



**LDES NATIONAL
CONSORTIUM**

Public/Private Funding Scenarios

Lead: Jeffrey Gifford, NREL

LDES National Consortium Annual Workshop 2024

Commerce, California

Session 2



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OCED
Office of Clean Energy Demonstrations



OTT
Office of Technology Transitions

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**Sandia
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Laboratories**



Argonne
NATIONAL
LABORATORY



INL
Idaho National Laboratory



NREL
NATIONAL RENEWABLE ENERGY LABORATORY



**OAK
RIDGE**
National Laboratory



Pacific Northwest
NATIONAL LABORATORY

Session Outline

- Introduction/Overview
 - Facilitator: Jeffrey Gifford, NREL
- Industry Perspective on LDES Investment
 - Presenter: Michael Sanders, Avicenne Energy
- Scenario Development



Jeffrey Gifford



Michael Sanders

Public and private investment into LDES has increased in recent years.

Form Energy Announces \$450M Series E Financing

Source: [Form](#)

Equinor Ventures-led consortium invests €30 million in electricity storage company Elestor

Source: [Elestor](#)

OCED Announces \$100 Million for Non-Lithium Long-Duration Energy Storage Pilot Projects

Source: [OCED](#)



Public investment has largely come from federal offices, but there are also states.

- DOE Office of Clean Energy Demonstrations (OCED)
- DOE Loan Program
- DOE Technology Offices - typically lower TRL
- California Energy Commission (CEC)
 - [Funding approved for US Barona 6.6 MWh LDES project](#)
- New York State Energy Research and Development Authority (NYSERDA)
 - [Over \\$5 Million Announced For Long Duration Energy Storage Projects](#)

Public support is not limited to grants, includes tax policy.

Tax Credit 48E

- Technology-neutral, standalone energy storage
- Investment tax credit (ITC)
- Begin construction after Dec 31, 2024
- Through 2032 or 75% GHG reduction from US electricity emissions
- Directly transferrable to unrelated third party
- Base rate: 6%
- Prevailing wages & apprenticeship (PWA): 30%
- +10% Bonuses (only +2% if PWA is not met):
 - Domestic Content
 - Energy Communities

Tax Credit 45X

- Advanced Manufacturing Production Tax Credit
- *Up to* 30% investment tax credit to re-equip, expand, or establish facilities
- Solar, wind, inverter, and “battery” components (includes thermal and flow)
- Production tax credit of \$35-45/kWh (inherently favors LDES due to higher energy capacities)

LDES Investment Tracker has started collecting publicly-available investment data to establish trends.

