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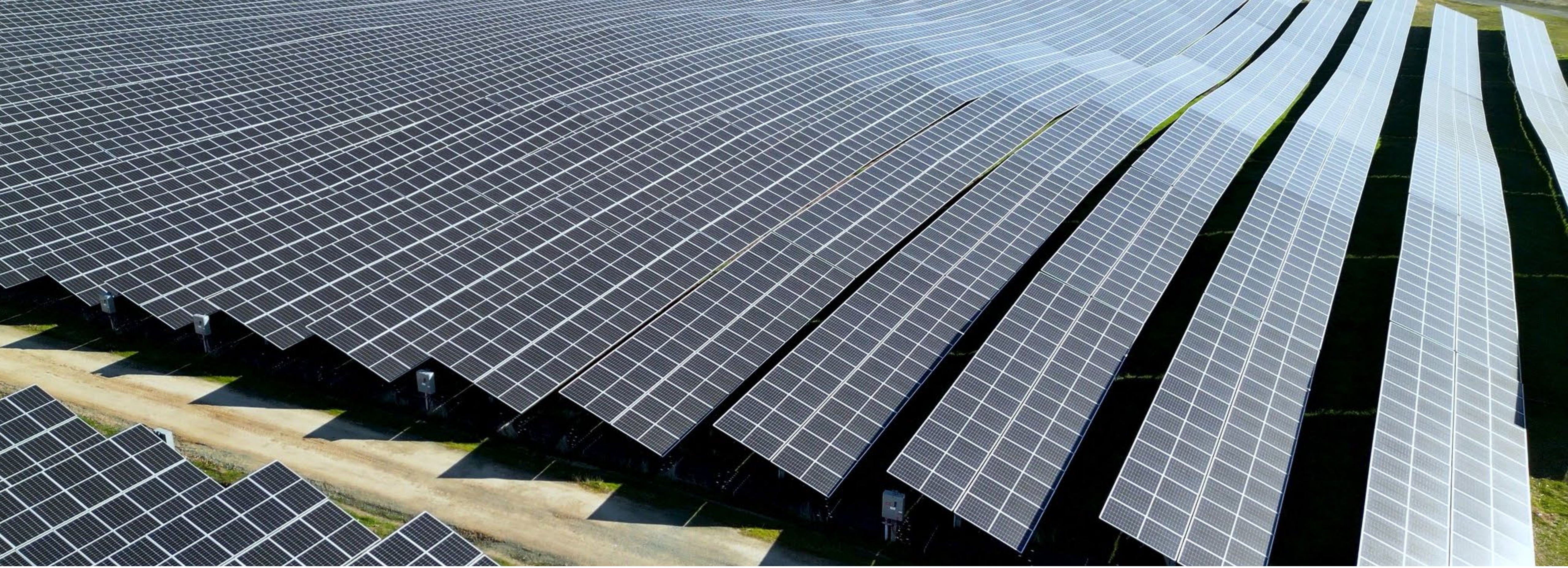


EPIC 5 CEC Draft Initiatives and Research Topics

June 11, 2026

Housekeeping

- This workshop will be recorded and posted to the CEC website: https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5
- Attendees will be muted during the presentation, will have an opportunity to ask questions and provide feedback throughout the workshop
- Submit written comments and feedback by **June 18, 2026**: https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=25-EPIC-01

Agenda

- EPIC Background and Workshop Goals
- Overview of Draft CEC EPIC 5 Initiatives and Research Topics
    - Transportation Electrification
    - DER Integration
    - Building Decarbonization
    - Getting to 100% Net Zero Carbon and the Coordinated Role of Gas
    - Climate Adaptation
- Question and feedback opportunity after each initiative presentation
- Question and feedback at the end of the workshop

EPIC Program Background

$185 million annual budget

Supports the development of new, emerging, and pre-commercialized clean energy innovations in California.

Provide benefits in the form of equitable access to safe, equitable, affordable, reliable, environmentally sustainable energy for electricity ratepayers.

Funds projects in three areas: Applied Research and Development, Technology Demonstration and Deployment, and Market Facilitation.

Administered by the CEC (80% funding) and Investor-Owned Utilities (20% funding).

EPIC 5 Development Process

Strategic Goals
- Critical Pathways

Clear and measurable goals for developing EPIC portfolios to be used in program evaluations to measure impacts of EPIC investments in supporting achievement of California's 2045 climate, energy, and equity targets.

Set of critical actions necessary to support meeting the State's 2045 energy, climate, and equity goals via the most effective strategies and technology innovation.

Strategic Objectives
- Key Gaps
- Unique Roles
- Cross-cutting Principles

Strategic Objectives are clear, measurable, and robust targets to guide EPIC investment plan strategies to scale and deploy innovation to align with EPIC's Strategic Goals.

Address the key gaps in critical pathways to achieving California's climate goals.

Focus on the unique role ratepayer funded research, development, and demonstration (RD&D) can play in leading innovation investment.

Consider important crosscutting principles identified in Commission decisions.

Administrator Initiatives
- Research Topic Areas
- Projects

Strategic Initiatives are Investment Plan strategies to accomplish Strategic Objectives.

Uniform metrics, assumptions, and methodologies will measure EPIC project and portfolio performance.

