

DOCKETED

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Project Title:	Development of the California Energy Commission Electric Program Investment Charge Investment Plans 2021-2025
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Filer:	Misa Werner
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Electric Program Investment Charge: 2021-2025 (EPIC 4) Investment Plan Scoping Workshop

Title: **Connecting Policy and Research in EPIC**

Presenters: CEC Energy Research & Development Division Staff and CPUC Energy Division Staff

Date: June 14, 2021

Introduction and Opening Remarks

Agenda

Introduction and Opening Remarks (10:00-10:05)

Laurie ten Hope, CEC Deputy Director, Energy Research & Development Division

EPIC Requirements, Priorities, and Related California Public Utilities Commission (CPUC) Proceedings (10:05-10:15)

Fred Beck, CPUC

EPIC 4 Investment Planning Overview, Timeline, and Public Participation (10:15-10:25)

Misa Werner, CEC

Policy Context for Research Planning (10:25 – 10:50)

1. Senate Bill 100 Joint Agency Report Overview
Liz Gill, CEC
2. R&D Opportunities for State Energy Policy, Planning, & Assessment
Jonah Steinbuck, CEC

Public Input Session (10:50-11:55)

Stakeholders and CEC Subject Matter Experts

Closing and Next Steps (11:55-12:00)

Misa Werner, CEC

EPIC Background

- EPIC was established by the California Public Utilities Commission (CPUC) in 2011 to **fill a critical gap in California's clean energy policy**.
- EPIC provides ~ **\$162 million annually to develop and demonstrate new technology innovations** that can provide benefits to electric ratepayers.
- The CPUC named the CEC as one of 4 administrators of EPIC along with Pacific Gas & Electric, Southern California Edison and San Diego Gas & Electric.
- The CEC administers 80% of the EPIC funding, investing in the areas of **Applied Research and Development, Technology Demonstration and Deployment, and Market Facilitation**.
- Senate Bill 96 provides additional statutory direction to the CEC to award EPIC funds for projects that will lead to **technological advancements and breakthroughs** to overcome the barriers that prevent achieving the state's statutory energy goals.
- Assembly Bill 523 requires a **minimum of 25% and 10%** of the CEC's EPIC Technology Demonstration and Deployment funds to go to **disadvantaged and low-income communities**, respectively.

CALIFORNIA'S INVESTMENT IN CLEAN ENERGY INNOVATION



Entrepreneurial Ecosystem

\$143 million invested

Through EPIC, the CEC is building a world-class ecosystem supporting clean energy entrepreneurship.



Grid Decarbonization & Decentralization

\$154 million invested

Improving the cost competitiveness and performance of key technologies.



Resiliency & Safety

\$106 million invested

Helping communities, businesses, and public agencies build a safer, more resilient energy system.



Industrial & Agricultural Innovation

\$113 million invested

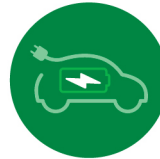
Scaling specialized technology solutions to drive energy efficiency without compromising production.



Building Decarbonization

\$170 million invested

Improving the affordability, health, and comfort of buildings.



Transportation Electrification

\$33 million invested

Supporting advances that reduce the cost of electric vehicle ownership and support the grid.

EPIC Requirements, Priorities, and Related California Public Utilities Commission Proceedings

Fredric Beck

Senior Regulatory Analyst for Energy RD&D
Climate and Equity Initiatives, Energy Division
California Public Utilities Commission

June 14, 2021



California Public
Utilities Commission

About the CPUC

The California Public Utilities Commission (CPUC) regulates investor-owned electric and natural gas utilities (IOUs) operating in California and provides oversight to the EPIC program.

Funding for the EPIC Program is provided by ratepayers of CPUC jurisdictional electric IOUs per CPUC Decision.

Through its oversight role, the CPUC has played a key role in making California a national and international leader on several energy-related initiatives designed to benefit consumers, the environment, and the economy.

The CPUC protects consumers, safeguards the environment, and assures Californians' access to safe and reliable utility infrastructure and services.

CPUC Expectations and Requirements for EPIC 4

The CPUC supports a range of stakeholders being engaged early and often in the strategic planning process for EPIC 4.

As defined in California Public Resources Code § 25711.5, the EPIC portfolio is intended to be **strategically focused** and **sufficiently narrow** to make advancement on the **most significant technological challenges**.

With the wide range of topics EPIC can potentially address, this requirement helps focus stakeholder input and administrator planning on EPIC initiatives that focus on the highest value projects that lead to **timely and substantive impact**.

CPUC Proceeding R.19-10-005 considers EPIC Policy Priorities

Phase 1 of the Proceeding reauthorized the EPIC program through 2030.

