Accelerating and Deploying Grid Edge Computing

BIL – Grid Resilience and Innovation Partnerships (GRIP)
DE-FOA-0002740
TECHNICAL VOLUME: TOPIC AREA 2

Submitted by:
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Oregon State University	Dr. Eduardo Cotilla-Sanchez	Assoc Prof EE
Saturday Academy	Brianna McCoy	Executive Director

Project Locations (Counties in Oregon State)
This project will be located within PGE's service area, which includes 7 counties and 4 congressional districts. **PGE Service Area:** Counties: Clackamas, Columbia, Marion, Multnomah, Polk, Washington, and Yamhill Congressional Districts: OR-001, OR-003, OR-005, and OR-006

Submitted to:
Department of Energy (DOE)
Grid Deployment Office (GDO)
Office of Clean Energy Demonstrations (OCED)
SUBMITTAL DATE: MARCH 17, 2023

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1. PROJECT OVERVIEW

1.1 BACKGROUND

Applicant Background: For more than 130 years, Portland General Electric Company ("PGE", and "the Applicant"), an investor-owned electric utility company based in Portland, Oregon, has been powering the pioneering spirit of the Pacific Northwest—servicing approximately 900,000 customers with a service area population of 2 million Oregonians in seven counties and 51 cities. Nearly half of Oregon's population lives in PGE's service area, which is largely urban and home to roughly 75% of the state's commercial and industrial activity. PGE owns both the distribution and transmission networks.

Challenge to be Addressed: There is more than 2800 MW of clean energy in PGE's portfolio, and it is seeking more clean resources, including an additional 1,600 MW from distributed energy resources (DER) by 2030. Within the next decade, PGE plans to source 25% of its peak load from its distribution system. This will require that PGE allow the adoption of DERs faster and at a scale higher than ever before. The capacity of PGE's circuits to host additional DERs is determined by constraints such as voltage, power quality, thermal characteristics, protection limits, current reliability and already-hosted DERs. PGE needs to better understand these grid conditions, and needs more tools to address system constraints.

Existing electric utility infrastructure does not provide real-time, granular visibility and device management at the edge of the grid to accomplish this goal. For example, PGE has limited data from its Advanced Metering Infrastructure (AMI) system, which is not available in real-time, and even newer smart meters lack the processing power to capture and fully analyze high volumes of edge data necessary for complex grid operations. Limited visibility and controls at the grid edge restrict real-time distribution system optimization, plug-and-play capabilities for DER integration, and effective clean energy programs for customers.

How the Proposed Project Addresses the Identified Challenge: To address current technical constraints and achieve PGE's ambitious clean energy targets, PGE proposes to install a scalable, distributed artificial intelligence (AI[1]) platform to accelerate grid edge computing capabilities and enhance DER integration. PGE will deploy up to 90,000 smart grid chips (SGC) by 2025, across approximately 10% of its residential and small commercial customers, as the first stage of a multiphase program to deploy advanced grid edge computing to all of PGE's customer base. In the next phase of the project, from 2025 through 2028, PGE and its partners will roll out grid-edge computing enabled use cases. The SGC is a distributed AI platform developed by Utilidata, a leader in grid edge software, and powered by an NVIDIA processor, the global leader in AI and accelerated computing. This deployment will allow PGE to target specific locations within its service territory with high penetrations of DERs and demonstrate the value of edge computing in these substations and feeders prior to a full system

[1] Artificial Intelligence (AI) is the capability of a computer program or a machine to think and learn and take actions without being explicitly encoded with commands.

deployment. It will also focus at least 40% of the 90,000 SGCs in disadvantaged communities (DACs) that will benefit from greater resiliency and clean energy parity.

1.2 PROJECT GOAL

This Project will transform PGE's utility operations to more efficiently and effectively integrate and aggregate DERs. The Project team will advance two core goals:

Goal #1: Accelerate the transformation of electric utility infrastructure by using advanced technology to optimize and integrate DERs: Through edge computing and advanced algorithms that collect and analyze high volumes of grid-edge data, and make decisions, in real-time, this project will accelerate and transform PGE's distribution system, enabling it to meet its clean energy targets. By allowing faster integration and greater value creation from DERs[2], this technology will be critical to achieving Oregon's state law to reduce the electric greenhouse gas emissions by 80% by 2030, 90% by 2035, and 100% by 2040.[3] Technical advancements from this project that will accelerate grid transformation include:

(1) Real-time grid-edge visibility: Operational insights provided by the SGC in real time will be essential for operating a grid with high penetrations of DERs and variable renewable wholesale generation and will support execution of PGE's Virtual Power Plant (VPP[4]);

(2) Real-time hosting capacity insights: The SGCs will provide real-time data, predictive modeling, and scenario generation to accelerate DER interconnection compared to the low-data, offline simulations PGE uses today to determine location specific capacity.

(3) DER integration and optimization: The SGC will utilize local computing power and communications to fully understand the system impact of DERs, integrate them into real-time operations, and execute local, autonomous control signals to rebalance the electrical system. PGE will use SGC capabilities to support development of a real-time digital twin (digital representation of real-world systems), providing a single system model for forecasting, planning, modeling, financial management, and operations.

(4) Validating DER performance: Integrating DERs into real-time grid operations requires understanding/predicting their distribution grid impact and validating their performance when called upon to support the grid, as required by FERC Order 2222. The SGC will give PGE the technical foundation to execute these requirements and maximize the system value of DERs.

(5) Enhanced grid resiliency: By training AI models to analyze waveform data and predict pre-outage conditions, PGE can address maintenance risks prior to outages and mitigate potential wildfire risk.

Goal #2: Support the delivery of community benefits to disadvantaged communities by enhancing and enabling programs that use grid edge data and promoting workforce development opportunities: Core to its mission, PGE is committed to delivering clean,

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[2] Y. Y. C. Zhang and M. Spieler, "Bringing Artificial Intelligence to the Grid Edge [Technology Leaders]," in *IEEE Electrification Magazine*, vol. 10, no. 4, pp. 6-9, Dec. 2022, doi: 10.1109/MELE.2022.3210778.

[3] https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/HB2021

[4] A VPP is a power plant consisting of distributed energy resources (DERs) and flexible loads, orchestrated through a central technology platform to provide grid and power operations services.

affordable, and reliable power to its customers. Over time, PGE anticipates this technology will increase parity in clean energy technology access, high-quality job creation, and regional energy resilience. By enhancing and enabling customer programs through newly available data and computing, PGE anticipates that new technology will drive long-term equitable community outcomes. As part of its Community Benefits Plan, PGE will ensure accountability by establishing a community coalition inclusive of DACs and will be actively engaged through all stages of the project. More than 40% of SGCs will ultimately be deployed in DACs.

To ensure project success, PGE will train its union workforce on SGC installation and management. This project will also require workers skilled in electrical and data engineering, data science and AI. PGE will partner with Saturday Academy, a local nonprofit organization with 40 years of experience dedicated to developing STEM education opportunities for underserved children in K-12 education, and Oregon State University to build a pipeline of students in STEM and AI related fields thereby expanding equitable access to jobs.