EPIC 5 Strategic Goals

Transportation Electrification

DER Integration

Building Decarbonization

Getting to 100% Net-Zero Carbon and the Coordinated Role of Gas

Climate Adaptation

EPIC 5 Strategic Objectives

1. Reducing Medium and Heavy-Duty Vehicle Charging Infrastructure Costs
2. Overcoming Barriers to EV Benefits in DVCs
3. Smart Planning Tools for New Load and Clean Resources
4. Reducing Cost of Whole Home Electrification
5. Innovative Approaches for Difficult-to-Decarbonize Sectors
6. Community-Scale Decarbonization
7. Impacts Research for New Generation and Storage
8. Increase Predictability of Weather Impact on, Intermittent Resources, Climate Risks, and Load
9. Leveraging DERs for Grid and Community Resiliency
10. Expediting and Streamlining Interconnection and Energization Processes
11. Providing Data Input into a Value of DER Framework
12. Optimizing Feeder / Circuit Operations
13. Cost-Effective Grid Hardening for Long-Term Climate Impacts

CEC Program Administration

Initiative & Budget Plan Development → Solicitation Scoping → Solicitation Development and Competitive Grant Funding Opportunities → Projects/Awards

Research Planning and Design

- Engage and consult with California Native American tribes
- Engage with Environmental Social Justice Groups
- Solicit feedback from the Disadvantaged Communities Advisory Group (DACAG)

Implementation

- Work to improve application and grant management process to relieve administrative burdens
- Provide preference points to grant applications that support benefits to disadvantaged vulnerable communities (DVCs) and tribes

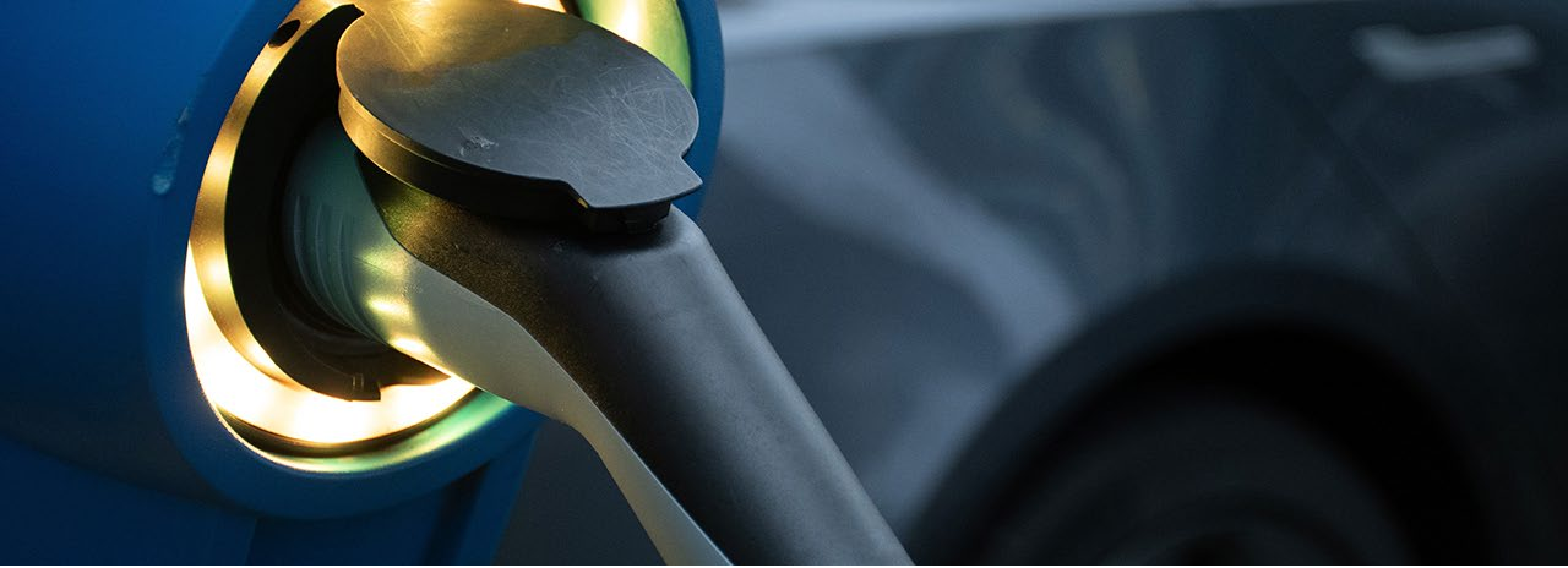
Workshop Goals

- Share CEC staff’s drafts for EPIC 5 investments through proposed strategic initiatives and research topics
- Receive public input on the draft initiatives and topics to hear about research priorities and challenges of different stakeholders

Draft CEC EPIC 5 Initiatives and Research Topics

Draft Initiatives

Strategic Goal	Draft Initiative
Transportation Electrification	Harnessing the Value of Transportation Electrification for Ratepayers
Distributed Energy Resources (DER) Integration	Leveraging DERs and Load Flexibility for Affordability and Grid Reliability
	Accelerating Grid Connection of Clean Resources and Beneficial Loads
	Community Led Clean Energy Capacity Building and Research Incubation for California Native American Tribes and Community Based Organizations
Building Decarbonization	Innovative Approaches to Building and Community Scale Decarbonization
Getting to 100% Net-Zero Carbon and the Coordinated Role of Gas	Advancing the Clean Energy Transition While Protecting Communities and Ecosystems
	Enhancing Clean Energy Technology Safety, Supply Chains, and Life Cycle Benefits
	Cost-Effective Industrial Decarbonization
Climate Adaptation	Leading Innovation in Electricity Sector Resilience and Adaptation



Transportation Electrification

Peter Chen

Harnessing the Value of Transportation Electrification for Ratepayers

Challenge: EVs will be a primary driver of load growth through 2045. Infrastructure investments will be needed to connect this growing and increasingly diverse EV load to the grid. Ratepayer savings can be achieved if technologies and policies are developed to reliably shape EV load at scale, in ways that synergize with grid needs and alleviate constraints.

Research Topics

- Scale Managed Charging as a Grid Resource
- Reduce Barriers to Beneficial Bidirectional Charging
- Strategic Electrification of Emerging Transportation End-Uses

Benefits

- Avoid grid upgrade costs that would otherwise be needed to support EV load growth
- Orchestrate EVs as DERs to provide grid services and net cost savings
- Enable faster and more cost-effective energization of EV charging infrastructure including for emerging customer types and vehicle segments

Scale Managed Charging as a Grid Resource

Gaps Addressed

- Low Carbon Fuel Standard (LCFS) managed charging programs are underway, but gaps remain around reliance on proprietary communications, participation across diverse customer types, and allocation of value streams.
- Unclear value of longer-term (non-bridging), dynamic (near-real time) flexible service connections (FSC) for enabling more capacity-efficient EV charging infrastructure.

