



U.S. DEPARTMENT OF
ENERGY

Office of
ELECTRICITY

2024 Power Electronics and Energy Conversion Workshop

Powering Change in an Energy Revolution

July 30, 2024

Albuquerque, NM

Erik D. Spoerke, Ph.D.

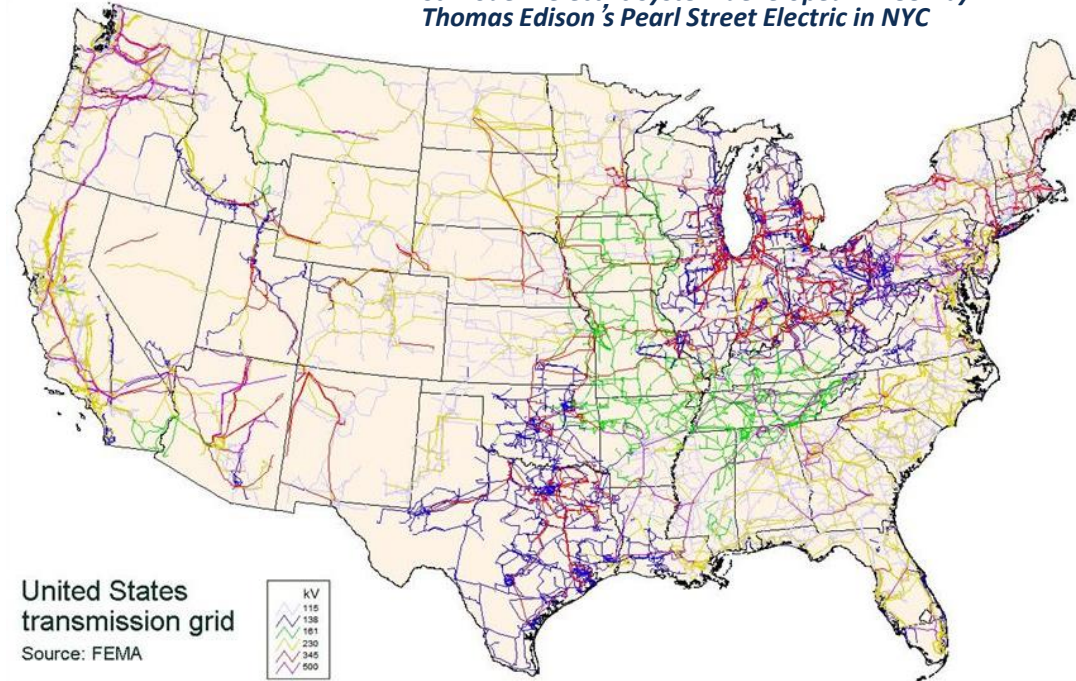
Senior Analytics Advisor for Energy Storage

Challenges to the Largest, Most Complex Machine Ever Built

Made up of:

- 7,300 power plants
- Over 150 thousand miles of transmission lines (AC & DC)
- Millions of transformers, relays, and controls
- Millions of miles of low-voltage power lines connecting over 145 million customers
- 100s of billions of dollars in total investments in transmission and distribution

First modern electric system developed in 1882 by Thomas Edison's Pearl Street Electric in NYC



	Common AC voltages
Transmission	<ul style="list-style-type: none"> • 765kV • 500kV • 345kV • 230kV
Sub-Transmission	<ul style="list-style-type: none"> • 69kV • 30kV
Distribution	<ul style="list-style-type: none"> • 15kV • 4kV • 2kV • 600V • 480V • 240V • 120V

Slide courtesy of Dr. Stan Atcitty, SNL

Inspiration from an Engineering Marvel: Saturn



Final Saturn V Launch Vehicle:

- Taller than the statue of liberty
- Had a takeoff weight greater than 25 fully-loaded jet liners
- Produced as much power as 85 Hoover dams
- Flew from 1967-1973 for the Apollo Missions and to put Skylab in orbit

