

Cirrus FLEX

AGGREGATED CONTROL OF
DISTRIBUTED ENERGY RESOURCES FOR
OPTIMIZED MARKET PARTICIPATION



**ENERGY
STORAGE**

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PRODUCT OVERVIEW

01

Cirrus Flex is a cloud based control and optimization platform which enables Distributed Energy Resource (DER) owners to maximize stacked benefits for their portfolio of disparate fleets of energy assets. This is achieved through control, reporting and visualization capabilities whilst interfacing across energy, grid services and flexibility markets.

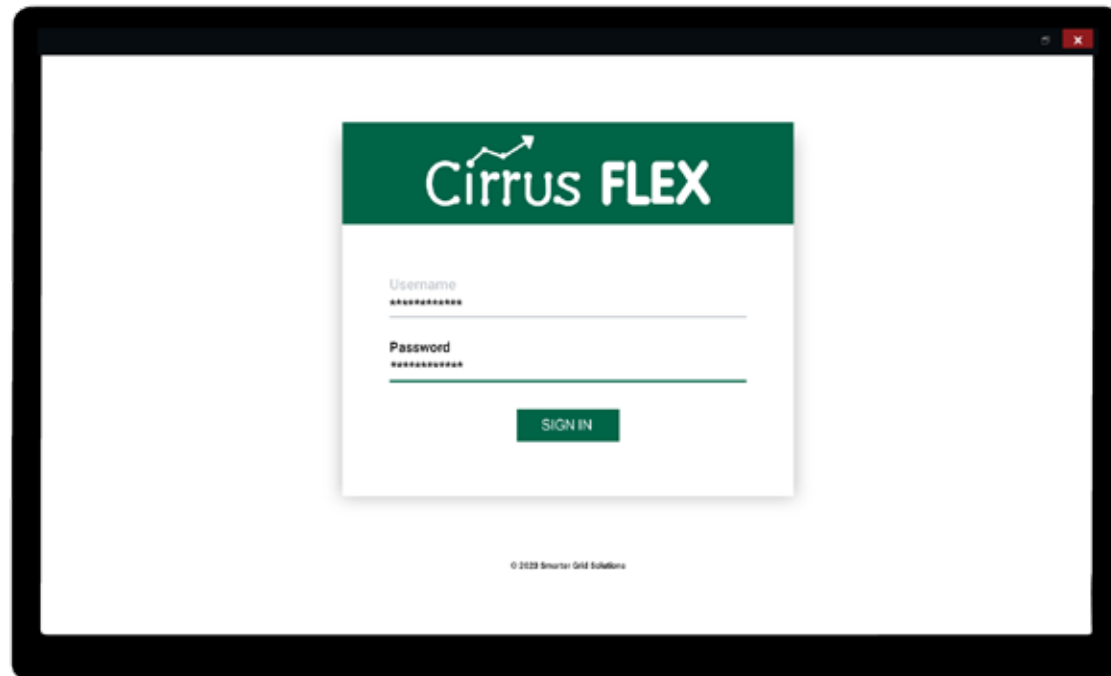
This cloud hosted Virtual Power Plant (VPP) platform enables optimized participation in markets, powered by advanced, predictive analytics, forecasting and seamless handling of disparate fleets of DERs. Cirrus Flex is setup to address emerging opportunities from FERC Order 2222 in the US and similar market transitions internationally.

Grid-scale battery owners/operators, energy asset Original Equipment Manufacturers (OEMs), finance houses, Commercial and Industrial (C&I) organizations, local authorities, and community energy organizations all need to visualize, report on, and control their DERs to maximize value from energy and flexibility markets. Cirrus Flex solves these customer problems and is optimized for user need.

Energy Service Companies require those same market interfaces plus enhanced user features for owned and third-party DER assets. Cirrus Flex integrates with a diverse range of the Internet of Things (IoT) enabled DERs through modern cybersecurity interfaces.

