RESILIENTPOWER

A project of CleanEnergyGroup

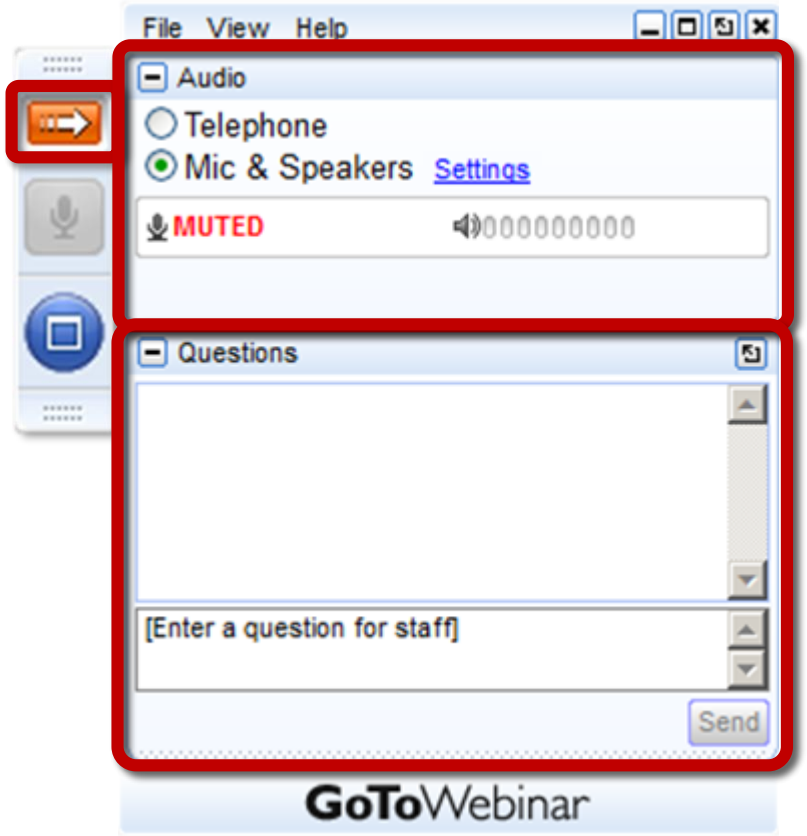
An Introduction to Virtual Power Plants

September 28, 2020

CleanEnergyGroup

Innovation in Finance, Technology & Policy

WEBINAR LOGISTICS



Join audio:

- Choose Mic & Speakers to use VoIP
- Choose Telephone and dial using the information provided

Use the orange arrow to open and close your control panel

Submit questions and comments via the Questions panel

This webinar is being recorded. We will email you a webinar recording within 48 hours. CEG's webinars are archived at www.cleanegroup.org/webinars


