

ARCTIC ENERGY SUMMIT, SEPTEMBER 19TH 2017, HELSINKI

Microgrid solutions

Integration of renewables and reliable power supply in Alaska

Erika Velazquez, Global Product Marketing Manager Microgrid

www.abb.com/microgrids

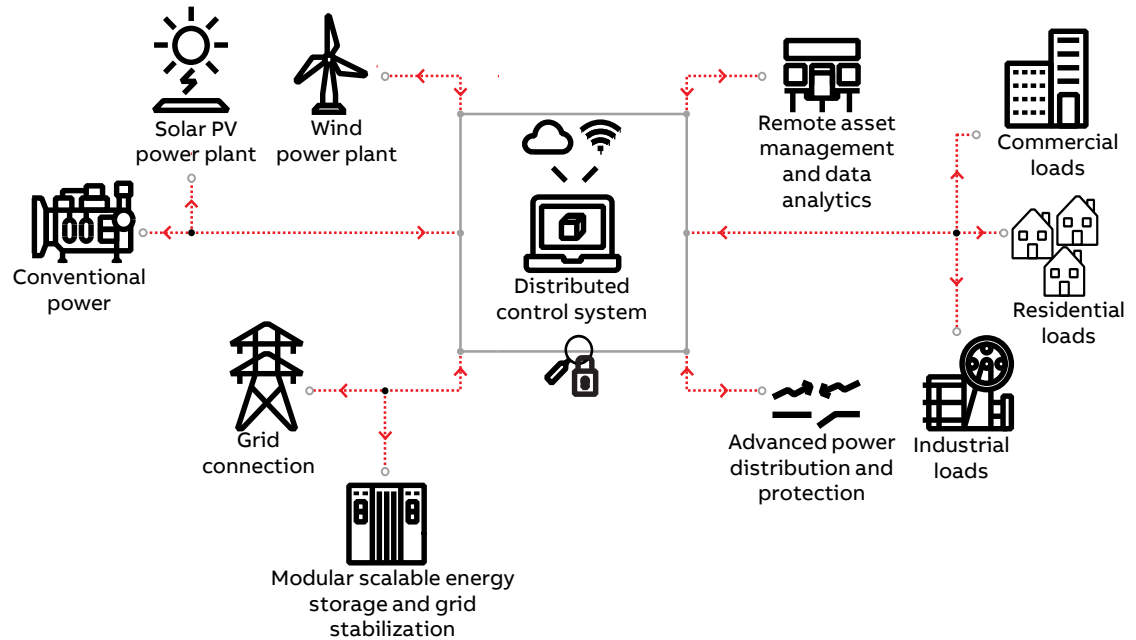
Microgrid

Generation at the point of consumption and always available

Microgrid definition

Distributed energy resources and loads that can be operated in a controlled, coordinated way either connected to the main power grid or in “islanded”* mode.

Microgrids are low or medium voltage grids without power transmission capabilities and are typically not geographically spread out.