1.3 DOE IMPACT

DOE funding of this project would enable and accelerate PGE's efforts to be an early adopter of distributed AI in the energy sector and serve as a model for other utilities that are seeking to rapidly decarbonize.

Utilities have not yet made investments in distributed AI because it requires investing in an interoperable platform with long-term benefits that cannot yet be fully quantified, and a software-defined, distributed solution that moves away from familiar centralized operational tools. As such, initial investments in distributed AI are more difficult to fund through state-based regulatory proceedings. Without DOE funding, PGE would likely deploy distributed AI more slowly, slowing progress toward clean energy goals and decreasing the impact of PGE's VPP investments. PGE is targeting a VPP with multiple DER management strategies and believes deploying distributed AI ubiquitously at the grid edge will standardize an approach for small to medium DER management and could serve as a template for utility scale VPPs nationwide.

Another direct impact of DOE funding will be helping catalyze private sector investment and domestic job creation. Utilidata assembles the SGC in Ann Arbor, Michigan, using multiple domestic-made components. By 2026, with sufficient demand for the SGC, Utilidata's goal is to produce more than 55 percent of the total cost of all components in the U.S. NVIDIA is simultaneously poised to invest significantly in distributing AI in the utility industry, including working with Utilidata to customize a chip specifically for the electric distribution grid. These examples highlight the significant private capital that would flow into distributed AI for the electric grid if PGE can help establish the business case for AI investments through this Project.

PGE is also committed to sharing the business case for distributed AI with other utilities, including smaller rural cooperatives, municipalities, and public utilities in Oregon and other western states with less exposure to next-generation technology. Specifically, PGE will share insights, change management strategies, and new software applications where applicable, enabling these utilities to have access to the latest grid technologies and strategies. This project is anticipated to catalyze transformational change in the performance of grid operations across the country and amplify the impacts of initial DOE investments in distributed AI.

1.4 COMMUNITY BENEFITS PLAN

This project directly supports PGE's vision of a community-centered electric grid. The Project will deploy technology that will increase high-quality job creation, job training for individuals, parity in energy technology access, and regional energy resilience. By enhancing and enabling customer programs through newly available data and grid edge computing, PGE anticipates generating long-term equitable community outcomes. PGE plans to install over 40% of SGCs for customers residing in census tracts that are designated as disadvantaged by the Climate and Economic Justice Screening Tool (CEJST).

PGE's Community Benefits Plan outlines SMART goals and milestones per budget period, including installing more than 36,000 SGCs in DACs to reduce overall Customer Minutes Interrupted (CMI), a measure of the consequences of disruptive events, by 5% each year, improving reliability and resiliency for these customers.

PGE has partnered with VertueLab, a local non-profit with over a decade of community engagement experience, to conduct in-depth community engagement and education of DACs, Community Benefit Organizations (CBOs), and other communities on the project and specifically gather feedback on 1) designing programs that utilize grid edge data to deliver community benefits and 2) how this project can alleviate other community burdens. PGE and VertueLab will engage between 2,500 to 5,000 stakeholders and 7 CBOs through community engagement sessions from communities where the SGC will be installed.

PGE will continue to work with IBEW 125 to retain its strong labor standards when deploying the SGCs and build pre-apprenticeship and apprenticeship training programs to ensure necessary skill development. The workforce advisory board and partnership with Oregon State University will further critical skill development for new entrants into the energy sector. PGE will be collaborating with Oregon State University to provide research opportunities for underserved graduate students to perform research and learn from implementation of an advanced technology such as SGC. PGE will be partnering with Saturday Academy to create AI focused STEM training and curriculum that aims to remove existing barriers that deter underrepresented groups from pursuing STEM related pathways in early childhood education. Additionally, the project will invest $125k with Oregon Tradeswomen, based in Gresham, a DAC that supports female/non-binary underserved populations within the construction sector, including formerly incarcerated, veterans, and women of color.

PGE and its project partners are committed to training and retaining a skilled, qualified, local, and diverse workforce for this project. The project team will work diligently to incorporate diversity, equity, inclusion and accessibility (DEIA) recruitment procedures in project hiring practices and implement DEIA recruitment procedures in expanding the Project's potential partner network. PGE designed objectives and goals to ensure equitable distribution of project benefits measured via SMART metrics discussed in the Community Benefits Plan. Please refer to the Community Benefits Plan for more detail.

1.5 LONG-TERM CONSTRAINTS ON NATURAL RESOURCES

The proposed project does not have any identified long-term constraints on natural resources.

1.6 CLIMATE RESILIENCY STRATEGY

Oregon is currently experiencing the effects of climate change, including increased risk of wildfires, more frequent extreme storms, reduced air quality, and more intense heat waves.[5] This was demonstrated in 2021, when a severe February ice storm caused widespread outages for PGE customers over a two-week period, and again in June when Portland experienced a rare, extended 116° F heat wave as the third hottest metro area in the United States. In a matter of months, PGE transitioned from a historical winter peaking utility to summer peaking.

PGE needs new technologies for its electric grid to manage the reliability and resiliency impacts of this extreme weather. Edge computing is a technology that enables more DERs and demand flexibility, has real-time awareness of their availability, and can more effectively dispatch them is foundational for long-term resiliency.

Under extreme weather events in the West over the past two years, grids have run out of resources. In California, demand flexibility was often the difference between a blackout and keeping the lights on. In a recent collaboration with the demand management company OhmConnect, a Utilidata analysis indicated that by providing real-time visibility into grid conditions and demand flexibility performance, the SGC could increase demand flexibility performance by at least 25%. In addition, by providing a local hub to understand and communicate with DERs, PGE can better leverage them for voltage and frequency support and demand shedding during extreme weather events. PGE seeks to utilize these capabilities for its VPP and other flexible resources.

Further, the SGC platform offers capabilities to improve PGE's distribution system resiliency by providing deeper insights on system anomalies that can lead to outages. Initially, the SGC will provide visibility into power quality anomalies that could be precursors to equipment failure or other pending reliability issues. Over time, AI models will be developed that have more precise predictive outage capabilities under both normal and extreme weather conditions. By 2027, the SGC's AI-based algorithms aims to have at least 90% accuracy in quantifying anomalies, helping to inform outage prediction.

PGE closely tracks reliability and resiliency measures and works to improve overall system reliability every year. PGE's goal is to reduce overall Customer Minutes Interrupted (CMI) by 5% each year, a measure of the consequences of disruptive events. The SGC will help PGE identify

[5] https://www.oregonmetro.gov/news/global-change-local-effects

potential problems in the distribution system and meet its CMI goals, providing customers with a greater overall energy experience.

