CLIMATE TRANSFORMED

CLIMATE 2023

A Preview of the Year Ahead

Stationary Storage: The Centerpiece of a Renewable Grid

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Stationary Storage: The Centerpiece of a Renewable Grid

Iola Hughes is a research manager at Rho Motion working on electric vehicle, battery, charging, and energy storage market analysis, and has been with the company since its inception.

Summary

Rho Motion's mission is to provide actionable intelligence on developing electric vehicles, battery charging, and infrastructure markets. In this session, Research Manager Iola Hughes talks to Paul Krake about stationary storage, micro-grids in Europe, and the potential for renewable energy management in combining battery energy storage with green hydrogen production. **Watch the full discussion here.**

Key takeaways

- Stationary battery storage continues in hyper-growth modes as the primary means of regulating the intermittent nature of renewables. Energy Storage Systems (ESS) are split into two broad categories: grid-integrated and behind-the-meter systems. It is the fastest-growing segment of the battery supply chain. While growth is driven by the US and China, stationary battery demand is truly global.
- The Inflation Reduction Act (IRA) is a further tailwind for Battery Energy Storage Systems. The Production Tax Credit (PTC) encourages renewable generation. Batteries are eligible for $35 per kilowatt (KW) and a further $10 per KW for system manufacturing. We are seeing foreign ESS manufacturers moving into the US market to leverage these PTCs.
- Expect to see the EU provide a stronger policy response to the IRA, and Australia, in particular, looks like an exciting policy space. In general, expect cell manufacturers to become system integrators and diverse new battery chemistries to come into the market also.
- Lithium-ion remains the dominant technology, but sodium-ion and vanadium flow batteries will grow dramatically in the next 5 years.

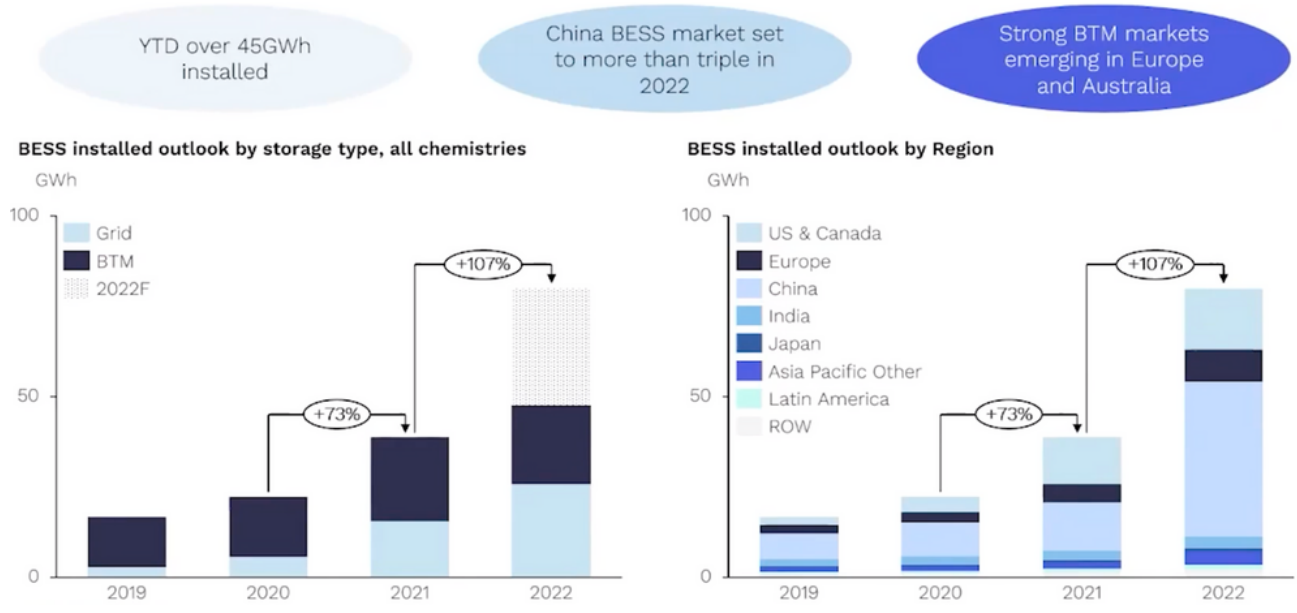
Paul's observations

There is little doubt about the demand for battery storage in the years ahead. However, the path for EVs is less clear than stationary storage. The pace of EV adoption will be driven primarily by consumer preference, and there are many questions about adoption rates in the US. Policy directives will drive demand for stationary batteries as part of efficiently regulated electricity grids. Between the IRA and the EU's scramble for energy self-sufficiency, it is tough to downplay the demand for stationary batteries of any chemistry over the next 5 years.

