Electric Power Sensing, Analytics and Digital Twin

11/08/2023

Jeremy Gill, Interim VP & CIO

With more than 20 years of information technology (IT) experience, Jeremy Gill currently serves as Duquesne Light Company's (DLC) Interim Vice President and Chief Information Officer (CIO).

In this role, Jeremy oversees DLC's IT department, including systems infrastructure and cybersecurity. He is responsible for providing strong leadership and oversight of the company's recent and future technology investments and implementations. This includes directing and managing the company's information and operations technology resources, including infrastructure and architecture, application development, networks, Critical Infrastructure Protection (CIP), technology operations and cyber security for the enterprise.

DLC strives to constantly improve its customer engagement, and technology plays a critical role in the organization's evolution. So, Jeremy collaborates closely with the DLC's Operations and Customer Service teams to enhance both internal/external systems and customer interactions while making the company a "digital utility" through the strategic use of technology.

Jeremy started his leadership journey as CIO at engineering and consulting firm Michael Baker Corporation. After that, he joined Pittsburgh-based supermarket chain Giant Eagle as director of technology and infrastructure. He began his career at DLC in 2016 as director of technical services.

A Hookstown, PA native, Jeremy earned a bachelor's degree in Information Systems from Robert Morris College (now Robert Morris University) and has an MBA from the University of Pittsburgh.

He serves as chair of the Pressley Ridge Foundation, and he's an Honor Board member for The Mentoring Partnership of Southwestern Pennsylvania.

Agenda

1. State of the Grid
2. Grid Impacts
3. Vision for the Grid of the Future
4. Grid Modernization Roadmap

State of the Grid

Where We Started…

Telephone service for communications (high latency, low bandwidth, security and flexibility)

Thousands of connected devices

Grid designed for one-way power flow

Centralized generation

Predictable customer needs
Moderate dependency on the grid
Moderate tolerance for outages

Where We are Today…

Public wireless, fiber, and wired communications (moderate latency, bandwidth, security and flexibility)

Millions of connected devices

Two-way power flow on a system designed for one-way power flow

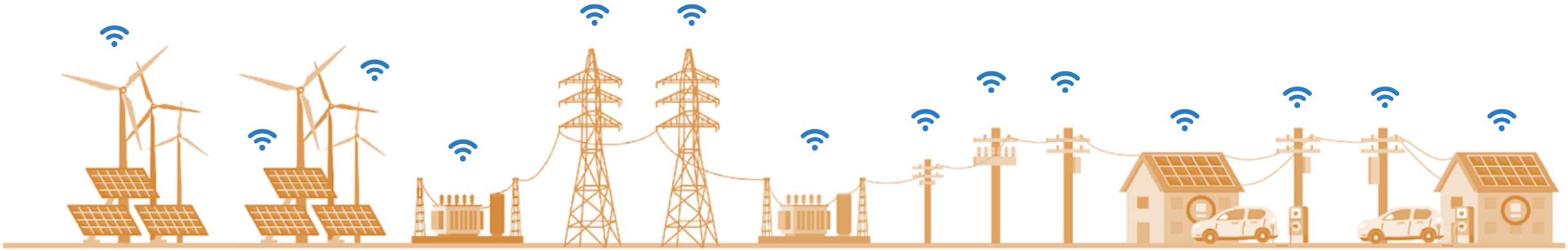
Centralized and distributed generation

Evolving and unpredictable customer needs
High dependency on the grid
High expectations

Where We Need to be…

Private wireless communications (pLTE) (low latency, high bandwidth, security and flexibility)

Billions of connected devices



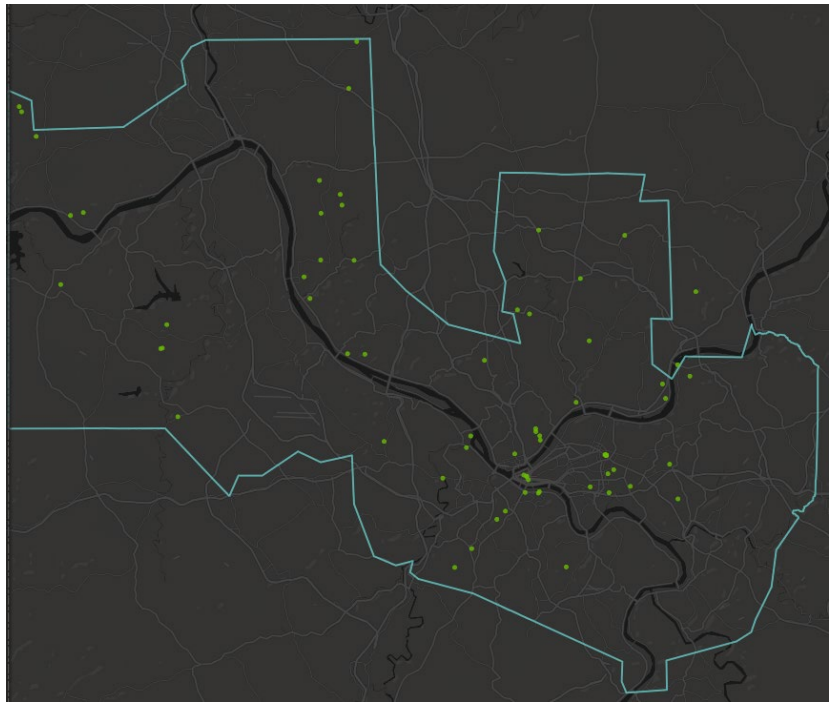
Situational awareness, grid automation, and real-time simulations optimized for two-way power flow