2. TECHNICAL DESCRIPTION, INNOVATION, & IMPACT

2.1 PROJECT RELEVANCE & MEETING THE OBJECTIVES OF SMART GRID GRANTS

The SGC solution is an interbase meter adapter with a native NVIDIA processor and software platform. The meter adapter is installed between the meter socket and electric meter, as shown in Figure 1. Installation will be conducted by trained IBEW union labor. The SGC is equipped with LTE and Wi-Fi communication, real-time data processing and grid operational software, and a scalable, secure software application environment.

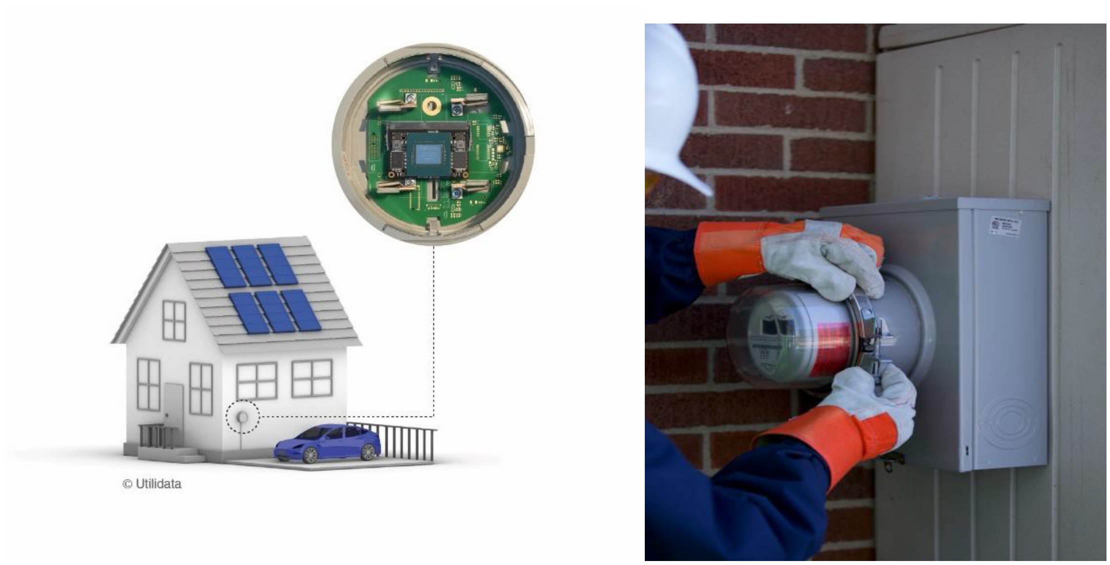

Figure 1. Diagram (left) and photograph (right) of a smart grid chip (SGC) installation. The SGC adapter is installed between the customer's meter socket and electric meter.

Distributed AI[6] is amongst the most advanced forms of edge-computing,[7] and is a critical tool to help address the exponential increase in operational complexity driven by DERs, building electrification and climate-driven reliability challenges.

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[6] Distributed AI refers to stand alone artificial intelligence and machine learning software apps run on adapters distributed throughout the grid (like the smart grid chip). Machine Learning (ML) employs algorithms and statistical models that enable computer systems to find patterns in massive amounts of data, and then uses a model that recognizes those patterns to make predictions or descriptions on new data. This combination of hardware and apps can record data, run algorithms, and make decisions in real-time directly on grid edge adapters.

[7] https://blogs.nvidia.com/blog/2022/02/17/what-is-edge-ai/

The SGC will capture unprecedented data about customer and grid energy usage patterns with sub-second granularity. Distributed AI systems will use ultra-fast iterative processing hardware and advanced algorithms that allow the computer to 'learn' from data patterns. The SGC has embedded software applications that perform on-device real-time analysis of this voluminous data. Insights from these applications will be used to make local decisions, as well as send relevant data to the cloud and/or centralized utility operating systems. Initial applications being provided by Utilidata will drive a variety of use cases and outcomes, including real-time system visibility, premise-level load forecasting, DER identification and integration, and outage analysis (location, type, impact). The open application environment means that PGE and other vendors, including energy service providers and/or DER companies, can also leverage the SGC to drive additional use cases and outcomes.

PGE selected the SGC, in part, because it is a software-defined solution with over 100 times more processing power than currently available metering platforms.[8] The SGC will allow PGE to execute distributed AI and achieve the edge visibility necessary to understand, predict, and manage grid and DER operations, including evolving to autonomous decision-making. As a software-defined solution, software improvements can be delivered via over-the-air updates. This capability will future-proof the hardware for its lifecycle and allow PGE to quickly and cost-effectively tackle emerging customer and operational challenges, without requiring physical hardware upgrades.

Data Privacy: PGE is committed to safeguarding the privacy of individuals and businesses with respect to nonpublic, personal, confidential, and financial information. PGE values customer relationships and recognizes that when a customer provides personal information to PGE, that customer trusts PGE to protect their information. PGE has taken steps to safeguard SGC customer information similar to smart metering data, and as outlined in PGE's formal Privacy Policy.[9] PGE complies with all federal and state laws regarding personally identifiable information (PII). Utilidata specifically protects customer data with Advanced Encryption Standard (AES) 256, and customer data will be backed up and protected using AWS's cloud native AWS Key Management Service.

This Project meets Objectives two, three and four of Topic Area 2:

> **Goal 2. Prevent faults that may lead to wildfires or other system disturbances:** By training AI models to analyze waveform data and predict pre-outage conditions, PGE can identify and mitigate maintenance issues and prevent faults that may lead to wildfires or other system disturbances.
>
> **Goal 3. Integrate variable renewable energy resources at the transmission and distribution levels:** The SGCs will use real-time data, predictive modeling, and scenario generation to enable dynamic hosting capacity data. This will accelerate DER interconnection and improve upon the low-data, offline simulations PGE uses today to

[8] Analysis of NVIDIA Jetson processor versus major metering company platforms available today.
[9] PGE Privacy Policy: Privacy Policy | PGE (portlandgeneral.com)

determine local hosting capacity. Local computation and controls will enable improved market participation by distribution-connected renewables (as required by FERC 2222).
Goal 4. Facilitate the aggregation and integration (edge-computing) of electric vehicles and other grid-edge devices or electrified loads: The Project will locally communicate with and optimize DERs on the distribution grid and verify performance to enhance their system value and utilize local computing power and communications to execute local, autonomous control signals to rebalance the electrical system. The project will use real-time edge visibility to support new infrastructure initiatives such as PGE's VPP. Additionally, by connecting or building out new engineering tools, such as a real-time digital twin, PGE can utilize a single model of the system for forecasting, planning, modeling, financial management, and operations.

Further, the Project meets multiple Topic Area 2 priority investment categories. First, by providing granular, real-time visibility at each meter where the SGC is installed, the Project dramatically improves the visibility of the electrical system to grid operators. The data will be shared across PGE planning, operations, and customer programs to increase their efficacy. During the timeframe of this Project, the SGC will utilize local computing power at the grid edge and communications to execute local, autonomous controls to rebalance the electrical system. Second, the Project will adopt an open distributed AI platform, meeting the Topic Area 2 investment objective of enhancing the interoperability of systems, particularly for information between electricity system operators and consumers. The SGC is designed with data capture and computing power to share actionable insights with both system operators and customers, such as DER generation profiles.

