Outline of Potential Battery Commission Topics for HB0468 and SB0532
Submitted by Robert Swaim on February 22, 2024
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Submitted to the Maryland House and Senate Committees for HB0468 and SB0532 regarding a Commission To Advance Lithium-Ion Battery Safety.

Senator Jason Gallion
Chairman Marc Korman
Delegate Sara Love
Delegate Regina Boyce

My name is Robert Swaim and I have been a Maryland resident for 36 years, since moving to the area to become an NTSB aviation accident investigator and I've worked closely with firefighters around the world since the late 1980s. In January 2013, I was the launch investigator responsible for the Boeing 787 lithium ion battery fire investigations. I've been working lithium-ion battery incidents since, including Tesla and other electric vehicle fires since early 2017.

I retired from the NTSB after 32 years in 2019, started the www.HowItBroke.com website, and developed the first firefighter course for electric vehicles to be based in the international 17840 format. The Maryland Fire Rescue Institute – or MFRI – now provides training for free to Maryland firefighters and we all need to support that. I am also a leader in the SAE J2990 Committee for First Responder Electric Vehicle Safety, consult on the topic, teach a Lithium battery and electric safety course for the Society of Automotive Engineers (SAE), and am a member of the National Fire Protection Association, or NFPA.

Almost a year ago I was asked to help the New York legislature with some ideas about improving battery safety in their State. These efforts are underway and largely revolve around preventing e-bike fires, charger kill-switch requirements, and a new SAE sticker for license plates to let firefighters know if they were working with an alternative fuel vehicle.

Last Fall I approached Chairman Korman, Delegate Love, and Delegate Boyce to see if they would be interested in similar ideas for our own State. This led to some excellent discussions as they brought in others and realized how pervasive lithium-ion batteries have become in our day to day lives.

Say "battery" and people think about cars, but those are actually a very small part of our reliance on battery technology. Since it was asked by the delegates, we estimate there were roughly 56 Maryland EV fires in 2022, more than a hundred this year, and of course the number will grow with the increasing fleet of EVs. But those are not our big issues for this Commission to address.

When I was teaching firefighters in Queen Anne County last year we had great discussions about the number of vape fires they've dealt with and people horribly burned. We talked about house fires from cheap e-bikes.

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When you drive along your own street and see houses with solar panels, realize that some of those will have a large Lithium-Ion power wall in the garage. I doubt that many here are aware that the electric utilities now have nice looking brick buildings which house lithium-ion banks for when the power goes out. There's one not far from here in Ann Arundel County.

We should fully support the proposed "Commission to Advance Lithium-ion Battery Safety in Maryland." While technically there is nothing new or cutting edge about what the Commission will do, the key is that it will be a tailored approach for what unique conditions are applicable by locations across Maryland.

For example, there are 60.9 gasoline car fires per EV, but they are dealt with differently. The best course of action for firefighters in Queen Anne or on I-70 in Allegheny County, where water needs to be trucked to a fire, is to let an electric car fire simply burn itself out. This approach could be disaster if the same car were to catch fire in a Baltimore apartment garage.

The Commission will need to look into how best to establish towing agreements because tow companies do not want to pick up cars which can re-light while on the bed of an expensive tow truck. At least one forward thinking County already has a standing agreement with a waste company to supply steel 20 foot roll-on containers for moving fire damaged EVs. An e-bike fire in Southern Maryland may burn down a house, but in the heart of West Baltimore it could burn down an entire block.

Firefighter training will be a major aspect, as one day they need to already know what to do when there is a burning lithium-ion power wall in a garage. On the next call they may deal with a burning e-bike. There is a right way and a wrong way to simply approach and move a burning e-bike. As a side note, there is current Federal funding available which should be pursued immediately for our firefighter training.