Distributed, variable generation

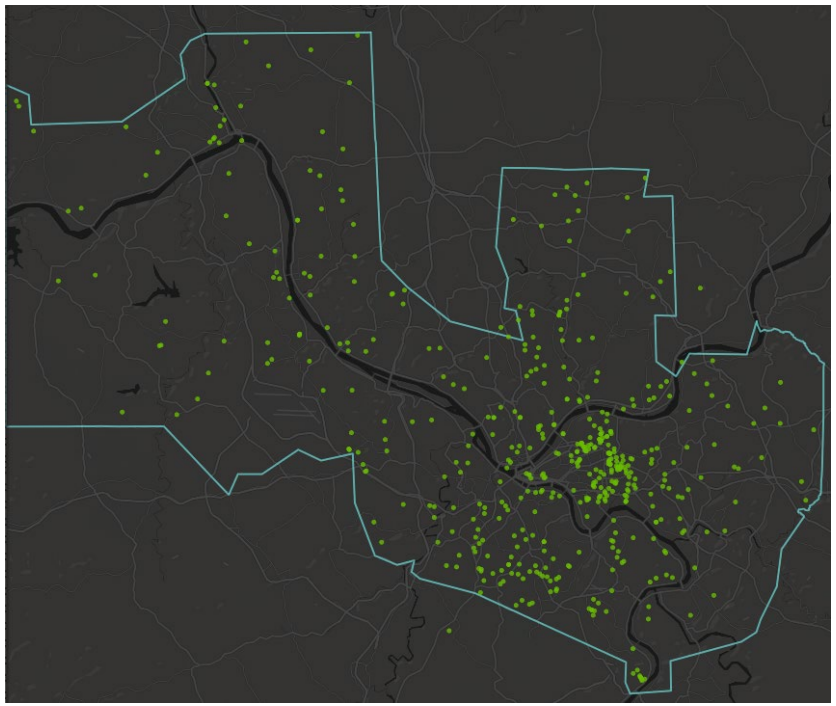
High dependency on the grid
High expectations for reliability
Leverage AI to predict customers' evolving needs

DER interconnection requests are growing exponentially

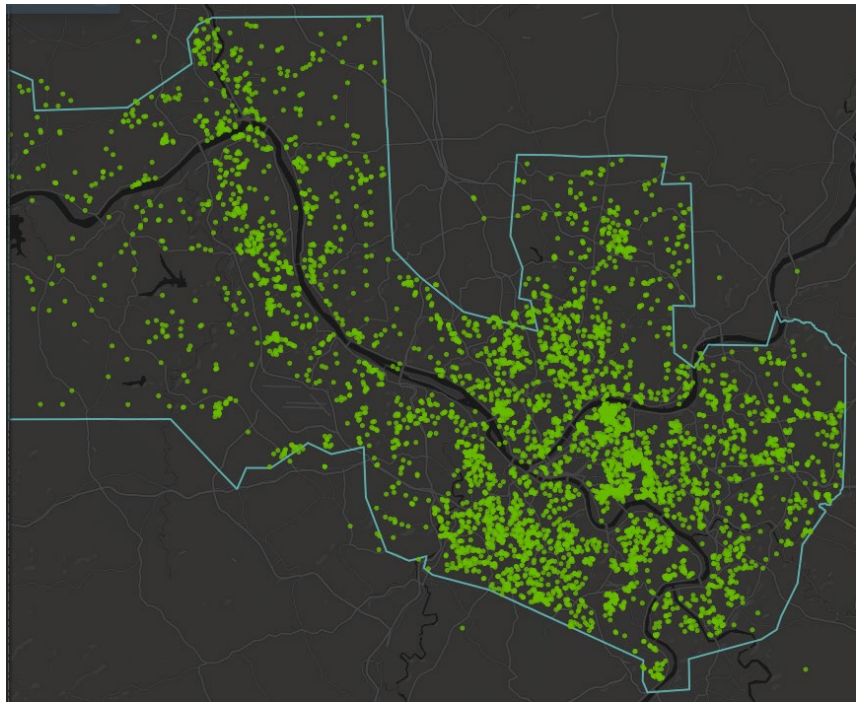
Average of 175 new interconnection applications monthly; 62% annual increase from 2021 to 2022



