



MICROGRID SOLUTIONS

PowerStore™

Javier Ricardo Ruiz, Local Sales and Marketing Manager

Potencia confiable donde y cuando se requiera



Agenda

Una Mirada el Mercado de Micro redes y drivers para almacenamiento de energía

ABB en Micro redes

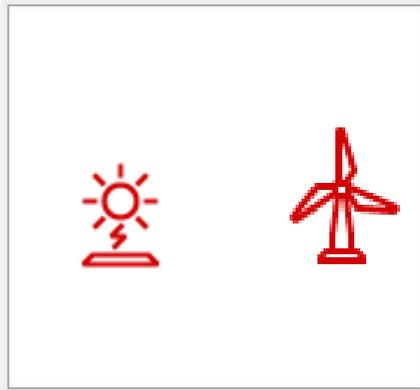
Soluciones de Micro redes

Casos de ÉXITO

Resumen

ABB in Microgrids

Mensajes Clave

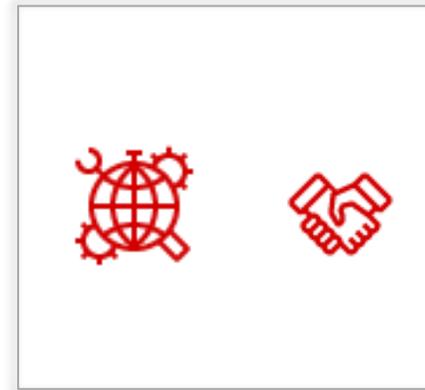


SIMPLICIDAD

Portafolio
confiable y
probado



ESCALABILIDAD / MODULARIDAD



EXPERIENCIA

Una mirada al Mercado de micro redes

Energía limpia es el futuro

Mercado de Micro redes

Tamaño del Mercado Global, crecimiento y pronóstico

El Mercado de Micro redes se espera alcance **\$ 38.99 Billones** en 2022, a una Tasa de Crecimiento Anual (CAGR) de 12.45%¹

La capacidad global de Micro redes, se espera crezca de 1.4 GW en 2015 a **7.6 GW** en 2024²

Más de **400** Proyectos individuales se encuentran en operación o en desarrollo a nivel mundial

El Mercado de Micro redes se expandirá a un extraordinario **20.70 % CAGR** debido al desarrollo de tecnologías de energías renovables⁴

El Mercado global de almacenamiento de energía en micro redes se espera crezca a una tasa de crecimiento anual (CAGR) de más de **27%** para 2019⁵

Una Mirada global al Mercado de Micro redes por varios analistas

Challenges of the future power grid

Long-term drivers for energy storage

Electricity Consumption on the rise

- Electrification of everything – moving towards electricity as the primary source of power
- Economic and population growth will lead to increasing demand for power

Coal plant retirements

- Reducing baseload power capacity
- Limited resources for ancillary services on the utility grid

Growth in renewables

- Governments and industry moving towards solar and wind
- Intermittent generation sources can reduce reliability on the electrical grid.

Electrification of transportation

- More users of EVs can increase peak loads placing more strain on the electrical grid.
- Increase in high speed rail

Proliferation of Smart Grid Technology

- Bi-directional flow of power requires additional coordination between power supply and demand

Tax and regulatory incentives

- Renewable mandates and incentives increasing demand for clean grid technologies
- Potential tax benefits for storage systems (residential, commercial and utility)