Microgrid segments and main drivers

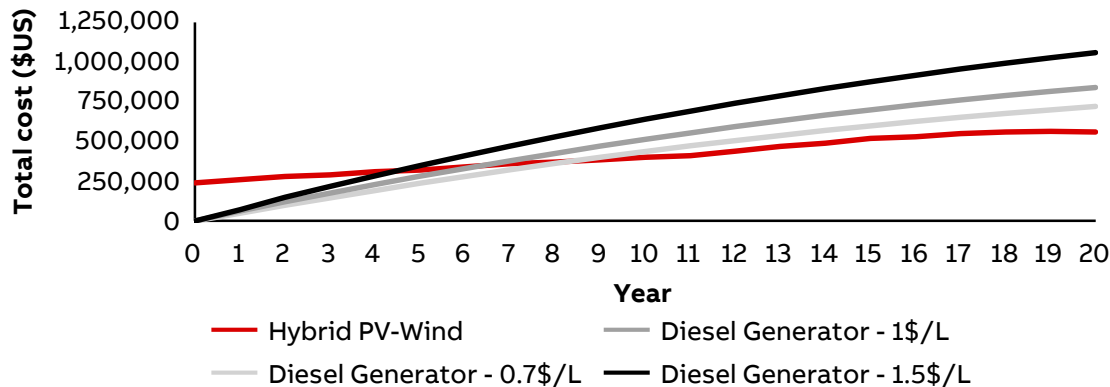
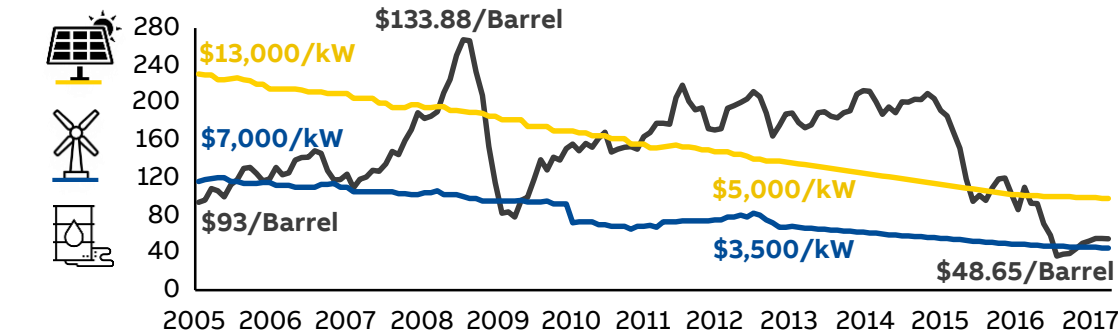
Covering a diverse range of applications

		Main drivers					
		Social	Economic	Environmental	Operational		
		Access to electricity	Fuel & cost savings	Reduce CO2 footprint	Fuel independence	Uninterrupted supply	
Segments	Typical customers						
Off-grid Weak grid Grid-connected	Island utilities	(Local) utility, IPP*	✓	✓	✓	(✓)	
	Remote communities	(Local) utility, IPP, Governmental development institution, development bank	✓	✓		✓	
	Industrial and commercial	Mining company, IPP, Oil & Gas company, Datacenter, Hotels & resorts, Food & Beverage		✓	(✓)	✓	✓
	Defense	Governmental defense institution		(✓)	(✓)	✓	✓
	Urban communities	(Local) utility, IPP			(✓)		✓
	Institutions and campuses	Private education institution, IPP, Government education institution		(✓)			(✓)

Driver: Fuel independence and lower LCOE

Secure power generation and fuel cost savings

Average Oil price USD\$/Barrel is volatile



Fossil fuel cost is volatile

Steady decline of renewable energy cost, making it economically viable

An optimized energy mix leads to a lower cost of electricity

LCOE: Levelized Cost of Electricity

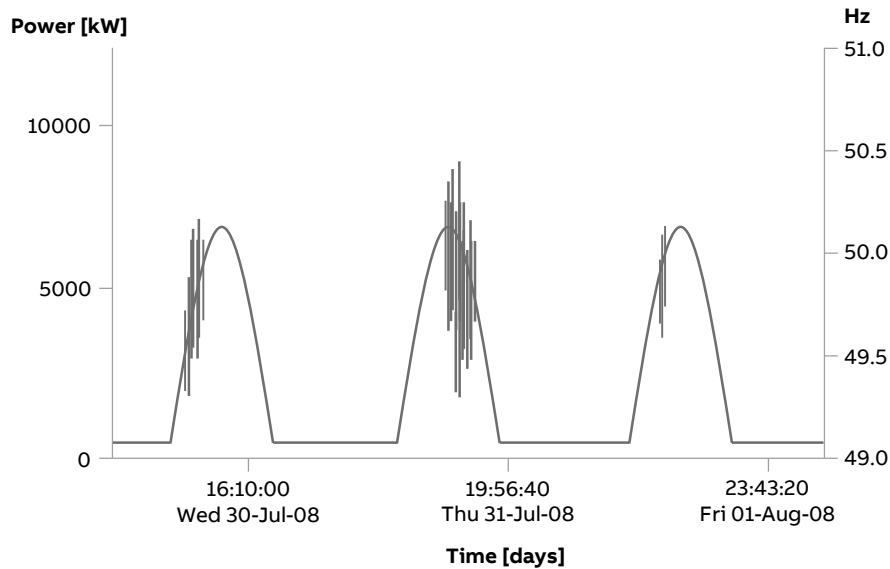
Sources:

1. US Energy Information Administration – Independent Statistics and Analysis
2. Alliance for Rural electrification (ARE). Projections made from a case study based in Ecuador with real natural conditions

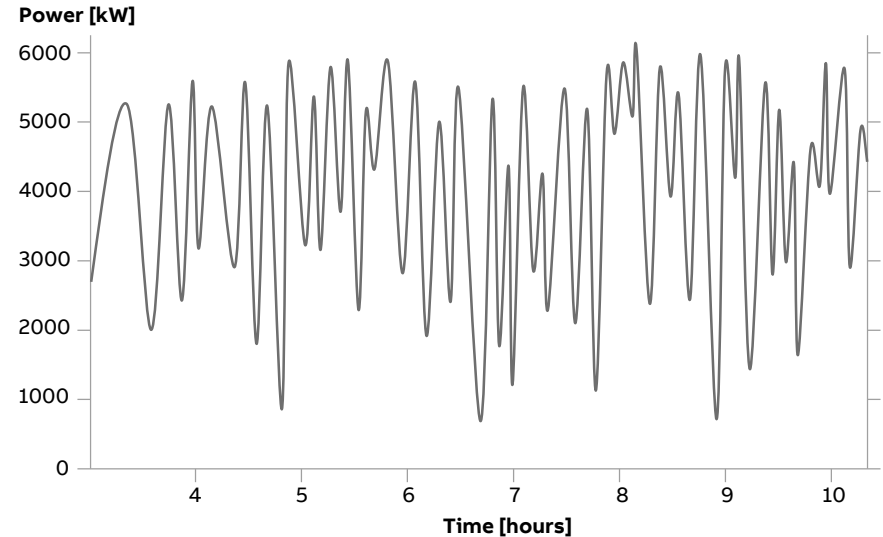
Driver: Uninterrupted power supply

Managing power fluctuations from renewables

Solar power variations



Wind power variations









Inherent volatility of renewables can compromise grid stability

Grid stability requirements are traditionally fulfilled by diesel generation (base load)

Optimized microgrid solution maximizes ROI* and fuel savings

How microgrids create value in Arctic locations

Increasing renewable penetration requires enhanced microgrid control capabilities

Microgrid Integration Technologies	Controlled system	Energy contribution (Fuel reduction)	Power penetration (At peak wind/solar)
Limited control/ basic fuel saving No Renewables control, negative load		7-10%	20-30%
Power control and optimisation Controlling renewables + generator		10-15%	20-50%
Power control and forecasting Controlling renewables + generator		15-30%	50-70%
Power control and grid stabilisation Controlling renewables + generator + storage		25-40%	100%
Power control and load management Controlling renewables + generator + storage + load		60-80%	100%
Power control + energy storage Controlling renewables + storage + load		100%	100%

Broad range of solutions possible – design choice based on economic and technical criteria