DER Interconnections, 2010



DER Interconnections, 2016

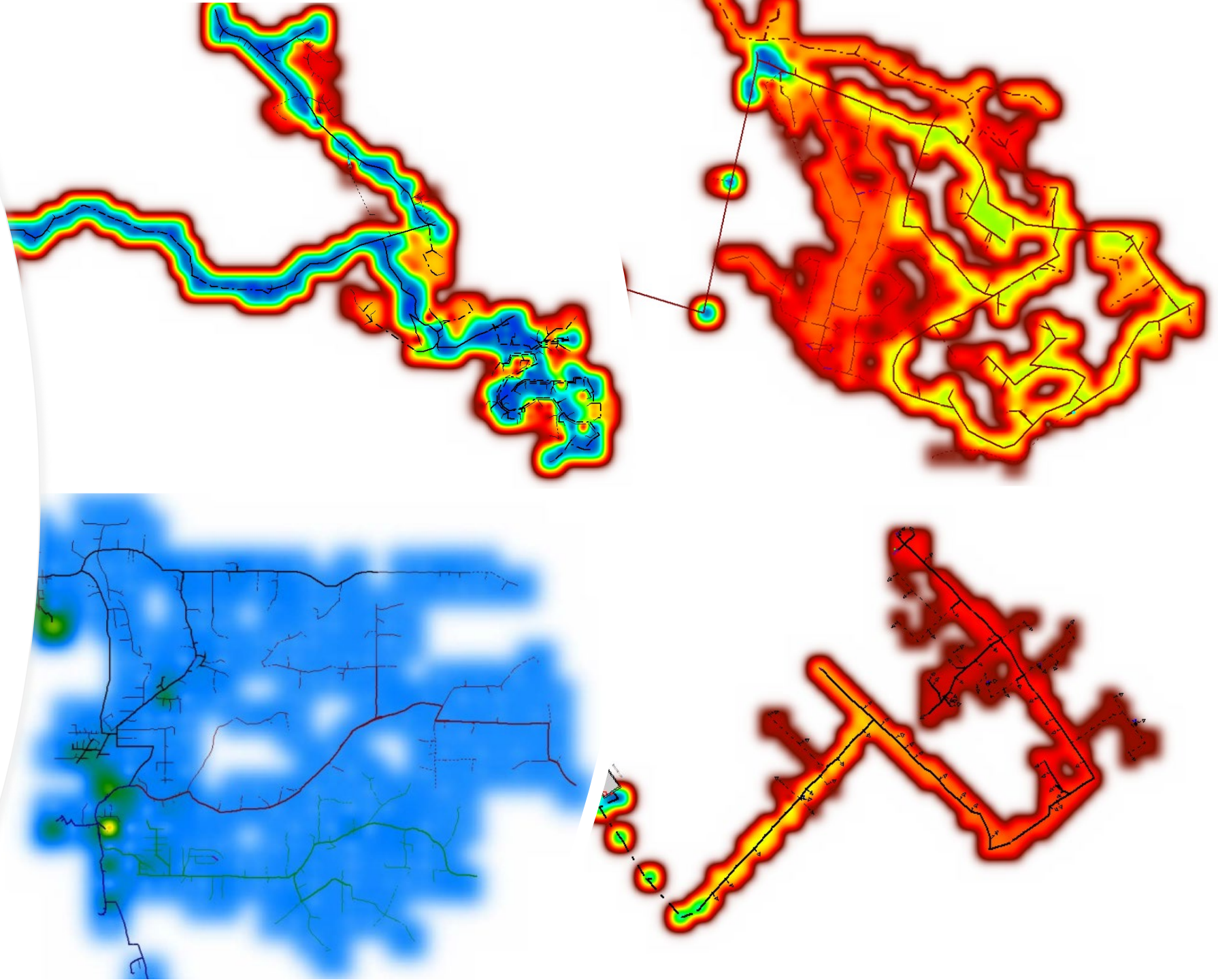


DER Interconnections, 2022

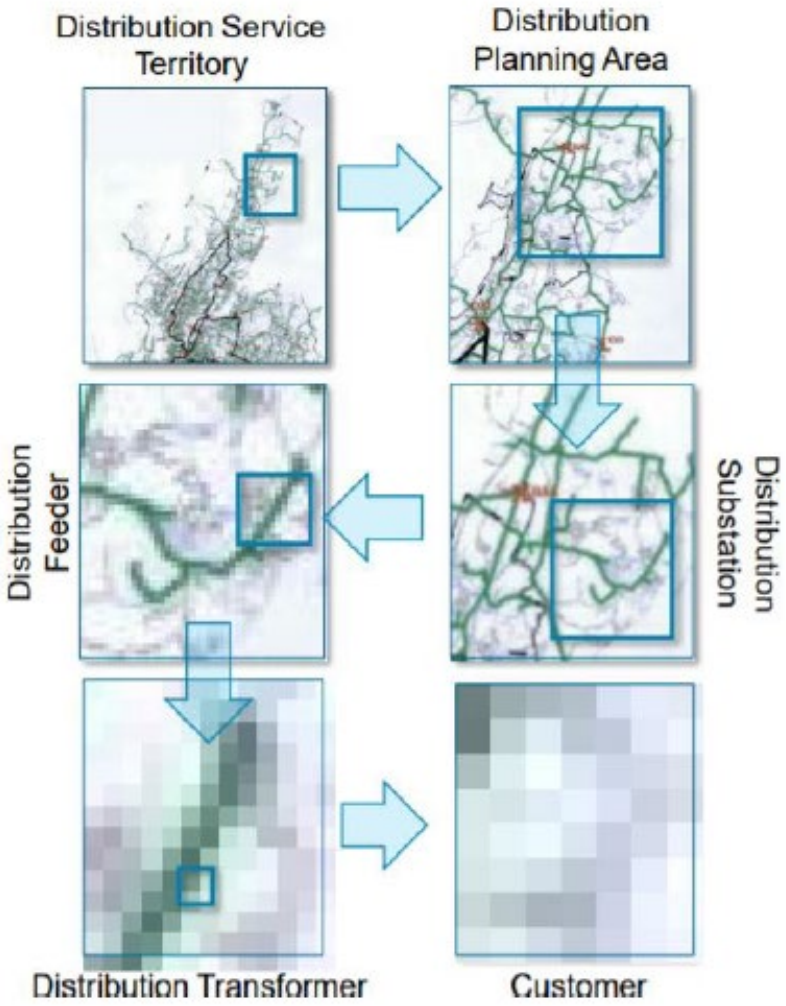
Grid Impacts

Expanding Current Planning Methods to Enable DERs

- DERs will increase the number of local problems on a circuit, including voltage and thermal violations.
- Current planning methods cannot keep up with the increased volume of analysis required as it is a labor-intensive process.
- Automation of model creation and execution will be necessary to maintain grid reliability.



Low Resolution Data is a Foundational Barrier to Answering Crucial Questions



What system capacity constraints are encountered during N-0 and N-1 conditions, due to electrification?

What are the infrastructure investments needed to resolve these system constraints?