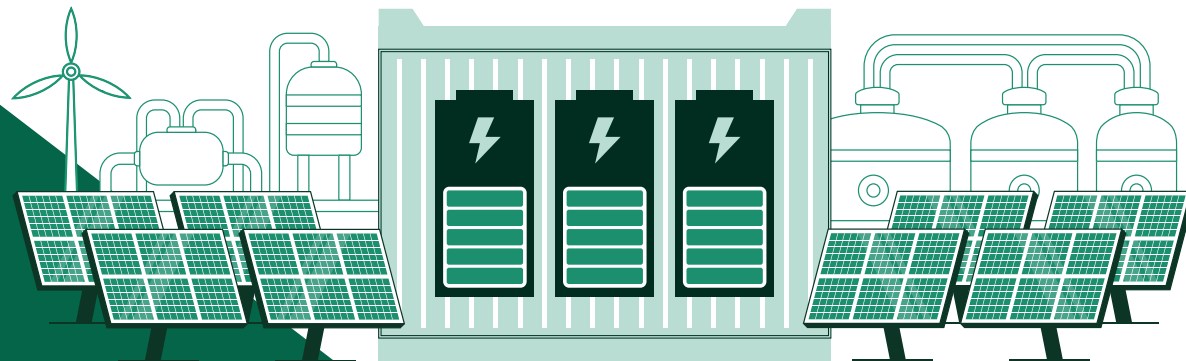


What makes Cirrus Flex unique?

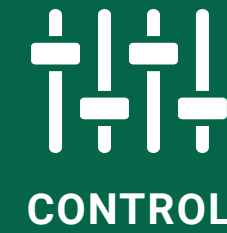


We have more than a decade of experience working with Utilities, delivering a wide range of DER use cases, device controls/protocols, and integration with utility ADMS and SCADA systems – all creating a robust, flexible and scalable platform to optimize, ensuring you have a highly resilient system to control and monetize your DERs.