CleanEnergyGroup
Innovation in Finance, Technology & Policy


Meridian Institute
Connecting People to Solve Problems


CleanEnergy
States Alliance


Barr
Foundation


THE JPB FOUNDATION


SURDNA
ANDRUS


THE
KRESGE
FOUNDATION

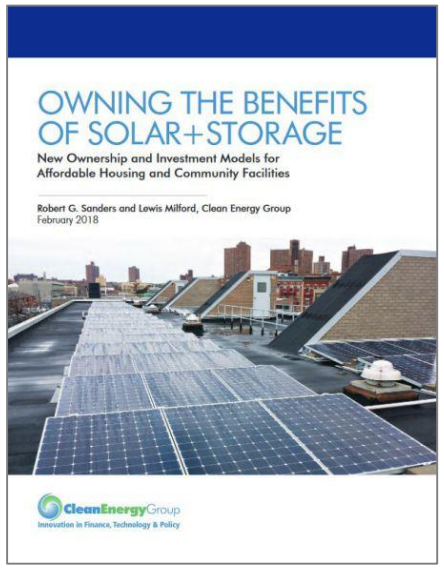

THE NATHAN
CUMMINGS
FOUNDATION

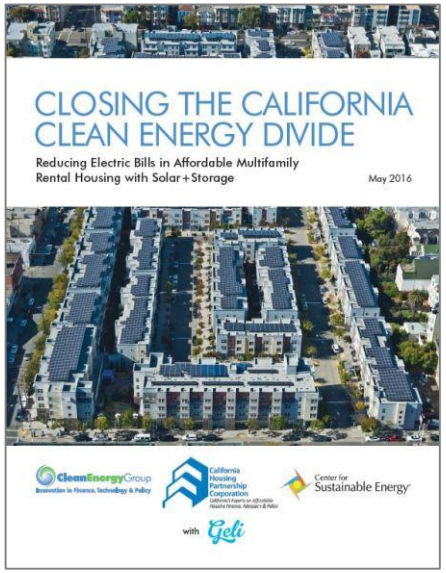

MFF

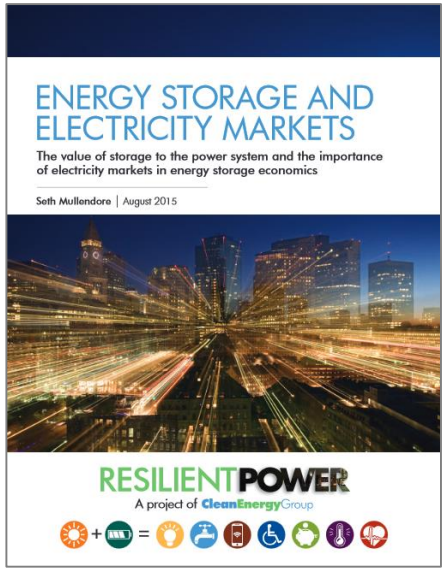

THE NEW YORK
COMMUNITY TRUST
NYCT

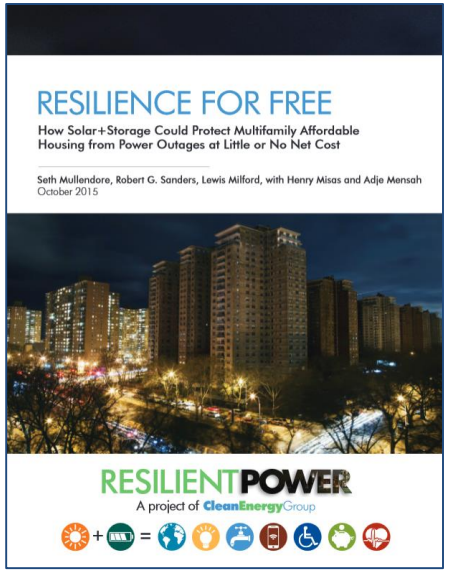
THE RESILIENT POWER PROJECT

- Increase public/private investment in clean, resilient power systems (solar+storage)
- Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
- Engage city, state and federal policy makers to develop supportive policies and programs
- Visit www.resilient-power.org for more information and resources









SUPPORTING 150+ PROJECTS ACROSS THE COUNTRY

Boulder: Nonprofit transportation center serving elderly and disabled residents

Boston: Multiple housing properties representing 1,000+ units of senior and affordable housing

DC: First solar+storage resilience center at affordable housing in DC

Puerto Rico: Supporting the installation of solar+storage at multiple community medical clinics

