



Case 4

No Batteries

reduce mining and smelting, cut costs and eliminate health risks

This article introduces the elimination of batteries as one of the 100 innovations that shape The Blue Economy. This is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

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The Market

In 2009 the world discarded an estimated 40 billion small batteries. This has fueled demand for rare metals. Cobalt is indispensable for rechargeable batteries. The Prius hybrid car would never operate without neodymium. While the volumes per unit are small, tiny variations in demand for rare metals can send prices up and down by a factor of ten. Industries face uncertainties about future supplies and hedge their position, since demand for batteries powering hearing aids, pacemakers, cell phones, MP3 players and watches may expand to 100 billion units per year worldwide within three to five years. We are looking at a €100 billion market retail annually.

Demand for these rare metals receives an additional boost from the introduction of “green technologies” such as wind turbines and eco-batteries. If we add the Chinese appetite for these rare commodities, then experts reckon that a major squeeze could come in the next decade. Most supplies of rhenium, cobalt, neodymium and samarium come from a handful of mines located in remote areas in Inner Mongolia, Siberia and the Republic of Congo, thus supply is subject to harsh climate and political uncertainties. Within this context it is no surprise that venture funds are heavily betting on the design of a wide portfolio of innovative green batteries.

The Innovation

Green batteries are not a solution to the challenges described, these are a transition. While green power sources substitute cadmium and mercury with lithium and nickel, these supposedly eco-friendly batteries that cause less harm to the environment and pose lower risks to our health, rely on a different variety of minute amounts of rare earth elements which require mining, smelting and carbon emissions that contribute to climate change.



The recent innovations in energy supply at the Fraunhofer Institute (Germany), one of the world's leading centers of applied research provides a different pathway. Peter Spies and his colleagues designed a cell phone that operates without batteries. The temperature difference between body and phone provides sufficient energy to keep the phone on stand-by. The conversion of sound waves created by voice into an electric current through a piezo-electric device powers the call - as long as we talk. The longer you talk, the longer your call. This is an existing science that turned promising, since the same team designed phone devices that require less energy.

Independent of this research, Jorge Reynolds - one of the inventors of the pacemaker - demonstrated the capacity to reduce resistance to current inspired by the whale's electric power generation and distribution using nano-carbon wires (see illustration). *A whale used to be a dog.* So in order to maintain the same level of pulsation power, the whale's heart needed to improve conductivity and did so, biologically. It is the combination of reduced resistance as imagined by Reynolds and reduced energy requirements as demonstrated by Fraunhofer that permits the redesign of power for miniaturized electronics, ultimately eliminating batteries.

The First Cash Flow

The introduction of new pacemakers without batteries requires years of research, lots of capital and perhaps even a decade of patience to obtain government approvals. The elimination of a battery from cell phones implies a redefinition of supply chain management. This is not viable short term. That is why Reynolds created CoroCare Inc., a California-based venture company to bring innovations to the market. The first application is a battery-free device to measure body temperature without wires. The market potential is large. This innovative application does not compete with existing electronic devices.

It is a well established fact that the body temperature of a woman increases when she ovulates. A simple patch attached to the chest could measure the body temperature and compare this against a pattern that is registered on a private website. If the temperature increases over the daily averages with more than half a degree (Celsius), then there is a high certainty that ovulation occurs. Today anti-conception is mainly based on chemical controls by "the pill". This battery-free innovation allows a simple and non-invasive management of social behavior without chemistry.

The Opportunity

The use of batteries has become a standard and most product designers take it for granted. Watches represent a huge segment. However the battery-free watches tend to be expensive and depend on a higher number of parts thus increasing assembly cost,



whereas battery-powered watches operate on a few electronic components. Battery-free watches represent a long term objective only.

The opportunity to enter the market of gadgets without batteries focuses on the high-end applications in mobile micro-electronics where the cost of electric current per kilowatt hour is high and the size of the battery creates discomfort. The first market that comes to mind after the patch is the hearing aid. The cost for one kilowatt hour is in excess of €100, and one device costs €2,000. This high cost permits to design a substitution of a battery power source to one driven by body temperature differentials. The hearing aid is placed outside the body, while the impulse generator is channeled inside the ear. This permits a heat exchange that is strong enough to power the tiny device. This device without battery is lighter, hardly visible, and cheaper. These are major improvements to the present expensive standard.

Reynolds went on to design a mobile electro-cardiogram device (EKG) that monitors the heart beat during 24 hours through a mere patch, equipped with minute electronics permitting the reading of the heart beat over 24 hours without batteries or wires. Imagine that Lance Armstrong participates in the next Tour de France, and everyone could monitor his heart condition in real time over the internet while he towers the Alps...

The substitution of batteries by no batteries is real. Since these core technologies are open source, it provides a platform for entrepreneurs, without overloading our environment with mining, smelting and the disposal of toxic waste at a lower cost and increased comfort. This is a new competitive business model in the making.

For further background on the 100 cases: www.blueeconomy.de

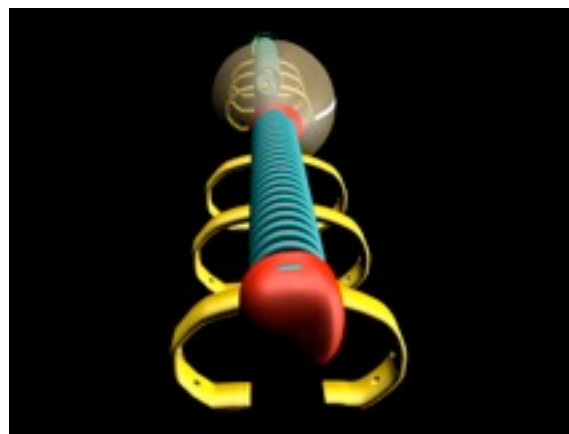
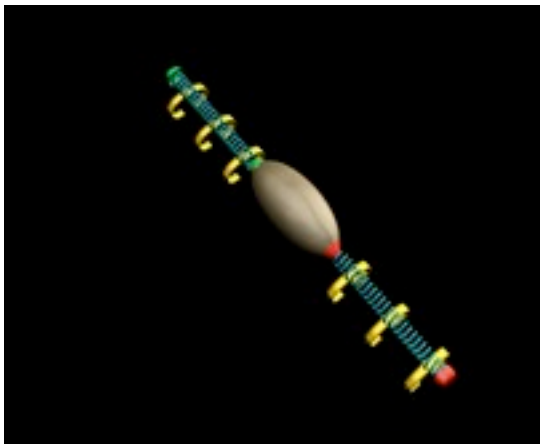
To pre-order the book *The Blue Economy: 100 innovations - 10 years - 100 million jobs*, please go to <http://www.paradigm-pubs.com/catalog/detail/BluEco>. You will receive a 10% discount if you order before April 1, 2010 and key in the promotional code: TBE4110.



Photos



The whale pumps 1,000 liters of blood each pulse powered by 6-12 volts generated through the chemical reaction of potassium, sodium and calcium combining 70 millivolts into a predictable stream of electricity for up to 80 years without maintenance. There are no batteries nor wires. (Photo courtesy of the author)



Nano-carbon wires designed by Dr. Jorge Reynolds reducing resistance to electric current the way the whales resolved the challenge, growing from a dog into the largest mammal. This eliminates the need for a pacemaker. (Drawings courtesy Jorge Reynolds)