But before all that and more important than the emergency response aspects are the needs for managing prevention through legislation and other programmatic aspects. How do we end the current problem of lithium-ion fires being created in our trash recycling locations? Since large scale back-up battery banks can emit a large plume of toxic smoke, how close can a utility place one upwind of a school for example? Should we allow a battery recycling facility to be built and where? Nobody currently knows how many large battery installations are in the heart of Baltimore skyscrapers. Can we get our Motor Vehicle Administration to begin using the SAE license plate stickers, informing firefighters they are approaching a burning alternate fuel vehicle? Should Maryland restrict sales of non-UL approved e-bikes, which is what New York now does? Are building codes ready for an apartment garage full of EVs?

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I am submitting an outline of all these topics to assist Legislators understand and envision suggestions regarding what this Commission could or should look into. Thank you for your time and I look forward to any questions, here or through my website at www How It Broke dot com.

Respectfully,

Robert Swaim

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MARYLAND COMMISSION TO ADVANCE LITHIUM-ION BATTERY SAFETY

INTRODUCTION
History
Goals
Process Used

1. PUBLIC UTILITIES, LARGE SCALE
   BACKGROUND
   - *Led by the Maryland Public Service Commission and while Maryland has targeted 3GW of energy storage by 2033 (2023 HB910), the management of battery energy storage systems (BESS) are currently spread among Commissions and agencies,. These group include the Department of Natural Resources, Office of People's Counsel (OPC), the Maryland Energy Administration (MEA), the U.S. Department of Defense (DoD), environmental organizations, electric companies, third-party providers of storage devices, the University of Maryland Energy Innovation Institute, the Maryland Clean Energy Center (MCEC), developers and owners of electricity generation, and other interested parties.*[1]
   - *This section is not intended to change the existing working relationships, it is meant to ensure that public safety is adequately addressed.*
   - *Note that there have been more than 75 explosions involving large scale BESS systems, four in 2023. (ref. https://storagewiki.epri.com/index.php/BESS_Failure_Event_Database)*

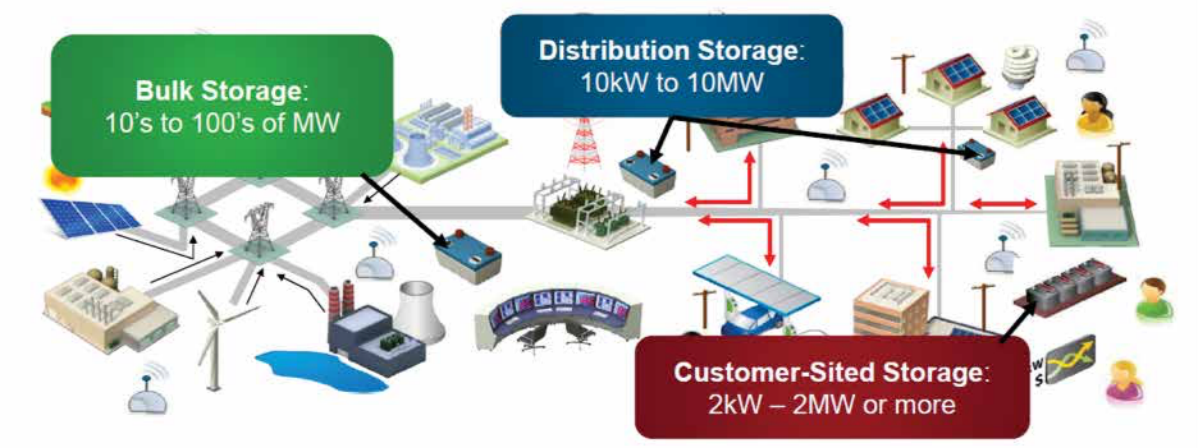

Fig. 1. Maryland Department of Natural Resources illustration
https://dnr.maryland.gov/pprp/Documents/Energy-Storage-In-Maryland.pdf

FACTUAL
- Review the Maryland Energy Storage Program (MESP) to ensure it is the viable path for the various agency, group policies, and planning fall under.
- Document existing large scale public utility battery storage and potential plans for growth, including inventories of site locations.
- Document adequacy of scheduled maintenance programs in terms of preventing failures. (Example: https://www.utilitydive.com/news/battery-energy-storage-fire-safety-report/707330/)

[1] *Md Public Service Commission:* https://www.psc.state.md.us/wp-content/uploads/Maryland-Energy-Storage-Program-MESP-MGA-Status-Report-2023.pdf,
MD Energy Administration: https://energy.maryland.gov/Pages/InsideMEA/index.aspx

- Document adequacy of planning for potential downwind and surrounding community risk prevention.
- Renewable sources (wind/solar) lithium-ion battery installations. Large scale battery storage is typically not located at the sites but some can have collection nodes.

