Greener Materials

Finding Greener Materials: Example 1

by Annika Bergen, George Cook, Ellie Cotlar, Dawn Suite (2017)

Note: This is a company-anonymized version of the file.

Comments:

Good work, team! You listed the material being replaced & why, listed 5 alternatives, and had URLs and price estimates (kind of), which is all good. You also clearly listed the winning choice, and had a very solid argument for it.

Some things to consider: most of this tech is clearly still in the research stage and thus doesn't yet have actual replacement potential, unless of course the client wants to go into the business of manufacturing sugar batteries. Other than The Bioo, these are not products from a business that could be substituted in a BOM. While I love the direction and thought process in terms of the biggest impacts Whole System-wise and bringing it back to your EPEAT recommendation, it would likely be a tough sell for your client because it ultimately means developing a new product. Also, your presentation layout was a little hard to follow--it feels cramped and the text hierarchy is confusing. That said, those are some amazing stats in terms of battery performance, and potential energy savings.

9.1 Find a Better Material //

Annika Bergen + **G**eorge Cook + **E**llie Cotlar + **D**awn Suiter

Replacing a High-Environmental Impact Material // BATTERY
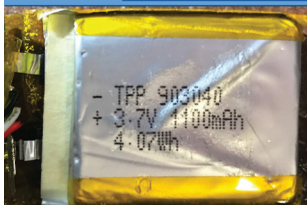
Current Material: 2 rechargeable Lithium Ion batteries are used in every device
(Model 903040 Li Polymer Battery, 3.7v, 1100mAh, 4.07Wh. Cost: $3.00 per battery / $6.00 per device.)

Rationale: Reducing ecological impact of the battery supports EPEAT recommendation of identifying materials with special handling needs and eliminating where possible.

Alternatives Explored (with linked references):
    Bioo Plant Charger (removing battery) // Rhubarb Flow Batteries // Batteries from Recycled Materials // Sugar-based Batteries
Supercapacitors // Virus-grown Batteries // Organic Biomaterial Batteries // Battery from Wood Materials // Organic Flow Batteries

Evaluation Criteria: Reduce environmental impact from battery materials, safety, energy density, size

Winning New Material: Sugar-based Batteries

Image: Virginia Tech College of Agriculture and Life Sciences
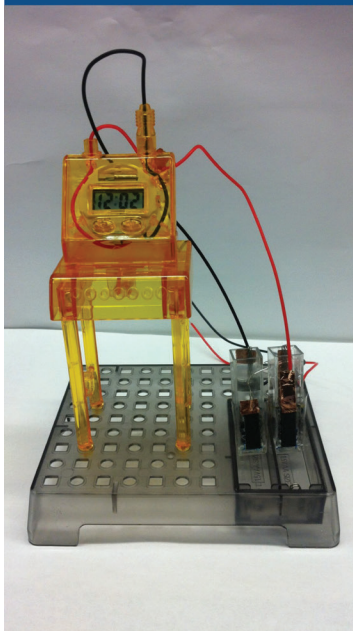
Dr. Y.H. Percival Zhang and his research team at Virginia Tech have developed a promising new battery technology that uses enzyme pathways to generate electricity.

These batteries replace lithium and nickel with renewable materials: 15% maltodextrin (a product of corn starch) and enzymes. Disposal of lithium ion batteries impacts the environment and human health (Environmental Protection Agency study). Instead of being disposed these batteries can be recharged by filling with fresh sugar solution.

They are also safer than the Li batteries they would replace: The fuel sugar solution used is not explosive or flammable. The prototype battery about the size of a AAA battery, has an energy density that is 10 times higher lithium-ion batteries according to their paper in Nature.

From a cost perspective, the researchers estimate these batteries could be manufactured at one-tenth the cost of lithium-ion batteries. The current cost of the Li batteries used in each ▬▬▬ device is about $6.00. Based on the researcher's estimates, these new batteries would lower the cost per device to $0.60. [Cost information was sourced from this article in Business Insider and based on the cost of the current battery on alibaba.com.]

See below for contacts team AGED has reached out to for more information.

Contacted for cost, more information:

Bioo Plant Charger
Arkyne Technologies
Emailed: info@bioo.tech

Rhubarb Flow Batteries
Green Energy Storage
Contacted:
http://www.greenenergystorage.eu/en/contact-us/

Batteries from Recycled Materials
Battery Resources
Contacted:
https://www.batteryresourcers.com/contact-us.html

Sugar-based Batteries (Winning material)
Dr. Y.H. Percival Zhang, Virginia Tech
Emailed: ypzhang@vt.edu

Supercapacitators
Augmented Optics Ltd,
Director: Dr. Donald Highgate
Emailed: info@supercapacitormaterials.com

Virus-grown Batteries
Dr. Angela Belcher, MIT
Emailed: belcher@mit.edu

Organic Biomaterial Batteries
Daniel Brandell, Senior Lecturer at the
Department of Chemistry, Uppsala University
Emailed: daniel.Brandell@kemi.uu.se

Battery from Wood Materials
Dr. Liangbing Hu, University of Maryland
Emailed: binghu@umd.edu

Organic Flow Batteries
Dr. Sri Narayan, USC Dornsife
E-mailed: srnaraya@usc.edu

List of References

Bioo Plant Charger, http://www.pocket-lint.com/news/137371-now-you-can-turn-any-plant-into-a-phone-and-tablet-battery-charger

Rhubarb Flow Batteries, http://www.lifegate.com/people/lifestyle/rhubarb-batteries

Battery Resources, https://www.batteryresourcers.com/home.html

Sugar-based Batteries, https://www.vtnews.vt.edu/articles/2014/01/012213-cals-battery.html, http://www.nature.com/ncomms/2014/140121/ncomms4026/full/ncomms4026.html, http://www.businessinsider.com/sugar-based-battery-developed-by-virginia-tech-2014-1

Supercapacitators, http://www.express.co.uk/news/science/740174/Battery-breakthrough-supercapacitor-technology-revolutionise-mobile-phones-electric-cars

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Organic Flow Batteries, https://pressroom.usc.edu/usc-scientists-create-new-battery-thats-cheap-clean-rechargeable-and-organic/

ABT Associates EPA Study on Lithium Ion Battery impacts, http://www.abtassociates.com/newsreleases/2013/study-identifies-benefits-and-potential-environmen.aspx

Alibaba for pricing on current battery, https://www.alibaba.com/product-detail/Ultra-capacity-lithium-Polymer-battery-3_60548460012.html?spm=a2700.7724838.0.0.gtyLpu