Phase 2 of the Proceeding will consider:

- The overall EPIC budget
- The role of utilities in EPIC
- Administrative and program structure improvements
- Investment planning and project impacts
- Program and administrator evaluations
- **Program principles and policy priorities**
 - How should the CPUC establish overall policy priorities for the EPIC program?

Stakeholder input in the EPIC 4 planning process will inform CPUC efforts to establish policy priorities

CPUC Priorities for EPIC

CPUC D.12-05-037 established provision of electricity **ratepayer benefits** as EPIC's mandatory and primary principle.

CPUC proceeding R.19-10-005 proposes to add environmental sustainability and equity to the existing definition of these EPIC benefits:

- **Improve Safety:** EPIC projects should improve the safety of operation of California's electric grid in the face of climate, wildfire, and emerging challenges.
- **Increase Reliability:** EPIC projects should increase the reliability of California's electric grid while continuing to decarbonize California's electric power supply.
- **Increase Affordability:** EPIC projects should fund electric sector technologies and approaches that lower California electric rates and ratepayer costs.
- **Improve Environmental Sustainability:** EPIC projects should continue to reduce GHG emissions, criteria pollutant emissions, and the overall environmental impacts of California's electric system.
- **Improve Equity:** EPIC innovations should increasingly support, benefit, and engage vulnerable, low-income and disadvantaged California communities.



California Public Utilities Commission

www.cpuc.ca.gov/energyrdd

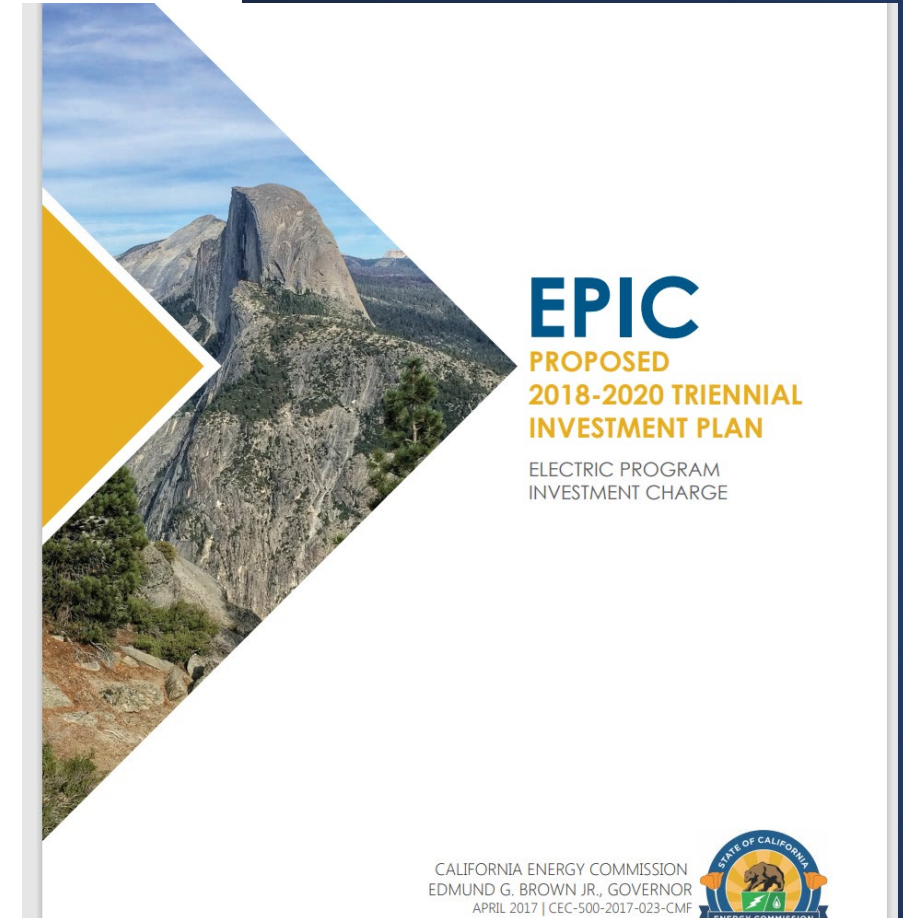


EPIC 4 Investment Plan Process, Timeline, and Public Participation

Misa Werner, CEC

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 Investment Plan can be found at: <https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M185/K575/185575884.PDF>
- Draft Proposed EPIC Interim Investment Plan 2021 <https://efiling.energy.ca.gov/getdocument.aspx?tn=236221>



EPIC 4 Investment Plan Research Themes



Decarbonization

Reduce GHG emissions and use of fossil fuels.



Resilience and Reliability

Manage through and recover from *large-area or long-duration outages*.
Reduce the frequency or impact of *small-scale or short-duration disruptions* in electric service.