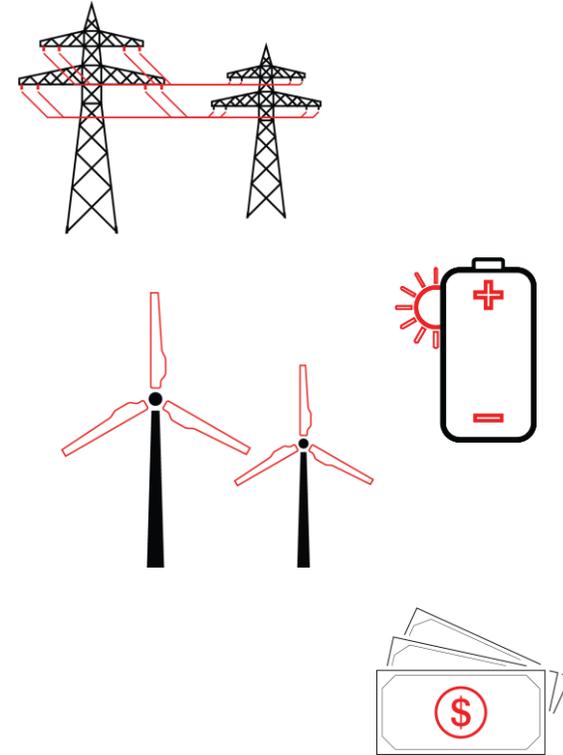


ABB in Microgrids

Rich experience and innovative solutions

ABB in Microgrids

Pioneer in technology, solutions and execution

25+



25+ years of experience

Innovation and technology leadership



Reliable and proven portfolio

40+



40+ successfully executed project

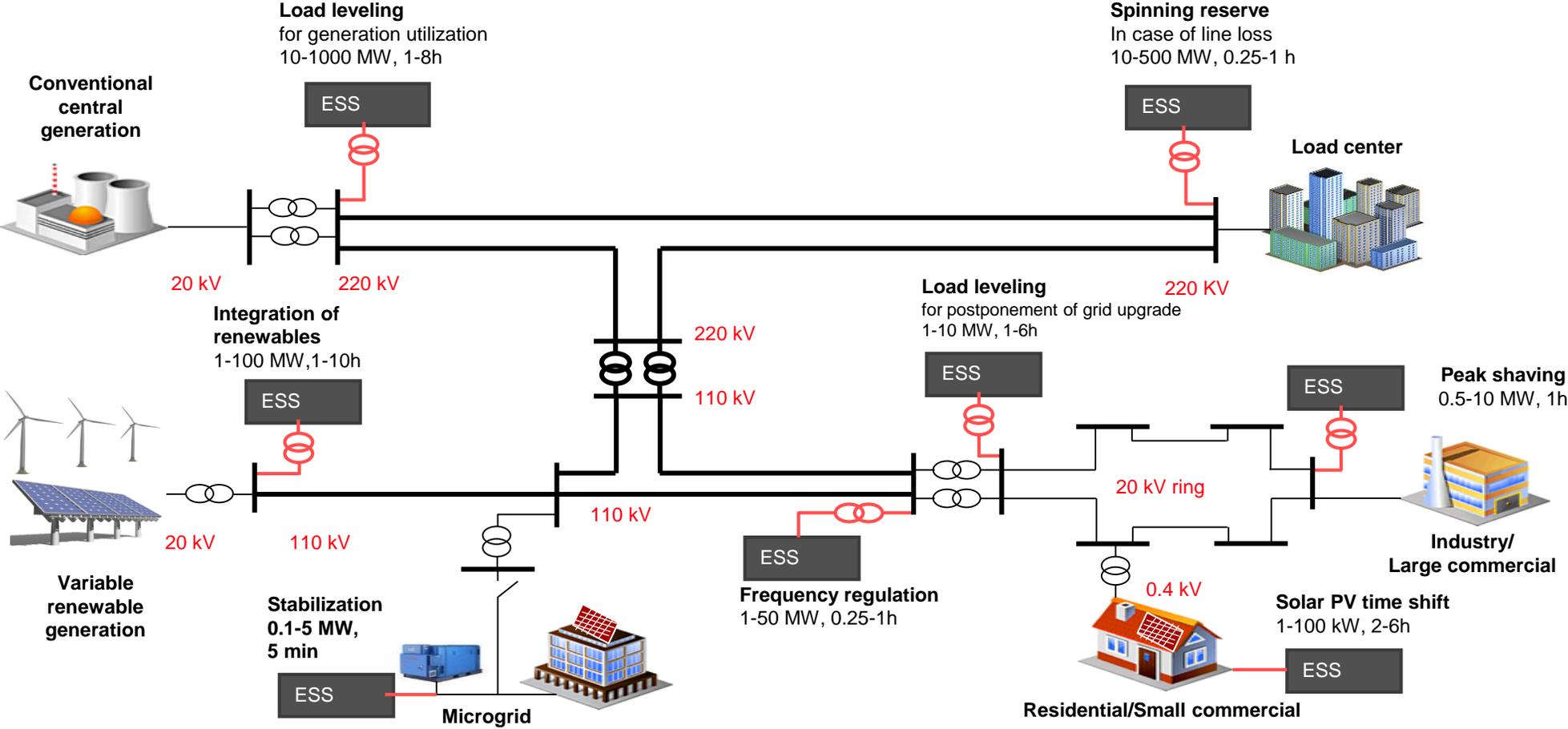
Global sales and service network



Microgrid Solutions

Products & services

Grid connected energy storage applications



Battery energy storage solutions

ABB stationary energy storage offering

Residential – REACT



C & I – EssPro™



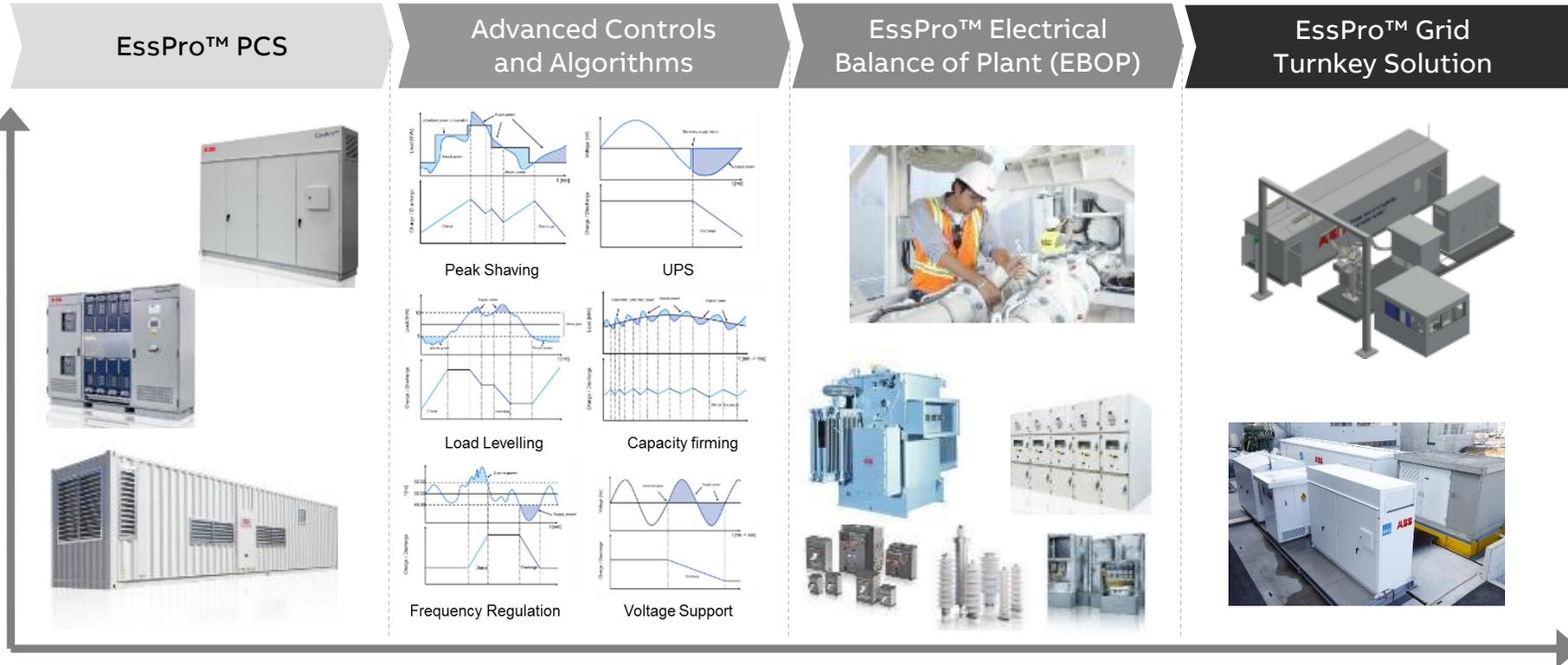
Utility-scale – EssPro™



ABB offers battery energy storage solutions from kW to MW range

EssPro battery energy storage solutions

Utility-scale offering



- ABB is a pioneer and leader in energy storage
- Flexible and modular solutions to fit customer requirements