Proposed Activity/Research

- Explore collaborations with utilities, EV OEMs, EVSE manufacturers, and aggregators to address limitations in data quality, transparency, and interoperability.
- Validate dynamic FSC approaches enabled by utility systems and related communications technologies.
- Research methods to boost participation in managed charging from commercial customer segments.

Expected Outcomes

- Mid-term: Improved data streams increase managed charging's reliability as a grid resource; interoperable systems support scale without vendor lock-in risk; quantified value of longer-term, dynamic FSCs for EV charging informs future policy direction and program offerings.
- Long-term: Significant amount of EV load can be reliably shaped by grid operators, unlocking both distribution and bulk grid value across EV customer segments.

Reduce Barriers to Beneficial Bidirectional Charging

Gaps Addressed

- Customer experience impacted by limited interoperability, high upfront costs, and complex interconnection processes for bidirectional charging technology.
- No statewide valuation framework or long-term compensation mechanism in place for V2G exports.

Proposed Activity/Research

- Expand customer access to bidirectional charging technology by simplifying installations, interconnection, interoperability, and overall experience.
- Develop tools for site-specific planning decisions based on estimated value for customers and the grid considering vehicle operations and local grid conditions.
- Explore joint project opportunities with the IOUs to test valuation frameworks and compensation.

Expected Outcomes

- Mid-term: Future demand response, rates, and DER orchestration frameworks mature to operationalize bidirectional charging use cases that generate net value for ratepayers while reducing costs for EV adopters.
- Long-term: Customer experience improves to enable a transition from early adoption for limited use cases to broad scale-up of bidirectional charging as a ubiquitous DER.

Strategic Electrification of Emerging Transportation End-Uses

Gaps Addressed

- Large majority of EV adoption to date is concentrated in the light-duty on-road segment where certain customer types have disproportionately higher adoption rates.
- Emerging vehicle types such as autonomous vehicles, advanced air mobility, ports, off-road equipment, rail, medium- and heavy-duty vehicles, and emerging customer types such as rural/low-income/renters will introduce:
  - Unique load profiles and customer needs
  - Electricity demand in potentially unprepared locations

Proposed Activity/Research

- Research load profiles, behavior, and expected locations of emerging end-uses to inform grid planning.
- Explore planning innovations like strategic co-location with other large loads to share infrastructure.
- Advance technologies to enable efficient grid connections and enhance customer access (e.g., DC distribution for multi-MW charging stations, wireless charging, mobile charging, and curbside charging).

Expected Outcomes

- Mid-term: Improved understanding of load attributes, role and readiness of innovative charging technologies, and opportunities for infrastructure co-location or other efficient grid integration strategies.
- Long-term: More timely and cost-effective energization of a variety of electrified transportation end-uses and customer types.

Questions and Feedback

Transportation Electrification

Two ways to ask questions:

1. Use the raise hand feature in Zoom:
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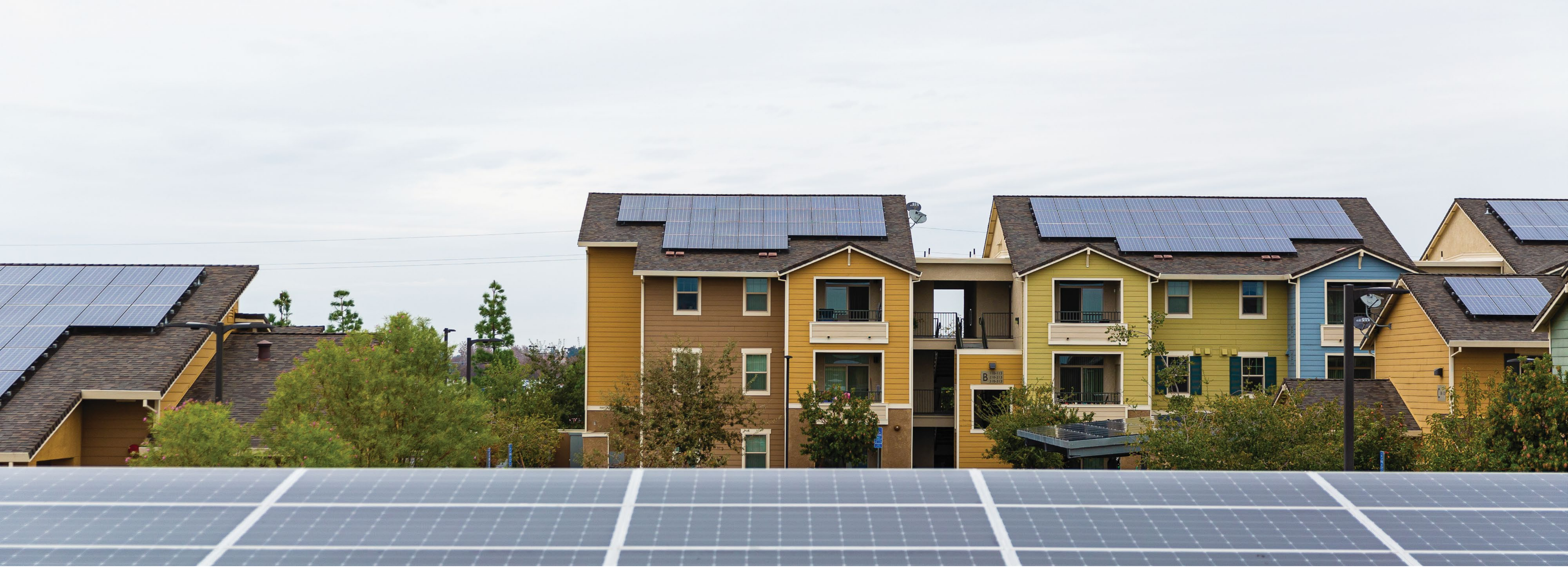

Distributed Energy Resource Integration

Hudson Spivey, Ben Wender, Lindsey Fransen, Lorraine Gonzalez

Leveraging DERs and Load Flexibility for Affordability and Grid Reliability

Challenge: A large and growing number of behind-the-meter DERs (solar, storage, flexible loads) remains fragmented and underutilized. Limited interoperability, visibility, and coordination across devices and grid actors prevents California from fully capturing their value for affordability, reliability and resilience – especially in disadvantaged and vulnerable communities (DVCs).