R. E. Bilstein. "Stages to Saturn: A Technological History of the Apollo/Saturn Launch Vehicles" (1980) NASA SP-4206.

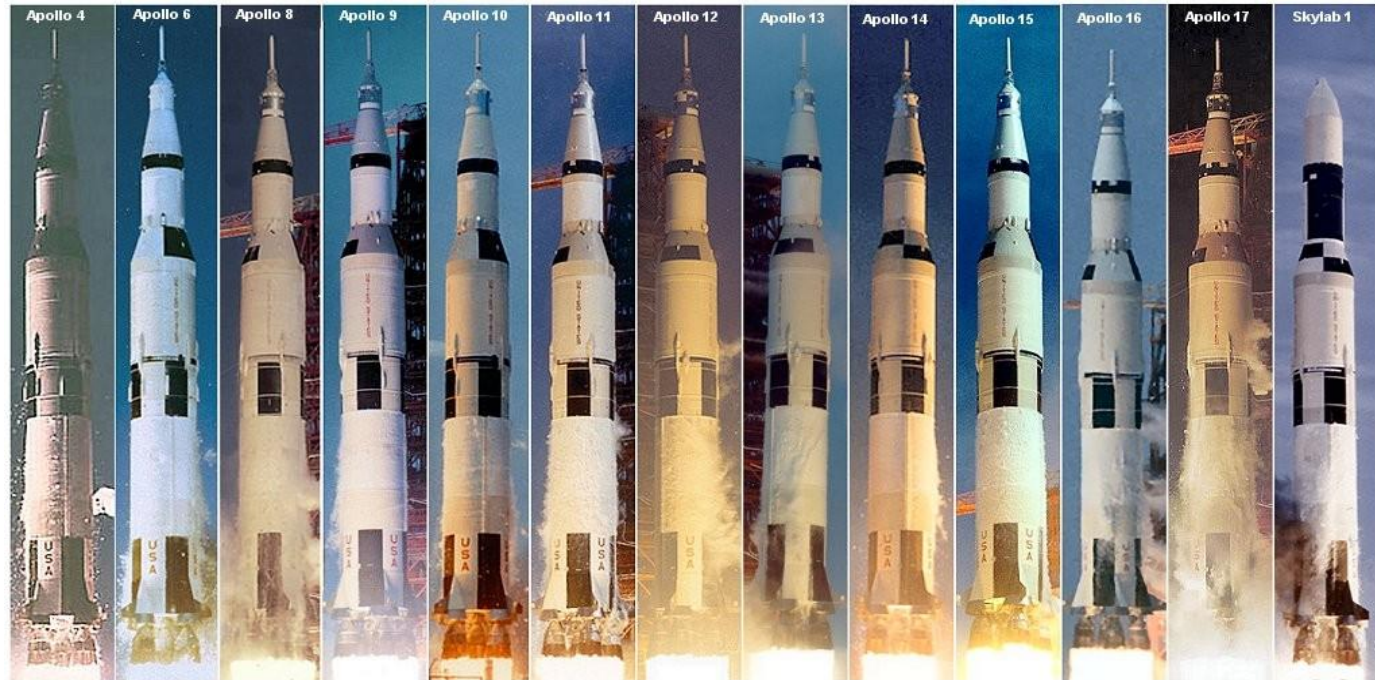
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