- Advanced controls and algorithms for full asset value and optimization
- Minimized risk due to proven technology

- Expertise in grid operations and systems
- Utility grade, robust designs

EssPro power conversion system (PCS)

System sizes from 50 kW to 50 MW

Indoor units



Outdoor enclosures



Outdoor system solutions



Modular and flexible design

Wide range of standard product offering

50kW-300kW power converters

Dynamic power control (P) and reactive power control (Q)

Harmonic mitigation up to 50th

Islanding mode and black start

CAN communication

Modularity for high-current applications

Full redundancy & flexibility (independent DC busses)



100kW-50MW power converters

Dynamic power control (P) and reactive power control (Q)

Generator emulation control mode

Grid stabilization features (synthetic inertia and active damping)

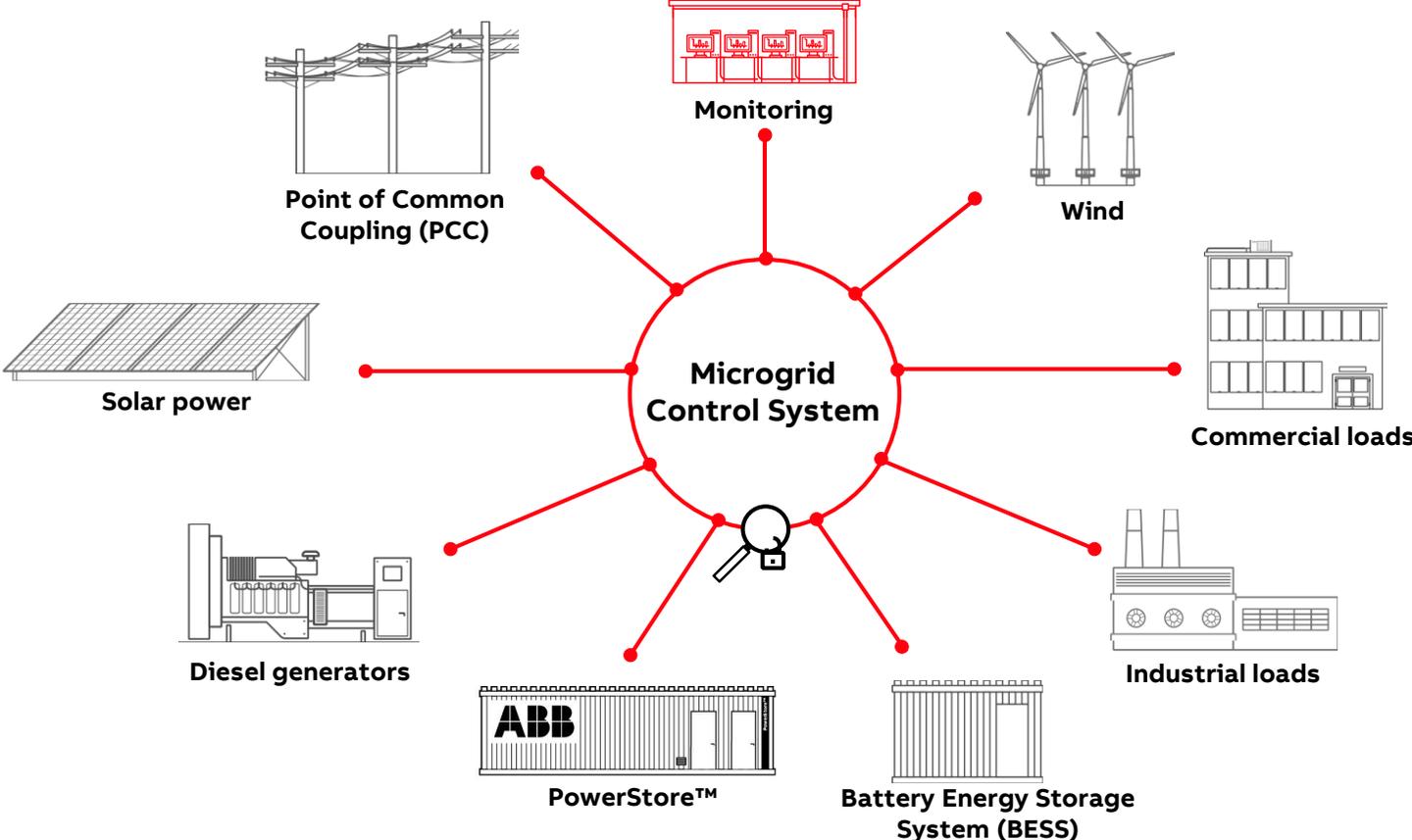
High and low-voltage ride through

Island mode and black start



PowerStore™ Automation

Scalable, flexible, expandable through distributed control



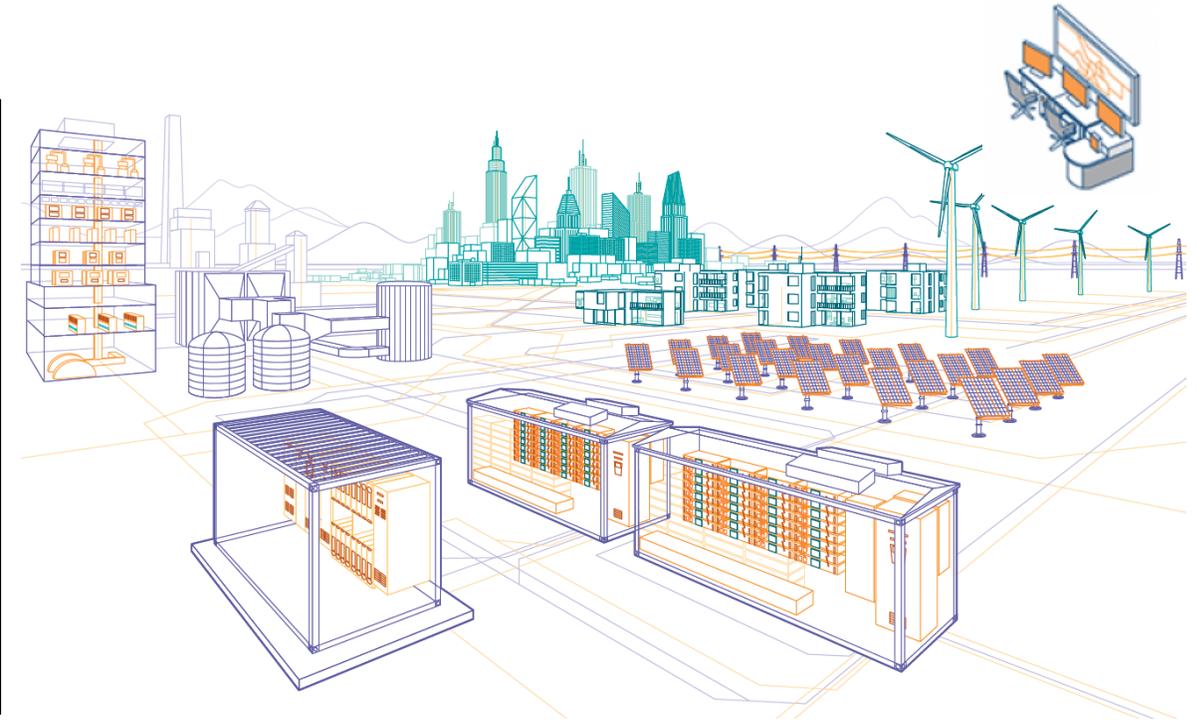
PowerStore™ Automation

Integration with the Microgrid Plus Control System

Unlocking the power of storage through smart automation

Microgrid Plus Control System responsible for coordinating the operation of different generation and loads and successfully integrating renewables into microgrids

- Distributed logic enhances reliability and scalability for future system expansions
- Enable optimum loading and spinning reserve of fossil fuel generators
- Easy to design, install, maintain and configure
- Optimizes use of renewable energy in systems with or without fossil fuel technologies in a cost and energy efficient manner
- Stabilizes the grid against fluctuations in voltage & frequency



Specially designed networked control system responsible for efficient and reliable power flow management

PowerStore™ HMI

Dedicated visualization for PowerStore™

Real-time view of your plant performance

With PowerStore™ HMI system you can remotely access, visualize, control and record most important variables/data from PV plant, wind turbines, feeders, and battery

- Simple intuitive user interface
- High-resolution trending, web based visualization packages, alarm system and event reporting
 - Local operation
 - Efficient maintenance
 - Remote access
- Optional Integration with plant level SCADA systems
- Interfacing with plant level control and visualization systems

