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DOE Global Energy Storage Database

The Role of Storage in Energy System Flexibility

October 22, 2014

Georgianne Huff



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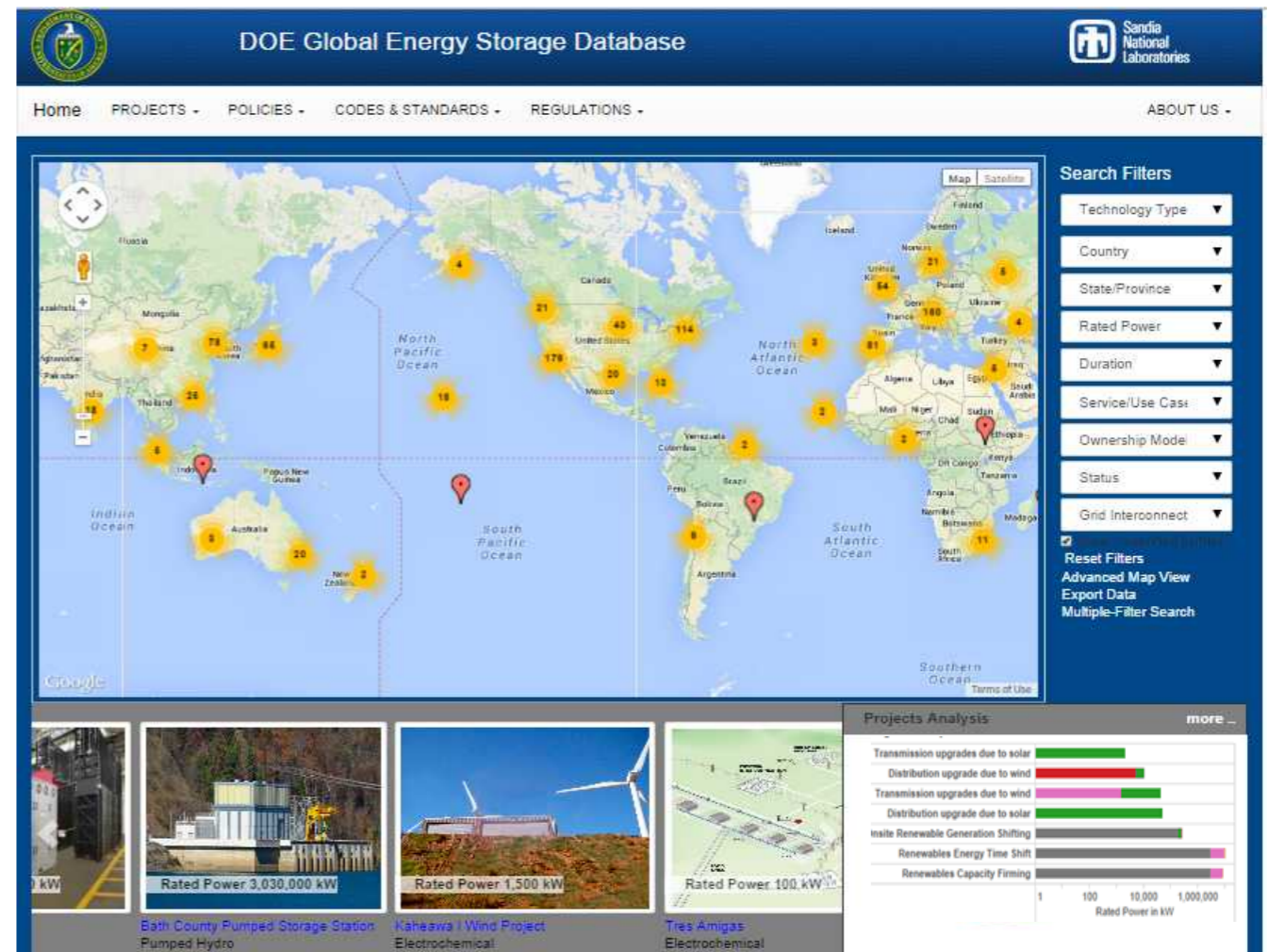