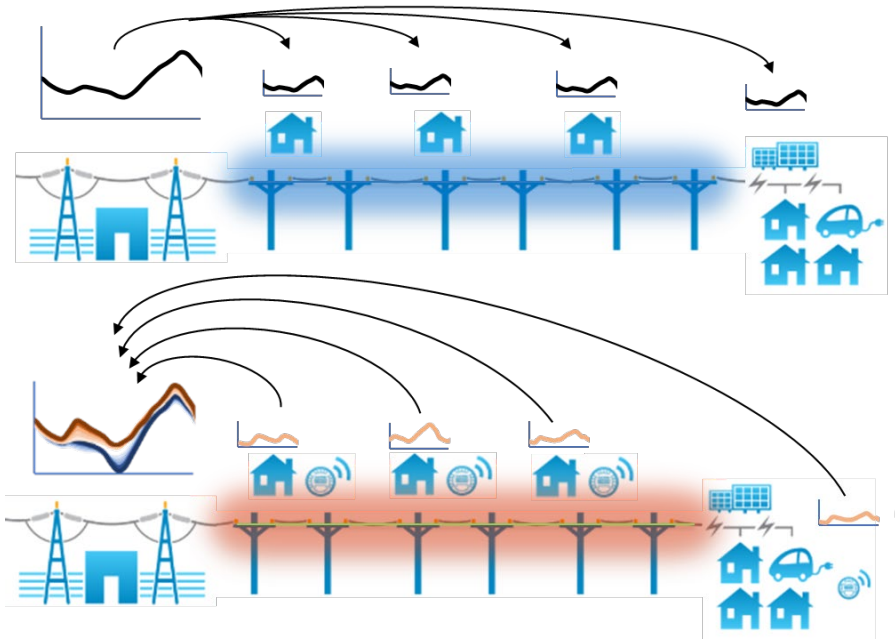
What impact does optimal switching, and DER technologies like solar, storage, EV, managed charging, DR, EE, have on these investments?

Are customer programs that encourage various DER technologies a cost-effective option for managing load?

Should the customer programs be targeted at overloaded areas or be offered uniformly?

Opportunity to Optimize Current Planning Processes to Meet Evolving Needs

- Today, decisions are being made based on traditional static data.
- There is an opportunity to centralize, streamline, and improve planning processes based on current data.
- However, all systems are intertwined, and integrated decision-making can achieve greater benefits.
  - Ex. Asset management (AM) decisions can affect distribution reliability.
- By modernizing the grid, advanced capabilities are unlocked for DLC.
  - Ex. Utility-led Integrated Distribution Planning (IDP), Asset Health Model, Asset Management Strategy, and many others.

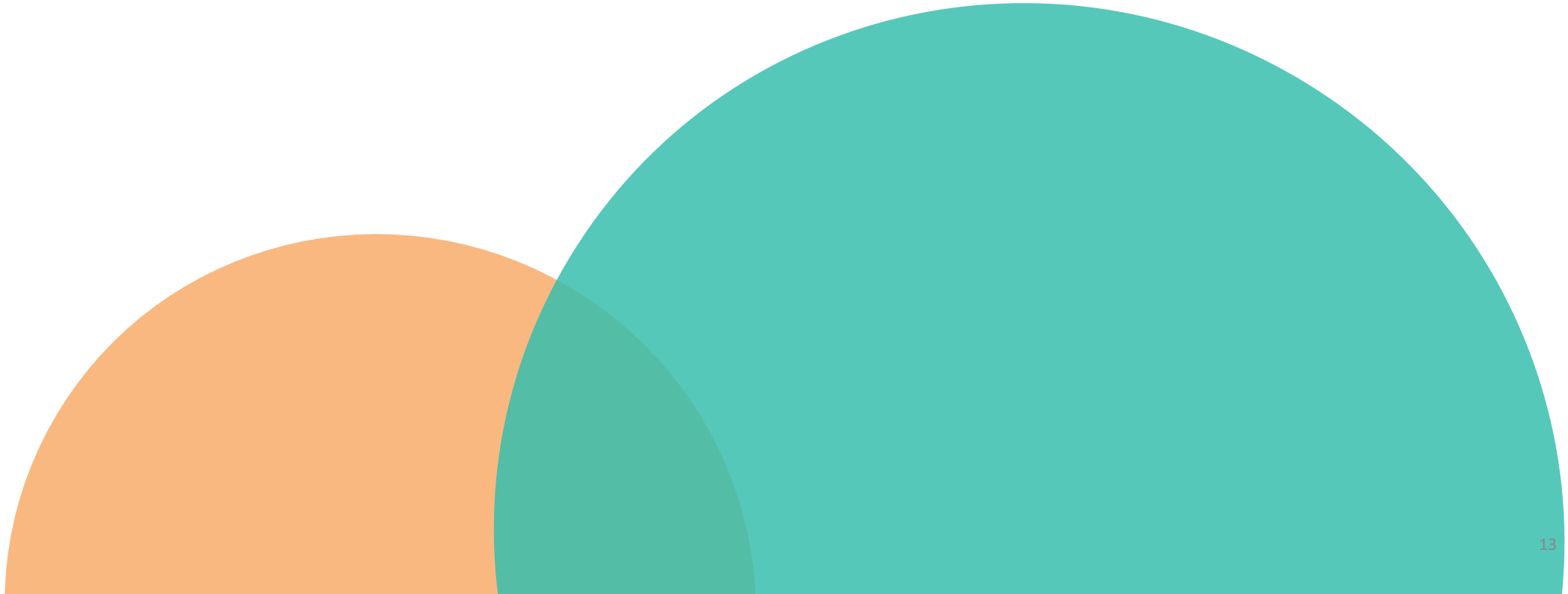


Current State
"Top Down" Allocation

Future State
"Bottom Up" Aggregation

Integrating more granular real-time data from the edge enables better planning enhances capabilities to inform operational tools

Vision for the Grid of the Future



Forging a New Path Toward a Resilient, Reliable & Modern Grid (a Clean Energy Future for All)

