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Electric Program Investment Charge: 2021-2025 (EPIC 4) Investment Plan Scoping Workshop

Title: **Draft Initiatives for EPIC 4**

Presenters: CEC Energy Research & Development Division Staff

Date: Wednesday, August 4, 2021

Welcome and Opening Remarks

Laurie ten Hope

Deputy Director, Energy Research and Development Division

Workshop Agenda

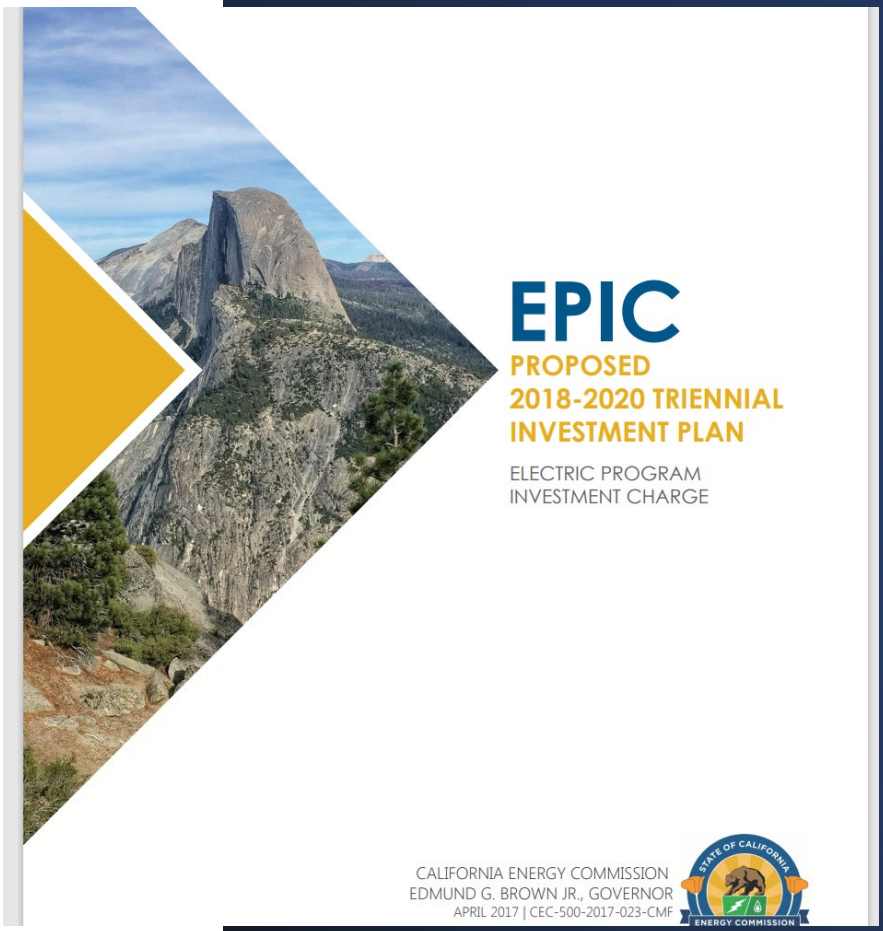
- EPIC 4 Investment Planning Timeline and Background (9:05-9:10)
- Overview of Draft EPIC 4 Research Initiatives (9:10 – 10:50)

5-Minute Break

- Public Comments and Questions (10:55-11:55)
- Closing and Next Steps (11:55-12:00)

EPIC Investment Planning Background

- The CPUC requires each EPIC administrator to submit an Investment Plan.
- Investment Plans lay out the proposed research investments for the funding period.
- The EPIC 4 Plan will describe the CEC's proposed investments for funding collected from **2021-2025**.
- CEC develops its plan through an open and transparent stakeholder process.
- The previous CEC EPIC 3 Investment Plan can be found at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M185/K575/185575884.PDF
- EPIC Interim Investment Plan 2021 – APPROVED 7/15/2021 https://efiling.energy.ca.gov/getdocument.aspx?tn=236221



EPIC 4 Plan Schedule

Task / Event	Date(s)
Public workshops to solicit stakeholder input on specific topic gaps	May – July 2021
Draft initiatives posted	July 29, 2021
Public workshop to get input and feedback on the CEC's draft research initiatives being considered for the EPIC 4 Investment Plan	August 4, 2021
EPIC 4 Investment Plan considered at CEC Business Meeting for approval	September 2021 (tentative)
EPIC 4 Investment Plan submitted to CPUC	October 1, 2021 (tentative, seeking extension)
CPUC Decision on EPIC 4 Plan expected	Spring-2022 (tentative)
The first EPIC 4 solicitations (Interim Plan Initiatives) released	Summer-Fall 2022

EPIC 4 Investment Plan Objectives

Accelerate Cost Reductions for Renewable Generation Technologies

Achieve Reliability and Create a Nimble Grid Responsive to Intermittent Renewable Generation

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

Cross-Cutting Initiatives

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)?

