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OnTo for Environmental and Economic Sustainability in Battery Recycling



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CEO CFO: Mr. Sloop, what is the idea behind OnTo Technology?

Mr. Sloop: The idea behind OnTo is to implement battery recycling to enable economic and environmental sustainability of electric vehicles and energy storage, and carbon neutrality for smaller batteries supporting internet technologies. Towards that end, OnTo invented its suite of Cathode-Healing™ technologies for safe, low cost, cathode-to-cathode/direct cathode recycling. Using 1% of the energy required by other technologies, Cathode-Healing recycles most any lithium-ion technology to produce low-cost manufacturing ready material.

CEO CFO: What are some of the challenges and what does it take to recycle a lithium battery?

Mr. Sloop: Challenges include safety, logistics, and cost. Lithium-ion is a "fire triangle" with oxygen, fuel, and heat generation potential; and they are all packaged together. At end-of-life small batteries frequently get compromised and ignite in municipal-waste transfer stations to cause property damage, compromise worker health, and loss of facility service. At aggregation or service centers for end-of-life large batteries, the risk for large fire/events increases with the fuel in the battery fire triangle. OnTo's battery deactivation technology removes the heat-generation-potential and fuel in that triangle to produce inert items from large or small batteries. It can be practiced at low cost with flexibility to a customer at a transfer station, service location, or aggregation site.

Logistics safety improves and cost decreases with elimination of the fire risk. Storage of inert items is much less risky than for items with a potentially active fire-triangle. Logistics accounts for the lion's share of the cost in Li-ion recycling, eliminating the risk and liability of dead batteries helps to enable their commoditization and simplification of commerce in recycling.

Finally, low-cost recovery of materials is critical for the economic sustainability of battery manufacturing. The current technical approaches produce material that is more costly than products from mining, that means recycling is a cost to the closed loop industry. Current techniques are inflexible to today's battery chemistries, and those of the future. The way we approach this challenge is to use a low-energy, cathode-healing™ to recover the most important crystal, the cathode material, and to put a little bit of energy into that to restore functionality for manufacturing. This process is flexible to any lithium-ion chemistry, produces a manufacturing viable product that is ten-times less expensive than the original cost of production, and well below the cost of mined materials for making batteries. This is one of the beauties of appropriate technologies for advanced batteries and lithium-ion, there are technical pathways to maintain the value, and they can be scaled as the industry demands.

CEO CFO: *Are you doing this now? Are you licensing your technology or working with partners? How does theory go into practice?*

Mr. Sloop: We are creating strategic partnerships to scale-up and commercialize cathode-healing™, sorting, and battery deactivation. OnTo has ongoing projects with battery manufacturers, environmental service providers, OEMs, and Federal and State agencies. Examples of our activities include a California Energy Commission award to improve the value of end-of-life battery materials; Defense Logistics Agency to develop cathode-healing and battery deactivation; Department of Energy EERE to eliminate class-9 hazards in lithium-ion recycling; Made in America Battery Recycling Phase II Prize awardee; CalTestBed for testing through Lawrence Berkeley National Laboratory; Johnson Matthey and the UK Battery Industrialization Centre for cathode-healing™ recycling of manufacturing waste; and other activities with OEMs.

CEO CFO: *Are the appropriate people concerned about recycling lithium batteries?*

Mr. Sloop: It is becoming more and more a front-of-mind issue with environment social governance (ESG), critical materials, carbon neutrality, and plain-old cost efficiency. Successful recycling, with OnTo's Cathode-Healing™ and battery deactivation, is foundational for the economic and environmental sustainability of large-format batteries for storage and EVs. Government has been tuned into this through multiple representative cycles, Defense and Energy departments are keenly aware of the manufacturing value chain requirements to maintain the new and growing industry, the electric vehicle manufacturing industry is developing stronger ties with new and existing recycling infrastructure, the investment community is activating in the area, and the environmental services sector is undergoing changes to provide for the need and opportunity here. We are pleased to have high profile visits from industry and government, including Governor Brown from the State of Oregon. This is a good group of appropriate people and there is always room for more.

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CEO CFO: *Would someone take advantage of all of the technologies; are they all interrelated or are some standalone?*

Mr. Sloop: There are both interrelations and standalone opportunities. We are pleased to have a focused development with Johnson Matthey on cathode-healing™ applied to closed-loop recycling of early-stage manufacturing scrap. It addresses a focused industrial problem of manufacturing wastage, with the intent to eliminate the physical losses of critical material and improve the razor-thin profitability for battery manufacturing.

CEO CFO: *When you are speaking with the right person, do they understand?*

Mr. Sloop: Certainly, people get the challenge and opportunities with recycling services all along the value chain. It is exciting to see that engagement. The technical side can be a challenge sometimes, since direct recycling is a new concept for the industry, and it may not be obvious – which is part of the nature of innovation and invention. So, I take lessons from my very first job, teaching physics and chemistry, sometimes a different angle or explanation is required to make the connection. And always, the best way to make the explanation is through an ongoing demonstration and that is what we do typically here at OnTo, for example, through manufacturing the first fully recycled NMC EV battery, third party verification of battery deactivation, and scale-up with key partners.

We continue to demonstrate the technology features and benefits with partners and explore options to increase traction. Maintaining and expanding demonstration, simplifying the explanation, and making the business case.

CEO CFO: *How do you deal with some of the frustration knowing you have something at OnTo Technology to help in such an important area and yet it is a real challenge to get it moving?*

Mr. Sloop: It is just part of the tech development job. It is always an opportunity to refine the pitch and advance the current partnerships. This is all part of the interesting and rewarding effort for commercialization. We have a very good success in activities with numerous industrial partners. We are keen to make those successful, reduce the risk of scale-up and commercialization, provide proof of the features and benefits of these technologies to stakeholders, and prove the bottom line.

We continue to demonstrate the benefits of cathode-healing™, battery deactivation, and sorting as low-cost methods to safely return materials back into manufacturing. The battery industry has a wide variety of unique approaches, people

want to differentiate themselves. OnTo's suite of battery recycling technologies provides ways for OEMs to differentiate themselves, improve safety, reduce cost, and win through efficiency and performance.

The battery industry is growing to meet the demands for electrification and storage. With such growth, what were small niches become chasms that threaten viability. OnTo will obtain traction within a market niche and enable winning business through resolving these market pains related to recycling.

