

# LDES NATIONAL CONSORTIUM



Prepared for the 4<sup>TH</sup> Annual  
Energy Storage Grand Challenge Summit

Will McNamara, Grid Energy Storage Analyst /  
Principal Investigator

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# WHAT I WILL DISCUSS TODAY

- Decarbonization and the role of energy storage.
- The need for new technologies
- What is LDES—technologies and applications.
- Introducing the LDES National Consortium
- Commercialization challenges & recommendations
- Q&A

# The following states have adopted decarbonization / clean energy / renewable goals.



	STATE	DEADLINE	GOAL	CLEAR ROLE FOR ES/LDES
1	CA	2045	100% carbon-free electricity	YES
2	CO	2050	100% carbon free electricity	Somewhat
3	CT	2040	100% carbon-free electricity	NO
4	HI	2045	100% renewable energy	Somewhat
5	IL	2050	100% carbon-free electricity	Emerging
6	LA	2050	Net zero greenhouse gas emissions	NO
7	ME	2050	100% clean energy	NO
8	MA	2050	Net-zero greenhouse gas emissions	NO
9	MD	2045	Net-zero greenhouse gas emissions by 2045	
10	MI	2050	Economy-wide carbon neutrality	NO
11	NJ	2050	100% carbon-free electricity	Somewhat
12	NM	2045	100% carbon-free electricity	NO
13	NV	2050	100% carbon-free electricity	Somewhat
14	NY	2040	100% carbon-free electricity	Somewhat
15	OR	2040	Greenhouse gas emissions reduced 100 percent below baseline emissions	Somewhat
16	RI	2030	100% renewable energy	NO
17	VA	2045	100% carbon-free electricity	NO
18	WA	2045	100% zero-emissions electricity	Somewhat
19	WI	2050	100% carbon-free electricity	NO