EPIC 4 Investment Plan

Accelerate Cost Reductions for Renewable Generation Technologies

1. Floating Offshore Wind Energy Technologies

Description: Advance offshore wind as a key clean supply resource for SB100 buildout and a complement to solar. Technology advancements may include:

1. Optimizing component designs for cost, durability, and operational efficiency;
2. Developing standardized processes for local manufacturing, assembly, and installation;
3. Grid integration innovations and port infrastructure readiness strategies;
4. Environmental impact assessment and minimization.

Goals:

- Support grid reliability by diversifying the energy portfolio
- Lower the levelized cost of energy through technology developments
- Reduce technical and financial risk of floating offshore wind energy deployments
- Inform environmental mitigation, deployment planning, and permitting

2. Advancing Geothermal Energy and Mineral Recovery Technologies

Description: Advance geothermal as a firm and flexible resource that complements intermittent renewables and catalyze low-impact production of in-state lithium for use in batteries. Technology advancements may include:

1. Improving drilling technologies and well-targeting; addressing corrosion and scaling; advancing flexible operations; improving the cost of small scale geothermal;
2. Demonstrating recovery methods for lithium and other brine co-products.

Goals:

- Lower the levelized cost of energy for geothermal
- Reduce technical and financial risk for geothermal deployments
- Improve operational performance of geothermal power plants
- Advance in-state lithium production from geothermal brine

3. Emerging Solar Energy Technologies

Description: Improve solar generation efficiency, cost, and output to support solar's central role in the SB 100 buildout. Technology advances may include:

1. Improving performance and lowering costs for thin-film solar (perovskites, bifacial thin-film, tandem PV);
2. Demonstrating technologies that enable increased solar output (bifacial PV, trackers).

Goals:

- Improve the performance of emerging solar PV technologies
- Lower the levelized cost of energy for emerging solar PV to increase commercial viability
- Expand the suitable applications for emerging solar PV technologies

EPIC 4 Investment Plan

Achieve Reliability and Create a Nimble Grid Responsive to Intermittent Renewable Generation

4. Short Duration Energy Storage Technology Demonstrations to Support Grid Reliability

Description: Improve Li-ion batteries and new and emerging short duration non-Li-ion chemistries energy storage systems (4 hours or less), including:

1. Lower costs (capital and life cycle)
2. Better lifetime performance
3. Greater depth of discharge
4. Reduced degradation over time
5. Better round-trip efficiency
6. Improved safety and better supply chain diversity

Goals:

- Lower cost and demonstrate measurable performance increases
- Diversify the portfolio of energy storage solutions available to the state
- Meet SB-100 projections for 8X increase in energy storage procurement with Li-ion and non-Li-ion technologies

5. Long Duration Energy Storage Technology Demonstrations to Support Grid Reliability

Description: Support new and emerging technologies able to provide long duration energy storage (4 hours or more), including, but not limited to:

1. Batteries such as flow batteries and other advanced battery chemistries
2. Mechanical systems such as flywheels, compressed air, and gravity energy storage
3. Thermal systems such as molten salt and molten sulphur
4. Other emerging technologies such as chemical storage of green hydrogen and green methane

Goals:

- Long duration energy storage systems that are reliable, manufacturable, cost effective, and able to meet the needs of the state
- Increase viable long duration energy storage technologies with system size to 10 MWs or larger with 8 hours or more duration

6. Energy Storage Use Case Demonstrations to Support Grid Reliability

Description: Create and demonstrate energy storage use cases to support grid reliability on the customer and utility sides of the meter. Use case applications may include, but are not limited to:

1. Dynamic charge reservation to enable back-up batteries to provide time-critical grid support
2. Energy storage coupled with large vehicle charging systems to improve VGI
3. Energy storage discharge response to the CPUC's Unified Universal Dynamic Economic Signal
4. Short-term predictive protocols
5. Advanced energy storage discharge protocols to better respond to both grid needs and distribution constraints in real time

Goals:

- Energy storage systems that more effectively meet grid reliability needs

7. Green Hydrogen (H2) Roadmap Implementation to Support Grid Reliability

Description: Provides for further implementation of the Green H2 Roadmap and Strategic Plan beyond that provided in the Interim EPIC Plan.

