



What does it mean to be green?

A truly green battery minimizes environmental impact and is backed by globally-recognized ecolabel certifications



Summary

This white paper describes what it truly means to be green and why Boston-Power® offers the best choice for environmentally-conscious users of notebooks or other portable electronic devices—the **Sonata**® battery. Being green means much more than offering a recyclable battery. An eco-friendly battery:

- Reduces waste (post-recycling scrap) by offering an extended service life.
- Makes optimal use of natural resources (manufacturing materials, energy, water, etc) by lasting the lifetime of a typical notebook computer.
- Is essentially free of dangerous substances that can harm the environment.

Sonata is the only notebook battery to fully meet these challenges and is the only rechargeable lithium-ion battery to receive both Nordic Ecolabel and Chinese Ecolabel certifications for environmental sustainability. When selecting batteries for notebooks or other portable electronic devices, Boston-Power is the clear choice for businesses, institutions and consumers who care about the environment.



What does it mean to be green?

A truly green battery minimizes environmental impact and is backed by globally-recognized ecolabel certifications.

Introduction

Increased environmental awareness and more stringent environmental legislation are causing businesses and consumers to seek out eco-friendly products and solutions in their everyday lives. Green products help preserve non-renewable resources for future generations and help safeguard the environment by preventing toxic materials from entering the ground and contaminating food and water supplies.

How eco-friendly are today's notebook batteries?

The casual observer may think he is doing his part for the environment by purchasing a conventional recyclable battery for notebooks or other portable electronic devices. In reality though, most lithium-ion batteries are not as eco-friendly as they could be.

- Most lithium-ion batteries last only about a year. In fact according to a Harris Interactive® market study¹, 40% of consumers who have owned a notebook for three years or longer have replaced the battery as many as five times. Frequent battery replacement wastes natural resources.
- Most lithium-ion batteries don't carry international certifications that attest to chemical control, sustainable product life, and corporate social responsibility.

A truly green battery must address environmental impact more fully. An eco-friendly battery must address all of the following:

- Maximize life expectancy to reduce waste and make best use of natural resources.
- Bear all of the latest international certifications for environmental sustainability.
- Contain no heavy metals or other dangerous substances that are harmful to the environment.
- At the end of life, be recycled properly.

¹September 2008 Harris Interactive® Poll



Maximum life expectancy reduces environmental waste

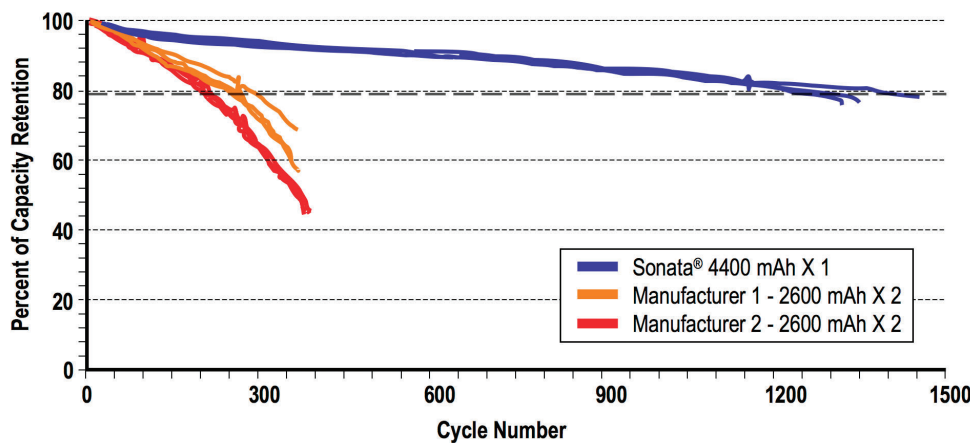
Manufacturers often tout advances in battery capacity—the amount of energy a battery can deliver in a single discharge. But greater capacity does not translate to improved battery service life or environmental sustainability. In fact, higher-capacity batteries fade more quickly and must be replaced more frequently—at greater cost to the environment.

To prove this, Boston-Power tested two industry-standard, high quality 2.6 Amp-hour cells with its Sonata cell to compare capacity retention. As the chart below illustrates, the higher capacity batteries faded more rapidly, reaching the end of their service life (80% of original capacity) in approximately 300 charge cycles.