# Energy Storage Policy—Current Status

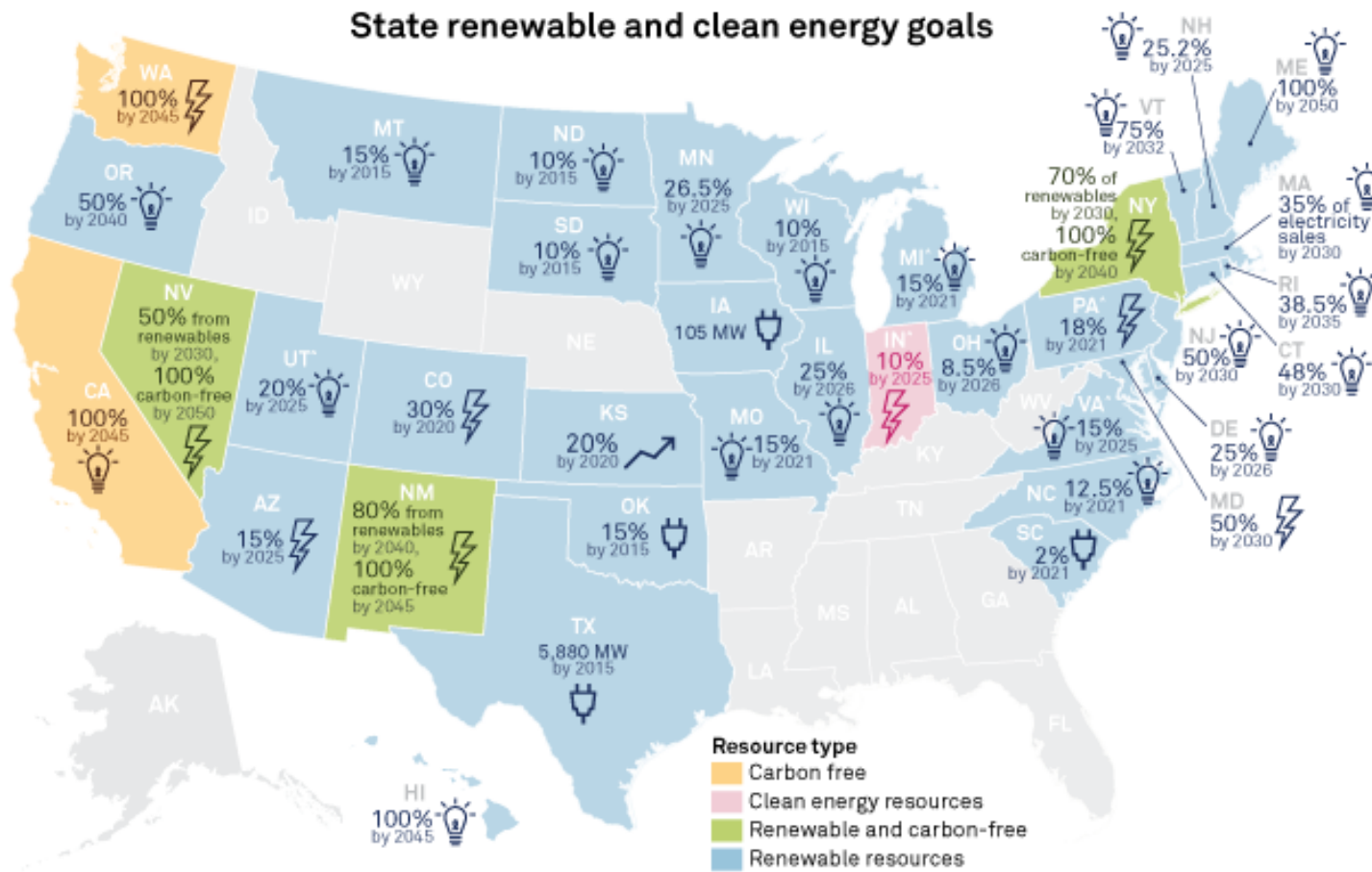


- About 15 states have adopted some form of energy storage policy, which in all cases exists along with a renewables policy.
- Energy storage activity still driven mostly in states that have the following policies:
  - Utility **procurement mandates, targets or goals** (11 states);
  - Financial **incentives / subsidies** (CA, MD, NJ, NY);
  - State-funded **demonstration projects** (MA, MD, NY, UT, WA)
- Requiring storage in **utility IRPs** is also becoming more common. (NV, NM)

## *Deployment:*

- ❖ Installation has been mostly concentrated in CA-ISO and PJM, and ERCOT regions, and in states that have developed enabling policy frameworks. Texas is an exception, where business incentives & wholesale opportunities have driven ES development.