Research Topics

- Customer-Sited DER Integration & Interoperability
- Scaling DERs and Demand Flexibility as Grid Resources
- Equity-Focused DER Solutions for DVCs

Benefits

- Lower overall costs for customers through better utilization of existing DERs
- Improved grid reliability by shifting and shaping load during peak periods
- Expanded DER access in DVCs to reduce energy burden and enhance resilience

Advancing Customer-Sited DER Integration and Interoperability

Gap Addressed

- A patchwork of proprietary protocols, lack of unified data models, and absence of standardized compliance testing programs require utilities and customers to build expensive, custom software for every device type.
- Traditional utility and LSE systems struggle to securely manage the continuous flow of data coming from millions of internet-connected devices, limiting the ability of DERs to dispatch reliably and rapidly in response to grid needs.

Proposed Activity/Research

- Research and evaluate existing protocols and standards to identify successful models and protocol consolidation opportunities.
- Develop & test unified communication protocols that align with common DER use-cases, paired with standardized data formats and cybersecurity measures.
- Conduct multi-stakeholder field projects across diverse building types to validate these protocols and data architectures under real-world conditions.

Expected Outcomes

- Near-Term: Establish unified, California-specific communication profiles based on open standards to lower integration costs for customers and enhance reliability of DER dispatch to improve system utilization.
- Mid-Term: Achieve secure, fast, and two-way data sharing between DERs and older utility systems while protecting customer privacy.
- Long-Term: Standardize a market-wide rollout of certified, plug-and-play products that operate as reliable grid resources.

Scaling DERs and Demand Flexibility as Grid Resources

Gap Addressed

- Customer-sited DERs remain underutilized at scale and system-wide benefits are not fully captured.
- LSEs and grid operators lack real-time visibility into where flexible capacity from DERs exists.
- Locational and operational benefits of DERs are insufficiently quantified and difficult to value.
- Existing planning and operational approaches rely on static assumptions and broad system-level signals that fail to capture localized grid conditions or dynamic operating needs.

Proposed Activity/Research

- Develop forecasting, planning, and valuation tools in collaboration with LSEs, aggregators, and grid operators for integration into existing planning and settlement processes.
- Demonstrate signal-responsive DER orchestration on targeted feeders or substations to assess system-wide impacts.
- Develop standardized data infrastructure, including common data formats, access protocols, and real-time sharing frameworks to enable broader demand flexibility participation for grid services.

Expected Outcomes

- Near-term: Demonstrate real-time DER orchestration, improve data visibility, streamline measurement & verification for timely participant settlement, and establish initial DER valuation methodologies.
- Mid-term: Expand the use of DERs to provide grid services through improved coordination, planning integration, and real-time dispatch strategies that increase utilization of existing grid infrastructure to benefit ratepayers.
- Long-term: DERS provide quantifiable, compensated grid services across distribution and bulk systems, deferring T&D upgrades and supporting mature, value-based market structures.

Equity-Focused DER Solutions for DVCs

Gap Addressed

- DER adoption gap for DVCs, renters, multifamily housing, tribes, and rural communities
- High upfront costs, split incentives, and limited financing options
- Limited access to resilience benefits and grid-service participation
- Lack of scalable community-centered deployment models

Proposed Activity/Research

- Demonstrate community microgrids, resilience hubs, multifamily DER packages, and VPP participation models
- Test innovative ownership, financing, and benefit-sharing approaches
- Partner with communities to co-design solutions and measure outcomes
- Evaluate customer, resilience, and grid benefits to inform future programs and policy

Expected Outcomes

- Near-term: Demonstrate and validate community-centered DER models that reduce bills and improve resilience
- Mid-term: Replicate successful models and increase DVC participation in DER and demand flexibility programs
- Long-term: Reduce the DER adoption gap, lower energy burden, improve community resilience, and avoid higher-cost grid infrastructure investments

Questions and Feedback

Leveraging DERs and Load Flexibility for Affordability and Grid Reliability

Two ways to ask questions:

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Accelerating Grid Connection of Clean Resources and Beneficial Loads

Challenge: The growing number and size of requests to connect to the electric grid are causing lengthy delays and costly grid upgrades. Large requests can necessitate grid upgrades that are costly and may take years to construct.

Research Topics

- Innovations in Bridging Solutions for Fast Grid Connections
- Technology Alternatives to New Lines and Rights-of-Way
- Data and Planning Tools for Grid Infrastructure Investments and Coordinating Customer Decisions
- Pre-Commercial Grid Tech Incubator

Benefits

- Faster connection of clean resources and electric devices
- Optimize use of existing grid infrastructure and reduced upgrade costs
- Prioritize infrastructure enhancements serving DVCs and tribes

Innovations in Bridging Solutions for Fast Grid Connections

Gap Addressed

- Constructing new electricity infrastructure can take many years, which can result in long delays to connect new clean resources and electric loads like EV charging stations
- “Bridging solutions” that allow customers to receive some level of service while permanent infrastructure is constructed can reduce these delays, however these require further innovation to broaden the range of solutions, improve their efficacy, and inform their inclusion in policy.