In stark contrast, Sonata maintained 80% of its original capacity even after over 1000 charge cycles.

An extended service life reduces waste (scrap materials at the end of the recycling process) plus conserves natural resources (water, energy, etc) and non-renewable materials (lithium, copper, nickel, etc.) consumed in the manufacturing process.

The myth about battery capacity





Government-issued accreditations

In response to increasing environmental awareness, certain governments have established official accreditation organizations to promote sustainability and help consumers identify eco-friendly products. The Nordic Ecolabel and the China Environmental United Certification Center (CEC) Ecolabel programs ensure products meet strict environmental guidelines. The Ecolabel seal of approval lets consumers know they are purchasing environmentally sound products.

Nordic Ecolabel

Introduced in 1989 by the Nordic Council of Ministers—comprised of Denmark, Finland, Iceland, Norway, and Sweden—Nordic Ecolabeling aims to reduce the total burden on the environment by encouraging companies to adopt more sustainable manufacturing practices. It also helps consumers choose products with reduced environmental impact, allowing them to shop with a “green” conscience.

The Nordic Ecolabel is recognized worldwide as the most stringent environmental product certification. In fact a 2008 global study commissioned by the British Government named the Nordic Council of Ministers Ecolabeling agency as a world leader and awarded the Nordic Ecolabel best practice for certification of sustainability in three different categories.²

Sonata’s Nordic Ecolabel accreditation verifies that it minimizes metal pollution by fulfilling the criteria for long life, high capacity, and smallest amounts of detrimental heavy metals.

Sonata is the first rechargeable lithium-ion battery to receive Nordic Ecolabel accreditation (awarded Q1 2007) and Boston-Power is the first U.S.-based company to receive this honor.

The Nordic Ecolabel is contingent upon:

- **Sustainable product life** – batteries must exhibit a cycle life of >400 cycles while retaining >80% of original capacity.
- **Chemical control** – products must contain no dangerous heavy metals at trace levels, and no PVCs.
- **Corporate social responsibility** – producers must engage in sustainable manufacturing practices.

²“Mapping and analysis of sustainable product standards. Final Report.”
UK Department for Environment, Food and Rural Affairs (Defra). March 2008



Chinese Ecolabel

The China environmental labeling program was established in 1993 by the China Environmental United Certification Center (CEC) in response to the World Environment and Development Conference of 1992 and input from the international environmental labeling movement.

Sonata was the first rechargeable lithium-ion battery to receive CEC Ecolabel certification (awarded Q1 2008) and Boston-Power is the first U.S.-based company to receive this honor. Based largely on Nordic Ecolabel guidelines, the CEC Ecolabel took it one more step:

- **Sustainable product life** – batteries must exhibit a cycle life of >800 cycles while retaining >80% of original capacity.
- **Chemical control** – products must contain no dangerous heavy metals at trace levels, and no PVCs.

No heavy metals or harmful substances

Sonata is certified to meet the strictest standards for hazardous chemicals including heavy metals such as mercury, lead, arsenic and cadmium that can contaminate landfills and harm food and water supplies. The Restriction of Hazardous Substances Directive (RoHS) limits the use of hazardous materials in the manufacture of various types of electronics equipment. While almost all batteries carry RoHS certification, Sonata is the only rechargeable lithium-ion battery to carry both RoHS certification *and* the Nordic Ecolabel certification. Compared to RoHS, the Nordic Ecolabel bans the use of chlorinated plastics, imposes limits for arsenic, plus defines more stringent restrictions for cadmium, lead and mercury. And while RoHS pertains solely to hazardous materials, the Nordic Ecolabel covers other areas of environmental concern such as corporate social responsibility and sustainable product life.

