

NATIONAL LITHIUM BATTERY ENERGY STORAGE



What is the National Blueprint for lithium batteries? This National Blueprint for Lithium Batteries, developed by the Federal Consortium for Advanced Batteries, will help guide investments to develop a domestic lithium-battery manufacturing value chain that creates equitable clean-energy manufacturing jobs in America while helping to mitigate climate change impacts.



Should lithium-based batteries be a domestic supply chain? Establishing a domestic supply chain for lithium-based batteries requires a national commitment to both solving breakthrough scientific challenges for new materials and developing a manufacturing base that meets the demands of the growing electric vehicle (EV) and electrical grid storage markets.



Why are lithium-based batteries important? Lithium-based batteries power our daily lives from consumer electronics to national defense. They enable electrification of the transportation sector and provide stationary grid storage, critical to developing the clean-energy economy.



Are lithium-ion batteries critical materials? Given the reliance on batteries, the electrified transportation and stationary grid storage sectors are dependent on critical materials; today's lithium-ion batteries include several critical materials, including lithium, cobalt, nickel, and graphite.¹³ Strategic vulnerabilities in these sources are being recognized.



Are lithium-based batteries a viable industrial base? A robust, secure, domestic industrial base for lithium-based batteries requires access to a reliable supply of raw, refined, and processed material inputs along with parallel efforts to develop substitutes that are sustainable and diversify supply from both secondary and unconventional sources.

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What should the US do about lithium-ion batteries? The U.S. should develop a federal policy framework that supports manufacturing electrodes, cells, and packs domestically and encourages demand growth for lithium-ion batteries. Special attention will be needed to ensure access to clean-energy jobs and a more equitable and durable supply chain that works for all Americans.



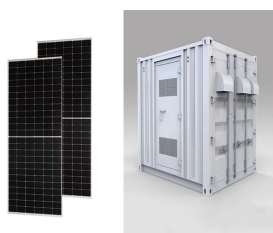
??? The Federal Consortium for Advanced Batteries ??? established to put the U.S. on a path to long-term competitiveness in the global battery value chain and led by the Departments of Energy, Defense, Commerce, and State ??? releases a National Blueprint for Lithium Batteries, 2021 ??? 2030, which serves as the 100-day report



The Grid Storage Launchpad will open on PNNL's campus in 2024. PNNL researchers are making grid-scale storage advancements on several fronts. Yes, our experts are working at the fundamental science level to find better, less expensive materials???for electrolytes, anodes, and electrodes. Then we test and optimize them in energy storage device prototypes.



Lithium-ion batteries are gamechangers for charging and energy storage and essential to a variety of household devices including laptops, bicycles, and cars. For the transportation sector, lithium-ion batteries are central to the rapid growth of electric mobility, making it feasible to travel farther and faster on a single charge. Lithium-ion batteries that ???



This two day virtual public summit will convene and connect national and regional thought leaders across industry, government, communities, and the research enterprise to catalyze solutions and partnerships around specific challenges to America's energy storage future. The schedule for Day 1 and Day 2 is 9:00 am???2:00 pm PT/12:00 pm???5:00 pm ET Day ???

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A lithium-ion batteries are rechargeable batteries known to be lightweight, and long-lasting. They're often used to provide power to a variety of devices, including smartphones, laptops, e-bikes, e-cigarettes, power tools, toys, and cars, and now homes.



- Today, the U.S. Department of Energy (DOE) announced \$125 million in funding for two Energy Innovation Hub teams to provide the scientific foundation needed to seed and accelerate next generation technologies beyond today's generation of lithium (Li)-ion batteries.



Funded primarily by the U.S. Department of Energy, and based at the Lawrence Berkeley National Laboratory (Berkeley Lab), the Energy Storage Group is one of the world's leading centers for advanced battery research. The Group devotes substantial effort to lithium-ion batteries, which are extremely promising for transportation applications



Current Year (2022): The current year (2022) cost estimate is taken from Ramasamy et al. (Ramasamy et al., 2023) and is in 2022 USD. Within the ATB Data spreadsheet, costs are separated into energy and power cost estimates, which allows capital costs to be calculated for durations other than 4 hours according to the following equation: $\text{Total System Cost} = \text{Energy Cost} + \text{Power Cost}$

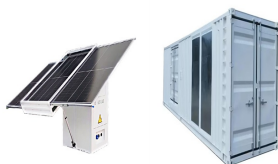


energy storage systems that can provide reliable, on-demand energy (de Sisternes, Jenkins, and Botterud 2016; G?r 2018). Battery technologies are at the heart of such large-scale energy storage systems, and lithium-ion batteries (LIBs) are at ???

