Bringing SaaS to managing the grid
The team who scaled Google

Astrid Atkinson
CEO
Google Sr Director • Pioneered & scaled Google’s reliability approach

Cody Smith
CTO
Google Principal Systems Engineer • tech lead for Site Reliability

Michael Ryan
COO
BD Biosciences, NetApp, Xerox • Enterprise IoT and data integration

EXPERIENCE

We know how to design highly-reliable distributed systems for critical networks, because we’ve done it before.

Camus Energy was founded to apply this knowledge and develop world-class tools for grid operators.
The job of the future grid is to get energy from the time & place where it’s produced, to the time & place where it’s needed.
STATUS QUO

Current grid management technology: from the 90’s

What’s included:
- Meters
- Circuits
- Transformers

What’s not:
- Flexible loads
- Distributed generation
- Supply & demand

UI from a leading ADMS

“Manage it? I can’t even see it!”
WHAT WE DO

Grid management platform

Advanced tools for real-time monitoring and control of a changing grid, designed for the zero-carbon future.

Real-Time Monitoring

Forecasting & Analytics

Advanced Control of Local Resources

Scheduling & Market Integration

PLATFORM COMPONENTS

Operator interface

Optimization and dispatch engine

Composite virtual grid

Distributed resource telemetry

Utility and customer data foundation
Managing a grid with customer and local resources

Taking advantage of local utility and customer resources requires new management capabilities - but enables new business models and cost savings.

Real-time management capabilities:

- System operations and real-time network operation
- Forecasting, procurement, and scheduling coordination
- Managing local markets and integrating with bulk markets
Lowering energy costs with local solar generation

THIS APPROACH HELPS UTILITIES...

- Monitor real-time generation from arrays with and without telemetry
- Forecast day-ahead generation to inform power supply strategies
- Adjust curtailment to avoid backflow from distribution-connected panels

Managing 100% local solar

Providing the operational insight and visibility to manage 100% daytime solar, cutting cost of energy in half (10c/kWh to 4.5c/kWh)
REAL-WORLD USE CASE

Leveraging member-owned DERs for resilience and cost savings

THIS APPROACH HELPS UTILITIES...

- Monitor and manage DER behavior with context of local constraints
- Dispatch DERs to serve system needs, taking into account grid conditions
- Integrate DERs into power supply while compensating the DER owners

Tapping Tesla Powerwalls with Power+

Delivering grid-aware monitoring and orchestration of residential batteries used for local resilience and shaving of system coincident peak demand.
REAL-WORLD USE CASE

Utilizing available data for new engineering insights

THIS APPROACH HELPS UTILITIES...

- Easily analyze data from IT + OT sources to inform operations and programs
- Assess voltage deviations and grid-wide impacts of local renewable generation
- Inform planning and member engagement related to DER adoption

Discovering transformer insights

Enabling rapid evaluation of loading on all transformers to manage equipment health, mitigate outages, and enable DER hosting capacity assessments.

DISTRIBUTION UTILITY NEAR DURANGO, CO

LPEA
La Plata Electric Association, Inc.
Leverage existing grid data for engineering insights

**Voltage Mapping:** Identify system-wide voltage deviations by
- Establishing “zones” (b/w OCRs, fuses, etc) with GIS data
- Processing voltage statistics for every meter
- Presenting deviations within zones in a heatmap

Allows for identification of voltage ‘hot spots’, end-of-line issues, DER capacity planning insights.

**Transformer Loading:** We combine multiple data sources,
- AMI (power, voltage)
- GIS (xfmr rated capacity, meter<>xfmr relationships)
- SCADA (substation loading, feeder voltage, power)

Providing insights into asset loading, and data aggregation at all points throughout the system.
Adding new data sources and providing integrated analytics

- Bring data together from multiple sources
- This enables flexible insights and informs many teams - programs, engineering, operations, etc
- Data from customer resources provides deeper insights into new behaviors
  - High penetration rooftop PV
  - Loads masked by batteries
  - EV charging
Utilize forecasts to manage supply costs

Coincident peak pricing is often a significant portion of power supply costs for distribution utilities.