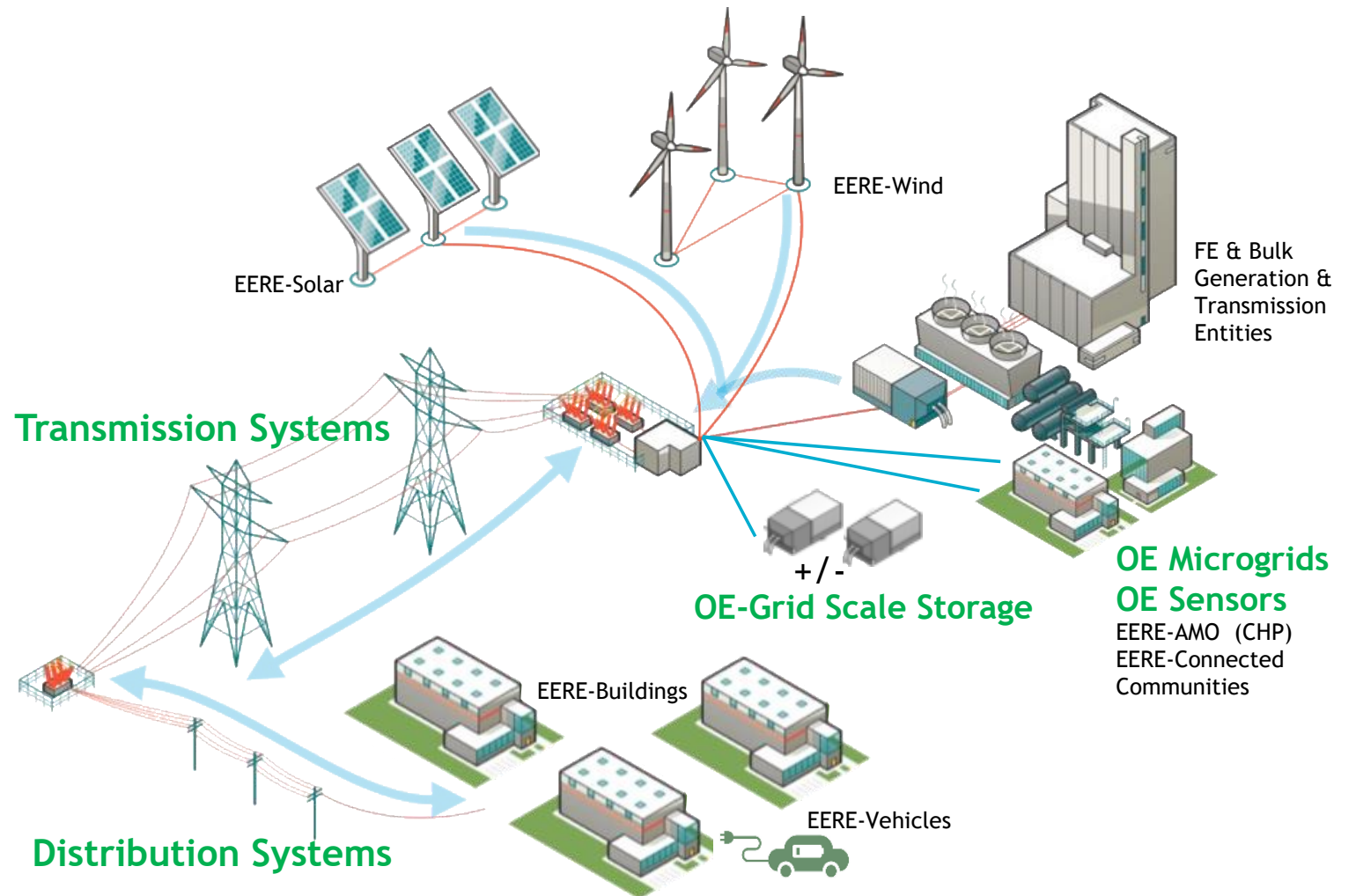
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By Maldoror - nasa.gov, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=442969>

