



PARTNER'S GUIDE TO THE SCE TECHNOLOGY ROADMAP

JANUARY 2025



About Southern California Edison



15 million
residents served

Our Company

- One of the nation's largest electric-only utilities, with over 5 million customers accounts in a 50,000-square-mile service area
- Wires-focused, with limited power generation ownership (< 20% of power delivered from own generation)

Safety

Safety is our top value: We are committed to keeping the public, our employees and contractors safe.

Affordability

We are committed to an affordable transition for our customers, and anticipate it will help households save ~40% on energy expenses by 2045.

Our Vision

SCE is committed to leading the utility industry in achieving net-zero emissions by 2045 and building the next-generation energy system to enable this transition



Aggressive climate goals met with clean, efficient, economy wide electrification



Decarbonize Electricity

100%

retail sales



Electrify Transportation

90%

of vehicles



Electrify Buildings

95%

of buildings



Use Low-Carbon Fuels

48%

non-electric energy



Sink Remaining Carbon

75

MMT carbon sink

Our Grid

SCE's core commitment is to **safely** provide electric service for customers. We build and operate a grid to meet current and future needs, with a focus on reliability, resiliency and readiness



125,000+

Miles of SCE T&D lines

Reliable

Improve the reliability of the grid so SCE can meet customers' needs today and in the future

Resilient

Deploy programs that protect the safety of customers and the public

Ready

Ensure the grid is ready to support widespread electrification and decarbonization

Executive Summary

The stakes are higher than they have ever been for California's clean energy transition. The state has an ambitious goal to reach carbon neutrality by 2045.

Edison International, the parent company of Southern California Edison, is a leader in enabling this transition while maintaining safety, affordability and reliability. We published our vision for a cleaner California in *Countdown to 2045* — achieving decarbonization through electrification and other tools, while also reducing customer energy bills and enhancing the resilience and safety of the system. To reach its goal, California must quickly and massively expand the electricity grid and adopt emerging clean energy technologies.

SCE previously published a comprehensive approach, *Reimagining the Grid*, to support this goal, and we have worked to accelerate it with continued initiatives at the forefront of grid innovation. We are now finalizing a comprehensive SCE Technology Roadmap to refine, expand and further accelerate the implementation of this strategy. This will help us build execution leadership in line with our established thought leadership.

Many of the technologies and capabilities required to achieve net zero have long lead times and require commitments beyond the utility. Equipped with our Roadmap, we are engaging stakeholders across the ecosystem to overcome today's challenges and deploy the next generation of innovations at scale.

While the Roadmap is an internal tool, this guide provides an overview of our approach and areas of focus. We invite you to partner with us to drive the clean energy transition forward.



The SCE Technology Roadmap provides a comprehensive vision for the technologies to transform our energy system, enabling greater collaboration with innovators and other industry stakeholders

This guide for external stakeholders provides a starting point for productive engagements with SCE.



The Roadmap is an internal strategic planning tool that outlines SCE's technology priorities and initiatives needed to achieve the company's strategy. This tool will be continuously refined with updates and additional technologies, including customer and workforce technology, serving as SCE's unifying plan for new technology adoption.

Objectives

The Roadmap is designed to achieve SCE's *Countdown* vision by focusing on six core technology objectives:

1. Power Density
2. System Utilization
3. Improving Interconnections
4. Power System Management
5. Safe & Resilient Infrastructure
6. Reliable 24/7 Energy

Technologies

The Roadmap currently provides detailed guidance on ~150 technologies, spanning the electric system, from generation to load. The technologies are not standalone; they must be integrated together into a complex system.

It has four technology groups:

- A. Grid Edge
- B. Transmission & Distribution
- C. Grid Platform
- D. Generation

Technology Roadmap Details



Customer-owned



Customer-sited



Meter



Secondary

(A)

Grid Edge

The grid edge is a crucial frontier for the grid, embodying the shift towards a more distributed, intelligent and responsive energy system. SCE's Tech Roadmap focuses on three classes of grid edge technology.

Tech Class	Vision and Key Considerations	Subclasses
Demand Flexibility	Continuous load management capability (e.g., load control, VGI/VPP ¹ aggregation) enabled by advanced metering can unlock system flexibility at scale and support low-cost electrification	Panel Enhancers, Load Management, Virtual Power Plants
Intelligent Service Point	Next-generation meters will bundle new grid edge capabilities and technologies to transform meters into an intelligent orchestration hub for customer devices and real-time grid management	Customer Metering Tech, Grid Edge Compute & Control
Secondary Distribution Tech	Secondary system redefined by a major shift in customer interconnections , with energy storage, solid-state technologies, and off-grid capabilities enabling more high-power, resilient and flexible service	Storage & Remote Grids, Energy Router/Solid State Power Conversion, Power Conditioning, Smart Inverters

(C)

Grid Platform

The grid platform is foundational to the whole system, providing critical infrastructure for real-time data processing, communication, cybersecurity and system control. This platform enables the grid to become more intelligent, decentralized and responsive by supporting technologies like edge computing, AI-driven analytics and advanced communication networks. SCE's Tech Roadmap focuses on five classes of grid platform technology.