Overview

DOE Global Energy Storage Database(GESDB)

www.sandia.gov/ess/database

- What is the GESDB?
- Who uses the database?
- Examples



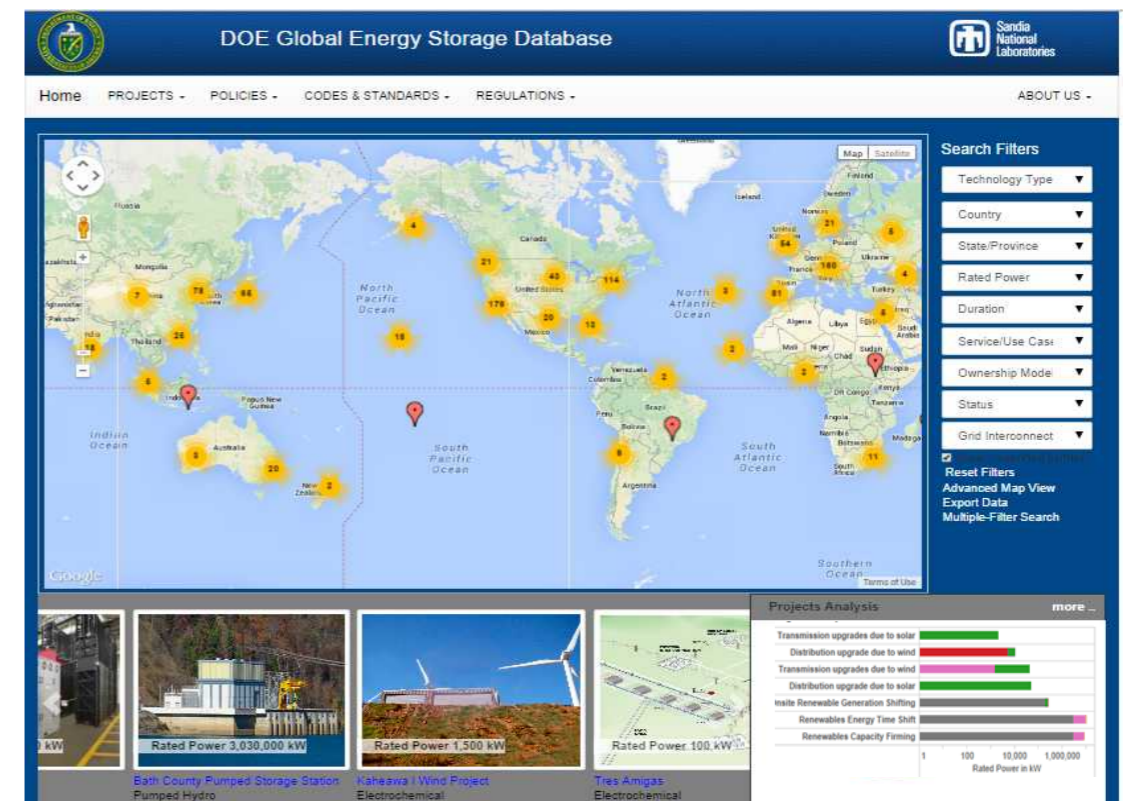


What is it?

DOE Global Energy Storage Database(GESDB)

- Only freely accessible database
 - World-wide energy storage projects and facilities
 - related US state and federal legislation/policies information

