Microgrid Solutions
Worldwide Installations
# ABB Microgrids and renewable energy

## Our offering

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## What is it?

- Turnkey solution for a greenfield microgrid project
- Integration of renewable energy into fuel-based microgrids (HFO, Diesel, gas etc.)
- Stabilization and flow optimization of renewable energy integration
- Stabilization of on-grid renewable energy plants connected to a weak grid
- Providing virtual inertia, grid stabilization, as well as other ancillary power system services

## Reference

- **Marble Bar** (solar/diesel)
- **Hopetoun** (wind/diesel)
- **Coral Bay** (wind/diesel)
- **Ross Island** (wind/diesel)
- **Rottnest** (wind/diesel)
- **Esperence** (wind/diesel)
- **Denham** (wind/diesel)
- **Faial** (wind/diesel)
- **Flores** (wind/hydro/diesel)
- **Carnegie** (wave)
- **Kalbarri** (wind)
- **SP Ausnet** (GESS)
- **Leinster Mine** (peak lopping)
- **Endesa** (grid connection)
- **REE** (grid connection)
Hybrid power plant
Turnkey solution for a greenfield microgrid project
Hybrid power plant
Marble Bar, PV/Diesel

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

ABB solution
- PV/diesel Microgrid with PowerStore grid-stabilizing technology and Microgrid Plus System
- The resulting system consists of:
  - Diesel (4 x 320kW)
  - PV (1 x 300kW)
  - PowerStore-flywheel (1 x 500kW)
  - Microgrid Plus System

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

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

*For both Marble Bar and Nullagine projects
Hybrid power plant
Nullagine, PV/diesel

**Project name**
Nullagine

**Location**
Western Australia, Australia

**Customer**
Horizon Power

**Completion date**
2010

**ABB solution**
- PV/diesel Microgrid with PowerStore grid-stabilizing technology and Microgrid Plus System
- The resulting system consists of:
  - Diesel (3 x 320kW)
  - PV (1 x 200kW)
  - PowerStore-flywheel (1 x 500kW)
  - Microgrid Plus System

**Customer benefits**
- Minimize diesel consumption, 182,000 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

**About the project**
Marble bar and Nullagine are the world’s first high penetration, solar photovoltaic diesel power stations

*For both Marble Bar and Nullagine projects*
Hybrid power plant
Hopetoun, wind/diesel

Project name
Hopetoun
Location
Western Australia, Australia
Customer
Verve Energy
Completion date
2007

ABB solution
- Wind diesel system with Microgrid Plus System
- Staged installation of the microgrid
- The resulting system consists of:
  - Diesel (7 x 320kW)
  - WTG (2 x 600kW)
  - Microgrid Plus System

Customer benefits
- Minimized diesel consumption
- Reliable and stable power supply

About the project
- Staged integration of diesel generators and wind turbines into the Hopetoun microgrid following load increase
- "The new wind turbine will provide about 42% of the town's electricity needs and will see a reduction in fuel consumption of over 400,000 liters per year, resulting in greenhouse gas savings of over 1,100 tons per year” Dr. David Kemp, Minister for the Environment and Heritage
Hybrid power plant
Coral Bay, wind/diesel

Project name
Coral Bay
Location
Western Australia, Australia
Customer
Verve Energy
Completion date
2007

ABB solution
- Implement a wind/diesel microgrid with PowerStore grid-stabilizing technology and Microgrid Plus System
- The resulting system consists of:
  - Diesel (7 x 320kW)
  - WTG (3 x 200kW)
  - PowerStore-flywheel (1 x 500kW)
  - Microgrid Plus System

Customer benefits
- Minimized diesel consumption
- Reliable and stable power supply

About the project
- Up to 95% wind penetration
- 45% total annual wind penetration
Hybrid power plant
Cocos (Keeling) Island, wind/diesel

Project name
Cocos (Keeling) Island
Location
Indian Ocean, Australia
Customer
- Dept. Transport & Regional
- Services*
Completion date
2004

