**Project Description**

* 1. **Overview, Vision, and Rationale --- REVIEW BY EVERYONE**

California State University, Sacramento (CSUS or Sacramento State) proposes the Energy, Power, and Innovation Collaborative (EPIC) NSF Engine designed to catalyze economic development in electrochemical technology platforms critical for US-made battery manufacturing, low-cost chemical and materials production and recycling, and next-generation fuels across California’s Central Valley. In partnership with California State University, Bakersfield (CSUB), California State University, Fresno (CSUF), California Mobility Center (CMC), Lawrence Berkeley National Laboratory (LBNL)/University of California, Berkeley (UC Berkeley), [OTHERS], EPIC will establish a transformative and sustainable regional innovation ecosystem that unites three major economic gateways: 1) California's East Bay and Northern Waterfront Regions (Oakland, Berkeley, Richmond, etc.) to the west, 2) Western Nevada’s distribution networks inland across the US to the east, and 3) Southern California’s industrial complex to the south. The nexus of these three gateways is Sacramento, serving its manufacturing core to the South and home to the West Coast’s largest railyard. EPIC is a first-of-its-kind initiative that will connect isolated manufacturing ecosystems and world-class innovation centers into a single, streamlined, comprehensive economic Engine that advances U.S. competitiveness.

EPIC will build and catalyze a robust, advanced innovation ecosystem in the rapidly growing *electrochemical technology* sector. Electrochemical technology links the fastest growing and cheapest energy resource – intermittent electricity generated by photovoltaic and wind power – and *everything else that is needed by society*. EPIC will lower costs of electricity through distributed energy resources (DER) that contribute to a resilient and efficient electrical grid, while growing advanced chemical, materials, and product manufacturing driven abundant, low-cost, and renewable electricity.

With Sacramento in the geographic heart of the Region, EPIC serves as a central hub to synthesize isolated projects and maximize opportunities for equitable participation in the future of advanced manufacturing, transportation, and energy. The Engine will foster and support both early-stage energy storage and conversion, transportation, and chemical and materials manufacturing companies and partner with established industries, including regional oil, gas, and petrochemical leaders aiming to leverage new electrochemical technologies to improve, augment, or replace legacy processes and drive world competitiveness. The Engine provides the community, researchers, innovators, and industry incumbents access to resources and physical facilities to build new knowledge, products, and services related to smart and shared energy sources, fueling and charging infrastructure, advanced electrochemical manufacturing and chemical production, and automated, connected, and zero-emission vehicles (ACZEV).

**Figure 1: Ecosystem for electrochemical technology development, education, and job creation from early stages to full-scale development**

A diagram of a process of manufacturing

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**Proposed Geographical Region of Service:** The Engine—centered in Sacramento—is focused in California’s Central Valley, a region characterized by agricultural output, diverse population, and a history of economic underinvestment. It includes key cities such as Bakersfield, Fresno, and Sacramento, which are strategic hubs for innovation and development. The Central Valley faces economic and environmental challenges, including reliance on the traditional O&G industry and poor air quality.

[SHOULD WE ADD IN A MAP HERE SHOWING THE GEOGRAPHY AND WHERE THE KEY PARTNERS ARE?] [UPDATED MAP TO BE ADDED – current map is a placeholder]

A map of the central valley clean mobility innovation corridor

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The State of California is often seen as a monolith and perceived as an incredibly wealthy, innovative, and productive part of the United States. Although it is true that California is a global driver of innovation and the world economy, when broken down into its regional components, extreme inequalities are found. For example, if California were to be broken into six different states, the Central Valley would be the poorest state in America, ranking below Mississippi.5 Meanwhile, Los Angeles would rank as the 16th largest economy in the world6 and the Bay Area as the 19th.[7](#bookmark5) Kern County’s unemployment rate, poverty rate, high school graduation rate, and percent of persons with a bachelor’s degree or higher are 7.4 percent, 20 percent, 73 percent, and 16 percent, respectively, in comparison to the state’s 4.1 percent, 13 percent, 83 percent, and 34 percent. This extreme level of inequality illustrates the fact that California is not a monolith. In fact, the perception of California as a wealthy economy damages the Central Valley as federal agencies with the intention of investing in underinvested regions often overlook the Central Valley. Meanwhile, the State and other federal agencies pour billions of dollars into high economic-performing areas in California, such as Silicon Valley and Los Angeles. This leads to a vicious cycle for the Central Valley: when people invest in California, they invest in its productive economies, but when they invest in the nation’s poorer economies, they sidestep the Central Valley. map to be added here that demonstrates severe inequalities – Disadvantaged community rankings, Justice40 communities, Distressed community as appliable, etc]

Underinvestment in the region has led to severe economic and environmental conditions in the region. Nicknamed “the Appalachia of the West,” the Central Valley has been aptly compared due to its declining industries, persistently high unemployment, low education rates, and extreme poverty.[8](#bookmark4) According to the White House Climate and Economic Justice Screening Tool, virtually all of the Central Valley is designated as a Disadvantaged Community (DAC).[9](#bookmark3) For example, the Central Valley’s largest city—Fresno—suffers disproportionately in terms of climate change burdens, poor workforce development, and lack of clean energy and energy efficiency. As a DAC, the City of Fresno is in the 98th percentile of the lowest income in the nation and the 95th percentile for least educated in the nation; it is in the 99th percentile for PM2.5 particles in the air and the 94th percentile in energy burden. Economically, Fresno is in the 95th percentile for poverty compared to the rest of the nation—that is, it is poorer than 95 percent of all other cities in the United States. It also ranks in the 96th percentile in unemployment rates and the 96th percentile in median income. These differences are extreme because they culminate in a fatal consequence: the City of Fresno is in the 96th percentile for low life expectancy—in other words, 96 percent of other cities in the country can expect to live longer than those born in Fresno by virtue of their birthplace.

Environmentally, the region’s situation is also challenged. The decadal California drought is disproportionately felt by the Central Valley, posing a serious threat to its farming industry, food, and people as the state’s resource is diverted to areas with larger populations.[10](#bookmark2) The Central Valley is also disproportionately affected by the wildfires that have become a year-round phenomenon; in addition to being devastating for families and damaging air quality, they also threaten one of the Central Valley’s main economic industries: agriculture.[11](#bookmark1)

Although the Central Valley clearly suffers the consequences of underinvestment, the region’s minority groups suffer disproportionately. For example, although the City of Fresno as a whole ranks as one of the worst cities for life expectancy, its black and brown communities specifically live on average 20 years less than white Fresno residents.[12](#bookmark0) A 20-year difference in life expectancy within a singular city is not insignificant, nor is it due to arbitrary circumstances. Starting with initial segregation laws in the 19th and 20th centuries, “unrelenting disinvestment, neglect, and a lack of representation have held back generations of black and brown residents.”[13](#bookmark2) This disinvestment has led to tangible negative outcomes: only 63 percent of Hispanic youth in Fresno County obtain their high school degree while nearly 100 percent of white Fresno citizens obtain their high school degree; nearly 30 percent of black Fresno County residents live in poverty, compared to 11 percent of whites; and 17 percent of black Fresno County residents are unemployed, compared to 8 percent of their white neighbors.[14](#bookmark1)

Finally, especially when compared to its coastal counterparts, the Central Valley bears the disproportionate burden of the State’s energy crisis. For example, 15 percent of Central Valley residents live in “energy poverty,” meaning that they spend 10 percent or more of their low income on household energy costs, compared to the coastal average of 3 to 4 percent.[15](#bookmark0)

Taken together, the Central Valley is the “Invisible California,” not able to reap the benefits of its neighbors’ economies while ignored by funders for opportunities to improve their own economy. In turn, this leads to severe economic and environmental conditions, with the burden being disproportionately carried by minority communities.

Despite these economic and environmental challenges, the Central Valley offers unique opportunities due to its growing innovation ecosystems, availability of academic institutions, the recent establishment of advanced research facilities like CSUB's $83 million Energy Innovation Building, the CMC’s proposed 180,000 square foot R&D and prototyping/testing center, and proximity to East Bay research powerhouse institutions, UCB and LBNL, that will be leveraged to spark regional innovation.

By spanning the corridor from both ends of the Central Valley in Sacramento to Bakersfield, each subregion (northern Central Valley, mid-Central Valley, and southern Central Valley) will serve as a gateway to leverage assets from its neighboring regional ecosystems (Silicon Valley and Los Angeles, respectively) to build upon its own internal assets and compound growth—both regionally and nationally. EPIC will draw upon the region’s rich history of and capabilities in energy production and technological manufacturing to develop innovative energy options through applied research, partnerships, and outreach that will positively impact economic and workforce development for generations.

The Central Valley has also taken steps over the last decade to lift its community out of poverty by improving its economy and environment. Currently, there are several—yet isolated—initiatives taking place in the Central Valley that are in their nascent stages and have not yet matured*.* By leveraging regional assets, cross-sector partnerships, and a commitment to diversity, equity, inclusion, and accessibility (DEIA), EPIC aims to catalyze new knowledge, products, and services that address the following specific regional, national, societal, and geostrategic challenges and national priorities:

**Regional Challenges:** ***Economic Disparities and Underfunded Regions:*** The Central Valley is one of the poorest regions in California and possesses some of the nation’s most polluted communities.4 It is often overlooked for private investment. EPIC aims to bridge this gap by fostering economic growth and innovation in this underfunded region around a multi-decade growth area in electrochemical technology. According to the American Lung Association’s 2024 State of the Air Report5, cities in the region like Bakersfield, Fresno-Madera-Hanford, Sacramento-Roseville, and Visalia appear on all three most polluted cities lists for high levels of unhealthy ozone days, particle pollution days, and annual particle pollution levels. ***Transition Regional Jobs to New Technologies:*** The historical O&G industry has resulted in significant environmental and health challenges for its workforce and regional residents of the Valley. EPIC will facilitate the transition from traditional O&G employment to well-paid careers with a strategic focus on electrochemical technology.

– to start battery manufacturing – but with an eye for exponential growth in the field to include manufacturing, recycling, carbon-dioxide capture and connecting to innovation in biotechnology through the intrinsically electrochemical machine-organism interface. EPIC also partners with O&G to simultaneously create high-road jobs and lower emissions from O&G using electrochemical technology.

***Disconnected Innovation Ecosystems*:** Despite its assets, the Central Valley’s innovation ecosystem is fragmented, with limited coordination between academic institutions, industry stakeholders, and community organizations. Existing research efforts are often siloed, hindering their ability to scale and address broader challenges. EPIC will synthesize isolated projects into a single, streamlined, comprehensive economic Engine to maximize opportunities for equitable participation in the future of electrochemical technology.

**National Challenges:** ***Energy Storage Needs:*** The rapid deployment of renewable energy sources requires advanced energy storage solutions. EPIC meets national energy storage needs for commercial and transportation uses through its focus on battery manufacturing, next-gen battery chemistry, and grid storage. ***Electrification Trends:*** Energy systems and grid-level modeling at Lawrence Berkeley National Lab (LBNL),6 along with current trends, particularly with the growing “duck curve” in California and the EPIC region,7, 8 show increasing variability in electric demand and generation driving price volatility,9 but also an opportunity for economic development that leverages new renewable intermittent electricity sources. EPIC focuses on electrochemical technology that dynamically manages this variability and ensures grid reliability while also building a workforce, innovation, manufacturing, education ecosystem of talent, and infrastructure to accelerate electrochemical technologies of the future that will drive the next century of economic activity. ***Clean Energy Advancement:*** The United States needs to advance clean energy technologies to meet climate goals and reduce greenhouse gas (GHG) emissions.10 EPIC will focus on innovations in electrochemistry, including next-gen batteries, hydrogen fuel cells, and direct air capture (DAC) technologies, to drive national progress in clean energy. Synthetic fuels that drop into existing internal combustion and jet Engines are central to speeding the energy transition.