Tech Class	Vision and Key Considerations	Subclasses
Grid Intelligence	AI-enabled grid planning & operations requires a modernized data management infrastructure and advanced engineering & analytical tools	Grid Planning Tools, Grid Engineering Tools, Grid Management Systems
Grid Sensors	Expansion of sensor technologies enables more holistic use cases and lowers the acquisition cost of real-time data needed for intelligent grid operations	Dynamic Asset Rating, Short Circuit & Inertia, Power System, Asset Monitoring
Grid Comms	Expanded Field Area Network is essential to enable high speed connectivity to ~6M controllable points and ~15M grid edge devices	Wired Comms, Wireless Comms, Network Management, Network Virtualization & Optimization, Grid Control & IoT Protocols
Grid Computing	Advanced computing technologies need to be deployed across the entire grid to bring decision making closer to grid actuation to enable an autonomous and adaptive grid	Advanced Computing, Distributed Computing
Grid Cybersecurity	New cybersecurity technologies and tools are critical to bolster current cyber defenses to address emerging threats	Advanced Cryptography, Security & Threat Detection, Identity, Access, and Trust Management, Security Orchestration, Automation & Response

(E)

Additional Areas

SCE's Tech Roadmap covers four groups of technologies today, but it will grow to include other key groups such as customer technology and workforce technology.

Key: (A) Grid Edge (B) Transmission & Distribution (C) Grid Platform (D) Generation (E) Additional Areas



Primary



B-Sub



Subtrans



A/AA Sub



Trans



Generation

(B)

Transmission & Distribution

T&D is at the core of SCE's operations. Innovations here will be essential to a reliable, resilient and ready grid. This includes enhancing grid capacity, ensuring stability, and implementing real-time monitoring and management. These technologies must support rapid interconnection of loads and renewable energy projects. Moreover, robust and resilient T&D systems are essential for adapting to climate-induced stresses. SCE's Tech Roadmap focuses on four classes of T&D technology.

Tech Class	Vision and Key Considerations	Subclasses
Advanced Conductors	Advanced conductor/cable tech can significantly increase power transfer capacity needed for high-density load, but today supply is still limited	High-Temp Low Sag Conductor, Covered Conductor, High-Temp Superconductor, Wireless Power Transfer (WPT)
Advanced Structures	New asset designs/enhancements and life extension technologies are key due to rapidly growing electrification, climate impacts and affordability challenges	Advanced Substations, Asset Life Extension & Enhancement, Grid Hardening
Grid Flex & Advanced Protection	Advanced protection and power control technologies are critical to manage grid challenges from an increasing number of inverter-based resources	Power Flow & Voltage Management, Power System Stability Management, Advanced Protection, Advanced Switchgear
DC² Systems	Expanding use of new DC technologies supports growing need for high power density to serve large C&I ³ loads/corridors and may unlock new grid architectures	DC Power Conversion, DC Circuit Breakers, DC Insulators & Cables

(D)

Generation

Reliable, safe and clean generation is central to meeting SCE's 2045 net-zero goals. Solar, on-shore wind and storage are anticipated to make up the majority of new generation, but additional innovation will be required in clean firm generation to feasibly reach 100% carbon-free electricity. SCE's Tech Roadmap focuses on five classes of generation technology.

Tech Class	Vision and Key Considerations	Subclasses
Advanced Energy Storage	Enhances renewable integration, industrial processes and grid stability with versatile, long-life high-density technologies	Mechanical, Thermal, Electrochemical, Novel (Beyond BESS ⁴)
Next-Gen Nuclear	Advanced fission and fusion tech offers safer solutions with substantial opportunities for out-of-state clean energy integration	Fission, Fusion
Next-Gen Geothermal	Deployable in diverse geologies; leverages advanced drilling, heat exchange and AI/ML-enabled ⁵ reservoir optimization; can replace retiring coal plants	Enhanced Geothermal Systems, Advanced Geothermal Systems, Reservoir Optimization
Offshore & Marine	Strong and consistent profiles complement midday solar power but require advanced turbines, floating platforms and ocean power technologies	Wind Turbines, Floating Platforms, Ocean Power
Advanced Gas Systems	Use pre- and post-combustion carbon capture to reduce emissions, enabling select gas plants to operate past 2045 if required	Carbon Capture (Point Source), Advanced Combustion

¹ Vehicle Grid Integration/Virtual Power Plant; ² Direct Current; ³ Commercial and Industrial; ⁴ Battery Energy Storage Systems;