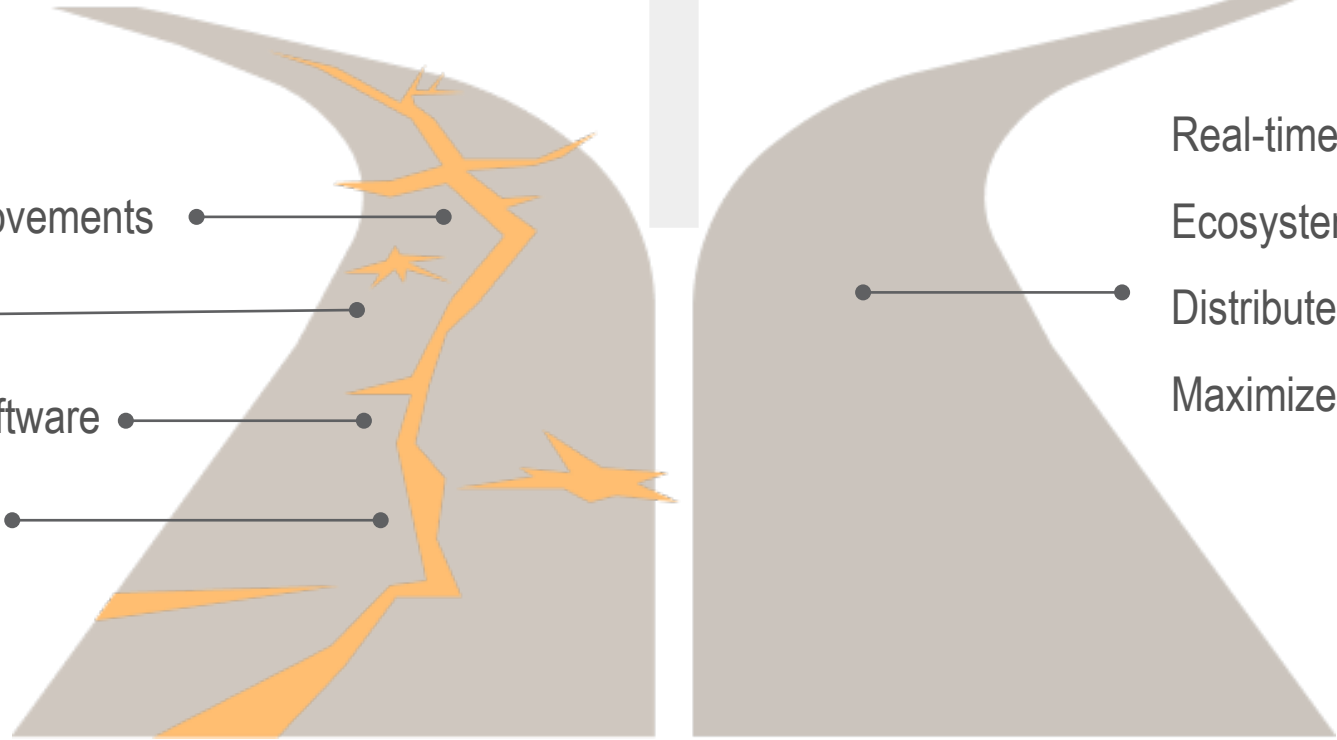
How will we maintain affordability and reliability amidst growing complexity and changing climate?

Familiar, reactive, manual, and capital intensive (i.e., asset upgrade approach vs. non-wires approach)

Traditional Path

New Path

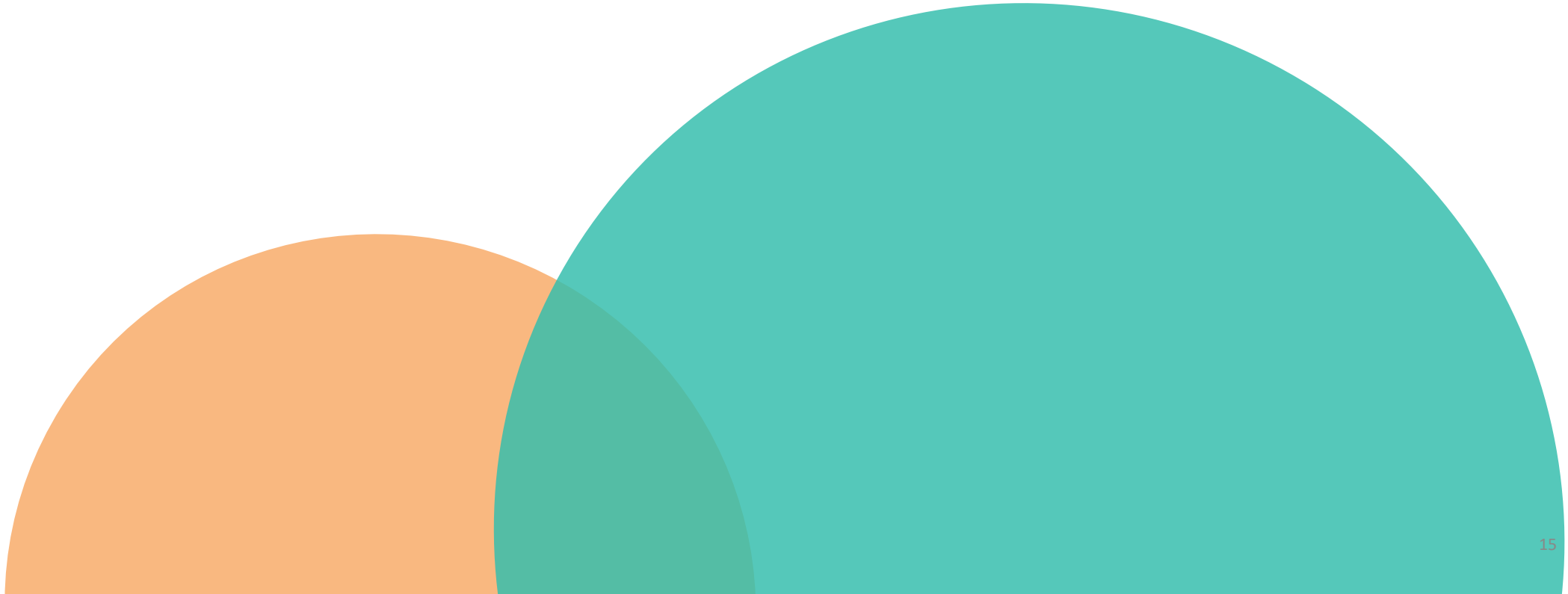
Software-defined, cost-effective, flexible



