

# What does battery energy storage mean for the power grid?

## The future.





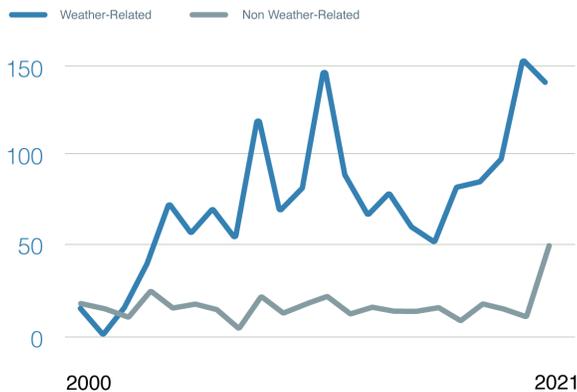
The energy sector is undergoing structural changes across the traditional and energy transition spectrum. Building on our decades of experience investing in differentiated products & services businesses enabling energy production and supply, White Deer is committed to supporting the build-out of all energy solutions that deliver reliable, sustainable, affordable, and secure energy. We are excited to share some of the most striking lessons we are learning about today's energy sector through our Illuminations series.

In December 2021, White Deer made an investment in Fortress Power, a rapidly growing designer and manufacturer of battery energy storage systems for residential, commercial, and industrial customers. White Deer had been researching this segment of the energy market for several years, so we are excited to share our view of the market and the fundamental drivers that led us to pursue this investment.

### POWER CONSUMERS ARE FACING CHALLENGES FROM ALL ANGLES

Power grids around the country are increasingly struggling to deliver power reliably, affordably, and sustainably. We consider satisfying these three pillars of energy security to be table stakes for any viable long-term solution.

### Major U.S. Power Outages



Number of outages affecting more than 50k customers. Source: U.S. Department of Energy form OE-417

**Reliability** can no longer be taken for granted, particularly in the U.S., where the average annual number of weather-related outage events increased ~78% during 2011 – 2021 compared 2000 – 2010.<sup>1</sup> Average duration of total annual electric power interruptions increased to an all-time high in 2020 of ~8 hours per customer nationally. As increasingly frequent extreme weather events disrupt service, underinvestment in critical grid infrastructure leads to a more brittle grid, and as grid operators struggle to balance the introduction of additional utility-scale, intermittent renewable generation assets, reliability is becoming a key theme in consumers' energy purchasing decision-making.

**Affordability** is unfortunately emerging as a major point for customers. The national average electricity rate is up ~8% in 2022 from the prior year, and in many states including New York, Florida, Illinois, and Hawaii, power prices have increased 15% or more. Rising natural gas prices are a primary driver of this trend, but there is long-term risk of substantial additional price increases as utilities pass through the costs of hardening power grids to improve reliability. Distributed generation resources like rooftop solar and battery energy storage haven't been immune to price increases either, with supply chain constraints driving up rooftop solar costs by ~23% compared to 2020 pricing, although that only translated into a <1% increase in the average quoted price of rooftop solar in 2H 2021 compared to 1H 2021.

<sup>1</sup> DNV GL, "Rethinking solar + storage in the wake of COVID-19"

<sup>2</sup> EIA, "U.S. electricity customers experienced eight hours of power interruptions in 2020"

<sup>3</sup> Utility Dive, "NERC sounds alarm on solar tripping in 'sobering' summer reliability report"

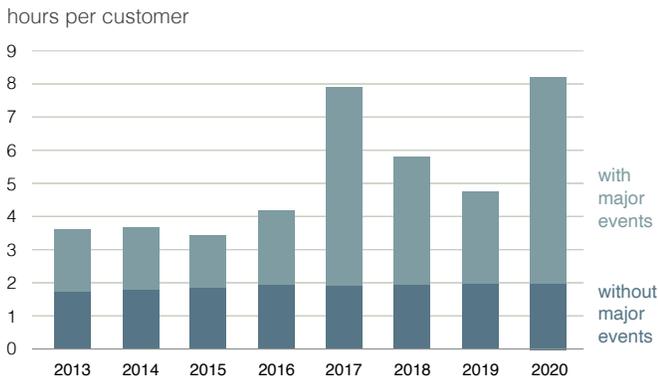
<sup>4</sup> EIA, "Electric Power Monthly"