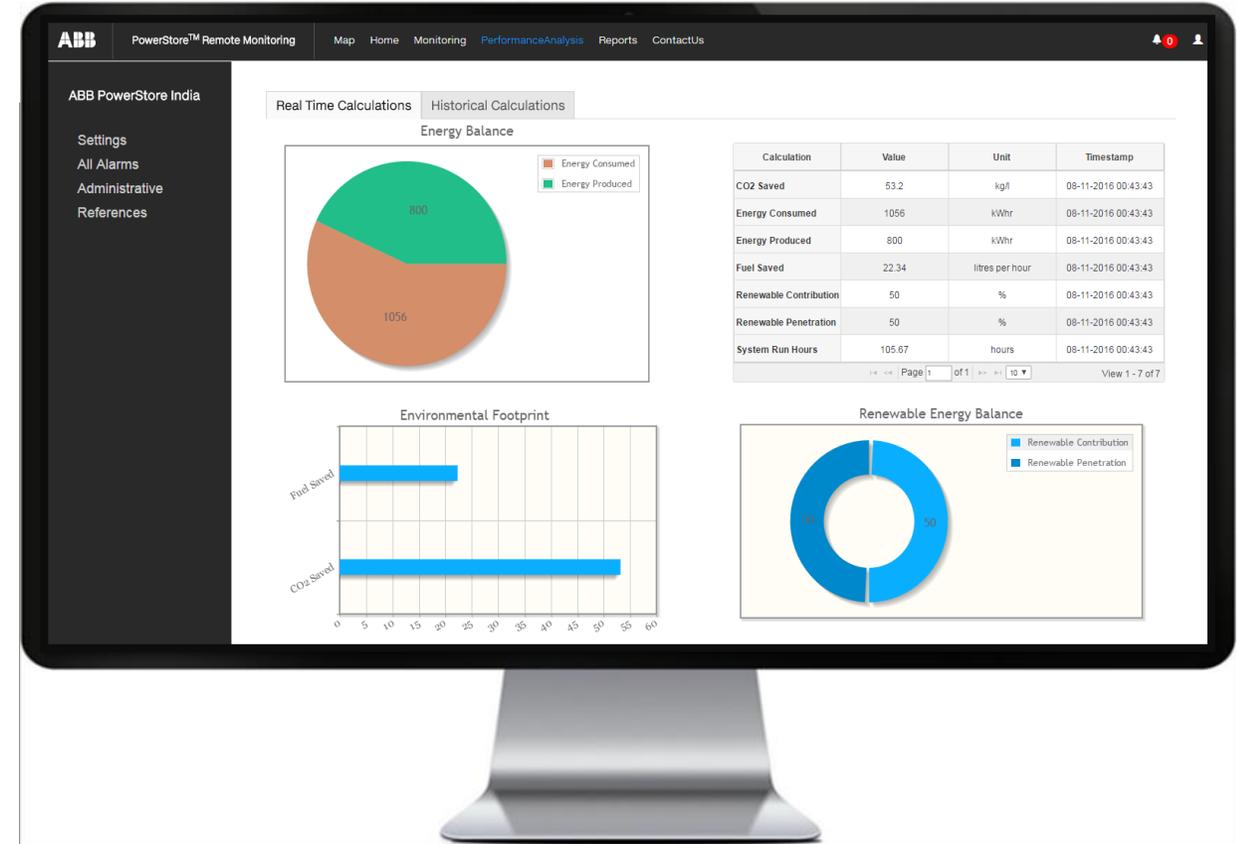


PowerStore™ Remote Monitoring

Efficient asset management

Monitor your assets anywhere anytime

- A comprehensive solution for unmanned sites to increase productivity, improve energy efficiency and reduce operational costs
- Edge computing architecture
- Cyber security compliance
- Main features:
 - Real time monitoring
 - Real-time & historical data trends
 - Key performance indicators
 - Alarms and controller parameters monitoring
 - Reports generation
 - User account management and user profiles



PowerStore™ Remote Services

Improving operations and maintenance with remote optimization

Cloud-based service portal

