Mobile Energy Storage Applications for Energy Security: Mitigation Technology Review Brief

1.0 Summary

Advancements in mobile energy storage systems (Mobile-ESS) enable flexible on-site emergency services and can support increasing electrified response practices in a community or region affected by a natural disaster. Mobile-ESS refers to battery energy storage systems that are not stationary and are intended or designed to be dispatched to localized electricity services. This definition includes electric vehicles (EVs) that have a primary purpose of being utilized for energy storage as well as traditional storage systems, often integrated with generators, that are designed to be portable.

This brief reviews the current state of the Mobile-ESS market, including available commercial products, deployment strategies, and real-world use cases. It describes key technical, economic, and regulatory challenges. Some of the challenges explored in this report include cost-effectiveness, capacity limitations, and safety considerations.

The brief is prepared to offer energy security analysts a preview into the status of risk mitigation solutions. Mobile-ESS shows strong potential in emergency response, disaster recovery, and off-grid environments.

2.0 Design, Comparison and Deployment Considerations

2.1 Basic Technical Standards for Mobile-ESS

Mobile-ESS is typically pre-engineered with standardized physical interfaces and management systems to simplify deployment for the user and assure safety. Proper testing and operation procedures for ruggedization, such as “anti-vibration, anti-collision, and waterproof capabilities,” must be addressed prior to any mobilization (Dugan, Mohagheghi and Kroposki 2021). There are separate standards regarding storage, transportation, and renewable energy separately, but no composite standards for Mobile-ESS specifically. IEEE 2030.2.1-2019 covers the design, operation, and maintenance for batteries including some specifics for Mobile-ESS, but the information is high-level and does not include other areas of consideration for Mobile-ESS deployment.

There is a possible but less likely scenario for Mobile-ESS, which provides direct support to the distribution system. Challenges for this application include significant technical requirements, including engagement with the local utility for safety, equipment, and interconnection procedures. Currently, Mobile-ESS is mostly applied in off-grid scenarios, as there are no safety and regulation concerns from external entities.

2.2 Comparison of Stationary ES vs. Mobile-ESS Applications

Large battery packs exceeding 10 kWh are developed for both stationary ES and Mobile-ESS. Most lithium-ion (Li-ion) batteries produced globally are manufactured to EV form factors and chemistries intended for transportation, while both stationary ES and Mobile-ESS account for a much smaller share of production (Massachusetts Department of Energy Resources 2020). There are many different chemistry types for Li-ion batteries. At their core, they all store and release energy through reactions between a lithium-based metal oxide cathode and a graphite anode (PNNL n.d.).

Both federal and state regulations set truck size and weight standards that limit the size of Mobile-ESS transported by road. On the National Network gross vehicle weight is limited to 80,000 lbs., 20,000 lbs. on any single axle and 34,000 lbs. for double axles. The maximum width is 102 inches except for Hawaii at 108 inches (CFR 2025). States can have different limits on non-national network roads and also can issue permits for moves that exceed these standards. Towable Mobile-ESS solutions are often containerized, with sizes ranging from man-portable units to standard 53-foot shipping containers (Massachusetts Department of Energy Resources 2020).

Use cases for stationary ES are not limited by mobility requirements; installations will vary more in capacity size. Products range from batteries designed for residential customers, such as the Tesla Powerwall (13.5 kWh), to utility-scale batteries for providing services to the grid, such as the Vistra Moss Landing battery storage installation that has a higher capacity (3,000 MWh) (Tesla n.d., Vistra 2023).

A trade-off of Mobile-ESS is that it incurs additional costs from design, manufacturing, operating, and maintenance. Mobile-ESS costs are estimated to be 5-10% higher than stationary ES costs due to the cost of labor, fuel, and interconnection materials (Massachusetts Department of Energy Resources 2020). The cost of stationary ES can vary widely with the cost being observed from $587/kWh to $1,400/kWh (Massachusetts Department of Energy Resources 2020).