- Tool designed to be accessible to a wide variety of stakeholders



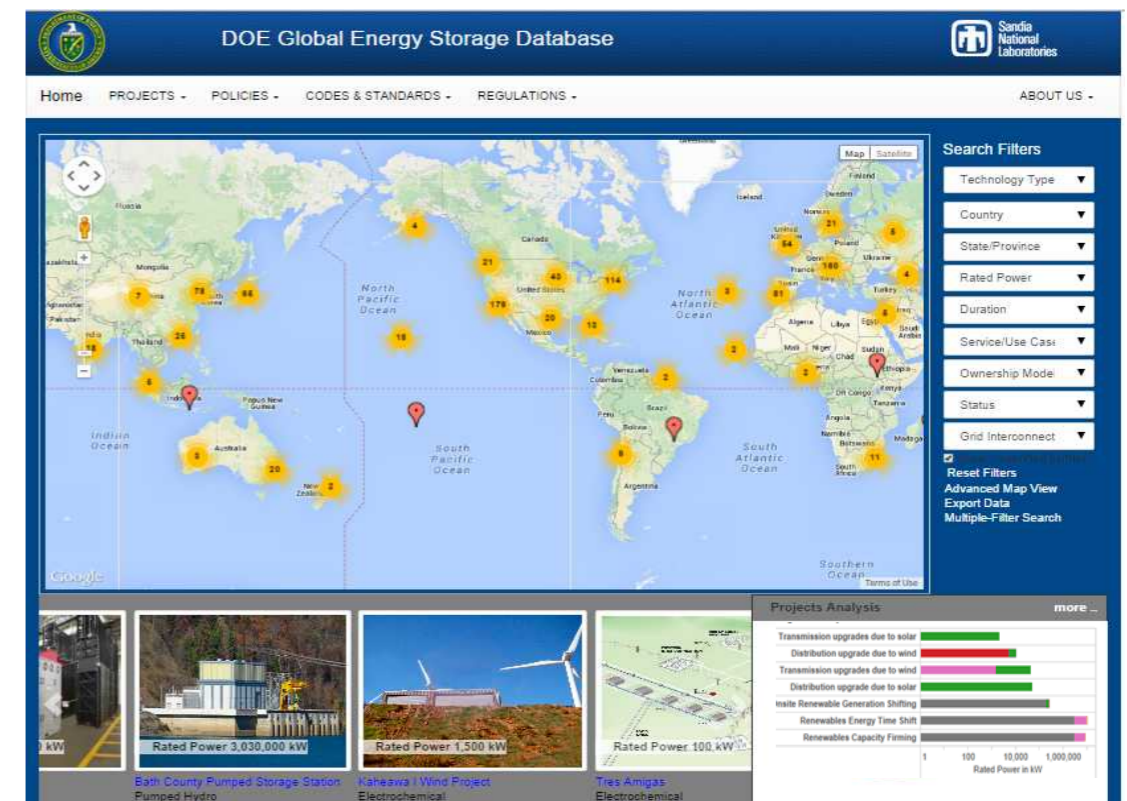


Who uses it?

DOE Global Energy Storage Database(GESDB)

- Policy makers
- Utilities and Power providers
- RD&D decision-makers, strategic planners, program managers
- Financial institutions
- Educators
- Energy Information Agency