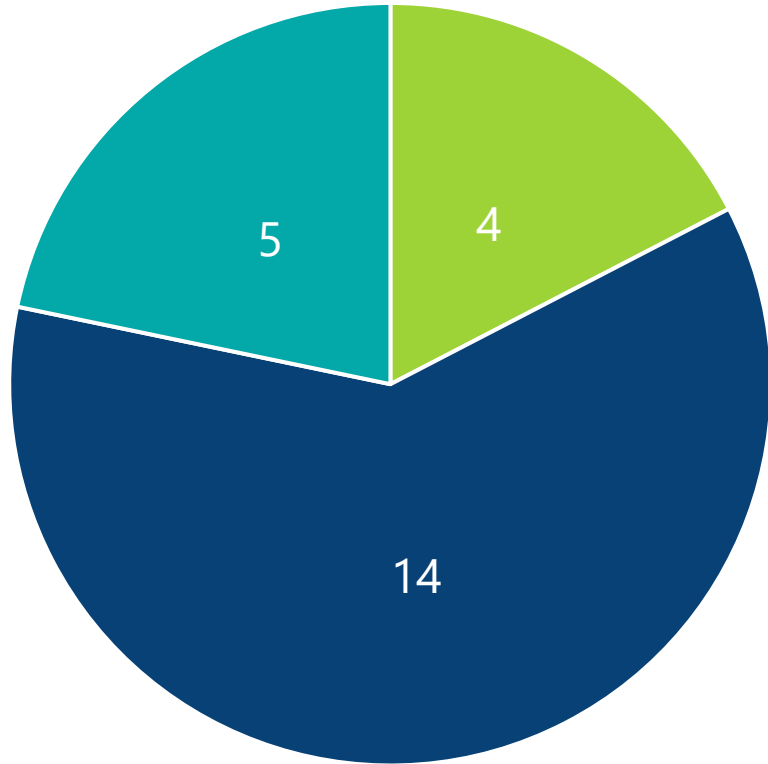
LDES Investment Tracker

LDES Company	Technology Description	Technology Category	Technology Subcategory	Investor	Investment Source Type	Amount (USD)	Investment Stage	Date
Sigma Energy Storage	Thermomechanical compressed air energy storage	Mechanical	Compressed Air (CAES)	Sustainable Development Technology Canada (SDTC)	Public - Federal Grant	\$2,400,000		3/30/2016
Jolt Energy Storage	Flow Batteries using organic compounds	Electrochemical	Redox Flow Battery (RFB)	Shell GameChanger Accelerator	Accelerator & incubator		Seed	
Eos	Aqueous zinc batteries	Electrochemical	Zinc Batteries	DOE Loan Programs Office (LP)	Public - Loan Program Office	\$298,600,000	Production	8/31/2023
Eos	Aqueous zinc batteries	Electrochemical	Zinc Batteries	Cerberus Capital Management LP	Institutional Investor	\$315,500,000		6/24/2024
Form Energy	Iron-air battery	Electrochemical	Iron Batteries	ArcelorMittal	Corporate strategic investment	\$450,000,000	Series E	10/5/2022
Form Energy	Iron-air battery	Electrochemical	Iron Batteries	California Energy Commission (CEC)	Public - State Grant	\$3,000,000	Deployment	
Form Energy	Iron-air battery	Electrochemical	Iron Batteries	New York State Energy Research and Development Authority (NYSERDA)	Public - State Grant	\$12,000,000	Deployment	9/18/2023
Invinity Energy Systems	Vanadium flow batteries	Electrochemical	Redox Flow Battery (RFB)	California Energy Commission (CEC)	Public - State Grant			
RayGen	Chiller, organic Rankine cycle	Thermal	Sensible Heat Storage	SLB (Schulberger)	Corporate strategic investment	\$20,000,000	Series D	4/30/2024
Energy Dome	Compressed CO2 battery	Mechanical	Compressed sCO2	Eni Next, Neva SGR, Japan Energy Fund, Barclays' Sustainable	Corporate strategic investment	\$43,000,000	Series B	4/30/2023
Energy Dome	Compressed CO2 battery	Mechanical	Compressed sCO2	Innovation Development Oman Investments, Vopack Ventures	Corporate strategic investment	\$21,000,000	Series B	7/20/2023
Antora	Thermophotovoltaic	Thermal	Sensible Heat Storage	Decarbonization Partners (BlackRock and Temasek)	Institutional Investor	\$150,000,000	Series B	2/27/2024
Antora	Thermophotovoltaic	Thermal	Sensible Heat Storage	Breakthrough Energy Ventures, Lowercarbon Capital Shell Vent	Venture Capital	\$50,000,000	Series A	2/17/2022
Malta Inc.	Pumped molten salt thermal energy storage	Thermal	Sensible Heat Storage	Siemens Energy Ventures, Alfa Laval	Corporate strategic investment			
Elestor	Hydrogen-bromine flow battery	Electrochemical	Redox Flow Battery (RFB)	Equinor Ventures	Corporate strategic investment	\$30,000,000	Series A	9/30/2022
CMBlu	Organic SolidFlow battery	Electrochemical	Redox Flow Battery (RFB)	STRABAG SE	Corporate strategic investment	\$106,700,000		10/25/2023
Noon Energy		Electrochemical	Redox Flow Battery (RFB)	Clean Energy Ventures (Amarco)	Corporate strategic investment	\$28,000,000	Series A	1/18/2023
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Rondo	Joule Stationary TES	Thermal	Sensible Heat Storage	Energy Impact Partners, Breakthrough Energy Ventures, SCG, Venture Capital		\$60,000,000		8/16/2023
Quidnet	Geomechanical Energy Storage	Mechanical	Geomechanical	Hunt Energy Network (HEN)		\$10,000,000	Deployment	
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ESS Inc.				Breakthrough Energy Ventures, SB Energy (Softbank)	Venture Capital	\$30,000,000	Series C	
Redflow	Zinc-bromine	Electrochemical	Zinc Batteries	California Energy Commission (CEC), Barona Tribal Communit	Public - State Grant	\$13,000,000	Deployment	6/19/2024

