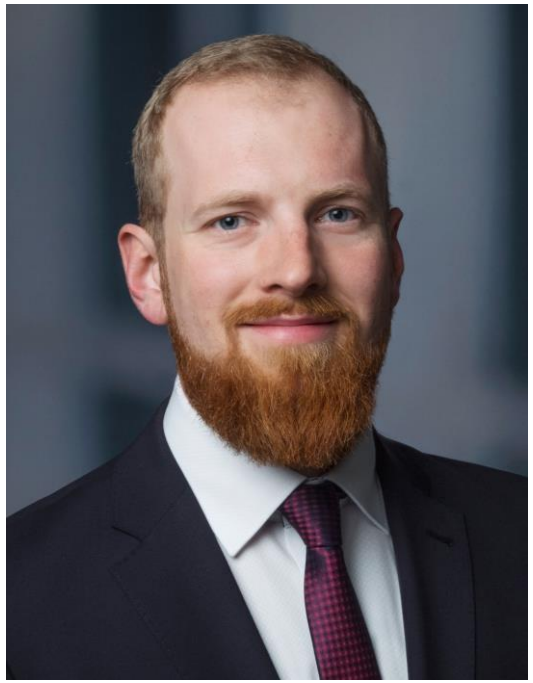
2ND ANNUAL ENERGY STORAGE GRAND CHALLENGE SUMMIT

Strategy Keynotes: Experiences with Energy Storage

ENERGY STORAGE GRAND CHALLENGE
U.S. DEPARTMENT OF ENERGY

Strategy Keynotes: Experiences with Energy Storage



Simon Bretschneider

Technical Lead Long-Duration Energy Storage Challenge, Research and Business Analyst, SPRIND

SPRIN-D

ENABLING LONG-DURATION ENERGY STORAGE

Simon Bretschneider
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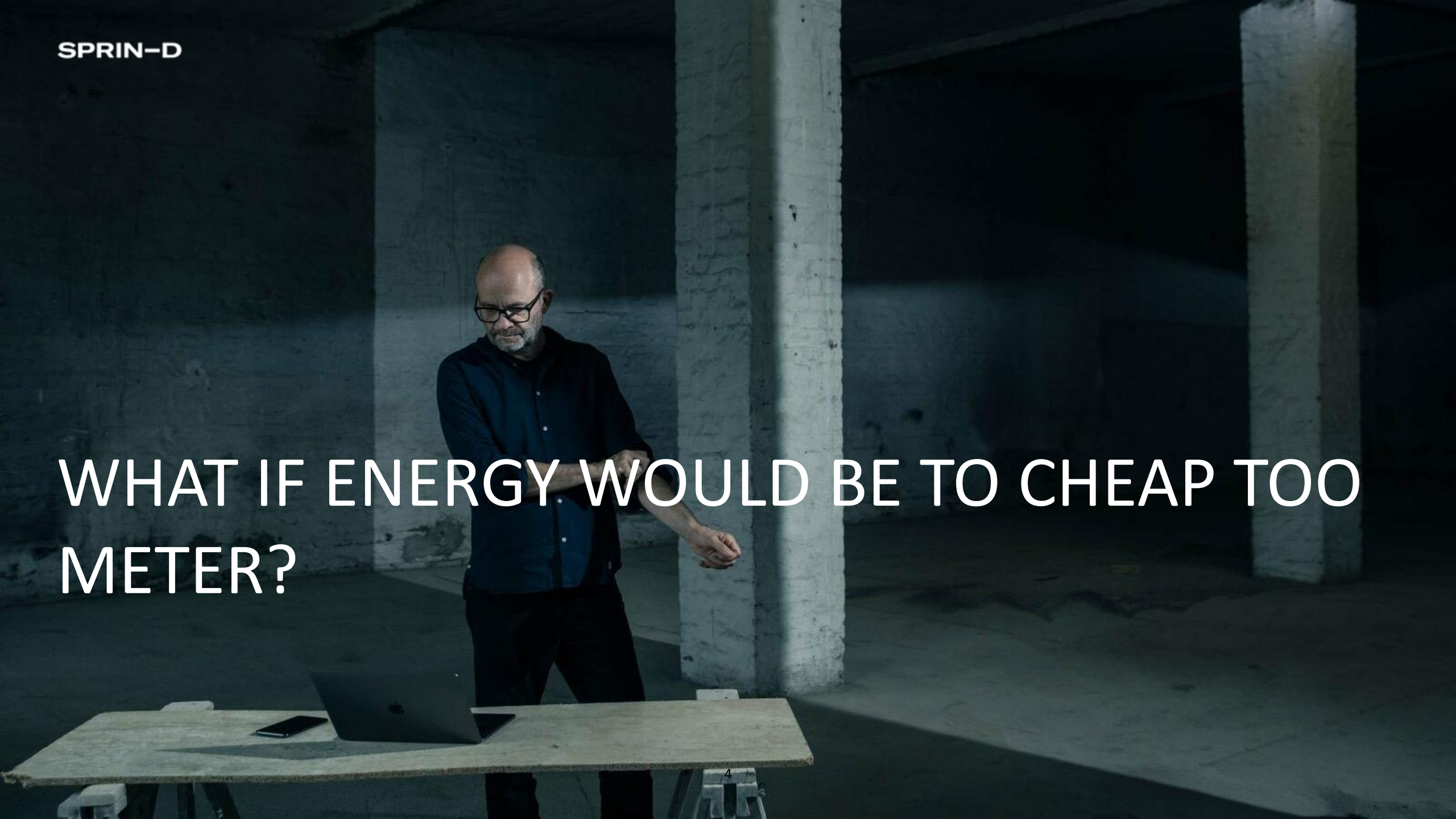