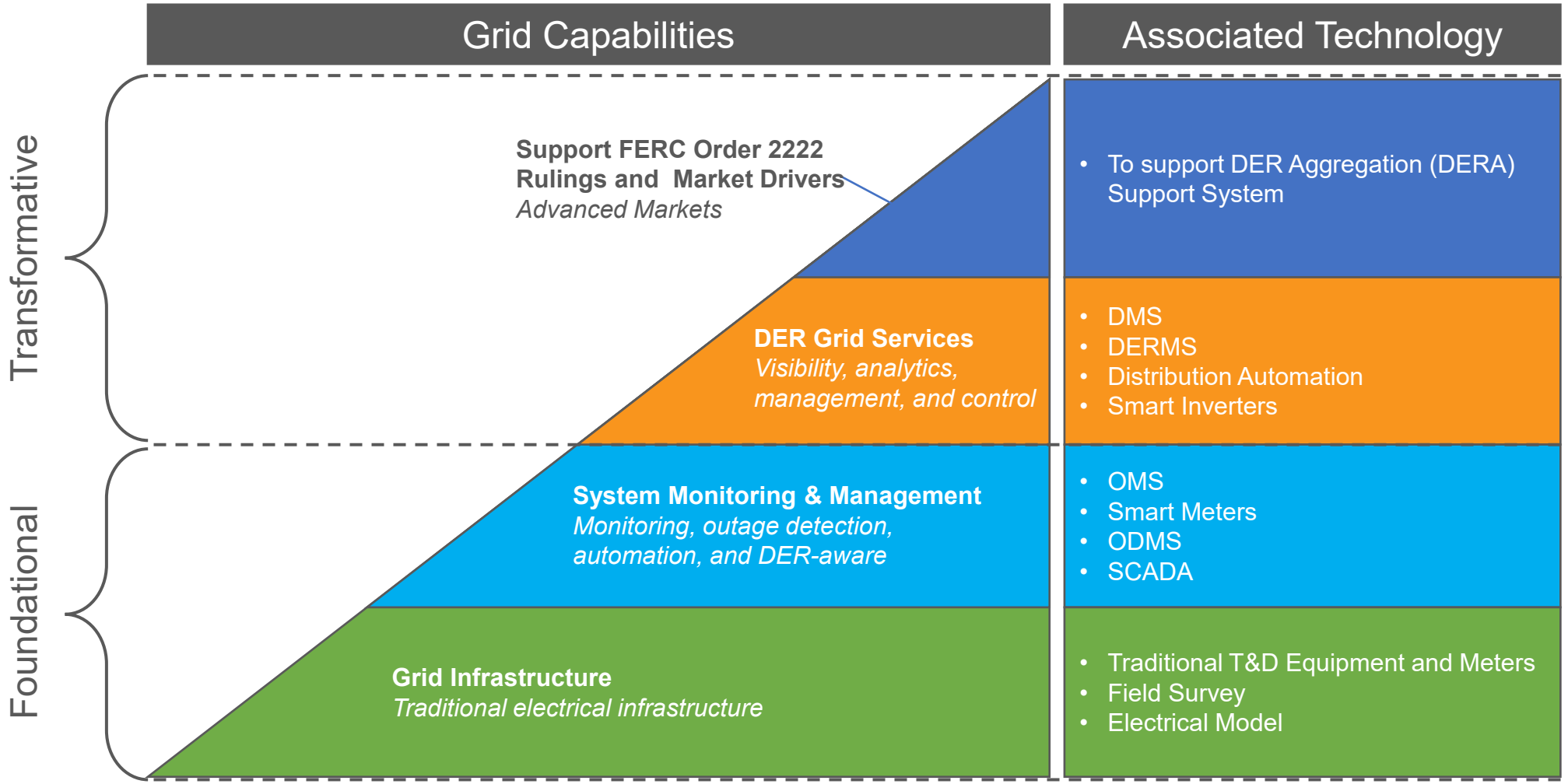
- Rely on small technological improvements
- Limited data and visibility
- Rely on centralized enterprise software
- Rebuild substations and feeders

- Real-time visibility to the edge
- Ecosystem built for innovation & agility
- Distributed decision-making and control
- Maximize value of customer-sited assets