Proposed Activity/Research

- Technology development, field testing, and larger demonstrations of innovative bridging solutions such as mobile, solid-state transformers and standards-based dynamic flexible service connections
- Coordinated projects with utilities, technology developers, and large electric customers to validate performance, inform standards and conformance, and integration into planning and operations

Expected Outcomes

- Participating large customers connected to grid more quickly, help electrify and decarbonize
- Improved standards, more standards compliant products, products that better meet customer and grid needs
- Downward pressure on rates through greater electricity sales with fewer upgrades while accelerating progress on climate and energy goals

Technology Alternatives to New Lines and Rights-of-Way

Gap Addressed

- Acquiring new land and permitting new infrastructure is time consuming and costly, particularly in densely populated areas or sensitive environments
- Advanced technologies can increase the amount of energy carried through existing rights-of-way, however utilities, planners, and regulators have limited experience using them in planning and operations

Proposed Activity/Research

- Development of studies and decision support tools to identify optimal locations, infrastructure characteristics, and combinations of advanced technologies to increase infrastructure utilization
- Targeted demonstrations to validate the benefits and tradeoffs of advanced technologies such as composite conductors or power control systems for permanent upgrade avoidance as an alternative to construction of new lines and facilities

Expected Outcomes

- Increased understanding of priority opportunities for planners and operators to pursue advanced technologies where cost effective
- Faster increases in available grid capacity to connect more clean resources and electrification
- Reduced ratepayer costs associated with land acquisition and permitting new infrastructure as well as increased utilization of existing infrastructure

Data and Planning Tools for Grid Infrastructure Investments and Coordinating Customer Decisions

Gap Addressed

- Existing grid planning tools are insufficient for times of rapid load growth, particularly with large loads such as EV charging plazas and data centers
- Uncertainty in when, where, and at what load factor these will materialize creates risk of delays connecting projects if the grid is not ready, or risks of stranded assets if the grid is expanded where not needed

Proposed Activity/Research

- Create advanced planning tools such as probabilistic, scenario-based methods and higher granularity forecasts to inform least regrets infrastructure investment ahead of customer service requests.
- Explore development of common data frameworks, data dictionaries, and other approaches to facilitated data sharing and improve transparency

Expected Outcomes

- Reductions in forecasting error and greater quantification of uncertainty
- Reduced delays for new customer and resource connections
- Affordability benefits from increased grid readiness (i.e., greater electricity throughput)

Pre-Commercial Grid Tech Incubator

Gap Addressed

- IOUs cannot conduct pre-commercial research with EPIC funds
- Technology developers struggle to gain access to IOUs
- Benefits of emerging grid technologies are slow to be realized

Proposed Activity/Research

- Provide targeted support to entrepreneurs developing technologies to strengthen grid capacity, alternatives to upgrades, and wildfire mitigation
- Collaborate with IOUs to identify technology needs and opportunities
- Connect entrepreneurs with IOUs for potential pilots, demonstrations, and deployment

Expected Outcomes

- Improved visibility and access for IOUs and grid technology developers
- Accelerated deployment of emerging technologies on California's grid
- Reduction in wildfire risk; improved reliability due to enhanced capacity; and reduced costs due to deferred or avoided upgrades

Questions and Feedback

Accelerating Grid Connection of Clean Resources and Beneficial Loads

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Community-Led Clean Energy Capacity Building and Research Incubation for California Native American Tribes and Community-Based Organizations

Challenge: California Native American tribes and community-based organizations face structural, resource, and access barriers that limit their ability to participate fully in clean energy research, planning, and demonstration activities.

Research Topics

- Tribal Energy Capacity Building and Mentorship Incubator
- CBO Clean Energy Capacity Building and Research Incubator

Benefits:

- Update tribal and community energy plans
- Support tribal- and community-centered clean energy demonstrations and adoption
- Improve siting, reduce project risks, and enhance affordability, reliability, and environmental outcomes for IOU ratepayers

Tribal Energy Capacity Building and Mentorship Incubator

Gap Addressed

- Structural and resource barriers limit tribal participation in clean energy research, planning, and demonstrations.
- Existing programs do not provide multi-year, sovereignty-centered, research-aligned support.

Proposed Activity/Research

- Multi-module training and dual mentorship.
- Technical assistance for early concept development and feasibility.
- Experiential learning through site visits and project tours.

Expected Outcomes

- Stronger tribal energy governance and updated plans.
- Greater readiness for clean energy grants, pilots, and RDD&D opportunities.
- Improved siting, reduced risks, and expanded tribal leadership in clean energy.

CBO Clean Energy Capacity Building and Research Incubator

Gap Addressed

- Structural and resource barriers limit CBO participation in clean energy research, planning, and demonstrations.
- No existing programs provide multi-year, clean-energy-specific RDD&D readiness or mentorship.

Proposed Activity/Research

- Clean-energy training and dual mentorship.
- Technical assistance for early research concept development and feasibility.
- Support for partnership building and community-driven planning.

Expected Outcomes

- Greater CBO readiness for clean energy grants, demonstrations, and proceedings.
- Stronger community-led research concepts and improved siting outcomes.
- Better affordability, reliability, resilience, and environmental outcomes for IOU ratepayers.

Questions and Feedback

Community-Led Clean Energy Capacity Building and Research Incubation

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Building Decarbonization

Jackson Thach

Innovative Approaches to Building and Community-Scale Decarbonization

Challenge: California's building sector remains a significant source of GHG emissions and grid stress during peak demand.

Aging infrastructure, high retrofit costs, and fragmented markets impede electrification and energy efficiency, especially in DVCs and tribes.