The integration challenge

Matching storage medium to application

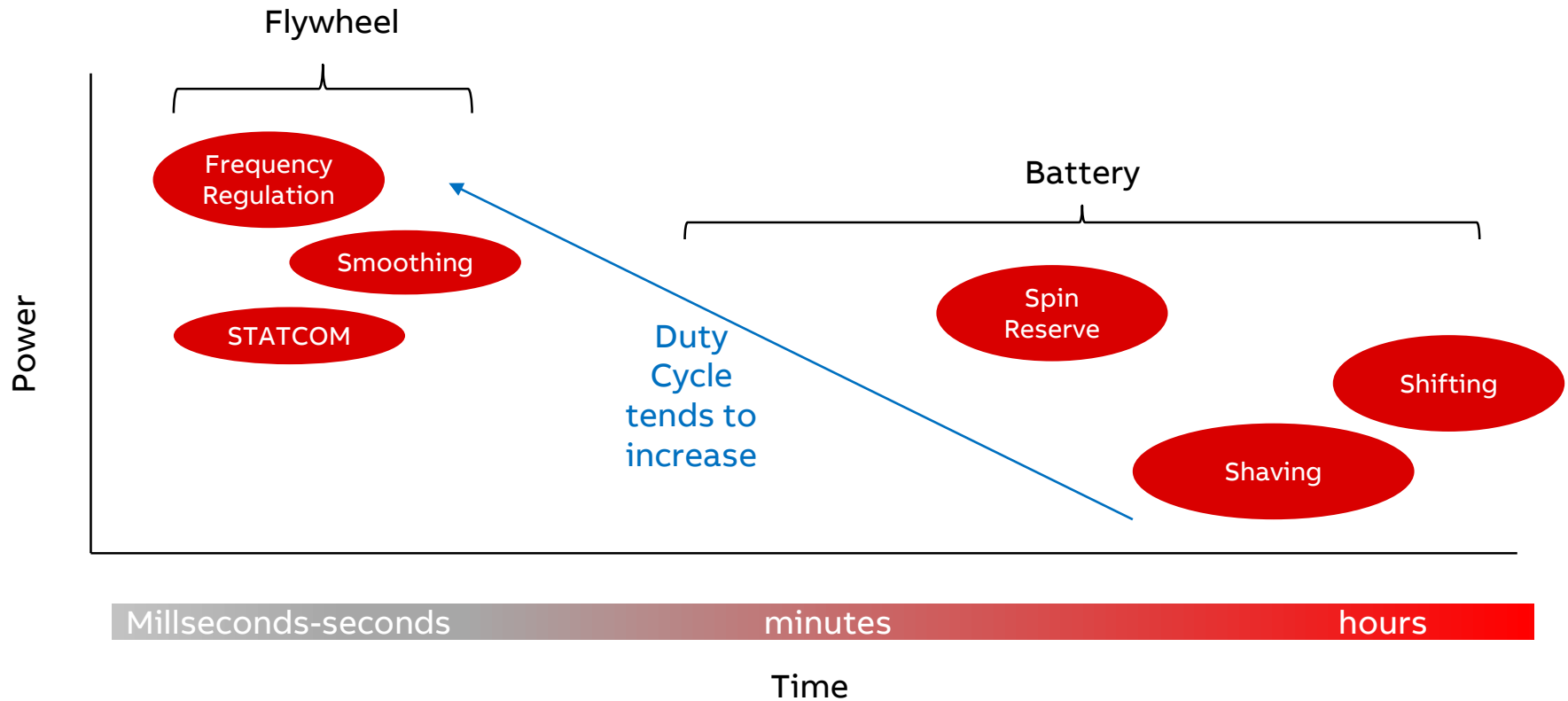


ABB - the global microgrid solution partner

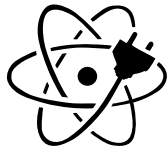
A leading provider of microgrid products and end-to-end microgrid solutions

