

2018 EPIC ANNUAL REPORT

ELECTRIC PROGRAM INVESTMENT CHARGE HIGHLIGHTS

EPIC'S IMPACT BUILDING A CLEAN ENERGY FUTURE THROUGH INNOVATION

California is transforming its energy landscape, making substantial progress in modernizing its electricity system while maintaining significant economic growth. From 2001-2016, the state's per capita greenhouse gas emissions declined nearly 23 percent while the state's gross domestic product (GDP) increased by 41 percent. As of 2018, California is the fifth largest economy in the world and has met its 2020 renewable goals ahead of schedule.

However, today's technologies are not expected to be capable of avoiding the most serious impacts of climate change and maintaining the momentum needed to achieve 100 percent renewable generation by 2045. Rapid innovation is critical to meeting both state and international goals. As a global clean-energy leader, California has the capacity to deliver innovation with its world-class universities, national laboratories, private-public partnerships, and entrepreneurial spirit.

The Electric Program Investment Charge (EPIC) program fills an important gap in California's clean energy policy goals by funding research, development, and demonstration projects that advance the technical performance and cost-effectiveness of clean energy technologies.

EPIC hastens the pace of innovation and the deployment of market-ready technologies through an innovation ecosystem that openly shares information and invests in an extensive portfolio of projects.

EPIC SUPPORTS RESEARCH IN CALIFORNIA'S CLIMATE CHANGE ASSESSMENT

Scientific research funded by the California Energy Commission has made clear that California's energy system is vulnerable to climate impacts. For example, EPIC-supported research in Cal-Adapt indicates that if greenhouse gas emissions remain unchecked, Fresno will witness a 12-fold increase in the number of extreme heat days, or days above 106.3°F, by the end of the century. This would make Fresno's summer climate similar to Phoenix, Arizona.

This extreme heat not only threatens the health and well-being of Californians and their communities, but also creates grid capacity losses that worsen with increases in peak hour loads from the rise in demand for space cooling. These electricity demand impacts will be difficult to overcome, even with aggressive energy efficiency measures.

The most serious impacts of climate change are listed in California's Fourth Climate Change Assessment. EPIC-funded research contributing to the most recent assessment was featured in working group discussions that support the California Public Utilities Commission's Adaptation Rulemaking (R.18-04-019). Additionally, the South Bay Cities Council of Governments intends to use the electricity demand and grid vulnerability projections from an EPIC-funded study to develop its climate action plan.

OUR CHANGING CLIMATE

Should greenhouse gas emissions remain unchecked, the frequency of extreme heat days with temperatures rising above 106.3 °F in Fresno will increase 12-fold by late century.

Innovative Ideas
Basic Research

Commercialization
Valley of Death

Production
Market Expansion

R&D

Prototype/
Proof of
Concept

Pilot/
Demonstration

Customers
in 1st Target
Market

Customers
in follow-on
Markets

Maturity/Price
Competition

BUILDING A SAFE AND RESILIENT ENERGY SYSTEM

An aging transmission and distribution infrastructure, coupled with a changing global climate, threatens the safety and resiliency of California's energy systems. Drought, heatwaves, wildfires, and flooding are becoming increasingly common and growing in intensity. The Energy Commission supports research and technological advancements to mitigate these impacts and help adapt to a changing climate.

In 2015, the Energy Commission provided EPIC funding to the Blue Lake Rancheria community to install and demonstrate a campus microgrid capable of providing power to the local American Red Cross evacuation center in Humboldt County.

On October 8, 2017, a wildfire started approximately a quarter-mile from the Rancheria, causing a 90-minute electrical outage that left nearly 1,900 customers without power. The microgrid detected the outage, automatically islanded (isolated) itself from the statewide grid, and prevented a blackout to the campus. Fire crews using the Rancheria campus as an emergency response and staging center did not have to contend with a loss of power that could have significantly hampered firefighting operations.

When power was restored, the microgrid automatically reconnected to the grid. The entire process was responsive and seamless to the extent that the outage went unnoticed by the Rancheria until the operational logs were reviewed. The

successful performance of the Blue Lake Rancheria microgrid in an unexpected emergency provides further evidence that microgrid technology will play a key role in building a more resilient electricity system.

