Batteries and secure energy transitions

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The IEA"s Special Report on Batteries and Secure Energy Transitions highlights the key role batteries will play in fulfilling the recent 2030 commitments made by nearly 200 countries at COP28 to put the global energy system on the path to net zero emissions. These include tripling global renewable energy capacity, doubling the pace of energy efficiency improvements and transitioning away from fossil fuels.

This special report brings together the latest data and information on batteries from around the world, including recent market developments and technological advances. It also offers insights and analysis on leading markets and key barriers to growth. By looking at the entire battery ecosystem, from critical minerals and manufacturing to use and recycling, it identifies synergies and potential bottlenecks across different sectors. The report also highlights areas that call for greater attention from policy makers and industry.

Battery storage in the power sector was the fastest growing energy technology in 2023 that was commercially available, with deployment more than doubling year-on-year. Strong growth occurred for utility-scale battery projects, behind-the-meter batteries, mini-grids and solar home systems for electricity access, adding a total of 42 GW of battery storage capacity globally. Electric vehicle (EV) battery deployment increased by 40% in 2023, with 14 million new electric cars, accounting for the vast majority of batteries used in the energy sector.

In the NZE Scenario, about 60% of the CO2 emissions reductions in 2030 in the energy sector are associated with batteries, making them a critical element to meeting our shared climate goals. Close to 20% are directly linked to batteries in EVs and battery-enabled solarPV. Another 40% of emissions reductions are from electrification of end-uses and renewables that are indirectly facilitated by batteries.

Batteries in EVs and storage installations reduce the need for imported fossil fuels, increasing self-sufficiency in many countries. EVs reduce the need for oil imports in many countries, including China, Europe, India, Japan and Korea. The need for natural gas and coal imports is reduced directly by battery-enabled renewables displacing natural gas-fired and coal-fired power, and indirectly by the electrification of industry and buildings where the use of electricity replaces fossil fuels.

The amount of battery storage capacity added to 2030 in the STEPS is set to be more than the total fossil fuel capacity added over the period. A significant part is behind-the-meter battery storage paired with rooftop solar PV, including many individual batteries aggregated into virtual power plants, as it becomes an increasingly attractive option for consumers in a world of broadly stable or rising retail electricity prices. For electricity access, the average electricity costs of mini-grids with solar PV and batteries halve by 2030.

The global market value of batteries quadruples by 2030 on the path to net zero emissions. Currently the global value of battery packs in EVs and storage applications is USD120billion, rising to nearly USD 500 billion in 2030 in the NZE Scenario. Even with today"s policy settings, the battery market is set to expand to a

total value of USD 330 billion in 2030. Booming markets for batteries are attracting new sources of financing, including around USD 6 billion in battery start-ups from venture capital in 2023 alone.

Batteries are a "master key" that can unlock several much bigger transformations and much bigger industrial prizes. The global car market is valued at USD 4 trillion today, and leadership in it will depend on battery technology. Batteries also support more wind and solarPV, which capture USD 6 trillion in investment in the NZE Scenario from 2024 to 2030, by balancing out their variations and stabilising the grid.

Scaling up critical minerals supply in time to meet rising needs is essential to the success of batteries and requires action to address policy and regulatory barriers. In the NZE Scenario, demand for critical minerals for batteries expands rapidly by 2030, with manganese, lithium, graphite and nickel increasing at least sixfold, and cobalt more than tripling. While this requires new mining and refining, innovation on chemistries, enhanced recycling and "right-sizing" of batteries can cut demand for critical minerals by about 25% by 2030.

The Low Battery Case would lead to prolonged use of coal and natural gas in the power sector and raise fuel import bills. Analysis indicates that import bills would be an average of USD12.5billion more per year from 2030 to 2050 in importing countries, with Europe and Korea as most exposed to this risk for natural gas imports and India for coal imports.

The IEA"s Special Report on Batteries and Secure Energy Transitions will highlight the important role of battery technologies to fulfil recent commitments made by nearly 200 countries at COP28, including tripling global renewable energy capacity by 2030, doubling the pace of energy efficiency improvements by 2030 and transitioning away from fossil fuels.

The report brings together the latest data and information on batteries from around the world, including recent market developments and technological advances, insights and analysis on leading markets, and key barriers to growth, highlighting areas that call for greater policy attention.

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