2.2 TECHNICAL FEASABILITY

The risks associated with deploying a new technology are mitigated by partnership with proven industry leaders, a multi-phased project approach, testing at a national lab, and initial SGC deployments by other entities.

The main software and hardware components of the SGC have been rigorously tested and scaled in other contexts. The SGC hardware is a modified version of a meter interbase design that has been deployed at-scale in the energy industry. Tests of the SGC durability and functionality were verified during the manufacturing process.

Utilidata's distributed software applications have been developed using synthetic grid data and leveraging the company's extensive history managing distribution grid operations. Utilidata has over a decade of experience using its software and algorithms to execute efficient substation-level grid control with American Electric Power and National Grid utilities. The SGC is also built using NVIDIA's Jetson platform. NVIDIA's chips and standard software packages are scaled and cybersecure; NVIDIA currently works with more than 3.5 million programmers and more than 130 ecosystem partners.

To accelerate development of the SGC technology, PGE is undertaking an initial Field Test phase in 2023, in which PGE will deploy 500 SGCs, refine the technology hardware, develop new software applications, and prepare for this project's scaled deployment to begin in 2024. Additional risk will be mitigated since the Utilidata SGC will be UL Listed, NEMA 3R Certified, and align with ANSI C12 standards.

PGE plans to utilize a phased approach leading to full system deployment:

- Field Test Phase: 500 SGCs; deployed in 2023 (funded by PGE's Innovation department)
- Phase 1: Up to 90,000 SGCs; deployed 2024-2025 (this application's proposed project)

(b) (4) [redacted]

[redacted]

[redacted]

Finally, the nature of the SGC solution partners and associated stakeholders provide broad confidence in the investment. In early 2022, Utilidata received investment of $26.75 million, including funding from NVIDIA, Moore Strategic Ventures, and the Microsoft Climate Innovation Fund, giving the SGC strong financial backing. Utilidata has also convened an advisory board consisting of investor-owned utilities, cooperatives, DER, and EV companies to guide the development of the SGC. PGE is a founding member of the advisory board, along with American Electric Power, PPL, Duquesne Light Company, Consumers Power, Southern California Edison, Holy Cross Energy, Sunrun, and General Motors.

2.3 INNOVATION & IMPACTS

The current standard technology for grid edge computing is deployed via smart meters, or AMI. However, smart meter technology and business cases are centered around reliable and accurate billing, not real-time grid operations and distributed AI. As a result, high-end smart meters have minimal data capture or computational power necessary for real-time grid operations or complex use cases that are quickly emerging, like DER integration.

In contrast, the SGC is a native AI platform, with well over 100 times more processing power than the highest-end smart meter available today. The SGC is not designed primarily for billing (although it captures all relevant billing data), but to provide real-time operational visibility, resiliency, and DER integration. The level of data capture and computation provided by the SGC, and its ability to deliver distributed AI capabilities, will be essential for PGE to meet its decarbonization and reliability goals quickly and affordably.

A primary example of this is preparing to meet PGE's goal of sourcing 25% of its peak load from its distribution system and 80% reduction in greenhouse gas emissions by 2030. Enabling capabilities through the SGC's distributed AI platform will drive PGE's grid transformation, redefine how electric utilities manage infrastructure, and allow PGE to decarbonize the grid more quickly and equitably. Specifically, PGE seeks to attain and evolve the following five capabilities (innovation advancements) between 2023 and 2028:

Innovation Advancement #1: Real-time edge visibility

Impact: New insights and enhanced real-time decision making

Real-time edge visibility will transform PGE's distribution grid engineering and operational capabilities. The SGC collects and analyzes granular power data in real-time, transmitting timely information to the central systems. This foundational, real-time data can then be shared across systems to increase their efficacy, including PGE's ADMS, GIS, AMI, mobility software solutions, and various engineering planning platforms .

Real-time edge visibility will also support new infrastructure initiatives, such as PGE's virtual power plant (VPP[10]), which will go-live during the timeframe of this proposed SGC deployment. An effective VPP must coordinate complex information, including determining what the grid needs (generation, voltage support, etc.), what the constraints are on the grid (e.g., distribution congestion, power quality) and what non-traditional resources are available (e.g., which EVs can stop charging or feedback to the grid, which heat pumps can be cycled off, how local weather conditions will affect solar production). All this complex information needs to be synthesized, optimized, and reassessed in real-time - as quickly as the weather changes or a customer changes their behavior. Deploying SGCs will enable PGE to directly integrate and manage DERs with the overall grid through system-wide grid edge management capabilities and provide a platform for PGE to engage other VPP providers. Without the SGC's real-time distributed decision making, this central-to-edge coordination through the VPP would be greatly diminished.

Detailed usage information about customers and their energy usage will also allow PGE to better identify which customers may be eligible for certain programs or stand to benefit most from programs and increase access, enrollment, and program impact, particularly for disadvantaged communities.

Innovation Advancement #2: Real-time hosting capacity

Impact: Speed interconnection processes and accelerate DER adoption

Today, PGE's interconnection queue can receive more than 200 new projects weekly. With each project taking an average of 25 days to complete, any future increase will further delay the queue. Today's engineering analytics using post-processed system data and an assessment of system capacity at proposed interconnection sites slow this process down. PGE expects interconnections to increase more than 3-fold by 2030, placing additional strain on today's approval process. Granular edge data and real-time SGC local hosting capacity analysis is expected to speed the interconnection of DERs, saving customers time and money and accelerating PGE's progress toward integrating DERs into the grid.

Innovation Advancement #3: DER integration and optimization

Impact: Real-time, distributed grid management

The SGC will provide an affordable, scalable way to locally communicate with and optimize DERs on the distribution grid, enabling a modern distribution grid that includes both central and local (nodal) decisions made in coordination with each other. While centralized systems have provided support for initial DER deployments, PGE is experiencing the limitations of integrating DER data into traditional grid ops and engineering systems, due to latency, a lack of data granularity, and a lack of connectivity to DERs.

[10] A Virtual Power Plant (VPP) is a power plant consisting of distributed energy resources (DERs) and flexible loads, orchestrated through a central technology platform to provide grid and power operations services.

Innovation Advancement #4: Validate DER performance

Impact: Optimized DER performance on the grid

The SGC's robust, real-time edge data, and the ability to share that data in a fast and non-discriminatory manner will help PGE comply with FERC Order 2222, which requires that distribution utilities allow DERs, including flexible demand, to participate in wholesale energy markets by verifying their performance and accounting for distribution system constraints.[11] The grid contribution of DERs is limited without the ability to quickly share data with market participants about the ongoing performance of these distributed resources. Given the data-centric nature of this problem, it is an optimal challenge for AI to address. PGE currently lacks access to this real-time shareable information. The SGC will provide the architecture to tackle these challenges.

