Aggregate data** by many different boundary types (e.g., county, zip code, watershed)
- Allow users to defined **thresholds**
- Plain English **descriptions** (captions!)

New Tool

Data Download

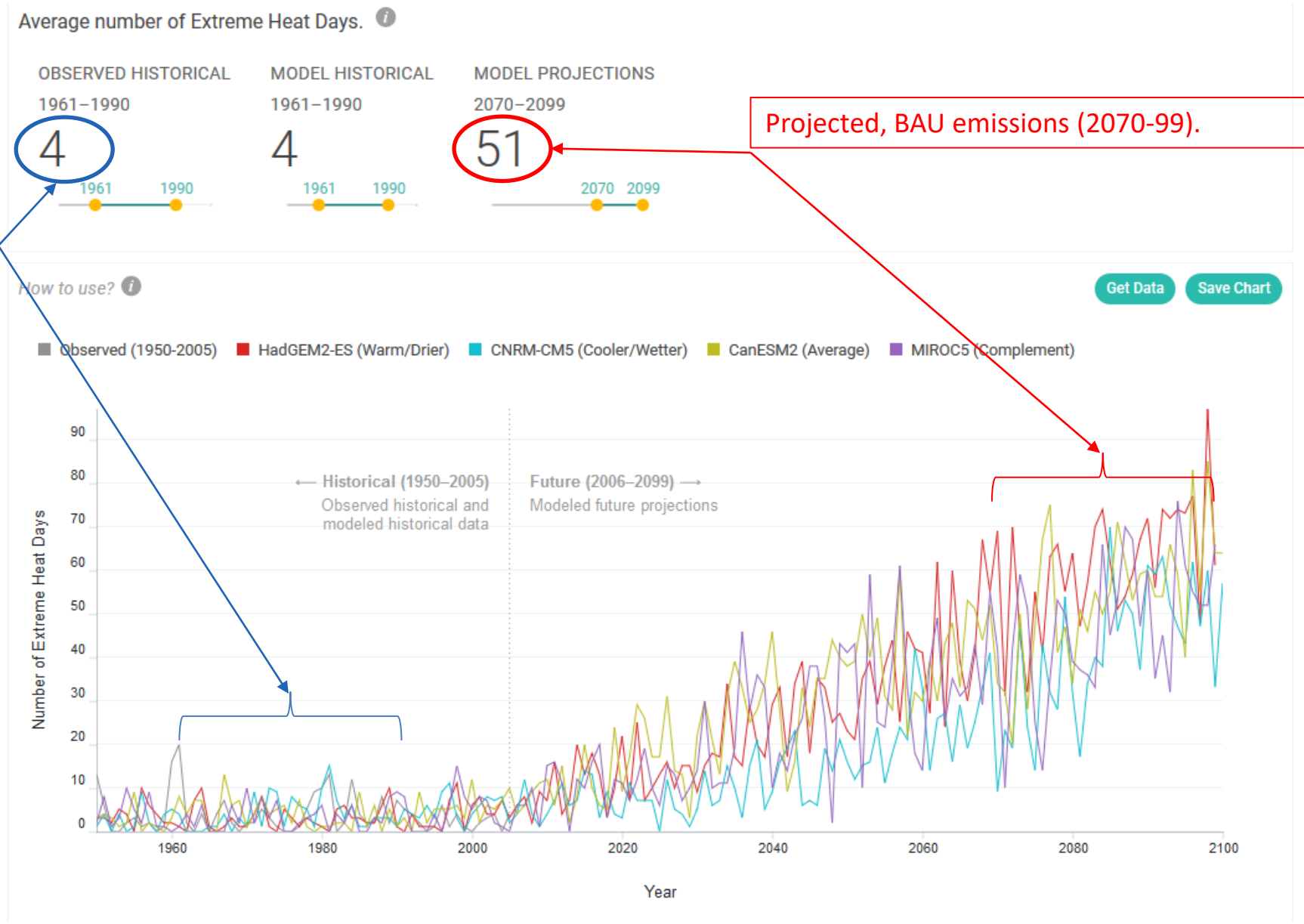
Search, select, subset, aggregate, and download climate data for a suite of projections

New Data

Wind Speed, Solar Radiation and Relative Humidity

LOCA downscaled data for daily wind speed, incoming solar radiation, minimum and

Projected annual number of extreme heat days in a Disadvantaged Community in Fresno



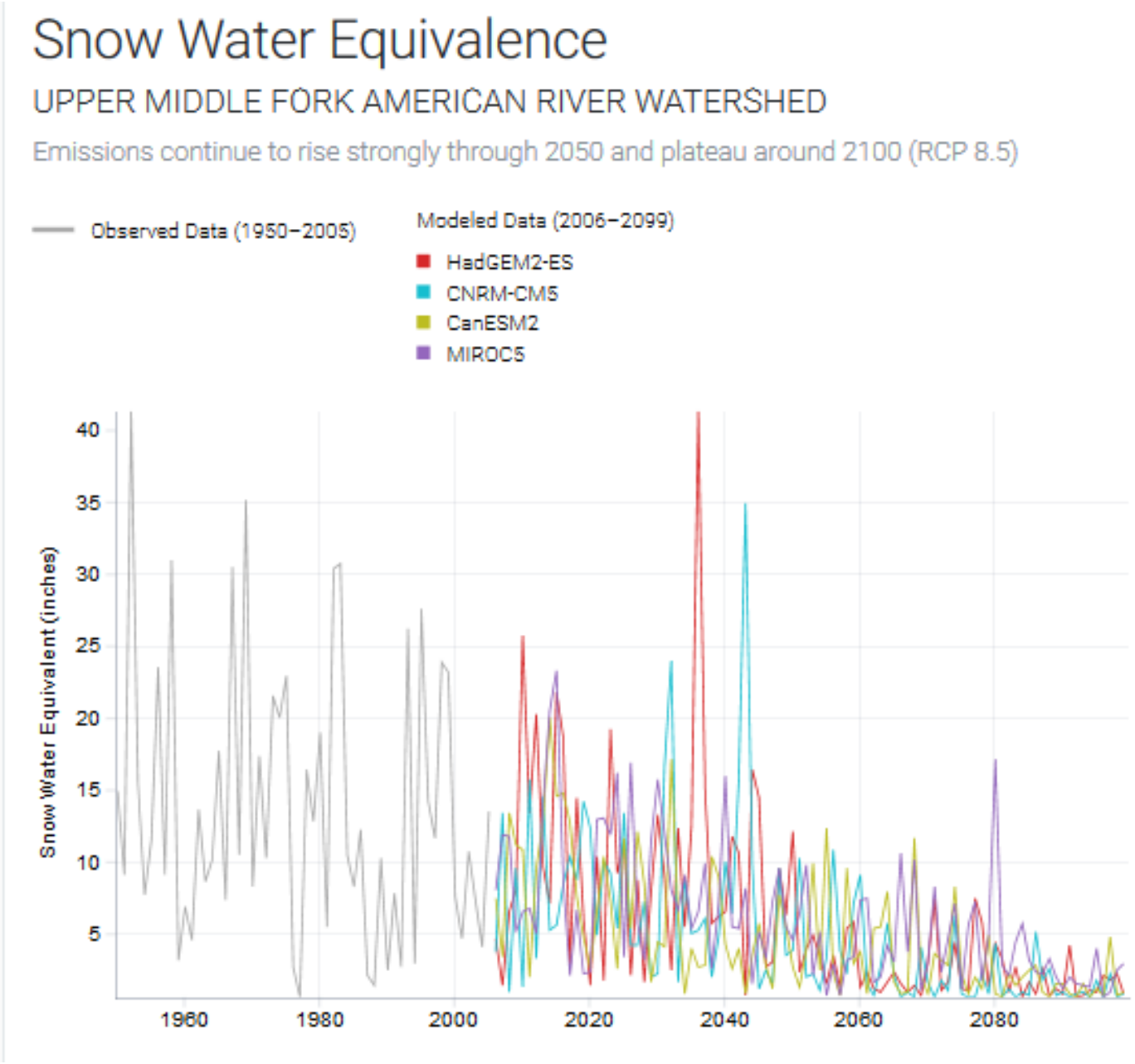
Historical (1961-1990)