- A cloud-based remote service system that maintains the integrity of microgrid assets around the clock – anywhere in the world
- Helps customers to operate their microgrid at the highest possible levels of capacity, flexibility, reliability and operational security, and to extend the plant life cycle
- Detailed data analysis to optimize the operation and to protect the customer's return on investment
- Works 365 days a year, 24 hours a day
- Provide predictive, preventive and corrective maintenance
- Offer process analysis and support from skilled staff
- Remote diagnostics and remote operational control
- Multiple Microgrid managed by one platform
- Performance monitoring and reporting

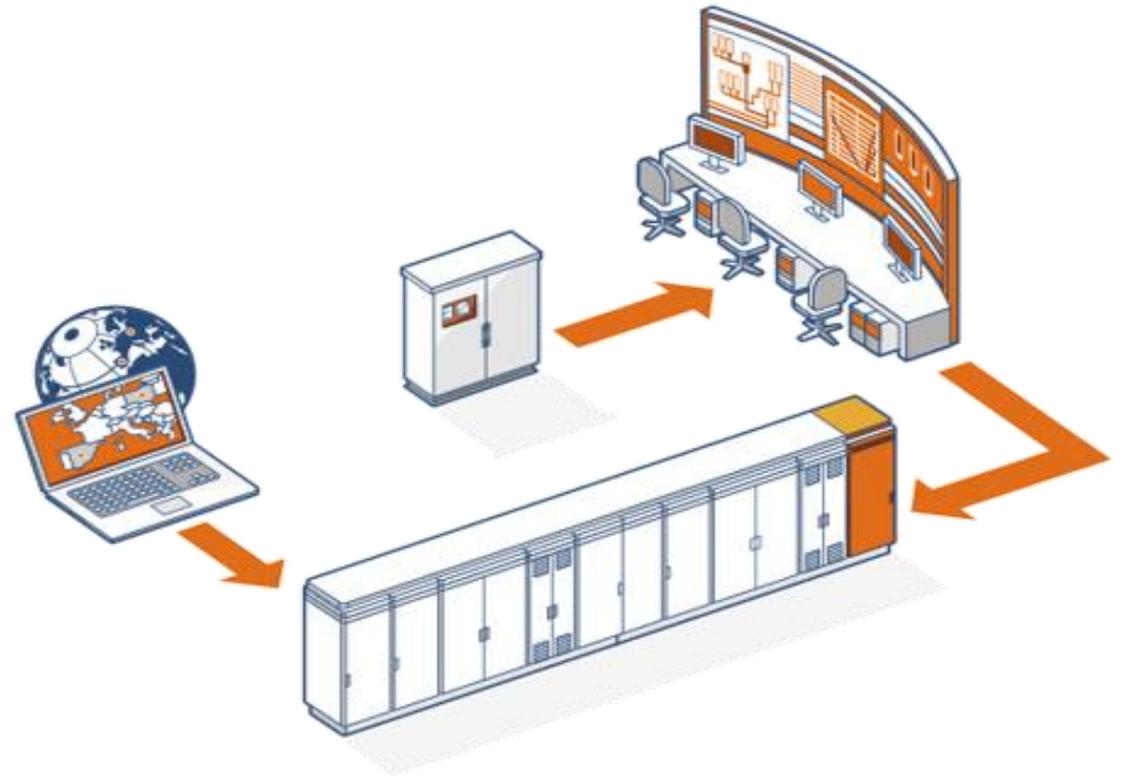
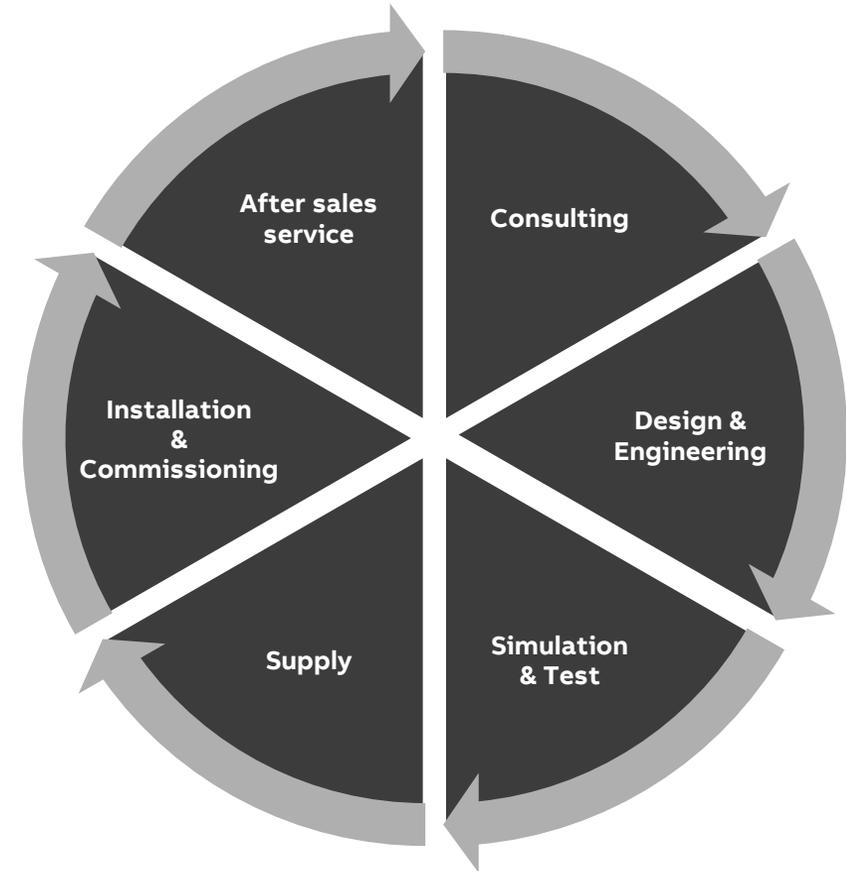