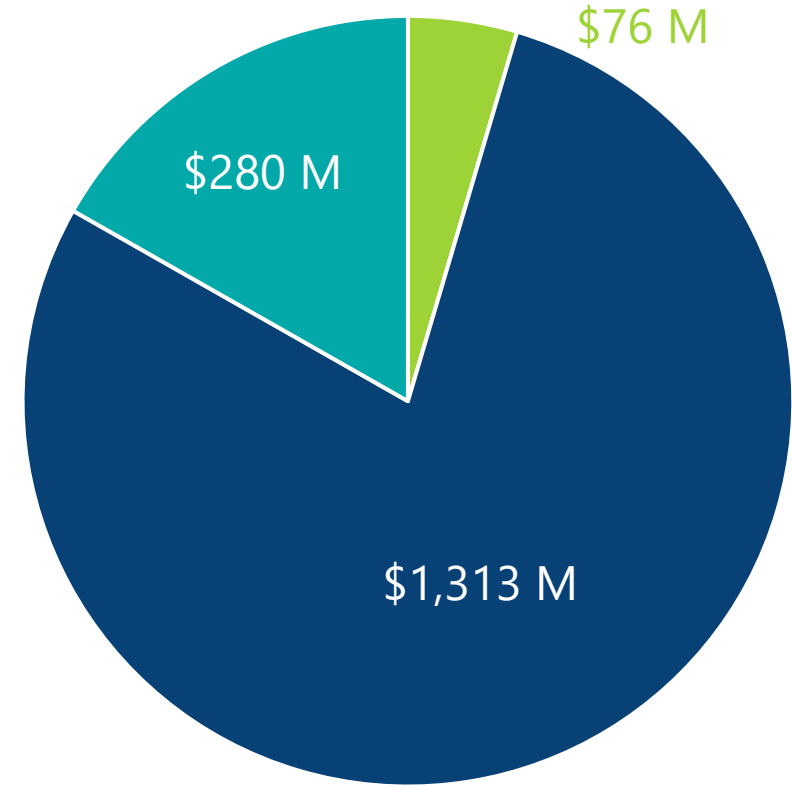
Have examples you want to include in the LDES Investment Tracker? Email Jeffrey.Gifford@nrel.gov!

LDES private investment spans technology readiness level, company stage, and technology category.

Investment instances by technology category*



Investment dollars by technology category*



■ Mechanical ■ Electrochemical ■ Thermal

■ Mechanical ■ Electrochemical ■ Thermal

Private investment spans venture capital, institutional investors, strategic investors, and more.

Venture Capital:

Breakthrough Energy to provide US\$20 million grant to Xcel for 100-hour iron-air battery projects

Institutional Investor:

Eos Energy Announces Strategic Investment of up to \$315.5 Million from Cerberus to Propel Eos' Expansion and Path to Profitability

Corporate Strategic Investor:

Malta Closes Funding to Deploy Its Long-Duration Energy Storage System

Siemens Energy Ventures, Alfa Laval and existing shareholders help Malta accelerate the global transition to a secure and decarbonized energy future.



Private investment spans venture capital, institutional investors, strategic investors, and more.