Leading global expertise

25+

25+ years experience

40+ executed projects



Innovation, technology & productization leadership



Global sales & service network

Broad portfolio of products & services

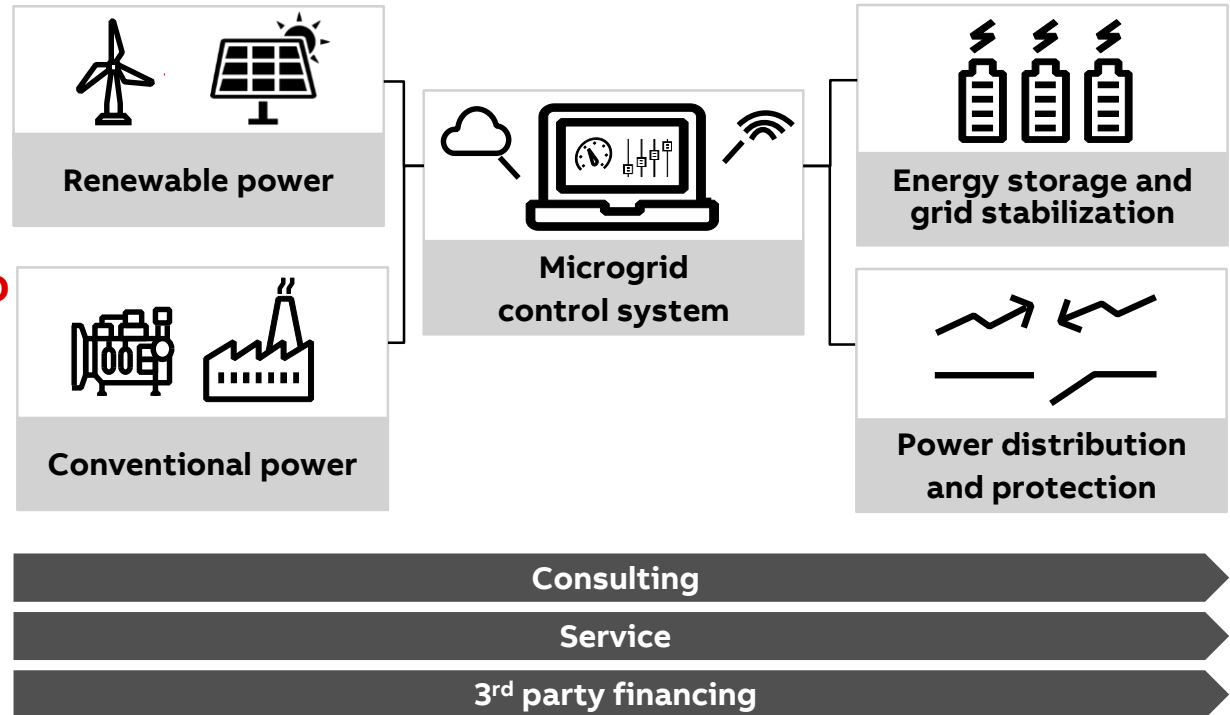


ABB in Microgrid

Grid stabilization and energy storage

PowerStore

Containerized plug-and-play solution in various ratings

Fully productized and scalable to address all market segment applications.

- Seamless transition from grid connected to islanded mode
- Stabilizes against voltage and frequency variations
- “Virtual Generator” can form the grid, integrating up to 100% of renewable energy
- Microgrid Plus Controller
 - Maximizes fossil fuel savings and optimizes use of renewable energy
 - Guarantees optimum loading and spinning reserve in fossil fuel generators
 - Distributed logic enhances reliability and scalability for future system expansions



Integration of renewables

Kodiak Island, PowerStore/Wind/Hydro/Diesel



Project name

Kodiak Island

Location

Alaska, USA

Customer

Kodiak Electric Association (KEA)

Completion date

2015

ABB solution

Two PowerStore flywheels act in parallel to shave off peak load and to reduce the stress placed on an existing battery energy storage system

The resulting Microgrid system consists of:

- PowerStore Flywheel (2 MW/ 33 MWh)
- 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