WHAT IF ENERGY WOULD BE TO CHEAP TOO METER?

SPRIND	CHALLENGES	LONG-DURATION ENERGY STORAGE

BRIDGING THE GAP

FROM EXCELLENT BASIC AND APPLIED RESEARCH

MARKET-SHAPING PRODUCTS AND SERVICES

A HOME FOR PEOPLE WITH RADIACAL NEW IDEAS

INDEPENDENT* FEDERAL AGENCY	HIGH RISK HIGH REWARD	TECHNOLOGY- BASED

CHALLENGES

FINDING THE BEST SOLUTIONS TO TACKLE
THE GRAND CHALLENGES OF OUR TIME

BET ON THE RACE, NOT THE HORSE

A COMPETITIVE APPROACH

STAGED CHALLENGE	2.5 YEARS MULTI-MILLION FUNDING	COACHING BUILDING AN ECOSYSTEM

AN EASY & FAST PROCESS

THE CHALLENGE

LONG-DURATION ENERGY STORAGE

ACT ON CLIMATE CHANGE	ENERGY INDEPENDENCE	INVIGORATING ECONOMICAL GROWTH

>10 HOURS STORAGE	EXTREMELY LOW COST	EXCELLENT SCALABILITY
NO CRITICAL RAW MATERIALS	HIGH ROUND-TRIP EFFICIENCY	A TEAM, READY TO DO WHATEVER IT TAKES

HOW CAN WE ENABLE A CARBON-FREE, RELIABLE ENERGY SUPPLY?

HIGH RISK, HIGH REWARD
BET ON THE RACE, NOT THE HORSE
EASY AND FAST
A GREAT TEAM

SPRIN-D

FEDERAL AGENCY FOR DISRUPTIVE INNOVATION

A HOME FOR PEOPLE WITH RADICAL NEW IDEAS

POWERED BY:

Bundesministerium für Wirtschaft und Klimaschutz

Bundesministerium für Bildung und Forschung

Strategy Keynotes: Experiences with Energy Storage

Mike Gravely

Team Lead and Senior Electrical Engineer, Energy Systems Research Branch,
California Energy Commission

The Role of Non-Lithium-Ion Energy Storage Technologies in California's Future

2022 Energy Storage Grand Challenge Summit

Mike Gravely, Energy Storage Technical Lead
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California Energy Commission Major Research Programs

- **Electric Program Investment Charge (EPIC)—Administered by the CPUC**
  - Ratepayer-funded program to benefit ratepayers
  - Administered by the Energy Commission and three Investor-Owned Utilities (PG&E, SCE, and SDG&E)
  - Energy Commission Program ~ $130 M/year for research
  - In 2020 the EPIC Program was extended by the CPUC for an additional 10 years

CALIFORNIA'S INVESTMENT IN CLEAN ENERGY INNOVATION

EPIC is California's premier public interest research program investing over $130 million annually to unleash innovation.

Entrepreneurial Ecosystem

$143 million invested

Through EPIC, the CEC is building a world-class ecosystem supporting clean energy entrepreneurship.

Resiliency & Safety

$106 million invested

Helping communities, businesses, and public agencies build a safer, more resilient energy system.

Building Decarbonization

$170 million invested

Improving the affordability, health, and comfort of buildings.

Grid Decarbonization & Decentralization

$154 million invested

Improving the cost competitiveness and performance of key technologies.

Industrial & Agricultural Innovation

$113 million invested

Scaling specialized technology solutions to drive energy efficiency without compromising production.

Transportation Electrification

$33 million invested

Supporting advances that reduce the cost of electric vehicle ownership and support the grid.