Projected, BAU emissions (2070-99).

More than **10-fold increase in average annual number of very hot days** (*above 106.3 F*) in Fresno DAC.

Substantial Decline in End-of Century Snowpack: Upper Middle Fork of American River

Upper Middle Fork of American River Watershed: 75% to 93% decline in April snowpack by end of century (BAU scenario).



How has Cal-Adapt 2.0 been used?

Cal-Adapt has affected adaptation practice, policy, & planning in California.

- **Publicly available** and utilized by many stakeholders.
- **Recognized as a key resource** by legislation and guidance.
- **Supports climate policy** by providing a point-of-access for data adopted by the state.
- Provides a resource **used by government agencies**.
- **Investor-Owned Utilities** (IOUs) have used Cal-Adapt to support adaptation efforts (infrastructure design, siting).

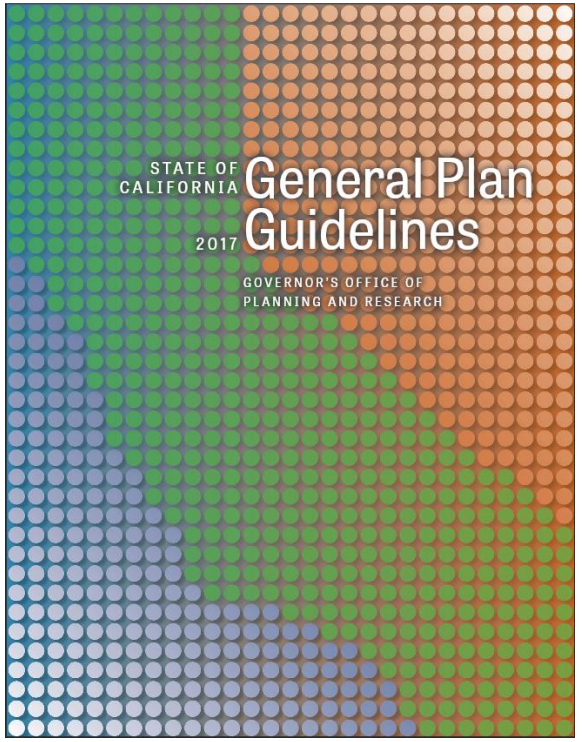


Figure: In 2017, California's Governor's Office of Planning and Research released updated General Planning Guidelines. Section 65302(g)(4) directs local governments to Cal-Adapt.

* Thomas, N., Mukhtyar, S., Galey, B., Kelly, M. (2018). (UC Berkeley). *Cal-Adapt: Linking Climate Science with Energy Sector Resilience and Practitioner Need*. California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CCCA4-CEC-2018-015.

Cal-Adapt as a Cornerstone of Energy Resilience Planning in California

CPUC's Decision on Phase 1 of Adaptation Rulemaking, issued Nov. 1, 2019*:

- Defines climate change adaptation for energy utilities in the state.
- Anchors acceptable data to California's Climate Change Assessments process, acknowledging the role of state in selecting recommended scenarios.
- Directs IOUs to Cal-Adapt as a source of data.
- Establishes criteria for acceptability of additional data or models.

Also sets expectations of climate data:

- "*Climate data should provide the geographical and temporal resolution required for the research or planning at hand.*" (p. 54)

* Decision 19-10-054, Rulemaking 18-04-019, Decision on Phase 1 Topics 1 and 2.
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M319/K075/319075453.PDF

Transitioning to a Zero-Carbon Grid: Resilience Challenges and Opportunities

Challenges include:

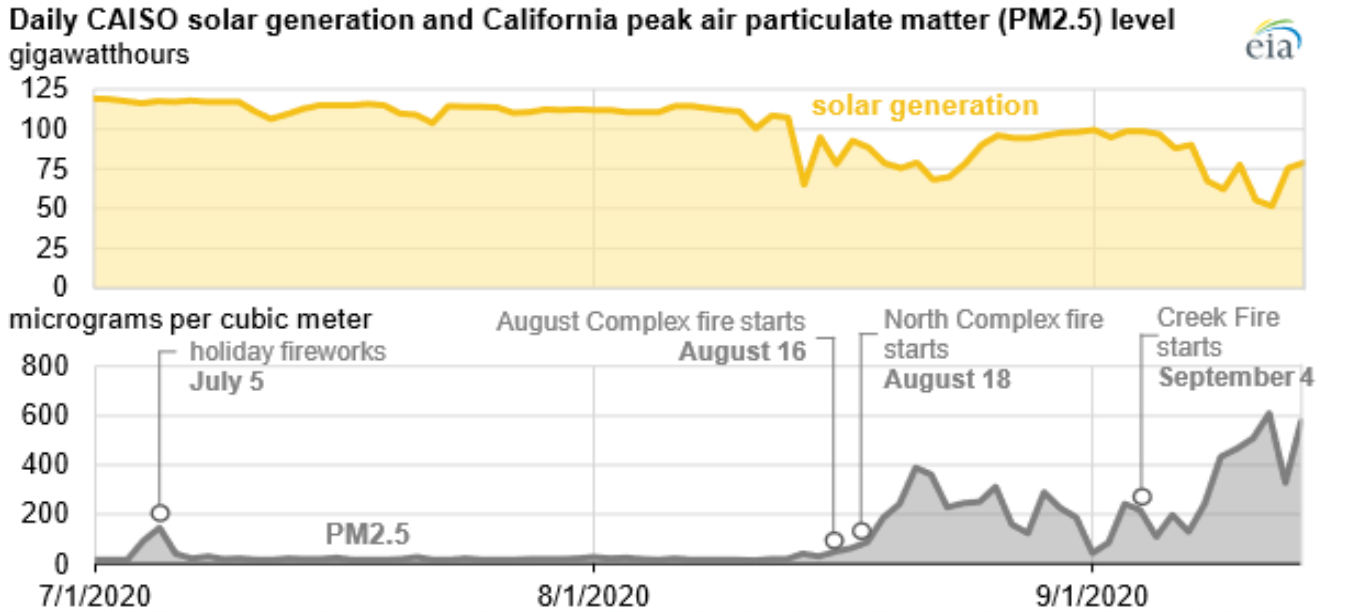
- Regional heat waves
- Attenuation of solar generation by smoke
- Wind “drought”
- Changing variability, timing, amount of hydroelectric resources
- Transforming data into actionable information that recognizes emerging relationships between climate, supply, and demand.

Opportunities:

- Incorporate resilience into grid in transition
- Prioritize investments in under-resourced communities

SEPTEMBER 30, 2020

Smoke from California wildfires decreases solar generation in CAISO



Source: U.S. Energy Information Administration, Hourly Electric Grid Monitor; California Air Resources Board, Air Quality and Meteorology System

Note: CAISO=California Independent System Operator.

CEC's Research Program Working to Address Critical Needs in Support of Energy Sector Resilience

Historical and projected data

- Higher-resolution data products (sub-daily, ca. 3 km by 3 km)
- Near real-time, quality-controlled historical data
- Open, transparent and reproducible data archive that provides a baseline reference product

Understanding and serving our stakeholders

- Vigorous, iterative stakeholder engagement (IOUs, CCAs, state agencies)
- Support for prioritization of resilience investments in Disadvantaged and Vulnerable Communities
- Guidance on selecting the right data and interpreting it
- Tractable set of recommended scenarios

Analytical support, including

- Computational resources and analytics to transform ~PB of data into model inputs, support for infrastructure investment and other decisions
- Probabilistic interpretations, including
  - Likelihood of extremes
  - Changing risks of compound events
  - Indicators of uncertainty, and how to deal with it

Key Elements of an Expanded Cal-Adapt Enterprise

Cal-Adapt.org
- Interactive, easy-to-use web application
- Designed for ~ 10 Tb data

Local governments and less technical users rely on an easy-to-use, interactive web application, the *front end*.

Next Generation Climate Projections
- Higher resolution
- Parameters of importance to a zero-carbon, high-renewable grid

Analytics Engine ***Analytics.Cal-Adapt.org (2022)***
- ~ 1 Pb data (*historical, near-real time, projected*)
- Analytics to transform climate and weather data into model inputs, decision support for infrastructure investment, etc.

Ongoing CEC-funded R&D efforts to develop next-generation projections and analytics engine to deliver data in stakeholder-informed ways. Responsive to IOU needs, CPUC's adaptation rulemaking.

See Docket Number: 19-ERDD-01, TN Number: 239123, "Follow-up on Staff Workshop Regarding Research to Support a Climate-Resilient Transition to a Clean Electricity System"
https://efiling.energy.ca.gov/GetDocument.aspx?tn=239123&DocumentContentId=72578

Invitation to Engage

Your Input Helps Shape Funding Opportunities and Resilience Research:

- Wednesday August 4th: EPIC 4 Investment Planning Workshop https://www.energy.ca.gov/event/workshop/2021-08/electric-program-investment-charge-2021-2025-investment-plan-scoping-draft
- September 27-28th (tentative): Workshop on Climate Data, Scenarios and Data Servicing for the Electricity Sector (hosted by Eagle Rock Analytics)
- Forthcoming solicitation ($3M): Research to Support a Climate-Resilient Transition to a Clean Electricity System https://www.energy.ca.gov/event/workshop/2021-03/staff-workshop-research-support-climate-resilient-transition-clean