ANALYSIS
- Discussion of growth from present storage capabilities and the meaning for changes in the grid.
- Potential distribution for architecture to become more resilient.
- Adequacy of maintenance to prevent failures.
- Potential risks to surrounding populations.
- Emergency response preparations and challenges with possible resolutions.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

2. LANDFILL AND TRASH FACILITIES

BACKGROUND

Improperly disposed batteries have become an increasing fire problem and risk for waste collection at all levels, from fires created when trash trucks compact contents to facility fires. Per DEP Director Adam Ortiz. "*We have seen fires caused by improperly disposed materials, such as batteries ...*" *An increasing number of cities are banning <u>all</u> batteries in trash pick-ups. Separately, there are an insufficient number of battery recycling facilities across the country which represents an opportunity to attract business. (example: https://www.wenatcheeworld.com/news/seattle-bans-throwing-away-batteries-in-garbage-citing-fire-risk/article_98eb8c78-bfa3-11ee-a9e3-5be414831bb5.html)*

FACTUAL
- Document history of Maryland landfill and trash facility fires, including those in waste transport vehicles.
- Document how the unique location of Maryland and the Port of Baltimore could attract businesses conducting recycling operations.

ANALYSIS
- Discussion of existing potential risks and problems, followed by examining possible resolutions.
- Discussion of how recycling should be in the future. Will need to examine costs.
- Examine opportunities and needed guidance for potential private recycling businesses to be established in Maryland.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

3. PRIVATE FACILITIES, LARGE SCALE AND MAJOR BUILDINGS

BACKGROUND

Lithium-based battery powered backup systems are becoming standard in large buildings and business facilities. Being privately owned and part of refurbishment, these may fall outside of awareness of the Public Service Commission. Building codes may require more thermal tolerance for structures to withstand longer burn times using extensively more water, and changes to response planning.

FACTUAL

- Investigate and report on the extent and use of large scale battery installations by corporate and private entities, including in major buildings.This includes facilities which perform battery testing. (example: https://www.wmar2news.com/news/local-news/lithium-battery-fire-causes-hazmat-situation-at-towson-black-decker-building)
- Renewable energy source (wind/solar) lithium-ion battery installations. As noted about those under the Public Service Commission, large scale battery storage is typically not located at the sites but some can have BESS collection nodes.

ANALYSIS
- Discussion of potential risks to surrounding populations
- Examine adequacy of emergency response preparations and challenges with possible resolutions.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

4. VEHICLE RECHARGING FACILITIES AND NETWORK

BACKGROUND
While the vehicle recharging network is not typically battery based per se, these systems frequently have numerous embedded lithium-ion battery storage systems (BESS) for storage and surge needs.
The recharging network is also so closely tied to the subject of vehicles with large format traction batteries (i.e. hybrid and battery vehicles) that it lends itself well to documentation and review by this commission.

FACTUAL
- Document state and capability of BESS in existing infrastructure.
- Consider documenting the related existing state of recharging stations in Maryland, to include rates of broken stations.
- Document power cut-off (“kill switch”) requirements in terms of National Electric Code and Maryland building codes. Includes ability to find and disable the source of power, as these may be in a shop or store and away from the actual charger if less than 60 amps. Many large charging stations have main power switches inaccessible due to being in locked panels.
- Document difficulty for charging by non-home owners. Charging is both expensive and inconvenient for those without the ability to charge at home, inhibiting Maryland goals for wide adoption of electric vehicles.