Grid Modernization Roadmap



Grid Modernization Roadmap



Smart Grid Chip

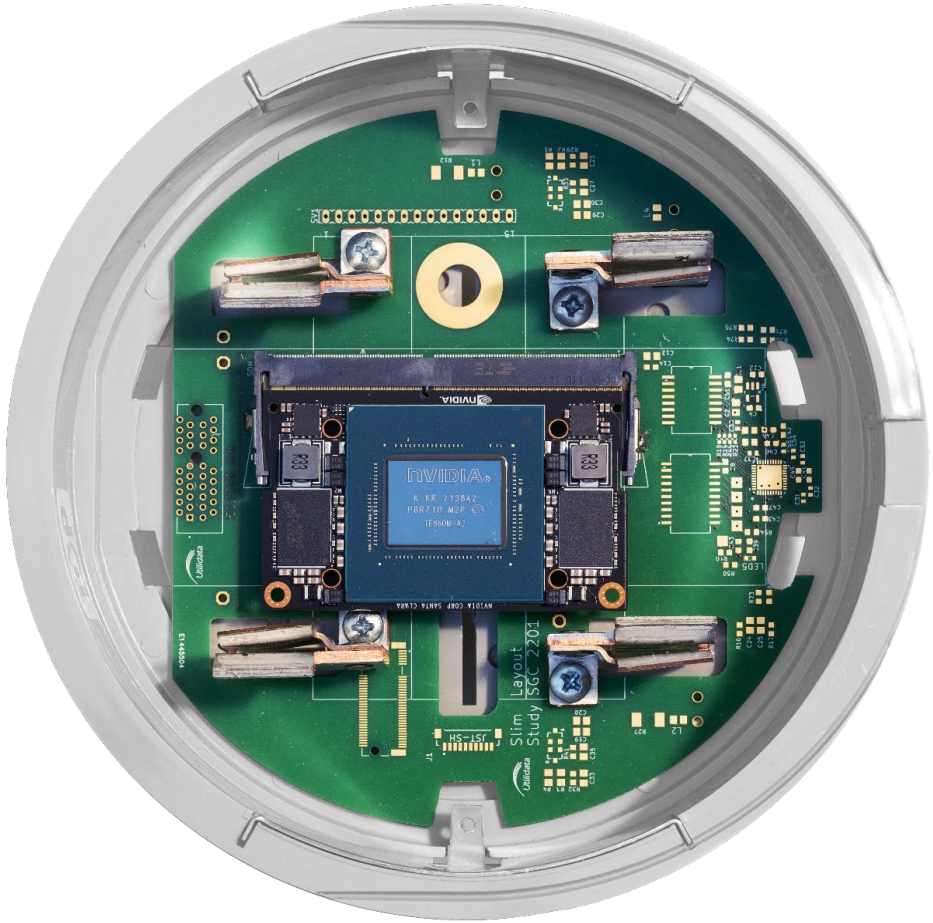
Grid Resiliency Improvement Project (GRIP)

Utilidata's Smart Grid Chip is a New Kind of Grid Edge Solution

With a combination of on-chip and cloud-based software, the smart grid chip leverages distributed artificial intelligence (AI) to provide real-time visibility, identify and manage distributed energy resources, enhance resiliency, and offset the need for infrastructure investments.

The smart grid chip is not a smart meter.

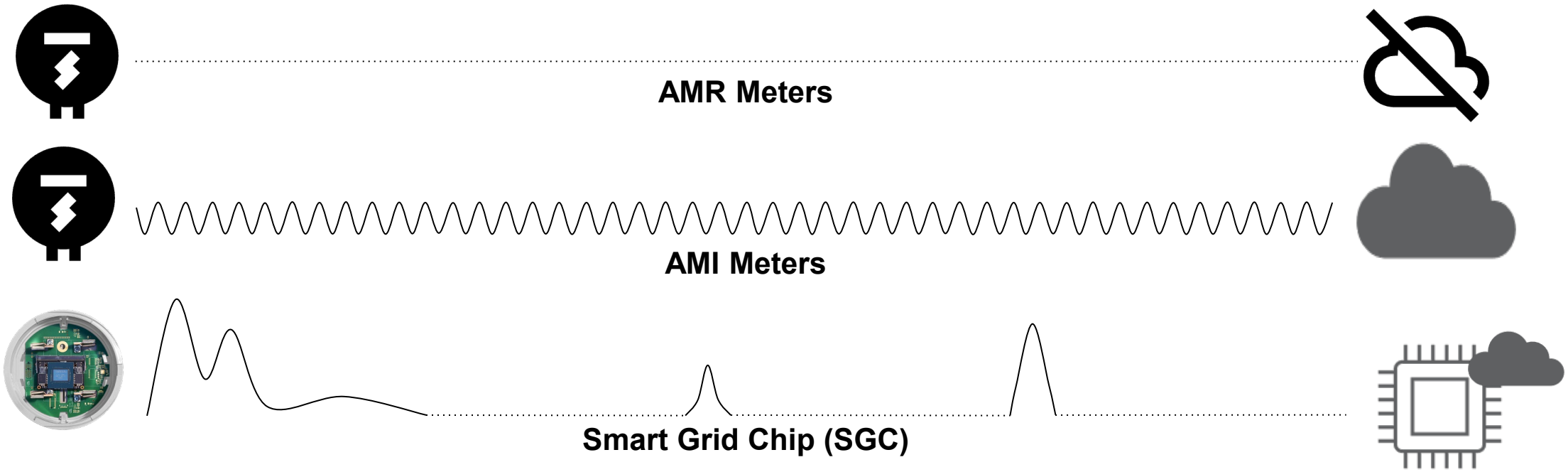
It is an open, software-defined platform that evolves and becomes more valuable over time.



Pilot Deployment of Smart Grid Chips

- DLC applied to the DOE Grid Resilience and Innovation Partnerships (GRIP) Program to partially fund (50%) deployment of smart grid chips and dynamic line ratings
- The target communities were selected due to their high concentrations of distributed energy resources (DERs) and/or service reliability needs.
- DLC was notified in Q4 2023 that we would receive approximately $20M to offset the cost of the project thereby delivering significant savings to customers.
- DLC is refining a detailed cost benefit analysis.