Stationary ES provides power to microgrids, distributed applications, and the bulk power system at fixed locations. Mobile-ESS is unlikely to be developed at the capacity scale of stationary systems, but it fills a different niche for providing power during outages at flexible locations. Since Mobile-ESS can be redeployed to different locations, it can also be used more frequently than traditional backup systems, helping to offset the higher upfront cost.

Mobile-ESS has the added benefit of being able to utilize offsite charging. EVs often run at partial battery capacity, similar to how fossil fuel powered vehicles routinely run with a partial tank. This spare battery capacity can be charged offsite when home power is unavailable and then used to deliver energy back to the household. This is especially useful during power outages. The ability to be dispatched as emergency needs change is a key advantage of Mobile-ESS over stationary ES. Mobile-ESS can provide off-grid emergency power to communications and first-responder equipment when the energy supply is disturbed or non-existent in different locations. These situations may be difficult to predict and make it challenging to find the right locations to install stationary ES in advance. Mobile-ESS can be combined with mobile generation such as a solar photovoltaic (PV) array in locations without permanent charging infrastructure. In addition, during fuel supply disruptions EVs may facilitate both transportation and energy delivery. Table 1 includes a high-level comparison between stationary ES and Mobile-ESS.

Table 1. Comparison of stationary ES and Mobile-ESS Products.

	Stationary ES	*Mobile-ESS*
Materials	Mostly Li-ion, other technologies also available depending on the size	Li-ion dominates
Capacity limit	No limit, ranges from residential to utility-scale	Depending on the size, must follow truck size and weight limits by federal[1] or state agencies
Cost	Base cost varies based on technology, capacity and application	ES base cost, with extra 5-10% design/transportation/labor cost[2]
Design codes/standards	Regular ES standards	ES standards, with extra mobility/anti-collision standards[3]
Financial incentives	Federal/state available	ES incentives apply

Sources: [1] (Federal Highway Administration 2015), [2] (Dugan, Mohagheghi and Kroposki 2021), [3] (Institute of Electrical and Electronics Engineers 2019).

2.3 Deployment Considerations for Mobile-ESS

2.3.1 Power requirements

Power design specifications for energy systems incorporating Mobile-ESS will follow use cases, which should consider the total load requirements, equipment hookups, and mobility. It may be, for example, that many small units deployed over a larger footprint are preferable to a single large resource. Latent capacity in electric vehicles may be very easy to use for certain applications, if equipment and procedures are clear. Disaster response introduces different requirements than typical grid operations, and these use case parameters should be a central focus of planning for Mobile-ESS. These use cases can include supplying power to critical facilities such as hospitals, fire stations and emergency shelters or maintaining communication networks, including cell towers.

Mobile-ESS is generally deployed as a stand-alone, independent asset. Depending on the use case, such as emergency backup power installation, Mobile-ESS may need to connect with a wide range of potential systems, and to connect with power and with communications systems. Mobile-ESS currently does not have universal standardized interfaces and is not “plug and play”.

2.3.2 Structural design and space requirements

Structural design specifications are another significant challenge. Like stationary ES, which must also be shipped to its deployment location, storage systems will consider transportation vibrations and managing exposure to extreme physical conditions, including cold and heat. Lithium-ion technologies are known to have safety concerns due to temperature sensitivity. For disaster response, Mobile-ESS will need to prepare for a wider range of exposure to weather conditions.

In addition to weather conditions, Mobile-ESS will need to be prepared for a variety of off-design conditions in roads and access points. Driving clearances may have changed, and equipment may be offline or unavailable. Still, Mobile-ESS by design can change its position to adapt to uncertain conditions, support emergency egress routes, and offer access for emergency responders.