ABB Microgrid Care

A trusted partner throughout the entire lifecycle

Care throughout the complete lifecycle

- ABB's Microgrid care is designed to maximize your return on investment and to keep the system operating at the highest efficiency and availability throughout its entire lifetime.
- ABB protect your investment through the stepwise evolution to minimize the consumption of energy, prolong microgrid asset operating life, and minimize the cost of ownership
- ABB consulting offering is based on extensive process and application know-how as well as one of the largest installed bases in the world
- ABB installation and commissioning services are available globally, supported by our teams of fast, efficient and highly-trained installation and commissioning experts
- ABB advanced remote services provide world-class support, the highest level of competence and deep understanding of all your Microgrid solutions and processes



— Success Stories

Proven track record with significant global installed base

EssPro™ Installed Base (Full Turnkey/PCS)

Worldwide experience

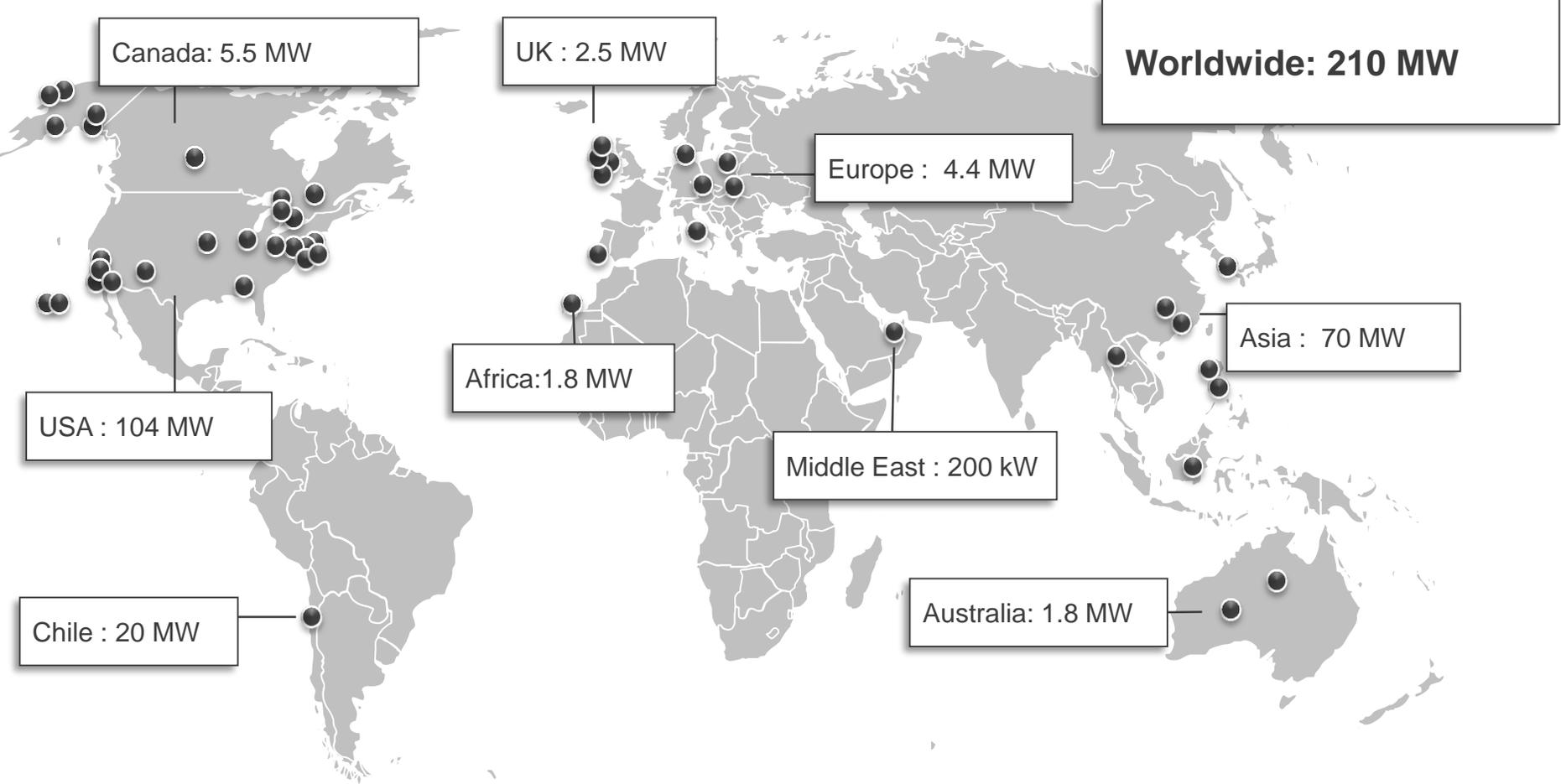


ABB Energy Storage Experience

BESS Project Chitose Hokkaido - Japan 17 MW

Need:

- 28 MW PV grid integration
- Ramp Rate control 1%/min - Voltage support - Capacity firming

Project details :