New Mexico: Added resilience for remote wildfire operations command center

WEBINAR SPEAKERS

Shadea Mitchell
Head of Client Success, Virtual Peaker

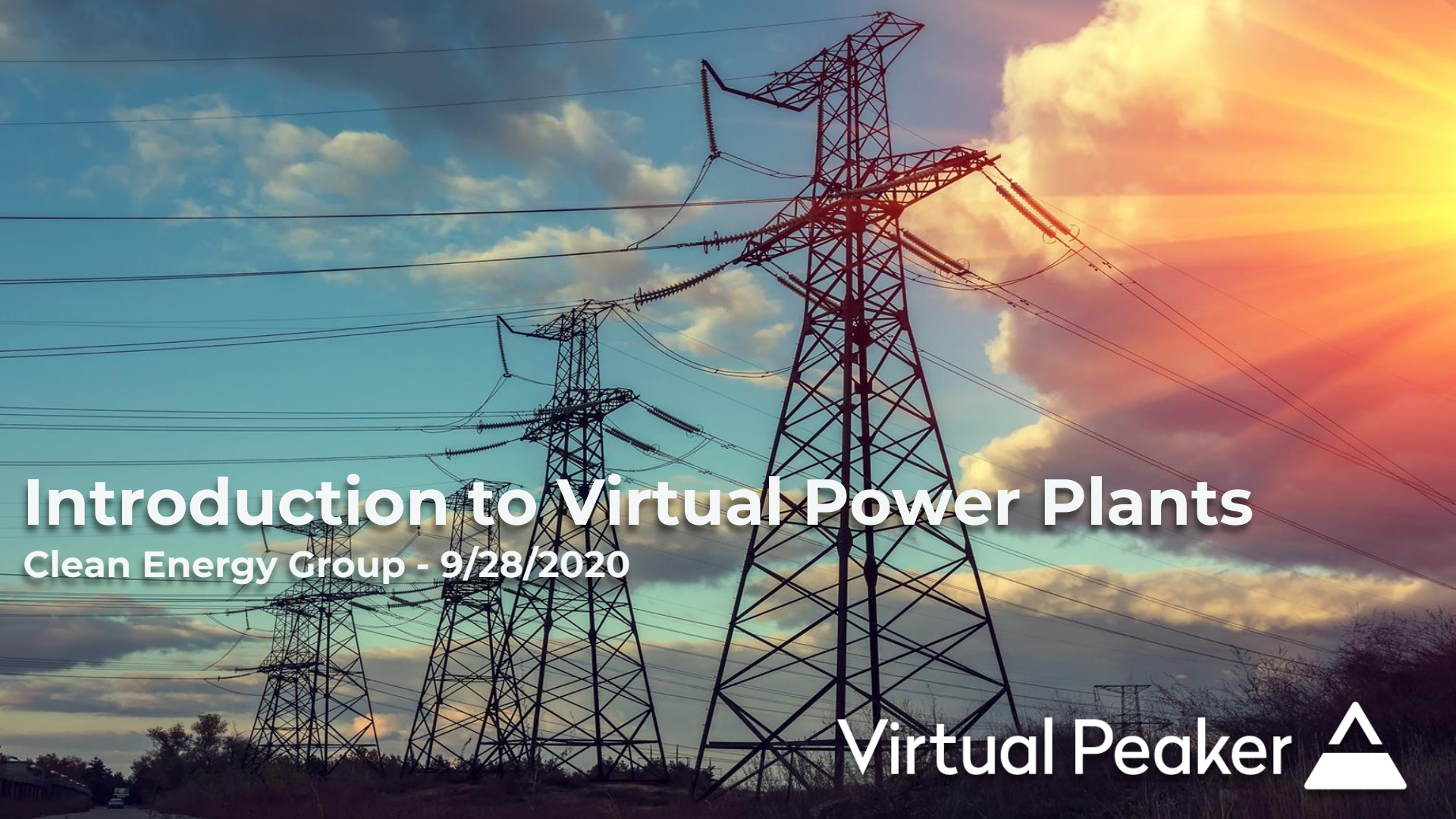
Audrey Burkhardt
Senior Product Development Specialist, Portland General Electric