BUILDING A STATEWIDE ECOSYSTEM TO SUPPORT CLEAN ENERGY ENTREPRENEURSHIP

To foster and support clean energy entrepreneurship across the state, the Energy Commission has created the California Energy Innovation Ecosystem, a statewide network of technology incubators, investors, universities, non-profit groups, and corporate partners.

The ecosystem includes the CalSEED small grant program, an innovation program for entrepreneurs investing in early-stage, novel energy solutions. One recent CalSEED grant awardee is Enerdapt, a startup based in the Sacramento County community of McClellan Park. Enerdapt has leveraged its CalSEED funds to demonstrate a real-time energy management software tool that uses artificial intelligence and machine learning to better manage space cooling in office buildings, resulting in operational savings of 20-30 percent.

To complement CalSEED, four regional innovation clusters have been established to provide entrepreneurial support services such as laboratory equipment, testing facilities, business



Figure 1. Blue Lake Rancheria Microgrid
Source: Siemens USA



Figure 2: Sunfolding's Tracking System
Source: Sunfolding

plan development, and connections to investors. Each cluster evaluates start-up companies within their respective regions and, if accepted, the cluster designs an entrepreneurial assistance and mentorship program that leverages the region's universities and research institutions, industries, businesses, economic development organizations, and other key regional stakeholder groups. In 2018, companies in the Energy Innovation Ecosystem attracted \$88 million in private and public funding.

ENABLING A MORE DECARBONIZED AND DECENTRALIZED ELECTRIC GRID

The declining cost of photovoltaic (PV) generation technologies has been one of the energy sector's biggest success stories of the past decade. Tracker systems that follow the sun's path significantly improve the economics of PV generation over traditional fixed-tilt systems. However, many PV trackers rely on motors and gearboxes with hundreds of moving parts and wear surfaces coupled with heavy steel structures. This creates high installation, operation, and maintenance costs compared to their fixed-tilt counterparts.

In 2015, EPIC funds were awarded to San-Francisco based start-up company Sunfolding to conduct a field validation of its AirDrive™ PV tracking system, which uses robust and reliable air-based components instead of mechanical parts. This system has the potential to use one-tenth the number of structural

components of a normal PV tracking system, resulting in cost savings on multiple fronts including a 65 percent reduction in labor hours for installation, a 7 percent reduction in operation and maintenance costs, and a 3 percent reduction in the levelized cost of electricity.

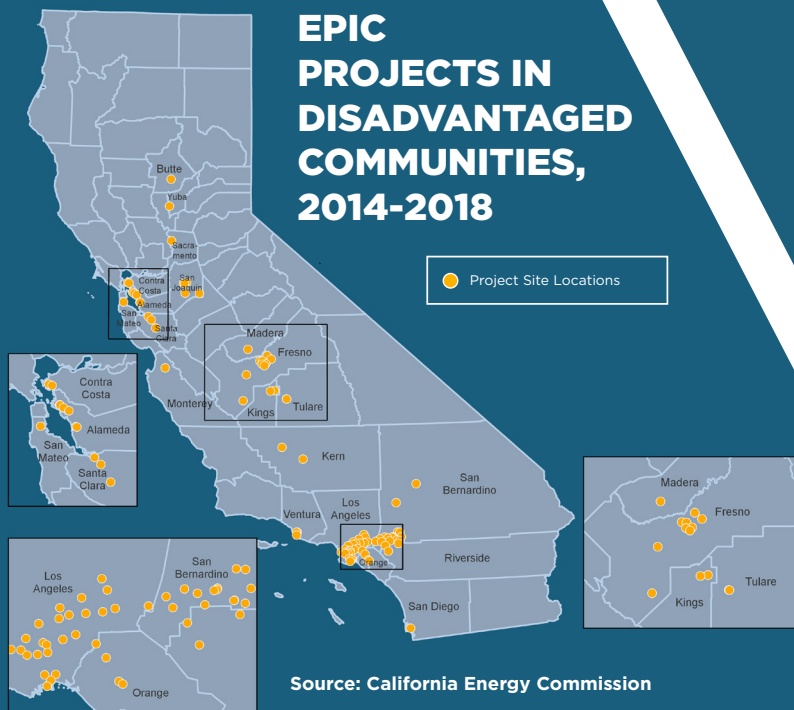
BRINGING BROAD PERSPECTIVES TO OPTIMIZE LINKAGES AMONG POLICIES, TECHNOLOGIES, AND MARKETS

Private sector investors are responding to the Energy Commission's funding awards and technical validation by contributing additional financing. In an Energy Commission analysis, clean energy projects that were awarded an EPIC grant had their private sector investment double compared to projects that received no EPIC funds.