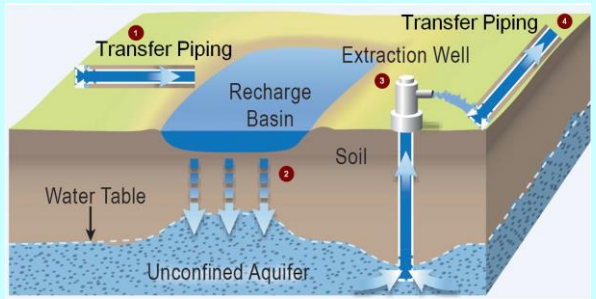
**Total investment, 2012-2019*

Energy Storage in California

Energy storage contributes to California's clean energy future:

- 3.3 GWs currently installed
- 15 GWs needed by 2032 (per CPUC)
  - 1 GW for long duration energy storage
- 40-50 GWs needed by 2045

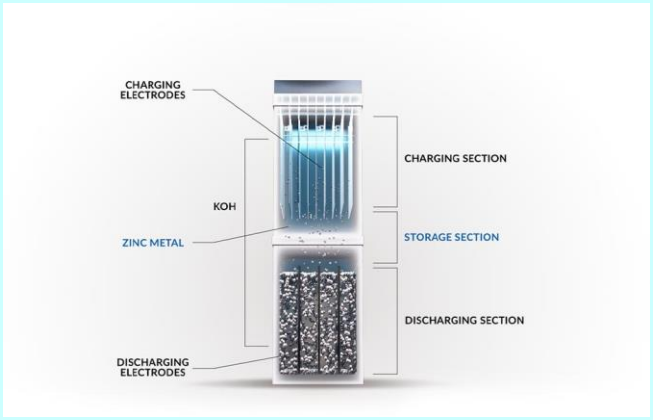
EPIC Program has Funded Energy Storage Research for More than a Decade

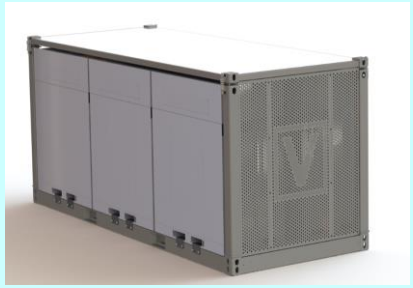


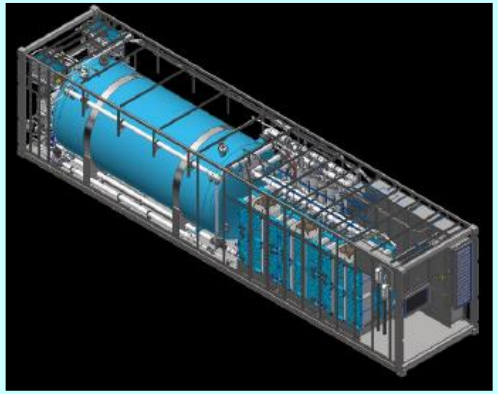
2020 was Pivotal Year for Long Duration Energy Storage Research

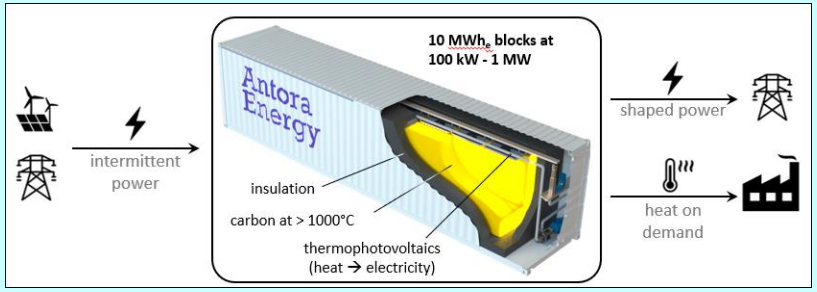
- CEC invested $100 million+ in energy storage in 2020
- Field demonstrations of non-Lithium-ion long duration storage
  - **8 sites** demonstrating **10+ hours** of energy storage duration
  - **3 early-stage grants** providing **up to 100+ hours** of energy storage duration

Examples of Promising Non-Lithium-ion Energy Storage Technologies









Opportunities for Non-Lithium-ion Technologies

- **Supply chain security:** Not reliant on Lithium-ion supply chain elements
- **Safety:** Reduce thermal runaway and improve safety
- **Cost and performance:** Improve $/kWh, energy density, charge time, and cycle life
- **Demonstrate Field Performance:** Validate performance and stability, enabling future financing opportunities

Investments in California's State Budget

- $140M in 2022-23 for non-lithium-ion long-duration energy storage
- 3 grants in development based on prior experience:
    1. **Viejas Native American Tribe Microgrid** (June 2023)
        - 60MWh hybrid system (flow battery and Zinc hybrid system)
    2. **Camp Pendleton Marine Core Base resiliency/commercial enterprise system** (June 2023)
        - 80MWh Zinc hybrid system
    3. **Utility front-of-the-meter system**
        - First-of-its-kind 5MW / 100Hr Iron-Air Technology System (late 2024/early 2025)

Future Funding Opportunity

- $240M in 2023-24 for non-lithium-ion long-duration energy storage
- Competitive solicitation to install new systems at 5-7 sites in Summer 2023
  - Preselected sites
  - Open to all that can meet the requirements
- Federal cost share to leverage additional funding
- Second solicitation in 2024 if funding is available

Open Discussion