**Societal Challenges:** ***Climate Change Mitigation:*** EPIC will contribute to global efforts to combat climate change by developing technologies that reduce reliance on fossil fuels and lower GHG emissions. ***Equitable Economic Opportunities:*** By incorporating an approach that uses equity as a driver for economic development, EPIC will create new accessible pathways for historically marginalized and underserved populations, ensuring that the benefits of clean energy innovation are widely shared.

**Geostrategic Challenges:** ***Global Energy Leadership:*** As the world transitions to more-diverse forms of energy, the United States must lead broadly in energy technology innovation and deployment. EPIC will position California and the U.S. as leaders in developing and commercializing next-generation electrochemical energy technologies including batteries and electrolyzers that use electricity to make fuels and materials. ***Supply Chain Security:*** By developing a network of facilities for material synthesis, battery fabrication, and commercial-scale manufacturing, EPIC will strengthen the domestic supply chain for critical next-generation energy components, reducing reliance on foreign sources and enhancing national security. Strategic partnerships with military bases in the region, such as Beale Air Force Base, will ensure that domestically produced batteries and energy technologies are prioritized to enhance national security and energy resilience. This collaboration will also provide critical testing and deployment opportunities for new technologies, accelerating innovation cycles while addressing the specific needs of military operations.

Despite the challenges associated historical lack of investment, the Central Valley is uniquely positioned to lead advancements in electrochemical technologies due to its geographic, economic, and resource advantages. Spanning Contra Costa County through Sacramento and into the San Joaquin Valley, the region is home to critical infrastructure, including research universities, industrial facilities, and energy production sites. Kern County is the largest provider of oil and renewable energy in California, producing 60 percent of solar power and has the largest wind project in the nation. CSUS and CSUB campuses, along with the UC Berkeley, provide a robust foundation of academic expertise to support innovation. The region’s proximity to Silicon Valley and the Bay Area creates opportunities for cross-sector collaboration, while its historical role in agriculture and energy production highlights its potential to integrate new technologies into legacy industries. EPIC will directly impact energy, transportation, and manufacturing industries. The ***energy industry*** will benefit from advancements in next-gen batteries, specifically lightweight/high-energy (e.g., for transportation) and low-cost/large-scale (for grid). The ***transportation industry*** will benefit from ACZEVs, EV charging infrastructure, and renewable, synthetic fuels, promoting cleaner and more efficient electrochemical solutions. Innovations in fabrication and material synthesis will transform the ***manufacturing industry***, leading to more sustainable production processes, particularly for the exponentially growing batteries industry. EPIC's equity-driven approachwill create economic opportunities in underserved communities, fostering inclusive growth while ensuring that the benefits of clean energy and advanced transportation technologies are widely shared. This inclusive effort will create a positive feedback loop with the technology efforts to power the Engine. EPIC will thus drive economic development, create well-paying, high-road jobs, and position California's Central Valley as a leader in clean technology and sustainable industrial practices. By addressing both domestic supply chain security and leveraging the unique geostrategic position of the Central Valley, including its collaboration with military bases to deploy domestically produced energy technologies, EPIC will advance national and regional goals while solidifying California's leadership in sustainable innovation.

**Region's Competitive Advantage and Economic Impact**: The Central Valley's competitive advantage within the proposed topic areas includes large geographical size, diverse economic landscape, and substantial agricultural industry, offering unique opportunities for implementing and testing renewable energy technologies in a large-scale, real-world environment. Additionally, the region's diverse and growing population provides a broad base for workforce development, ensuring a steady supply of talent for clean energy jobs. The Central Valley's strategic location also facilitates access to major transportation corridors (highways and interstate routes like HWY-99, I-80 and I-5; Ports of Sacramento, Stockton, Benicia, Oakland, and Richmond; multiple international airports; and major railyards like Roseville), enhancing the logistics for deploying and scaling new technologies. These factors, combined with ongoing investments in infrastructure and a supportive policy environment for renewable energy, position the Central Valley for significant success in advancing clean energy and transportation innovation, driving substantial economic growth, and creating high-quality clean tech jobs, thereby addressing regional disparities and fostering inclusive economic development.

EPIC envisions creating a robust, inclusive, and self-sustaining innovation ecosystem that accelerates technological advancements in electrochemical technologies, fosters equitable economic growth, and positions the Central Valley as a national leader in clean energy and transportation solutions. At its launch, the Engine will drive innovation and collaboration throughout the supply chain through partnerships with early-stage and entrepreneurial battery manufacturers, mature electric vehicle (EV) companies, and organizations aiming to increase their grid-storage capabilities. Early-stage and entrepreneurial battery manufacturers include Sparkz, Sepion, LiCap, and Lunar, which are smaller startups focused on advancing battery technologies. Additionally, partnerships with more mature companies like Tesla, already established in the San Joaquin Valley and producing the Powerwall, provide opportunities for growth and scaling. PG&E and other utilities are actively testing microgrids and vehicle-to-grid (V2G) capabilities, which further support innovation across the supply chain.

Partners span technology development and commercialization organizations focused on batteries, fuel cells, electrolysis for hydrogen and carbon dioxide, petrochemicals, emerging electrochemical manufacturing and carbon dioxide capture processes, EV and EV service equipment manufacturers, and the nation’s largest public institutions of higher education in the California State University and the University of California systems. As it pertains to mature EV companies, Tesla, Rivian, GM, and Ford are advancing technologies that align with EPIC’s goals, while medium- and heavy-duty companies like Volvo/Mack, Daimler, and International are driving innovation in freight and commercial transportation. School bus manufacturers are also integrating clean technologies into their fleets, supported by California’s recent legislation requiring vehicles and charging infrastructure to be bidirectional within the next 15 years.

EPIC creates new accessible pathways for historically left-behind populations, emphasizing equity as a driver for the core technology and economic development goals. The EPIC regional and economic impact will transition Central Valley and Contra Costa County residents from traditional roles in oil and gas (O&G) into new well-paid, high-road energy and electrochemical technology careers through partnerships in low-income communities with community-based organizations (CBOs) alongside regional O&G industry partners.

The EPIC Engine will create and nurture a workforce network by connecting K-14, CSUs, a new summer training and upskilling academy, a professional Master of Science/Engineering (MS) program for industry R&D, and leading researchers training PhDs and beyond into a collaborative workforce development (WFD) team. EPIC is co-located with relevant R&D leaders to accelerate iteration and bring technologies to full-scale deployment to meet national and global energy storage needs. EPIC will train the next generation of manufacturing, R&D, and business leaders to drive the biggest economic transition of the century, which requires electrochemical technology to use, store, and deploy clean electricity across industry and society. Global projections by 2030 estimate a 33 percent annual growth in market demand for energy storage, reaching 4,700 GWh and valued at $400 billion,1 $410 billion for electrochemical electrolysis/fuel-cell technology,2 and $15 billion for CO2 capture.3 EPIC leverages these opportunities to catalyze a domestic supply chain, aligns technology development and manufacturing with national and global policy needs, and creates significant economic benefits for California and the rest of the nation. EPIC drives economic growth, collaborates with and addresses key gaps in neighboring innovation ecosystems, enhances environmental sustainability, aligns with state and national climate change mitigation goals, and fosters equitable opportunities in clean energy and transportation technologies. This strategic alignment of resources positions EPIC to become a national leader in clean energy R&D.

**Innovation Ecosystem Goals:** EPIC's innovation ecosystem aims to achieve the following overarching goals: ***1) Foster Collaboration and Stakeholder Alignment:***Build strong partnerships among government entities, industry leaders, academic institutions, non-profits, and community organizations to drive clean energy and transportation innovation. Specific collaborations will include working with the California State University and the University of California systems to leverage academic research, partnering with local and state government agencies and utilities to align policy and funding support, and engaging industry leaders in clean energy and transportation to drive innovation across the supply chain and commercialize technologies developed by the Engine. This alignment will ensure that diverse stakeholders are working together towards common goals, maximizing the impact of their collective efforts. ***2) Advance Use-Inspired R&D:***Conduct research focused on practical solutions to societal challenges, particularly next-generation batteries, petrochemicals and fuels leveraging electrochemical technology, and materials recycling and separations, ensuring these innovations meet user needs. EPIC will establish a pilot-scale material synthesis and battery fabrication facilities in Sacramento, Bakersfield, and the East Bay / Northern Waterfront to advance electrochemical innovations. The R&D efforts will be driven by practical applications, such as improving energy storage solutions and reducing GHG and pollution emissions, ensuring that the innovations developed are directly relevant to practical applications across multiple industries addressing current societal needs*.* ***3) Support Innovation Translation and Workforce Development:*** Facilitate the commercialization of new technologies through partnerships with early-stage and entrepreneurial battery manufacturers, mature EV companies, and organizations focused on increasing grid storage capabilities. This includes creating a network of connected facilities for material synthesis and battery fabrication and establishing pilot projects to demonstrate and validate new technologies. Additionally, EPIC will develop a strategic workforce by providing training and career opportunities in clean energy and transportation, particularly targeting historically underserved communities. This will involve collaborations and investments in K-12 schools, community colleges, CSUs, and professional MS programs to develop a skilled labor pool supporting the just energy transition. ***(4) Promote Inclusive Engagement and Strategic Investment:***The project will include diverse participation and perspectives related to geography, race, ethnicity, gender, and types of organizations. This will be achieved through outreach and partnerships with CBOs in low-income areas to create accessible pathways for participation in the clean energy economy. EPIC will also attract ongoing investment to support R&D and technology innovations, working with venture capital firms, government grants, and private investors to secure funding. This strategic investment will ensure the long-term sustainability and growth of the innovation ecosystem, enabling continuous advancements in technology.

**High-Impact Outcomes**: EPIC will drive economic growth and create well-paying, high-road jobs in the Central Valley by fostering next-generation energy and transportation careers, augmenting O&G industries and creating pathways for workers to new opportunities. Technologically, EPIC will first advance and commercialize next-generation batteries, based on established innovations from UCB/LBNL, which will enable subsequent advancements in smart grids and ACZEVs. Then EPIC will accelerate, leveraging the facilities and trained regional workforce ecosystem, broader related electrochemical technologies (synthetic fuel production and CO2 management) leading to a self-sustaining Engine that will drive economic growth through electrification and electrochemical technology for the coming century. The project ensures inclusive economic opportunities through targeted WFD, education, and training for underserved communities, promoting equity and diversity. EPIC will build a robust network of facilities and stakeholders, supporting continuous innovation and the transition of research into market-ready solutions. It will also reduce air pollution and GHG emissions, improving public health. Nationally, EPIC will enhance energy independence by advancing domestic energy storage and production capabilities, reducing reliance on foreign sources. Educationally, it will strengthen research at California State University and R&D in the Central Vally via close partnerships with world leading institutions in UCB/LBL, thus fostering regional innovation leadership in science, technology, engineering, and math (STEM) fields. Communities and industries will benefit from improved environmental quality and health outcomes, while society will gain from economic and technological advancements. These outcomes will position California’s Central Valley as a leader in electrochemical technology, driving sustainable growth and addressing critical energy and environmental challenges.

