Grid Scale Energy Storage,
DOE Office of Electricity

IMRE GYUK, DIRECTOR,
ENERGY STORAGE RESEARCH, DOE-OE
Office of Electricity, Priorities:

- Puerto Rico and U.S. Virgin Islands Restoration and Resiliency Efforts
- North American Energy Systems Resiliency Model
- Mega-Watt Scale Grid Storage
- Revolutionize Sensing Technology Utilization
- Operational Strategy for Cyber and Physical Threats
Applied Research: Materials, Devices, Systems

Sandia, Pacific NW, Oak Ridge National Laboratories

University, Industry Partners

FY18: Published. 34; Accepted. 11; Submitted. 30
Patents Granted: 12, submitted: 14

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233 Articles, 106 Patents, 9 R&D 100 Awards!
University Partners:

Harvard University – MA
Case Western Reserve – OH
West Virginia University – WV
Penn State – PA
UW – WA
Davidson College – NC
City University – NY
Northeastern Univ – MA
New Mexico State University
Stony Brook – NY
Univ. Kentucky – KY
UC -Irvine -CA
Southern Methodist – TX

Univ. of Alaska Fairbanks – AK
Univ. of Houston – TX
Univ. Texas- Austin- TX
Ohio State University – OH
Univ of Texas – Arlington – TX
New Mexico Tech – NM
Univ. New Mexico – NM
Washington Univ – MO
Michigan State University – MI
Univ. of Utah – UT
South Dakota State – SD
Clemson – SC.
Univ. of Tennessee – TN
Designing a Business Case:

The **Cost** of a Storage System depends on the Storage Device, the Power Electronics, and the Balance of Plant.

The **Value** of a Storage System depends on Multiple Benefit Streams, both monetized and unmonetized.

Metrics will depend on locality!
Energy Storage for Resiliency

Puerto Rico, 2017
Mexico 2017
Hawaii 2018

Every $1 on protection measurements can prevent $4 in repairs after a storm!

Trends indicate the situation will get worse not better!!
Sterling, MA: Microgrid/Storage Project
$1.5M Grant from MA Community Clean Energy Resiliency Initiative
Additional DOE-OE Funding, Sandia Nat. Laboratories Analytics

Actual Savings:
- Arbitrage $11,731
- Monthly Peaks $143,447
- Annual Peak $240,660
- Total $395,839

2017 GTM Grid Edge Award!

Visitors: Germany, Denmark, England, Japan, Malaysia, Taiwan

2018 Heat Wave: $250K realized in avoided payments!!
Recent Grid Scale Project Involvements
DOE Office of Electricity Energy Storage Program

Alabama
Southern Company/Southern Research – Birmingham, AL – 100kW/400kWh

Alaska
Cordova Electric Co-op – Cordova AK – 1 MW / 1 MWh
Alaska Energy Authority – AK

Arizona
Navajo Tribal Utility Authority – Dikon, AZ - 6 KW / 12 KWh Zinc Manganese Oxide

California
ANZA Electric Co-op – Anza, CA. est. 2 MW / 2MWh BESS.

Colorado
Gunnison Electric – Gunnison, CO
**Massachusetts**

**Sterling Municipal Light Department** – Sterling MA. - 2 MW/3.9 MWh Lithium-ion.
**City of Northampton** – Northampton, MA
**National Grid** – Nantucket Island, MA - 6 MW / 48 MWh lithium-ion system.
**National Grid** – Worcester, MA – 500kW/3MWh V/V flow battery
**Boston Medical** – Boston, Ma – Est 1-2MW / 1- 4MWh battery system.

**Hawaii**

**Natural Energy Lab of Hawaiian Authority** – Kona Hi – 100 KW / 400 KWh

**New Mexico**

**Public Service of New Mexico** – Albuquerque, NM – Est 5-20 MW / 10- 40 MWh
**Sandia National Laboratories** – Albuquerque, NM – 250 KW / 1 MWh.
**Santa Fe Community College** – Santa Fe, NM – Est. 2 MW / 2 MWh
**Albuquerque Public Schools** -Albuquerque, NM – Est. 500 KW / 1 MWh.

**New York**

**City College of New York** – New York, NY – 50 KW / 160 KWh zinc manganese oxide
**Oregon**

Portland General Electric – Salem, OR - 5 MW / 1.25 MWh  
Eugene Water and Electric Board – Eugene OR – 500kW / 1MWh

**Tennessee**

Electric Power Board – Chattanooga, TN – 100 KW /400 KWh

**Vermont**

Burlington International Airport – Burlington, VT – 1 MW / 4 MWh  
Green Mountain Power – Rutland, VT – 2 MW / 4 MWh lead acid and

**Washington**

Avista - Pullman, WA -1 MW / 3.2 MWh  
Avista - Spokane, WA - (2X) ~100kW/400kWhr  
Puget Sound Energy -Glacier, WA -2 MW / 4.4 MWh  
Snohomish PUD- Everett, WA - 2 MW / 1 MWh  
Orcas Power and Light Co-op, Decatur Island, WA - 0.5 MW / 2.0 MWh  
Energy Northwest- Richland, WA - 1.0 MW / 4.0 MWh  
PNNL- Richland, WA – 100kW/200kWh  
Douglass County PUD - Pearl Hill, WA - 6 MW / 30 MWh
Global Energy Storage Data Base – 1800 entries

US Energy Storage State Policy Data Base – just issued!

Valuation Handbook – under development

ES System Cost Data Base – to be issued soon

PNNL Reliability Test Center – to be established in FY19
With new Technologies Cost will go down, Safety and Reliability will increase.

With every successful Project the Value Propositions will continue to increase!

More jobs will be created!!