02



VISUALIZATION



CONTROL

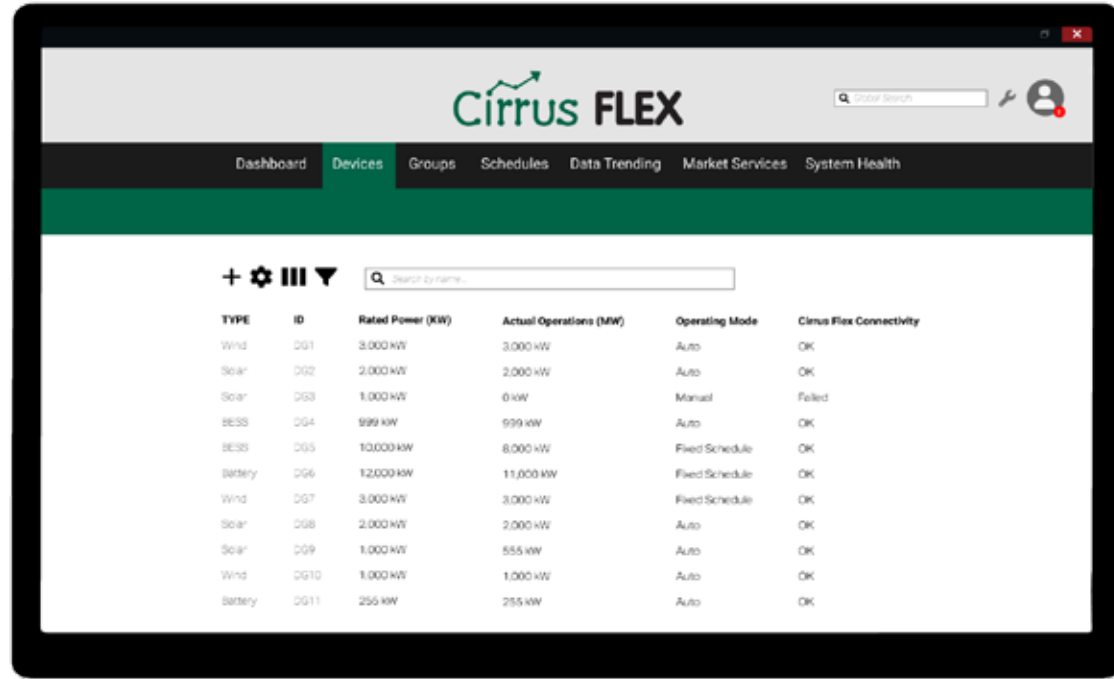


REPORTING

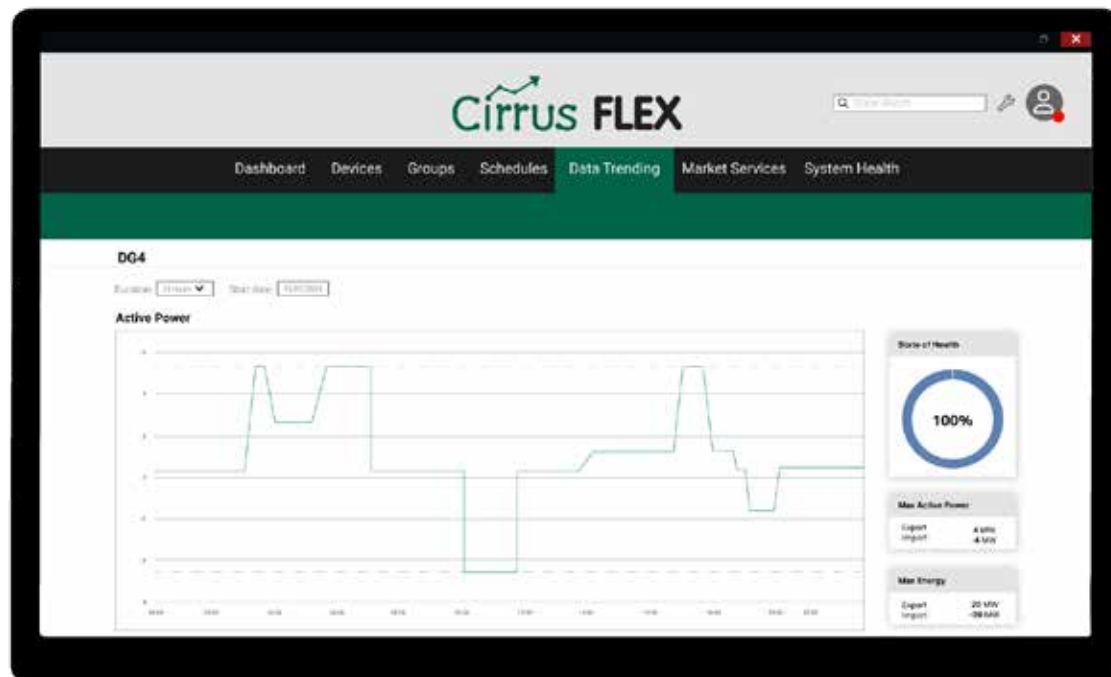
- Enabling portfolio and group control of DERs, diverse across technology and size
- Multiple DER integration options to support control direct to DERs, in-front and behind-the-meter, individual devices, hybrid sites and aggregations through direct or scheduled dispatch, via open standards and secure public internet networks
- Optimized interfaces to energy and flexibility markets
- Predictive Analytics that provide users with the flexibility to build the best solutions to meet business requirements without being restricted to 'out of the box' algorithms
- Open Data Access – Cirrus Flex stores all the data you need to create settlement, baseline, and performance reporting for your DERs using simple Application Programming Interface (APIs) to access data stores, and leverage powerful Business Intelligence (BI) tools



