



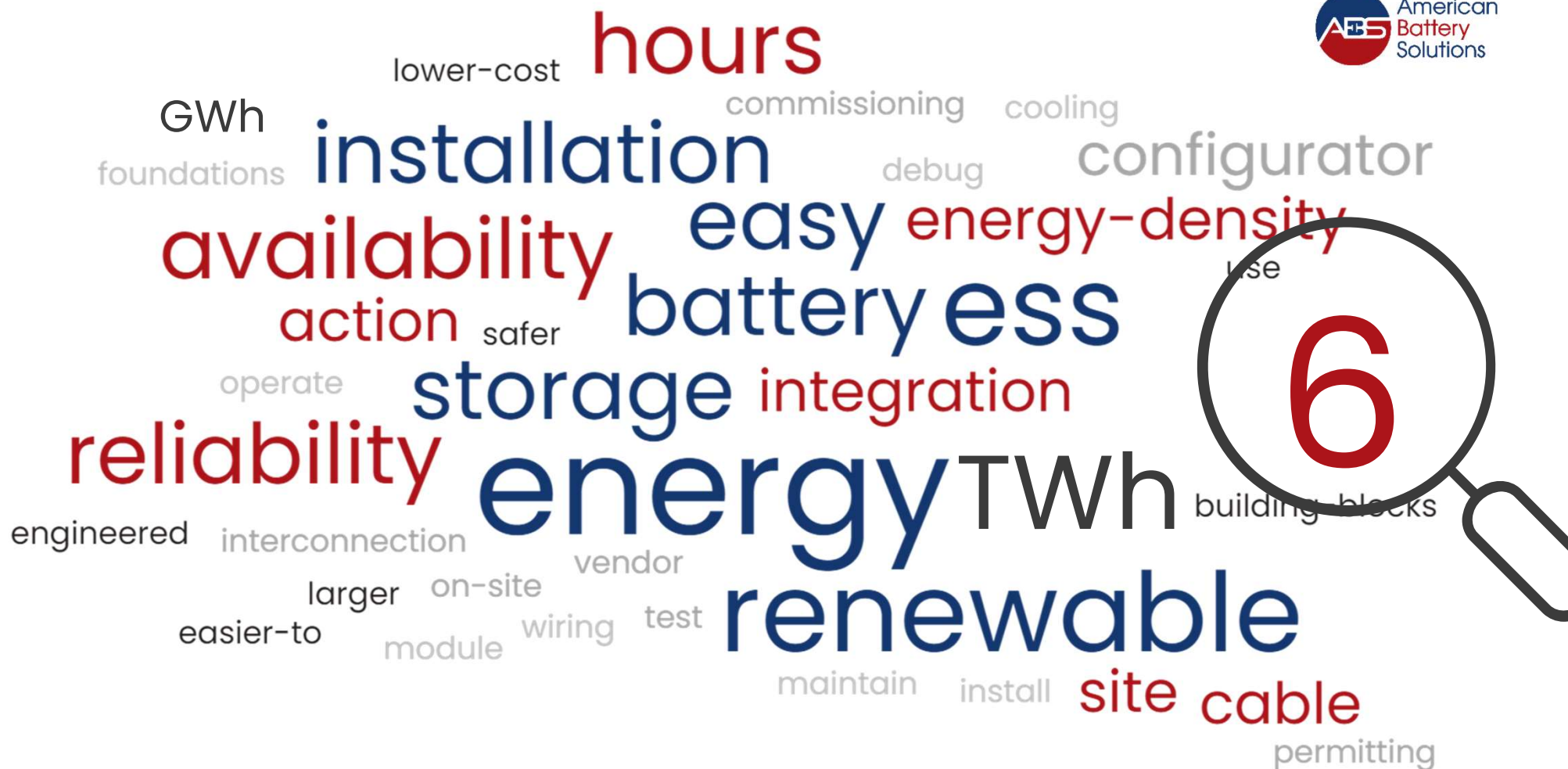
ENERGY STORAGE SYSTEMS

[www.americanbatterysolutions.com/ess/ess-home](http://www.americanbatterysolutions.com/ess/ess-home)

# The Next Generation of Energy Storage, Today

ENERGY STORAGE MADE EASY

Presented by  
**C. Michael Hoff**  
CTO, American Battery Solutions – ESS Division