To manage peak costs, utilities should leverage:

- Autoregressive and machine learning techniques to forecast system peak
- Statistical likelihood algorithms that use (1) forecasted peak values, (2) peak to date in demand period, and (3) historical ranges to classify likelihood of system peak
- Control of local resources (EVs, Batteries, etc.) to manage coincident peak charges

Forecasting demand and supply based on integrated data can provide a foundation for workflows that incorporate local resources.
Grid-aware control of local resources

Dispatching local resources is most useful in context of grid and power supply data.

- Peak shaving and load shaping should be informed by forecasting.
- Integrated view of local resources and grid conditions allows local resources to support reliability and cost management.
- Customer incentives enable broader integration of controllable resources.
Incentives for DERs to support the grid

Customers get paid $0.35 to delay charging to after 10pm

Curtailing charging at 8pm lowers risk at SUB23-4 and provides flexibility for operators

157 customers behind SUB23-4 have electric vehicles

Feeder SUB23-4 gets within 15% of a transformer limit

Coordinating market dispatch of DERs

Utility signals Aggregator to safely dispatch flexible building loads

Aggregator registers an ISO offer for 1.2MW of load reduction from 4-5pm

1.4MW of flexible building load is managed by Aggregator below SUB23

Smart load dispatch limit for SUB23 from 4-5pm is 5MW
How do we sell, and who’s buying?
Basics of Utility SaaS

- 2-phase process - services + subscription
  - Utility data integration & setup (~6mo)
  - Device integration and management (~3mo per device)
- Hosted service model
  - Subscription covers software operations, maintenance and updates
  - One service instance per customer, individually scaled (from ~10s of servers to 1000s)

Changes for one customer benefit all - virtuous cycle.
Working with change makers - for now

Next-gen integrated grid management

Providing extended grid management to leverage distributed resources locally and manage market integration under FERC 2222.

100% carbon free electricity by 2030

Delivering integrated visibility and control of local resources to decrease peak energy costs, and supporting zero carbon emissions by 2030.
Take control of a changing grid.

The grid management software platform for a distributed, zero-carbon future.

One Unified Platform

- Real-Time Monitoring
- Forecasting & Analytics
- Advanced Control of Local Resources
- Scheduling & Market Integration

Built by the Team Who Scaled Google

We know how to design highly-reliable distributed systems for critical networks, because we’ve done it before.

Deployed at Scale

We’re helping utilities save millions in energy costs, safely integrate DERs, and achieve decarbonization goals.
Grid-wide monitoring and control – similar to a lightweight ADMS
Traditional Software vs Cloud-based scale for real-time data and AI

Secure, massively parallel cloud processing supports online ML for real-time intelligence at scale

Hierarchical system-of-systems approach leverages the team’s unique expertise to provide grid-wide autonomous control

Deployed on a small number of large servers. Storage and processing power are limited.
Cybersecurity

“We can’t use the cloud because of cybersecurity concerns.”

“The cloud lets us borrow the best cybersecurity engineers in the world.”

“We don’t know what to do with all this data.”

“Data provides the foundation for our future business model.”

Managing Scale
The Elephant in the Room - Capitalization

- Investor owned utilities operate under a regulated rate of return
  - Energy costs are a pass-through
  - Cost of capitalized assets can be recovered in a rate case
  - O&M costs are part of operating costs

Regulated utilities don’t love subscriptions, but do want to save money and have to satisfy customers and regulators.

- Public sector utilities are sensitive to cost of energy
  - Energy costs are part of rate model
  - Savings translate directly into customer / member savings
  - Public utilities are non-profit and return gains to business or customers
  - Still prefer capital costs to O&M!
SAAS BENEFITS

Enabling Rapid Change - Iteration in the Field

2019

Initial product development
1 utility customer
Full-scale data integration

2020

Analytics product deployment
Control product development
3 utility customers
Full-scale grid data integration

2021

Operating utility + customer assets
4 utility customers
Grid + customer and 3rd party data
3rd party device control

2022

Markets product development
6 utility customers
ML-driven forecasting & analytics
Grid-aware control & automation
THANK YOU

And we’re hiring!

Build the world you want to live in.

Join our team at
www.camus.energy/careers