3.0 Market and Deployment Overview

The rate of Mobile-ESS adoption is forecasted to rise to $24.8 billion in 2032 (Global Market Insights 2024). This is an increase of over $20 billion from 2023. Growth in the US is spurred by emergency preparedness initiatives, remote outdoor activities, adoption of EVs, and vehicle-to-grid (V2G) advancement. EVs accounted for nearly one in five cars sold in the US in 2024 (Abboud 2024).

3.1 Current Mobile-ESS Products

While Mobile-ESS technology is a growing sector, several products and initiatives are already available on the market. Mobile-ESS can be classified into two categories: self-mobile and towable containers. These two categories can be further broken down for commercial product comparisons as shown below and in Table 2.

Self-mobile:

- V2G LDV/utility van: Passenger or cargo vehicles 10,000 lb. and under
- V2G Bus: Vehicle for public transportation of passengers

Towable:

- Tow-behind ES trailer: Towable trailers loaded with ES
- Semi-trailer truck: Semi-truck that transports large, containerized ES

Towable Mobile-ESS currently has a slower adoption rate than self-mobile EV-based Mobile-ESS products, but these systems offer greater capacity to provide backup or electrified support services during an emergency. Self-mobile systems such as EVs are widely available and distributed across communities. As they are already present, they will be a part of the solution toolkit for frontline assistance and more easily dispatched to different locations.

Table 2 shows examples of self-mobile and towable systems with battery power and capacity ranges, dimensions, and applications of use. These products are commercially available on the market. They have been used in different cases and promoted new business models, which will be introduced in Section 3.2.

Table 2. Example Mobile-ESS currently on the market and related applications.

Mobile-ESS Type		Example Products	Battery Charging or Output Power (kW)	Energy Capacity (kWh)	Dimension (L x W x H)	Application
Self-mobile systems	V2G LDV/utility van	• Tesla • Rivian • Nissan • Hyundai • Ford • Chevrolet	• Level 1: 1 kW • Level 2: 7–19 kW • DC Fast Charging: 50-350 kW[1]	21.3–123 kWh[2]	Similar with conventional vehicles	• Transportation • Emergency response
	V2G Bus	Blue Bird	60–125 kW[3]	155–196 kWh[4]	Similar with conventional buses	• Transportation • Emergency response
Towable systems	Tow-behind trailer / Semi-trailer truck[5, 6, 7]	• NOMAD • Generac • Aggreko • Power Edison	5–1000 kW	10 kWh–2 MWh	3.3' x 1.8' x 3.2' (10 kWh) – 40' x 8.5' x 13' (2MWh)	• Emergency response • Grid operation • Energy services • Upgrade deferral

Note: Only EVs with V2G capabilities are considered Mobile-ESS in this comparison.

Sources: [1] (Department of Transportation 2025), [2] (EV Database n.d.), [3] (Nuuve n.d.), [4] (Blue Bird Corporation 2024), [5] (NOMAD n.d.), [6] (Generac n.d.), [7] (Aggreko n.d.)

3.2 Demonstrated Applications and Use Cases

Tables 3 and 4 below summarize recent demonstrated use cases of Mobile-ESS in both normal operating conditions and emergency response scenarios. Zero emissions and lower noise are a commonly reported benefit observed from these demonstrated use cases when compared to traditional diesel generators.

Table 3. Demonstrated Mobile-ESS Deployments for Utilities and Commercial Applications

Organization	System Description	Use Case	Benefits Observed
US Army Engineer Research Development Center[1]	RE nanogrid with PV and hydrogen fuel cells.	Off-grid power for remote surveillance and environmental monitoring at test site.	Silent operation, no emissions, sustained low-load power delivery, test of hydrogen integration.
Eversource[2]	Towable Mobile-ESS trailer with 500 kW / 1 MWh capacity.	Maintenance support during grid upgrades in Framingham, MA.	Avoided customer outages, faster repair windows, lower noise than diesel generator.
Green Mountain Power[3]	NOMAD Voyager mobile battery system.	Backup for Twincaft Skincare's industrial facility during planned outage.	Maintained continuous manufacturing operations.