*now operated by Water Corporation, WA, Australia
Picture courtesy of Wikipedia

ABB solution
- Wind Microgrid with Microgrid Plus System
- The resulting system consists of:
  - Diesel (4 x 320kW)
  - WTG (4 x 20kW)
  - Microgrid Plus System

Customer benefits
- Minimize diesel consumption
- Allow for maximum contribution to the town’s electricity from the wind turbines
- Reliable and stable power supply
Hybrid power plant
Bremer Bay, wind/Diesel

Project name
Bremer Bay
Location
Western Australia, Australia
Customer
Verve Energy
Completion date
2005

ABB solution
- Implement a wind/diesel microgrid with a Microgrid Plus System
- The resulting system consists of:
  - Low load diesels (1300 kW)
  - WTG (1 x 600kW)
  - Microgrid Plus System

Customer benefits
- 40% of the town’s electricity supplied with wind energy
- Reduced greenhouse gas emissions by 1100 tons a year
- Cuts diesel consumption by up to 400,000 liters a year

About the project
"The new turbine and power station will enable the Bremer Bay community to have access to a reliable and continuously available electricity supply […]" Ian Campbell, WA Senator
Integrated wind or PV plant
Integration of renewable energy to fuel-based microgrids
Integrated wind or PV plant
Laing O‘Rourke, PV/Diesel

Project name
Laing O‘Rourke construction camp

Location
Remote Queensland, Australia

Customer
Laing O‘Rourke

Completion date
2015

ABB solution
- Integration of solar PV into a diesel powered grid using the Microgrid Plus System
- The resulting system consists of: Diesel (4 x 450kW), PV plant (141kW), Microgrid Plus System
- Project supported by the Australian Renewable Energy Agency

Customer benefits
- Expected diesel fuel saving is 88,865 litres per year
- Scalable Microgrid Plus solution adapted for redeployment of semi portable hybrid system & extendable with energy storage

About the project
- World first large-scale portable solar hybrid plant
- “A portable hybrid system, constructed off-site and easily transportable, could be a real game changer for off-grid locations in Australia and beyond” Ivor Frischknecht, ARENA Chief Executive
Integrated wind or PV plant
Gorona del Viento, wind/pumped-hydro/diesel

Project name
Gorona del Viento
Location
Canary islands, Spain
Customer
Elecnor
Completion date
2014

ABB solution
- Power and automation solution for the integration of wind turbines and pumped-hydro into the existing diesel power station
- Supply of a 800xIA control system as well as electrical system components such as drives, MV switchgear and protection relays
- The resulting system has: Wind (5 x 2.3 MW), Hydro (11.32MW), Diesel generators for emergency (11 MW)

Customer benefits
- Single responsibility of control system and electrical equipment
- Stable frequency and voltage
- 100% renewable energy contribution to the system

About the project
- The world’s first 100% renewable energy island powered by a wind/pumped-hydro system
Integrated wind or PV plant
Ross Island, Wind/Diesel

Project name
Ross Island
Location
Ross Island, Antarctica
Customer
New Zealand’s Antarctic Division
USA McMurdo Station
Completion date
2009

ABB solution
- Integration of wind turbines into the microgrid with PowerStore grid-stabilization and Microgrid Plus System
- Implement a frequency converter to connect a 50Hz network to a 60Hz one
- The resulting system consists of: Diesel (9 x 125kW), WTG (3 x 330kW), PowerStore-flywheel (1 x 500kW), Microgrid Plus System, frequency converter

Customer benefits
- Minimize diesel consumption
- Reduced environmental risk of transporting diesel
- 463,000 liters of diesel fuel saved annually
- 2,800 tons CO2 avoided annually
- Up to 70% wind power peak penetration

About the project
- Integration of the southernmost wind farm in the world into a dual 50 and 60Hz microgrid
## Project name
Rottnest Island

