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ITEM 5

CEC staff presents EPIC 4 proposed initiatives

EPIC 2021-2025 Investments in California's Energy Future

DACAG Meeting | EPIC 4 Investment Plan

October 15, 2021

CEC Energy Research and Development Division Staff

DACAG EPIC 4 Engagement Overview

CEC Staff met with DACAG EPIC Working Group August 19 & September 20, 2021

Actions we are taking:

- Applying the DACAG Equity Framework across all initiatives
- Generating EPIC 4 Equity Matrix with expected equity outcomes
- Incorporating feedback into the plan

A few key points:

- Continue to prioritize underresourced communities
- Enhance diversity, equity, and inclusion within the entrepreneurial ecosystem
- Support partnerships for innovation among technology developers and underresourced communities (i.e., Empower Innovation “Places”)

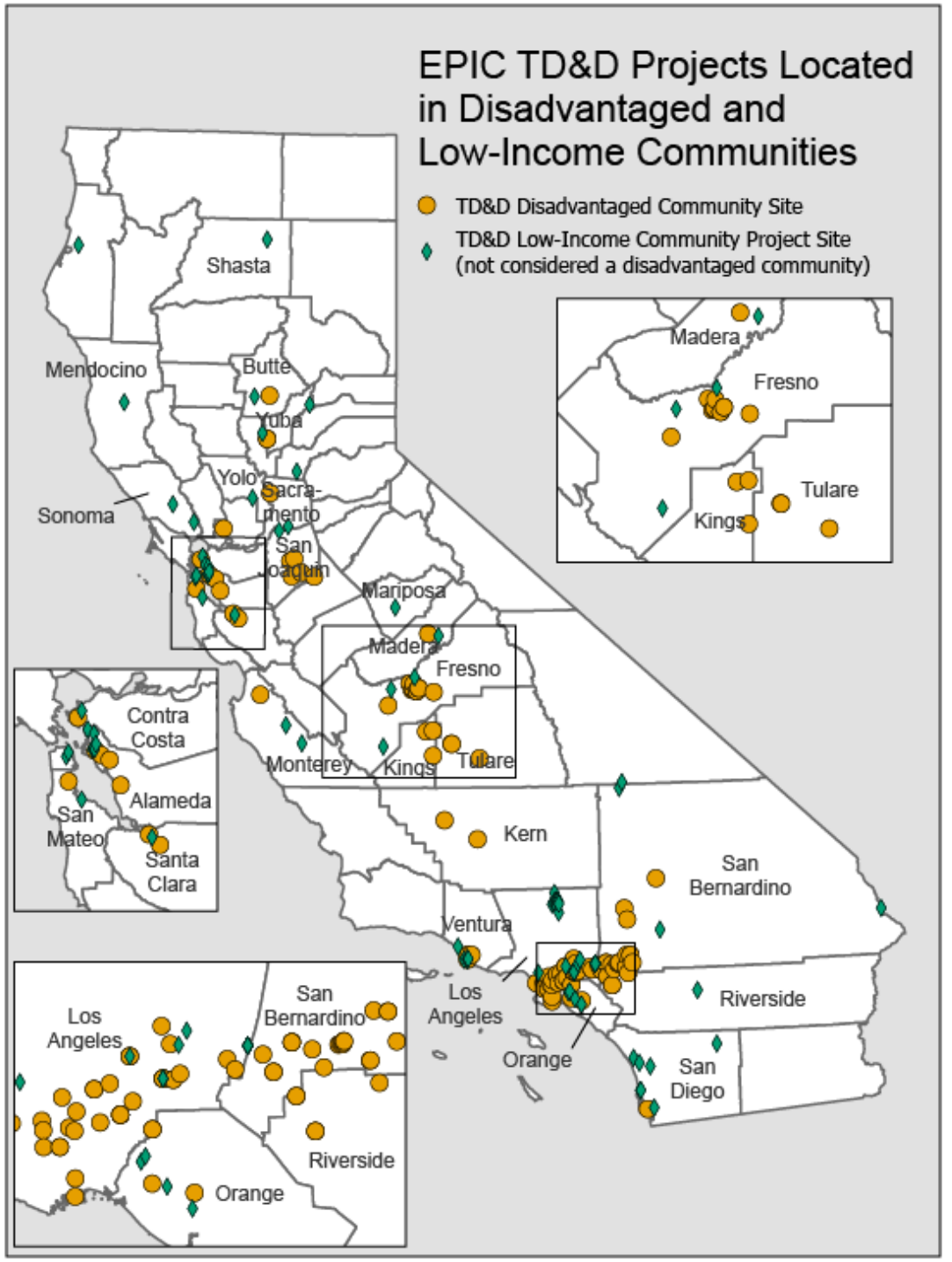
EPIC 4 Equity Matrix Underway

Table 2: EPIC 4 Equity Matrix

#	R&D Topic	Health and Safety	Access and Education	Financial Benefits	Economic Development
1	Floating Offshore Wind Energy Technologies	✓	✓	✓	✓
2	Advancing Geothermal Energy and Mineral Recovery Technologies	✓	✓	✓	✓
3	Emerging Solar Energy Technologies	✓	✓	✓	✓
4	Short Duration Energy Storage Technology Demonstrations to Support Grid Reliability	✓	✓	✓	✓