Office of Electricity: “The Office of the Grid”

- Grid Systems and Components
- Grid Controls and Communications
- Energy Storage

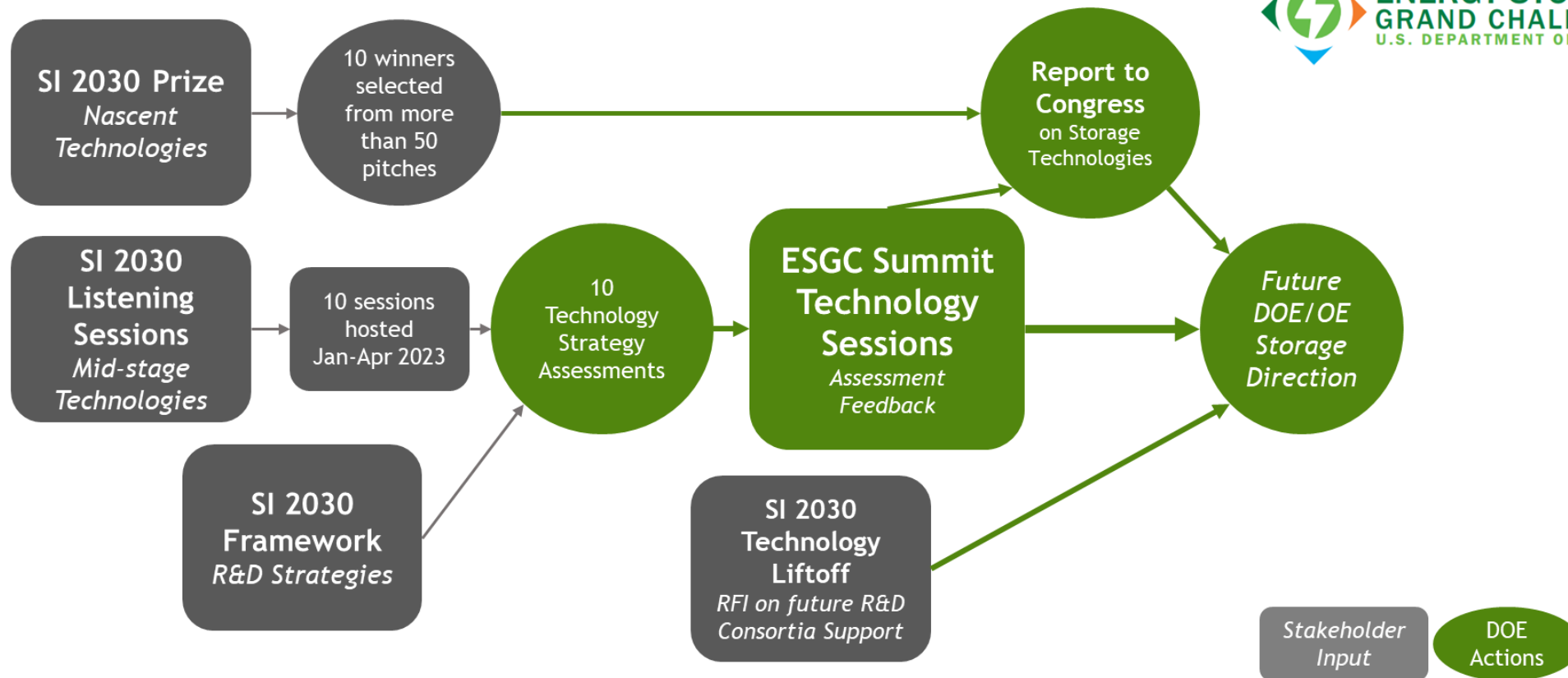


Energy Storage Division

- Energy storage enables a 100% carbon pollution-free electricity grid; provides new tools to improve grid resiliency, especially in underserved communities; and creates new options for infrastructure planning, from deferral to rapid expansion.
- OE Energy Storage research, development, demonstration, and deployment (RDD&D) efforts accelerate the development of long-duration grid storage technologies through
 - increasing performance, reducing technology costs, de-risking technologies to ensure safe long-term reliability
 - developing analytic models to uncover technical and economic benefits
 - demonstrating the ability of storage to provide clean and equitable energy access for consumers and communities
 - Supporting workforce, entrepreneurial, and education outreach activities to facilitate storage adoption



Pursuing an Industry-Engaged Approach to Innovation: Storage Innovations 2030



<https://www.energy.gov/oe/storage-innovations-2030>

New Capabilities Toward Bankability and Scaling

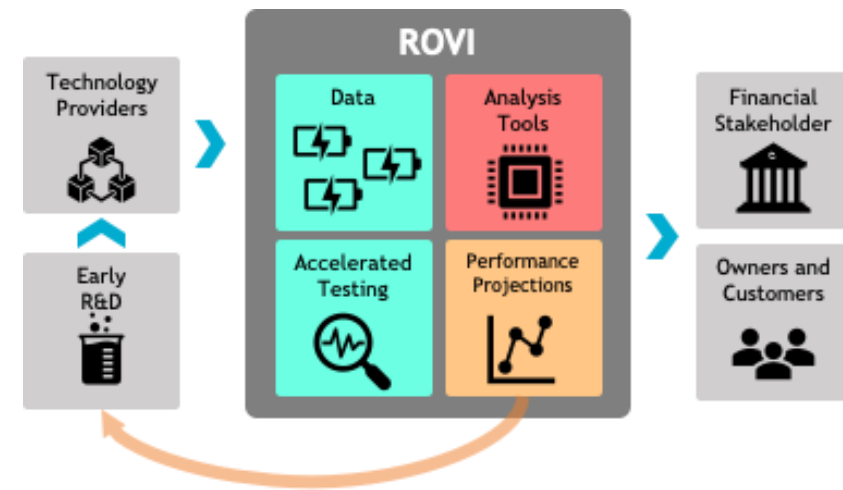
Grid Storage Launchpad

- Opening: August 2024
- 93,000 sq. ft facility
- Provide systematic and independent validation of new grid storage technologies from basic materials and components, through prototyping under grid operating conditions (<100kW)