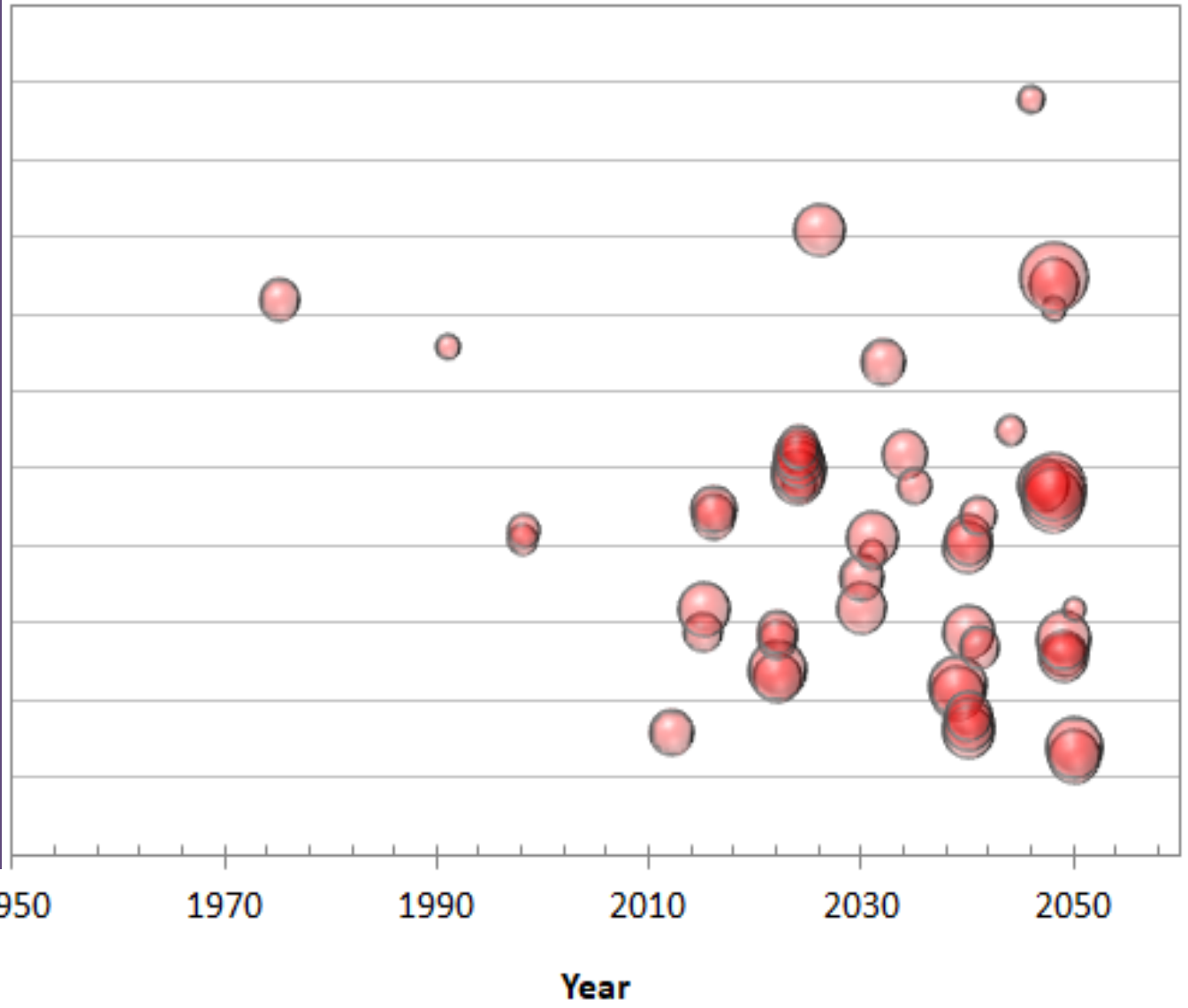
Questions? ***Susan Fischer Wilhelm,*** susan.wilhelm@energy.ca.gov, *916.776.0824*

Extras

Example: Statewide Heat Waves

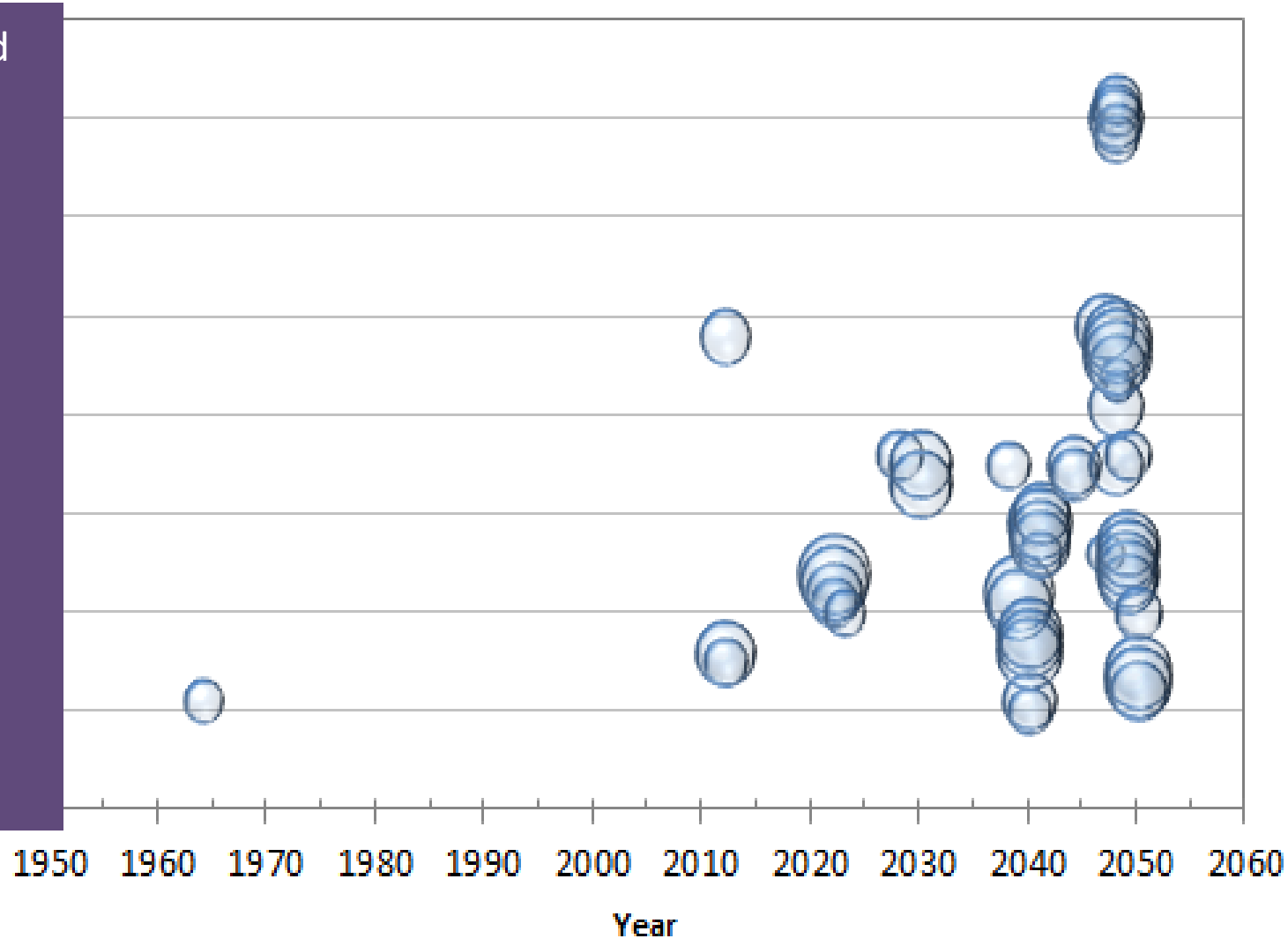
- Statewide heat waves arbitrarily defined here to occur when major cities in California **simultaneously** experience a daily maximum temperature exceeding the local historical 1 in 200-year threshold.