Research Topics

- Advancing Affordable Building Electrification Systems for Residential Homes
- Whole-Home Retrofit Solutions
- Neighborhood-Level Decarbonization
- Advanced Decarbonization Pathways for Difficult-to-Decarbonize Commercial Buildings

Benefits

- Reduce total electrification and retrofit costs
- Improve indoor air quality and climate resilience by replacing combustion systems
- Enhance grid stability and load flexibility

Advancing Affordable Building Electrification Systems For Residential Homes

Gaps Addressed

- High electrification costs
- Equitable access barriers
- Lack of integrated solutions

Proposed Activity/Research

- Development and validation of next-gen low-power appliances and plug-in-play DERs
- Advancing HVAC, & water heating innovations
- Pilot & field demonstrations in under-resourced communities

Expected Outcomes

- Generate real-world performance data and identify opportunities to reduce costs
- Lower upfront costs, expand access to high-efficiency electric technologies, reduce energy bills, and improve grid reliability
- Widespread adoption to avoid infrastructure upgrade costs and long-term cost savings

Whole-Home Retrofit Solutions

Gaps Addressed

- High envelope retrofit cost
- Intrusive and time-consuming retrofits
- Owner/Renter split-incentives
- Envelope retrofit access for renters

Proposed Activity/Research

- Demonstrate nondestructive and nondisruptive diagnostic tools
- Demonstrate renter-focused, minimally-disruptive retrofits
- Develop and demonstrate split-incentive business models

Expected Outcomes

- Clear market facilitation pathway, lower total cost of electrification, increased access for low-income renters, and reduced deployment friction.
- Lower retrofit costs and improved building performance, reduced HVAC loads, and higher electrification adoption.
- Scalable whole building or community scale retrofit markets supporting decarbonization, large-scale rental housing participation in statewide decarbonization

Neighborhood-Level Decarbonization

Gaps Addressed

- Community Thermal Energy Networks (CTENs) enable thermal sharing, waste heat reuse, and neighborhood-scale efficiency.
- Neighborhood DER coordination can improve resilience, reduce peaks, and lower long-term energy costs.

Proposed Activity/Research

- Demonstrate neighborhood-scale decarbonization solutions integrating Community Thermal Energy Networks (CTENs), shared central plants, and coordinated DER systems.
- Develop scalable deployment models and California-specific performance data to support future utility planning and market adoption.

Expected Outcomes

- Reduce peak demand and defer costly grid upgrades.
- Enable scalable, resilient neighborhood decarbonization.

Advanced Decarbonization Pathways for Difficult-to-Decarbonize Commercial Buildings

Gaps Addressed

- Lack of integrated, low-GWP thermal systems for commercial and light-industrial buildings
- Fragmented HVAC, DHW, refrigeration, and process-heat solutions limit electrification
- Minimal cross-sector R&D connecting commercial and industrial-adjacent needs

Proposed Activity/Research

- Develop and validate heat pumps and low-GWP refrigeration with heat recovery
- Demonstrate integrated thermal systems in representative commercial and industrial-adjacent facilities
- Produce open performance data and scalable retrofit/design guidance

Expected Outcomes

- Validated prototypes of ultra-low-GWP heat pumps, advanced heat-recovery refrigeration, and integrated HVAC–DHW–refrigeration systems.
- Pilot demonstrations showing peak-load reduction, major gas displacement, and operational savings.
- Sector-wide adoption of integrated thermal-recovery systems, scalable retrofit packages, and broad reductions in costs, emissions, and air pollutants.

Questions and Feedback

Building Decarbonization

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10 Minute Break

Getting to 100% Net Zero Carbon and the Coordinated Role of Gas

Julia Harnad, Maninder Thind, Elyse Kedzie, Ilia Krupenich, Lindsey Fransen,

Advancing the Clean Energy Transition While Protecting Communities and Ecosystems

Challenge: Accelerating rollout of clean energy while protecting communities and ecosystems requires innovation in data, tools, and metrics.

Research Topics:

- Advancing Health and Air Quality Research to Inform Building and Transportation Electrification in California
- Innovation in Clean Energy Environmental Impact Assessment and Mitigation

Benefits:

- Leverage the energy transition to improve ratepayers' air quality and health outcomes, reducing healthcare burdens and costs
- Accelerate renewable generation deployment while reducing ratepayer costs, conserving species and ecosystems
- Increase economic potential through dual-use clean energy operations

Advancing Health and Air Quality Research to Inform Building and Transportation Electrification in California

Gap Addressed

- Electricity ratepayers lack trusted, actionable information on the health and cost implications of electrification choices.
- Limited integration of health, air quality, affordability, and community impacts in electrification policy, planning, and implementation programs.
- Limited standardized data, metrics, and tools linking building and transportation electrification with indoor/outdoor air quality and health outcomes.

Proposed Activity/Research

- Conduct policy-relevant epidemiology and monitoring to characterize and quantify health and air quality impacts of building and transportation electrification, including in DVCs.
- Develop integrated data analytics, models, and publicly accessible tools linking electrification, air quality, health, and affordability outcomes.
- Quantify and monetize healthcare and societal benefits to inform cost-effective, equitable electrification strategies, incentives, codes, and ratepayer investments.

Expected Outcomes

- Near-term: Standardized datasets and validated methods linking electrification, air quality, and health.
- Mid-term: Integration of health and air quality metrics into program design, codes, and incentives.
- Long-term: Reduce healthcare burdens and long-term ratepayer costs through data-driven electrification planning.

Innovation in Clean Energy Environmental Impact Assessment and Mitigation

Gap Addressed

- Lack of environmental mitigation innovations necessary to maintain clean energy project timelines and costs for SB100 buildout goals.
- Insufficient metrics, tools, and data on the lifecycle impacts of clean energy technologies on California's environment and natural organisms.

Proposed Activity/Research

- Advance studies, data collection, and technology development that supports environmental permitting, siting and construction activities for clean energy buildouts.
- Develop technologies for new environmental mitigation solutions, providing validated alternatives for more rapid and responsible clean energy development.
- Investigate emerging dual-use clean energy production solutions.
- Synthesize varied clean energy siting datasets through publicly accessible tools.

Expected Outcomes

- Short-term: lowering risks and costs of clean energy project development and operations and shortening energization timelines.
- Mid-term: deploying clean energy projects more rapidly and expanding reliability; expanding economic potential and resource stewardship through dual use energy production.
- Long-term: protecting environmental and biological resources for a sustainable clean energy development.