Reference Architecture

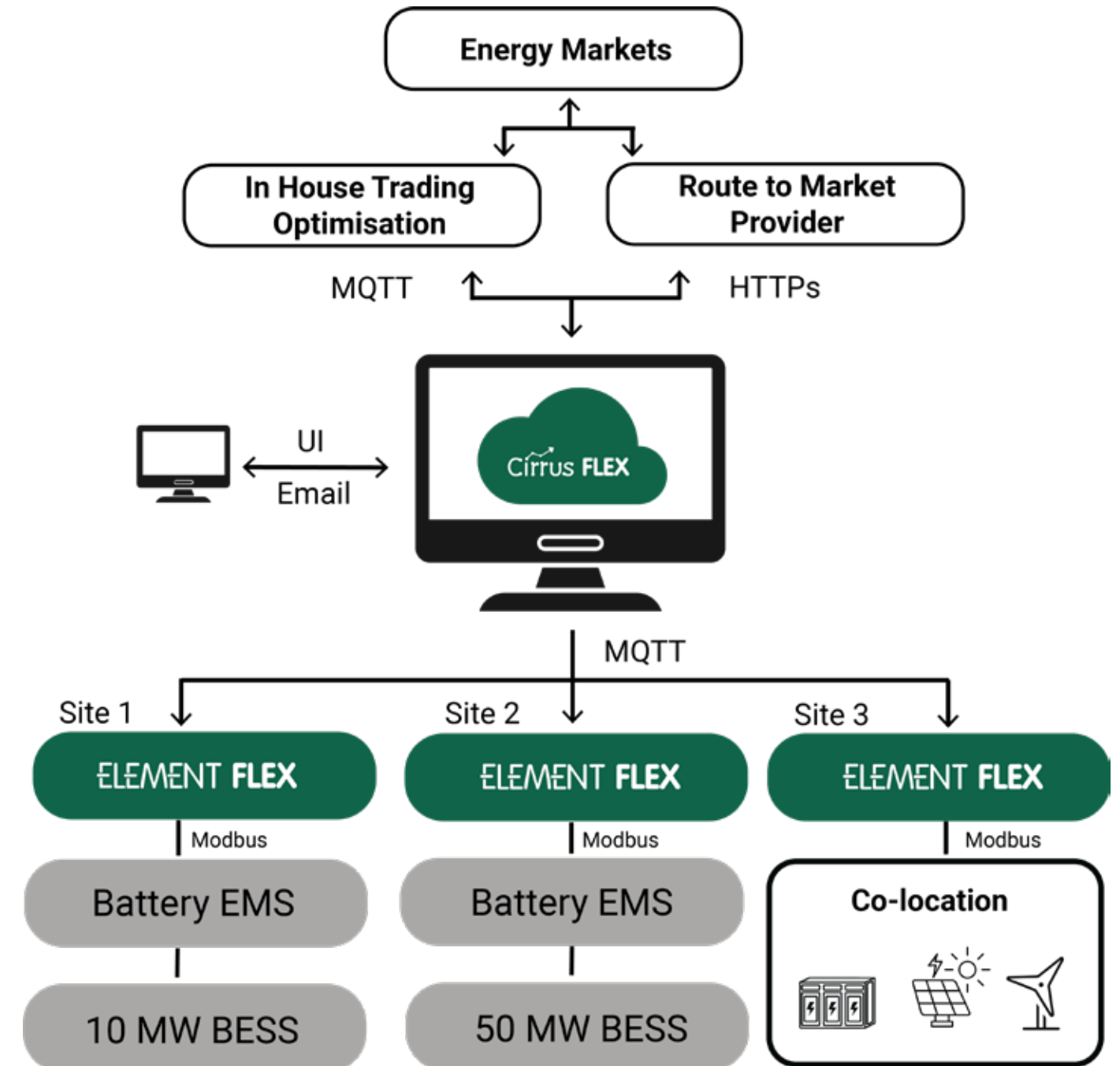


Devices Overview



Data Trending

03



Cirrus Flex interfaces to multiple trading partners/optimisers, to spread trading strategy risk

Hosting Environment and Security

Cirrus Flex exploits inherent cloud capabilities to provide enhanced levels of resiliency and ensures it can scale both vertically and horizontally to meet current and anticipated needs.