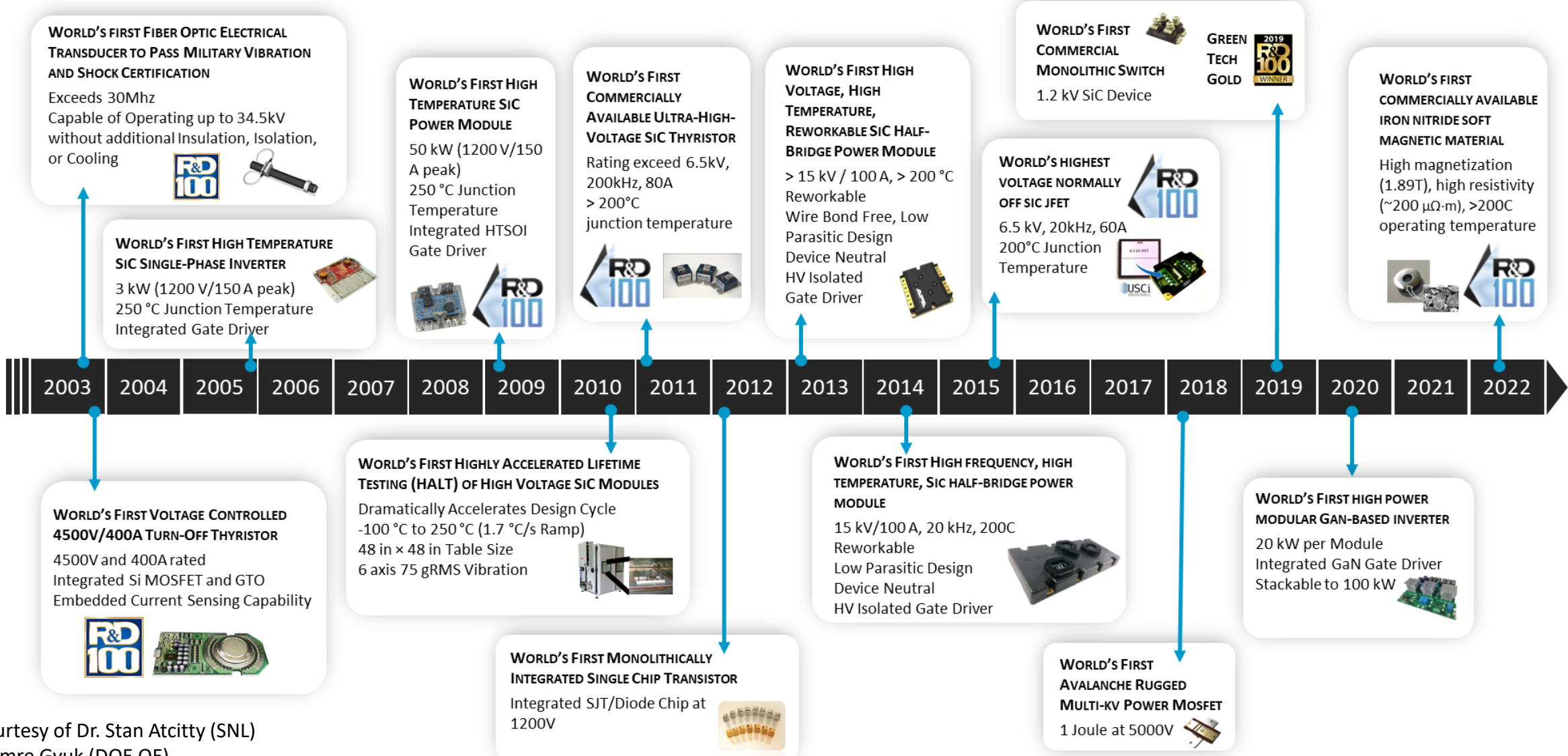


Rapid Operational Validation Initiative (ROVI)