Entrepreneurship

Support clean energy entrepreneurs developing breakthrough technology solutions from idea to market.



Affordability

Improve the affordability of energy services for all electric ratepayers.

EQUITY is an overarching theme for EPIC investment planning. Initiatives will include funding set-asides for projects in under-resourced communities and other equity-targeting elements.

EPIC 4 Plan Schedule

Task / Event	Date(s)
Public workshops to solicit stakeholder input on specific topic gaps	May – July 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)
CPUC Decision on EPIC 4 Plan expected	Spring-2022 (tentative)
The first EPIC 4 solicitations released	Summer-Fall 2022

EPIC 4 Workshops

Workshop Title and Description	Date
Unlocking Flexibility from Customer Load Management and Distributed Energy Resource (DER) Technologies	Monday, June 21, 2021 9:30 a.m.
Building Decarbonization	Monday, June 28, 2021 9:30 a.m.
Hydrogen Technology	Thursday, July 1, 2021 1:00 p.m.
Offshore Wind Energy R&D Opportunities for EPIC 4	Wednesday, July 14, 2021 1:00 p.m.
Industrial Decarbonization	Friday, July 16, 2021 9:30 a.m.
Technology Advancements for Energy Storage	Tuesday, July 20, 2021 9:30 a.m.
Improving the Bankability of New Clean Energy Technologies	Thursday, July 22, 2021 10:00 a.m.
Draft Initiatives for EPIC 4	Wednesday, August 4, 2021 9:00 a.m.



<https://www.energizeinnovation.fund/events#tab-upcoming-events>

Stakeholder Input Form

- Download at <https://www.energy.ca.gov/media/5703>
- Submit to Docket 20-EPIC-01
- Due July 2

ELECTRIC PROGRAM INVESTMENT CHARGE 2021-2025 (EPIC 4) RESEARCH CONCEPT PROPOSAL

The CEC is currently soliciting research concept ideas and other stakeholder input for the EPIC 4 Investment Plan. For those who would like to submit an idea for consideration, we ask that you complete this form and submit it to the CEC by 5:00 p.m. on **July 2, 2021**.

To submit the form, please visit the e-commenting [link](https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01), <https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01>, enter your contact information, and then use the “choose file” button at the bottom of the page to upload and submit the completed form. Thank you for your input.

1. Please provide the name, email, and phone number of the best person to contact should the CEC have additional questions regarding the research concept:

Click or tap here to enter text.

2. Please provide the name of the contact person’s organization or affiliation:

Click or tap here to enter text.

3. Please provide a brief description of the proposed concept you would like the CEC to consider as part of the EPIC 4 Investment Plan. What is the purpose of the concept, and what would it seek to do?

Click or tap here to enter text.

4. In accordance with Senate Bill 96, please describe how the proposed concept will **"lead to technological advancement and breakthroughs to overcome barriers that prevent the achievement of the state's statutory energy goals."** For example, what technical and/or market barriers or customer pain points would the proposed concept address that would lead to increased adoption of clean energy technologies? Where possible, please provide specific cost and performance targets that need to be met for increased industry and consumer acceptance. For scientific analysis and tools, what data and information gaps would the proposed concept help fill, what specific stakeholders will use the results, and for what purpose(s)?

[Click or tap here to enter text.](#)

5. Please describe the anticipated outcomes if this research concept is successful, either fully or partially. For example, to what extent would the research reduce technology costs and/or increase performance to improve the overall value proposition of the technology? What is the potential of the technology at scale?

[Click or tap here to enter text.](#)

6. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed research concept.

[Click or tap here to enter text.](#)

7. Please provide references to any information provided in the form that support the research concept's merits. This can include references to cost targets, technical potential, market barriers, etc.



EMPOWER
INNOVATION

empowerinnovation.net

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:

The Stakeholder Input Form and 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 **June 21, 2021**.