Investing Equitably in Technology Demonstration & Deployment

- 68% in underresourced communities
- Geographic diversity
- Must bring tangible benefits to the community
- Meaningful engagement of community members
- Seeking additional strategies



Proposed EPIC 4 Investment Plan Overview: Strategic Initiatives

CEC ERDD Office Managers: Virginia Lew, Mike Petouhoff, Jonah Steinbuck, Erik Stokes

EPIC 4 Strategic Initiatives:

Accelerate Advancements in Renewable Generation Technologies

Create a More Nimble Grid to Maintain Reliability as California Transitions to 100 Percent Clean Energy

Increase the Value Proposition of Distributed Energy Resources to Customers and the Grid

Improve the Customer Value Proposition of End-use Efficiency and Electrification Technologies

Enable Successful Clean Energy Entrepreneurship Across California

Inform California's Transition to an Equitable, Zero-Carbon Energy System that is Climate Resilient and Meets Environmental Goals

Strategic Initiative: *Accelerate Advancements in Renewable Generation Technologies*

1. Floating Offshore Wind Energy Technologies
2. Advancing Geothermal Energy and Mineral Recovery Technologies
3. Emerging Solar Energy Technologies

(Highlighted topics will be described as illustrative examples. Descriptions for the remaining topics are given in the EPIC 4 Plan Summary document [https://efiling.energy.ca.gov/getdocument.aspx?tn=239994].)

Advancing Geothermal Energy and Mineral Recovery Technologies (#2)

Innovations

- Advance geothermal drilling technologies, well targeting, flexible operations, and address corrosion and scaling
- Demonstrate lithium recovery technologies and processes

Goals

- Lower cost
- Reduce technical and financial risk
- Advance in-state lithium

Geothermal plants near the Salton Sea (source: Land Use Database)

Strategic Initiative: *Create a More Nimble Grid to Maintain Reliability as CA Transitions to 100% Clean Energy*

4. Short Duration Energy Storage Technology Demonstrations
5. Long Duration Energy Storage Technology Demonstrations to Support Grid Reliability
6. Energy Storage Use Case Demonstrations to Support Grid Reliability
7. Green Hydrogen (H2) Roadmap Follow-up and Implementation
8. Infrastructure, Market Analysis, & Demonstrations to Support Firm Zero-Carbon Firm Dispatchable (ZCFD) Resources
9. Advancing Clean, Dispatchable Generation
10. Technology Demonstrations to Address Grid Congestion Resulting from 3X Generation Growth on the Path to a Decarbonized California
11. Demonstrate Technologies to Maintain Reliability and Power Quality (PQ) in the Inverter-Centric Grid of the Future Associated with High Levels of Renewable Penetration
12. Furthering Cybersecurity with Highly Modulatable Grid Resources

Energy Storage Demonstrations to Support Grid Reliability: Short & Long Duration Tech, Use Cases (#4-6)

Innovations

- **Short** Duration Storage Technologies
- **Long** Duration Energy Storage Technologies and comparison framework to ZCFD
- Energy Storage **Use Cases**

Goals

- Meet SB 100 projections for 8X storage increase with least cost and optimal performance
- Short duration: improve depth of discharge, degradation, thermal runaway & supply-chain diversity
- Long duration: minimize cost and environmental impact

Strategic Initiative: *Increase the Value Proposition of Distributed Energy Resources to Customers and the Grid*

13. Improving Forecasts of Behind-the-Meter Solar Storage, and Load Flexibility Resources
14. Direct Current Systems for Efficient Power Delivery
15. Behind-the-Meter Renewable Back-up Power Technologies
16. Design-Build Competition
17. Efficient Transportation Electrification and Charging Technologies
18. Technology Enablers for Using Electric Vehicles as Distributed Energy Resources
19. Integrating Distributed Energy Resources for Grid-Supportive Vehicle Charging
20. Lithium-ion Battery Reuse and Recycling Technologies
21. Enabling Grid Resilience with Load Flexibility in the Industrial, Agriculture and Water (IAW) Sectors
22. Virtual Power Plants with Autonomous and Predictive Controls
23. Increasing Reliability and Interoperability of Load Flexible Technologies

Design-Build Competition (#16)

Innovations

- Design and build a mixed-use development that is affordable, equitable, resilient, grid-interactive and emission-free.
- Bring together key stakeholders including communities, architects and technology developers to reimagine building design and construction.
- Enable building and community stakeholders to pursue advanced technologies and practices to realize their shared vision.
- Unlock the full value proposition of emerging energy technologies through new design, engagement and construction practices.