# The role of LDES in a decarbonized future.



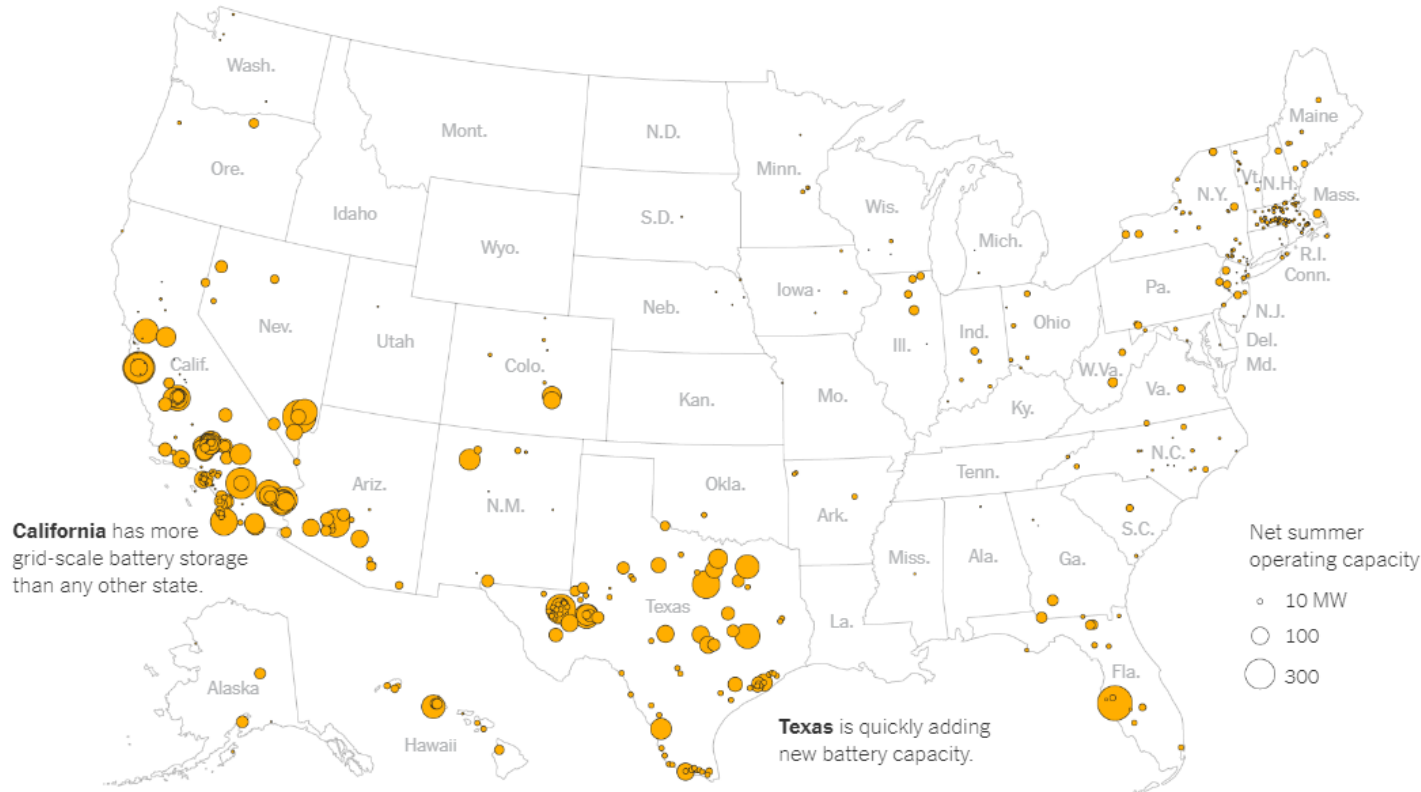
Source: EIA

- As renewables penetration exceeds 60%, this creates critical operational needs and market opportunities for LDES.
- Increase of “grid stress events”—extended periods of under-generation.
- Extreme weather events are also increasing...a rise in “winter peaking” scenarios with longer extended peaks.

# The need for new technologies.



Battery Storage Plants Across the United States



Source: EIA

- But depending solely on lithium-ion batteries is not an option.
  - ✓ By 2040, Demand will be twice the available Supply!
  - ✓ Li-ion batteries are arguably better suited for electric cars and portable electronics, and not as good for stationary storage. Plus there is not enough of it to accommodate grid-scale storage.
  - ✓ 4-hour duration limitations, fire hazards.
- For true LDES, 10 hours to 3 days, we will have to turn to Thermal, Gravity, or Chemical Storage.



# Identifying key markets for LDES.



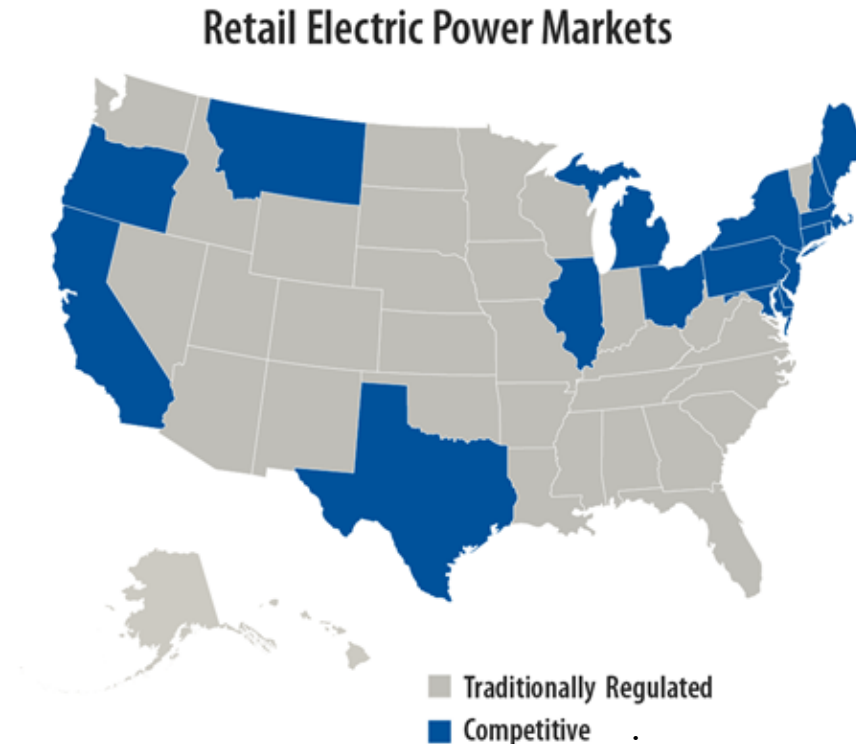
## Regulated Markets

“Vertically integrated” utility **owns or controls** generation, transmission, and distribution

**Regulated by states** (public utility commissions)  
Cost recovery via rates charged to customers

**LDES needs to solve grid problem and be reliable, low-risk**

*Electricity markets are not homogenous.*



<https://www.epa.gov/repowertoolbox/understanding-electricity-market-frameworks-policies>

## Restructured Markets

Market is **competitive**

Utilities usually prohibited from owning G&T assets.