Validating DER performance will be critical to firm and dispatchable load-resource adjustments. The SGC's granular visibility into DER behaviors can support decision-making during peak load events by understanding how and where it is best to call distributed resources onto the grid. This also supports equitable decision-making during peak load events by being able to best serve specific areas of the grid and meet level of service standards at critical times.

Innovation Advancement #5: Enhanced grid resiliency:

Impact: Reduced outages and increased savings from preventative maintenance

Enhanced visibility from the SGC will improve PGE's ability to detect potential operational problems and shorten outage times. This capability is particularly needed in 24 locations, where substation SCADA does not exist today, and where power quality for these rural and disadvantaged communities can be assessed and improved over time with SGC power quality analysis. Outage mapping and responses today rely on AMI data, which is dependent on communication system backhaul and more limited data systems, providing information delayed up to 1-hour. Deploying SGC adapters will improve PGE's resiliency through more granular information - sub-minute level - from more sites, more often. It will also enhance PGE's ability to more quickly diagnose issues in particular neighborhoods based on correlated grid edge data, such as transformer issues, before infrastructure fully fails.

Over the 2024-2028 Project timeline, this visibility will progress to AI models, trained through analysis of waveform data from the SGC, to predict pre-outage conditions or pending equipment failure. Finally, greater amounts of flexible demand and grid support from DERs, unlocked by the SGC, will be a contributor to reliability and resiliency. By prioritizing installation in disadvantaged communities, PGE can direct system improvements to these customers first.

2.4 PROJECT ALIGNMENT WITH STATE/LOCAL GOALS

PGE joined Oregon's Climate Pledge, committing to an 80% reduction in GHG emissions from electricity supplied to customers by 2030. In meeting this goal, PGE plans to source 25% of its

[11] FERC Acts on First of Order No. 2222 Compliance Filings | Federal Energy Regulatory Commission

peak load from distribution-connected resources; the SGC will be foundational to achieving this. In 2019, the state of Oregon released a 10-year plan to reduce energy burden and improve energy efficiency for low-income residents.[12] PGE will help to advance this plan with targeted customer programs, using technologies that provide more visibility on customer usage patterns, like the SGC.

Specifically, the granular data around home energy usage from the SGC will enable PGE to expand customer access to programs, such as the heat pump program, that help accelerate electrification/clean energy parity and more resilient homes. Finally, The City of Portland has extensive local energy justice goals, including a 2018 ordinance to fund local clean energy projects with a priority focus on delivering benefits to low-income communities and communities of color.[13] This project's Community Benefits Plan directly aligns with the City of Portland's goals.

From a technical standpoint, all of the DER interconnection, integration and optimization outcomes described in the Innovation & Impacts section will be essential to meeting climate goals. The level of complexity posed by this penetration of clean distributed resources cannot be managed effectively and affordably without a distributed AI platform.

3. WORKPLAN

3.1 PROJECT OBJECTIVES

The primary workplan objectives of this project are to:

1) Deploy up to 90,000 SGCs by the end of 2025,
2) Evaluate 5 grid edge computing use cases, as described in the Innovation & Impacts section, through iterative AI software validation between 2024-2028, and
3) Deliver measurable community benefits by 2028.

As outcomes, this project seeks to demonstrate the value of increased grid visibility and DER control shown through measurable community benefits, detailed in the Community Benefits Plan. This includes:

1. Reducing overall Customer Minutes Interrupted (CMI) by 5% each year in DACs,
2. Enrolling a planned number of new customers living in DACs in the income-qualified heat pump discount program,
3. Increase amount of DERs in substations serving DACs (count and/or MWs),
4. Speeding up solar interconnection times by a measurable target determined in budget period 2.

3.2 BUY AMERICA REQUIREMENTS

PGE is a for-profit investor-owned utility (IOU). As such, Buy America Requirements for Infrastructure Projects are not applicable to this project. PGE and its contractors will make best efforts to source materials and products domestically.

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[12] https://www.oregon.gov/energy/Get-Involved/Documents/2018-BEEWG-Ten-Year-Plan-Energy-Burden.pdf
[13] https://www.portland.gov/bps/cleanenergy/faq-changes-pcef-structure

3.3 TECHNICAL SCOPE SUMMARY

Technical project scope is divided into parts, to align with the Project's primary objectives and outcomes: 1) SGC field deployment, 2) software validation, and 3) community benefits delivery. Details of each section are outlined below.

1) SGC Field Deployment

Field deployment will encompass all tasks leading up to, during, and closing out field installation of the SGCs. This phase is anticipated to run for a duration of approximately 2-years, from Q1 2024 through Q4 2025, with a 1-year field deployment plan. This scope is considered the deployment phase of the Project. A brief summary of each field deployment activity is provided below.

- ***Q1 2024: Project initiation.*** Kick-off the Project, build out program charter, update the project management plan, hire program staff, contractor selection, create/update the detailed integrated project schedule, create/update the risk registry
- ***Q2 2024: Contractor/staff onboarding.*** Hire/onboard staff, execute contracts, onboard contactor
- ***Q3: 2024: Pre-deployment check-list review.*** Review a detailed list of Go/No-Go criteria, including: technical system integrations, installations processes, customer communications, warehouse preparations, training, asset tracking procedures, receive inventory, safety procedures, emergency protocols, field repair processes, RMA processes
- ***Q4 2024-Q3 2025: Field installation.*** Technicians deploy SGCs in the field, warehouse inventory is managed, fleet management software is configured, ongoing customer communications are delivered
- ***Q4 2025: Field installation ramp down.*** Technicians deploy SGCs in the field for any site revisits, ramp down of field deployment vendor activities (e.g., warehouse closeout)
- ***Q1 2026: Closeout.*** Closeout the deployment workstream upon completion, lessons learned

2) Software Validation

The project's software development and validation scope will utilize deployed SGCs to demonstrate value of the platform for specific use cases. Timing for this scope will align to Utilidata's software release roadmap, and follow a typical pattern of identifying use cases, developing apps, deploying/evaluating apps as a minimum viable product, and iterating.

Mid-year, annual reviews are planned to evaluate progress compared to the original roadmap and expected benefits from each use case app. It is understood that use case benefits may depend on field data needed to train and refine AI models. This data may require months or years to collect, process, and use to show iterative improvements. A brief summary of each activity is provided below.