Goals

- Showcase new models for mixed-use development to support California energy and affordable housing policy goals.
- Demonstrate technical pathways for grid-interactive, zero-emission buildings in the mixed-use building sector.
- Facilitate adoption of advanced technologies and practices by the building industry as standard offerings and practices.

Strategic Initiative: *Improve the Customer Value Proposition of End-use Efficiency and Electrification Technologies*

Industrial Decarbonization

25. Low-Carbon / High-Temperature Industrial Heating
26. Energy Efficiency and Decarbonization of Concrete Manufacturing
27. Energy-Efficient Separation Processes

Building Decarbonization

24. Building Electrification Technology Prize Competition
28. High Efficiency and Low-GWP Heat Pump Water Heaters and HVAC Heat Pumps
29. Innovative Solutions for Improving the Value Proposition for Building Envelope Upgrades
30. Combination Heat Pump for Domestic Hot Water & Space Conditioning
31. Nano-Grid HVAC Module Development and Demonstration
32. Demonstrate Smart Energy Management Systems to Accelerate Electrification of Homes at a Reduced Cost. Energy Management Systems (SEMS) for Homes
33. HVAC Decarbonization for Large Buildings

Source: US DOE, IEPR Presentation

High Efficiency & Low Global Warming Potential (GWP) Heat Pump Water Heaters (HPWH) and HVAC Heat Pumps (#28)

Innovation

- Design and develop energy efficient 120 and 240V heat pumps

Goals

- Use low-GWP refrigerants
- Reduce refrigerant leakage
- Operate at high efficiency
- Have life and maintenance like existing heat pumps
- Be cost-competitive

High Efficiency Heat Pump
Source: From DOE-IEPR Presentation

Strategic Initiative: *Enable Successful Clean Energy Entrepreneurship Across California*

34. Activating Innovation and Expanding California's Clean Energy Entrepreneurial Talent Pool*
35. CalSEED
36. Provide Support for Entrepreneurs to Test, Verify, and Validate Their Innovations
37. Bringing Rapid Innovation Development to Green Energy (BRIDGE)
38. Realizing Accelerated Manufacturing and Production for Clean Energy Technologies (RAMP)
39. Mobilizing Significant Private Capital for Scaling Clean Energy Technologies*
40. Supporting Advanced Battery Scale-up in California*
41. Cost Share for Private, Non-Profit Foundation, or Federal Clean Energy Funding Opportunities
42. Outreach and Events

* New additions to the CEC's Entrepreneurial Ecosystem

Activating Innovation and Expanding California's Clean Energy Entrepreneurial Talent Pool (#34)

Innovation

- New incubator program to attract entrepreneurial talent, particularly from diverse and under-resourced backgrounds
- Match talent with IP developed at research institutions that is ready to be commercialized
- Assist in negotiating licensing agreement and other initial business setup

Goals:

- Lower entry barriers to clean energy entrepreneurship
- Increase the commercialization of IP from research institutions
- Broaden and expand clean energy entrepreneurship

Strategic Initiative: *Inform California's Transition to an Equitable, Zero-Carbon Energy System that is Climate Resilient and Meets Environmental Goals*

43. Evaluating Air Quality, Health, and Equity in Clean Energy Solutions

44. Integrating Climate Resilience in Electricity System Planning

45. Advancing the Environmental Sustainability of Energy Deployments

Evaluating Air Quality, Health, and Equity in Clean Energy Solutions (#43)

Innovations

- Examine air quality, health, and equity in clean energy strategies and demonstrations
- Develop tools, metrics, data for integrating health and equity in energy policy

Goals

- Enable prioritization of equity
- Maximize air quality and health benefits
- Promote affordability of solutions

Poor outdoor air quality (source: Sacramento Bee)

Measuring indoor air quality (source: LBNL)

Questions for Comment

- What is your top-priority initiative where you believe the most funding and emphasis should be placed because it could have the most significant impact (and why)?
- Are there any gaps in the proposed research?
- Do you have suggestions on changes to certain initiatives?
- What are your suggestions to promote equity (and to which initiatives should they apply)?