➢ Data source: Cal-Adapt (CANESM2, RCP8.5)



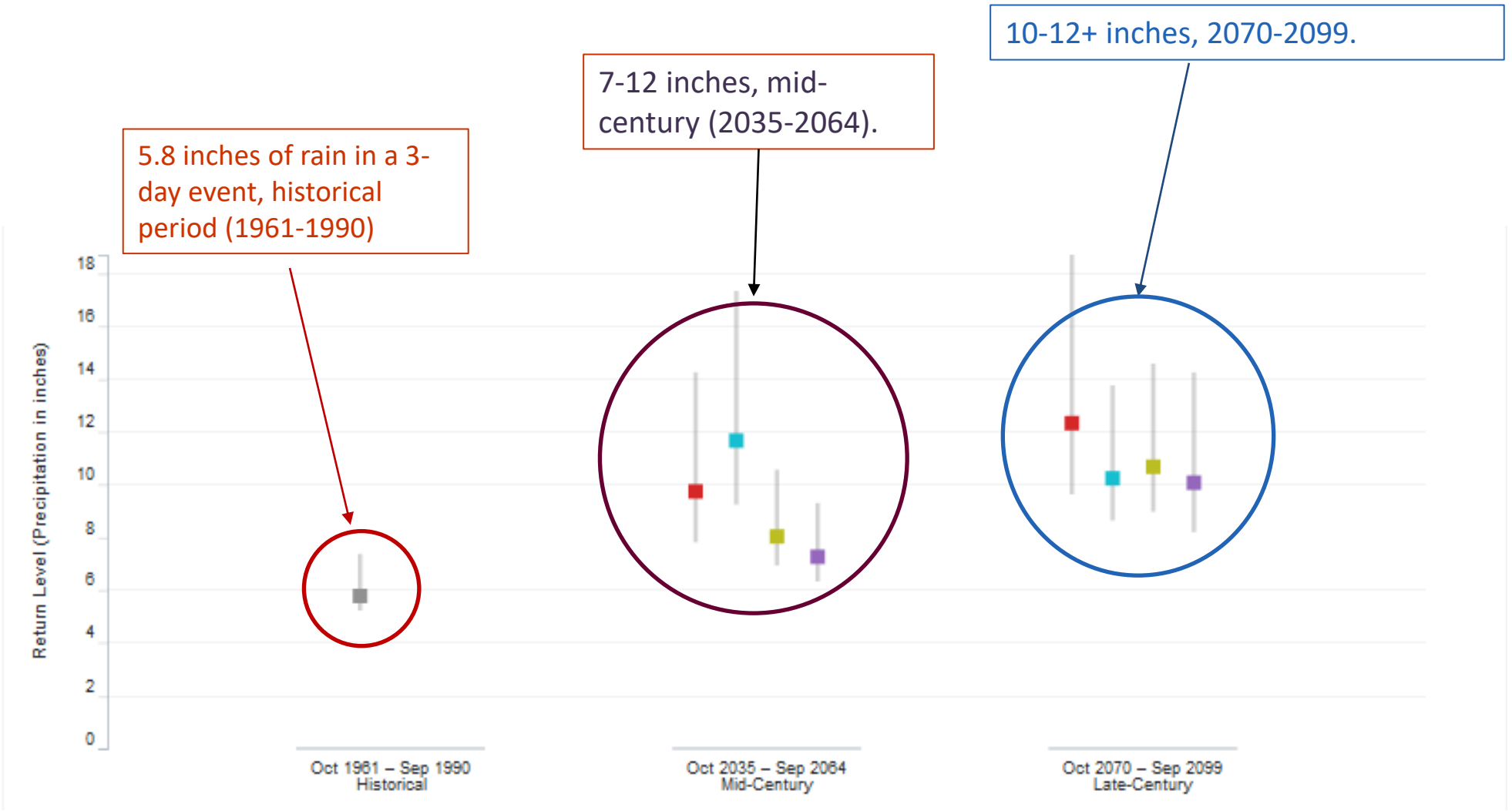
Example: Region-wide Heat Waves

- Region-wide heat waves arbitrarily defined here to occur when major cities in California, Arizona, Utah, and Nevada **simultaneously** experience a maximum daily temperature exceeding the local historical 1 in 50-year threshold.
  - Data source: Cal-Adapt (CANESM2, RCP8.5)



Projected doubling of rainfall in 3-day extreme precipitation event** in Eureka

*** Graph shows a "1-in-20" event, which has a 5% chance of happening each year*



Extreme precipitation tool represents uncertainty by calculating 95% confidence intervals (gray bars).

Examples of energy-related applications for available or forthcoming research products

- **Consideration of hourly solar and wind generation** profiles (e.g., SB 100 resource assessment and reliability analysis)
  - 11 years available now (EPC-16-063)
  - More available in April/October 2022 (EPC-20-006)
- **Support for demand forecasting** through publicly available, documented, peer-reviewed historical hourly temperature data at 39 weather stations throughout state
  - Data available on Cal-Adapt
  - All stations available from 1973 onward (some much earlier)
- Providing support for **understanding and planning for climate extremes**
  - Characterization of “cold” events to support natural gas reliability planning
  - Observed temperature extremes at weather stations contextualized in terms of past 30 years’ climatology
  - Characterization of regional extreme heat waves, based on historical data and climate projections
  - Anticipated evaluation of interactions between wildfire smoke, solar generation, and heat events

Breakout Sessions: Engaging Local Communities in Resilience

Session 1: The Role of Stakeholder Processes

Speaker:
Michelle Gransee, Director, Minnesota State Energy Office
Moderator:
Marion Gold, Senior Advisor, Electricity, NASEO

Session 2: A View of Municipal Electric Utilities and Rural Electric Cooperatives

Speaker:
Debra Smith, General Manager and Chief Executive Officer, Seattle City Light
Moderator:
Ruchi Sadhir, Associate Director, Strategic Engagement and Development, Tribal Liaison, Oregon Department of energy

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Break

2:45-3:00 PM ET

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Clean Energy Transition's Impact on Resilience

Speakers:
Krystal Laymon, Deputy Director for Climate Resilience, Council on Environmental Quality
Stephen Walls, Energy Transition Initiative Program Lead, U.S. Department of Energy
Aidan Tuohy, Program Manager, Electric Power Research Institute

Moderator:
Kirsten Verclas, Senior Program Director, Electricity, NASEO

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ENERGY TRANSITIONS INITIATIVE
U.S. Department of Energy

Partnership Project

Resilience in ETI and ETIPP

Presenter: Stephen Walls

August 3 2021

OFFICE OF STRATEGIC PROGRAMS | SOLAR ENERGY TECHNOLOGIES OFFICE
WATER POWER TECHNOLOGIES OFFICE | OFFICE OF ELECTRICITY

Vulnerable communities, unique challenges

Many r**emote, island, and islanded communities** seek to transform their energy systems and shore up their vulnerabilities

Remote

Flooding and erosion pose imminent threats to critical infrastructure in 30+ Alaska villages

Island

Maine islanders face electric bills 4X national average due to aging infrastructure, few scalable options

Islanded

The coastal-Washington Tahola village (Quinault Indian Nation) re-located due to climate change and natural disaster vulnerabilities.