Stationary batteries may not be seeing the level of innovation that EVs are, but the consistency of demand does imply that the track to profitability is much more visible. As global capital floods into the United States as part of the IRA, there is a chance that too much attention goes to EVs where long-term demand remains a little cloudy. Investors should focus on those firms looking at the renewables ecosystem if profitability is a priority. China still dominates this segment, as it does every part of the battery supply chain, but venture and infrastructure investors should not lose sight of the near-term opportunities in stationary battery production. New US plants production should focus here as well as the more sexy EV battery segment.

"The path for EVs is less clear than stationary storage."

The fastest-growing battery market



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Presentation:
Sizing up stationary storage demand

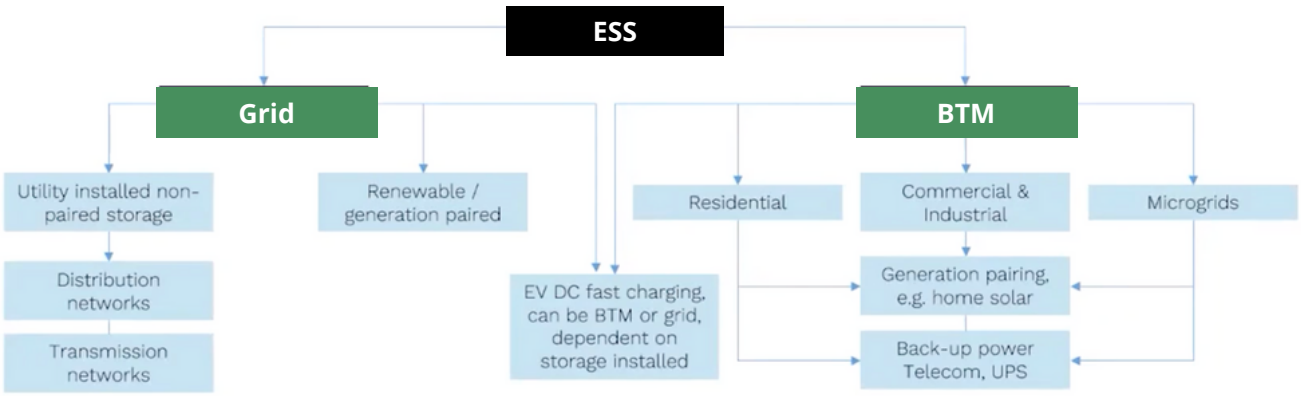
Energy storage is becoming more important as countries aim to increase the share of renewable energy in their power supply and achieve net zero emissions. It is essential to ensure grid stability and optimize the extent of curtailment that can be achieved. Energy Storage Systems (ESS) are split into two broad categories: grid-integrated and behind-the-meter systems.

Grid-integrated ESS are connected to the distribution or transmission networks and can be used for frequency regulation, curtailment, maximizing profits, voltage support, and backup. Utility-installed non-paired storage is installed on a distribution or transmission network, but not connected to a renewable energy plant. On the other hand, renewable generation paired storage is directly linked to renewable assets such as solar or wind farms.

Behind-the-meter ESS comprises three categories: residential, commercial & industrial, and microgrids. The residential would typically be a household installing home batteries with rooftop solar. Commercial & industrial includes rooftop solar with batteries, but also backup power systems for factories and hospitals that need to ensure a constant supply. Batteries are also critical to the operation of a microgrid.

Telecoms is one of the biggest markets engaging backup power with battery storage to replace previous diesel generators. EV fast charging can be either grid-integrated or behind-the-meter.

ESS are split into two broad categories:



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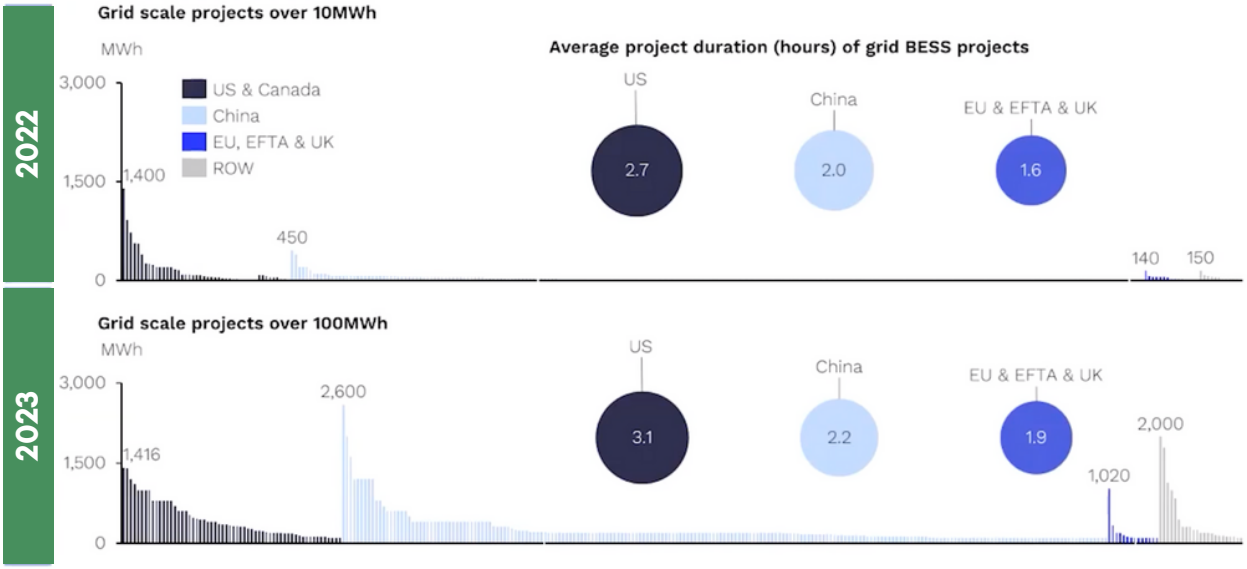
The stationary storage market is the fastest-growing battery segment in 2022. The EV market will grow by 60% this year and the battery market by 107%. This growth is coming from the US and China. Due to strong policy support, the Chinese market is set to triple in 2022. We are also seeing behind-the-meter markets emerging in Europe and Australia.

Regional trends in grid project size and duration

We are observing an upward trajectory in the size of projects and also the number of projects. To

demonstrate the magnitude of this uplift, note that the chart for 2023 is for projects over 100 megawatt-hour (MWh), whereas the chart for 2022 is a tenth of that. The US is building large projects with a long duration, while China has a sheer number of projects driving the market. Also, projects are starting to emerge in Europe, Australia in particular, and other parts of the world.



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The IRA

The IRA will significantly impact the stationary storage market via the Investment Tax Credit (ITC) and the Production Tax Credit (PTC). There was already an ITC for storage where it was paired with solar. This has now been extended and added to with the introduction of the standalone storage ITC. As a result, the Battery Energy Storage System (BESS) location is no longer constrained, and there is more opportunity to maximize profit. This translates to a 30% CapEx reduction for any storage developers, potentially reducing this by a further 20%.

The criteria for the extended ITC include using brownfield sites or sites in communities with significant gas or mining employment. We are seeing many more projects come through on the back of this.

PTC encourages renewables in terms of generation. Batteries are eligible for $35 per KW and a further $10 per KW for system manufacturing. We are seeing ESS manufacturers moving into the US market to access that $10 part.

China leads with strong policy support and targets

Local policies now require 1-2 hours of storage at 5-20% power for any new renewable generation project. China has strong targets for renewable deployment, and each province has its targets for renewable energy and BESS. Consequently, the volume of BESS in planning and deployment is huge. The behind-the-meter market struggles due to a low utility price, so there is less impetus for householders or businesses to install their battery systems. The National Energy Association (NEA) in China has proposed a ban on Nickel Cobalt Manganese (NCM) batteries and sodium–sulfur batteries (Na-S) for large-scale

BESS due to concerns about safety relating to thermal runaways and fires. Lithium iron phosphate batteries (LFPs) are cheaper, but also less at risk of thermal runaway.

Opportunity in the European Market

Europe is somehow behind and has suffered from a lack of policy support and even policy inhibiting the market. The energy crisis in 2022 has brought attention to BESS as a way to optimize supply, and rising prices have also stimulated uptake on behind-the-meter projects. Moreover, the European Energy Tax Directive (ETD) will be reviewed in 2023. Currently, a project may be taxed as both the consumer and the distributor of energy, effectively double taxation, which will be amended under the 2023 ETD. Development in the UK has been at an advantage since Brexit as this has not applied to them. REPowerEU increases Europe's targets for renewable deployment from 40% to 45% of power supply by 2030. The European Investment Bank (EIB) has also announced in the last few weeks that some of the REPowerEU finance will be available for BESS projects.