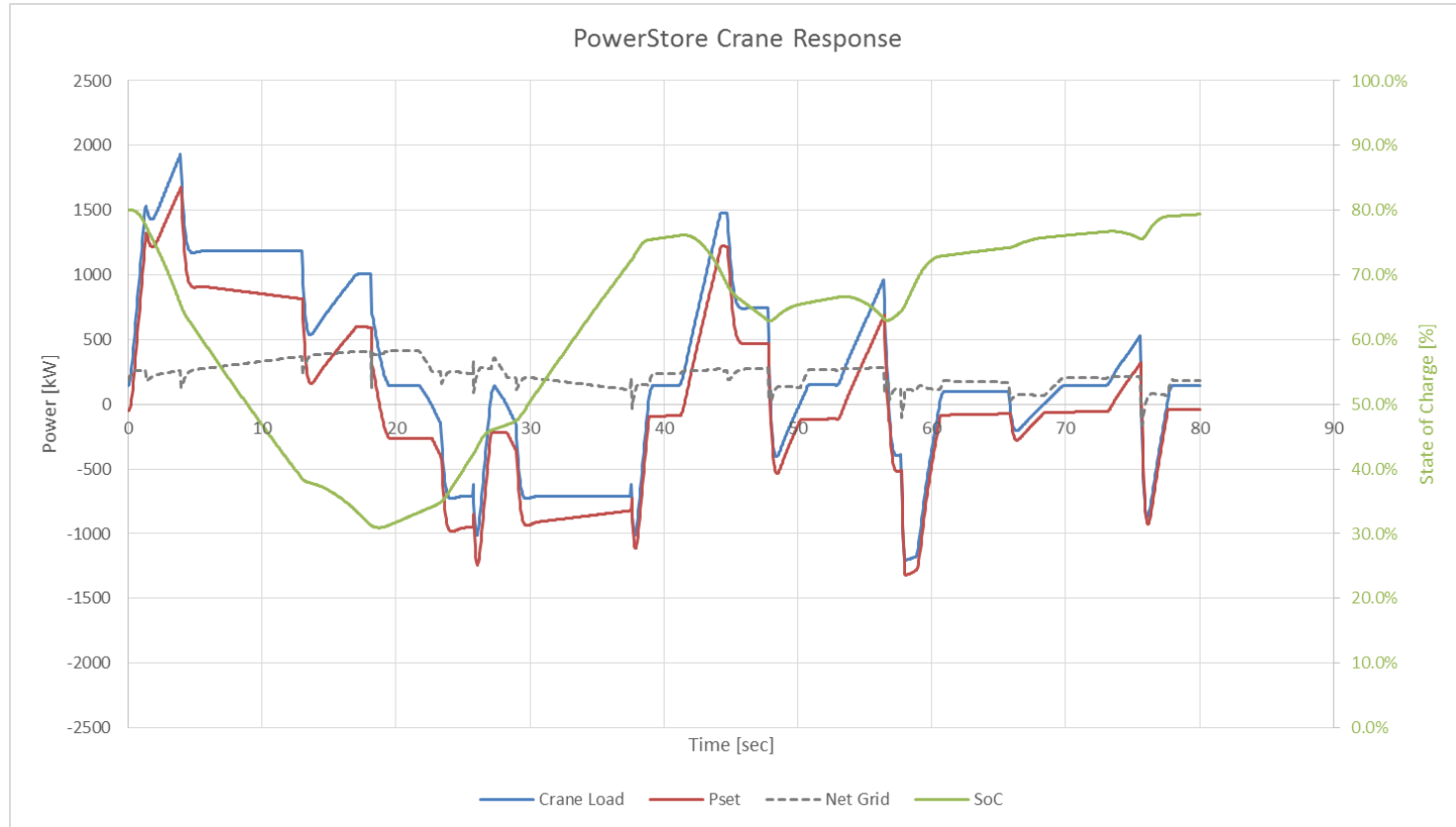
Reduced reliance on diesel generators

About the project

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

Microgrid solution

Reduced peak demand, improved power quality and minimized fuel consumption



Integration of renewables

Chugach Electric, PowerStore/Wind/Diesel



Project name

Chugach Hybrid Storage

Location

Alaska, USA

Customer

Chugach Electric

Completion date

2017

ABB solution

Two PowerStore flywheels act in parallel to shave off peak load and to reduce the stress placed on an existing battery energy storage system

The resulting Microgrid system consists of:

- Wind (11 x 1.6 MW)
- PowerStore Flywheel (1 x 1 MW)
- PowerStore Battery (1 x 2 MW)
- Diesel (1 x 17.6 MW, 1 x 9 MW, 1 x 3.6 MW, 1 x 0.76 MW)