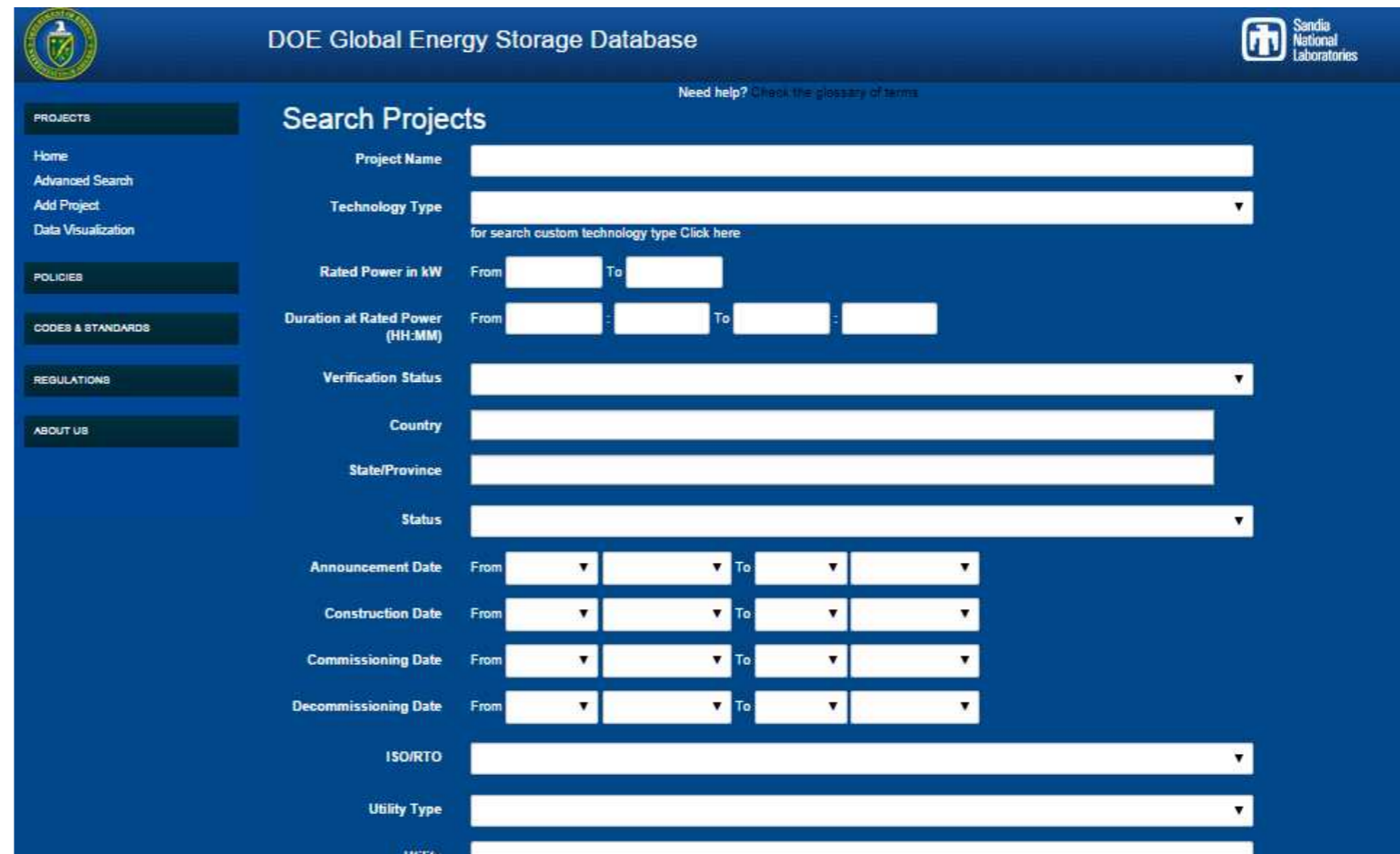
Help grow ES industry -
providing data allowing analysis
by a variety of users



What does the database contain?

Features:

- 60+ data fields
- 50+ energy storage technologies
- 3rd party verification process
- Data exportable
 - Excel or PDF
- Data Visualization
- Easy Project Sharing
- Social media engagement



The screenshot shows the 'DOE Global Energy Storage Database' search page. It features a left sidebar with navigation links: PROJECTS (Home, Advanced Search, Add Project, Data Visualization), POLICIES, CODES & STANDARDS, REGULATIONS, and ABOUT US. The main area is titled 'Search Projects' and contains various search filters: Project Name (text input), Technology Type (dropdown menu with a link for custom types), Rated Power in kW (From/To range), Duration at Rated Power (HH-MM) (From/To range), Verification Status (dropdown), Country (text input), State/Province (text input), Status (dropdown), Announcement Date (From/To date range), Construction Date (From/To date range), Commissioning Date (From/To date range), Decommissioning Date (From/To date range), ISO/RTO (dropdown), and Utility Type (dropdown). A 'Need help? Check the glossary of terms' link is also present.