Policy Context for Research Planning

Senate Bill 100 Joint Agency Report Overview

- Liz Gill, CEC

R&D Opportunities for State Energy Policy, Planning, & Assessment

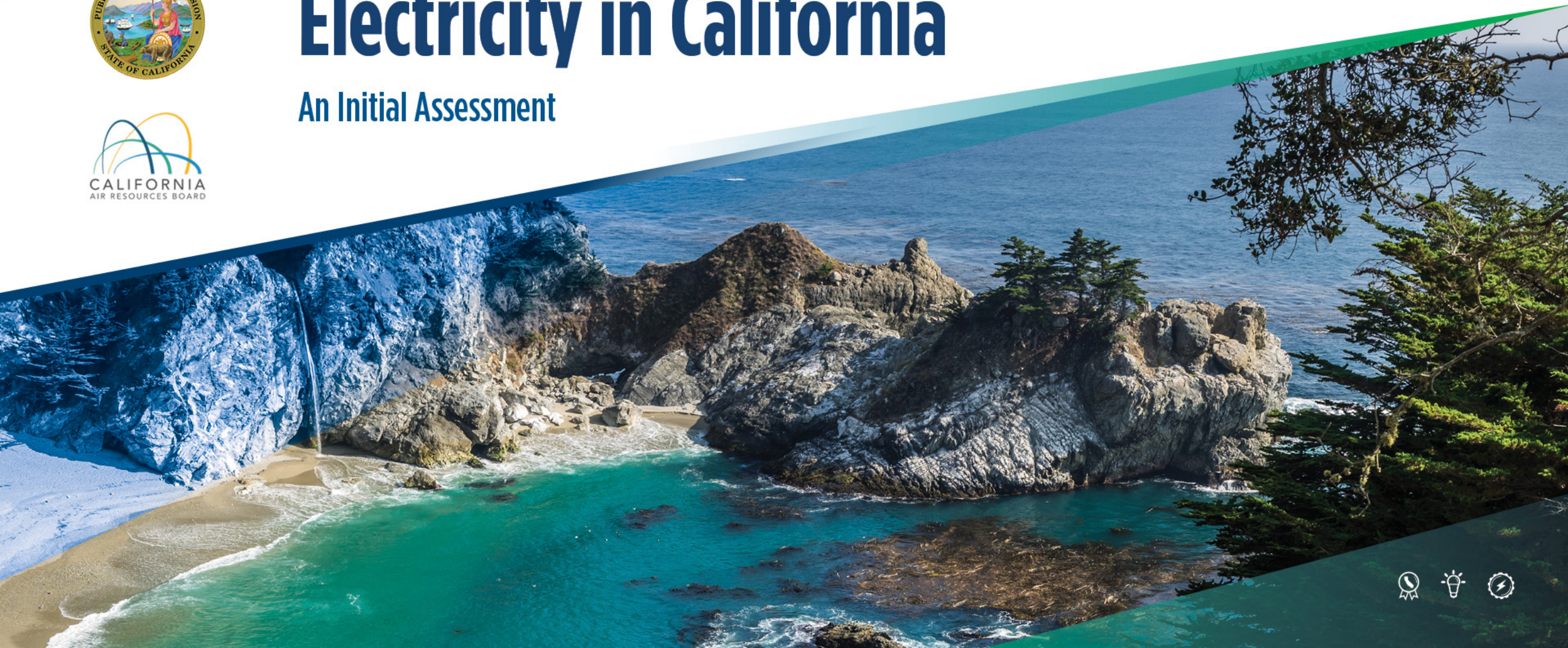
- Jonah Steinbuck, CEC



2021 SB 100 Joint Agency Report Summary

Achieving 100% Clean Electricity in California

An Initial Assessment



Senate Bill 100

Officially titled “The 100 Percent Clean Energy Act of 2018,”
Senate Bill 100 (SB 100, De León):