- ***Q1 2024: Project initiation.*** Kick-off the project, build out program charter, update the project management plan, create/update the detailed integrated project schedule, create/update the risk registry

- ***Q2 2024: 500 SGC pilot recommendation is published.*** Go/No-Go Decision: Review of pilot recommendations and lessons learned for scaling the SGC platform
- ***Q3 2024: Initial apps prepared:*** Initially available apps are reviewed and updated for mass deployment, following 500 SGC pilot
- ***Q4 2024: Initial apps deployed, new use cases identified.*** Initially available apps are deployed over the air to SGCs in the field, app functionality is verified, Utilidata's AI software roadmap is updated with new use cases based on pilot use case discovery
- ***Q1 2025 – Q1 2028: Use case app development, field data collection.*** Ongoing app development, iterative app updates, and field data collection through the SGC
- ***Q3 2025/Q3 2026/Q3 2027: Annual use case progress report published, roadmap updated.*** Annual Go/No-Go Decision: Review of use case progress and benefits delivery, Utilidata's AI software roadmap is updated with new use cases based on progress and use case discovery
- ***Q2 2028: Final project report is published.*** Closeout the workstream upon completion, lessons learned

<u>3) Community Benefits Delivery</u>
The project's community benefits delivery scope includes stakeholder engagement, community engagement, CBO collaboration, and Justice40 benefits realization. A brief summary of key activities is provided below.

- ***Q1- Q2 2024: Community and Labor Engagement.*** Engage with 2,500 to 5,000 stakeholders and 7 CBOs from the communities where the SGC will be installed
- ***Q2 2024: Labor Training and Diverse Hiring***. Review existing corporate hiring trainings to identify additional areas for training to eliminate bias in hiring. Update existing trainings to incorporate any new learnings
- ***Q4 2024 OSU Graduate Students***: Onboard two OSU graduate students to research and codevelop computational power models
- ***Q1 2026: Justice40 Goals realization and assessment.*** Committed spend (indicated in the Budget Justification Workbook) over the whole project on training, recruiting, and removing barriers for residents of DACs and underserved communities in order to increase their access to job opportunities created during and after the project.
- ***Q4 2024- Q4 2028: Ongoing community engagement.*** Update the community coalition at least once every budget period regarding progress and achieve the coalition's concurrence on PGE's community benefits progress
- ***Q4 2024- Q4 2028: DAC community resilience.*** Contribute to overall goal of CMI reduction by 5% in every disadvantaged community in which the SGC is fully deployed.
- ***Q4 2028: Final CBP Delivery.*** 5% CMI reduction in every disadvantaged community in which the SGC is fully deployed. Increase the count and/or MWs of DERs in substations serving DACs, in which SGCS are fully deployed.

3.4 WORK BREAKDOWN & TASK DESCRIPTION SUMMARY

As shown in Table 1, the project is anticipated to be divided into 8 primary workstreams (tasks) that support the overall project scope objectives and are reflected in the project work breakdown structure (WBS).

Table 1. Project WBS Summary

Task	Description	BP1	BP2	BP3	BP4	BP5
1	**IIJA Program Management**	**X**	**X**	**X**	**X**	**X**
1.1	Create Project Charter, conduct kick-off and establish program governance					
1.2	Create a comprehensive project plan including budget, schedule, and risk registry					
1.3	Engage Human Resources and Procurement to begin hiring and sub-contracting activities					
2	**Procurement**		**X**			
2.1	Finalize SGC contracts and begin contractor onboarding					
2.2	Select field deployment contractor through a competitive bidding process, finalize contract					
2.3	Select Systems Integration vendor through a competitive bidding process, finalize contract					
3.0	**System Integration**		**X**			
3.1	Conduct process workshop and requirement gathering on field installation tool					
3.2	Create blueprint for application design					
3.2	SI development, testing and go-live					
4	**Deployment**		**X**	**X**		
4.1	Finalize install locations and deployment plan specifying date of installation per location					
4.2	Review cellular coverage requirements					
4.3	PGE meter shop to complete FAT testing of mass produced SGC's					
4.4	Conduct pre-field deployment activities (resourcing, tool, customer communication)					
4.5	Outline field deployment install, repair process and define emergency/safety protocols					
4.6	Complete pre-deployment checklist for go/no-go decision					
5	**Software Validation**	**X**	**X**	**X**	**X**	**X**
5.1	Deploy applications to provide visibility into end points for predictive capabilities					
5.2	Develop/deploy capability to inform real-time hosting capacity to facilitate DER integration					
5.3	Develop/deploy edge-computing capabilities to help optimize the output of DERs					
5.4	Establish data processes for DER performance validation applications					
5.5	Develop/deploy capability and optimizations to respond to power quality problems					
6	**Business Operations**	**X**	**X**	**X**	**X**	**X**
6.1	Map and document new business processes required to support SGC capabilities					
6.2	Identify new business users and coordinate on new processes					
6.3	Create data governance practices					
6.4	Transition hardware ownership to PGE staff through a hand-off process					
7	**Business Transformation and Change**	**X**	**X**	**X**	**X**	**X**
7.1	Identify training needs and draft an organization change management plan					
7.2	Conduct training and communications for internal as well as external stakeholders					
7.3	Develop a comprehensive benefits delivery dashboard					
8	**Community Benefits Delivery**	**X**	**X**	**X**	**X**	**X**
8.1	Partner with community organizations and conduct engagement activities					
8.2	Conduct detailed workshops to discuss project scope and benefits					
8.3	Conduct ongoing engagement to discuss progress on scope and community benefits					

3.5 MILESTONE SUMMARY

Table 2 below lists planned milestones for the project, including anticipated means of verification.

Table 2. Project Milestones

#	Milestone	Year	Quarter	Means of Verification
M1	500 SGC Pilot Recommendation is Published	1	Q1 2024	Published Report; Data Access/Dashboards/Charts
M2	Field Installation Vendor is Onboarded	1	Q2 2024	Executed Contract
Go/No-Go	Mass Deployment Pre-Checklist is Complete	1	Q3 2024	Internal Plan Review & Deliverables
M3	15k Cummulative SGCs Deployed	1	Q4 2024	PGE Asset Install Tracking Report
M4	SGC Core Services Deployed and Functional	2	Q1 2025	Data Access and Dashboard/Charts
M5	50k Cummulative SGCs Deployed	2	Q2 2025	PGE Asset Install Tracking Report
Go/No-Go	Use Case Capabilities Progress Report #1	2	Q3 2025	Published Report; Data Access/Dashboards/Charts
M6	90k Cummulative SGCs Deployed	2	Q4 2025	PGE Asset Install Tracking Report
M7	SGC Deployment Complete	3	Q1 2026	PGE Asset Install Tracking Report
M8	Community Benefits Progress Report #1	3	Q2 2026	Measurable Community Benefits Calculations
Go/No-Go	Use Case Capabilities Progress Report #2	3	Q3 2026	Published Report; Data Access/Dashboards/Charts
M9	Hardware Learnings Report #1	3	Q4 2026	Hardware Diagnostics and Use Case Report
M10	Community Benefits Progress Report #2	4	Q2 2027	Measurable Community Benefits Calculations
Go/No-Go	Use Case Capabilities Progress Report #3	4	Q3 2027	Published Report; Data Access/Dashboards/Charts
M11	Hardware Field Support Handoff	4	Q4 2027	Hardware Diagnostics, Learning Report and Use Case Report
M12	Final Project Report is Published	5	Q1 2028	Published Report; Data Access/Dashboards/Charts

3.6 GO/NO-GO DECISION POINTS

Go/No-Go decision points are planned approximately annually, tied to mid-year progress reports. Table 3, below, lists planned Go/No-Go Points for the project, including relevant evaluation criteria. Primary criteria are based on anticipated software validations to occur during that period, Justice40 SMART goal progress, and the ongoing success of installed hardware (minimum hardware failures).