Our product has been independently penetration tested to ensure compliance with industry standards, and is based on established and accepted security architecture best practices:



- Multiple geographical deployments to ensure high availability & scalability of services
- Leverages Amazon Web Services (AWS) Security & Networking features to protect information and assets
- AWS Identity Access Management policies to control access to resources using a Grant Least Privilege policy
- Monitoring, logging and alerting capabilities for observability
- Integration with Auth0 for modern authentication & permission management
- Support for flexible password policies and session control, including timeout, lockout & multi-factor authentication
- Support for fine-grain role-based access control to allow flexible access to assets and control capabilities
- Secure HTTPS access to User Interface (UI) & web services using TLS 1.2 encryption
- Comprehensive security auditing of user activity at both operating system and application layers
- AWS Network Firewalls enabled with deny-all default policies
- Infrastructure & Application software built using best practice hardening policies
- Regular Security patching and updates to ensure a stable and secure platform

04

Key Features and Integrations

05

| | |
|---|---|
| ✓ | Automated, scheduled, and direct dispatch of DER with re-dispatch capabilities |
| ✓ | Aggregated DER portfolio optimization against customer objectives |
| ✓ | DER and market operational forecasting |
| ✓ | DER registration and management |
| ✓ | DER real-time monitoring |
| ✓ | DER reporting, including performance visualization and delivery verification |
| ✓ | Service delivery event settlement |
| ✓ | Management reporting (e.g. CO2) |
| ✓ | Owned and third-party asset integration |
| ✓ | Direct and aggregator integration |
| ✓ | Front-of-the-meter (FTM) and Behind-the-meter (BTM) DER integration |
| ✓ | Trading tool or platform integration |
| ✓ | Coordinated local, regional, and national market interfaces and user interactions |
| ✓ | Utility systems integration |
| ✓ | Operator user interface |
| ✓ | End customer portal / app integration |

Reference Projects



Confidential Australian Developer Battery Aggregation and Market Participation

Status: In Construction

The Australian Battery Developer is adding multiple utility scale, front-of-the-meter batteries and needs a solution to hold and dispatch schedules, monitor and report on device operation and provide insight into device performance. The solution is a VPP powered by Cirrus Flex, allowing for aggregated participation in multiple markets with interfaces to trading optimisers. Cirrus Flex optimally dispatches individual batteries fulfilling the aggregated trading position whilst accounting for price, asset warranty conditions and operating conditions.



Community Energy Virtual Power Plant

Status: Operational

Low Carbon Hub is leading an ambitious, wide-ranging and innovative trial, seeking to accelerate the UK's transition to a zero-carbon energy system. The solution uses Cirrus Flex as a cloud hosted platform to deliver new market and flexibility models, advance the capabilities of distribution networks to manage smart, renewable and storage technologies (including building management systems, battery storage and solar power) and facilitate local community group participation in energy markets.



Smart Energy Management Platform for Net-Zero Carbon

Status: Operational

West Berkshire and Reading Borough Councils are installing new Electric Vehicle (EV) charging infrastructure in combination with renewables and building energy management systems. The primary objective is meeting municipal carbon reduction targets through improved asset operational status monitoring and integrating energy, carbon and market data flows to Cirrus Flex. That data is then used by Cirrus Flex to check the performance and optimize the operating schedules of the new, clean, on-site energy assets.



Battery Revenue Stacking

Status: Operational

Con Edison and Endurant wanted a solution to aggregate utility scale batteries to dispatch peak load relief services, and then allow Endurant to trade residual battery capability in the New York Independent System Operator (NYISO) markets. The deployed solution consists of a cloud-hosted instance of Cirrus Flex that integrates directly with both ConEd and NYISO to enable both utility grid services and market revenues. Revenue stacking grid load relief services and NYISO market services has enhanced the return on investment.