BESS technologies overview

Energy density is important for the EV sector as this affects how far an EV can travel on a single charge, but far less critical in the stationary storage sector. Key performance indicators (KPI) for BESS are more oriented to cost, lifespan and safety. For example, lifespan may be expressed as a time or how long a battery retains a certain level of performance over how many charge-discharge cycles. LFP is swiftly becoming the chemistry of choice for BESS, though we expect to see diversification going forward. From 2020 to 2022, there has been a strong shift towards LFP, with the Chinese market now 90% LFP.

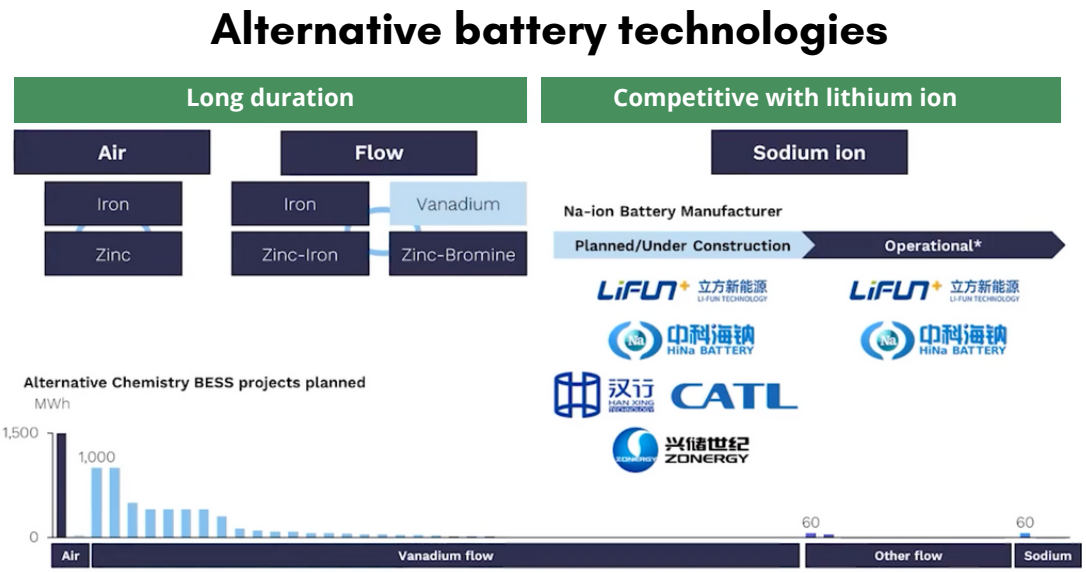
Alternative battery technologies

Alternative batteries fit into two categories: long duration and those competitive with lithium-ion. A good long-duration battery would be over 10 hours, while lithium-ion batteries can go up to 6 to 8 hours, although the limiting factor is the cost. Long-duration batteries are further split into air batteries and flow batteries. The most commercially advanced of these is the vanadium flow battery. The chart on page 6 shows many vanadium flow battery projects in the pipeline, particularly in the Chinese market. Sodium-ion has become increasingly discussed over the last 2 years, and the supply chain is starting to come together. Several notable battery manufacturers have made announcements regarding sodium-ion battery production, including CATL, who say they will have a supply chain up and running next year. Furthermore, HiNa now has a 1 gigawatt-hour (GWh) sodium-ion battery production facility, producing their first batteries just a few days ago. They will supply batteries to the 60 MWh project on the far right-hand side of the chart below, which is set to come online in the middle of next year. The sodium-ion is a lower energy density than LFP, but it is good in terms of cycle life and cost.

Second-life batteries for BESS

There is a lot of potential for second-life batteries in BESS. The majority of second-life projects to date are

pilot projects by Auto Manufacturers (OEMs) in Europe, generally on a small scale. This is typically a relationship between an OEM and an electricity provider. A large-scale example is China, with Chine Tower, a Chinese telecom provider, running a 2 GW trial of second-life batteries across different storage sites. The emerging results could be more positive, with battery performance and lifetime issues. This suggests that when a battery reaches the end of its life in an EV, there may be more of a market for it in recycling rather than BESS.