# Massive Deployments of ES are Needed to Meet 2050 Renewable Goals



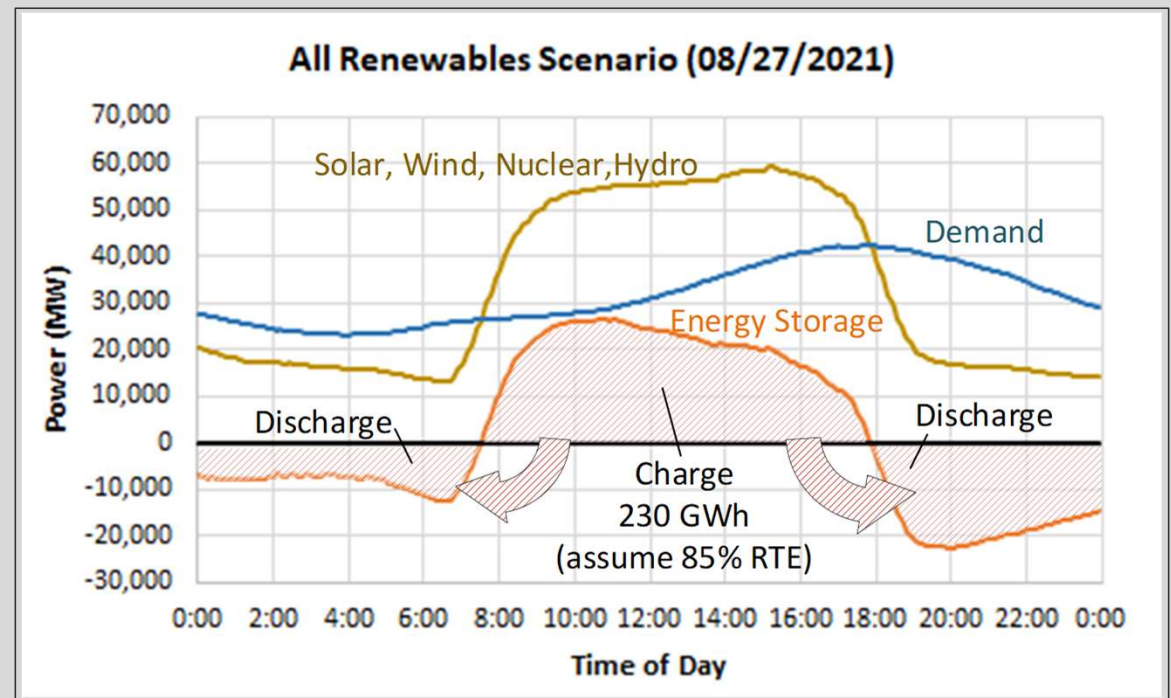
CAISO example: Hypothetical extrapolation to all renewables

Using 2019 load data

230 GWh is needed to support an all-renewable scenario

That's **5.5x** the peak summer load

*remember that number*



Source: C. Michael Hoff "Energy Storage Technologies and Applications" Artech House Publishers

# US-based Demand Growth



NREL futures study

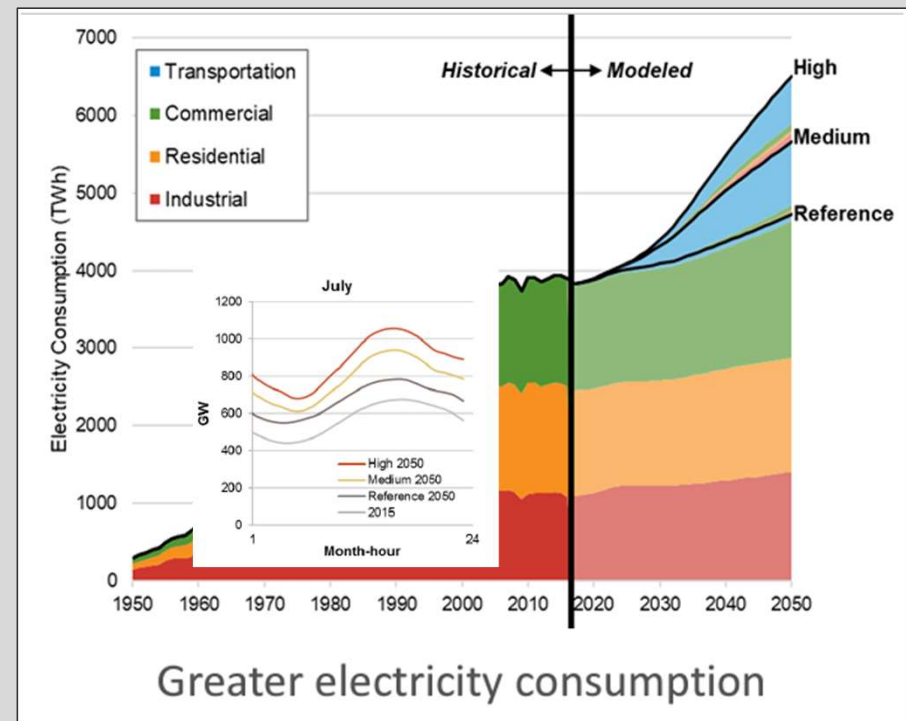
US demand expected to almost double by **2050**