Nordic Ecolabel vs. RoHS Standards

Chemical	Requirements for Detected Levels (ppm)	
	Nordic Ecolabel	RoHS
Cadmium (Cd)	≤20	≤100
Lead (Pb)	≤20	≤1000
Mercury (Hg)	≤0.1	≤1000
Arsenic (As)	≤20	Not covered
Chlorinated Plastics	Cannot be used	Not covered
Hexavalent Chromium (Cr6+)	Not covered	≤1000
Polybrominated biphenyl (PBB)	Not covered	≤1000
Polybrominated diphenyl ethers (PDBE)	Not covered	≤1000



Boston-Power: fostering environmental sustainability

At Boston-Power, being green means much more than offering a recyclable notebook battery.

Boston-Power helps conserve resources for future generations. Boasting a service life that is at least triple the industry average, Sonata lasts the lifetime of a typical notebook computer. An extended service life reduces waste, plus conserves natural resources and non-renewable materials used in the manufacturing process. As a testament to long service life, with Sonata, notebook PC providers such as HP, can offer industry-leading three year warranties on their notebook batteries.

Sonata meets the most stringent environmental standards. Sonata is certified to meet the strictest standards for hazardous chemicals including heavy metals such as mercury, lead, arsenic and cadmium that can contaminate landfills and harm food and water supplies. And Boston-Power notebook PC partners make recycling easy and convenient. For example, as part of the HP Eco Solutions program, the product can be dropped off for recycling at over 32,000 locations throughout North America.

Being green means more than just delivering green products. Boston-Power believes in Corporate Social Responsibility (CSR) and is working to influence global policy on environmental sustainability. The company is an active participant in *The Road to Copenhagen* which advises the 2009 UN Conference on Climate Change, and is an active member of the New England Clean Energy Council.

Sonata: a truly green lithium-ion battery

Sonata is the clear choice for environmentally-conscious consumers and organizations. A truly green product, Sonata:

- Conserves natural resources and eliminates waste by offering the industry's longest service life.
- Is the only rechargeable lithium-ion battery to receive the coveted Nordic Ecolabel and Chinese Ecolabel certifications for environmental sustainability.
- Contains no heavy metals or other harmful substances that can harm the environment.

With Sonata, users don't have to choose between battery performance and the environment. With Sonata, users of notebooks and other portable electronic devices can enjoy the highest performing battery available on the market today, while doing their part to protect the environment and preserve resources for future generations.



Glossary

Battery – a collection of lithium-ion cells governed by electronics packaged together to power portable electronic devices, such as notebook PCs. Also referred to as a battery pack.

Capacity – a measure of the amount of energy that a battery can deliver in a single discharge, normally listed in amp-hours or watt-hours. Over time, all rechargeable batteries eventually lose their ability to retain their original capacity. Sonata batteries are designed and built to retain 80% of their original capacity over three years (assuming 300 cycles per year)—the typical useful life of a notebook computer. Most conventional lithium-ion batteries can only retain 80% capacity for 200-300 cycles.

Cell – an electrochemical device capable of storing electrical energy. Notebook batteries contain cells and other components.

Cumulative Runtime – the collective runtime delivered by the battery over its entire service life. Conventional lithium-ion batteries deliver a cumulative runtime of about 800-1200 hours. Sonata delivers a cumulative runtime of over 4000 hours.

Cycle Life – the total life expectancy of a battery, expressed in charge/discharge cycles. A conventional lithium-ion battery has a typical cycle life of 200-300 charge/discharge cycles. Sonata has a typical cycle life of at least 1000 charge/discharge cycles.

Fade – to lose the ability to maintain battery charge. Over time all rechargeable batteries eventually lose their ability to hold charge. Conventional lithium-ion batteries begin to fade after just a hundred or so charges. Sonata retains its ability to maintain charge longer than conventional batteries, allowing users to enjoy several years of long battery runtime.

Lithium-ion Battery – a rechargeable battery commonly used in portable computers and other consumer electronics.

Retention – a battery's ability to maintain charge. Over time all batteries eventually lose their ability to retain charge. Conventional batteries retain less than 80% of their original capacity after 200-300 charge cycles. Sonata retains 80% of original capacity even after 1000 charge cycles.

Runtime – the amount of time a notebook can run before its battery needs to be recharged—usually about four hours for a new battery depending on individual notebook settings.

Service Life – the total life expectancy of a battery, expressed in time. A conventional lithium-ion battery has a typical service life of about a year. Sonata has a typical service life of at least three years.