Table 3. Go/No-Go Decisions

#	Year-Qtr	Go/No-Go Decision Point and Criteria (numbered)
1	2024-Q3	Mass Deployment Pre-Checklist is Complete 1) All items on the Pre-Deployment Checklist are complete
2	2025-Q3	Use Case Capabilities Progress Report #1 1) Planned use cases for the period meet minimum viable functionality 2) Justice 40 SMART goals are on track for the project 3) Cumulative hardware failures and/or issues are less than 2% of installs
3	2026-Q3	Use Case Capabilities Progress Report #2 1) Planned use cases for the period meet minimum viable functionality 2) Justice 40 SMART goals are on track for the project 3) Cumulative hardware failures and/or issues are less than 2% of installs
4	2027-Q3	Use Case Capabilities Progress Report #3 1) Planned use cases for the period meet minimum viable functionality 2) Justice 40 SMART goals are on track for the project 3) Cumulative hardware failures and/or issues are less than 2% of installs

3.7 END OF PROJECT GOAL

By the end of this project, PGE expects to achieve the following SMART Goals:

1) Deploy up to 90,000 SGCs by the end of 2025.
2) Demonstrate 5 grid edge computing use cases, as described in the Innovation & Impacts section, through iterative AI software validation between 2024-2028.
3) Demonstrate measurable benefits of by the end of 2028:
    a) Community and Labor Engagement: PGE will establish a community coalition inclusive of DACs and train union workforce.
    b) Investing in the American Workforce: Provide Skills Training for Union Workforce and Recruit New Talent. PGE will establish a workforce development program with project partners focused on both SGC hardware installation and on data analytics, artificial intelligence, machine learning and energy engineering to build a robust pipeline of qualified workers that can support the SGC project and its operations.
    c) DEIA: Increase Access to PGE Employment Opportunities for Underrepresented Populations
    d) Justice40:
        i) Job Creation and Job Training Access: PGE has planned for committed spend (indicated in the Budget Justification Workbook) over the whole project on training, recruiting, and removing barriers for residents of DACs and underserved communities in order to increase their access to job opportunities created during and after the project.
        ii) Increasing Parity in Clean Energy Technology: Increase the count and/or MWs of DERs in substations serving DAC's. Identify a measurable target to speed solar interconnection times by end of the project. Enroll DERs from households in disadvantaged communities in PGE's VPP related programs.
        iii) Increasing Energy Resilience: Install at least 40% of the total SGCs in DACs to reduce overall Customer Minutes Interrupted (CMI), a measure of the consequences of disruptive events, by 5% each year.

This Project is a key component to enable an intelligent, real-time grid that is more efficient, reliable, and resilient. Multiple investments are required to reach this vision, but the most fundamental is grid edge computing. Grid edge computing will enable distributed AI and transform grid operations from circuit management to granular DER optimization. PGE believes this Project, in combination with its utility-scale VPP project, will fully integrate the grid from the customer home to the utility operations floor. This will create a new paradigm for customer-utility interaction and drive realization of Oregon's decarbonization 2030 and 2040 targets, which are dependent on the successful growth and integration of DERs.

3.8 PROJECT SCHEDULE

Figure 3 provides a Gantt chart depicting schedule for the entire project, including durations, milestones, and Go/No-Go decision points.

Figure 3. Preliminary Project Schedule

3.9 PROJECT MANAGEMENT PLAN

Approach and Organization for Managing the Work

PGE will use a centralized program management office, located within PGE's Integrated Grid project delivery team. Workstreams will be housed under the overall program and executed in parallel to gain efficiencies for each scope element and to group each task by subject matter expertise (e.g., field deployment, system integration, etc.).

Critical Handoffs/Interdependencies Among Project Team Members

Critical handoffs/interdependencies among project team members will be addressed in the integrated program schedule maintained by the Program Management Office. This schedule is anticipated to be reviewed at weekly program meetings to ensure the identification of any risks, the management of issues, and timely handoff of tasks between workstreams.

Technical/Management Aspects of the Management Plan

The Project PMO will maintain technical aspects of the Project Management Plan, including establishing and maintaining weekly and monthly project status reporting, monthly financial reporting, a centralized hub of coordination, and maintaining the Project Management Plan itself. The PMO will keep a centralized RAID log (risks, issues, action items, and decisions), meeting minutes, and ensure program governance is followed.

Approach to Project Risk Management

Risks and issues will be tracked in a formal registry. Each entry will be scored based on its likelihood, cost impact, schedule impact, and scope impact. The Project PMO will review, prioritize, and update tracked items weekly, with the goal to log proactive mitigation measures for each risk. PGE expects to mitigate workforce risks by working closely with IBEW Local 125 prior to and following project award to ensure alignment regarding PGE versus contractor installations and classification of work. Community and labor dispute risks will be mitigated through a proactive information campaign led by existing PGE liaisons, to ensure alignment early and often. Furthermore, PGE and CBO partner VertueLab will take a staged engagement approach to incorporate stakeholders' perspectives in the project plan, to allow for transparency and reduce project risks. PGE's strong executive sponsorship and policy support will serve as a foundation for project success and risk mitigation.

Project Changes

Changes will be formally managed through a centralized change management log, maintained by the Project Management Office. Each change will be sequentially numbered, the change documented including what scope, schedule, or budget change occurred, and be approved in writing by the program manager and any applicable governance. Only changes of substantive nature will be tracked, including contractual changes, schedule changes >30 days from original baseline, scope changes affecting committed project outcomes and/or features, and cost changes >$100,000 (1% of project budget).

Approach to Quality Assurance/Control (QA/QC)

QA/QC will be managed in two primary ways. 1) During Field Deployment, PGE will utilize regular and randomized inspections of both field installations and warehouse management. Install inspections are expected to range from 2-5% of all deployed SGCs, inspected by advanced PGE personnel, tracked against the installer, and any deficiencies or trends immediately corrected. 2) During Software Validation, PGE anticipates using existing datasets and known system information to cross-compare initial AI results, to validate and refine app development.

Communications Among Project Team Members

Communications with project team members will be maintained through the following methods: weekly 90-minute program meetings (including report outs from each workstream lead), weekly workstream status reports, a weekly program status report, monthly governance meetings with sponsoring executives, and monthly program reports published to stakeholders. Additional methods of regular communication will include email, phone, text, and MS Teams chat, and a centralized list of published contact information containing all project team member contact information.