Current US summer demand is 0.7 TW

Peak Summer demand could be 1.1 TW in 2050

1.1 TW x 5.5 ~ 6 TWh

*the US may require 6 TWh of energy storage to be fully carbon free*



Source NREL "Electricity Futures Report"

# How Do We Get to 6 TWh?

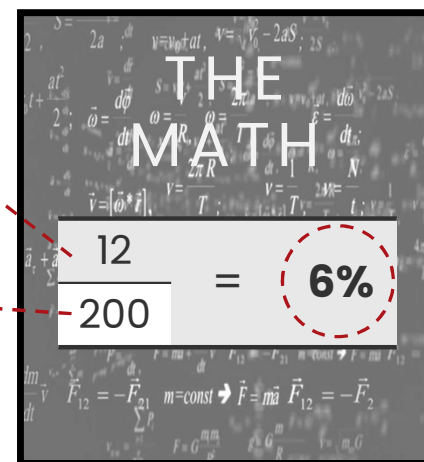
The energy storage dilemma: Transforming to meet the 30-year critical path

2022 was a **record year** with a full **12 GWh** installed in the US!

*...which is good...BUT...*

In order to achieve 100% renewable energy use by 2050, an average of **200 GWh** need to be installed **each year**.

*...that's roughly **1.5 GWh every other day**...*



Current large project time-frames are around 1-2 years, and installation times are 6-9 months.

*...why does it take so long to install battery energy storage...*

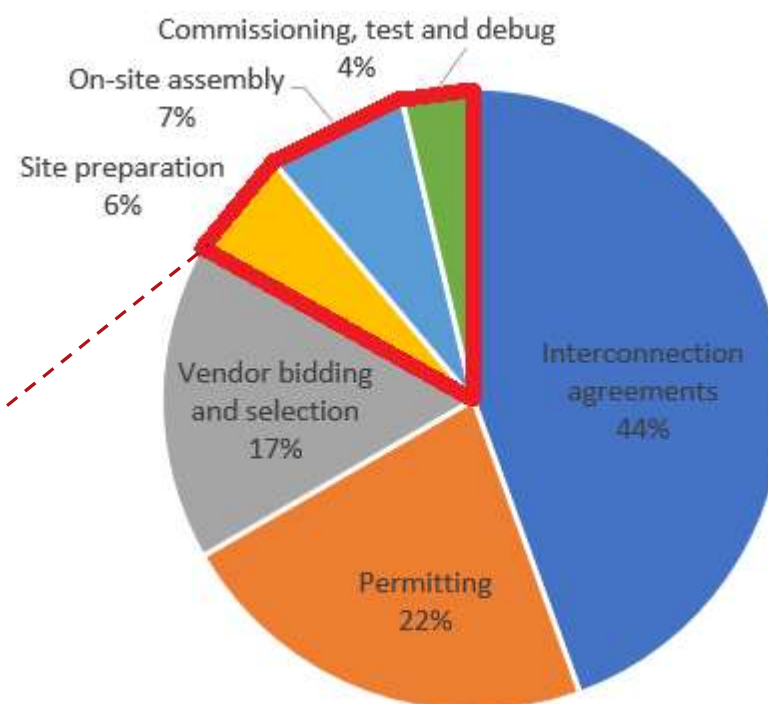
# What takes so long?

## Installation Energy Storage

- ✓ Interconnection agreements
- ✓ Vendor bidding and selection
- ✓ Site permitting
- ✓ Site preparation
- ✓ On-site assembly
- ✓ Commissioning, test and debug

*A 6th of the energy storage development time is related to the site installation of its hardware.*

Time to Develop Energy Storage Sites



Source: Informal survey among experienced storage developers and EPC companies

# Installation Effort

Time-consuming on-site installation activities



## Site preparation

- ✓ Land preparation
- ✓ Foundations
- ✓ Cable trenching



## On-site assembly

- ✓ Unpacking
- ✓ Module and rack assembly
- ✓ Wiring and connections
- ✓ Cooling system installation