- Dive deeper into issues of green H2 for grid reliability identified in public comments.
- Update the roadmap and strategic plan before EPIC 5 to reflect developments in technology and progress in the industry over time.
- Conduct H2 technology demonstrations relevant to defined opportunities.

Goals:

- Assess how and where green H2 can become a key technology to help California meet future decarbonization goals, especially in sectors with few other viable options.

8. Infrastructure, Market Analysis, & Demonstrations to Support Firm Dispatchable Decarbonized Generation (FDDG)

Description: Support development of FDDG for grid reliability in a future with highly intermittent renewables penetration. For example:

- Formulate framework to evaluate the cost and performance between various forms of FDDG and long duration energy storage (LDS).
- Evaluate storage and transmission capacity to support FDDG.
- Demonstrate FDDG optimization (e.g., through a directed biogas supply chain and minimizing criteria pollutants by coupling with energy storage.)

Goals:

- Provide objective comparisons of FDDG options and LDS to ensure cost, performance, and availability are optimized for ratepayers.
- Demonstrate optimal technologies to support FDDG to meet SB 100 goals.

9. Advancing Clean, Dispatchable Generation

Description: Advance performance and cost competitiveness of clean, dispatchable generation technologies to reduce dependence on fossil-based peaker power plants, complement intermittent renewables, and support SB 100 implementation. Technology advancements may include:

1. Fuel cell systems;
2. Combustion systems (gas turbines and reciprocating engines) that use high blends of green hydrogen;
3. Expanding green hydrogen production pathways (electrolysis and reforming) for electric generation applications;
4. Bioenergy conversion technologies (digesters and gasification) for electric applications.

Goals:

- Support grid reliability and climate resiliency
- Reduce greenhouse gas emissions by displacing fossil-based generation
- Improve performance, efficiency, and durability of clean, dispatchable generation technologies
- Lower the levelized cost of energy for clean, dispatchable generation

10. Technology Demonstrations to Address Grid Congestion Resulting from 3X Generation Growth on the Path to a Decarbonized California

Description: Demonstrate technologies and achieve a nimbler grid to carry more power on the same rights-of-way, supporting Garamendi Principles. Use cases include alleviate congestion, improve regional intertie capacity, reduce renewable energy curtailments, improve interconnection capacity, reduce line losses, and reduce wildfire ignition risk. Potential technologies may include:

1. Power flow control technologies
2. Smart conductor technologies
3. Optimization of technology combinations above, with energy storage

Goals:

- Demonstrate viability of technologies
- Identify the optimal mix of technologies for use cases and ratepayer benefit
- Demonstrate ability to meet 3X increase in renewable generation as defined in SB 100 safely, equitably, and at a reasonable cost

11. Demonstrate Technologies to Maintain Reliability and Power Quality (PQ) in the Inverter-Centric Grid of the Future Associated with High Levels of Renewables

Description: Develop and demonstrate emerging technologies to address PQ factors, which are essential to maintaining a reliable grid (e.g., harmonics, power factor (PF), and rotational inertia).

- Assess extent of PQ issues and their importance in an evolving grid.
- Demonstrate technologies such as grid forming inverters, harmonics filters, and PF correction devices (e.g., synchronizing condensers, capacitor banks).
- Measure and evaluate impact to PQ.

Goals:

- Obtain better understanding of PQ impact from higher concentrations of inverter-based technologies and demonstrate optimal solutions.
- Provide recommendations on new standards and regulations.