Overcoming these challenges and reducing risk requires **ramping up resilience**—often with **limited resources and capacity**.

Create & Sustain Clean Energy Leadership

- **Champions of clean energy economy**
  - Leverage long-standing partnerships Hawaii, USVI, et al.
  - Cultivate channel partners (RMI, ETIPP)
  - Solve novel technical and policy questions (Labs)

- **Community-wide engagement**
  - Promote equitable access to process & benefits
  - Recognize that projects FAIL without this engagement (e.g., RUS)
  - Distribute lessons learned

DOE & National Lab Analysis Capabilities

Fuels/Interdependencies
- LNG Infrastructure
- Telecom Infrastructure
- Solar Resource and Supply Curves

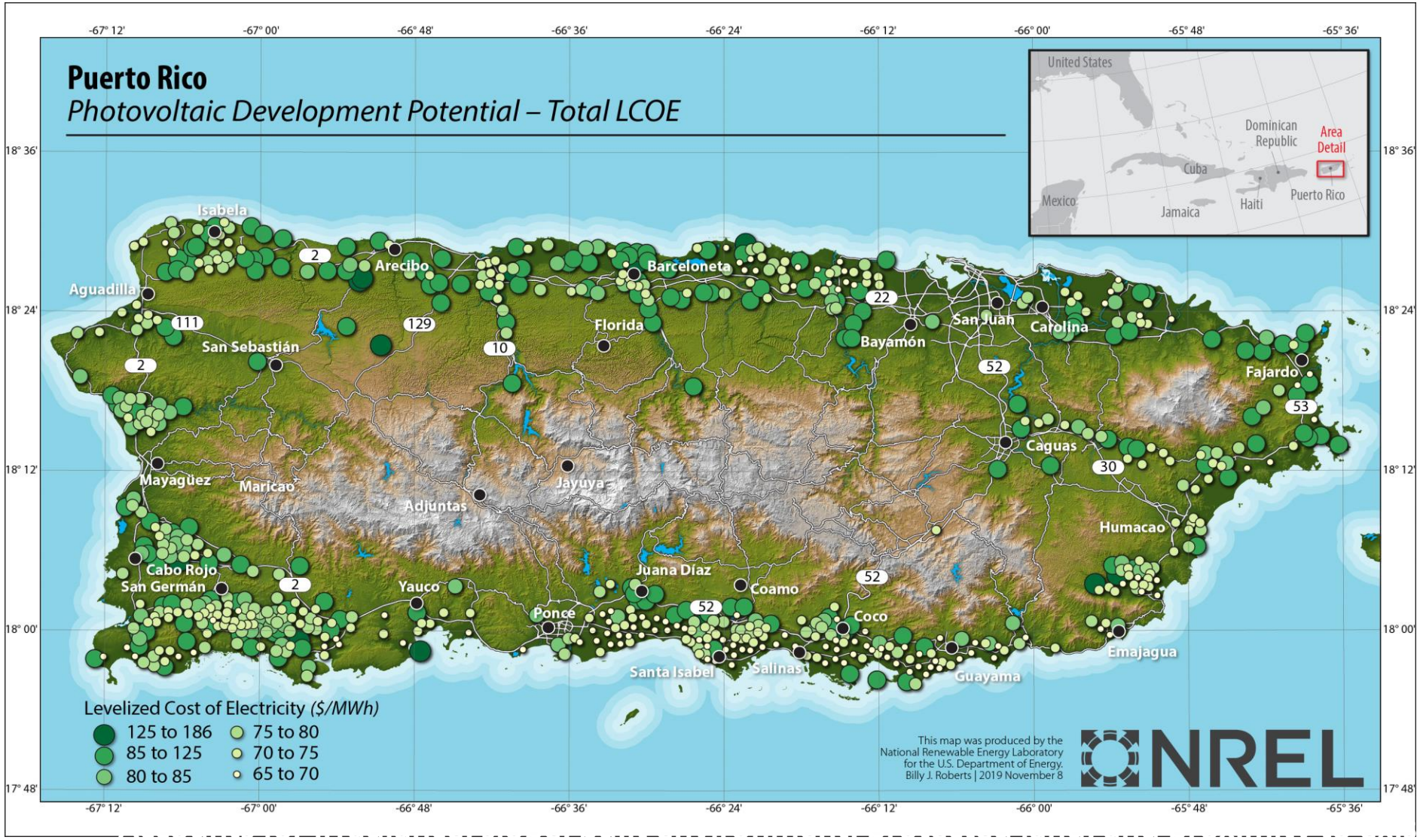
Bulk Power System
- Investment Support Tools
- Capacity Expansion Modeling (AURORA)
- Production Cost Modeling (FESTIV)
- System Stability Modeling (Epfast)
- Dynamic Modeling (MAFRIT)

Transmission
- Protection and R/T Info
- Risk-Based Contingency Analysis
- Grid Asset Benefit-Cost Evaluations