<sup>5</sup> New York Times, "Get Ready for Another Energy Price Spike: High Electric Bills"

<sup>6</sup> Solar Magazine, "Rooftop solar installation price will temporarily increase in 2022, says GlobalData"

<sup>7</sup> EnergySage, Solar Marketplace Intel Report 2021

## Average duration of total annual electric power interruptions, United States (2013-2020)



Source: U.S. Energy Information Administration, Annual Electric Power Industry Report

**Sustainability** is increasingly becoming a driver of energy consumer behavior. Customers are demanding greener power, but the “green” content of their grids depends entirely on where they are located and the procurement decisions of utilities. The most remarkable change in the power markets over the past decade is the emergence of power as a product – namely the ability for residential, commercial, and industrial customers to elect to generate power locally through solar (and more recently energy storage) solutions from a wide variety of suppliers at lower \$/kWh prices than their utility contracts. This trend towards distributed generation assets is unlocking a new marketplace of products, services, and software businesses seeking to manufacture, install, and link disaggregated grid assets.

### BATTERY ENERGY STORAGE ALLEVIATES THESE CHALLENGES

In this rapidly evolving landscape, battery energy storage is emerging as a critical solution delivering a unique value proposition.

**1. LOAD SHIFTING** | Battery energy storage can reduce customers’ utility costs daily by charging when power is cheapest and discharging during the most expensive parts of the day, minimizing capacity charges and lowering overall electricity costs. When paired with rooftop solar, energy costs can be reduced even further as energy that otherwise might have been sold to the

grid at a discount is stored to offset future peak energy demand.

**2. SHORT-TERM BACKUP GENERATION** | Over 50% of U.S. power outages last 2 hours or less and over 75% of outages last 4 hours or less. These durations align perfectly with the capabilities of residential battery energy storage systems available today. Just 1–3 batteries (depending on the vendor and home size) can deliver whole-home backup for that period of time with no interruption.

**3. SUSTAINABLE LONG-TERM BACKUP GENERATION** | Attaching battery energy storage to rooftop solar (also known as “solar + storage”) is an increasingly popular choice. In 2021, 28% of all new behind-the-meter solar installs included battery storage, up from 20% in 2020 and 15% in 2019. That attachment rate is only expected to accelerate. The benefits of solar + storage include (i) long-term, sustainable backup generation, (ii) fixed-price financing solutions, (iii) optimized energy costs, (iv) the ability to go fully off-grid, (v) avoiding O&M for comparable fuel-powered backup generation, and (vi) avoiding fuel costs for comparable fuel-powered backup generation

### RAPID ADOPTION IN THE MARKET

Looking beyond customer outcomes, the overall battery energy storage market is benefiting from a virtuous cycle of scaling adoption, cost declines, product innovation, and regulatory support.

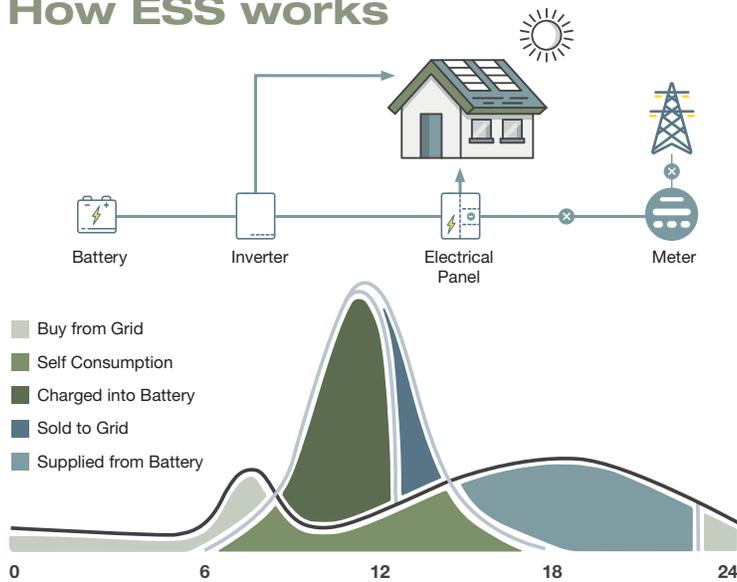
Adoption is skyrocketing, with U.S. annual energy storage deployments across all market segments growing 1,263% from 258 MW in 2016 to 3,509 MW 2021. Growth has continued into 2022, with Q2 2022 seeing record quarterly deployments of utility scale (2,608 MWh) and residential (375 MWh) battery energy storage systems.