- Li-ion batteries
- Installed in 2016

ABB Scope:

- (4) x 4 MW + (1) x 1 MW Outdoor PCS
- PCS inverters, DC contactors, AC circuit breakers
- MV-LV Coupling transformer
- MV Switchgear
- Local controller integrating PCS, Switchgear and MBMS
- Local HMI



ABB Energy Storage Experience

BESS Project Yangguang Power Plant - China 9 MW

Need:

- Integration with coal fired power plant 300 MW
- Frequency regulation

Project details :

- Li-ion batteries (15 minutes)
- Installed in 2016

ABB Scope:

- (3) x 3 MW Outdoor PCS
- PCS inverters, DC contactors, AC circuit breakers
- MV-LV Coupling transformer
- MV Switchgear
- Local controller integrating PCS, Switchgear and MBMS
- Local HMI



ABB Energy Storage Experience

KIUC Anahola Project – Hawaii 6 MW

End user & Installation year:

- KIUC installed in 2015

System size & Technology:

- 6 MW - 4 MWh lithium-ion batteries

Customer needs:

- Help integrate solar power on the network
- Frequency & Voltage regulation; spinning reserve

ABB Scope:

- PCS rated at 6 MW integrated in (2) 20'ISO containers
 - 2 x 3 MW Converters
 - HVAC
- EssPro Controller
 - Frequency regulation
 - Voltage regulation
 - Firming



ABB Energy Storage Experience

BESS Integrator / PJM - USA 20 MW

Need:

- PJM Regulation Market
- Frequency regulation

Project details :

- Li-ion batteries
- Installed in 2014

ABB Scope:

- (4) x 5 MW Outdoor PCS / 35kV
- Includes inverters, dc circuit breakers, ac circuit breakers, control, protection and external isolation / step-up transformer to 35kV grid
- Metering / Data Management
- Noise suppression



ABB Energy Storage Experience

Tehachapi – USA 8 MW



8 MW / 32 MWh Tehachapi Storage Project

Customer needs

- Smart grid program
- Assess the capability and effectiveness of storage to support 13 operational applications

Project details

- Li-ion batteries
- Installed in 2013

ABB response

- (2) x 4 MW / 4.5 MVA PCS100 for BESS
- EssPro Vantage Controller
- DC bus and protection circuit breakers
- System models, RTDS and simulations
- Commissioning, training and installation supervision

ABB Energy Storage Experience

Angamos, Chile - 20 MW

Need:

- Spinning reserve
- Frequency regulation

Project details :

- Li-ion batteries
- Installed in 2011

ABB Scope:

- 5 x 4 MW PCS Containers
- Each containing inverters, circuit breakers, step up transformers, control, MV Disconnect Switch



20 MW / 5MWh

ABB Energy Storage Experience

World's largest battery – Fairbanks – Alaska 46 MW

Need:

- Improve reliability of electricity services
- Emergency power source to feed energy to the grid until backup generation can come online

Project details :

- 15 minutes power boost to get generators online, leading to 90 percent reduction of power blackouts due to grid faults
- Cost-effective and reduced carbon emission solution.
- Installed in 2003

ABB Scope:

- Turnkey BESS including converter, transformer, Ni-Cd batteries (battery supplier SAFT), metering, protection and control devices and service equipment
- 27 MW - 15 minutes / 46 MW - 5 minutes
- BESS operation at temperatures as low as -52°C



ABB Energy Storage Experience

ENEL - Italy 2 MW

Need:

- Battery energy storage system connected to the distribution grid

Project details :

- Peak shaving
- Frequency regulation
- Renewable integration

ABB Scope:

- Turnkey BESS providing 2MW for 30 minutes including system studies and specification
- Containerized Li-ion-battery based solution (battery supplier FAAM/FIB) including converter, transformer, switchgear, control and protection systems
- Standard control algorithms



ABB Energy Storage Experience

EKZ, Switzerland 1 MW

Need:

- Battery energy storage facility connected to the distribution grid, with integrated solar panels and e-mobility charging stations

Project details :

- Possibility to evaluate grid-linked BESS for peak shaving, frequency regulation and integration of renewables
- Forecasting to enhance operational efficiency
- State-of-the-art technologies enabling to address future demands on the grid

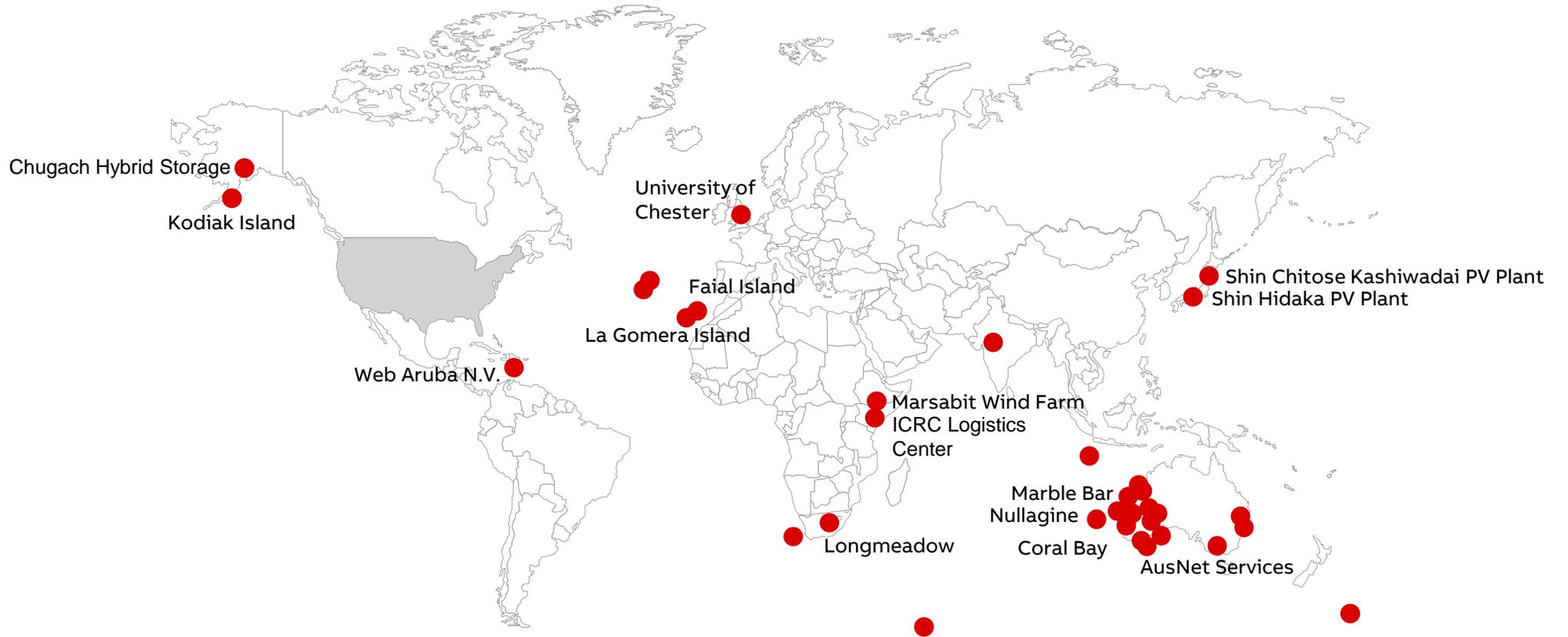
ABB Scope:

- Turnkey BESS providing 1 MW for 15 minutes including system studies and specification
- Containerized Li-ion-battery based solution (battery supplier LG Chem) including converter, transformer, switchgear, control and protection systems
- Standard and advanced control algorithms



ABB Microgrids

Global References



Remote Communities

Marble Bar, PowerStore/PV/Diesel

About the Project

- **Project name:** Marble Bar
- **Location:** Western Australia, Australia
- **Customer:** Horizon Power, Government of WA
- **Completion date:** 2010

Solution

The resulting Microgrid system consists of:

- PowerStore Flywheel (500 kW/ 16.5 MWs)
- Microgrid Plus Control System
- Solar PV (1 x 300 kW_p)
- Diesel (4 x 320 kW)

Customer Benefits

- Minimize diesel consumption - 405,000 liters of fuel saved annually
- Minimum environmental impact - 1,100 tons CO₂ avoided annually
- Reliable and stable power supply
- 60% of the day time electricity demand is generated by the PV plant



[Press Release](#)
[Video](#)

Marble bar and Nullagine are the world's first high penetration, solar photovoltaic diesel power stations

Urban Communities

AusNet Services, PowerStore/Diesel

About the Project

- **Project name:** AusNet Services
- **Location:** Victoria, Australia
- **Customer:** AusNet Services
- **Completion date:** 2014

Solution

The resulting Microgrid system consists of:

- PowerStore Battery (1 MW/1 MWh)
- Microgrid Plus Control System
- Diesel (1 x 1 MW)

Customer Benefits

- Active and reactive power support during high demand periods
- Transition into isolated/off-grid operation on command or in emergency cases without supply interruption
- Delay of power line investments
- Mobile and transportable containerized solution



[Press Release](#)
[Video](#)

First embedded generation system with battery grid energy storage for distribution network support in Australia

Industrial and Commercial Sites

Longmeadow, PowerStore/PV/Diesel

About the Project

- **Project name:** Longmeadow
- **Location:** South Africa
- **Customer:** Longmeadow Business Estate
- **Completion date:** 2016

Solution

The resulting Microgrid system consists of:

- PowerStore Battery (1 MW/380 kWh)
- Microgrid Plus Control System
- Solar PV (1 x 750 kW_p)
- Diesel (2 x 600 kW)
- Remote Monitoring

Customer Benefits

- Stabilizing the grid for reliable and stable power supply
- Optimized renewable energy contribution to the facility
- Seamless transition from grid connection to islanding in case of an outage
- CO₂ reduction: over 1,000 tons/year
- Up to 100% renewable energy penetration



[Press Release](#)
[Infographic](#)
[Video](#)
[Data Sheet](#)

The microgrid solution is for the 96,000 sqm facility in Johannesburg that houses both ABB South Africa's headquarters, as well as a manufacturing facility employing close to 1,000 employees

Island Utilities

Kodiak Island, PowerStore/Wind/Hydro/Diesel

About the Project

- **Project name:** Kodiak Island
- **Location:** Alaska, United States of America
- **Customer:** Kodiak Electric Association (KEA)
- **Completion date:** 2015

Solution

The resulting Microgrid system consists of:

- PowerStore Flywheel (2 MW/ 33 MWs)
- Wind (6 x 1.5 MW)
- Hydro (3 x 11 MW)
- Diesel (1 x 17.6 MW, 1 x 9 MW, 1 x 3.6 MW, 1 x 0.76 MW)

Customer Benefits

-
- Stabilizing - frequency regulation
 - Provide frequency support for a new crane
 - Help to manage the intermittencies from a 9 MW wind farm
 - Reduced reliance on diesel generators



[Press Release](#)
[Infographic](#)
[Video](#)

Two PowerStore Flywheels act in parallel in order to deliver optimal grid stabilization on Kodiak Island

Institutions and Campuses

University of Chester, Wind/PV/Thermal

About the Project

- **Project name:** The Thornton Science Park Microgrid
- **Location:** United Kingdom
- **Customer:** University of Chester

Solution

- ABB's microgrid solution helps in maximizing the penetration of renewable energy in grid system. Also, the microgrid controller allows the university to connect or disconnect seamlessly from the main grid and operate in an islanded mode, ensuring continuity of supply in case of an outage.

Customer Benefits

- Maximize renewable energy penetration in grid system
- Helps to operate in off-grid (islanded) mode
- Continuity of power supply during outage



University of
Chester

[Press Release](#)

The microgrid at the Energy Centre, University of Chester is first of its kind in a UK university campus to demonstrate where new energy technologies can be developed and tested, bringing industry and academia together to drive innovation



AABB