

GE Transportation
Energy Storage Technologies



Durathon™ Battery Technology

energy storage for utilities, reinvented




With more than 100 years at the vanguard of innovation, GE has committed its resources to develop, manufacture, and distribute Durathon battery technology on a global scale. This potent combination offers a historic opportunity to change the way the world uses energy.




High Performance and Distinctive Features


Durathon is far more than just a battery: it's a complete energy storage module with remote-monitoring capabilities, so no third-party battery management equipment is needed. It can be easily integrated into energy storage systems and is fully compatible with utility applications. With an innovative, modular design, Durathon battery modules can be connected in parallel to produce the required site power. The robust fail-safe design of the Durathon battery ensures that in the unlikely event of a cell failure, battery operation continues as before but at a slightly reduced voltage.



ENERGY DENSITY


With a gravimetric energy density of 115 Wh/kg and volumetric energy density of 160 Wh/L, Durathon is among the most energy-dense batteries available today – nearly four times the gravimetric energy density of a lead-acid battery






TEMPERATURE INDEPENDENT


Durathon batteries are capable of operating in temperatures ranging from -20°C to 60°C with no adverse effect on performance or cycle life, meaning that heating or air-conditioning systems are not required for most installations.





LONG CYCLE LIFE

With a shelf life of more than 20 years, Durathon batteries can deliver >3,000 operating cycles at 80 percent DOD on a two-hour rate.





ENVIRONMENTALLY FRIENDLY

Durathon batteries are composed of simple, abundant materials with multiple sources of supply. They are sustainable, nontoxic, fully recyclable and produce zero emissions.

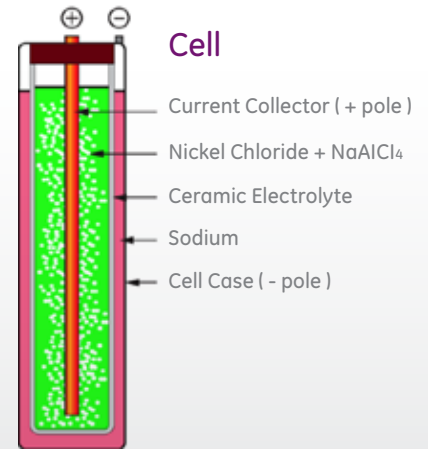




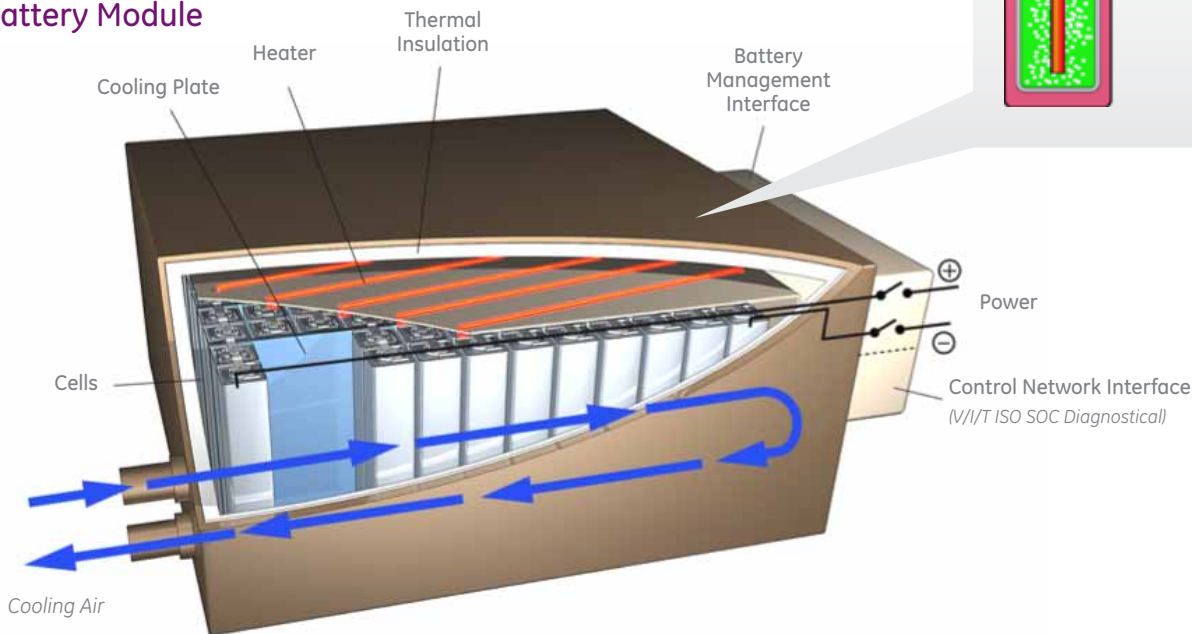
Inside Durathon Battery Technology

HOW IT WORKS

GE's sodium-metal-halide battery consists of a nickel chloride cathode, a beta alumina separator and a liquid sodium anode. During charging, Cl is extracted from NaCl and combined with Ni to form NiCl₂. The Na ions are then transported through the beta alumina to the anode reservoir. Discharge is the reverse of this process. Because sodium ions move easily across the beta alumina but electrons cannot, there are no side reactions, and therefore no self-discharge. All of the materials are housed in a hermetically sealed steel case, which becomes the individual cell. Cells are then contained in a thermally insulated battery module. An integral battery management system is installed on all battery modules and controls charge/discharge, monitors battery parameters, provides battery protection, and passes information to the outside world through common modbus protocol.



Battery Module



A LONG-TERM COMMITMENT TO DEVELOPMENT AND LARGE-SCALE PRODUCTION

In 2007, GE acquired Beta R&D, a pioneer in the development of sodium metal halide batteries. Over decades of research, Beta R&D had demonstrated the durability of this technology. Sodium metal halide batteries have been used in pure electric and hybrid electric vehicles for over 20 years and have accumulated thousands of successful in-use operating hours.

In 2009, GE announced a \$160 million investment in battery technology, with Durathon as its flagship offering. Durathon is currently being produced in limited volumes for testing and evaluation, with mass production scheduled for Q3 2011. Contact GE representative for details.



High volume manufacturing facility online in 3Q2011



*Based on preliminary testing conducted by GE.

Applications for the Utilities Industry

Durathon battery technology can help utilities achieve the widespread adoption of a range of applications. Its high energy density and long cycle life can support localized storage solutions, helping utilities to generate and distribute energy where and when it's needed.

RENEWABLE-ENERGY SOURCES

Improve integration and increase utilization of energy generated from photovoltaics and wind turbines

COMMUNITY ENERGY STORAGE

Provide numerous benefits including load leveling, backup power, renewables integration and ancillary services

RESIDENTIAL ENERGY STORAGE

Enable demand-side management and time-of-use applications with placement of batteries in residential homes

SMART GRID/MICROGRID

Create a new and more flexible grid by combining smart devices and real-time communication with energy storage

TRANSMISSION & DISTRIBUTION

Defer upgrades, relieve congestion, control voltage and improve reliability

ANCILLARY SERVICES

Spinning reserves, supplemental reserves, load following and other ancillary services



For more information, visit www.geenergystorage.com.



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