12. Furthering Cybersecurity with Highly Modulatable Grid Resources

Description: Implementation of cybersecurity protocols in CEC EPIC projects. Work with IOUs and others to develop new protocols, which may include:

- Requiring best cybersecurity practices for CEC-funded projects
- Applying cybersecurity lessons learned from previous work of CEC PIER, IOUs, EPRI, DOD, DOE, and Homeland Security in future grants
- Developing additional cybersecurity protocols
- Developing cybersecurity testing and performance verification facility to allow testing of cybersecurity sensitivities for new and emerging technologies

Goals:

- Ensure cybersecurity with increasing deployment of modulatable technologies

EPIC 4 Investment Plan

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

13. Improving Forecasts of Behind-the-Meter Solar and Storage

Description: Improve the accuracy of methods for forecasting behind-the-meter (BTM) solar PV and storage to limit reserve resource requirements and realize associated cost benefits. Research advancements may include:

1. Developing new models to strengthen forecasts of solar irradiance;
2. Improving methods for load forecasting by better accounting for energy flows from BTM solar PV and storage under different conditions.

Goals:

- Improve existing solar irradiance forecast models
- Provide accurate projections of BTM energy flows
- Reduce cost associated with procuring spinning and non-spinning reserves

14. Direct Current Systems for Efficient Power Delivery

Description: Improve efficiency in power delivery by utilizing DC systems, generating cost savings for customers and reducing demand on the grid. The primary focus would be on behind the meter applications. Technology advancements may include:

1. Developing and deploying low-cost, modular, and replicable BTM DC power systems that enable efficient, clean, and reliable power for EVs and other DC end-uses such as solid-state lighting and motor-driven loads;
2. Developing power system components such as DC circuit breakers, meters, controls, bidirectional multi-port inverters (inverters that can simultaneously manage multiple inputs and outputs), and other power electronics;
3. Enhancing the interoperability of various DC end-use devices.

Goals:

- Improve power system efficiency by reducing losses in conversion and distribution
- Reduce costs in equipment, installation, and operations and maintenance
- Accelerate the deployment of efficient EV charging

15. Behind-the-Meter Renewable Backup Power Technologies

Description: Develop and demonstrate low-cost, behind-the-meter (BTM) renewable energy technologies that enable customer resilience to grid outages. Technology advancements may include:

1. Developing modular power electronics that enable BTM renewable generation systems (e.g., rooftop solar) to provide back-up power at reduced cost;
2. Reducing hardware costs of backup power electronics;
3. Making battery storage an optional addition to backup systems rather than required;
4. Increasing standardization of solutions to promote replicability.

Goals:

- Enable rooftop solar to provide backup without requiring energy storage
- Simplify site engineering and ease permitting
- Streamline installation and reduce soft costs
- Enable deployment of resilient BTM systems in under-resourced communities

16. Design-Build Competition

Description: This initiative seeks to implement the next design-build competition for EPIC – building off the efforts of the Advanced Energy Communities Program and the Mixed-Use Development Design-Build Competition funded under previous investment plans. This initiative will fund the build phase of the Mixed-Use Development Competition as well as fund a new competition focused on a different building sector.

Goals:

- Design and demonstrate replicable technology, business, and financing models for large-scale integrated clean energy technology projects.
- Overcome lock-in barriers that prevent adoption of emerging technology solutions.

17. Efficient Transportation Electrification and Charging Technologies

Description: Conduct applied research, development, and technology demonstrations of new high efficiency charging devices and systems that reduce electric losses and costs of electric vehicle charging. This initiative will span all vehicle classes and power levels, including efficient electrification of challenging transportation sectors. Technology advancements may include:

1. Advanced on-board charger design, prototyping, and performance validation;
2. Next generation power electronics for high-efficiency, high-power charging systems (e.g., wide bandgap materials);
3. Enabling efficient electrification of agricultural and other off-road vehicles.

Goals:

- Increase efficiency of charging devices and systems
- Lower electricity consumption and costs for fleets and owners of electric vehicles
- Accelerate efficient electrification across transportation segments and vehicles

18. Enabling Plug-in Electric Vehicles as Distributed Energy Resources

Description: Advance technologies and demonstrate plug-in electric vehicle (PEV) charging and discharging that is flexible, safe, reliable, and coordinated with grid needs. Technology advancements may include:

1. Developing grid-interactive inverters in bi-directional charging equipment;
2. Advancing software for integrating PEV charging with building management systems;
3. Demonstrating high-accuracy, low-cost submeters for PEV chargers to avoid separate service requirements.

