



CANADA'S ENERGY STORAGE & MINING MICROGRIDS

CANADA'S PROVEN TECHNOLOGIES AND CUSTOMIZED APPLICATIONS FOR MINES



Canada is at the forefront of the mining sector's demand for proven, scalable and replicable energy storage and microgrid solutions. Canadian companies are developing and exporting cutting-edge storage and microgrid technologies which are transforming remote power for mines.

Mines are being challenged by rising and volatile energy costs, increasingly remote operations, and pressures to reduce carbon emissions. Canadian energy storage and microgrid solutions address these challenges by delivering affordable, reliable and sustainable power.

Through groundbreaking projects, innovative collaborations, and world-leading R&D and testing facilities, Canadian firms are delivering customized solutions to mines and project partners. Canadian companies are energy storage and mining microgrid experts, playing key roles in hybrid projects for global mining leaders including Barrick Gold, Glencore and TMAC Resources.

RAGLAN MINE: BENEFITS OF STORAGE FOR OFF-GRID MINES

This award-winning project set a new landmark in renewable energy penetration of diesel autonomous grids by coupling leading-edge storage technologies and an advanced controller to a wind turbine at a remote Canadian Arctic mine. Led by TUGLIQ Energy partnering with leading Canadian companies - Electrovaya, Hatch and Hydrogenics - the project combines an Arctic-rated 3 MW wind turbine with three forms of energy storage. The system has achieved 97.6% availability, displacing 8.5 million litres of diesel and 23 700 kT tons of greenhouse gases and will continue to save Glencore 2.3 million litres of fuel per year. TUGLIQ is leading an expansion of this project adding a 3 MW wind turbine coupled with a 3MW-1MWh Battery Energy Storage System to drive further carbon and diesel savings.

CANADIAN ENERGY STORAGE AND MINING MICROGRID SOLUTIONS

ENERGY STORAGE TECHNOLOGIES:

- > **Electrovaya**
Portable lithium-ion battery power solutions
- > **eCAMION**
Battery and storage systems designed for extreme conditions
- > **Hydrogenics**
Hydrogen generation and fuel cell products
- > **Hydrostor**
Advanced Compressed Air Energy Storage (A-CAES) technology
- > **NRStor**
Energy storage project developer
- > **Novacab Inc.**
Thermal energy storage specialists
- > **Peak Power**
Energy storage software and project solutions
- > **Salient Energy**
Zinc-ion battery supplier

- > **Sigma Energy Storage**
Hybrid Thermal-Compressed Air Energy Storage (HT-CAES) technology

CONTROL SYSTEMS:

- > **Clear Blue Technologies**
Smart hybrid controllers for off-grid systems
- > **Eguana Technologies**
Intelligent power electronics for microgrid applications
- > **Canadian Solar**
Microgrid development and technologies
- > **Enbala Power Networks**
Virtual Power Plant (VPP) software
- > **Hatch**
Microgrid controller and development
- > **Opus One Solutions**
Software intelligence for distributed energy
- > **Opal-RT Technologies Inc**
Microgrid simulation platform

- > **RTDS Technologies Inc.**
Digital power system simulation

MINING MICROGRIDS:

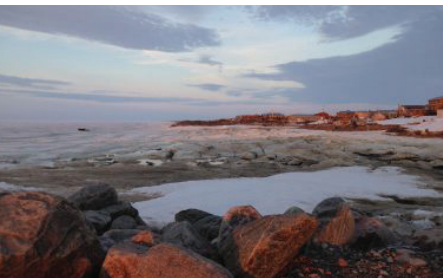
- > **Aspin Kemp and Associates**
Systems integrator focusing on energy efficiency in diesel and microgrid power
- > **Canadian Solar**
Development and operation
- > **Golder Associates**
Engineering and consulting services
- > **Hatch**
Engineering, procurement and consultation for hybrid systems
- > **Heron Canada**
Developer and supplier of remote microgrids
- > **Isla Power**
Renewable energy developer
- > **Lumos Energy**
Clean energy advisors
- > **Phoventus**
Engineering and consulting services