Venture Capital:

Breakthrough Energy Ventures, Grok Ventures, Elemental Excelsior

Institutional Investor:

Cerberus Capital Management, Barclays' Sustainable Impact Capital, Novum Capital Partners, Innovation Development Oman Investments, Decarbonization Partners (BlackRock and Temasek)

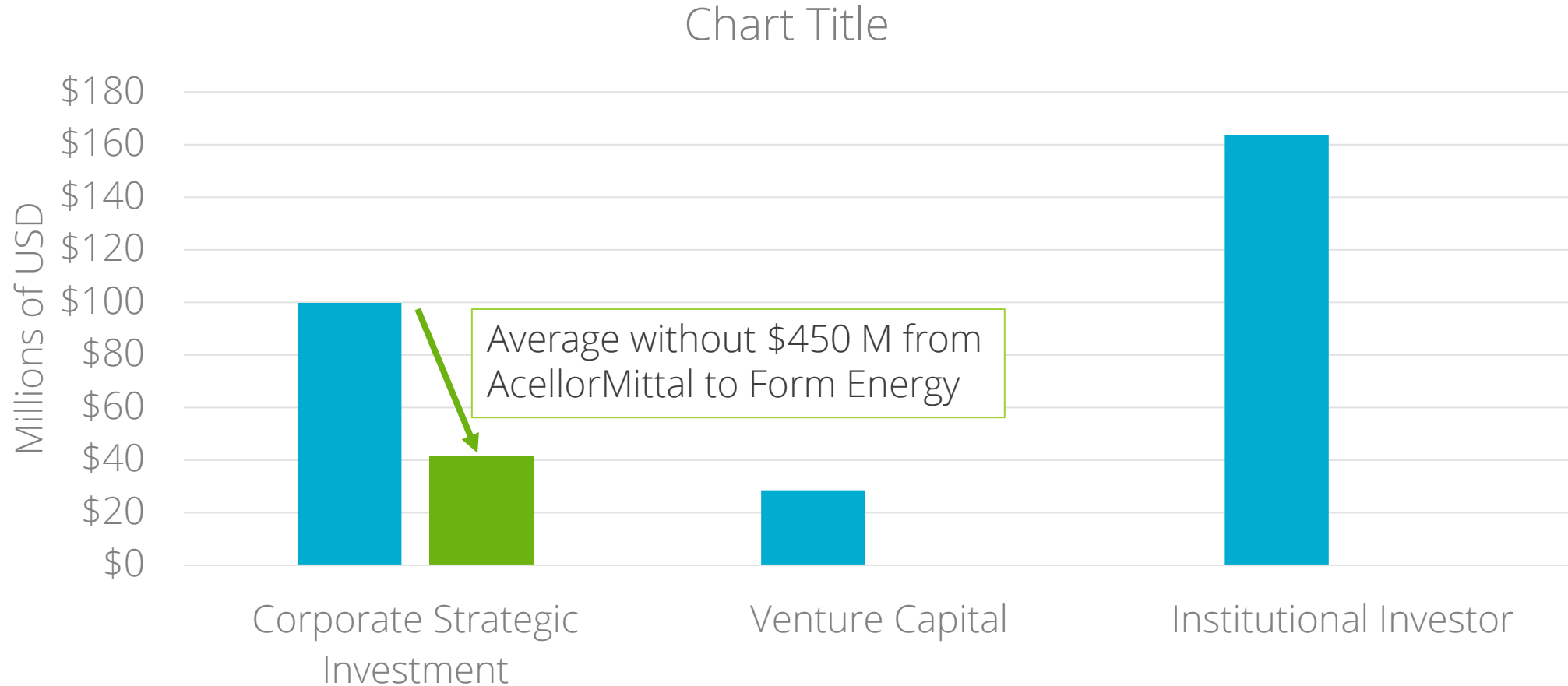
Corporate Strategic Investor:

ArcelorMittal, SLB (Schulberger), Eni Next, Aramco Ventures' Sustainability Fund, Rio Tinto, Equinor Ventures, Microsoft's Climate Innovation Fund

Bold = Oil & gas



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What other questions would you want answered using the LDES Investment Tracker?