

Intelligent Grid Planning & Orchestration (IGPO)

INITIATIVE DESCRIPTION

A21

- IGPO will demonstrate innovative digital technologies, analytical tools, and modeling approaches that enable faster interconnection and energization of distributed energy resources (DERs) and transportation electrification infrastructure.
- IGPO improves grid visibility, forecasting, and data exchange to help utilities identify available capacity, evaluate constraints, and reduce the time required to make interconnection and energization decisions.
- Its four RTAs generate the data, visibility, and operational intelligence needed to streamline interconnection and energization processes as DER adoption, EV charging, and electrified load growth increase the scale, complexity, and pace of customer interconnections.

PROPOSED INITIATIVE BUDGET	\$14,971,292
% OF TOTAL BUDGET (excl. admin & overhead)	22%
# OF RESEARCH TOPIC AREAS	4

ALIGNMENT SUMMARY

STRATEGIC OBJECTIVE ALIGNMENT

A21-A22

“Supports the acceleration of the development, testing, and integration of innovative technology, communication protocols, and modeling approaches to streamlining interconnection and energization processes for DER and electric vehicle charging infrastructure, with a goal to demonstrate the capability to significantly reduce interconnection and energization approval timelines under multiple high DER penetration and electrification scenarios”

IGPO develops, tests, and integrates digital technologies, communications capabilities, and analytical approaches that streamline the evaluation, approval, and interconnection of DER and transportation electrification projects. By improving grid visibility, information exchange, and decision-making, IGPO enables faster interconnection and energization while addressing the growing complexity of connecting DERs, EV charging infrastructure, and electrified loads under high-electrification scenarios.

CPUC ALIGNMENT

A21, A22

- CPUC planning increasingly focuses on accelerating DER and transportation electrification deployment while reducing interconnection and energization timelines, creating a need for improved visibility into grid capacity, constraints, and customer-level electrification impacts.
- IGPO will provide validated forecasting methods, planning scenarios, digital models, interoperability requirements, and operational evidence to inform planning assumptions, investment prioritization, standards, program design, and future rate cases.
- Ratepayer-funded EPIC demonstrations are appropriate because utility-scale validation requires representative grid data, operating constraints, cybersecurity controls, system integration, and decision workflows that individual vendors cannot independently reproduce.

Enhanced Grid Operations

10. Expediting and Streamlining Interconnection and Energization Processes

WHAT PROBLEM ARE WE SOLVING? A53

Expediting interconnection and energization requires utilities to rapidly evaluate grid capacity, operational constraints, and the impacts of growing DER and electrification adoption. However, planning and operational workflows remain fragmented and increasingly challenged by the volume and complexity of grid data. Without digital tools that transform complex grid data into actionable planning insights, utilities cannot consistently provide the timely evaluations needed to support accelerated interconnection and energization. Enhanced Grid Operations addresses this challenge by accelerating the grid-impact evaluations needed to evaluate and integrate DER and electrification projects, enabling faster interconnection and energization timelines.

Intelligent Grid Planning & Orchestration (IGPO)

START	2027-2028
OUTPUTS	2029-2032
MARKET READY	2030-2035

ALIGNMENT SUMMARY

WHAT IS THE DISTINCT RESEARCH APPROACH?	HOW WILL YOU KNOW YOU ARE SUCCESSFUL?	HOW WILL YOU COORDINATE?
• Demonstrate an integrated environment that combines AI-assisted workflows, digital twins, and high-speed simulations to accelerate evaluation of DER and electrification impacts. (A53) • Produce structured and explainable planning evaluations that transform complex grid data into decision-ready assessments of capacity, risk, and operational constraints within a common analytical framework. (A54) • Validate integrated analytics, grid models, operating data, and AI-assisted workflows to evaluate and integrate DER and electrification projects within actual utility operating environments, demonstrating how these capabilities work together rather than as standalone tools. (A53-A54)	• Produce validated use cases, data requirements, workflow prototypes, and operator-reviewed decision-support pilots. (A55) • Demonstrate faster and more consistent evaluations through reduced manual analysis, improved prioritization, and shorter workflow cycle times. (A54-A55) • Establish integration and governance requirements for scalable, operator-supervised decision-support capabilities that accelerate DER and electrification evaluations.(A55) • Primary result: Validated operator-supervised decision-support workflows that accelerate DER and electrification evaluations. (A55) • Metrics: Reduced manual analysis, evaluation cycle time, and workflow cycle time; improved consistency of planning evaluations supporting DER and electrification integration. (A54, A55)	• Build on prior distribution automation, outage management, DER integration, advanced metering, grid sensing, digital-substation, and AI-enabled operational work.(A54) • Integrate established data, analytics, and platforms into coordinated decision-support capabilities rather than relying on standalone or after-the-fact analytics.(A54) • Coordinate with the CEC and other EPIC Administrators to align complementary demonstrations, support grid integration, and avoid duplication. (A54)

WHAT PROBLEM ARE WE SOLVING? A50 - A52

Growing DER adoption, EV charging, and electrified load are increasing the complexity of interconnection and energization decisions. Utilities need faster, more accurate visibility into available capacity and system constraints to evaluate new interconnections without unnecessary delays. Digital Substations addresses this gap by integrating advanced sensing, communications, and analytics to provide a high-fidelity view of grid conditions, enabling faster identification of available capacity, improved assessment of system readiness, and accelerated interconnection and energization decisions.