## Location
Western Australia, Australia

## Customer
Verve Energy*

*(now operated by Programmed Facility Management)

### ABB solution
- Integration of a wind turbine into the existing diesel power station through the Microgrid Plus System
- The resulting system consists of: diesel (3 x 325kw), wind (1 x 600kW), Microgrid Plus System

### Customer benefits
- Minimize diesel and gas consumption
- Reduce reliance on limited water resources by powering the desalination plant
- Reliable and stable power supply

### About the project
- Wind power powers a desalination unit to mitigate underground water supply depletion
- "Benefits for people in remote locations include greater access to electricity, reduction in noise and air pollution, and reduction in the costs of transporting fuel over long distances.“  Ian Campbell, WA Senator

*Picture by Mark (Own work) [GFDL (http://www.gnu.org/copyleft/fdl.html)], via Wikimedia Commons
Integrated wind or PV plant
Mawson, wind/diesel

**Project name**
Mawson

**Location**
Robertson Land, Antarctica

**Customer**
Australian Antarctic Division

**Completion date**
2003

**ABB solution**
- Integration of two wind turbines into the existing diesel power system through a Microgrid Plus System and a grid boiler interface
- Grid boiler interface sends excessive wind energy into the electric boiler
- The resulting system consists of: diesel (4x 125kW), WTG (2 x 300kW), grid boiler interface, Microgrid Plus System

**Customer benefits**
- Minimize diesel consumption
- Reliable and stable power supply
- Optimized control of station heating and electrical loads supply

**About the project**
Wind/Diesel plant at the longest continuously operating station south of the Antarctic Circle
Integrated wind or PV plant
Denham, wind/diesel

Project name
Denham
Location
Western Australia, Australia
Customer
Western Power
Completion date
2003

ABB solution
- Staged integration of 3 wind turbines into a diesel powered grid through the Microgrid Plus System

Customer benefits
- Minimize diesel consumption
- Reliable and stable power supply
- 175,000 liters of fuel saved per year
- 500 tons of CO2 avoided annually
Integrated wind or PV plant
Esperance, wind/diesel

ABB solution
- Integration of 6 new wind turbine generators as well as the existing Ten Mile Lagoon Wind Farm into the existing Esperance Diesel Power Station through the Microgrid Plus System

Customer benefits
- Minimize diesel consumption
- Reliable and stable power supply

About the project
"The Howard Government is committed to meeting the energy needs of remote communities. It is also committed to working to meet Australia's Kyoto target. It is also developing a significant renewable energy industry. Projects such as this deliver on both objectives.” Dr. David Kemp, Minister for the Environment and Heritage

Project name
Esperance

Location
Western Australia, Australia

Customer
Verve Energy*

Completion date
2003

*(now operated by Programmed Facility Management)
Optimized microgrid integration
Stabilization and flow optimization of renewable energy integration
Renewable to grid connector
Marsabit, wind/diesel

**Project name**
Marsabit wind farm

**Location**
Kenya

**Customer**
Socabelec East Africa Ltd (SEAL)

**Completion date**
2016

### ABB solution
- Supply, installation and commissioning supervision of a PowerStore-flywheel
- Stabilizes the connection of 2 x 275kW wind turbines to the grid

### Customer benefits
- System optimization to avoid curtailment of excess wind power
- Reliable and stable power supply

### About the project
ABB solution allows the customer to maximize renewable energy penetration by stabilizing the system and avoiding curtailment of excess wind power
Optimized microgrid integration
Legion House, Biogas/battery system

Project name
Legion House
Location
Sydney, NSW, Australia
Customer
Grocon, KLM group
Completion date
2014

ABB solution
- Design, supply, installation and commissioning of a PowerStore-battery solution
- The PowerStore stabilizes the internal (islanded) power network against fluctuations in frequency and voltage

Customer benefits
- Enables 100% renewable operation with fuel gas from renewable sources
- Building operates in isolated mode (not connected to the grid)