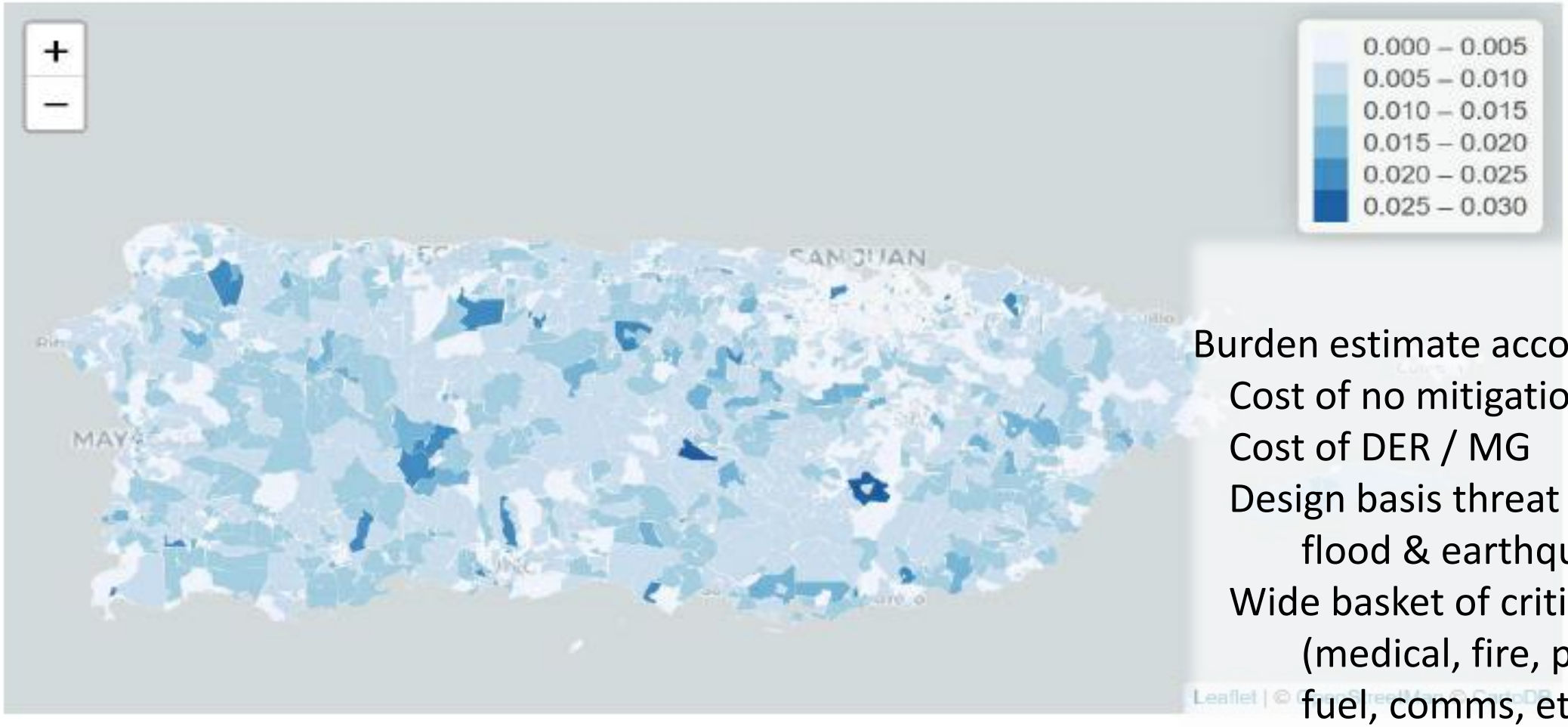
Distribution & Edge
- System Advisory Model & PVWatts
- DER Interconnection Standards
- DER Feeder Hosting Methodology
- GIS Resiliency Improvement Tool

Lead Lab Key:
- ANL
- NREL
- ORNL
- PNNL
- SNL

Example: Solar Development Potential



Burden to Access All Critical Services in one of the Cost-Effective Portfolios (SNL)

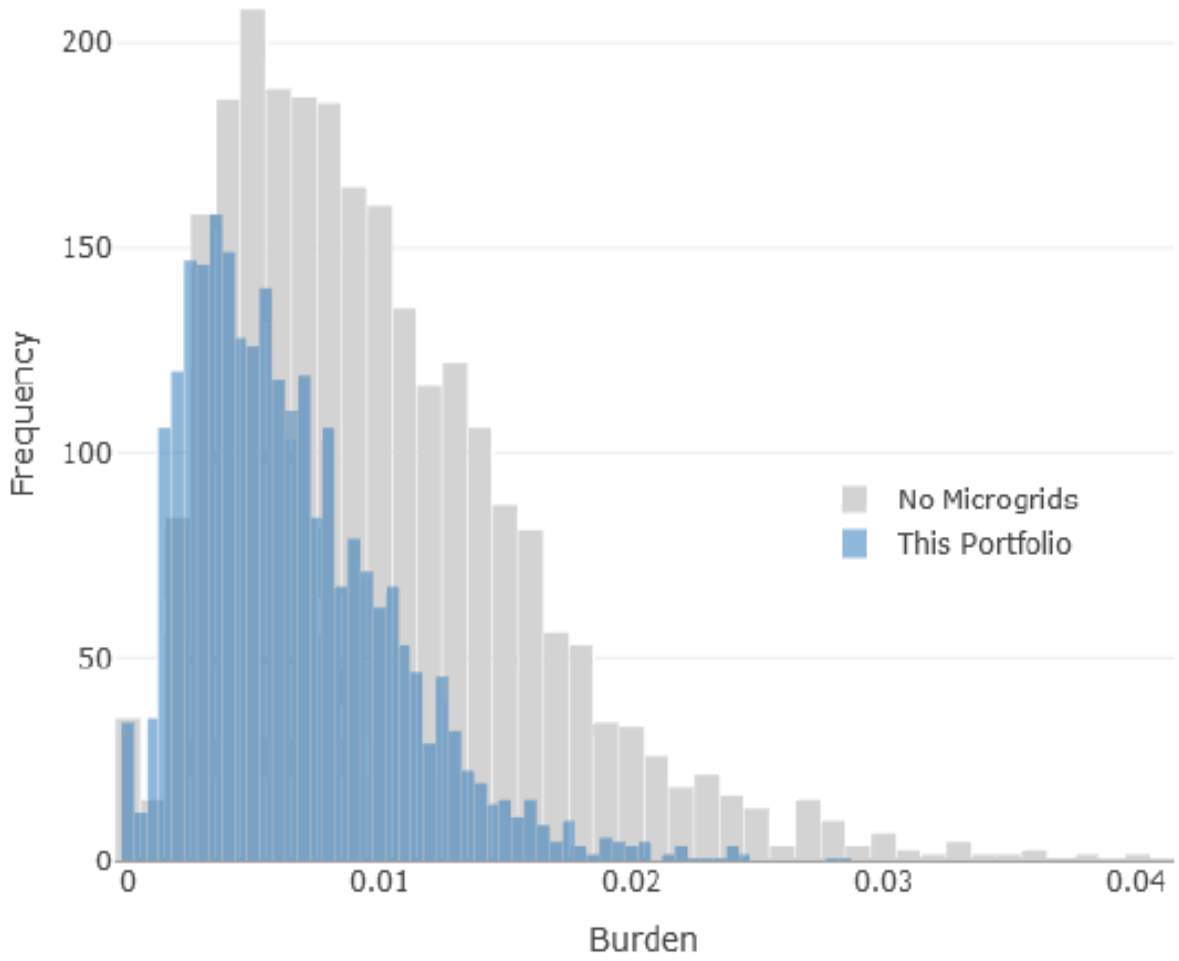


Burden estimate accounts for:

- Cost of no mitigation
- Cost of DER / MG
- Design basis threat of storm, flood & earthquake
- Wide basket of critical services (medical, fire, police, water, fuel, comms, etc.)

