Electric Vehicle (EV) Batteries

What Municipal Staff Need to Know

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Hybrid vehicles such as the Toyota Prius entered the Canadian market in about the year 2000, and plug in hybrids (like the Hyundai Ioniq) as well as full battery electric vehicles (like the Tesla) entered the new vehicle market in 2010. Batteries from electric vehicles last 8-10 years or more unless in an accident, and are either nickel metal hydride (NiMH) (for many hybrids) or lithium ion (Li-ion) (for some hybrids, and all plug-in and full electric vehicles). While it is unlikely that municipalities will see these batteries anytime soon, it is always good to know something about them in case they show up at a recycling facility, drop off site, transfer station or landfill.

California is looking at policy options for end-of-life EV batteries as they are concerned about potential illegal dumping if recycling options are not available. This has already happened in California for solar energy system photovoltaic (PV) panels. Solar PV units last about 30 years and the first California installations are now at end-of-life. The cost of recycling and lack of recycling options for solar panels have led to an illegal dumping

problem, and California does not want this to happen with EV batteries. The California EPA, Department of Toxic Substances and CalRecycle have formed a multi-stakeholder Lithium-ion Car Battery Recycling Advisory Group to study the issue. The recently announced Alberta electronics program expansion pilot includes solar panels.

EV batteries retain about 80% of their charge when no longer useful for an electric vehicle. The charge (up to 200 volts) makes these batteries dangerous if handled by someone who is not aware of the proper occupational health and safety procedures and protocols. These end-of-life EV batteries need handled by someone who has been properly trained and knows what they are doing, because they can cause serious electric shock and burns if not handled by an expert.

EV batteries are heavy (93kg for a Toyota Prius Liftback hybrid; 124kg for a Ford Fusion PHEV and 478kg for a Tesla 3). They have complex wiring for the battery management system (BMS), and contain many cells or packs which are generally housed in steel casings. Dismantling the EV batteries to separate the various components for recycling is labour intensive and therefore expensive. For the foreseeable future, it is expected that the recycling of EV batteries will require a fee because of the complex handling and dismantling requirements. This is in contrast to lead acid batteries found in regular vehicles where recycling was always profitable because of the value of lead.

EVs are beginning to appear in sufficient numbers in scrap yards and vehicle recyclers to raise concern about proper management. Though the numbers are relatively small now, volumes will grow in the future. There have not been any reports of EV batteries showing up at municipal recycling depots, transfer stations or landfills to date, but this may change in the foreseeable future as the number of EV batteries at end of life increases.

Currently, some scrap yards store the EV batteries, waiting for the right opportunity to reuse or recycle them. However, this is only a temporary solution as storage takes up a lot of space. Ideally, Li-ion batteries should be stored at some distance from each other and not stacked. Where space is limited, the maximum amount that should be stacked is 2 units, with appropriate packaging and protection between the lower and upper unit. Sources in the Canadian vehicle recycling industry have reported that brokers often offer to take the batteries away from scrap yards or metal shredders at no cost, however scrap yard managers generally don't know what happens next. It is likely that these batteries are dismantled and cells which are in good condition with significant charge remaining are sold into the battery reuse market.

An EV battery reuse business has emerged recently which is expected to grow substantially. The EV batteries or cells can be used for energy storage as part of renewable energy systems, can be combined with new cells to create refurbished EV batteries, or the cells can be separately deployed to operate drones, wheelchairs and other equipment which has lower energy requirements. There are at least three established EV battery reuse businesses in the US (Speirs New Technologies (SNT) ; BigBattery and ITAP in California), but none in Canada at this time. Some Canadian companies ship the end-of-life EV batteries to SNT

Traditional recycling of lithium ion batteries involves processing them to produce various side streams that are sent to smelters for nickel and cobalt recovery. A number of Canadian companies are currently developing direct "cathode to cathode" recycling approaches which are likely to offer a different economic profile for EV battery recycling. Most cathode to cathode recycling approaches (none are yet operating at full scale) would recover separate materials such as lithium, manganese, aluminum, cobalt and nickel from the cathodes through hydrometallurgical processes and avoid the energy intensive smelting process. If successful, these new approaches would allow the recyclers to sell recovered metals directly back to battery manufacturers, rather than selling materials to smelters for further processing (which is the current approach).

While municipalities are unlikely to see many EV batteries in the near future, proper policies and procedures should be developed to address the batteries should they show up.

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