EPIC’s shared vision aligns with NSF’s programmatic goals by advancing cutting-edge R&D through commercialization while fostering inclusive economic development. The Engine’s activities are tailored to the Central Valley’s unique strengths and needs, addressing critical infrastructure, investment, and workforce development gaps. EPIC’s focus on equity ensures that underserved communities, which have historically faced systemic barriers, will be integral to the region’s innovation ecosystem. By leveraging its assets and addressing its needs, the Engine is well-positioned to achieve the aforementioned high-impact outcomes.

**Broader Impacts**

EPIC’s impacts will be extensive and multifaceted, addressing critical societal and economic challenges. Through robust partnerships between academia, national laboratories, industry, and other stakeholders, EPIC will drive collaborative efforts that transcend traditional silos. Societal well-being will be improved by creating well-paying, high-road jobs in next-generation energy and electrochemical sectors, augmenting historical O&G industries, investing in infrastructure, and reducing environmental pollution. The Engine significantly increases public scientific literacy and engagement with STEM, fostering a culture of innovation and inclusivity. By strengthening the participation of women, persons with disabilities, and underrepresented minorities in STEM, EPIC promotes diversity and inclusion while building a larger, more robust workforce to drive the Engine goals. The Engine will enhance STEM education at all levels, developing a diverse and globally leading STEM workforce essential for national security and economic competitiveness. The Engine’s focus on next-generation electrochemical technologies will bolster infrastructure for research and education and increase private-sector investments in these technologies for the next century. EPIC will revitalize industrial brownfield sites into battery and electrochemical technology production centers, boosting local economies. The Engine will work to stabilize and modernize the grid through the deployment of advanced energy-storage technologies, ensuring renewable energy can power homes, businesses, and transportation with 100 percent reliability and lower electricity costs. EPIC builds a domestic supply chain for battery technologies by fostering collaboration among government agencies, academia, and industry, aligning with federal initiatives. The Engine’s infrastructure will facilitate the application of advanced battery technologies to sectors such as transportation, manufacturing, and agriculture, driving innovation and sustainable practices across these industries and building an ecosystem for launching the next generations of electrochemical technology. By addressing these key areas, EPIC creates a sustainable and inclusive innovation ecosystem with far-reaching regional, national, and global impacts.

* 1. **Proposing Team and Organizational Structure**

**Figure X: Organization Chart**

~~California State University, Sacramento (CSUS) has partnered with core partners California State University, Bakersfield (CSUB), California State University, Fresno (CSUF), California Mobility Center (CMC), Lawrence Berkeley National Laboratory (LBNL)/University of California, Berkeley (UC Berkeley) to serve as anchor institutions within the EPIC NSF Engine, as seen in Figure X. [PLACEHOLDER TO ADD IN FINAL ROLES/SCOPES].~~

Contracting with each partner is expected to be completed in a manner that minimizes overhead costs. CSUS will lead the EPIC Engine by coordinating project activities, maintaining the strategic direction of the Engine, managing budgets, and ensuring compliance with funding requirements. Rigorous evaluation and reporting processes will be implemented to track progress and measure outcomes. Table 1 further details the roles and contributions of CSUS and the core partner organizations.

**Table 1: Core Partner Organizations**

|  |  |  |
| --- | --- | --- |
| **Core Partner** | **Engine Role** | **Contributions** |
| California State University, Sacramento (CSUS) | Lead institution; community college liaison/lead | CSUS will coordinate the overall project management, ensuring alignment with the project’s strategic goals. Provide research facilities and foster collaboration among academic researchers, students, and industry partners. Spearhead WFD programs, collaborating with UCB and leveraging its academic resources to train and educate the next generation of clean energy professionals. |
| California State University, Bakersfield (CSUB) | Academic partner and Regional Hub | CSUB will focus on R&D in battery and smart grid solutions. It will utilize its new $83 million Energy Innovation Building to provide lab and office spaces for researchers and entrepreneurs. CSUB will serve as the educational hub in the Southern Valley for talent development and engage in community outreach to ensure local participation and benefit from the project. |
| California State University, Fresno (CSUF) | Academic partner and Regional Hub | [description] |
| California Mobility Center (CMC) | Commercialization and industry/labor organizations liaison partner | CMC will lead efforts to commercialize new technologies. It will provide testing, deployment, and pilot manufacturing facilities, complementing the UCB lower-TRL R&D facility and helping early-stage companies bring products to market. CMC will coordinate industry and labor partnerships, ensuring that the Engine’s innovations meet market needs, attract private investment, and further the skilled labor pool supporting the just energy transition. Current partnerships at the CMC include an introduction to EV battery manufacturing course with the United Auto Workers’ Center for Manufacturing a Green Economy and a partnership with local utilities and ChargerHelp to put on an EVSE maintenance technician training. This training would feed local IBEW apprentice programs. |
| Lawrence Berkeley National Laboratory (LBNL)  And  University of California, Berkeley (UC Berkeley) | Research/ technical support, industry partnership facilitator | LBNL provides technical expertise in next-generation energy and electrochemical technologies, supporting R&D efforts across the project. It will help develop and test new materials and processes for battery and next-gen electrochemical technologies. LBNL will provide guidance on best practices for technology deployment and commercialization, including technoeconomic analyses.  UCB will contribute advanced research capabilities, particularly in next-gen low TRL electrochemistry technology. UCB will launch an open-access shared facility for electrochemical device prototyping and testing. UCB will ensure that innovations effectively transition from research to practical applications by mentoring startups and early-stage companies involved in the project and connecting them with capital investment. UCB will launch a new R&D workforce training program in electrochemical technology. |

**Key Personnel:** Key executive positions include (Table 2) Michelle Willard (CSUS) as Principal Investigator and Engine CEO, providing overall leadership; Orville Thomas (CMC) as Project Director, managing day-to-day operations and Community Engagement Director, overseeing outreach activities; Shannon Boettcher (LBNL/UCB) as Research Director, overseeing electrochemical R&D programs that bridge basic science discoveries at LBNL/UCB to the innovation Engine in the Central Valley; Jane Dong (CSUB) as Workforce Development Director, leading training and education programs; and Shannon Boettcher and Orville Thomas will serve as Commercialization and Innovation Co-Directors, managing the transition of technologies to market.

**Table 2: Key Personnel**

| **Key Personnel** | **Role(s)** | **Experience and Qualifications** |
| --- | --- | --- |
| **Michelle Willard**  *CSUS* | * Principal Investigator * Engine CEO | Description |
| **Orville Thomas**  *CMC* | * Project Director * Community Engagement Director * Commercialization and Innovation Co-Director | Orville Thomas has worked on transportation and energy policy for over a decade. He has led public affairs efforts in the Central Valley and statewide on transportation infrastructure, clean energy technology, and public health. He has worked to pass federal legislation like the Bipartisan Infrastructure Law, Inflation Reduction Act, and has helped the State of California pass over $1.5 billion in funding for clean energy and transportation projects. |
| **Shannon Boettcher**  *UCB/LBNL* | * Research Director * Commercialization and Innovation Co-Director | Description |
| **Jane Dong**  *CSUB* | * Workforce Development Director | Dr. Dong brought substantial experience in cultivating program development, research capacity building and institutional cultural change in STEM education and workforce development. She has established partnership with local industry in energy, agriculture, aerospace, healthcare, and K-12 education. As the Dean of NSME, she oversees the California Energy Research Center. |
| **[PLACEHOLDER]**  *CSUF* | * TBD | Description |

**Governance and Management:** EPIC has built a strong and cohesive strategy for governance and management, starting with the Executive Steering Committee (Figure X), which will maximize collaborations that lead directly to commercialization, investments in technologies, WFD, and community engagement. The Executive Steering Committees is integral to the organizational structure and designed to facilitate functional working groups (called Focus Groups). The Executive Steering Committee is composed of senior representatives from each core partner and major stakeholders. The governance structure has been established to ensure the core partner organizations and leadership teams of EPIC work cohesively and provide varied expert perspectives from designated representatives of each key partner and stakeholder.

**Figure X: Executive Steering Committee Governance Structure**A colorful hexagons with icons

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The Executive Steering Committee provides strategic direction and oversight through regular Focus Group meetings. The Management Team, led by Principal Investigator Michelle Willard, will manage day-to-day operations and coordination. The Focus Groups – centralized around 1) industry research and commercialization, 2) innovation and technology, 3) workforce development, 4) community engagement, and 5) economic development – report to the Management Team to ensure detailed planning and execution. Through the Focus Groups, EPIC provides a platform for state agencies such as the California Energy Commission (CEC), California Air Resources Board (CARB), California Labor Agency, and California Public Utilities Commission to collaborate on workforce , next-generation batteries, emissions reductions, and outreach to DACs while also giving California State University and University of California direct access to the National Lab network for enhanced next-gen energy, electrochemical, and emissions reduction partnerships. The Engine fits directly in the State of California’s larger plan on next-generation energy, offering an opportunity to grow alliances with state departments and agencies for continued success. As technology innovation springs from the EPIC Engine, the Governor’s Office of Business and Economic Development (GO-Biz), CEC, and CARB have millions of dollars to invest in locating manufacturing in California and increasing private-sector R&D and commercialization. Table 3 displays the EPIC key partners and stakeholders.

**Table 3: EPIC Key Partners and Stakeholders**

|  |  |  |
| --- | --- | --- |
| **Community Champions** | **Innovation Builders** | **Commercializers** |
| Central Valley Health Policy Institute  Kern Inclusive Entrepreneur Hub  La Familia Counseling Center  Greater Sacramento Urban League  Fresno Metro Black Chamber of Commerce  Asian Resources, Inc.  Green Empowerment Zone | CSUS (prime)  CSUB  Fresno DRIVE  UCB  CSU Fresno’s WET Center and iHub2  LBNL | CMC  SMUD  PEM Motion  3C Capital Fund  Momentum  GO-Biz |

Regular communication channels will maintain transparency and alignment amongst all key partners and stakeholders, including monthly progress meetings, quarterly updates, and an annual strategic review. A project management system will streamline coordination and track progress, providing real-time updates accessible to all partners. A structured conflict-resolution mechanism, mediated by the Executive Steering Committee, will address disputes promptly, fostering a collaborative environment. Shared leadership and decision-making processes will ensure inclusivity, reflecting the collective expertise of the entire EPIC team, major stakeholders, and the community. This interdependent approach will enable EPIC to address systemic challenges, mitigate risks, and adapt to emerging opportunities over the 10-year project period.

* 1. **Strategic and Implementation Plans**

EPIC will pursue technology development and future-oriented innovations in electrochemical technology which has tremendous range of applications that are enabled by core competencies supported by the Engine ecosystem.

PLACEHOLDER TEXT ON TECHNICAL R&D EFFORT: Shannon Boettcher is iterating with team.