Goals:

- Lower site costs and enable operational benefits for customers deploying PEV chargers
- Increase ratepayer savings through efficient utilization of existing electricity infrastructure
- Accelerate standardized and scalable solutions for seamless implementation and operation

19. Integrating Distributed Energy Resources (DERs) for Grid-Supportive Vehicle Charging

Description: Integrate DERs (e.g., distributed solar, storage, etc.) with transportation electrification to mitigate the grid impacts and GHG emissions associated with EV charging. Technology advancements may include:

1. Developing, testing, and validating hardware and software solutions to advance load management capabilities and reduce installation and operating costs;
2. Conducting pilot demonstrations of promising use cases to scale up deployment;
3. Developing and expanding tools for quantifying the benefits of pairing EV infrastructure with other DERs to address grid constraints.

Goals:

- Improve the value proposition of EV charging by integrating DERs
- Support future grid planning efforts, including opportunities to avoid, defer, or reduce infrastructure upgrades
- Develop best practices and leverage lessons learned for future demonstrations and deployments

20. Lithium-ion Battery Reuse and Recycling

Description: Improve, scale-up, and demonstrate innovative reuse and recycling technologies for end-of-life lithium-ion batteries to conserve critical materials, promote material sustainability, and reduce the cost of new storage products by lowering material costs. Technology advancements may include:

1. Battery design to facilitate repurposing and recycling;
2. Demonstrating the performance of recovered materials in new batteries;
3. Developing flexible methods for efficient battery collection, sorting, and diagnostic testing.

Goals:

- Lower the costs of new battery storage products through reuse and increasing recycled content
- Reduce life cycle environmental impacts of lithium-ion batteries
- Encourage innovation and domestic supply chain investments focused on battery end-of-life

21. Enabling Grid Resilience with Load Flexibility in the Industrial, Agriculture and Water (IAW) Sectors

Description: Establish the *California Industrial, Agricultural, and Water Flexible Load Research and Deployment Hub* to conduct research to:

1. Increase the use and market adoption of advanced, interoperable, and flexible demand management technologies and strategies as electric grid resources
2. Develop and advance flexible load technologies, tools, and models to facilitate and increase grid resiliency and demand response (DR) participation. Potential advancements include: (a) tools to optimize IAW operations based on rate structures and user needs and (b) hardware efficiency improvements

Goals:

- Improve grid stability
- Increase load flexibility and overall load efficiency
- Improve the value proposition of and participation in DR programs
- Provide data to policymakers and the CPUC for future industrial program and rate design

22. Virtual Power Plants Autonomous and Predictive Controls

Description: Develop and demonstrate open-source data and management controls that use autonomous and predictive methods to aggregate customer loads into virtual power plants (VPPs) so that community choice aggregators (CCAs) and others can follow grid signals and participate in wholesale energy markets. This research can include:

1. Development of telemetry, measurement and verification, real-time data collection and analysis practices
2. Development of hardware and software systems to aggregate and manage customer loads and DERs to provide load flexibility to the grid

Goals:

- Advance new monitoring and control solutions for managing customer loads and DER operations in response to grid signals and wholesale market participation.
- Create standard approaches to reduce adoption costs and facilitate VPP adoption.

23. Increasing Reliability and Interoperability of Load Flexible Technologies

Description: Advance control technologies, sensors, and communication systems to integrate flexible loads and DERs with the low-carbon grid. Potential research:

1. Develop technologies that increase or enhance interoperability and functionality between devices within buildings and between buildings and the grid
2. Deploy load flexibility technologies and evaluate ability to provide deeper and more reliable load impacts during times of need
3. Evaluate and verify the value proposition of load flexibility technologies to customers and the grid

Goals:

- Increase technology interoperability and integration improvements
- Increase the capability, availability, reliability, ease of use, and cost-effectiveness of load flexibility technologies

5-Minute Break

EPIC 4 Investment Plan

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

24. Technology Prize Competition for Advanced Electric Stovetops

Description: This initiative seeks to fund a prize competition for contestants to develop an advanced electric stovetop that can overcome consumer and industry acceptance barriers. Two prizes are proposed – one for residential applications and one for commercial kitchen applications.

Goals:

- Encourage new ideas and thinking that can lead to significant advancements in electric stovetop technology.
- Design and scale advanced electric stovetop designs that have the potential to significantly exceed the cost and performance of gas cooktops.
- Increase consumer and industry awareness and excitement around advanced electric stovetop technologies.