ANALYSIS
- Discuss expansion and growth needs for related electrical infrastructure, including in light of changes in various energy sources.
- Discuss expansion and growth needs for charging stations across Maryland.
- Examine adequacy of power cut-off methods in place.
- Should policy address the prohibitive hurdle of charging by people who do not have ready access in a home?

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

5. VEHICLES
BACKGROUND

- *The Maryland EV population doubled in only two years, from 18,000 in 2020 to 46,100 in 2022. Calculating with 2022 data estimates that there were about 56 EV fires out of approximately 3,397 total Maryland vehicle fires. Obviously growth is quickly increasing the percentage of EVs on our roads so next year in 2024 we ought to easily pass 100 EV fires.*
- *While there is only one BEV fire per 60.9 ICE vehicles, the BEVs burn for substantially longer than building codes were designed for. This poses an immediate threat to parking structures.*
- *It is increasingly difficult to know which vehicles have alternate forms of power, especially since hybrids are a form of battery powered vehicle. Fast identification is further complicated when a single model may be sold in versions which are extremely hard for firefighters to distinguish. For example, the Hyundai Kona is sold with a gasoline powered internal combustion engine (ICE), in a hybrid battery/gasoline version, and as a battery electric vehicle (BEV). Although they look identical, the BEV has been involved in fires. The Jeep Wrangler is sold as an ICE and plug-in hybrid (PHEV) which are remarkably hard to tell apart; the hybrid versions having been recalled after a number of fires and explosions.*
- *Plug-in vehicles represent a potential asset in Maryland energy distribution and management, known as Vehicle to Grid (V2G).*

FACTUAL

- Investigate and report on various aspects such as Maryland rates of adoption, etc.
- Cost projections related to the future and increasing fleet of alternate fuel vehicles.
- Document vehicle to grid (V2G) capabilities which use vehicles as storage devices, such as when surge storage is needed for summer air conditioning.
- Aspects about vehicles themselves, starting with how to identify them, built-in safety items, etc.
- Document which Counties have methods to move fire damaged electric vehicles which can re-ignite.
- Emergency response capabilities and preparedness. History of incidents in parking structures in terms of building codes, etc. This is separate from the firefighter section.

ANALYSIS

- Examination of growing fleet size in Maryland in terms of cost and needs.
- Plans for vehicle adoption as State vehicles, which represents a potential for V2G to decrease State electrical utility bills.
- Examine the pros and cons of using vehicles as a buffer for the State energy supply and needs.
- Discussion of high level of preparedness for vehicle incidents.
- Examine agreements with waste companies to be able to quickly provide steel rollon / roll-off containers to move vehicles which may re-ignite.
- Vehicle-specific issues NOT covered in the firefighter/emergency response section.
- Something which can be initiated in the near term for minimal cost is Motor Vehicle Administration adoption of the SAE J3108 Alternate Fuel Marking stickers for firefighters. (Figures 2, 3, and 4)

Fig 2. Jeep plug-in hybrid undergoing battery failure was hard to differentiate from non-hybrid Wranglers. The cabin was full of flammable vapors. (Belgium 10/30/23)

Fig. 3. Jeep exploded after firefighters broke a window to ventilate the interior. Note firefighters in blast.

Fig. 4. SAE J3108 license plate marking (sticker) for firefighter awareness about alternative fuels and power sources.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

6. RESIDENTIAL
BACKGROUND
More and more residential houses with solar panel installations have an accompanying lithium-ion BESS or other battery back-up power system.

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Fig 5. Power Wall BESS visible above front of car.

When these systems fail they can create the potential for explosive gasses to build in the garage. (Figures 6 and 7)

Fig. 6. Solar panels which may connect to garage BESS.

Fig. 7. Ashburn VA after explosion launched garage door across street. Failure of charging car battery filled garage with explosive hydrogen, similar to failure of BESS systems.

Residential BESS systems also represent a potential asset in the ability to provide storage and buffer capabilities, such as during the summer when air conditioning demands are highest.