PGE Experience With Large IT/OT Programs

PGE was an early adopter of AMI in the mid 2000's. During the AMI implementation, PGE implemented software-based solutions and undertook the full-scale field effort to deploy AMI meters for approximately 850,000 of its customers. This effort required collaboration across cross-functional teams at PGE (IT, Engineering, Corporate Communications, Legal etc.) and multiple project partners. PGE was awarded the first Utilimetrics AMI/Smart Grid Excellence Award for demonstrating innovation and superior achievement of the outcomes of the AMI implementation project. Based on PGE's experience with an existing AMI roll-out, this project is expected to deliver results faster and meaningfully through targeted deployment areas.

Another similar experience PGE has, is working with a set of partners to provide fast charging for heavy-duty electric commercial vehicles at PGE's Electric Island site along the Interstate Highway (I-5) which is the first of its kind in the US. As part of this initiative, PGE partnered with several cities to provide equitable access to charging by installing EV chargers on utility poles. These successes are based, in large part, on PGE's well-established Project Management Office (PMO). PGE's PMO has a track record of completing and meeting strategic objectives of projects that are extremely complex in nature and much larger in scale in comparison to the SGC project. The projects PGE's PMO has experience shepherding varying types of projects that include large transmission projects, fiber optic installation, and complex IT/OT implementations. These multiyear complex programs have benefited from rigorous project management processes and standards that are in practice at PGE.

The SGC was built leveraging the experience of Utilidata and NVIDIA. For over a decade, Utilidata has used a centralized software platform to execute real-time, data-driven grid operations using machine learning. This software is scaled with major utilities and proven to deliver an average of 3% energy savings. Utilidata also built the first distributed grid operational software applications for two of the largest metering companies in the world. No other company has as much experience executing centralized and distributed grid data analysis and operations.

NVIDIA has unprecedented experience developing AI-powered chips and bringing this technology to scale in new markets, such as gaming, autonomous driving, health care, and robotics. There are more than 35,000 companies leveraging NVIDIA AI Graphics Processing Units (GPUs) and software platform architecture in other sectors.[14] This project will leverage their success in scaling distributed AI. Like all NVIDIA platforms, the SGC is designed to provide easy access for third-parties and support ecosystems of innovation.

4. TECHNICAL QUALIFICATIONS & RESOURCES

4.1 PROJECT TEAM QUALIFICATIONS

As reflected in Table 4, PGE's Larry Bekkedahl, Sr. VP – Advanced Energy Delivery, and his organization will be closely involved in the implementation of the SGC project. Larry will provide executive sponsorship and governance to the project, and the roles and responsibilities of other key personnel from PGE as well as its partners are summarized in Table 4. Resumes for each key personnel listed in Table 4 are included in the "Resumes.pdf" deliverable.

Final staffing plan will reflect the need to deliver each workstream's scope on schedule and with the expected quality to meet the project's measurable outcomes.

[14] https://images.nvidia.com/aem-dam/Solutions/homepage/pdf/NVIDIA-Story.pdf

Table 4. Project Team

Team Member Organization	Team Member	Title	Project Role	Time Commit(peak phases)
Portland General Electric (PGE)	Larry Bekkedahl	Sr. VP, Advanced Energy Delivery	Executive Sponsor	5%
	Matt Hubbard, P.E., PMP	Manager, Distributed Device Strategy	Program Manager	100%
	Jerry Case	Manager, Procurement	Procurement and Contracts Workstream Lead	100%
	Shruthi Murthy	Manager, Application Development	System Integration Workstream Lead	100%
	Rick Tetzloff	Director, Construction Management	Deployment Workstream Lead	100%
	Uma Venkatachalam	Manager, Application Development	Software Validation Workstream Lead	100%
	Shane Freepons	Sr. Manager, Engineering Services	Business Operations Workstream Lead	100%
	Tara Beckman	Principle Technical Program Manager	Business Transformation & Change Workstream Lead	100%
	Steven Nakana	Manager, Community Outreach	Community Benefits Delivery Workstream Lead	100%
Utilidata/ NVIDIA	Dr. Marissa Hummon	Chief Technology Officer	Executive Sponsor/Technology Lead	25%
	Jess Melanson	President and Chief Operating Officer	Executive Sponsor/Deployment Lead	25%
	Matt Langlois	Vice President of Customer Success	Project Manager	100%
	Richard Marcaccio	Vice President, Technical Operations	Hardware/IT Lead	50%
	Taylor Spalt	Algorithms Architect	Algorithms Lead	50%

	Eder Borgas	Electrical Engineer	Engineering Lead	50%
	Sophie Janeway	Regulatory Lead	Public Policy Affairs Lead	50%
	Yingchen "YC" Zhang	Vice President of Product Solutions	Product Lead	50%
VertueLab	Johanna Brickman	Deputy Director	Community Outreach	5%
Saturday Academy	Brianna McCoy	Executive Director	K-12 STEM Education Pathways	5%
Oregon State University (OSU)	Dr. Eduardo Cotilla-Sanchez	Assoc Prof Electrical Engineering	Graduate Research Programs	5%

4.2 FACILITIES, EQUIPMENT, & MATERIALS

Planning and technology development work related to this project will be conducted primarily at PGE's headquarters in Portland, Oregon at 121 SW Salmon St. PGE has various satellite offices across its service territory that will be leveraged for performance of the project as needs arise. PGE's well equipped meter testing laboratory will support the field-testing phase of the project by testing meter performance when installed with the SGC and recommend any suggested changes to the configuration of the chips.

PGE has contracted with Utilidata for supply of SGCs in required quantities for the test phase and anticipates executing contracts for the full-scale deployment phase. Utilidata procures prepopulated circuit board modules and has established relationships with the manufacturers of the communications module. Utilidata is working with the current transformer manufacturer to scale up production to meet anticipated demand, and pre-ordering electronics and hardware assemblers in advance of the anticipated assembly schedule. For electronics assembly, Utilidata is working with a Michigan-based electronics components assembler with more than 40 years of experience. All assembled electronics are tested before they are shipped to the hardware assembler. For hardware assembly, Utilidata has contracted with a Michigan-based assembler Brooks Utility Products, an ISO 9001 certified facility with a 140-year history in manufacturing and assembly of hardened electrical utility-grade devices.

4.3 RELEVANT PREVIOUS EXPERIENCE

For the majority of 2022, PGE and Utilidata have collaborated to plan this project. Both organizations have contributed on how to drive this project as efficiently as possible and have agreed to work as "one team" to realize the expected outcomes from this initiative. Extensive interactions have occurred between the organizations in getting this solution reviewed and approved by PGE's cybersecurity team. This process enabled interactions at technical levels as well as with leadership. Senior executives from PGE as well as Utilidata are engaged on a regular basis and will provide the necessary governance and support to ensure any unforeseen issues are resolved quickly. This collaboration gives PGE confidence in a successful deployment. NVIDIA and Utilidata have partnered the past two years to co-develop an integrated hardware-software solution, leveraging expertise in grid operations, distributed software, and AI.