Munich Airport[4]	All-in-one container with wind turbines, PV panels, and Li-ion battery storage.	EV charging in areas without fixed charging infrastructure.	On-site renewable generation, up to 200 kWh/day production potential.
Power Edison[5]	Towable mobile EV charging platform with high-power battery banks.	Scalable EV fast charging depot deployment.	Initial plans for up to 1 MW per charger and mobile grid support.
Event Deployments[6]	NOMAD (1.3 MWh) and Aggreko (3x 30 kVA batteries).	Temporary power for concerts and sports events, replacing diesel gensets.	Zero emissions, no fumes or generator noise, easy to switch over.

Sources: [1] (Espinosa 2025), [2] (Eversource 2025), [3] (Green Mountain Power 2023), [4] (elective n.d.), [5] (Businesswire 2021), [6] (NOMAD 2024)

Table 4. Demonstrated Mobile-ESS Deployments for Emergency Response

Organization	*System Description*	*Use Case*	*Benefits Observed*
Sesame Solar[1]	Mobile nanogrid with PV, battery storage, water filtration, refrigeration, Wi-Fi, and workspace for triage.	Medical and humanitarian response in off-grid emergency conditions after Hurricane Maria.	Rapid deployment in less than 15 minutes, no fuel required, silent operation, multi-function capability.
PG&E[2]	Exportable battery truck for critical load support.	Power for evacuation centers during wildfire-related outages in California.	Enabled continued operations during public safety power shutoff (PSPS) events, utility owned and operated.
Local community[3]	EVs from the local community.	Post-earthquake support during gasoline shortages and blackouts.	Powered devices, improvised disaster response.

Sources: [1] (Sesame Solar n.d.), [2] (Morris 2015), [3] (Belson 2011)

3.3 Emerging Mobile-ESS Use Cases

3.3.1 Large, electrified vehicles as emergency response

Electric school buses (ESB) have been studied to determine whether fleets are a viable Mobile-ESS for resilience (Holland, Dave and Sridhar n.d.). In this context, viability is defined as the ability of the fleet to provide power to a remote location, after fulfilling its primary purpose of transporting students to and from school functions. If the nation's school buses were fully electrified, up to 61.5 GWh of ES could be dispatchable and have high availability in the summer when there are significant needs for power outage support. In the summer months, power outages can be dangerous for U.S. populations susceptible to heat-related illnesses, among other risks.

A case study examines the use of electric school bus fleets for emergency shelters operating during four-, twenty-four- and seventy-two-hour outages (Holland, Dave and Sridhar n.d.). The main metrics for viability are resilience load requirements, fleet size, battery sizes, and state of charge during different months and time of day. If only used a few times a year for resilience, ESBs could be fully cycled without hurting the battery life. The case study highlights the potential of ESB for emergency resilience when shelter locations are close to charging or storage sites, minimizing battery depletion during transit.

3.3.2 Rail-based mobile energy storage (RMES) and marine vessels

Rail-based mobile energy storage (RMES) is another potential application for Mobile-ESS. RMES can assist the grid with alternative non-connected power transfer to address high-impact resilience issues. RMES provides a unique benefit over other Mobile-ESS as it can deliver greater usable capacity due to more advantageous weight constraints. A train can carry 1 GWh of battery storage which compares to the carrying capacity of roughly 1,000 semi-trucks (Moraski, Popovich and Phadke 2023). The rail system is expansive and already connects to areas with high population and congestion making its high carrying capability well positioned for deployment.

There is potential for marine vessel Mobile-ESS to also provide grid support where there are connection points at the shore (Massachusetts Department of Energy Resources 2020). Electric and hybrid-electric vessels such as ferries, tugboats and work skiffs are beginning to emerge in the marketplace. Washington State Ferries recently released their first hybrid-electric ferry which is the largest of its type in the United States (Banse 2025).