FACTUAL

- Document the extent of currently installed residential battery installations and growth of use. These uses may include collection of solar energy into backup power devices such as Power Walls and for home vehicle charging.
- Document typical house power panel capabilities in terms of being able to return grid energy (battery to grid, B2G) or store it.
- Document electrical code about such installations and how to disable systems in emergencies.

ANALYSIS

- Discuss use and potential hazards of BESS such as Power Walls.
- Discuss ability for use of home BESS systems to integrate with grid energy (battery to grid, B2G).
- Discuss how to facilitate responders being able to disable home power systems (BESS) in emergencies.
- An action which does not need to wait for the Commission to finish is a marking requirement for home vehicle chargers. (example: Figure 8)

Figure 8. Home vehicle charging plug labeled for responders to know where to disable power.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

7. MOBILITY DEVICES,
BACKGROUND
   - *E-bikes, scooters, and other mobility devices have become a leading source of house and apartment fires, some of which have been fatal. Montgomery County alone reported having 24 major fires last year.*
   - *They are not registered as motor vehicles and are loosely regulated by the Federal Consumer Product Safety Commission (CPSC). In addition to personal devices, these items intended to be recreational are now commonly used commercially as transportation by service people in urban environments, delivery workers, etc.*

Fig. 8. E-bike fire.

FACTUAL

- Estimate the numbers of e-bikes, scooters, and other mobility not registered as a motor vehicle in Maryland for recreational use and growth of the fleet. Also estimate the extent of use by service people in urban environments such as tradesmen, delivery workers, etc.
- Examine and document the difference between construction of consumer devices those intended to be used commercially. Document the differences between UL-approved and low-cost devices.
- Document fires and failures in Maryland.

ANALYSIS

- Examine and try to quantify extent of mis-use, inappropriate chargers, and the pros and cons of requiring UL approvals.
- Discuss the above in terms of the history of Maryland fires, failures, and future trends.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

8. CONSUMER DEVICES,
BACKGROUND
   - *Consumer devices include lap-tops, tablets, phones, and failures regularly lead to fires which ignite surrounding paper and other flammable materials. (Figure 9)*

Fig. 9. Damaged consumer items emit flammable and toxic fumes, as shown with this new versus burnt booster pack.

   - *Vape devices are banned on Navy ships and in many companies because of the rate of exploding batteries in pants pocket which create fires leading to extensive burn injuries and even injuries resulting in death. (Gigure 10)*

Fig. 10. “24-year-old William Eric Brown died from a stroke when his vape pen blew up in his face and tore a major artery in his neck.” (https://www.nbcnews.com/nightly-news/video/e-cigarette-explosion-blamed-for-texas-man-s-death-1437812803559)

FACTUAL

- For context, document general numbers of lap-tops, tablets, phones, etc. This may have overlap with the charging and recycling sections.
- Document involvement of consumer devices and vapes in fires and injuries in Maryland.

ANALYSIS

- Examine means to better protect consumers in Maryland from personal injuries.
- Examine means to protect public locations in the event of device failures.
- Discuss responder times and adequacy of equipment when confronted with personal device failures.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

9. FIREFIGHTER TRAINING [This should become a major section.]
BACKGROUND
Note that State firefighter training for electric vehicle responses is provided by the Maryland Fire Rescue Institute (MFRI). However, as can be seen from this document, there are many other aspects of lithium-ion battery failures which responders need to prepare for.

FACTUAL

- Document existing emergency response preparations and guidance for each of the above topic areas.
- Determine cost of existing training accomplished.
- Quantify availability of tools and assets by stations. (example: extrication chain and vehicle fire blankets for garage structures)
- Examine use of HazMat versus non-HazMat crews.

ANALYSIS

- Evaluate adequacy of training resources.
- Estimate costs for future training needs, beyond just electric vehicles.
- Estimate costs of tools and assets needed.
- Discuss benefits of dispatching HazMat crews since response may result in ability to bill and recover fire fighting costs.

PROPOSED POLICY AND RECOMMENDATIONS
[To be developed]

SUMMARY
APPENDICES AND ATTACHMENTS