Questions and Feedback

Advancing the Clean Energy Transition While Protecting Communities and Ecosystems

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Enhancing Clean Energy Technology Safety, Supply Chains, and Life Cycle Benefits

Challenge: Concerns for fire safety, environmental risk, and community health often prevent adoption of batteries and other clean energy technologies. Further, gaps in the domestic supply chain for critical materials and expensive recycling strategies slow the affordable deployment of clean energy solutions.

Research Topics:

- Advancing the Safety of Next Generation Storage Solutions
- Enhancing Energy Storage Performance and Longevity Through Advanced Battery Analytics
- Strengthening Critical Materials Supply Chains for Clean Energy Technologies

Benefits:

- Improve fire and safety codes and standards.
- Mitigate safety risk to communities.
- Lower cost of energy storage on grid.
- Help reduce grid outages and interruptions, increasing resiliency benefits and improving health outcomes for DVCs and tribes.

Advancing the Safety of Next Generation Storage Solutions

Gap Addressed

- Novel storage technologies face significant certification barriers due to unknown safety hazards.
- Emergency response and coordination remain underdeveloped for next-generation lithium-ion and non-lithium-ion storage systems.

Proposed Activity/Research

- Generate data, protocols, and California-specific guidance needed to safely deploy next-generation storage.
- Develop permitting and emergency response guidance and tools for regulators, fire officials, and project developers.

Expected Outcomes

- Evaluate chemistry-specific hazards for a range of technologies, such as solid-state, sodium, zinc, and iron-based chemistries, as well as incident air emission analysis.
- Develop large-scale validation tests that produce design curves, plan-check worksheets, and pass/fail tools for AHJs.
- Use findings to inform UL, NFPA, and California Fire Code standards.

Enhancing Energy Storage Performance and Longevity Through Advanced Battery Analytics

Gap Addressed

- Rapid EV adoption strains local distribution grids without coordinated charging strategies.
- Current battery management systems cannot predict degradation or optimize charging for grid integration.
- Uncoordinated charging risks local circuit overloads, driving expensive ratepayer-funded infrastructure upgrades.

Proposed Activity/Research

- Develop hardware-agnostic, intelligent charging processes that adapt to varied battery degradation states.
- Conduct lab testing and field demonstrations to validate peak demand mitigation strategies.
- Advance early failure detection methods to identify internal anomalies and protect public safety.

Expected Outcomes

- Validate intelligent charging strategies to improve battery longevity and safety across multiple chemistries.
- Integrate interoperable processes with fleets and aggregators to flatten localized peak demand.
- Lower ratepayer costs by systematically deferring expensive utility distribution infrastructure upgrades.

Strengthening Critical Materials Supply Chains for Clean Energy Technologies

Gap Addressed

- Supply chains for many clean energy technologies rely on critical materials, such as lithium, cobalt, nickel, rare earth minerals, and platinum group catalysts.
- Recent disruptions and price volatility in supply chains highlight the need to develop a domestic energy economy.

Proposed Activity/Research

- Improve material sourcing, refining, and manufacturing processes for energy storage, wind power, and fuel cells.
- Develop new recycling pathways and recovery processes for high value materials.
- Develop novel or alternative materials and processes that are available domestically.

Expected Outcomes

- Pilots and applied R&D de-risk emerging sourcing, processing, and recycling pathways.
- Scaled recycling, improved refining processes, and novel domestic materials lead to measurable reductions in costs, directly lowering electricity rates.
- Ratepayers see lower and more stable electricity costs, as dependence on volatile global markets is reduced and recycled materials supply a meaningful share of demand. Local economies will benefit from new manufacturing and recycling industries.

Questions and Feedback

Enhancing Clean Energy Technology Safety, Supply Chains, and Life Cycle Benefits

Two ways to ask questions:

1. Use the raise hand feature in Zoom:
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     - *9 – Raise hand
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Cost-Effective Industrial Decarbonization

Challenge:

- Industrial emissions impact climate, air quality, and public health
- Many industrial processes remain difficult and costly to decarbonize due to high-temperature heat requirements, process emissions, and long-lived equipment
- Electrification must be deployed in a way that supports grid reliability and affordability

Research Topics:

- Grid-Integrated Industrial Electrification for Affordability and Reliability
- Decarbonizing Construction Materials for Cost-Effective Infrastructure
- Affordable Clean Chemical Production
- First-of-a-Kind Deployment Support for Difficult-to-Decarbonize Sectors

Benefits:

- Deliver cleaner air and lower GHG emissions
- Reduce strain on the grid and avoid expensive upgrades, supporting more reliable and affordable electricity supply
- Increase local jobs and access to clean energy technologies

Grid-Integrated Industrial Electrification for Affordability and Reliability

Gap Addressed

- Economic and operational barriers limit adoption of industrial electrification technologies
- Technical hurdles remain for high-temperature heat, contaminated process streams, and process emissions
- Electrification at scale may increase grid costs and impact reliability

Proposed Activity/Research

- Advance solutions for difficult-to-electrify industrial applications and demonstrate them under California operating conditions
- Validate flexible loads, thermal energy storage, demand response, and integrated energy management strategies; allowing more electrification, and reducing grid costs

Expected Outcomes

- Near-term: Validated electrification technologies, operational performance data, and emissions reduction pathways.
- Mid-term: Increased adoption of electrification technologies, flexible loads, thermal energy storage, and integrated energy management systems.
- Long-term: Reduced emissions, improved air quality, enhanced grid reliability, and improved ratepayer affordability.

Decarbonizing Construction Materials for Cost-Effective Infrastructure

Gap Addressed

- Limited availability of low-carbon construction materials
- Alternative manufacturing pathways for cement, steel, glass, and other materials require further development and validation
- Potential impact of emerging production pathways on electric grid

Proposed Activity/Research

- Advance and demonstrate low-carbon materials and circular material pathways
- Explore beneficial integration with grid and industrial operations

Expected Outcomes

- Near-term: Validated low-carbon materials, alternative manufacturing pathways, and air quality benefits.
- Mid-term: Expanded production capacity, proven material performance, grid-supportive industrial plants, and circular material pathways.
- Long-term: Reduced embodied emissions, improved air quality, resilient supply chains, and cost-effective infrastructure development.