3.3.3 Distributed EVs for Backup Power Service

EV batteries are currently used mainly for transportation, and the benefits and potential of EVs providing backup energy during emergencies are still limited. Most individual EVs cannot give power back to the grid, the central concept of V2G, and neither utilities nor car companies, with some notable exceptions promote these uses. Utilities currently only endorse frequency regulation from EVs. How battery degradation caused by V2G activities will be handled by warranties in the future is unclear as current warranties are unaffected (Nissan Motor Corporation 2024).

If this can be addressed, especially for larger vehicles, EVs have a distinct advantage for Mobile-ESS: they are already widely deployed at the local level even if distributed and small. (Dugan, Mohagheghi and Kroposki 2021).

4.0 Challenges and Gaps

Given the nascency of Mobile-ESS, there are several opportunity areas to further Mobile-ESS.

4.1 Use Cases

Although there is growing interest in Mobile-ESS, comprehensive studies remain limited, particularly for disaster response. Understanding the current and potential range of requirements for electricity services through use cases will focus design and deployment opportunities for Mobile-ESS. In addition to comprehensive use case studies, there is a need for clear qualitative and quantitative benefits from various use cases, including the benefit of mobility and applications. These benefit assessments will also support cost-effective design and a greater understanding of required operational characteristics.

4.2 Cost-effectiveness

Unlike stationary ES, which operates with largely known revenue streams and market services under standard operating conditions, Mobile-ESS is dominantly valued for its ability to operate under emergency conditions, which have a different economic structure. The current literature does not have a standardized method to quantify the effectiveness of Mobile-ESS to improve response and resilience. Since Mobile-ESS primarily supports emergency operations and disaster response, standard methods used for stationary ESS are instructive but cannot be directly adapted. A cost-benefit model would need to capture the costs of outages during emergencies and the value of mobility and power benefits. Furthermore, benefits need to be evaluated within the limited capacity of Mobile-ESS and recharge suitability.

4.3 Capacity Limit

All batteries shipped by road are subject to gross vehicle weight and axle load restrictions. Battery cells from stationary ES units are often removed from the container prior to shipping which makes the shipment lighter, however, Mobile-ESS are shipped as a complete assembled system. As the weight of a battery is correlated to the total energy stored these transportation weight restrictions can limit the capacity (Dugan, Mohagheghi and Kroposki 2021).

It may take more Mobile-ESS units to support larger facilities as well as adequate charging infrastructure for long-term charging. In emergency response situations batteries are finite resources if recharging infrastructure is not available. Mobile-ESS only offers a short-term solution and its usefulness may be limited in long-term extreme events or large areas without multiple units.

4.4 Physical and Siting Considerations

There are safety, regulatory, and environmental concerns for both stationary ES and Mobile-ES applications that need to be addressed for wider adoption. For example, a challenge for using Li-ion is safety and temperature sensitivity. Li-ion batteries perform optimally in temperate environments, above freezing and below extreme heat. However, commercially available products are designed for a wider operating range. Temperatures that are too high or too low can reduce efficiency or even damage the battery, limiting applications in extreme conditions.

Another challenge is ensuring Mobile-ESS has access to adequate charging capability, either by siting them near existing charging infrastructure or by configuring them with supplemental generation sources such as PV arrays or diesel generators. Determining the most effective approach for different operational scenarios remains a technical and economic challenge.

Resource allocation and routing are additional challenges for utilizing Mobile-ESS. Deploying units during an active emergency may require navigating both hazards and disruptions to the transportation network, including traffic congestion, debris blockages, icy conditions and road closures.

5.0 Conclusion

Serving a different purpose than stationary ES, Mobile-ESS offers increased flexibility to support emergency response and disaster recovery during contingency events when the power system is offline. Where electric vehicles are available, they may offer readily accessible, if dispersed and small, solutions to power provision while electricity is unavailable or in field conditions. While promising, market growth for Mobile-ESS may depend on how the challenges outlined in this report are addressed.