DOE Global Energy Storage Database

Continually evolving to address the data needs of
emerging industry

Social Media Engagement

www.sandia.gov/ess/database



Energy Storage

@EnergyStorageDB

The DOE Global Energy Storage Database provides free information on grid-connected energy storage projects and relevant state and federal policies.

World

energystorageexchange.org

46 Photos and videos



TWEETS 209 PHOTOS/VIDEOS 46 FOLLOWING 712 FOLLOWERS 422 FAVORITES 10 More ▾

Tweets Tweets and replies

Energy Storage @EnergyStorageDB · 3h
GreenChargeNetworks & Shore Hotel go LEED w/ 30kW Greenstation:
ow.ly/Au6dL @ShoreHotelSM @GreenChargeNet

Energy Storage @EnergyStorageDB · Aug 21
Just Added: 23 Active Power Inc. projects - 52 MW of #Flywheel #UPS
on the DOE #EnergyStorage DB: ow.ly/AAiDy @activepower

Energy Storage @EnergyStorageDB · Aug 21
Test your tech @SandiaLabs's Solar Thermal Test Facility. More on the DOE
#EnergyStorage DB: ow.ly/Au5aI

Retweeted by Energy Storage
CALMAC @EnergyStorage · Aug 21
Ever wonder how thermal energy storage works? calmac.com/how-does-energy... #energy #aia #hvac #buildings

Retweeted by Energy Storage
CSE @ccse · Aug 20
The growth of wind energy farms in the US, an interactive map.
#windweek 1.usa.gov/1tmcD6z

Energy Storage @EnergyStorageDB · 9m
Gangneung Low Carbon Green City #Korea -
100kW #EnergyStorage from Kokam and SK
C&C: ow.ly/APtt0 @skcc_twt



Energy Storage @EnergyStorageDB · Sep 3
Check out Stafford Hill Solar Farm & Microgrid
- 4MW of #EnergyStorage on the DOE
Database: ow.ly/ANfD9



GreenChargeNetworks @GreenChargeNet · Sep 3
Here's @EnergyStorageDB on our project that helps @Avis charge 21
electric vehicles simultaneously near Lagaardia
energystorageexchange.org/projects/143

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Energy Storage @EnergyStorageDB · Sep 3
CALMAC's Ice #EnergyStorage Saves School District \$5 Million in Utility
Costs: via ACHRNEWS achrnews.com/articles/12748... @energystorage