Costs for battery energy storage systems have declined 29.5% since 2H 2014 and for lithium ion battery packs by 88% since 2010 as the industry has benefited from economies of mass production and continued product improvements. Even with recent inflationary cost increases in key inputs like lithium driven by supply chain constraints,

<sup>8</sup> DNV GL, “Rethinking solar + storage in the wake of COVID-19”

<sup>9</sup> EnergySage, “Solar Marketplace Intel Report H1 2021 – H2 2021”

## How ESS works



Bloomberg NEF expects only a 2.3% increase in the cost of lithium ion battery packs in 2022 compared to 2021.

As more mature products continue to see scaled adoption, venture capital, private equity, public equity, debt, corporate, and infrastructure capital is accelerating the maturation of the entire sector and promoting new innovation. Industry leaders like Tesla are diversifying their lithium ion battery chemistries from exclusively NMC (which contains rare-earth metals like cobalt) to include LFP-based batteries (which are safer and avoid rare-earth metals, but are less energy-dense). New solutions like Form Energy's long duration energy storage offering have the potential to further revolutionize and stabilize power markets by targeting under-served problems with new storage technologies that utilize abundantly available source materials.

In the battery innovation ecosystem, utility scale energy storage and EV charging are the twin drivers of battery energy storage technology innovation. Behind-the-meter battery energy storage for residential and C&I customers tends to rely on mature, mass-produced battery technologies, which in turn reinforces their bankability and eases further mass adoption.

Finally, regulatory support, such as the Inflation Reduction Act's extension of the 30% Investment Tax Credit to standalone battery storage projects, is expected to supercharge these strong underlying industry tailwinds.

BloombergNEF estimates the IRA will add an additional 30 GW/111 GWh of battery storage capacity to the grid through 2030, a ~30% increase from prior forecasts.

### THE ROLE OF FORTRESS POWER

Given these overwhelming market trends, White Deer has been searching for great partners in the sector. In Jing Yu, founder & CEO of Fortress Power, and Eric Wang, CTO of Fortress Power, we found an exceptional set of entrepreneurs with a keen focus on efficiently delivering differentiated battery energy storage products.

Fortress Power designs and sells proprietary battery energy storage systems geared towards the residential and C&I markets. Fortress battery energy

storage systems offer 1.5x – 2x the storage capacity of direct competitors in a single battery, yielding simpler jobs for installers and more robust systems for end customers. The company utilizes third-party OEM vendors for key components and assembly, mitigating direct technology risk by sourcing battery cells from dedicated suppliers of LFP battery cells and thereby benefiting from long-term supplier cost declines. Its products are sold through a network of 100+ distributors and 800+ installers across North America and the Central Caribbean. Fortress prizes these customer relationships and invests in them through extensive training programs, technical support services,

**“IN THE ENERGY ECOSYSTEM, BATTERY ENERGY STORAGE IS NO LONGER A FUTURE MAYBE, IT’S AN IMMEDIATE NECESSITY.”**

and continuous product improvements to ensure ease of installation. This has led to significant market adoption of Fortress Power's battery energy storage products.

### WHAT IT ALL MEANS

White Deer expects battery energy storage solutions will experience structural long-term growth, with adoption still in its infancy. Batteries are the lynchpin to distributed power generation and renewables adoption, enabling reliable, affordable, and sustainable energy at any scale.

<sup>10</sup> D Wood Mackenzie, "2021 Year in Review Energy Storage Monitor Executive Summary"

<sup>11</sup> Ibid.

<sup>12</sup> Evercore

<sup>13</sup> BloombergNEF's 2021 Battery Price Survey

<sup>14</sup> BloombergNEF, "Global Energy Storage Market to Grow 15-Fold by 2030," October 12, 2022