***Next-Gen Batteries:***

Immediately, researchers at CSUS, CSUB, Fresno State, and LBNL/UCB will work on advancing battery technologies, specifically scaling the materials synthesis of disordered-rock-salt cathode materials, invented to senior personnel Prof. Gerd Ceder at UCB/LBL and piloting production with a commercial partner using the upscaled routes to production (Sidebar 1). These

A diagram of a complex structure

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**Sidebar 1. Disordered rock-salt (DRX) cathodes.** DRX offer high energy density, cost-effectiveness, and improved safety due to their ability to incorporate earth-abundant elements, accommodate high lithium mobility, and suppress oxygen release.2 Their structurally stable and flexible design enables tolerance to lattice strain, wide voltage operation, and compatibility with advanced electrolytes. However, challenges like low electronic conductivity, voltage hysteresis, and cycling stability need to be addressed for commercial viability. To upscale DRX cathodes for manufacturing, we propose developing an optimized solid-state synthesis process combined with mechanochemical activation to produce uniform, high-purity materials at scale, followed by integration with scalable coating and particle morphology control techniques like spray pyrolysis or molten salt synthesis. This workplan will include pilot-scale testing, process parameter optimization for energy efficiency, and real-time quality control to ensure consistency and cost-effectiveness.

EPIC team members are world leaders in battery science and engineering and lead teams that span UCB and LBNL. EPIC partner Prof. Bryan McCloskeyis a leading expert in understanding12, 13 and mitigating14 challenges associated with fast-charging and high-energy Li-ion batteries. During fast-charge – as an electric commuter plane or semi-truck would routinely encounter– Li plating, material cracking, and excess heating currently result in severe safety risks. McCloskey and his team in the Battery Group at LBNL will lead EPIC efforts in materials and device design that improve fast-charging performance. They will also characterize15, 16 and develop better light-weight high-energy materials for batteries for aviation,17 including with Li metal18 and silicon19 anodes and new cathode active materials20-23 and solid-state systems24, 25 while leveraging the EPIC UCB and CMC facilities to prototype, pilot and bring to commercial scale the new technologies, diagnosing battery materials degradation pathways and solving reliability issues. Related efforts will build large, low-cost batteries for grid storage.

***Materials and supply chain.*** Adapting electrochemical processes to the mining and refinement industry offers transformative potential for clean energy manufacturing by providing scalable, energy-efficient, and environmental solutions to modernize manufacturing. Given the increasing importance of critical materials production and refinement to support the growing demand for battery technology and other next-generation energy technologies illustrate the strategic importance of this area. LBNL has a proven track record of taking basic research in this field and supporting development for eventual private sector commercialization in this area. For example, sodium sulfate waste is one of the predominant waste sources in both the mining and LIB recycling industries with one metric tonne (t) of black mass generating approximately 6000 t of sodium sulfate waste during LIB recycling. Aepnus Technology, an LBNL spin-out, utilizes hydrogen depolarized anode salt-splitting electrolysis for the energy efficient manufacturing of manufacture of sulfuric acid and caustic soda from this waste to enhance process circularity and saves money by avoiding need for supplying fossil fuel derived sulfuric acid in the mining and refinement industries.

Dr. Andrew Haddad with Dr. Mike Tucker and the industry partner network will work in the Engine to apply electrochemical processes within the space of mining and refinement across the entire vertical of this supply chain, including mining, refinement, material synthesis, and product or pack manufacturing, to support the evolution of a sector that predominantly relies on energy and reagent intensive thermochemical processes. Recent work on electrochemical ore leaching of lithium highlights that adapting electrochemical processes can lead to greater than 60 % reductions in energy and cost intensity while minimizing chemical reagent use and waste generation. It also opens the door for subsurface electrochemical mining, an emerging area that leverages the mature horizontal drilling and hydraulic fracturing industries to achieve mineral recovery directly from ore bodies, significantly reducing surface disruption, water usage, and the carbon footprint associated with traditional mining. Moreover, transformational electrochemical processes that can eliminate intermediate process steps and produce metals directly from ores are also being pursued. By coupling the selectivity of electrochemistry with the enhanced kinetics of high temperatures, high temperature electrochemical processes hold immense potential for future applications in metal and alloy production. These systems enable efficient production of metals and alloys from raw materials with minimal impurities reducing traditional processing complexity. They offer a closed-loop approach, optimizing resource utilization and reducing energy consumption, especially when integrated with renewable energy sources, and have potential for direct Li metal, copper metal production from ores. Finally, enhanced circularity can be achieved by utilizing traditional waste materials as new feedstocks for targeted critical elements. The development of composite membranes that leverage selective ion capture materials affords ability to selectivity recover elements using mature and derisked electrodialysis cells, improving the economic viability of extracting critical elements from low-grade ores and recycling streams.

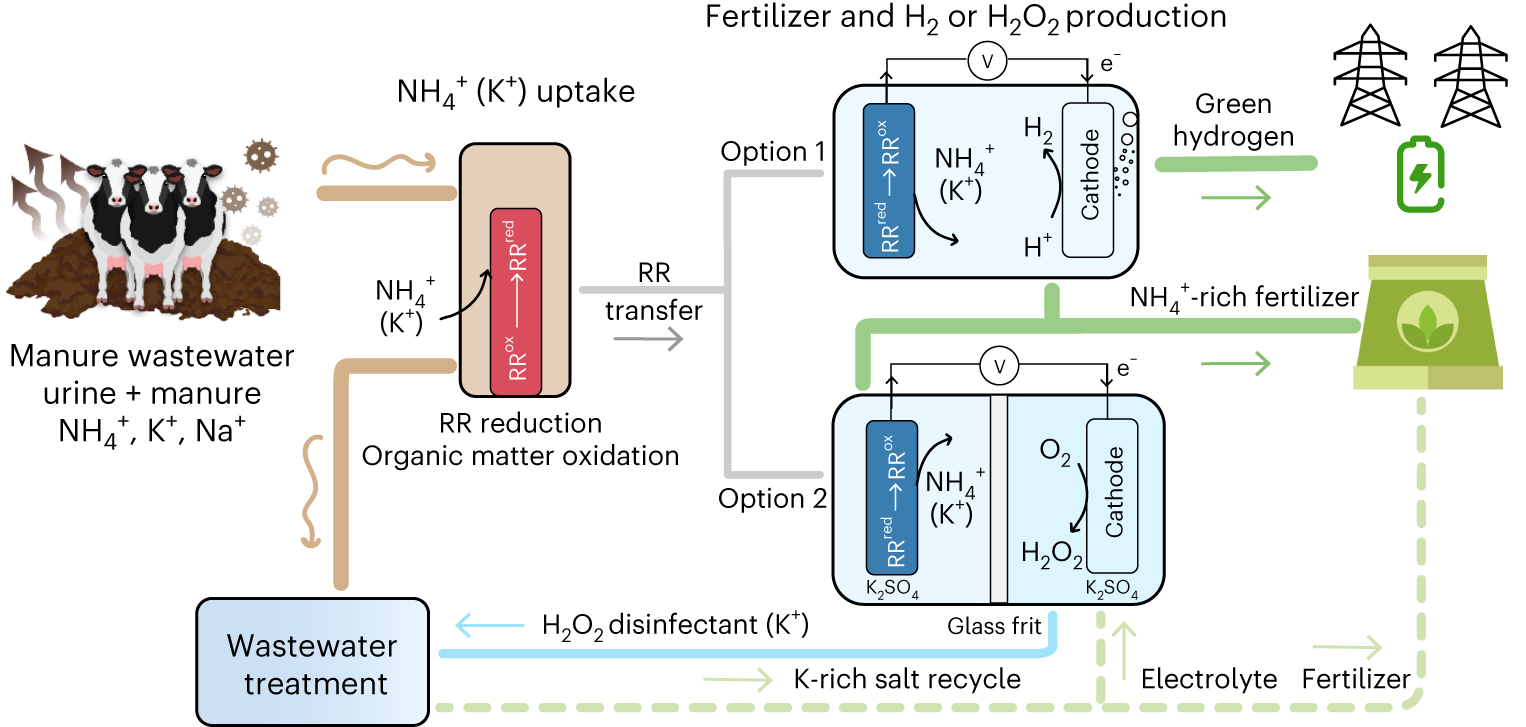
A diagram of a transport cycle

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**Sidebar 2. Liquid hydrogen carriers.** LBNL aims to develop a dynamic and dispatchable strategy for renewable energy conversion, storage, and transportation using liquid organic hydrogen carrier (LOHC) technology.1 The LOHC hydrogen storage system has been developed using thermocatalysis approaches, such as by Chiyoda’s. These approaches require a centralized chemical plant to store and generate H2 gas on a large scale to reduce storage costs, and without considering the capacities of renewable H2 producer and, especially, widespread distribution of hydrogen users. electrochemical LOHC hydrogenation (EH) into water electrolyzers with renewable electricity, and electrochemical dehydrogenation (EDH) using low-temperature solid oxide fuel cells (LT-SOFC, 400-450 oC) to provide electricity for users. The LOHC pair used is methylcyclohexane (MCH) and toluene (TOL) which stores three hydrogen molecules in one LOHC molecule. The study of TOH EH and MCH EDH are in their early stages. The team will improve both EH and EDH devices, develop advanced electro-thermal catalysts to advance the technology to enable a highly efficient, durable, in-situ, gaseous-H2-free hydrogen storage and delivery system for commercialization

By integrating these electrochemical advancements, the mining and refinement industry can meet the dual goals of environmental stewardship and economic feasibility. The ability to deploy clean, scalable, and high-yield processes fosters a secure and resilient supply chain for critical minerals. Moreover, these technologies leverage the synergies between industrial operations and renewable energy infrastructure, positioning them as cornerstones for the transition to a sustainable energy future.

***Fuels and Products:*** The EPIC team will develop electrochemical processes that *readily ramp up or down in response to grid electric prices* (thus stabilizing a variable renewable energy electric grid and ultimately allowing increased renewable penetration and lowering electrical energy prices).9 PI Boettcher, working the team across the Engine and at UCB/LBL including senior personnel Prof. Alex Bell (National Academy, world expert in catalysis science), Prof. Neil Razdan (rising star in electrochemical and thermochemical catalysis), Dr. Stacey Zones (recently retired from Chevron and now affiliated at UCB), and Dr. Ji Su (leader of applied catalysis lab at LBL)bwith will pursue thermo-electrocatalytic processes to bridge the divide between low-temperature electrolysis in liquid water,26-28 and high-temperature thermochemical processes normally required to activate strong bonds to make liquid fuels and used in O&G currently.29-32 Both N2 and CO2 are abundant precursors that can be reduced electrochemically to make liquids like ammonia (NH3) and multi-carbon hydrocarbon products, including synthetic aviation and ethanol fuels. But these are very challenging processes - there are no scaled economic commercial processes to convert CO2 to energetic feedstocks.33 The three leading CO2 hydrogenation/reduction technologies – direct CO2 reduction in aqueous electrolyzers, high-temperature CO2 electrolyzers,34 and classical gas phase thermocatalytic CO2 hydrogenation – each have roadblocks. The EPIC team will develop integrated electrochemical-thermocatalytic reactorsthat are currently low-TRL but can be deployed broadly to electrify processes that currently require fossil fuels (Sidebar 2) The Central Valley has expansive agricultural activities; crop residues, livestock manure-derived biogas, and dairy wastewater are abundant. In addition, increasing hazardous woody biomass is generated from forest management activities to slow or stop the progress of wildfires. EPIC will pilot research to convert these resources to alternative low-carbon fuels, including synergistic waste treatment for hydrogen production.