25. Low-Carbon / High-Temperature Industrial Heating

Description: Conduct applied research and technology demonstrations to promote electrification and energy efficiency in the industrial sector. Potential technology advancement and focus areas include:

1. Direct electrification of process heating
2. High temperature heat pumps to utilize waste heat as zero-carbon heat sources
3. Fuel switching to green hydrogen for higher temperature process heating that is technically and economically challenging for direct electrification

Goals:

- Reduce capital and operating costs of industrial heating equipment
- Provide industry flexibility for decarbonization with multiple technology options for direct electrification or the use of renewable electric power via green hydrogen
- Reduce industrial GHG emissions and criteria air pollutants associated with industrial heating, improving the air quality in the surrounding community

26. Energy Efficiency and Decarbonization of the Cement Industry

Description: Conduct applied research and technology demonstration and deployment of electro-technologies specific to cement industry by advancing:

1. Electrically driven carbon capture and utilization to increase the energy efficiency of carbon capture and utilization processes to reduce GHG emissions
2. Alternative raw materials, chemistries, and processes that facilitate electrification
3. Fuel switching solutions to transition from fossil fuels to electricity

Goals:

- Transition from fossil fuel use to renewable electricity use
- Increase adoption of carbon capture and utilization to eliminate process CO_2 emissions, which account for over 60% of CO_2 emissions in cement production
- Reduce GHG emissions and criteria air pollutants associated with combustion of fossil fuels
- Evaluate cost of GHG reductions for various options

27. Energy-Efficient Separation Processes

Description: Separation processes (like evaporation) massively use natural gas in the industrial sector releasing large quantities of CO_2 and criteria air pollutants.

This initiative will

1. Develop and demonstrate equipment that replaces thermal separation with alternative non-thermal electricity-driven methods, and
2. Improve electric energy efficiency of existing separation processes that have not been widely adopted due to unfavorable economics

Goals:

- Replace natural gas used for separations with electric-driven processes and determine energy savings and GHG reduction benefits
- Improve electric energy efficiency of existing separation processes
- Eliminate criteria air pollutants associated with combustion of natural gas

28. High Efficiency & Low Global Warming Potential (GWP) Heat Pump Water Heaters (HPWH)

Description: This initiative will design and develop a 120V and a 240V HPWH that uses low-GWP refrigerants.

Goals:

- Use refrigerants with a GWP of less than 150
- Operate at an efficiency equal to or higher than currently available electric HPWHs operating at same voltage
- Have similar life and maintenance as currently available electric HPWHs
- Be cost competitive with currently available electric HPWHs

29. Innovative Solutions for Improving the Value Proposition for Building Envelope Upgrades

Description: Conduct applied research and technology demonstrations to improve the value proposition of building envelope retrofits. Potential focus areas include:

1. Develop and demonstrate new envelope technologies and manufacturing processes to reduce cost
2. Develop and test thermal storage materials to enable building envelopes to actively store and release thermal energy with an emphasis on lower cost
3. Develop and test affordable non-intrusive home performance assessment and diagnostic tools to determine building envelope attributes, such as air leaks, moisture, presence of asbestos or lead, R-value of existing insulation in a building

Goals:

- Lower electricity consumption and costs for space cooling and heating
- Increase the affordability of building envelope retrofits by reducing the cost, time, and intrusiveness
- Introduce innovative building materials, designs, and manufacturing practices which can reduce cost while maintaining high energy efficiency performance

30. Combination Heat Pump for Domestic Hot Water & Space Conditioning

Description: Develop and demonstrate a packaged, modular hot water and space conditioning heat pump, potentially using a single compressor. Research may include:

- Evaluate technical feasibility and economics of maximizing heat recovery – such as using cool exhaust from the heat pump to precool outside air entering the building
- Evaluate feasibility and economics of combining heat pumps on a refrigeration loop or with hydronic heating

Goals:

- Use less energy to accomplish the same output as unitary, standalone units
- Be affordable, reduce engineering and integration effort, reduce installation complexity and cost
- Reduce operation and maintenance cost
- Reduce climate impacts by using low-GWP refrigerants
- Avoid the need to upgrade the electrical infrastructure

31. Nano-Grid HVAC Module Development and Demonstration

Description: Develop and demonstrate a module that includes a low-GWP heat pump, solar and energy storage. The heat pump will use direct current (DC) power from the solar and energy storage when available and grid electricity during other times. System will be sized to eliminate peak electric demand during the summer peak periods and will not have an interconnection agreement. Targets under-resourced communities in the Central Valley and may include multi/single family buildings or small commercial that have barriers to traditional solar installations.