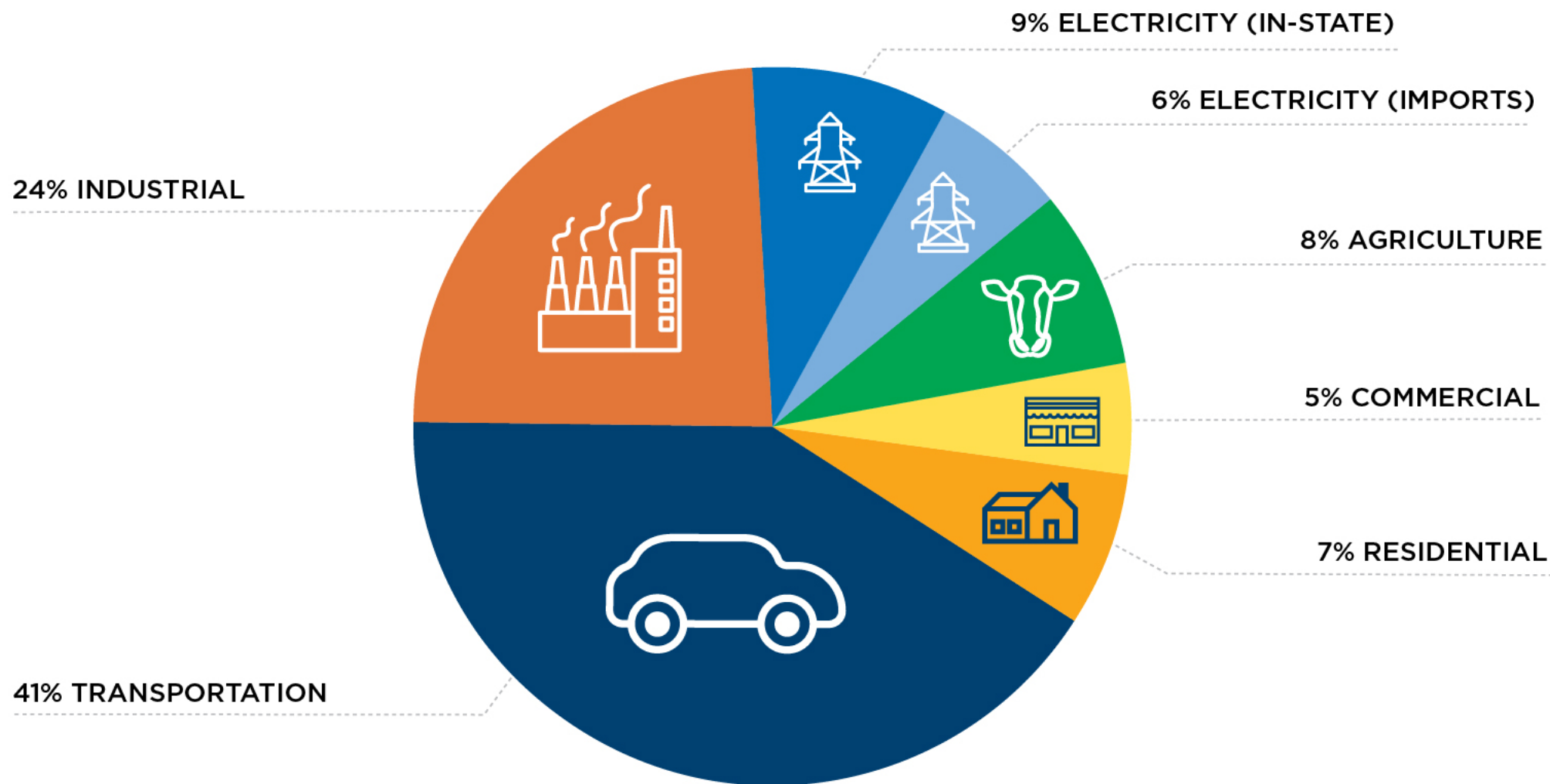
- 1** Sets a 2045 goal of powering all retail electricity sold in California and state agency electricity needs with renewable and zero-carbon resources.
- 2** Updates the state’s Renewables Portfolio Standard to ensure that by 2030 at least 60 percent of California’s electricity is renewable.
- 3** Requires the CEC, CPUC, and CARB to use programs under existing laws to achieve 100 percent clean electricity and issue a joint policy report on SB 100 by 2021 and every four years thereafter.





California's

2018 Greenhouse Gas Emissions



Source: California Air Resources Board

Benefits

of 100% Clean Energy

Achieving 100% Clean Electricity in California



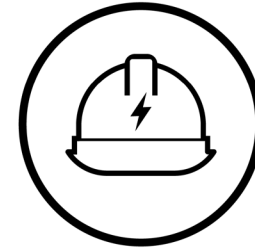
Improves Public Health

The phaseout of fossil fuel-generated electricity is expected to reduce criteria air pollution and related deaths and illnesses.



Advances Energy Equity

Disadvantaged communities—low-income neighborhoods that have historically suffered poor health, dirty air and other burdens — will reap the highest health benefits from clean electricity.



Restores and Creates Clean Energy Jobs

SB 100-driven growth will restore thousands of clean energy jobs lost during the pandemic and create thousands of new high-quality clean energy jobs.



Public Outreach



A diverse array of interests informed this report through a year-long series of public workshops and comment opportunities. Participants included:

Community leaders

Energy experts with utilities, technology companies and trade groups

University researchers

Environmental groups

Environmental justice organizations

The joint agencies also consulted with:

The California Balancing Authorities

The Disadvantaged Communities Advisory Group

The 2021 SB 100 Joint Agency Report

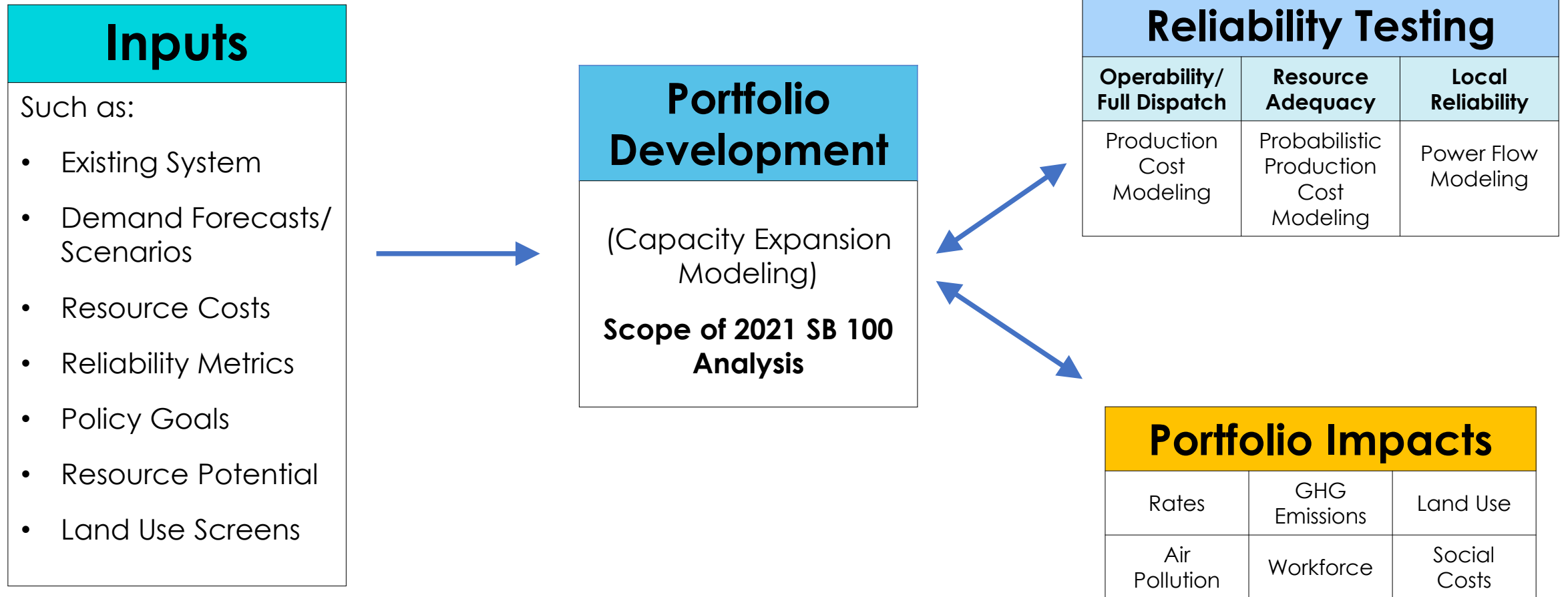
The 2021 report is a first step to evaluate the challenges and opportunities in implementing SB 100.

It includes an initial assessment of the additional energy resources and the resource building rates needed to achieve 100 percent clean electricity, along with the associated costs.

The estimates in this report will change over time as additional factors, such as system reliability, land use, energy equity, and workforce needs, are more closely examined.



Resource Planning Modeling & Analytics



Inputs, impacts, and tools listed are for illustrative purposes

Renewable/Zero-Carbon Technologies Modeled:



Solar, photovoltaic
and thermal (existing only)



Wind, onshore and offshore



Geothermal



Bioenergy



Fuels cells



Hydroelectric, existing
large and small operations only



Nuclear, existing
power plants only



California

Clean Electricity Resources

**Projected to increase annual costs
6% above a 60% RPS baseline**













* Includes in-state

** Includes in-state and out of state capacity

† New hydro and nuclear resources were not candidate technologies for this round of modeling and could not be selected



Achieving 100% Clean Electricity in California

		Existing Resources	Projected New Resources	
		2019*	2030**	2045**
	Solar (Utility-Scale)	12.5 GW	16.9 GW	69.4 GW
	Solar (Customer)	8.0 GW	12.5 GW	28.2 GW
	Storage (Battery)	0.2 GW	9.5 GW	48.8 GW
	Storage (Long Duration)	3.7 GW	0.9 GW	4.0 GW
	Wind (Onshore)	6.0 GW	8.2 GW	12.6 GW
	Wind (Offshore)	0 GW	0 GW	10.0 GW
	Geothermal	2.7 GW	0 GW	0.1 GW
	Biomass	1.3 GW	0 GW	0 GW
	Hydrogen Fuel Cells	0 GW	0 GW	0 GW
	Hydro (Large)	12.3 GW	N/A†	N/A†
	Hydro (Small)	1.8 GW	N/A†	N/A†
	Nuclear	2.4 GW	N/A†	N/A†

To Achieve Clean Energy

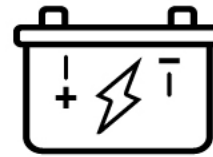
Development Needs
To Rapidly Accelerate



Solar & Wind

3X

Solar and wind build rates need to nearly triple*



Battery

8X

Battery build rates need to increase by nearly eightfold**



*Based on 10-year average | **Based on 2020



Additional Scenarios: Preliminary Findings

Study Scenarios

The agencies also explored scenarios outside their interpretation of SB 100 to inform broader state planning efforts



High Demand Flexibility:

Increased flexibility may lower overall resource needs and systems costs



No-Combustion:

Reduces criteria air pollution but results in higher costs



Zero-Carbon Firm Resources:

Commercialization of emerging technologies or cost decreases in existing firm resources may lower overall system costs



Accelerated Timeline:

These targets may be achievable but may increase overall costs

Key Takeaways from Modeling

This initial analysis suggests SB 100 is technically achievable through multiple pathways.