Microgrids Are Key Resilience Strategy (SNL)

- DER & MG portfolio docks the tail of event impacts
- Assures energy supply to life-saving/sustaining services
- 159 sites for ~$1100mn, hybrid NG/diesel & PV, BESS
- MG interconnection rules not established, can build from IEEE 2030.7
- NREL reviewed DER interconnection processes



Partnership Approach

Energy Transitions Initiative Partnership Project (ETIPP)

ETIPP provides **tailored, holistic, technology-neutral technical assistance, strategy, and solutions** based on ETI's proven framework

Community priorities

Remote, **island**, and **islanded** community energy and infrastructure **challenges, values,** and **goals**

+

Partnership approach

Deep energy-sector **experience**, **expertise** of the **national labs** + **local, trusted stakeholder organizations**

→

Energy assessment and planning

Provide **resources** and **on-the-ground support**

→

Resilient energy systems

Knowledge sharing → **lessons learned, use cases** → future application

High-impact, replicable energy transitions rapidly scalable to any geographic region or type of community

Partnership approach

Communities (8-12)
Unique challenges, values, goals

Regional Partners (5)

Local, trusted, community-based

- **Stakeholder engagement and outreach**
- Translate technical content
- Share learnings, support use-case development

National Labs (4)

Deep energy-sector experience, expertise

- **Technology-neutral technical assistance**
- Identify and advance strategic, tailored solutions
- Address challenges, build capacity, and accelerate sharing of best practices and innovations

U.S. DOE Offices (4)

Funding, support, expertise

- **Support energy assessment, planning, and operations** to achieve energy-resilient communities
- Foster **cross-technology collaboration**, planning, and solutions

Current ETIPP Communities

Designing Impactful Place-Based Work

4 Key Questions

1. How do place-based programs select places and subject matter, conceptually and in practice?
2. How do we align DOE mission and priorities with local need?
3. How do we efficiently coordinate inside HQ?
4. How can we improve the process of building a PB program?
    - Functions, mechanisms, program models, audiences

Thank you!

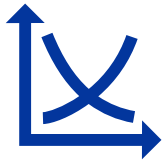
Pre-Requisites for a Reliable, Resilient Decarbonized Grid

New Grid Operation Capabilities

New protection, control, and other technologies to reliably and resiliently operate the grid

Revised Market Designs

Markets must incent investment and properly compensate resources for grid services provided



Grid Investment and Development

Adequate investment, supply chain, and workforce to develop extensive new supply, demand, and T&D resources

Efficient Regulation and Collaboration

Faster timelines for siting, permitting, and building new infrastructure and developing and deploying new technology

Integrated Planning for Reliability and Resiliency

Tools and processes for regional investment plans across electric and other energy systems in context of changing climate and other hazards

Resource Adequacy as the Grid Evolves

Role: 2X Electricity Share of Final Energy

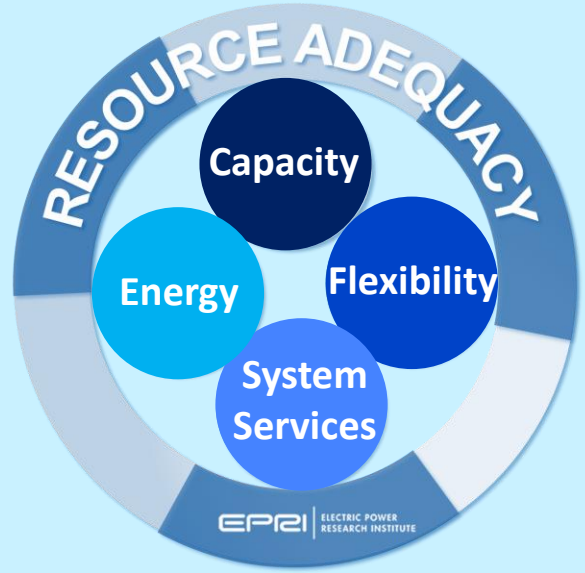
A greater portion of societal needs will be dependent on the reliable supply of electricity.

Challenge: Evolving Grid and Hazards

The resource mix will have significantly different performance characteristics and the grid must adapt.

Opportunity: Resilient Energy Supplier

Meeting customer expectations for reliable energy supply will build trust and create new opportunities.



Resource Adequacy is the ability to meet customer energy needs at a targeted risk level considering planned and unplanned outages.

Resource Adequacy processes and tools must evolve.

Breakout Sessions

Session 1: The Role of Electricity Markets in Regional Planning and Achieving Climate Goals

Speaker:

Evelyn Robinson, Managing Partner- State Government Affairs, PJM Interconnection

Moderator:

Jennifer Richardson, Executive Director, Indiana Office of Energy Development

Session 2: Integrating Resilience for Mission-Critical Facilities and Defense Critical Electric Infrastructure

Speaker:

Jonathon Monken, Principal, Converge Strategies

Moderator:

Commissioner Andrew McAllister, California Energy Commission

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Key Takeaways and Closing Remarks

4:30 PM ET

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Preview of Tomorrow's Agenda

- 1:00 to 1:05 PM ET – Welcome, Introductions, and Overview of Day 4
- 1:05 to 1:45 PM ET – How to Prioritize Resilience Projects
- 1:45-2:30 PM ET – Understanding and Accessing Federal Funding Opportunities
- 2:30-3:15 PM ET- Breakout Sessions: State Case Studies on Opportunities to Leverage the U.S. State Energy Program (SEP) in Resilience Planning
- 3:15-3:30 PM ET – Break
- 3:30 to 4:30 PM ET – Leveraging Public-Private Partnerships (P3s) and State Funding and Financing Mechanisms for Resilience
- 4:30 PM ET – Key Takeaways and Closing Remarks

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End of Day 3

Thank you!

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