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• Demonstrate an integrated digital-substation architecture that combines sensing, process-bus communications, analytics, and virtualized monitoring functions to create a unified, real-time view of grid conditions for interconnection and energization decisions.(A50) • Evaluate whether protection, monitoring, and operational functions that traditionally require separate physical devices can be virtualized through shared sensing, communications, and analytics, reducing data silos and improving visibility into system constraints. (A50-A51) • Validate interoperability, cybersecurity, operational integration, and cost under utility conditions to determine whether digital substations can provide a scalable pathway to faster, more data-driven interconnection and energization processes. (A52)	• Produce a validated digital-substation reference architecture defining sensing, network, cybersecurity, interoperability, and analytics requirements for scalable deployment. (A52) • Demonstrate integrated monitoring, faster event diagnosis, earlier abnormal-condition detection, and improved visibility into system conditions and constraints. (A50, A52) • Establish a validated deployment pathway for transitioning from conventional substations to scalable digital-substation architectures.(A52) • Primary result: Validated digital-substation reference architecture. (A52) • Metrics: Number of functions virtualized or integrated, time to actionable information, interconnection assessment time, and reduction in interconnection study effort or cost. (A52)	• Build on prior SCE EPIC work involving IEC 61850 communications, process-bus architectures, substation automation, and virtualized protection systems that established the technical foundation for Digital Substations. (A51) • Leverage external research on waveform analytics, power-quality monitoring, incipient fault detection, and secure grid monitoring to support integrated visibility and decision-making capabilities. (A51) • Coordinate with the CEC and other EPIC Administrators to align utility demonstrations, share lessons learned, and avoid duplication while advancing scalable Digital Substation deployment pathways. (A51)

WHAT PROBLEM ARE WE SOLVING?

A56

Expediting interconnection and energization depends on rapidly exchanging information and coordinating actions among DERs, field devices, substations, and utility systems. However, existing communications infrastructure lacks the coverage, performance, and interoperability needed to support real-time coordination across an increasingly digital and distributed grid. These limitations can delay visibility into grid conditions, available capacity, and system readiness needed to efficiently integrate DER and electrification projects. Grid-Wide Connectivity addresses this challenge by delivering a secure, resilient, and scalable communications foundation needed to coordinate DERs and utility systems, enabling faster interconnection and energization.

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• Demonstrate utility-specific communications architectures that enable secure, real-time coordination among DERs, field devices, substations, and utility systems. (A56, A57) • Test communications performance, resiliency, and interoperability under actual grid, outage, climate, and degraded-network conditions to support timely integration of DER and electrification projects. (A56, A57) • Validate secure and interoperable data exchange across DERs, field devices, substations, planning platforms, DERMS, ADMS, SCADA, and OMS, reducing information-sharing barriers that slow interconnection and energization. (A57, A58)	• Produce validated secure and interoperable communications architectures, requirements, and priority use cases. (A58) • Demonstrate measurable improvements in communications performance, DER connectivity, interoperability, and resilience supporting large-scale DER and electrification integration. (A57,A58) • Establish scalable integration pathways reducing barriers to faster DER interconnection and electrification energization. (A58) • Primary result: Validated secure, interoperable communications architecture supporting DER coordination. (A58) • Metrics: Improved network availability and latency; increased DER connectivity; reduced communications-related delays in DER integration. (A57-A58)	• Build on the Integrated Grid Project and EASE demonstration involving DERMS, hosting capacity, DER onboarding, and IEEE 2030.5 interoperability. (A57) • Extend DOE-funded GRIP planning and analytics capabilities through the communications layer needed to coordinate DERs and scale those capabilities across utility systems. (A57) • Coordinate with the CEC and other EPIC Administrators to align complementary demonstrations and avoid duplication. (A57)

WHAT PROBLEM ARE WE SOLVING?

A59

Expediting interconnection and energization requires utilities to rapidly process, analyze, and act on growing volumes of data from DERs, field devices, and operational systems. However, existing computing architectures struggle to scale with the increasing complexity of DER integration, electrification, and real-time grid operations, delaying actionable insights and coordination of grid resources. Without advanced computing capabilities, utilities cannot consistently provide the responsiveness needed to support accelerated interconnection and energization. Intelligent Grid Computing addresses this challenge by enabling scalable processing across edge, substation, and enterprise environments, supporting timely integration of DER and electrification projects.

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WHAT IS THE DISTINCT RESEARCH APPROACH?	HOW WILL YOU KNOW YOU ARE SUCCESSFUL?	HOW WILL YOU COORDINATE?
• Demonstrate edge, substation, cloud, and hybrid computing architectures that accelerate processing of grid data needed for DER and electrification integration. (A60,A61) • Evaluate advanced computing technologies under utility requirements for interoperability, cybersecurity, latency, reliability, and scalability to support real-time grid coordination. (A60) • Determine where and how grid data should be processed, secured, governed, and exchanged to reduce delays in generating insights and coordinating DER and electrification projects. (A60)	• Establish whether edge, cloud, and hybrid computing architectures can improve data ingestion, processing, interoperability, and operational visibility across utility grid applications.(A60-61) • Demonstrate improved latency, throughput, scalability, data quality, and time to actionable insight, reducing delays in grid decisions. (A60) • Produce a standardized, secure, and interoperable edge-to-cloud computing capability that supports a more dynamic and distributed electric system.(A61) • Primary result: Validated edge-to-cloud computing capability supporting DER coordination and real-time decision support. (A61) • Metrics: Processing latency, data throughput and scalability, and time required to evaluate DER and electrification impacts. (A60, A61)	• Build on prior investments in grid modernization, DER integration platforms, digital substations, grid communications, advanced analytics, forecasting, and grid-edge visibility that established the digital foundation for DER integration. (A60) • Focus on the computing layer and integrated data processing, security, governance, and exchange needed to accelerate DER and electrification evaluations and coordination. (A60) • Coordinate with the CEC and other EPIC Administrators to align complementary demonstrations and avoid duplication. (A60)