Construction of clean electricity generation and storage facilities must be sustained at record-setting rates.

Diversity in energy resources and technologies lowers overall costs.

Retaining some natural gas power capacity may minimize costs while ensuring uninterrupted power supply during the transition to 100 percent clean energy.

Increased energy storage and advancements in zero-carbon technologies can reduce natural gas capacity needs.

Further analysis is needed.

Recommendations for Further Analysis

- 1 Verify that scenario results satisfy the state's grid reliability requirements.
- 2 Continue to evaluate the potential effects of emerging resources, such as offshore wind, long-duration energy storage, green hydrogen technologies, and demand flexibility.
- 3 Assess environmental, social, and economic costs and benefits of the additional clean electricity generation capacity and storage needed to implement SB 100.
- 4 Hold annual workshops to support alignment among the joint agencies and continuity between SB 100 reports.

Thank You

The 2021 SB 100 Joint Agency Report and Summary Document
can be found at:

<https://www.energy.ca.gov/sb100>

For SB 100 report questions contact: Liz.gill@energy.ca.gov

R&D Opportunities for State Energy Policy, Planning, & Assessment

Jonah Steinbuck, Manager of the Energy Generation Research Office



State Policy, Planning, and Assessment

- **SB 100:** Renewable and zero-carbon resources supply 100% of retail sales by 2045
- **SB 32:** Achieve statewide GHG reductions of 40% below 1990 level by 2030
- **AB 3232:** Assess building GHG reductions of 40%+ below 1990 levels by 2030
- **EO N-79-20:** New passenger vehicles 100% zero-emission by 2035
- **AB 2127:** Assess electric vehicle charging infrastructure needs for 2030



Objectives Informing R&D Opportunities

- Achieve the magnitude of buildout
- Drive continued cost reductions
- Ensure reliability and resilience
- Address land use and environmental implications
- Advance equity



R&D Opportunities: Solar & Storage

Solar

- **SB 100 Analysis:** Solar has largest projected buildout of capacity
- **Possible R&D:** Photovoltaic (PV) technologies (e.g., thin film, tandem, bifacial), tracking, forecasting

Storage

- **SB 100 Analysis:** Storage has second largest projected buildout; significant ramp up in battery buildout rate
- **Possible R&D:** Cost reductions, long duration, material sustainability; lithium in-state



R&D Opportunities: Wind & Hydrogen

Wind

- **SB 100 Analysis:** Availability of offshore wind and out of state wind has implications for buildout of solar, storage, other resources
- **Possible R&D:** Tall towers; blades; offshore turbine substructure, port readiness, ocean environmental research, grid and storage integration

Hydrogen

- **SB 100 Analysis:** Hydrogen fuel cells not selected in core scenarios; play significant role in no combustion scenario; hydrogen-based combustion generation a potential valuable firm, zero-carbon resource
- **Possible R&D:** Hydrogen combustion generation demos (cost, safety, durability); cost reductions in production; evaluating end uses; advancements for long-duration storage



R&D Opportunities: Electrification and Load Flexibility

Electrification

- **SB 100 Analysis:** Extent of electrification has major implications for supply-side resource buildout and grid infrastructure
- **Possible R&D:** EV charging (high-efficiency, heavy-duty); heat pumps

Load Flexibility

- **SB 100 Analysis:** Load flexibility reduces need for storage, decreases economic gas retention, lowers total costs
- **Possible R&D:** Grid-responsive water heating, HVACs, battery storage, EV charging



R&D Opportunities: Reliability, Resiliency, and Land Use

Reliability and Resilience

- **SB 100 Analysis:** Recommendation to conduct reliability analysis
- **Possible R&D:** Research on climate impacts for electricity demand, wind, solar, hydropower that informs reliability analysis