Preferred Citation:
Hamilton V.A., P.R. Jackson, and C. Holland. "Mobile Energy Storage Applications for Energy Security: Mitigation Technology Review Brief." August 2025. PNNL-SA-215295

References

Abboud, Monica. 2024. *U.S. share of electric and hybrid vehicle sales increased in the second quarter of 2024.* U.S. Energy Information Administration. https://www.eia.gov/todayinenergy/detail.php?id=62924.

Banse, Tom. 2025. *Washington's first battery ferry to enter service next week.* August 13. Accessed August 13, 2025. https://washingtonstatestandard.com/2025/07/10/washingtons-first-battery-ferry-to-enter-service-next-week/.

Belson, Ken. 2011. "After Disaster Hit Japan, Electric Cars Stepped Up." *The New York Times*, May 6. https://www.nytimes.com/2011/05/08/automobiles/08JAPAN.html.

Blue Bird Corporation. 2024. *Vision Electric Technical Specifications.* https://blue-bird.com/wp-content/uploads/2024/05/Blue-Bird-Vision-Electric-Spec-Sheet_04_16_2024.pdf.

Businesswire. 2021. *Power Edison Partnership to Develop the Nation's Largest Electric Vehicle Charging Site in Metropolitan New York Area.* November 11. Accessed August 11, 2025. https://www.businesswire.com/news/home/20211111005277/en/Power-Edison-Partnership-to-Develop-the-Nations-Largest-Electric-Vehicle-Charging-Site-in-Metropolitan-New-York-Area.

CFR. 2025. *TRUCK SIZE AND WEIGHT, ROUTE DESIGNATIONS—LENGTH, WIDTH AND WEIGHT LIMITATIONS.* July 15. Accessed August 14, 2025. https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-658.

Department of Energy. 2024. "An Action Plan for Rail Energy and Emissions Innovation." chrome-extension://https://www.energy.gov/sites/default/files/2024-12/doe-eere-modal-reports_rail-energy-emissions-action-plan.pdf.

Department of Transportation. 2025. *Charger Types and Speeds.* January 31. https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds.

Dugan, Jesse, Salman Mohagheghi, and Benjamin Kroposki. 2021. "Application of Mobile Energy Storage for Enhancing Power Grid Resilience: A Review." *Energies* 14 (20): 6476. https://doi.org/10.3390/en14206476.

electrive. n.d. *Mobile energy generation and storage container at Munich Airport.* Accessed August 11, 2025. https://www.electrive.com/2024/06/27/mobile-energy-generation-and-storage-container-at-munich-airport/.

Espinosa, Sophia. 2025. "ERDC celebrates Army's first hydrogen-powered nanogrid." January 2. https://www.erdc.usace.army.mil/Media/News-Stories/Article/4020290/erdc-celebrates-armys-first-hydrogen-powered-nanogrid/.

EV Database. n.d. *Useable battery capacity of full electric vehicles.* Accessed March 2025. https://ev-database.org/cheatsheet/useable-battery-capacity-electric-car.

Eversource. 2025. *Mobile Battery Energy Storage System.* Accessed August 11, 2025. https://www.eversource.com/content/residential/about/sustainability/renewable-generation/mobile-battery-energy-storage-system.

Federal Highway Administration. 2015. *Compilation of Existing State Truck Size and Weight Limit Laws.* U.S. Department of Transportation. https://ops.fhwa.dot.gov/freight/policy/rpt_congress/truck_sw_laws/index.htm.

Global Market Insights. 2024. "Portable Energy Storage System Market Size: Global Forecast (2024-2032)." Report ID: GMI10696. https://www.gminsights.com/industry-analysis/portable-energy-storage-system-market.