- 6 National Laboratory Consortium
- Demo projects provide data to consortium
- Target 15 years of financial grade performance projections with 1 year of combined accelerated testing
- Provide a platform to benchmark the performance of emerging technologies
- Establish a pathway to feed back field results to early-stage R&D

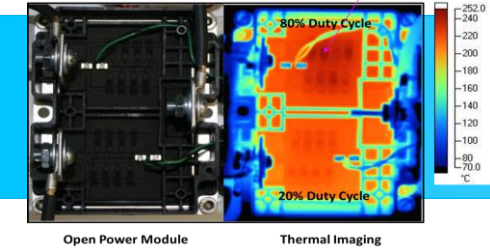


DOE OE Power Electronics Development



Slide courtesy of Dr. Stan Atcitty (SNL) and Dr. Imre Gyuk (DOE OE)

Example of Impact: Power Electronics for Grid Energy Storage



Silicon-based semiconductor is limited to max operational junction temperature of 150°C, and high temperature packaging is a challenge.

OE funded SBIR research with APEI. Increased junction temperature to 250°C and developed a high temperature power module, which received a 2009 R&D 100 award.

APEI (now Wolfspeed, a Cree Company) commercialized the HT-3000 module to take advantage of the superior characteristics of silicon carbide power devices.

Direct Sales in:

- *Electric Motor Drives*
- *Power Supplies*
- *Inverters (Solar Arrays, Wind Generators, etc.)*
- *Battery Chargers*
- *Power Distribution (Electric Grid)*

Industry Collaboration



OE has been working with Arkansas Power Electronics International (APEI) for over 8 years. In 2015, APEI was acquired by Cree, a market leader in SiC power and radio frequency products, to accelerate the market for high-performance SiC power modules.

Technical Assistance Opportunities

Office of Electricity

Energy Department Announces \$1M for Storage Vouchers

APRIL 25, 2024

Office of Electricity » Energy Department Announces \$1M for Storage Vouchers

The U.S. Department of Energy's (DOE) Office of Electricity (OE) today announced a new \$1M storage [technical assistance voucher program](#). Two OE-funded vouchers are intended to spur innovations in Long Duration Energy Storage (LDES) technologies among developers, small businesses, research institutions, and communities. The program aims to increase LDES project deployments nationwide and help achieve the Biden-Harris Administration's clean energy goals.

Deadline - August 28, 2024 3:00 pm ET

Voucher Opportunity 7: Long Duration Energy Storage (LDES) Technology Acceleration (Recipients)

Deadline - August 28, 2024 3:00 pm ET

Voucher Opportunity 8: Long Duration Energy Storage (LDES) Community Development (Recipients)

The DOE Voucher Program builds bridges between U.S. entrepreneurs, businesses, technology developers or other relevant partners and third-party voucher providers to advance commercialization and demonstration at scale of innovative energy technologies.

<https://www.energywerx.org/opportunities>

Critical Facilities Energy Resilience (CiFER) Notice of Intent

Overview: Intended FOA is expected to provide up to **\$15 million** for cost-shared demonstration projects to facilitate the deployment innovative long duration storage technologies to support resiliency at critical infrastructures.

Timeline: Anticipated FOA release by end of **August 2024**

Objectives:

- Demonstrate the benefits of innovative long duration energy storage technology being used in the field by large energy end-user and potential investor ecosystem
- Benefit a host site/critical infrastructure that has a compelling need for a dependable supply of energy based on potential impact during low frequency high impact events or if the site were not able to maintain normal operations
- Conduct quantitative and qualitative analysis on the value of resiliency provided by the Long duration energy storage system

Potential Applicants/Partners:

Technology Providers	Critical Facility or Infrastructure Owner	Resiliency Analytics Partner
<ul style="list-style-type: none"> • A private energy storage company • An institution of higher education • Other organizations that develop or deploy energy storage 	<ul style="list-style-type: none"> • A first responder or emergency response facility • Critical service sites such as healthcare, telecommunications, data centers, utilities, financial institutions and government facilities etc. 	<ul style="list-style-type: none"> • Academic or Research Organizations • Consultants • National Labs

Thank you

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