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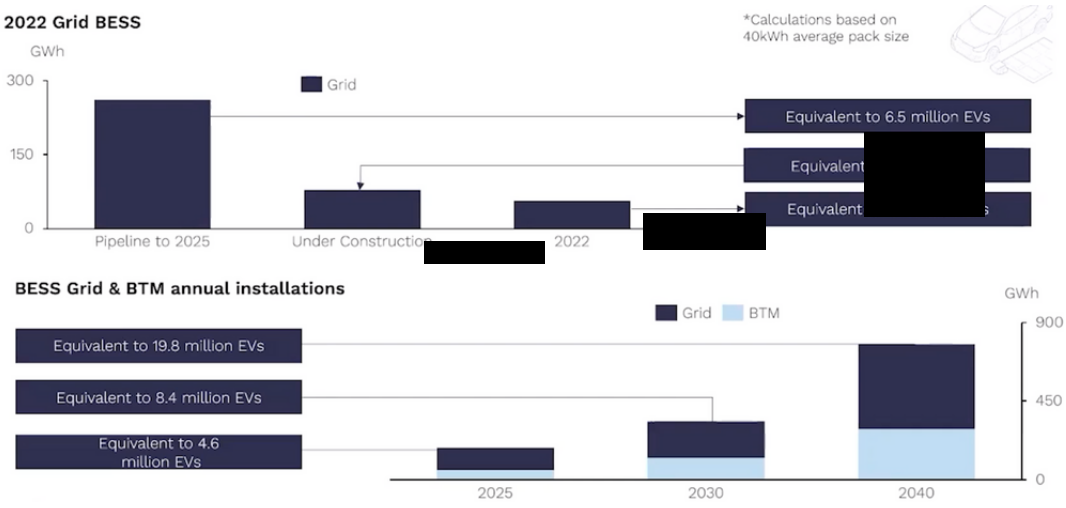
BESS demand relative to the EV market is around 10% rising to 20% by 2040

BESS grid and BTM installation per year are expected to be equivalent to 4.6 million EVs by 2025, 8.4 million by 2030, and 19.8 million by 2040. While the EV space is limited by what percentage of the vehicle market can be electrified and how quickly, the BESS market is not limited in that way. Instead, BESS is tied more to renewables deployment and policy.



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Questions & Answers

Is it possible to sell second-life EV batteries for use in microgrids?

Several companies are doing this already, and some of the challenges relate to warranties and liabilities, complicating the insurance. Given a choice, I would prefer a new battery with up-to-date technology rather than a 10-year-old battery that has been cycled in an EV, partly because technology has moved forward significantly in those 10 years, including in terms of safety.
Under the European Battery Directive, OEMs will be required to incorporate a certain percentage of recycled material, so they are under pressure to reclaim batteries and recycle the materials.

What is happening in the microgrid space?

There is a lot of opportunity, and there has always been a lot of interest in this area. In the past, this has been stronger in Africa, but now we see growing interest in microgrids in Europe in the context of energy security and rising energy costs. In Eastern Europe, we have seen communities come together to form microgrids for their communities, using solar and wind generation with batteries. Often there would still be a grid connection in place, so rather than being entirely off-grid, it would be the ability to operate off-grid as much as possible or in the event of grid outages or high prices.

Will NIMBYism hold back the demand for stationary storage?

At the moment, pumped hydro is the dominant storage technology. However, this is geographically limited, though some projects have looked into using flooded mines as reservoirs. Batteries are the fastest-growing storage technology, and they are location agnostic. Concerns about the visual impact of on-shore wind turbines will not affect the deployment of sufficient renewable generation capacity to drive stationary storage. Instead, a more pressing issue in Europe is the need for more policy support, which is a more immediate issue to address.

"Concerns about the visual impact of on-shore wind turbines will not affect the deployment of sufficient renewable generation capacity to drive stationary storage." – Iola Hughes

What is the European Union Battery Directive?

It sets out the minimum amounts of recycled materials that must be included in the production of batteries.

Lithium-ion batteries compared to others

Lithium-ion batteries are at their best up to a 4-hour life cycle, though they are being pushed up to 6 or even 8 hours. The cost of lithium-ion batteries is affected by the cost of individual ingredients in the mix. For example, LFP is generally cheaper than high-nickel or low-cobalt versions. Next, the supply chain for sodium-ion has yet to be up and running, so Li-ion is still cheaper, but once vanadium and sodium-ion are in process, their costs will become cost competitive or cheaper than Li-ion.
Lead acid batteries are cheap with a short life cycle. They are still regularly used by telecoms and data centers, but lead acid's market share has dropped significantly over the last few years. Despite this, lead acid batteries are still being deployed consistently, but as a market percentage, they are diminishing.
There is the potential for battery packs that include both Li-ion and sodium ion cells to bring the benefits of both onboard.
The market is so huge that there is plenty of space for vanadium and others to come into the market and complement each other with different benefits and use cases.

Green hydrogen alongside batteries

Green hydrogen has the potential to operate in conjunction with battery systems, where it is efficient to use hydrogen products rather than electricity directly.
I expect to see the EU provide a stronger policy response to the IRA, and Austria, in particular, looks like an exciting policy space. Australia is showing signs of interesting developments in the battery markets. In general, I expect cell manufacturers to become system integrators and diverse new battery chemistries to come into the market also.

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