Goals:

- Increase opportunities for solar and energy storage to those that have limited roof area and capital to install a full solar array
- Eliminate HVAC load during critical peak summer hours
- Demonstrate overall energy and cost savings and be a hedge on future electric rate increases
- Reduce engineering, installation, and complexity by producing a plug-and-play module that can benefit more Californians.

32. Smart Energy Management Systems (SEMS) for Homes

Description: Demonstrate the effectiveness of SEMS (such as smart electrical panels, home energy management systems, smart circuit splitters) in reducing upfront costs of electric panel upgrades with the potential to:

1. Respond to GHG, rate signals, and grid signals to increase demand flexibility
2. Support different communication protocols to communicate with any smart device
3. Provide an easy-to-use interface that allow homeowners to view, manage, and control their electrical loads
4. Aggregate loads for possible bidding into DR programs to control customer loads.

Goals:

- Minimize the cost and need for electrical panel and service upgrades
- Show the value proposition (including energy costs savings, and increased demand flexibility) to homeowners through demonstrations in actual homes
- Meet relevant codes such as NEC standards (UL 67,UL 916, UL 869a) and all other fire and safety codes

33. HVAC Decarbonization for Large Buildings

Description: Develop and demonstrate decarbonization solutions, such as:

1) Hybrid, low-GWP electric heat pump systems that can operate during lower load conditions with boilers and chillers used during the high load situations.

2) Advanced, high efficiency large air source and water source heat pumps that use low-GWP refrigerants and at a competitive price.

3) Other HVAC technologies, such as non-vapor compression cooling, solid state cooling, and ground-source heat pumps.

Goals:

- Maximize use of low carbon HVAC technologies to reduce or eliminate natural gas use
- Demonstrate the value proposition (e.g., energy and cost savings) of various options
- Increase deployment among equipment manufacturers, engineers and designers of these options when planning future retrofits or upgrades

EPIC 4 Investment Plan

Enable Successful Clean Energy Entrepreneurship Across California

34. Bringing Rapid Innovation Development to Green Energy (BRIDGE)

Description: Provides support to promising technologies and companies that have previously received federal or CEC funding.

Goals:

- Help start-up companies minimize the time between when their successful publicly funded project ends, and the time new public funding becomes available
- Accelerate early-stage research funded by the federal government and the CEC through the later-stages of the TRL spectrum
- Mobilize more early-stage capital in the clean energy space by providing non-dilutive, matching investments in promising clean energy companies alongside investors and commercial partners

35. Realizing Accelerated Manufacturing and Production for Clean Energy Technologies (RAMP)

Description: Supports clean energy entrepreneurs transition innovative technologies from prototype development to initial production scale-up. This initiative will help companies advance the Manufacturing Readiness Level of their technology to the Low-Rate Initial Production (LRIP) stage.

Goals:

- Increase manufacturing scale and production capacity of innovative technologies to meet customer demand
- Increase production yield
- Lower per-unit costs of new technologies
- Increase in-state manufacturing jobs for clean energy

36. Provide Support for Entrepreneurs to Test, Verify, and Validate Their Innovations

Description: Continues the CalTestBed program, which provides clean energy entrepreneurs access to a wide network of testbed facilities that can provide independent, third-party validated testing results on a technology's performance, supporting clean energy entrepreneurs on the path to technology commercialization.

Goal:

- Provide entrepreneurs with valuable third-party validated testing data, which can be used to attract customers or investors

37. Mobilizing Significant Private Capital for Scaling Clean Energy Technologies

Description: This initiative seeks to increase the "bankability" of clean energy technologies and increase the use of traditional (non-Venture Capital), large institutional financiers to deploy technologies at scale.

Goals:

- Mobilize private, philanthropic, and public capital into EPIC-supported technologies and technology projects in California and focus benefits toward under-resourced communities.
- Address a critical funding gap as new clean energy technology and technology companies scale from demonstration units to broader deployment.

38. Accelerating Tech Transfer

Description: This initiative seeks to facilitate the accelerated transfer of energy technology related intellectual property (IP) from institutions, such as universities and laboratories, to private entities focused on commercialization.