**RTOS/ISOs** responsible for inter-/intra-state T, D and O&M with oversight from FERC

**LDES needs to make money**

- Most states have not developed an LDES policy (CA is an exception)
- Little agreement about where, how and why LDES will be deployed.

# Defining LDES—starting points.



- Presently definitions of LDES have focused on **duration**...defined as the length of time a storage system can sustain power output at its maximum discharge rate.
- DOE definition is by duration with a minimum of 10 hours.
  - ✓ Most states have no duration-based definition at all.
- Dozens of LDES chemistries in development with hundreds of companies in competition.
- Diversity across LDES technologies will be key...no “one size fits all” solution...different technologies for different applications.
- Thus, increasingly, LDES technologies will be defined by the applications / use cases they serve.



# Challenges—High-level perspectives.



- **Challenge #1:** Lack of policy consistency
  - ✓ Most states have not developed an LDES policy (CA is an exception)
  - ✓ Little agreement about where, how and why LDES will be deployed.
  
- **Challenge #2:** It's unclear what LDES should do, and where.
  - ✓ Most regions have only adopted a 4 hour-or-less energy storage requirement
  - ✓ Currently little need or value beyond 4 hours
  
- **Challenge #3:** Little consensus on how LDES should be valued or compensated.
  - ✓ In restructured markets, LDES needs to make money.
  - ✓ Efforts to define ISO/RTO, utility and customer services remain incomplete.

# All of this led to the DOE's Lab-only Proposal Call.



- Released in the summer of 2023.
- U.S. DOE Office of Technology Transitions and Office of Clean Energy Demonstrations
- Funding provided by Bipartisan Infrastructure Law Technology Commercialization Fund
- Intended to address commercialization challenges that arise when many entities working in similar areas work in isolation.
- 50% cost-sharing requirement due to the opportunity being defined as a demonstration project.
- Sandia applied as lead lab with five lab partners.





LDES NATIONAL  
CONSORTIUM

# The National Consortium for the Advancement of LDES Technologies

**Will McNamara**  
*Sandia National Laboratories*  
**Principal Investigator**



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525 SAND2024-00410PE.



**OCED**  
Office of Clean Energy Demonstrations



**OTT**  
Office of Technology Transitions

This project is funded by the Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (BIL), as part of the DOE Technology Commercialization Fund (TCF), administered by the Office of Technology Transitions in collaboration with the Office of Clean Energy Demonstrations.



**Sandia  
National  
Laboratories**





# THE NATIONAL CONSORTIUM FOR THE ADVANCEMENT OF LDES TECHNOLOGIES

The LDES National Consortium provides a forum through which stakeholders across the LDES ecosystem can convene to **identify barriers, determine potential synergies, and collaboratively develop and implement strategies necessary to achieve LDES technology commercialization** within the next decade.

## MAJOR DELIVERABLES OVER NEXT THREE YEARS:

- LDES Demonstrations & Deployments Tracking System
- LDES Technology Maturity Evaluation Framework
- Assessment of Utility Needs for LDES
- Geographical Readiness Assessments
- Evaluation of US Wholesale Markets
- Evaluation of US Retail Markets
- Full Set of Commercial Pathways Recommendations
- Networking and Community Outreach

### Lab Leadership

Lead by Sandia Labs partnering with ANL, INL, NREL, ORNL, & PNNL

### Website

Community of Knowledge and Best Practices ensuring findings are easily accessible

### 180+ Teaming Partners

LDES National Consortium will be comprised of U.S. industry and community stakeholders, known as "Teaming Partners."