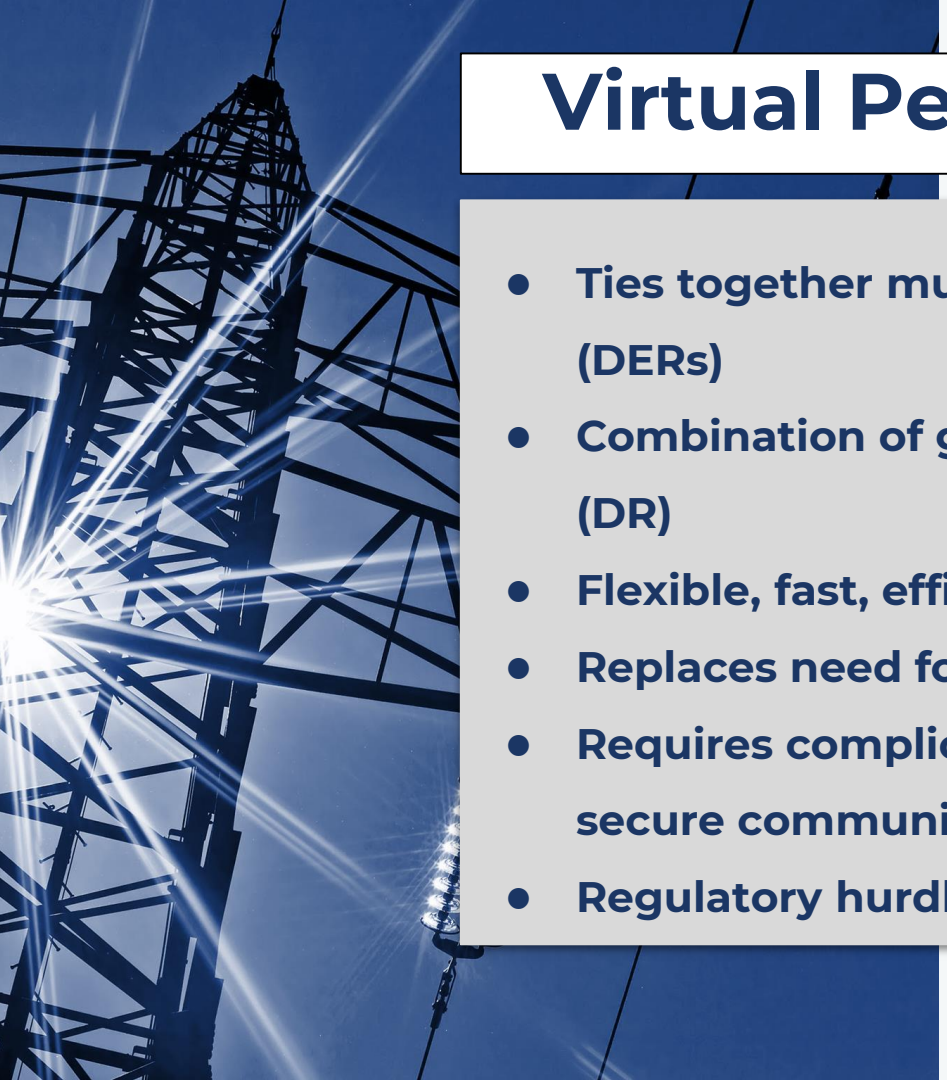
Seth Mullendore
Vice President and Project Director, Clean Energy Group (moderator)

Virtual Peaker

Portland General Electric

CleanEnergyGroup
Innovation in Finance, Technology & Policy


Introduction to Virtual Power Plants
Clean Energy Group - 9/28/2020
Virtual Peaker



Virtual Peaker Plants (VPPs)

- Ties together multiple distributed energy resources (DERs)
- Combination of generation and demand response (DR)
- Flexible, fast, efficient
- Replaces need for fossil-fuel generation
- Requires complicated optimization, control, and secure communications.
- Regulatory hurdles and limitations

The Evolution of Demand-Side Management

DIRECT LOAD CONTROL

One-way communication
High cost
Load shed only
Zero touch with customer

BASIC DR

Two-way communication
Manage events in aggregate
Limited device flexibility
Low-touch with customer

REAL-TIME CONTROL

Device optimized
Manage events at household level
Infinite device types
High-touch with customer
AI and Machine Learning