**Sidebar 3. Ammonia Recovery from Livestock Manure Wastewater.** Livestock manure wastewater, containing high level of ammonia, is a major source of water contamination, posing serious threats to aquatic ecosystems. Efficient recovery from manure wastewater offers sustainability benefits in pollution control and resource recovery. Electrochemical ammonia recovery typically uses membrane-based processes, such as bioelectrochemical systems, electrochemical stripping, and electrodialysis, but these methods can be costly and complex. Recent lab-scale proof-of-concept experiments have demonstrated the simultaneous recovery of ammonium from manure wastewater and electrochemical synthesis of H2 or H2O2 using an ion-selective redox material as a mediator, showing that integrating membrane-free nutrient ion recovery with electrochemical synthesis can improve both process efficiency and sustainability. However, further scale-up, device engineering, and optimization of operational conditions to minimize energy consumption, as well as the development of NH4+ selective redox materials with higher capacity, improved stability, and lower cost, have yet to be achieved. The EPIC team at LBNL propose to develop advanced and low cost NH4+ selective redox catalyst to further advance the technology.

***Electrochemical CO2 management:*** EPIC will also accelerate technologies that leverage the flow of ions to generate acid and base to capture CO2 from the atmosphere (DAC) or ocean (DOC). Current methods to capture CO2 from the air require high temperatures for absorbent regeneration and are too expensive and energy-intensive to effectively scale.EPIC partner Dr. Adam Weber at LBNL is an expert electrochemical engineer who will lead the development of next-generation electrodialysis technology enabling low-temperature *electrochemical CO2 capture to reach the thermodynamic minimum energy inputs* to address this gap.35, 36 He will collaborate with Boettcher, McCloskey, and the broader EPIC team along the commercialization pipeline. Addressing basic science gaps, such as a detailed predictive understanding of interfacial and selective ion-transfer processes,37-39 and applied science gaps related to co-engineering coupled electrolysis-electrodialysis devices for high efficiency remain. Once solved, this technology will scale to a $100B+ industry process in EPIC. More applications are envisioned, such as for onsite acid/base generation for water treatment, which is important in California due to increasing drought and clean water scarcity.

A specific target in the first two years of the Engine is commercialize advanced bipolar membranes and associated high current density electrodialysis stacks under development at UCB and LBL by Boettcher and the team of collaborators.3-6

***An Integrated Tech Ecosystem:*** The Engine creates an electrochemistry workforce-ready region akin to the world-changing semiconductor ecosystem40 of the 1990s by fostering diverse andcompetitive tech development. With the initial focus on next-generation batteries, R&D efforts include long-duration batteries made from regionally sourced, low-cost materials like sodium metal, iron, manganese ores, and sulfur. Advanced batteries for transportation, featuring solid-state and metal anodes, will be developed and scaled for safe, efficient use. Immediate manufacturing and pilot projects bridge gaps in current technologies, with plans for R&D in advanced electrochemistry, pilot-scale material synthesis, and battery fabrication. The initiative also emphasizes battery recycling, improving processes for consumer and large-format applications. EPIC leverages partnerships between utilities (SMUD, SoCal Edison, PG&E), research labs, educational institutions, and regulatory agencies to integrate efforts within the electrochemical technology innovation ecosystem and ensure benefits are realized across additional industries. Key areas include developing smart grid solutions to integrate with existing infrastructure, enabling shared energy resources and peer-to-peer trading, and supporting electrochemical technology that adjusts power consumption based on grid signals. Collaboration with automotive companies facilitates the deployment of ACZEVs, ensuring seamless integration with clean energy sources and infrastructure. Coordinated policy advocacy and smart grid roll-out are crucial to implementing and scaling these technologies. The other EPIC electrochemical technologies build on and leverage the next-generation battery ecosystem. These technologies benefit from established supply chain and manufacturing pilot initiatives. Synthetic (clean) fuel production, including synthetic fuels for ICE and jets, expands the impact of the Engine. For fuel cells, EPIC enables more efficient devices that are easier and cheaper to construct and create more power from liquid fuels for sectors like aviation, maritime, and construction. Collaborations with H2 tech companies and clean-energy infrastructure projects facilitate field trials and scalability. Technologies for managing CO2 emissions, like DAC and electrodialysis, will be developed through R&D partnerships and pilot projects, for example reaching to regional companies like Captura (LA). Cal EPIC will develop more efficient and capable DAC CO2 capture systems, with the opportunity to deploy them in high PM 2.5 Central Valley communities.

EPIC will execute a robust and detailed strategic plan, structured around three distinct phases—years two (2), five (5), and ten (10)—designed to transform the Central Valley and Contra Costa County into a leading innovation ecosystem for electrochemical technologies and clean energy. By leveraging its core drivers of ecosystem change, including its world-class academic institutions, burgeoning industrial base, and underutilized community talent, EPIC will address critical regional, national, societal, and geostrategic challenges while achieving transformative outcomes.

Use-Inspired Research and Development

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| --- | --- | --- |
| **Timeline** | **Goals** | **Objectives** |
| Year 1 (mid-point, Nascent Phase) | Establish the Community Champions and Innovation Council | Create dialogue between communities, researchers, and innovators to ensure equitable innovation. |
| Year 2 (end, Nascent Phase) | Establish an innovator funding program and solidify office and testing spaces | Create a way to fund innovators, prioritize underrepresented entrepreneurs, and demonstrate technologies. |
| Year 3.5 (mid-point, Emergent Phase) | Initiate expansion of lab and testing facilities for clean energy innovation | Provide innovators with access to the resources needed to succeed, including workforce-ready facilities. |
| Year 5 (end, Emergent Phase) | Solicit community feedback and incorporate findings into the implementation plan | Ensure that the research and commercialization activities remain use-inspired and community-aligned. |
| Year 7.5 (mid-point, Growth Phase) | Receive first programmatic R&D financial support from outside NSF | Transition to a self-sustaining model for continuous innovation and development. |
| Year 10 (end, Growth Phase) | Realize sufficient revenues from EPIC’s outputs to sustain further R&D independently | Continue producing and scaling regional innovation for long-term regional and national benefits. |

Translation of Innovations to Practice

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| --- | --- | --- |
| **Timeline** | **Goals** | **Objectives** |
| Year 1 (mid-point, Nascent Phase) | Launch EPIC field trial and deployment program for market-ready innovations | Create recurring and regular dialogue between innovators, community representatives, and industry stakeholders. |
| Year 2 (end, Nascent Phase) | Establish a voucher system to support product testing and validation | Advance technical readiness to de-risk commercial investments in clean energy and transportation. |
| Year 3.5 (mid-point, Emergent Phase) | Establish an Implementation Collaborative to bridge the gap between technology and users | Develop resources to support innovators and implementers in executing demonstration projects. |
| Year 5 (end, Emergent Phase) | Demonstrate success through initial private-sector funding | Validate the Engine’s ability to attract private-sector investment and commercialize technologies. |
| Year 7.5 (mid-point, Growth Phase) | Secure 50 percent of project funding for technologies from non-NSF sources | Build an effective network of entrepreneurs and investors to drive innovation cycles. |
| Year 10 (end, Growth Phase) | Achieve 100 percent of project funds for technologies from non-NSF sources | Fully self-sustain the organization while scaling impact across multiple sectors. |

Workforce Development to Grow and Sustain Regional Innovation

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| **Timeline** | **Goals** | **Objectives** |
| Year 1 (mid-point, Nascent Phase) | Scale EPIC’s Career Pathways program to the entire Central Valley region | Create consistency and continuity across the region while focusing on equitable access. |
| Year 2 (end, Nascent Phase) | Adopt a Knowledge Transfer Plan for information sharing via Community Champions | Establish regular and recurring communications between workforce development programs and partners. |
| Year 3.5 (mid-point, Emergent Phase) | Establish a workforce pipeline for clean energy entrepreneurs | Ease the burden of scaling businesses by providing trained workers ready for clean energy sectors. |
| Year 5 (end, Emergent Phase) | Publish a Clean Energy Best Practices Toolkit | Share replicable strategies to enhance clean energy workforce readiness regionally and nationally. |
| Year 7.5 (mid-point, Growth Phase) | Create and disseminate Innovation Demonstration Kits | Invest in K–12 education and hands-on learning to build local technical skills for future careers. |
| Year 10 (end, Growth Phase) | Develop the Workforce Development Best Practices Toolkit | Share insights broadly to enhance workforce development on a national scale. |

Ecosystem of Partners

|  |  |  |
| --- | --- | --- |
| **Timeline** | **Goals** | **Objectives** |
| Year 1 (mid-point, Nascent Phase) | Broaden the ecosystem of commercialization partners | Maximize resources available to innovators and increase cross-sector collaboration. |
| Year 2 (end, Nascent Phase) | Initiate quarterly Topic Webinars to engage stakeholders | Present current issues and opportunities in clean energy, manufacturing, and transportation. |
| Year 3.5 (mid-point, Emergent Phase) | Create the EPIC Clean Energy Innovation Corridor Symposium | Share findings and foster collaboration across a broad range of stakeholders. |
| Year 5 (end, Emergent Phase) | Develop the EPIC Navigator Plan to assist participants through funding opportunities | Leverage public and private investment to accelerate innovation and adoption. |
| Year 7.5 (mid-point, Growth Phase) | Establish an Investor Network that regularly hears pitches for new businesses | Expand the ecosystem of private investors aligned with EPIC’s mission. |
| Year 10 (end, Growth Phase) | Demonstrate a balanced budget without NSF funds | Align contributions from all partners to sustain the program’s long-term operations. |

This phased strategic plan ensures that EPIC evolves intentionally, aligning R&D efforts, workforce development, and community engagement to drive transformative change while achieving scalability and sustainability by year ten (10).

EPIC’s risk assessment and mitigation strategy are integral to its strategic plan, ensuring that the Engine remains adaptable and resilient in the face of evolving challenges. A dedicated Risk Assessment Task Force embedded within the Governance and Management Focus Group will continuously evaluate external and internal risks, including competitive pressures, economic fluctuations, and technological disruptions. Specific mitigation strategies include:

* **Competitive Landscape Analysis**: Annual assessments will benchmark EPIC’s progress against both national and international competitors in clean energy innovation, ensuring the Engine remains at the forefront of technological advancements. The Innovation Council will provide real-time insights to pivot priorities as needed.
* **Diversified Funding Streams**: Beyond NSF funding, EPIC will prioritize diversifying its revenue sources, including securing private investment, state funding, and philanthropic contributions. Early pilot projects and commercialization efforts will demonstrate the Engine’s value to attract sustained financial support.
* **Scalability and Flexibility**: EPIC’s modular approach to infrastructure development and workforce training ensures that activities can scale quickly to meet increased demand or shift focus in response to changing regional needs.
* **Rapid Decision-Making**: Streamlined governance, empowered by the Innovation Council and executive leadership, will facilitate agile decision-making, enabling EPIC to respond to challenges and opportunities at speed.

EPIC places a central emphasis on inclusivity as a foundational principle, ensuring that its innovation ecosystem reflects the diversity of the Central Valley’s population. The leadership team will include representatives from historically marginalized communities, ensuring diverse perspectives inform decision-making at every level. Community Champions, comprising local organizations and advocacy groups, will act as critical partners, facilitating outreach and engagement with underrepresented populations.