**3 Years  
\$7M Federal  
Funds + Cost  
Share**

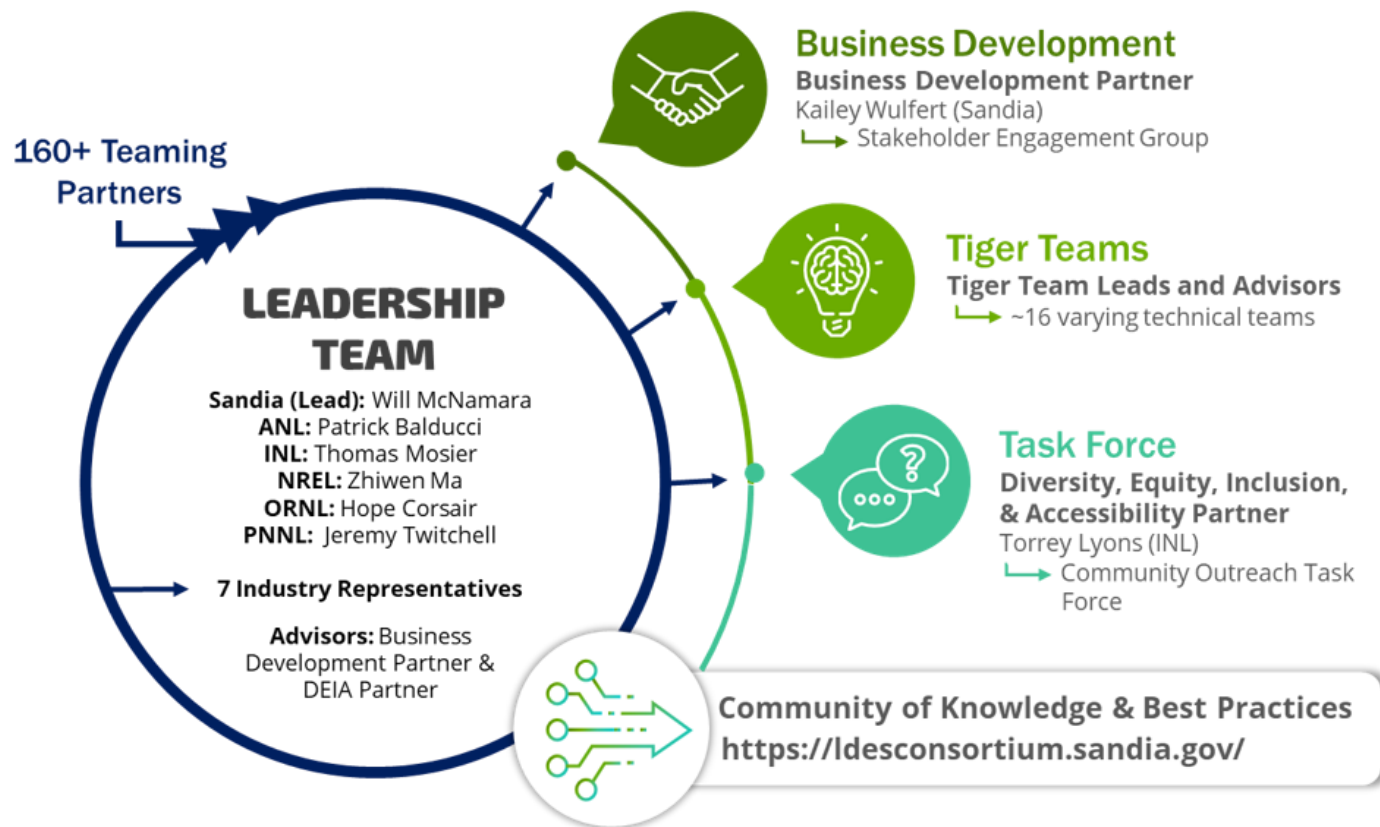
### 16 Tiger Teams

Topical working groups to evaluate challenges.

## National Launch: January 2024



# Organizational Structure



## TIGER TEAMS

- Customer Adoption
- Demonstrations & Deployments
- Economics & Valuation
- Equity
- Grid Infrastructure
- Interconnection, Standards & Permitting
- Investor Confidence / Finance
- Market Planning
- Policy & Regulations
- Reliability & Resilience
- Safety & Grid Security
- Supply Chain & Manufacturing Efficiencies
- Technology Development, Evaluation & Testing
- Use Case Development
- Utility Resource Planning
- Workforce Development

***Tiger Teams will develop what ultimately will become the public stakeholder recommendations for these specific focus areas.***