## Commissioning, test and debug

- ✓ Integration testing
- ✓ Startup debugging
- ✓ Commissioning testing




Courtesy of Florida Power & Light

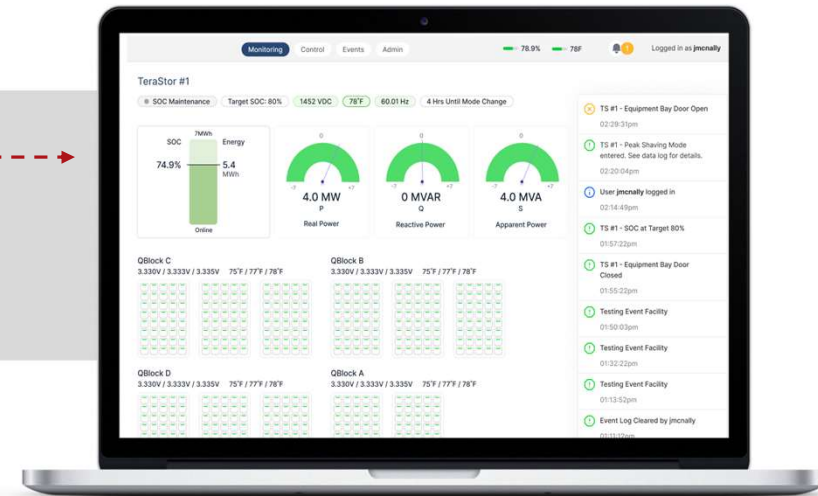
# Introducing a Better Way to Install Energy Storage



6 hours\* from arrival on-site to commissioning



---> 6 hours --->  




\* Assuming a team of 4 people for each TeraStor™ installed



*Designed from the ground-up to be:*

- ✓ EASY TO PURCHASE
- ✓ EASY TO INSTALL
- ✓ EASY TO OPERATE
- ✓ EASY TO MAINTAIN

**7.2**  
MWh  
AC CP/4



**600**  
MWh  
per Acre

\* double stacked,  
300 if single

*With a revolutionary new architecture that:*

- Eliminates **280,000 parts** from comparable solutions
- Installs on-site with **22 simple connections**
- Removes risk of **cell-to-cell propagation**
- Is designed, manufactured, tested and supported as **a single product**

# Reducing the Installation Effort



Some examples...

Current State of the Industry	ABS TeraStor™
<b>Site preparation</b> <ul style="list-style-type: none"><li>- Land preparation</li><li>- Foundations</li><li>- Cable trenching</li></ul>	<b>Site preparation</b> <ul style="list-style-type: none"><li>- High industry energy density dramatically reduces land use, foundations, and cable connections</li></ul>
<b>On-site assembly</b> <ul style="list-style-type: none"><li>- Unpacking</li><li>- Module and rack assembly</li><li>- Wiring and connections</li><li>- Cooling system installation</li></ul>	<b>On-site assembly</b> <ul style="list-style-type: none"><li>- Factory assembled &amp; tested units require minimal site connections and just 6 hours of assembly</li><li>- TeraStors are self-powered, self-cooled and self-controlled</li></ul>
<b>Commissioning, test and debug</b> <ul style="list-style-type: none"><li>- Integration testing</li><li>- Startup debugging</li><li>- Commissioning testing</li></ul>	<b>Commissioning, test and debug</b> <ul style="list-style-type: none"><li>- Factory tested and safety certified TeraStors require no on-site compliance certification, nor integration debugging</li><li>- StorView executes commissioning autonomously</li></ul>



# Energy Storage Should Be **easy**



**99.999%**  
availability

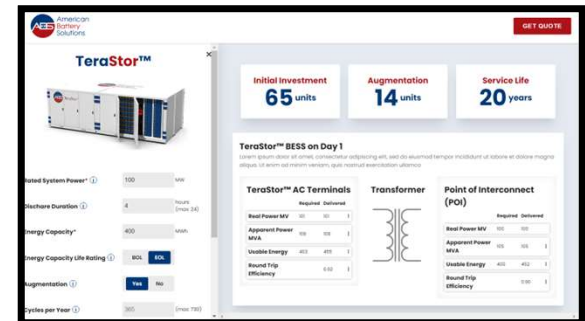
MAINTAIN

PURCHASE

easy

OPERATE

INSTALL



**On-line configurator**



# Summary Points

Getting to **100% renewables** by 2050



Current state of the industry will not get us to this goal



Need improvements in all aspects of storage development

- Interconnection
- Vendor selection
- Permitting
- Site preparation
- Installation
- Commissioning



ABS proposes a way to radically reduce on-site effort per project

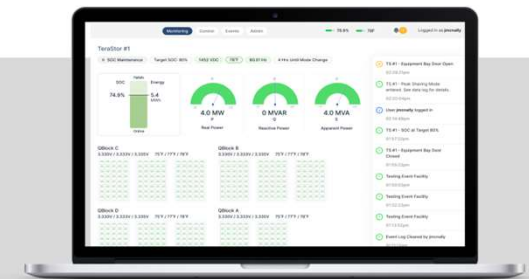
- ✓ Site preparation
- ✓ Installation
- ✓ Commissioning



6 hours from arrival on-site to commissioning



Let's Go!



# Thank You



There is a pathway to bridge the gap with larger engineered building blocks that are lower-cost, safer and easier-to-use.

“We must challenge conventional thinking in order to meet the needs of today and tomorrow...”



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## Questions?