* **Broadened Participation**: EPIC will implement targeted recruitment initiatives, including outreach to rural and disadvantaged communities, to integrate untapped talent into its workforce and entrepreneurial pipelines. Programs will include mentorship for minority-owned startups, scholarships for STEM education, and internships tailored to first-generation college students.
* **Resource Allocation for Expanding Access**: A dedicated portion of the budget will be allocated to equity-driven initiatives, including travel vouchers for underrepresented innovators, testing and prototyping subsidies, and capacity-building grants for community organizations.
* **Expanding Geographic Reach**: Through strategic partnerships with community colleges, K-12 schools, and local governments, EPIC will extend its network into underserved areas, ensuring equitable access to resources and opportunities.

By embedding inclusivity into its governance, outreach, and resource distribution, EPIC will cultivate a culture of equity and shared prosperity, amplifying the impact of its innovation ecosystem across the entire region.

1. **Cross-sector Partnerships and Stakeholder Alignment**

One of the most-pressing challenges in the Sacramento-San Joaquin Valley is the lack of coordinated partnerships among key sectors, including government, industry, academia, utilities, and community organizations. These sectors often operate in silos, resulting in fragmented innovation ecosystems and missed opportunities to leverage collective expertise and resources. This fragmentation is particularly detrimental in the Central Valley, where systemic underinvestment and geographic isolation exacerbate economic and environmental disparities. The California Energy, Power, and Innovation Collaborative (EPIC) seeks to address this challenge by synthesizing isolated efforts into a unified and comprehensive economic Engine. Through strategic cross-sector partnerships governed by the Executive Steering Committee, EPIC will maximize opportunities for equitable participation in the development of electrochemical technologies while driving immediate impacts on clean energy and transportation solutions.

To achieve this vision, EPIC will use the structured Focus Group framework, each aligned with specific domains critical to the success of the Engine. These Focus Groups will include Innovation and Technology, Industry and Commercialization, Economic Development, Workforce Development, and Community Engagement. The Focus Groups will bring together representatives from organizations outlined in the organizational chart, including national laboratories like Lawrence Berkeley National Laboratory (LBNL) and industry leaders like CALSTART, as well as community-based organizations and economic development entities. Each group will focus on a distinct aspect of the innovation ecosystem, ensuring that solutions are inclusive, practical, and aligned with the region’s needs and opportunities.

The **Innovation and Technology Focus Group** will bridge the gap between academic research and industry application. This group will include UC Berkeley and LBNL, alongside industry partners like CALSTART, to co-develop and deploy electrochemical solutions for energy storage, materials and chemical recovery and synthesis, carbon capture and utilization, and transportation. By uniting core technical expertise with commercialization pathways, this Focus Group will accelerate the development and market entry of cutting-edge technologies, ensuring that EPIC becomes a leader in electrochemical technology innovation.

The **Industry and Commercialization Focus Group** will align the needs of private sector partners, such as SMUD, PEM Motion, and 3C Capital Fund, with the Engine’s R&D priorities. This group will focus on scaling technologies for market readiness, addressing barriers to commercialization, and fostering investment in infrastructure such as testing and prototyping facilities. The group will ensure that innovations are deployed at scale and contribute to the region’s economic transformation by streamlining regulatory and market processes. The Industry and Commercialization Focus Group will include Dr. Jibran Zuberi (LBNL) who specializes in technoeconomic modeling of energy systems, focusing on industrial electrification, energy efficiency, and emissions reduction. We will evaluate the economic feasibility of electrochemical technologies, integrating technical performance data from the R&D team with cost analysis to set priorities for commercialization efforts and partnerships.

The **Economic Development Focus Group** will involve partners like GO-Biz, the Greater Sacramento Economic Council (GSEC), and B3K Prosperity to create a favorable environment for attracting businesses and generating new opportunities. The group will work to align EPIC’s initiatives with California’s economic policies, ensuring that investments in clean energy and transportation directly benefit disadvantaged communities. Specific strategies will include tax incentives, public-private partnerships, and regional marketing campaigns to position the Central Valley as a hub for sustainable industries.

The **Workforce Development Focus Group** will play a pivotal role in ensuring that EPIC’s initiatives are inclusive and equitable. With leadership from CSUB and CSUS, the group will develop tailored training programs to prepare residents for high-demand jobs in clean energy and advanced manufacturing. Partnerships with labor organizations, such as the Central Valley labor unions, will enhance workforce readiness and ensure that training programs align with industry needs. Community Champions, including organizations like the Kern Inclusive Entrepreneur Hub and Fresno Metro Black Chamber of Commerce, will lead outreach efforts to connect underrepresented populations with these opportunities.

The **Community Engagement Focus Group** will prioritize collaboration with local organizations to ensure that EPIC’s programs address the needs of historically underrepresented communities. Key partners, such as La Familia Counseling Center and Asian Resources, Inc., will provide critical insights into barriers to participation and strategies for removing them. The group will also focus on fostering trust and transparency through community forums, resource hubs, and regular communication with stakeholders.

The **Executive Steering Committee** will oversee the Focus Groups to ensure alignment with EPIC’s strategic objectives. Composed of representatives from governance and grant management (Momentum), academia (CSUS and CSUB), industry (CMC), economic development entities (GO-Biz), and community organizations, the Steering Committee will provide high-level guidance and facilitate cross-sector collaboration. Quarterly meetings will enable Focus Groups to report on progress, share insights, and refine strategies as needed.

Through this comprehensive framework, EPIC’s partnerships will yield significant benefits. EPIC will accelerate technology development and deployment by integrating the expertise of academic institutions, the resources of private industry, and the insights of community organizations. For instance, the collaboration between UC Berkeley, LBNL, and CALSTART will streamline the commercialization of advanced battery technologies, reducing the time and cost of bringing innovations to market. Furthermore, partnerships with Workforce Development Boards (WDBs) and Community Champions will ensure that residents of disadvantaged communities are prioritized for training and employment opportunities, creating a more inclusive regional economy.

EPIC’s partnerships will also drive investment in critical infrastructure. Collaborations with entities like SMUD and GO-Biz will enable EPIC to secure public and private funding for facilities such as energy storage hubs and testing laboratories. Additionally, the alignment of policy and regulatory frameworks through the Policy and Regulatory Focus Group will streamline permitting processes, minimize administrative burdens, and create a supportive environment for innovation.

This collaborative approach will transform the Sacramento-San Joaquin Valley’s fragmented innovation ecosystem into a cohesive and high-impact Engine. By aligning the efforts of government, industry, academia, utilities, and community organizations, EPIC will foster equitable opportunities, accelerate economic growth, and establish the Central Valley as a national leader in next-generation energy and electrochemical innovation. This model of cross-sector collaboration not only addresses the region’s immediate challenges but also establishes a scalable framework for sustainable development that can be replicated nationwide.

1. **Use-inspired Research and Development (R&D)**

The Central Valley’s limited focus on technical, market-driven R&D poses a significant barrier to effectively addressing real-world challenges and meeting critical user needs. Historically, the region has lacked the innovation infrastructure required to foster applied R&D, leaving gaps in its ability to leverage emerging new technology paradigms. Recognizing this, EPIC will adopt a multi-faceted approach to R&D centered on bridging infrastructure gaps, fostering industry-academic collaboration, and advancing market-driven and community-responsive solutions around the important and fast-growing electrochemical technology area.

EPIC’s geographic footprint, spanning the Sacramento-San Joaquin Valley and Contra Costa County, presents unique opportunities to tackle pressing challenges. Central Valley communities face some of the worst air quality in the nation, primarily due to emissions from O&G operations and agricultural activities. Large refineries and chemical plants, which play a critical role in the local economy, are also working to meet state-mandated carbon intensity reduction goals and shareholder-driven environmental, social, and governance (ESG) standards. EPIC’s R&D strategy is tailored to address these regional challenges by developing technologies and practices that align with the evolving energy economy and in partnership with these companies.

The R&D activities conducted at institutions such as LBNL and the University of California (UC) system will serve as the backbone of EPIC’s applied research efforts. LBNL will focus on advanced electrochemical technologies, including next-generation batteries, hydrogen storage, and carbon capture systems, which are essential for meeting clean energy and decarbonization goals. Researchers at UCB will collaborate with LBNL to translate these innovations into scalable prototypes and pilot programs, emphasizing grid-scale energy storage solutions that can stabilize renewable energy systems. The California State University (CSU) system will play an equally critical role in EPIC’s R&D initiatives.

Faculty at CSUF will represent the agricultural industry, addressing the nexus of energy and water efficiency in one of the most resource-intensive sectors in the region. Research efforts will include precision irrigation technologies powered by renewable energy and the development of biofuels derived from agricultural waste. These innovations will support both economic resilience and environmental sustainability in the Central Valley’s agricultural sector.

CSUB resides in Kern County where the energy evolution is taking place and will focus on applied R&D aimed at transitioning traditional energy operations to cleaner, greener alternatives. Faculty at CSUB will partner with LBNL to explore the potential of direct air capture technologies, renewable hydrogen production, and carbon sequestration. In addition, CSUB faculty will collaborate with UCB on integration of battery technology with smart grid solutions, and battery applications in Microgrid. California Energy Research Center (CERC) at CSUB is the hub to connect local O&G companies, new energy sectors, community colleges and K-12 education organizations. CERC will facilitate the deployment of these technologies within existing infrastructure, empowering the industry to thrive while meeting regulatory and shareholder mandates.

EPIC’s strategy emphasizes collaboration between the UC system and faculty at CSUs to identify applied research opportunities that address regional needs. This partnership ensures that R&D efforts are informed by practical challenges and grounded in the realities of the local economy. For instance, researchers at UC Davis, specializing in decarbonization technologies, will work closely with CSUF’s faculty to pilot renewable energy solutions for agricultural applications. These collaborations will focus on developing technologies that are not only innovative but also feasible for widespread adoption. In addition to UC-CSU collaborations, EPIC will establish interdisciplinary Focus Groups that include representatives from community colleges, industry partners, and government agencies. These groups will conduct needs assessments to identify high-priority R&D areas, ensuring that EPIC’s activities remain aligned with the region’s economic, environmental, and social goals. For example, a joint working group involving LBNL, CSUB, and Chevron could explore opportunities for repurposing abandoned oil wells as sites for geothermal energy production or underground carbon storage.

EPIC recognizes that successful R&D efforts must ultimately lead to commercialization to achieve meaningful impact. To this end, EPIC will invest in infrastructure and programs that support the transition from research to market. A dedicated electrochemical technology Innovation Hub, co-managed by UC Berkeley and LBNL, will provide state-of-the-art facilities for prototyping, testing, and scaling technologies. This Hub will also house technology transfer offices to streamline the process of licensing intellectual property and connecting researchers with industry partners. As the first stage in building the Innovation Hub, EPIC will create a combined electrochemistry workforce and innovation facility on the UCB campus with flexible laboratory space provided by the College of Chemistry. The facility will support small-scale device-level applied R&D suitable for de-risking first of a kind electrochemical reactors and include basic characterization tools for rapid materials and failure analysis. The facility will also be used for hands-on workforce and educational laboratory activities through the Electrochemistry Summer Academy (described below) launching in Summer of 2025 (and open to any traditional or non-traditional student in the region, not solely Berkely students) as well as the Electrochemical Engineering professional masters program, co-developed and offered between the CSU and UC campuses, to be launched in 2027.

One key commercialization pathway will involve leveraging existing relationships with large industrial stakeholders, such as SMUD and CALSTART, to pilot new technologies. For instance, an advanced battery storage system developed at LBNL could be tested in collaboration with SMUD’s renewable energy grid, providing real-world validation and opening the door to broader market adoption. Similarly, biofuel technologies originating from CSUF’s agricultural research could be commercialized through partnerships with transportation companies and fuel suppliers.