About the project
ABB microgrid technology enables a heritage building to become an ‘Autonomous Zero Carbon Life Cycle Building’ and achieve a 6 Star energy rating
## Optimized microgrid integration

**Faial, wind/diesel**

### Project name
Faial wind/diesel stabilization

### Location
The Azores, Portugal

### Customer
Electricidade dos Acores (EDA)

### Completion date
2013

### ABB solution
- Design, supply, installation and commissioning of a Microgrid Plus System
- The control system optimizes the wind penetration into the microgrid and helps dispatch the HFO generators optimally

### Customer benefits
- Optimized wind penetration to ensure minimum fuel consumption and grid stability
- Reduced maintenance through automatic management of the wind farm power set point

### About the project
The integration of wind energy combined with ABB’s innovative solution will save an estimated 3.5 million liters of fuel per year
### Project name
Flores Island PowerStore

### Location
The Azores, Portugal

### Customer
Electricidade dos Acores (EDA)

### Completion date
2005

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### ABB solution
- Supply, install and commission a Microgrid Plus System and a PowerStore-flywheel
- The system smoothens out wind power fluctuations

### Customer benefits
- Increased wind power penetration
- Minimized diesel consumption
- Reliable and stable power supply

### About the project
100% renewable penetration – Diesel off mode
Renewable to grid connector
Stabilization of on-grid renewable energy connected to a weak grid
Project name
Carnegie Wave Energy Plant
Location
Garden Island, WA
Customer
Carnegie Wave Energy
Completion date
2014

ABB solution
- Integration into an 11 kV microgrid
- Supply and commissioning of the generator/inverter system using ACS800 inverters
- Symphony Plus process control system
- Third-party high speed data acquisition system

Customer benefits
- Reliable grid integration and process control system from a single supplier
- Smooth grid integration of renewable energy

About the project
- Electrical and control solution for the first commercial-scale CETO grid and desalinated water connected wave energy project
- "We chose ABB, confident they have the expertise required to cover the range of disciplines for the success of our development.” Greg Allen, Chief Operating Officer from Carnegie Wave Energy
Renewable to grid connector
Kalbarri, end-of-grid wind farm

Project name
Kalbarri wind farm

Location
Western Australia, Australia

Customer
Verve energy

Completion date
2008

ABB solution

- Supply, install and commission a PowerStore-flywheel acting as a STATCOM
- Smoothens the voltage of an end-of-grid network to which 2 x 800kW wind turbines are connected

Customer benefits

- Optimize the system
- Reliable and stable power supply
- Improved quality of electricity supply to Kalbarri

About the project

ABB solution allows the integration of wind energy at the end-of-grid to provide about one third of the Klabarri community demand.
Ancillary power system services

Grid stabilization, virtual inertia and other ancillary power system services
Ancillary power system services
DeGrussa Mine - PV/Diesel

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Project name
DeGrussa Copper-Gold Mine
Location
Western Australia, Australia
Customer
juwi Renewable Energy
Completion date
2016

ABB solution
- Integration of a new 10.6 megawatt (MW) solar PV field and a battery storage system with existing diesel generation to provide reliable base-load power.
- The resulting system consists of: PowerStore™ grid stabilization solutions (2 x 2 MW), solar inverter stations (5 x 2 MW), solar MV stations, a transformer and the Microgrid Plus System

Customer benefits
- Expected diesel fuel saving is 5 million liters per year, cutting diesel consumption by 20%

About the project
- The new hybrid solar facility will be the largest integrated off-grid solar and battery storage plant in Australia.
- Once fully integrated, the plant will reduce CO2 emissions by 12,000 tons.
Ancillary power system services
Longmeadow, PV/Diesel/Battery

Project name
Longmeadow

Location
South Africa

Customer
Longmeadow Business Estate

Completion date
2016

ABB solution
- PV/diesel microgrid with battery-based system to maximize solar contribution and ensure security of power supply at ABB’s premises in Johannesburg
- The resulting system consists of:
  - 750 kWdc rooftop PV plant, including ABB PV inverter
  - 1 MVA/380 kWh battery-based PowerStore
  - Microgrid Plus System