Affordable Clean Chemical Production

Gap Addressed

- Limited deployment of alternative chemical production pathways
- Technical and economic barriers remain for electrochemical processes, advanced separations, carbon utilization, and sustainable feedstocks
- Potential impact of emerging production pathways on electric grid

Proposed Activity/Research

- Advance and demonstrate alternative chemical production pathways, advanced separations, carbon utilization, and sustainable feedstocks
- Explore integration with grid and industrial operations

Expected Outcomes

- Validated alternative production pathways, operational performance data, and air quality benefits.
- Improved cost competitiveness, proven use cases, grid-supportive chemical plants, and expanded deployment opportunities.
- Reduced emissions, resilient supply chains for critical chemical inputs, and cost-effective industrial decarbonization.

First-of-a-Kind Deployment Support for Difficult-to-Decarbonize Sectors

Gap Addressed

- Novel but proven industrial technologies (e.g., thermal energy storage for process heat; industrial heat pumps; low-carbon cement; decarbonized processes for glass, steel, and chemicals) can be slow to scale due to lack of project development skills within new, entrepreneurial companies.
- Traditional sources of finance are not structured to support commercial deployment of such technologies, particularly at the scale needed to decarbonize the industrial and commercial sectors.

Proposed Activity/Research

- Assemble and coordinate firms and organizations with needed project development skills and connect with emerging industrial technology developers and potential offtakers / customers
- Provide and / or support provision of catalytic capital to reduce risk and attract project finance
- Collect and share data relevant to CPUC proceedings, support policy or regulatory reforms to facilitate broader deployment of industrial decarbonization technologies

Expected Outcomes

- Tools and coalitions developed to support and scale deployment of emerging industrial decarbonization projects
- Commercial-scale deployment of multiple industrial decarbonization projects in California using tools and funding from this topic
- Acceleration of subsequent industrial decarbonization deployments due to reduced perception of financial risk

Questions and Feedback

Cost-Effective Industrial Decarbonization

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Climate Adaptation

Jill Horing

Leading Innovation in Electricity Sector Resilience and Adaptation

Challenge: Climate change increasingly impacts grid and community energy resilience, including for DVCs and tribes. Legacy approaches to resilience must be adapted to contain these threats while supporting California's clean energy goals, controlling escalating energy system costs, and providing equitable, reliable energy services.

Research Topics

- Advancing Energy System Resilience Under Climate Change and Extreme Weather
- Supporting Wildfire Mitigation that Manages Risk and Advances Affordability
- Building Community Energy Resilience and Reliability

Benefits

- Equip planners to anticipate and manage climate impacts on electricity systems
- Identify and evaluate affordable solutions for wildfire ignition and outage risk
- Advance locally customized resilience strategies, including support for critical services

Advancing Energy System Resilience Under Climate Change and Extreme Weather

Gap Addressed

- Climate change and extreme events such as extreme temperatures, wildfire, atmospheric rivers, extended droughts, and sea level rise pose a significant threat to the resilience of California's electricity grid
- Utilities and ratepayers experience escalating costs, disruptions to grid service, reduced power output, damaged infrastructure, and increased peak demand

Proposed Activity/Research

- Fill critical gaps in climate data and modeling tools to inform grid infrastructure, operational, and adaptation analyses
- Innovation in grid-hardening and operational resilience

Expected Outcomes

- Near-term: Improvements to utility and policy planning processes (e.g. IRP, demand forecast, CAVAs)
- Mid-term: Inform utility decisions and align investments with emerging climate risks
- Long-term: More cost-effective adaptation investments, reduced exposure to climate-driven outages, improved affordability

Supporting Wildfire Mitigation that Manages Risk and Advances Affordability

Gap Addressed

- Wildfire risk mitigation and liability costs have become a major driver of rising utility rates
- Mitigation options carry significant tradeoffs in cost, risk reduction, service reliability

Proposed Activity/Research

- Advancements to wildfire science and hazard characterization
- Modeling and analysis to support utility risk mitigation and regulatory processes; incorporation of strategies to reduce spread and consequence of fire
- Technology innovation for wildfire risk reduction

Expected Outcomes

- Near-term: Improved data, modeling, and decision-support tools to support wildfire mitigation planning
- Mid-term: Inform utility investment decisions and regulator evaluation
- Long-term: Development and validation of more cost-effective wildfire mitigation technologies, reduced reliance on disruptive measures, improved safety and affordability

Building Community Energy Resilience and Reliability

Gaps Addressed

- Uneven reliability and climate pressures leave some communities —especially in rural and tribal areas —more vulnerable to outages, with big impacts on community well-being
- Grid planning and investment are not oriented to reliability outliers, nor directly tied to ameliorating outage cost burdens or community benefits

Proposed Activity/Research

- Assess community-specific energy and climate resilience needs and opportunities, and translate into planning methods and resources for utilities, agencies, and communities
- Support strategies and alliances that enable rural and tribal landscapes to strengthen local resilience, advance tribal energy sovereignty, improve system reliability, and shape future grid evolution

Expected Outcomes

- Near-term: Resilience approaches that are better optimized to community benefits and contexts
- Mid-term: Substantial progress toward energy system equity
- Long-term: Natural integration of community resilience with grid reliability and affordability for all ratepayers

Questions and Feedback

Climate Adaptation

Two ways to ask questions:

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Feedback and Discussion

General Questions and Answers

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Next Steps

- Submitting written comments by **June 18**: https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=25-EPIC-01
- To stay involved in EPIC 5, visit CEC's website for workshop info, presentations, docket, e-commenting, and EPIC listserv sign up: https://www.energy.ca.gov/proceeding/electric-program-investment-charge-2026-2030-investment-plan-epic-5
- EPIC Administrators submit EPIC 5 Investment Plans to the CPUC by August 26, 2026

Thank you!