OPERATIONAL FORECASTING

Cirrus Flex integrates with external weather forecasting API's and real-time grid telemetry to provide ruggedized operational load and generation forecasting that can subsequently power advanced DER optimization and other predictive analytics. A fully configurable DER schedule and dispatch engine supports diverse DER participation models that can be configured depending on the operational objectives to provide DER forecasting, optimization, and control, either in isolation or altogether.

ASSET MONITORING, CONTROL AND REPORTING

The Cirrus Flex User Interface delivers a modern experience and puts power in the hands of the operator to monitor their assets in real-time, whilst delivering insight and verifying historical performance with customizable visualizations.

It provides control capabilities at both an aggregated level and down to individual devices, to allow the user to override and take control actions.

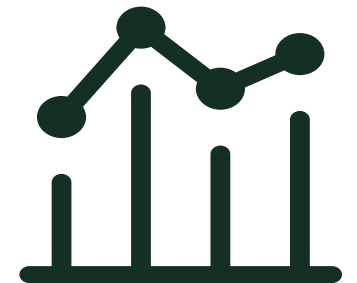
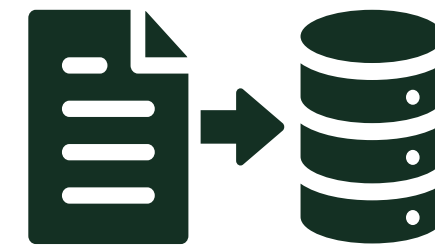
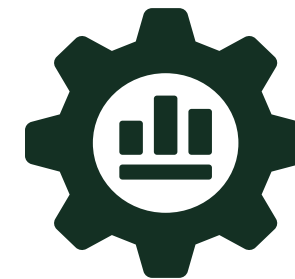
Cirrus Flex enables a diverse set of DER operation and market participation models. Users can group DER to make a single controllable entity and utilize the same monitoring and control capabilities as they would with individual DER assets to manage any number of devices.

In addition, Cirrus Flex contains an operational data store which records all system actions, calculations, and DER feedback data for reporting purposes and post-event analytics to fuel analysis and refinement.

ADVANCED DER OPTIMIZATION

Cirrus Flex brings together best-in-breed technologies and techniques that interface with device, grid and market data to maximize the utilization of disparate fleets of DERs to unlock multiple, stacked revenue streams. Cirrus Flex hosts a configurable optimization application, to enable customers to specify objective functions that fit their specific operational strategies and optimize energy, carbon, costs and revenues.

Our optimization approach is highly flexible and leverages the power of AMPL (third-party optimization software) to solve complex problems. Any monitored or calculated data point is available to the optimization, and objectives and constraints are customizable based on customer needs and the use case. Our diverse real-world experience in operationalizing advanced analytics ensures that the DER optimization strategy deployed is suitable for reliable operations.



ADVANCED VIRTUAL POWER PLANT OPERATION

Using its unique DER device management and real time application hosting capabilities, Cirrus Flex can be easily configured to provide Virtual Power Plant (VPP) operation for a wide range of aggregated DER assets and in technical and commercial VPPs of different scales. These flexibly and dynamically grouped DERs within VPPs can be scheduled and controlled to deliver value adding services for the DER owner, grid and market.

MARKET AND GRID INTEGRATION

Enabling customers to stack revenues, maximizing the value of energy assets through flexibility market, energy market, grid services and behind-the-meter revenue and value streams. Cirrus Flex provides the ability for customers to opt-in / opt-out from any event via the user interface or over the aggregator API, and provides the tools needed to assist our customers in achieving FERC Order 2222 objectives.

The Cirrus Flex optimization application can be used to optimize asset schedules based on market price or asset forecasts, or to inform the optimal bid/offer combination for different assets and aggregations. Objective functions are developed in collaboration with customers to reflect the business strategy and available operational data and forecasts.