EPIC’s use-inspired R&D efforts will deliver transformative benefits to the Central Valley and beyond. By addressing innovation infrastructure gaps, EPIC will augment traditional O&G-based jobs to include new more efficient electrochemical processes and the next-generation energy economy. Investments in renewable energy technologies, such as synthetic liquid fuels appropriate for aviation, will create new job opportunities while reducing greenhouse gas (GHG) emissions. Additionally, EPIC’s focus on applied R&D will ensure that solutions are both market-ready and tailored to the unique needs of the region’s communities. The collaboration between UC, CSU, and industry partners will also enhance workforce development, creating pathways for residents to participate in the emerging clean energy sector. Training programs will be aligned with R&D activities, equipping workers with the skills needed to implement and maintain new technologies. This alignment will ensure that the economic benefits of innovation are equitably distributed across the region.

By fostering a culture of collaboration and innovation, EPIC will transform the Central Valley into a national leader in use-inspired R&D. Its efforts will address the immediate challenges of transitioning to a cleaner energy economy and lay the foundation for long-term sustainability and resilience. This integrated research, development, and commercialization model can serve as a blueprint for other regions seeking to navigate similar transitions.

1. **Translation of Innovation to Practice**

The lack of infrastructure and support for transitioning innovations from research to commercialization has historically hindered the Central Valley’s ability to bring new technologies to market. By failing to bridge the gap between discovery and deployment, the region has faced challenges in ensuring that promising technologies reach full market readiness. Recognizing this, EPIC aims to transform the region’s capabilities by creating a robust pipeline for translating innovation into practice. With CMC at the heart of this effort, it will serve as a hub for commercialization activities, offering resources, infrastructure, and expertise to guide technologies through the Technology Readiness Level (TRL) pipeline.

As shown in Figure X, the TRL framework is central to EPIC’s strategy for advancing technologies from conceptualization to operational deployment. The TRL system, which ranges from basic principles observed (TRL 1) to actual system operation in a real-world environment (TRL 9), provides a clear roadmap for the development process. EPIC will leverage this framework to ensure that innovations progress efficiently through each stage, from experimental proof of concept to full-scale demonstration and market integration. For example, technologies at TRL 4—validated in a lab setting—will move to TRL 5 and 6 through field trials and testing in relevant environments facilitated by CMC resources.

**Figure X: Title**

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California’s unique geographic advantages further enhance EPIC’s ability to support this pipeline. The state is home to one of the world’s largest known lithium deposits, providing a critical resource for next-generation batteries and other electrochemical technologies. These lithium deposits, located in areas such as the Salton Sea, offer a strategic advantage for the region, reducing reliance on imports and bolstering the domestic supply chain. For materials not yet accessible within California, imported lithium and other rare earth elements enter the U.S. through the ports of Los Angeles and Oakland, both of which are strategically connected to the Central Valley. These logistical connections streamline the delivery of critical materials directly to EPIC’s facilities, ensuring that researchers and manufacturers have access to the resources they need to advance innovation.

The Adoption Readiness Level (ARL) framework will complement the TRL pipeline, helping EPIC measure the progress of technologies as they move from development to widespread adoption. While TRL focuses on technical validation and operational readiness, ARL assesses factors such as market demand, stakeholder buy-in, and regulatory alignment. By integrating both frameworks, EPIC will ensure that its innovations are technically viable and poised for successful market entry. For example, an electrochemical storage solution developed at TRL 7—demonstrated in an operational environment—will also be evaluated for ARL metrics, such as its compatibility with existing energy infrastructure and its ability to meet regulatory standards set by California’s air and energy regulators.

The CMC’s location near California’s key regulatory agencies, including CARB and CEC, provides additional strategic benefits. By situating the hub in close proximity to these entities, EPIC will streamline the regulatory approval process, ensuring that technologies meet state and federal standards more efficiently. This proximity will also facilitate partnerships with policymakers, enabling the CMC to align its activities with California’s climate and energy goals. Furthermore, the CMC’s centralized position allows CSUB, CSUF, and Contra Costa County to focus on specific pieces of the innovation ecosystem rather than duplicating efforts, creating a more efficient and cohesive regional strategy.

The translation of innovation to practice also relies on partnerships with private industry and academic institutions. EPIC’s network of partners, including SMUD, CALSTART, and LBNL, will play a critical role in advancing technologies through the TRL pipeline. For instance, the grid-scale batteries and electrolyzers developed at LBNL and UCB will be tested and validated in SMUD’s energy grid, moving it from TRL 5 to TRL 7. Similarly, collaborations with CALSTART will support the deployment of clean transportation technologies, ensuring that innovations reach end-users in the most effective and impactful way.

Additionally, EPIC’s infrastructure investments will include state-of-the-art testing and prototyping facilities, which are essential for advancing technologies through the later stages of the TRL pipeline. These facilities, such as [identify the specific facilities here], will provide researchers and manufacturers with the tools and space needed to refine and scale their innovations. For example, advanced prototyping labs at the CMC will enable teams to simulate real-world conditions, accelerating the transition from TRL 6 (technology demonstrated in a relevant environment) to TRL 8 (complete system qualified and ready for deployment).

By addressing the critical gaps in infrastructure and support for commercialization, EPIC will create a seamless pathway for translating innovation into practice. Its integration of TRL and ARL frameworks, combined with the state’s natural and logistical advantages, positions the Central Valley as a leader in advancing clean energy and mobility technologies. This comprehensive approach ensures that innovations not only reach market readiness but also achieve widespread adoption, driving economic growth, reducing GHG emissions, and establishing California as a global hub for sustainable innovation. Through the collaborative efforts of its partners and stakeholders, EPIC will transform the region’s innovation ecosystem, setting a new standard for translating groundbreaking research into practical, market-driven solutions.

1. **Workforce Development**

A gap in targeted education and training programs for clean energy and technology careers limits the development of a skilled workforce, particularly among underserved populations. The Central Valley has historically been a cornerstone of California's economy, yet it faces a critical transition as traditional oil and gas industries decline, necessitating workforce shifts into clean energy and sustainable technologies. Kern County, housing over 70 percent of the state's oil and gas wells, exemplifies the region's dependence on this sector. However, environmental and health consequences tied to these industries have disproportionately impacted disadvantaged communities. For instance, nearly 9 out of 10 residents in low-income communities live within proximity to active oil wells, bearing a disproportionate burden of pollution and adverse health effects.

Simultaneously, the Central Valley’s agriculture-dominated economy employs thousands across the region in labor-intensive, often seasonal positions that lack long-term stability. With agriculture accounting for significant water consumption and environmental impacts, the sector faces increasing pressure to innovate and adopt sustainable practices.

This dual reliance on oil and agriculture underscores the need for a transformative workforce strategy that prioritizes clean energy, sustainable agriculture, and emerging technologies. The Central Valley’s shift toward clean energy provides an unprecedented opportunity to align workforce development initiatives with the region’s evolving needs. However, systemic gaps, including limited access to training programs, a lack of connectivity between industry and education providers, and historical underinvestment in workforce pipelines, persist.

EPIC aims to develop a comprehensive understanding of current and future workforce needs through its use-inspired research and the translation of innovations into practice. An ecosystem of workforce development and management is an essential part of the engine to meet the following goals: 1) a close collaboration between the regional industry, business and education sectors to monitor the workforce evolution and identify the gaps in talents; 2) a well-established education pathway for talent development, including outreach and community engagement; 3) identify new ways to build skills and credentials and establish a wide array of career development programs for students or job seekers; and 4) leadership development to effectively cultivate a culture to support diversity, inclusion, and life-long learning.

EPIC will facilitate training and job opportunities in clean energy and electrochemical sectors that meet the definition of high-road jobs and serve disadvantaged communities experiencing poverty and low levels of educational attainment. Increases in manufacturing jobs will also allow community members with high school equivalent levels of education access to union and middle-income job security with opportunities for growth. Recruitment efforts will include partnerships with CBOs, Workforce Development Boards (WDBs), and educational institutions to provide comprehensive training and job placement services. The program will integrate on-the-job training opportunities, internships, and apprenticeships to ensure participants acquire both technical skills and real-world experience. Community Champions will lead outreach efforts to connect marginalized populations with program resources to further enhance inclusivity. This DEIA-driven strategy ensures the equitable distribution of opportunities while fostering a diverse workforce capable of driving regional innovation.

CSUB, CSUF, and CSUS will serve as regional hubs to broaden educational access in collaboration with local community colleges and high school districts. Stackable certificate programs will be developed to provide a flexible educational pathway to develop talents adapted to the proposed engine. Opportunities for union workers to transition their skills into a new workforce will help alleviate the economic dip that may come from the worldwide transition away from O&G industries.

At UCB/LBNL, the EPIC will leverage the world’s most prolific and impactful scientific institutions to partner with CSU system institutions and build unique industry R&D training programs at the undergraduate and master’s levels to support the battery and electrochemical technology ecosystem. The first step at UCB is the Electrochemistry Summer Academy, founded by Prof. Boettcher as part of the Center for Electrochemical Science, Engineering, and Technology (CESET). The academy immerses diverse students in the foundational and applied aspects of electrochemistry and prepares them for industry R&D. As a summer offering, it is open to any qualified person, and thus will be available to not only UCB students, but also CSU students and industry professionals aiming to upskill and reskill, for example in O&G. Phase I includes three courses have already been approved by the UCB coursework committee to launch in Summer 2025 at UC Berkeley and include complete 3-credit courses on *Fundamentals of Electrochemistry* and *Electrochemical Engineering* along with *Electrochemical Technology Research Projects Laboratory,* which is built on team-based mentored projects with industry partners. Phase II in Summer 2026 will expand offerings to include courses *Electrochemical Methods Laboratory* and *Electrochemical Technology,* resulting in sufficient credit hours for the first *Electrochemistry Minor* in the USA. In Phase III, the Electrochemistry Summer Academy courses will be combined with new and existing academic year science, engineering, data/programming, and technology courses both at UCB and at the CSU campuses to build a Professional Master’s degree in electrochemical technology.

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EPIC is projected to train 3,000 individuals by the end of its first five (5) years, generating an economic impact of $500 million. Participants will gain access to high-quality jobs, with average wages exceeding $25 per hour, while employers will benefit from a steady pipeline of skilled workers. Additionally, the program is expected to create 700 indirect jobs and an estimated 1,200 induced jobs across related sectors. By prioritizing underrepresented communities, EPIC will ensure that these benefits are equitably distributed, empowering the region’s most vulnerable populations. Table X shows the time-bound goals and milestones for achieving the aforementioned projections.

**Table X: Goals and Milestones of WFD Plan**

|  |  |  |  |
| --- | --- | --- | --- |
| **Goal** | **Milestone** | **Qtr.** | **Yr.** |
| Develop Workforce Development Outreach Plan | **Deliverable:** Completed Plan | 4 | 1 |
| Target Population outreached | 1 | 2 |
| Conduct trainings/technical trainings | Trainings implemented and completed | 4 | 10 |
| Transition trained participants to entry-level position | Successful job placement | 4 | 10 |
| Assess outcomes of program | **Deliverable**: Completed Outcome Report | 4 | 10 |

The intended outcome of EPIC’s workforce development efforts is to create a sustainable, inclusive pipeline of skilled workers capable of meeting the demands of clean energy and advanced manufacturing sectors. By addressing both immediate workforce gaps and long-term systemic challenges, the Engine will position the Central Valley as a model for equitable and sustainable economic transformation.