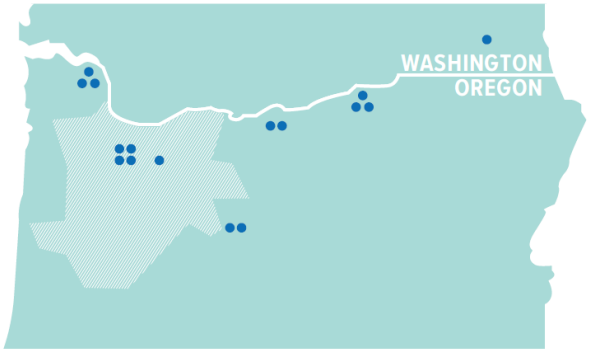
PGE Smart Battery Pilot

Audrey Burkhardt
Senior Product Developer

PGE at a Glance

Quick Facts:

- Vertically integrated company including generation, transmission and distribution. Serving 4,000 mi^2
- PGE customers:
  - Residential 773,514
  - Commercial 110,028
  - Industrial 200
- Serves 46% of Oregonians, 51 incorporated cities
- Total number of employees ~3,000



Diverse generation mix

Hydro, Coal, Natural Gas, Wind, Solar

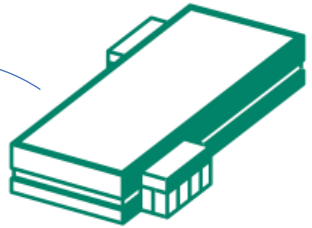
Proposed Projects

Port Westward – 5 MW

Coffee Creek Substation – 20 MW

Baldock Mid-Feeder – 2 MW

Beaverton Public Safety Center
&
Anderson Readiness Center Microgrids



Smart Battery Pilot – 525 homes

Residential Pilot

Objectives

Small scale research study intended to optimize learnings of dispersed battery storage

Grid

- Study and model value to the grid for future use in IRP
- Primary use cases:
  - autonomous volt/var support
  - autonomous frequency response
  - contingency reserve, bulk generation capacity
  - customer power reliability
- Locational benefits studied through Testbed density

Program

- Determine the optimal design for a future scalable, cost-effective program
- Incentive levels, optimal dispatch strategies, integration with power operations, communications & controls technologies

Customer

- Conduct interviews and surveys to understand customer resiliency needs, hurdles to adopting storage
- Balance expectations of battery performance with PGE management of battery operations