Goals:

- Increase amount of successfully commercialized technologies originating from universities and national laboratories
- Increase access to valuable IP to wider array of entrepreneurs throughout California

39. Advanced Battery Manufacturing

Description: This initiative seeks to support the scale up of advanced battery manufacturing in California focusing on advanced technologies such as Lithium-metal batteries at the component, cell, and battery pack levels.

Goals:

- Shorten time to production of new advanced battery technology components
- Increase production capacity of advanced lithium batteries in California
- Accelerated adoption of new battery technologies at larger scales
- Provide workforce development in support of California manufacturing

EPIC 4 Investment Plan

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

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

Description: Conduct research that supports an equitable distribution of benefits from clean energy solutions. Research advancements may include:

1. Examining the air quality, health, and equity implications of clean energy deployment strategies, including SB 100 implementation and transportation electrification;
2. Evaluating the benefits of early demonstrations, such as residential building electrification projects;
3. Developing associated analytical approaches, modeling tools, data, and metrics that support integration of health and equity into energy policies.

Goals:

- Enable prioritization of equity in resource planning for SB 100 implementation
- Maximize air quality and health benefits of clean energy pathways
- Promote affordable building decarbonization and transportation electrification in under-resourced communities

41. Integrating Climate Resilience in Electricity System Planning

Description: Develop tools and strategies to support a climate-resilient transition to a zero-carbon electricity system. Research advancements may include:

1. Evaluating climate impacts on electricity demand, supply, and distribution to support electricity planning and operations;
2. Quantifying the benefits of strategies to ensure grid reliability and community energy resilience;
3. Informing energy resilience investments that address the needs of California's Disadvantaged and Vulnerable Communities (DVCs).

Goals:

- Integrate climate considerations into electricity system operations, planning, and investment
- Inform policies and market frameworks for addressing community- and grid-level resilience
- Prioritize energy resilience investments in DVCs while also addressing other vulnerabilities and challenges faced by DVCs

42. Advancing the Environmental Sustainability of Energy Deployments

Description: Ensure that the anticipated rapid growth of clean energy deployments to achieve SB 100 targets meets other environmental and sustainability objectives. Research advancements may include:

1. Developing tools and methods to assess land and sea use changes associated with resource buildout scenarios;
2. Assessing environmental risk (e.g., for sensitive species and habitats) from specific technologies at the project level;
3. Developing and validating mitigation techniques and technologies to minimize impacts;
4. Developing new monitoring technologies and validating them for use in energy projects. projects.

Goals:

- Identify and mitigate land and sea use impacts from clean energy buildout
- Expedite permitting by validating mitigation methods to minimize impacts
- Reduce soft costs by determining which environmental risks warrant detailed assessment

Cross-Cutting Initiatives

43. Cost Share

Description: This initiative will provide cost share to California-based entities to leverage private, non-profit, and federal funding opportunities for projects consistent with the goals and objectives of EPIC.

Goal:

- Attract federal or privately-funded projects to California.

44. Events and Outreach Support

Description: This initiative will fund support for CEC staff to carry out critical technology transfer and outreach activities such as the EPIC Symposium, Technology Forums, Innovation Tours, as well as manage online platforms such as Energize Innovation and Empower Innovation.

Goals:

- Expand the reach of tech transfer events and networking platforms.

PUBLIC INPUT SESSION

Stakeholder Comments on the Draft Initiatives for the EPIC 4 Investment Plan

- 3 minutes per commenter, 1 commenter per organization
- Please clearly state your name and affiliation
- Use the raise hand function in Zoom and wait to be called upon to unmute
- Type questions/comments into the Q/A window

https://www.online-stopwatch.com/full-screen-stopwatch/

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)?

To stay involved in EPIC 4:

Visit CEC's website for workshop info, presentations, docket, e-commenting, and EPIC listserv sign up: www.energy.ca.gov/epic4

Submitting Written Comments:

Workshop Comments may be submitted using CEC's **e-commenting** system: https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01

See this event's **notice** for **e-mail and U.S. Mail** commenting instructions: https://efiling.energy.ca.gov/getdocument.aspx?tn=238093

For all comments, please include docket # **20-EPIC-01** and "EPIC 4 Investment Plan" in the subject line and on the cover page. Comments for this workshop are due **August 11, 2021*.**

*any update to this deadline will be shared with those on the EPIC listserve.

Thank You