1. **Inclusive Engagement**

There is a need for greater inclusion of diverse talents and perspectives across geography, race, ethnicity, gender, and organizational types, which currently hinders equitable participation in the innovation ecosystem. ***Strategy:*** EPIC’s geographic footprint represents some of the most diverse populations across race, ethnicity, gender, geography, and educational attainment. The EPIC proposal is supported by statewide and local chambers and CBOs and builds off relationships from the regional educational institutions. The Engine will use this to work to maximize inclusive engagement.

Inclusive engagement is a foundational element of EPIC, recognizing that the full potential of the innovation ecosystem cannot be realized without the diverse talents and perspectives of the Central Valley’s communities. Despite the region’s rich diversity across race, ethnicity, gender, geography, and educational attainment, systemic barriers have historically limited equitable participation in economic development and technological innovation. These barriers include lack of access to educational opportunities, underrepresentation in leadership positions, and insufficient outreach to historically excluded populations. EPIC is committed to addressing these challenges by building a fully inclusive and equitable innovation ecosystem that leverages the strengths of its geographic footprint and the relationships cultivated with CBOs, chambers of commerce, and regional educational institutions.

The Central Valley is one of the most demographically diverse regions in the United States, with a population that includes significant Hispanic/Latino, Black, Asian, and Indigenous communities. Environmental and economic inequities, including exposure to air pollution and limited access to high-quality jobs in emerging industries have disproportionately impacted these populations. EPIC’s commitment to inclusive engagement ensures that these communities are not only represented but actively involved in shaping the region’s clean energy future. This begins with partnerships with organizations such as the Kern Inclusive Entrepreneur Hub, Fresno Metro Black Chamber of Commerce, and La Familia Counseling Center, which bring deep expertise in community engagement and advocacy for underrepresented groups.

EPIC’s inclusive engagement strategy is informed by its geographic and demographic diversity, with initiatives tailored to address different communities’ unique needs and strengths. For example, in rural areas with limited access to higher education, such as Delano or taft. EPIC will collaborate with community colleges to provide tailored training programs that prepare residents for careers in clean energy and advanced manufacturing. In urban centers, such as Bakersfield and Fresno, EPIC will work with chambers of commerce to support minority-owned businesses and entrepreneurs in accessing funding, mentorship, and market opportunities. These localized approaches ensure that EPIC’s programs are relevant, accessible, and impactful across the full spectrum of its service area.

One of EPIC’s primary mechanisms for fostering inclusive engagement is its Community Engagement Focus Group, a core component of its governance structure. This group will include representatives from community-based organizations, advocacy groups, and local governments, ensuring that diverse perspectives are integrated into decision-making processes. The Community Engagement Focus Group will conduct regular listening sessions and town halls to gather input from residents, particularly those from DACs. Insights from these engagements will inform EPIC’s strategic priorities, ensuring that programs address real-world challenges and opportunities identified by the community.

To further enhance inclusivity, EPIC will implement targeted outreach and recruitment strategies designed to increase representation in its workforce development programs, leadership positions, and entrepreneurial initiatives. This includes proactive efforts to recruit women, immigrants, and individuals from low-income backgrounds into training programs and leadership pipelines. For example, EPIC will collaborate with CSUB and CSUF to launch mentorship programs for first-generation college students, pairing them with industry professionals who can provide guidance and support. Additionally, EPIC will offer scholarships and financial assistance to reduce barriers to participation for individuals facing economic hardship.

EPIC’s partnerships with statewide and local chambers of commerce will play a critical role in maximizing inclusive engagement. Organizations such as the Greater Sacramento Economic Council (GSEC) and B3K Prosperity bring extensive networks and resources that can be leveraged to support underrepresented entrepreneurs and businesses. Through these partnerships, EPIC will provide targeted assistance, such as grant-writing workshops, business development training, and access to capital, ensuring that historically excluded groups have the tools they need to succeed in the innovation economy.

A key component of EPIC’s inclusive engagement strategy is its focus on educational attainment and workforce development. Recognizing that access to education is a critical determinant of economic mobility, EPIC will partner with regional educational institutions to create pathways from K–12 schools to postsecondary programs and careers in clean energy. Initiatives such as hands-on STEM workshops, internship opportunities, and dual-enrollment programs will provide students from diverse backgrounds with the skills and experiences needed to thrive in the emerging green economy. By aligning these efforts with the needs of local industries, EPIC will ensure that educational programs are inclusive and directly linked to high-demand job opportunities.

To measure its progress and ensure accountability, EPIC will implement a robust evaluation framework that tracks its metrics, including participation rates, demographic representation, and community satisfaction ratings. These metrics will be disaggregated by race, ethnicity, gender, and geography, enabling EPIC to identify gaps and adjust its strategies as needed. Regular reports on these metrics will be shared with stakeholders, fostering transparency and building trust within the community.

Through its comprehensive approach to inclusive engagement, EPIC will create an innovation ecosystem that reflects and benefits the full diversity of the Central Valley. By partnering with community-based organizations, chambers of commerce, and educational institutions, EPIC will ensure that historically excluded populations have access to the resources, opportunities, and support they need to participate in and benefit from the region’s clean energy transition. This commitment to inclusivity addresses long-standing inequities and strengthens the overall resilience and competitiveness of the Central Valley’s innovation ecosystem, setting a new standard for equity-driven economic development.

1. **Strategic Regional Investment/Capital Investment**

The Central Valley has faced significant barriers to achieving long-term innovation, commercialization, and growth due to inadequate and inconsistent funding streams for R&D and technology deployment. These funding challenges have constrained the region’s ability to scale transformative technologies and sustain economic momentum. EPIC aims to overcome these barriers by establishing a strategic framework for regional and capital investment. By leveraging existing funding programs, voter-approved bonds, and innovative financing mechanisms, EPIC will ensure the financial sustainability of its initiatives through commercialization while driving regional economic growth and environmental resilience.

EPIC’s funding strategy is anchored in collaboration with state agencies, including CEC, CARB, and the California Public Utilities Commission (CPUC). These agencies oversee a variety of programs designed to advance clean energy, transportation, and technology innovation, which EPIC will integrate into its funding portfolio. For example, the PowerForward battery manufacturing grant, managed by the CEC, provides targeted support for scaling battery production facilities. EPIC will utilize this grant to fund the development of advanced battery manufacturing hubs in the Central Valley, aligning with the region’s goals to transition from fossil fuel reliance to clean energy solutions.

The Clean Transportation Program, another critical resource administered by the CEC, will play a key role in supporting EPIC’s efforts to deploy clean mobility solutions. This program provides funding for infrastructure projects such as EV charging stations and hydrogen refueling networks, both of which are essential for achieving California’s zero-emission transportation goals. EPIC will collaborate with regional partners, including CALSTART and SMUD, to secure grants under this program, ensuring that the Central Valley remains at the forefront of clean transportation innovation.

In addition to these established programs, EPIC will leverage voter-approved bond funding to finance large-scale infrastructure projects. California voters have demonstrated strong support for clean energy and climate resilience initiatives, approving bonds that fund critical investments in battery development, grid modernization, and renewable energy infrastructure. EPIC will work with state and local governments to allocate these funds toward priority projects, such as constructing state-of-the-art testing and prototyping facilities at CMC and developing energy storage hubs near key logistics corridors.

Cap-and-trade auction proceeds from the Greenhouse Gas Reduction Fund (GGRF) will provide another important funding source for EPIC’s initiatives. These funds, generated through California’s cap-and-trade program, are allocated to projects that reduce GHG emissions and benefit DACs. EPIC’s focus on equity and inclusion makes it uniquely positioned to secure GGRF funding for technologies and programs that address environmental justice issues in the Central Valley. For example, investments in renewable hydrogen production and carbon capture systems will directly benefit communities disproportionately impacted by air pollution while creating new job opportunities in clean energy sectors.

EPIC will also explore partnerships with private investors and philanthropic organizations to diversify its funding streams. By demonstrating its initiatives' economic and environmental benefits, EPIC will attract investment from impact funds, venture capitalists, and corporate stakeholders. For instance, a partnership with [add potential corporate partner here] could support the commercialization of advanced battery technologies, while contributions from philanthropic foundations could fund workforce training programs tailored to underserved populations.

To ensure the effective allocation and management of these funds, EPIC will establish a Financial Oversight Committee within its governance structure. This committee, composed of representatives from state agencies, industry partners, and community organizations, will oversee funding decisions and monitor the financial performance of EPIC’s projects. The committee will also work to identify emerging funding opportunities, such as federal grants under programs like the Department of Energy’s Advanced Research Projects Agency-Energy (ARPA-E).

By integrating these diverse funding sources into a cohesive strategy, EPIC will create a sustainable financial model that supports long-term innovation and growth in the Central Valley. Its approach will address the systemic funding challenges that have historically limited the region’s progress, enabling the deployment of transformative technologies and the creation of high-quality jobs. Through strategic regional and capital investment, EPIC will drive economic and environmental resilience and establish a blueprint for other regions seeking to advance clean energy and technology innovation. This holistic funding strategy ensures that EPIC’s impact extends beyond the Central Valley, positioning California as a global leader in sustainable development.

* 1. **Evaluation Plan**

To create clarity and transparency in communication, CSUS will work with NSF to establish an evaluation plan that includes the milestones and deliverables. CSUS will meet monthly with NSF to discuss the overarching progress of the Engine.

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The Engine’s governance structure and Executive Steering Committee —which is composed of representation of the entire team—will manage all process and outcome evaluation efforts with inputs from specific organizations on specific outputs. The Executive Steering Committee will take inputs and outputs from each partner via the data management plan to generate a yearly evaluation report. Each Quarter 1 (Q1) will be dedicated to developing the evaluation strategy for that year, and a final report will be generated at the end of Quarter 4 (Q4) for that year. The research representatives on the Executive Steering Committee will be the team members charged with evaluating and validating the data, implementing evaluation best practices, and ensuring fidelity. Annual evaluation reports will be sent to the EPIC partner network. Based on outcomes (for example, if goal metrics set during Q1 are not met by the end of Q4), partners may adjust their methods, procedures, and activities to reach their goals. Conversely, depending on the scope of the outcome, the Advisory Board may also adjust the metric to be more achievable during its next strategy meeting in Q1 of the following year.

**Key Outcomes:** Outcome metrics will be strategized and decided upon at the beginning of each year. A final meta-analysis and evaluation report will be completed at the end of the 10-year period to report on the overall outcomes of EPIC. Although measurable goals have yet to be determined, the Project Team expects the following metrics to be key to measuring EPIC’s efficacy:

* Number of persons from Central Valley DACs who enter workforce development training programs
* Number of persons of Central Valley DACs who are placed into well-paying, sustainable careers as a result of workforce development training programs
* Number of students from Central Valley DACs entering higher education
* Number of students placed into high-paying sustainable careers in the electrochemical space
* Number of patents filed as a definite product from research to commercialization
* Number of patents filed by underrepresented entrepreneurs
* Speed from idea to commercial product
* Number of new courses at local academic institutions as a result of EPIC innovations and research
* Number of jobs created in the emerging electrochemical sector within the Central Valley
* Number of ideas coming into EPIC from underserved communities into commercialized products compared to the number of ideas coming from academia

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