ENERGY AS A SERVICE BUSINESS MODELS

Our solutions enable customers to develop new business models by combining and optimizing mixed portfolios of DER assets for grid and market applications. Our customers can incorporate and realize investment finance and build in operational objectives as configurable rules to secure those business models.

Our product enables individual device control utilizing SGS's grid edge product, Element Flex, or integration with existing device control systems.

DEVICE MANAGEMENT

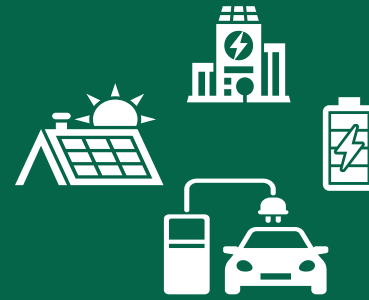
Cirrus Flex has a technology agnostic approach to integration with the ability to integrate directly or via aggregators for all types of DER: energy storage (including grid-scale batteries), distributed generation (PV, wind, thermal), water pumps, AC cycling switches, and utility owned/third party owned Energy Storage Systems, smart thermostats, residential, or, commercial & industrial (C&I) devices.

Cirrus Flex uses modern IoT protocols including Message Queuing Telemetry Transport (MQTT) and REST APIs to provide reliable connections to owned and third-party assets, either via direct links or aggregators. Adaptors can be used to extend to ICCC, DNP3, Modbus, OpenADR, SunSpec. Our product enables individual device control utilizing SGS's grid edge product, Element Flex, or integration with existing device control systems.

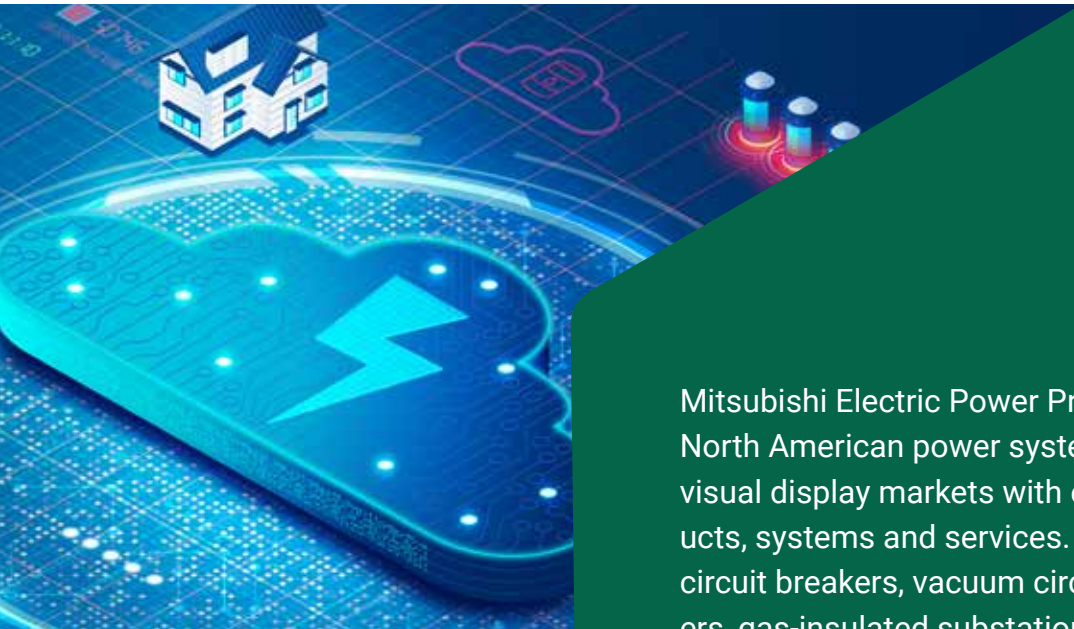
Cirrus Flex can be used to meet FERC 2222 operating guidelines and manage groups of assets - DER are able to be grouped dynamically by the user (e.g., by DER type, zone substation, or ISO node).



Behind-the-Meter



Front-of-the-Meter



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