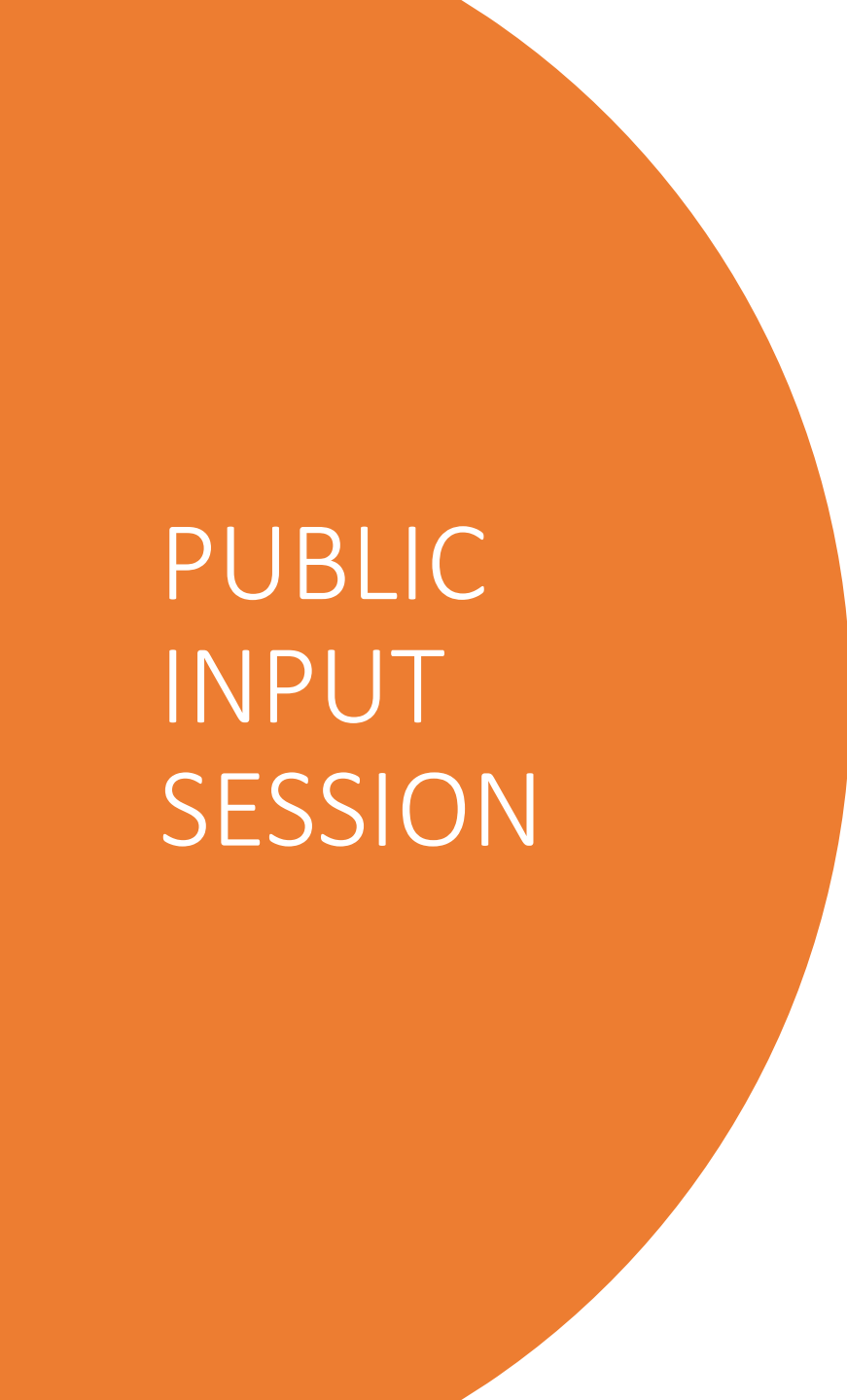
Land Use Implications

- **SB 100 Analysis:** Recommendation to conduct land use impact analysis
- **Possible R&D:** Research land use impacts, footprint of different technology portfolios, approaches to mitigation and tradeoffs with other objectives



Questions for Comment

- **Which areas of technology innovation and complementary research are particularly important in achieving our state energy goals?**
 - What is compelling about the proposed innovation?
 - What is the impact potential for the R&D area?
 - Are there existing activities and resources that could be leveraged?
- **How can we effectively advance equity as part of the EPIC Program?**
 - Are there specific technology needs or outcomes (e.g., air quality, resilience) that you see as priorities in under-resourced communities?
 - What R&D topics and strategies would enable broad access to clean energy?
 - Are there program implementation approaches that you would suggest to promote equity?

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PUBLIC INPUT SESSION

Stakeholder Comments on the Scope of 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/>



Next Steps

To stay involved in EPIC 4:

Visit www.energy.ca.gov/epic4.

Submitting Written Comments and EPIC 4 Plan Concepts:

Please use CEC's **e-commenting** system:

<https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=20-EPIC-01>

See **notice** for **e-mail** and **U.S. Mail** commenting instructions:

<https://efiling.energy.ca.gov/getdocument.aspx?tn=238093>

Workshop Comments are due June 21, 2021.

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<https://www.energy.ca.gov/media/5703>)



Thank You