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Among the existing electricity storage technologies today, such as pumped hydro, compressed air, flywheels, and vanadium redox flow batteries, LIB has the advantages of fast response rate, high energy density, good energy efficiency, and reasonable cycle life, as shown in a quantitative study by Schmidt et al. In 10 of the 12 grid-scale



A 2020 report from the U.S. Department of Energy's National Renewable Energy Laboratory projects that the battery energy storage industry will need a minimum of 130,000 additional workers in the U.S. by 2030; at least 12,000 of those workers will be needed in Texas. Earlier this year, Tesla broke ground on a Texas lithium refinery to produce



1.2 Components of a Battery Energy Storage System (BESS) 7 1.2.1gy Storage System Components Ener 7 1.2.2 Grid Connection for Utility-Scale BESS Projects 9 4.12 Chemical Recycling of Lithium Batteries, and the Resulting Materials 48 4.13ysical Recycling of Lithium Batteries, and the Resulting Materials Ph 49.



Battery Storage: 2023 Update. Wesley Cole and Akash Karmakar. This work was authoredby the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. -AC36-08GO28308. lithium-ion battery systems, with a focus on 4-hour duration systems. The



Interstate Renewable Energy Council External Link; International Code Council's Batteries and Energy Storage Ad Hoc Committee External Link; National Fire Protection Association Lithium Ion Battery Safety External Link. US Fire Administration Lithium-Ion Batteries External Link; Consumer Product Safety Commission External Link

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Future Years: In the 2023 ATB, the FOM costs and the VOM costs remain constant at the values listed above for all scenarios.. Capacity Factor. The cost and performance of the battery systems are based on an assumption of approximately one cycle per day. Therefore, a 4-hour device has an expected capacity factor of 16.7% ($4/24 = 0.167$), and a 2-hour device has an expected ???



As defined by the NFPA, an ESS is an assembly of devices capable of storing energy to supply electrical energy for future use. Indoor battery storage, on the other hand, simply refers to areas where lithium-ion and other batteries are housed for future use or disposal and does not include manufacturing or testing facilities.



Safety of Electrochemical Energy Storage Devices. Lithium-ion (Li-ion) batteries represent the leading electrochemical energy storage technology. At the end of 2018, the United States had 862 MW/1236 MWh of grid-scale battery storage, with Li-ion batteries representing over 90% of operating capacity [1]. Li-ion batteries currently dominate



NBS WESS450 wall mounted lithium energy storage battery pack \$ 999.00. Wall mount series adopts high-quality lithium iron phosphate batteries, equipped with intelligent BMS battery management system, long cycle life, high National Battery Supply provides a custom-made Battery Management System, or BMS, that enhances the efficiency and

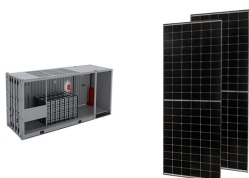


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A rechargeable battery bank used in a data center Lithium iron phosphate battery modules packaged in shipping containers installed at Beech Ridge Energy Storage System in West Virginia [9] [10]. Battery storage power plants and uninterruptible power supplies (UPS) are comparable in technology and function. However, battery storage power plants are larger.



NATIONAL BLUEPRINT FOR LITHIUM BATTERIES 2021???2030
OVERVIEW Significant advances in battery energy . storage technologies have occurred in the . last 10 years, leading to energy density increases and battery pack cost decreases of approximately 85%, reaching . \$143/kWh in 2020. 4.



The U.S. Department of Energy announced the creation of two new Energy Innovation Hubs led by DOE national laboratories across the country. One of the national hubs, the Energy Storage Research Alliance (ESRA), is led by Argonne National Laboratory and co-led by Berkeley Lab and Pacific Northwest National Laboratory.



Oak Ridge National Laboratory researchers are working with the U.S. Department of Energy (DOE) and industry on new battery technologies for hybrid electric and full electric vehicles that extend battery lifetime, increase energy and power density, reduce battery size and cost, and improve safety for America's drivers. Scientists are concentrating their expertise in ???



ATB represents cost and performance for battery storage across a range of durations (2???10 hours). It represents lithium-ion batteries (LIBs)???focused primarily on nickel manganese cobalt (NMC) and lithium iron phosphate (LFP) chemistries???only at this time, with LFP becoming the primary chemistry for stationary storage starting in 2021.

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A battery energy storage system (BESS) captures energy from renewable and non-renewable sources and stores it in rechargeable batteries (storage devices) for later use. A battery is a Direct Current (DC) device and when needed, the electrochemical energy is discharged from the battery to meet electrical demand to reduce any imbalance between



A one megawatt hour lithium-ion BESS at the National Renewable Energy Laboratory's National Wind Technology Center (Photo by Dennis Schroeder, NREL 47215) While non-battery energy storage technologies (e.g., pumped hydroelectric energy storage) are already in widespread use, and other technologies (e.g., gravity-based mechanical storage



In its draft national electricity plan, released in September 2022, Lithium-ion battery storage continued to be the most widely used, making up the majority of all new capacity installed. Global investment in battery energy storage exceeded USD 20 billion in 2022, predominantly in grid-scale deployment, which represented more than 65%