Green Mountain Power. 2023. *Green Mountain Power's Mobile NOMAD Battery-on-Wheels Prevents Outage, Keeps Manufacturing Customer Twincraft Skincare Powered Up.* August 8. Accessed August 11, 2025. https://greenmountainpower.com/news/green-mountain-powers-mobile-nomad-battery-on-wheels/#:~:text=GMP%20turns%20to%20stored%20energy%20in%20the,to%20power%20100%20homes%20for%2024%20hours.

Holland, Christine, Prathit Dave, and Sid Sridhar. n.d. "Electric School Bus Potential for Resilience."

Institute of Electrical and Electronics Engineers. 2019. "IEEE Guide for Design, Operation, and Maintenance of Battery Energy Storage Systems, both Stationary and Mobile, and Applications Integrated with Electric Power Systems." IEEE, December 13. https://standards.ieee.org/ieee/2030.2.1/5832/.

Massachusetts Department of Energy Resources. 2020. "Mobile Energy Storage Study: Emergency Response and Demand Reduction." https://www.mass.gov/info-details/mobile-energy-storage-study.

Moraski, J. W., N. D. Popovich, and A. A. Phadke. 2023. "Leveraging rail-based mobile energy storage to increase grid reliability in the face of climate uncertainty." *Nature Energy* 8: 736-746. https://doi.org/10.1038/s41560-023-01276-x.

Morris, Charles. 2015. "PG&E exportable power truck saves the day in California wildfire evacuation." *Charged*, October 19. https://chargedevs.com/newswire/pge-exportable-power-truck-saves-the-day-in-california-wildfire-evacuation/.

Nissan Motor Corporation. 2024. "Nissan approves enhanced Fermata Energy FE-20 bidirectional charger and V2X Platform for use with Nissan LEAF." *USA Newsroom*, August 28. https://usa.nissannews.com/en-US/releases/nissan-approves-enhanced-fermata-energy-fe-20-bidirectional-charger-and-v2x-platform-for-use-with-nissan-leaf.

Nomad Power. 2024. *Guster Concert Runs on Clean Power Thanks to NOMAD.* July 10. Accessed August 11, 2025. https://www.nomadpower.com/news/guster-concert-runs-on-clean-power-thanks-to-nomad.

Nuuve. n.d. *Electric Bus Charging Solutions.* Accessed March 2025. https://nuvve.com/buses/#:~:text=V2G%20Compatible%20Buses-,Nuvve%20offers%20a%20complete%20vehicle%2Dto%2Dgrid%20(V2G),for%20fleet%

20operators%20and%20utilities.&text=*%20Nuvve%20has%20the%20only%20system,with%20Blue%20Bird%20electric%20buses.
Saldarini, Alessandro, Michela Longo, Morris Brenna, and Seyed Mahdi Miraftabzadeh. 2023. "Literature Review - Mobile Electric Storage System (MESS): Use Cases and Applications." *2023 International Conference on Clean Electrical Power (ICCEP)* 789-795. https://doi.org/10.1109/ICCEP57914.2023.10247436.
Sesame Solar. n.d. *Case Studies.* Accessed August 8, 2025. https://www.sesame.solar/case-studies.
Tesla. n.d. *Powerwall.* Accessed August 13, 2025. https://www.tesla.com/powerwall.
n.d. *The Definitive Guide to Lithium Battery Temperature Range.* Accessed August 18, 2025. https://holobattery.com/lithium-battery-temperature-range/ .
Vistra. 2023. *Vistra Completes Milestone Expansion of Flagship California Energy Storage System.* August 1. Accessed August 1, 2025. https://investor.vistracorp.com/2023-08-01-Vistra-Completes-Milestone-Expansion-of-Flagship-California-Energy-Storage-System.

Pacific Northwest National Laboratory

902 Battelle Boulevard
P.O. Box 999
Richland, WA 99354
1-888-375-PNNL (7665)

www.pnnl.gov