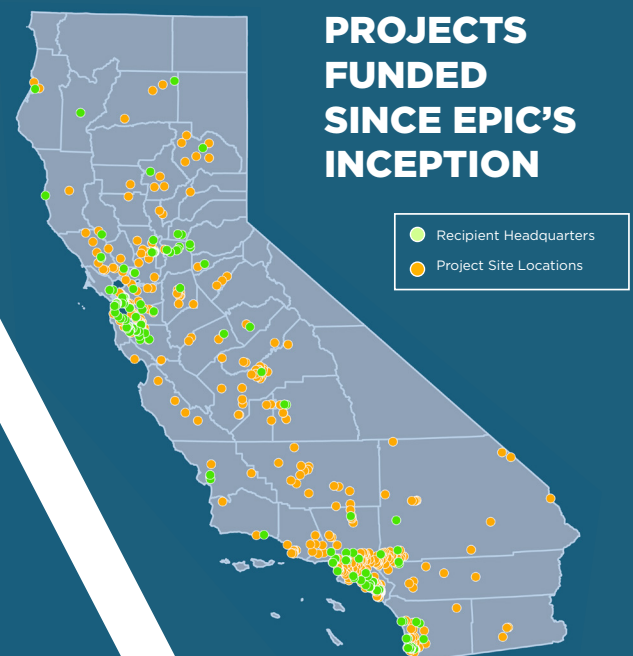
BUILDING ON PUBLIC INVESTMENT

Through 2018, companies in the Energy Innovation Ecosystem have attracted \$88 million in private and public funding.

EPIC PROJECTS IN DISADVANTAGED COMMUNITIES, 2014-2018



PROJECTS FUNDED SINCE EPIC'S INCEPTION



INCREASING DIVERSITY AND EQUITY IN EPIC

State policy supports EPIC's increased engagement and participation from underrepresented groups, especially disadvantaged and low-income communities. Assembly Bill (AB) 523 (Reyes, Chapter 551, Statutes of 2017) codified the program's diversity outreach and new requirements for the Energy Commission's administration of the EPIC program:

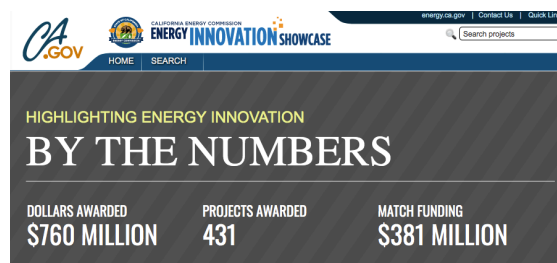
- At least 25 percent of EPIC technology demonstration and deployment funds shall go to projects located in and benefitting disadvantaged communities.
- Additionally, at least 10 percent of EPIC technology demonstration and deployment funds shall go to projects located in and benefitting low-income communities.
- The Energy Commission shall consider the adverse localized health impacts of proposed projects to the greatest extent possible.

To date, approximately 32 percent of EPIC's technology demonstration and deployment funds have been awarded to projects in low-income or disadvantaged communities. The Energy Commission also conducts stakeholder outreach across the state to ensure grant solicitations are accessible to all Californians.

Many of California's underrepresented communities will be the most impacted by climate change. Through targeted solicitations, the Energy Commission ensures technological learning reaches a range of geographic locations, market segments, and communities.

CONNECT WITH US

With innovation happening across the state, the Energy Commission is eager to share the results of public-interest investments. The Energy Commission's research program has established the Innovation Showcase in which visitors can discover a breadth of research in smart grid technology, efficient lighting, renewable generation, clean transportation, building efficiency, and more. Visit the Innovation Showcase at innovation.energy.ca.gov.



Sustained investment in a range of clean energy technologies is critical to meeting California's emissions reduction goals and carbon neutrality in the state's energy mix by 2045.

Meeting state and global goals will require California's energy system to be safer, more affordable, more reliable, and more resilient. To build this future and mitigate the most serious impacts of climate change, California must continue to build on its legacy of sustained public-interest investment in innovation and remain a leader in bringing low-carbon solutions to all.

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