Smart Battery Pilot Design

Virtual Power Plant of 525 residential batteries for grid services

2 - 4 MW / 6 - 8 MWh

$40 or $20 per month for interconnected devices

Additional rebate in Testbed to drive density for locational benefits

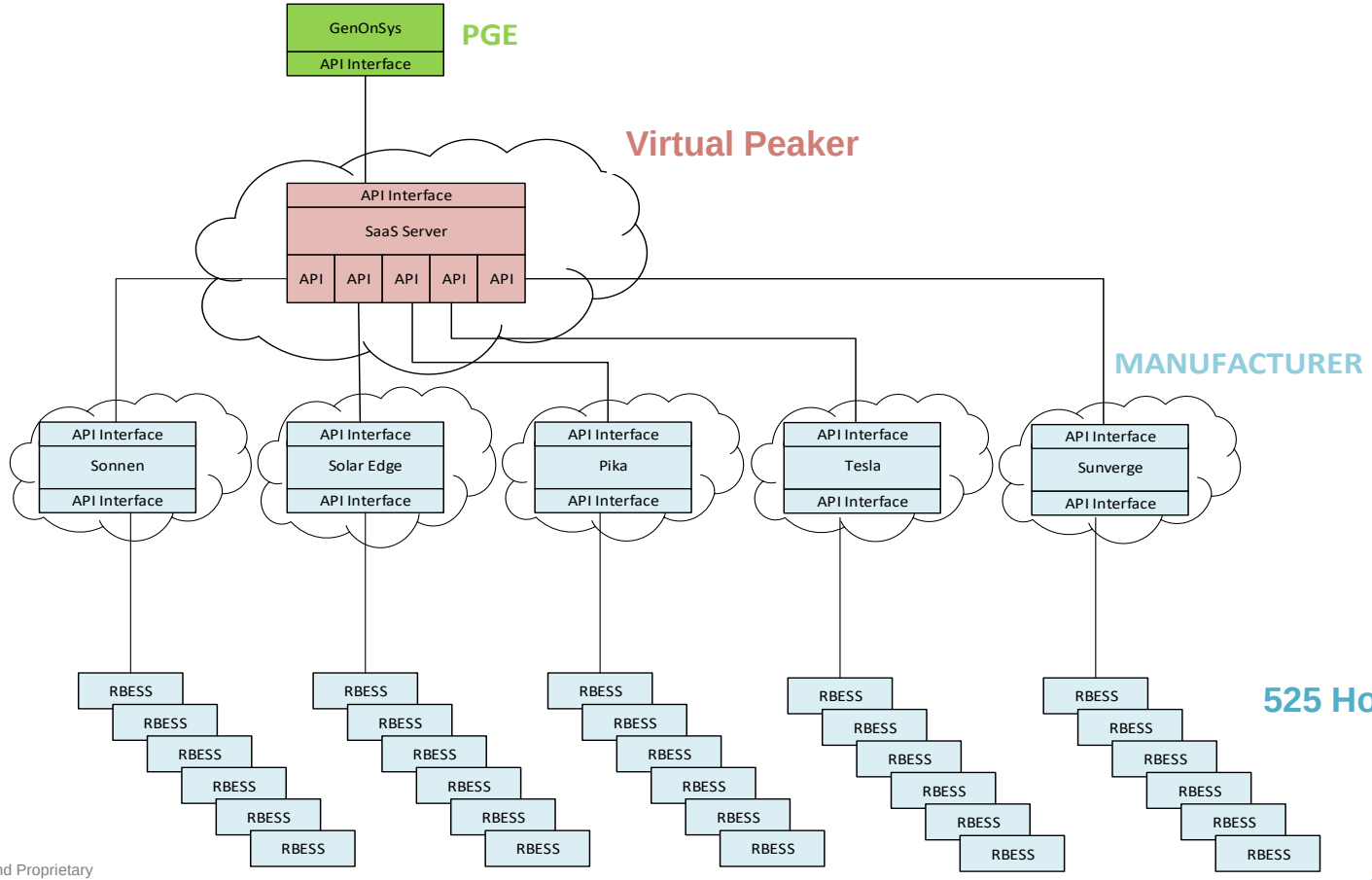
$3,000 → $2,000 → $1,000

Solar Within Reach for Income Qualified

$5,000 for installing storage in conjunction with Solar Within Reach

Qualified devices are Tesla, Generac/Pika, SolarEdge, Sonnen, Sunverge

Architecture



Virtual Peaker

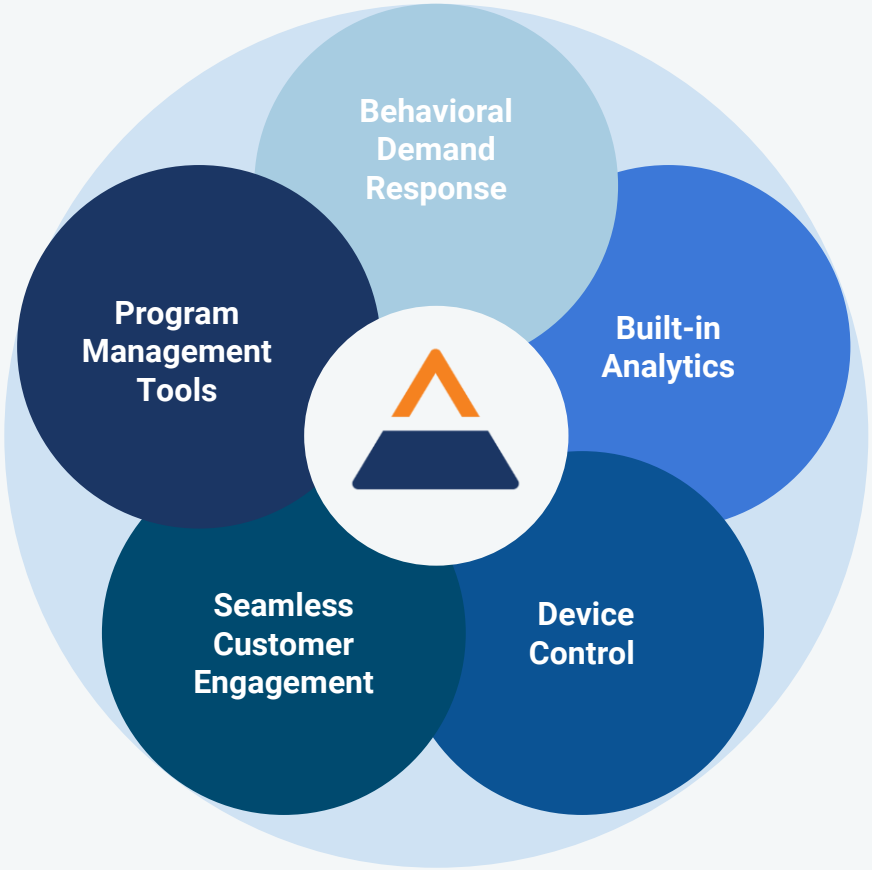
Founded: 2014

Located: Louisville, KY

Business Model: SaaS

- Serves as the software engine behind residential DER, DR, and VPP programs across the US

Virtual Peaker: An adaptable SaaS solution

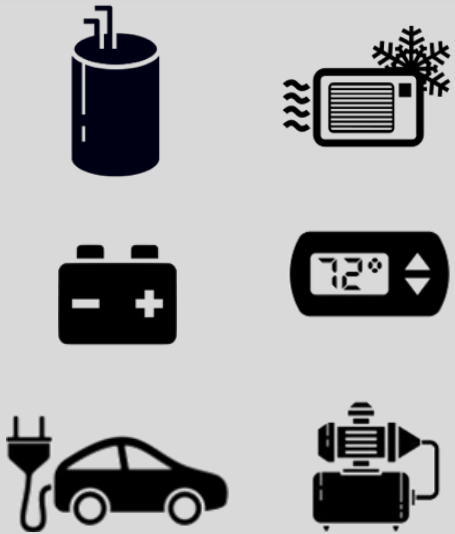


- Tie together multiple programs needs
- Manage both front and back end requirements
- Deploy in weeks, not months
- Right-size contract for any utility

Virtual Peaker

How We Do It

Energy Demand

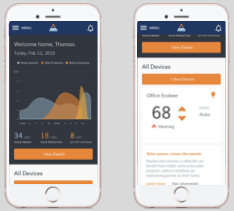


Integration

Real-time Analytics And Control

Utility API

Action



Homeowner Interface

Utility Interface

The Broadest Manufacturer Support