Customer benefits*
- Reliable and stable power supply
- Optimized renewable energy contribution to the facility
- Ability to island from the grid in case of an outage
- CO2 reduction: over 1,000 tons/year
- Up to 100% renewable energy penetration

About the project
The microgrid solution is for the 96,000 sqm facility houses hosting ABB South Africa’s headquarters as well as manufacturing facilities with around 1,000 employees. The innovative solution will help to maximize the use of solar energy and ensure uninterrupted power supply.
Ancillary power system services
SP AusNet Grid Energy Storage System

Project name
SP AusNet GESS
Location
Victoria, Australia
Customer
SP AusNet
Completion date
2014

ABB solution
- Design, engineering, installation and testing of PowerStore-Battery, transformer and diesel generator
- Microgrid Plus System for overall system management
- Based on transportable containerized solution

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

About the project
First Embedded Generation system with Battery Grid Energy Storage for distribution network support in Australia
Ancillary power system services
Lanzarote, grid stabilizing system

Country
Lanzarote PowerStore

Location
Canary islands, Spain

Customer
Red Eléctrica de España

Completion date
2014

ABB solution
- Supply, install and commission of a PowerStore-flywheel grid stabilizing solution as well as transformer
- The PowerStore acts as a stabilizer for both the frequency and voltage for the Lanzarote-Fuerteventura electricity system

Customer benefits
- Improved security and stability of the grid
- Reduced frequency and voltage deviation
- Promote the integration of additional renewable energies on the island

About the project
Part of Red Eléctrica de España's pioneering R&D+i projects
Ancillary power system services
Kodiak Island, grid stabilizing system

Project name
Kodiak Island

Location
Alaska, United States of America

Customer
Kodiak Electric Association (KEA)

Completion date
2015

ABB solution
- Deliver two PowerStore-flywheel units to stabilize the power grid and increase renewable energy

Customer benefits
- Provide voltage and frequency support for a new crane
- Extend the life of the battery systems by up to 6 years
- Help to manage the intermittencies from a 9 MW wind farm
- Reduced reliance on diesel generators

About the project
- Two PowerStores act in parallel in order to deliver optimal grid stabilization on Kodiak island
- “Not only will the ABB PowerStores allow us to shave the peaks off our cranes’ load, it will also reduce the stresses placed on our battery systems and extend their lifespans, which was a key deciding factor to move forward with this project.”  Darron Scott, president and CEO of Kodiak Electric Association

Image by, Karl Musser, created based on USGS data. (self|cc-by-sa-2.5) Category:Maps of Alaska
Ancillary power system services
La Gomera, grid stabilizing system

Project name
La Gomera PowerStore

Location
Canary islands, Spain

Customer
Endesa

Completion date
2014

ABB solution
- Supply, install and commission of a PowerStore-flywheel 500 kW grid stabilizing solution
- Solution upgradable to 1MW
- PowerStore adds inertia in the 22MW isolated power system of La Gomera

Customer benefits
- Reduced frequency and voltage deviations
- Reduced load shedding events
Ancillary power system services
Leinster Mine, Peak Shaving

Project name
Leinster Mine
Location
Western Australia, Australia
Customer
BHP Billiton
Completion date
2005

ABB solution
- Install a 1MW PowerStore-flywheel device
- The PowerStore-flywheel provides the 1MW to the winder during peak consumption and recharges when the total demand is within the contractual limits

Customer benefits
- Reduction of peak demand by 1MW
- Reduction of spinning reserve by IPP of 1MW
- Avoid changing IPP contractual agreement
- Increase winder production without affecting power system reliability
- Fully automated solution

About the project
- Peak lopping for large cyclical loads in demanding mining environments
Power and productivity for a better world™