Customer benefits

Reduce ramp rate violations on existing wind farm

Reduce Area Control Error (ACE) violations

Allow for additional wind capacity to be constructed

About the project

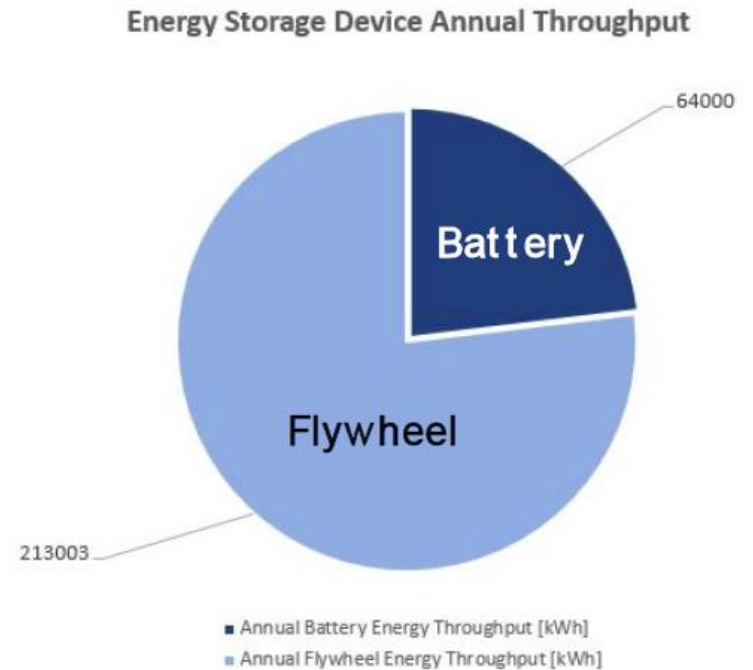
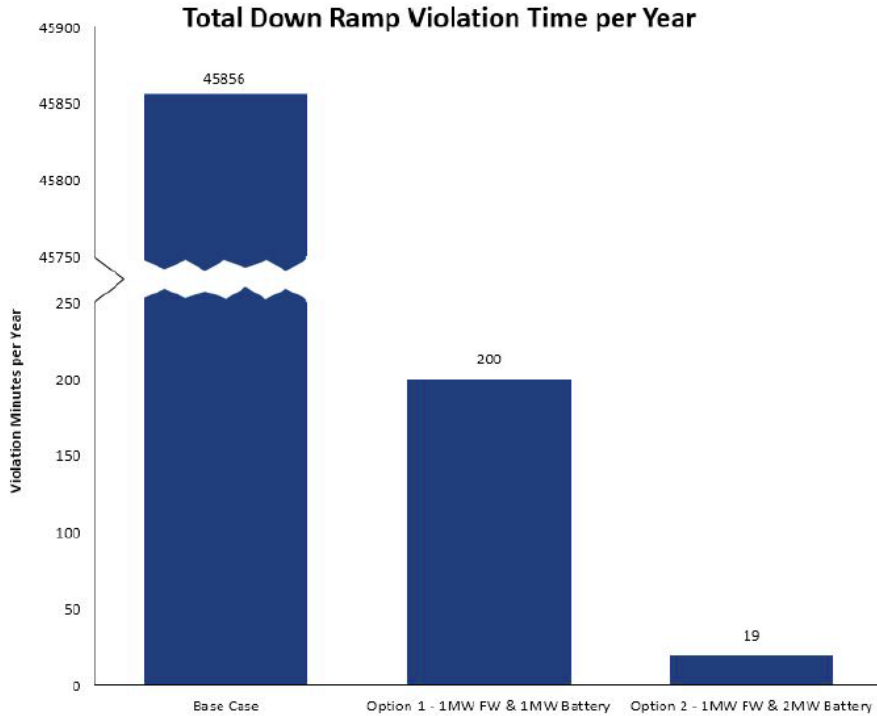
Combination of PowerStore Battery and Flywheel are in ratio to best absorb cycling duty from wind farm fluctuation

Microgrid solution

Improved power quality and relieved stress on existing battery storage

99.9% annual ramp rate violation reduction

Energy sharing: optimizing battery lifetime through hybrid storage solution



Questions?



ABB