Thermostats	Water Heaters	Storage	EVSE	Room AC & Mini-Splits	Smart Circuit Breakers
nest resideo ecobee EMERSON	GE Rheem aquanta e-Radio	GENERAC solaredge sonnen SUNVERGE TESLA POWERWALL	JuiceNet SMART [GRID] EV CHARGING chargepoint flo	LG GE SENSIBO IntesisHome	EATON Powering Business Worldwide

Robustly integrate with a new device in ~2 weeks

Virtual Peaker

Shadea Mitchell

Head of Client Success

270.519.3192 smitchell@virtual-peaker.com

Thank you for attending our webinar

Seth Mullendore
Vice President and Project Director
Clean Energy Group
seth@cleanegroup.org

Find us online:

www.resilient-power.org
www.cleanegroup.org
www.facebook.com/clean.energy.group
@cleanenergygrp on Twitter
@Resilient_Power on Twitter

CleanEnergyGroup
Innovation in Finance, Technology & Policy

RESILIENT POWER
A Project of Clean Energy Group

Upcoming Webinars

Nantucket Island Energy Storage: Batteries for Reducing Peak and Deferring Infrastructure Investment
Friday, October 9, 2-3pm ET

Financing Resilient Power in Underserved Communities: Moving Forward with Distributed Solar+Storage Projects
Tuesday, October 20, 2-3:30pm ET

Read more and register at: www.cleanegroup.org/webinars