We are Entering a New Era of Data Transmission, Computing, and AI



	Local (Edge) Compute	Artificial Intelligence	Data Transmission Reliance	Cloud Support	Cloud Reliance	Cost Effectiveness
AMR	X	X	High	Minimal	X	-
AMI	X	X	Moderately High	✓	High	-
SGC	✓	✓	Low reliance, configurable	✓	Low reliance, configurable	✓

Solving Immediate Challenges While Providing Mutual Benefits to the Customer and DLC

Challenges

- Electrification of homes and vehicles will require more sophisticated distribution planning, and central to that planning is real-time, easily accessible data.
- DLC, and the industry, currently has limited visibility and access to data, which is foundational to safety and operational efficiency.

Example Solutions

- Fully understand the impact of EVs on the grid in real time, allowing DLC to accommodate more EVs charging without denying service and incurring long delays for grid upgrades.
- More efficiently process solar and battery interconnection applications through automation and using real-time edge data compared to time- and capital-intensive planning studies based on worst-case scenario planning.
- Identify optimal DER locations that can offer individual and community resiliency.
- Establishes foundation to upcoming and future regulatory mandates (e.g., FERC 2222)

Customer Benefits

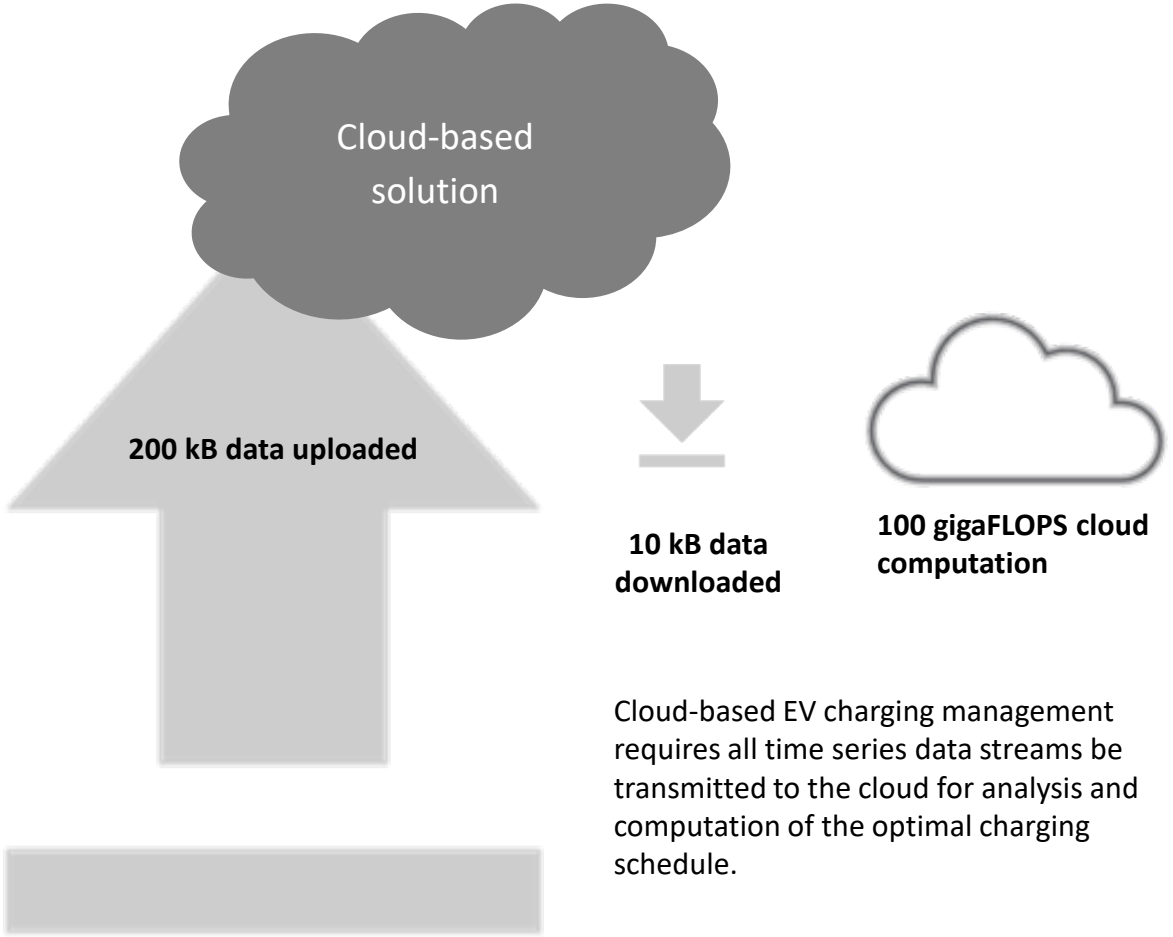
- Defer necessary capital investments in infrastructure to support EV adoption through cost-effective EV management, resulting in customer savings.
- Technical and economic optimization and management of the grid based on real-time data from the edge and AI algorithms.
- Reduce interconnection times and enable enhanced hosting capacity capabilities.
- Situation awareness and analytics to improve reliability, resilience, and optimal capacity procurement.

Q&A

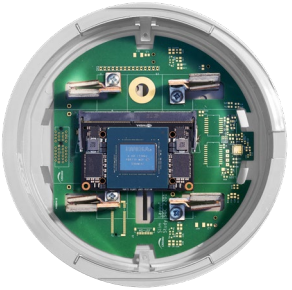
Appendix

Distributed AI Reduces Data Transmission and Cloud Costs

Estimated data and computation rates per day for EV charging management



Cloud-based EV charging management requires all time series data streams be transmitted to the cloud for analysis and computation of the optimal charging schedule.



Smart Grid Chip

1 kB data uploaded

1 kB data downloaded

0.01 gigaFLOPS cloud computation

0.01 gigaFLOPS on-chip computation

SGC EV charging management analyzes and computes the charging dispatch schedule locally, only relying on periodic updates from the cloud-based optimization to provide directions for each control zone of the grid.