⁵ Artificial Intelligence/Machine Learning

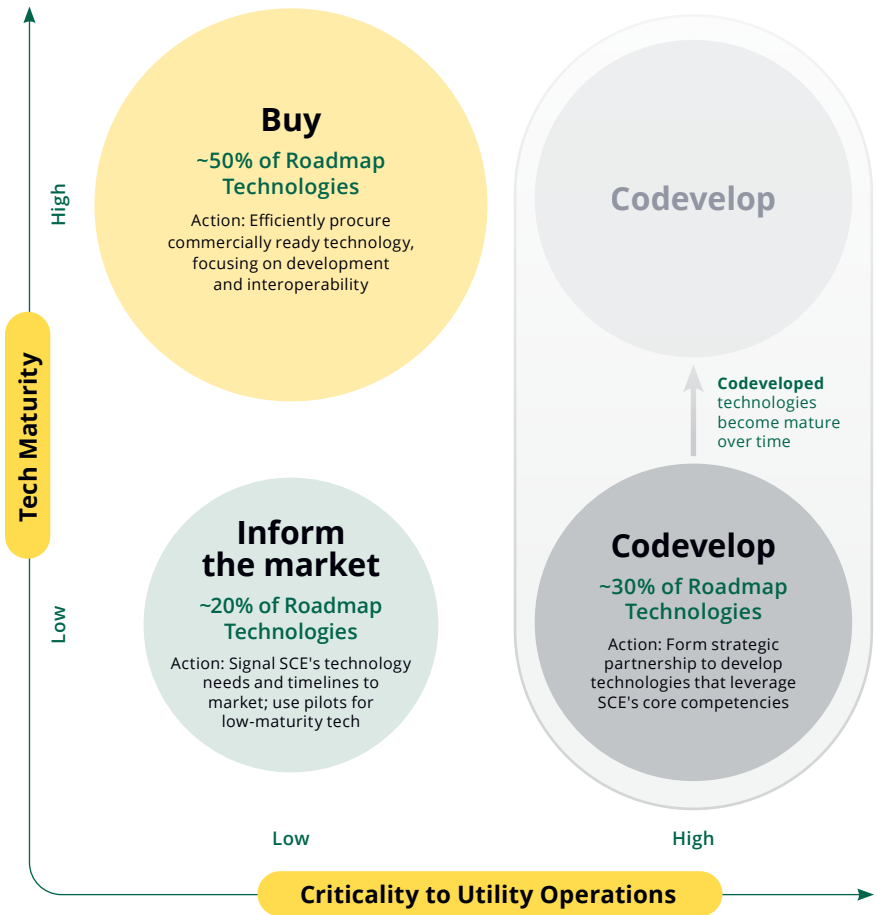
SCE's Commercial Approach

Vision: proactive, transparent and intentional engagement with the industry's top innovators

We understand the maturity of the technologies in the Roadmap differs widely, as does their relative criticality to our core utility operations. The Roadmap provides guidance for decision makers in SCE's operating units on how to engage with the market for each technology. There are three distinct types of engagements to help internal and external stakeholders move forward most effectively.

The Roadmap also provides guidance on prioritization, with about 50 of 150 technologies most important to move forward with today, considering the role they play in supporting the fully integrated system of technologies.





Guide for Partners



This approach demands close collaboration with global innovators and a rethinking of legacy utility procurement. SCE strives to remain an industry leader in shaping innovation; partnership with top innovators is foundational. This booklet intends to drive alignment and accelerate engagements with industry.

The Implementation Imperative

Refining SCE's internal processes to support implementation of the Technology Roadmap at the speed and scale required to achieve our strategy

From Thought Leaders to Execution Leaders

SCE is developing a new mindset toward innovation paired with a redesigned tech execution process. We must become execution leaders to capture the real opportunities described in our extensive thought leadership. This will require greater prioritization, alignment, timeliness and appropriate risk-taking across our risk-taking across our operations.





Innovation Model Vision

Technologies must efficiently move from the pages of the Technology Roadmap all the way to deployment at scale on SCE's grid. We are focused on achieving this vision by improving three essential steps in the process:



Step 01 Engagement

Goal: SCE provides transparency about our needs and processes, proactively shaping what's available in the market and leading to consistent sourcing of innovations aligned with the Tech Roadmap.



Step 02 Assessment

Goal: The Tech Roadmap provides a common, strategic framework for technology decision-making across business units; procurement and evaluation processes are right-sized and risk-informed in line with the technology's commercial approach; and operational technology owners are engaged in pilots and demos from the start.



Step 03 Tech Transfer

Goal: Clearly defined success metrics and engaged owners from Step 2 enable seamless, transparent and accountable transfer of innovations to business unit operations, who will be prepared to own and begin deployments at scale in the field.



The countdown to 2045 is on, and Edison International is leading the charge toward a carbon-neutral California and beyond. A future of greater electrification is one of exceptional opportunity — with good jobs and a cleaner, reliable and resilient grid powering our communities. We are proud to accelerate progress toward the clean energy future while meeting the needs of communities we serve today, and we are ready to collaborate with all stakeholders to address the challenges ahead.

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