- > **TUGLIQ Energy**
Developer specializing in remote power systems
- > **Windiga Energy**
Renewable energy developer
- > **NRStor**
Microgrid systems
- > **ABB**
Microgrid technology
- > **WSP**
Engineering and consulting services



CLEAN TECH
MINING

INNOVATIVE CANADIAN COMPANIES



CLEAR BLUE TECHNOLOGIES > www.clearbluetechnologies.com

Clear Blue Technologies, the Smart Off-Grid™ company, delivers clean, managed, “wireless power” to meet the global need for reliable, low-cost, solar and hybrid power for lighting, telecom, security, Internet of Things devices, and other critical systems. Combining solar and wind energy with advanced communications and Clear Blue’s Illumience cloud software, systems with Smart Off-Grid technology are managed, controlled and proactively serviced over the Internet. This provides unmatched reliability, long lasting system performance, and significantly lower maintenance cost. Today Clear Blue has over 300 customers and 2,500 systems under management across 33 countries.

HYDROSTOR > www.hydrostor.ca

Hydrostor’s proprietary Advanced Compressed Air Energy Storage (A-CAES) technology is the leading low-cost bulk energy storage solution. Hydrostor’s A-CAES solution uses an emission-free, adiabatic process combined with purpose-built air accumulators that can be sited virtually anywhere – enabling CAES to fulfil its potential. It addresses intermittent renewable generation (solar, wind), reserve capacity, peak shaving, and transmission and distribution deferral. Hydrostor offers a complete solution including financing and warranty through our strategic partnership with AECOM.

SIGMA ENERGY STORAGE > www.sigmaenergystorage.com

Sigma Energy Storage provides scalable energy storage solutions for microgrids, utilities, and industrial clients. Microgrids implementing Sigma’s Hybrid Thermal-Compressed Air Energy Storage (HT-CAES) technology reduce fossil fuel consumption and enable green energy use. HT-CAES firms and leverages intermittent renewables for maximum economic and environmental impact. HT-CAES can capture, store, and dispatch thermal energy directly, which means higher energy efficiency for existing diesel assets and available heat to district heating systems.

NRSTOR > www.nrstor.com

NRStor is a technology agnostic energy storage project developer with a division dedicated to partnering with off-grid communities and mine sites to reduce dependence on diesel fuel. NRStor works to develop, finance, own and operate industry leading clean energy microgrid projects in partnership with progressive stakeholders and leading technology suppliers. NRStor Remotes has a strong understanding of project development in remote locations and is a market leader in understanding energy storage technologies, their costs, and the benefits they can provide customers across the energy supply chain.

FALLING BATTERY COSTS

Bloomberg New Energy Finance projects battery prices will be around 73 USD/kWh in 2040 down from 250 USD/kWh in 2017. Declining costs for battery technology will further underline the economic case for renewable energy solutions for mines and Canadian storage providers are ready to be part of this exciting transition.

CANADA HAS A BREAKTHROUGH OPPORTUNITY

Hybridization has become an important tool for mines to reduce operating costs and lower carbon emissions. As the business case for energy storage and hybrid systems for mines continues to grow, Canadian firms are supplying solutions and are partnering on these mining projects.

Canada is home to world-leading storage companies that specialize in technologies for industrial applications including remote mines. These firms are reaching beyond Canada’s borders with interest from partners and industrial energy users in Africa, Australia, the U.K., the Caribbean, Chile, India, Mexico, and the U.S.

CANADIAN STORAGE SUPPLIERS AND MINING APPLICATIONS

NRStor, a Canadian energy-storage developer, recently secured a CAD\$120-million debt facility from Swiss-based investment house SUSI Partners AG to help fund industrial and commercial storage projects. The company is also actively developing microgrid projects for Canada’s remote indigenous communities and pursuing opportunities in the Caribbean and the U.S.

Hydrogenics is supplying technology for a wind-hydrogen power plant in Thailand and Hydrostor is developing its first utility-scale storage plant in Australia. These projects demonstrate the operability and applicability of these technologies for mines.

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