# 11 Challenges—Pulled directly from the DOE's Lift-Off Report.



1. Cost of an LDES system needs to come down by 2030
2. LDES technologies must achieve 7-15% improvement in roundtrip efficiency to compete with Li-ion storage and hydrogen.
3. The specific needs related to LDES workforce training (i.e., skills and training) are presently not well defined.
4. A uniform approach toward developing resource adequacy compensation for LDES technologies does not exist, in either regulated markets (PUC evaluation) or competitive markets (ISO/RTO).
5. A comprehensive assessment of necessary supply chain improvements specific to LDES technologies does not presently exist.
6. There is presently a lack of resources regarding how to evaluate grid upgrades or expansions that will be necessary to accommodate both new variable renewable generation sites and LDES systems
7. Presently, there is no publicly available evaluation of LDES technologies against primary competitive factors.
8. LDES is not included in most utility grid firming plans.
9. LDES use cases require market changes.
10. ISO and RTO markets will need to develop support mechanisms.
11. State-level policymaking specific to LDES has been very limited.

## #4—Resource adequacy compensation



- Further assessment is needed to determine how Regional State Committees (RSCs) can assume a more significant role in ensuring that both decarbonization goals and resource adequacy standards at the state level are being fully considered in federal rulemaking standards and wholesale market rules.
- Alternatives to the Effective Load Carrying Capability (ELCC) should be developed as a means to evaluating the contributions that LDES can make toward resource adequacy requirements.
- Approaches regarding the treatment and compensation of resource adequacy proposed in Massachusetts's Recent Report and Study entitled: Charging Forward: Energy Storage in a Net Zero Commonwealth should be assessed for the potential to be offered as a standardized approach to other states.
- Further analysis of whether the approach that California is taking to monetize resource adequacy (its "Slice of Day" policy) should be conducted to determine the viability of offering this as a standardized approach for other states to adopt.



## #6—How to evaluate grid upgrades.



- A research entity should be tasked with conducting an interconnection standards gap analysis that is specific to LDES technologies and their unique requirements.
- Initiate a docket to investigate proactive interconnection planning processes and increased sharing of upgrade costs across multiple developers.
- The authorization process of scheduled interconnection agreements within RTO/ISO markets should be streamlined.
- Improve the capabilities of existing modeling software tools currently available to grid planners to capture the full value of LDES resources.

## #11—State level policymaking.



- States that have adopted an energy storage procurement target, goal or mandate should be encouraged to take a further step and specifically identify the amount of LDES that is to be procured at where renewable energy mix is high and the storage gap is large.
- Compile/develop LDES policy recommendations for states.
- Develop an LDES benefit/cost model, to use in utility regulatory dockets.
- States should be encouraged to conduct analysis examining the potential for an increase of “winter peaking” scenarios, which would require a significant need for LDES resources. and/or additional generations to meet customer needs.

# Website Information

*The Community of Knowledge & Best Practices Website is the official name for the LDES National Consortium's public facing Website.*

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- **The Website will be the primary repository for the output of the LDES National Consortium, along with knowledge-sharing information that seeks to enhance the public's understanding of LDES and the role it will play in the energy future of the US.**
- **It is anticipated that the Website will include, but is not limited to:**
  - A list of participating Teaming Partners that includes organization name, URL, primary point of contact name and title, and contact information (after approval from the Teaming Partner organization).
  - Commercialization recommendations developed by Tiger Teams.
  - A glossary of "LDES common terminology" with suggestions on how key terms should be defined.
  - A library of previously published LDES materials developed by our national Lab Partners and DOE offices.

[ldesconsortium.sandia.gov](https://ldesconsortium.sandia.gov)



# The LDES marketplace is still nascent.



*We are in the midst of a full convergence of industry forces...  
technology, manufacturing, supplies, investors, policymakers and customers  
are all coming together to move the energy sector forward!*

- From now through 2030, we will likely remain in a phase of **demonstrations and solution development**, spurred largely by federal subsidies.
- Literally billions of dollars being injected into this space driving what is nothing less than an industry transformation!
- Now is the time to define end-use applications and how LDES technologies can be used!
- Ultimately, a diverse set of LDES technologies will be needed for different applications in different locations.

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THANK YOU!



WILL MCNAMARA  
PRINCIPAL INVESTIGATOR  
LDES NATIONAL CONSORTIUM  
SANDIA NATIONAL LABORATORIES  
[JWMCNAM@SANDIA.GOV](mailto:JWMCNAM@SANDIA.GOV)