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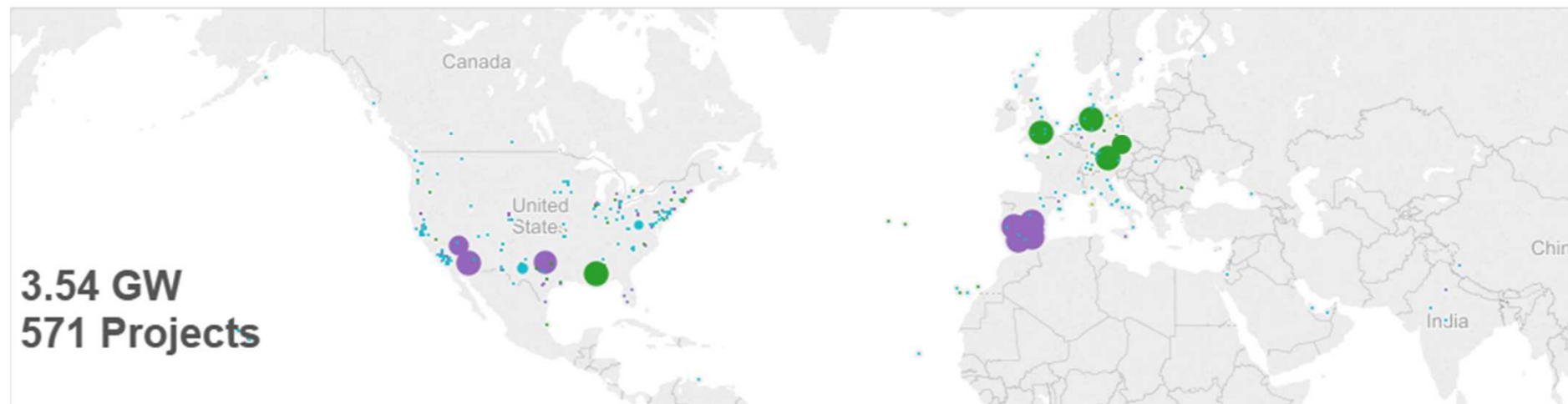
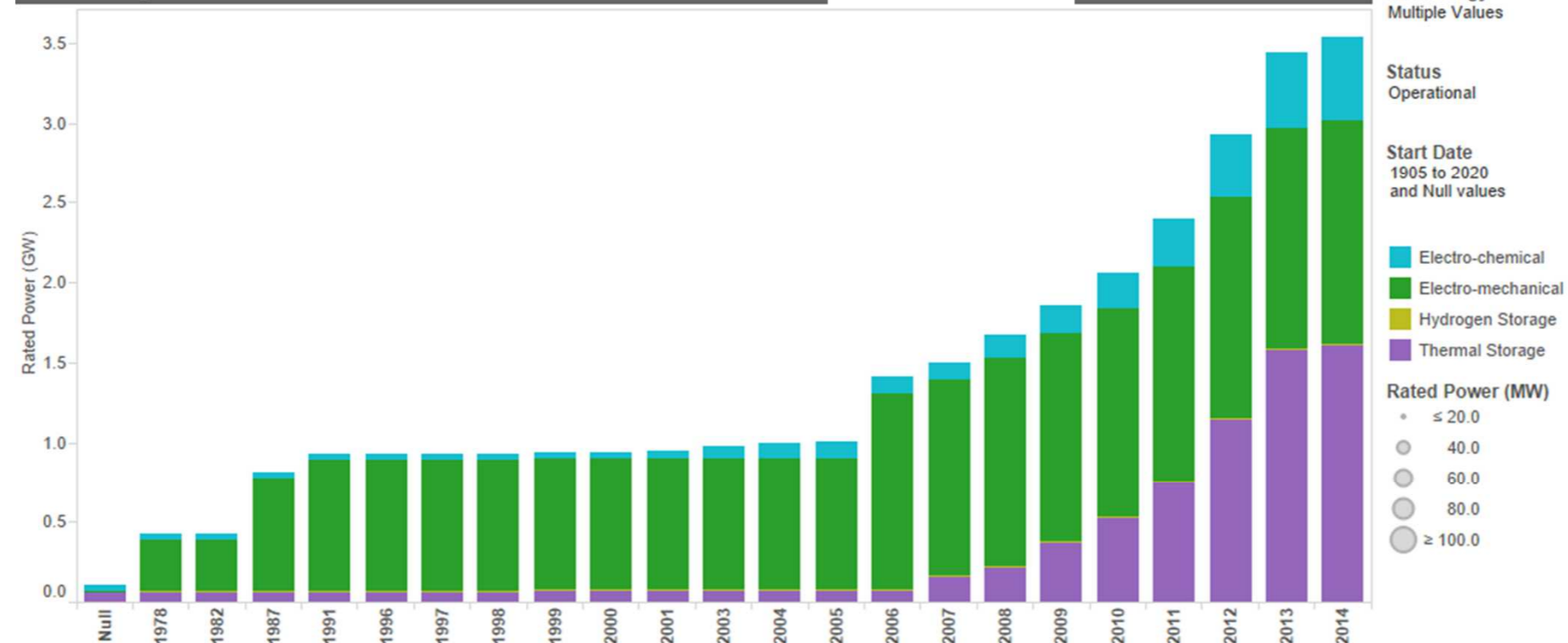
us @EnergyStorageDB

Example of Embedded, Data Visualization Tool

DOE Global Energy Storage Database

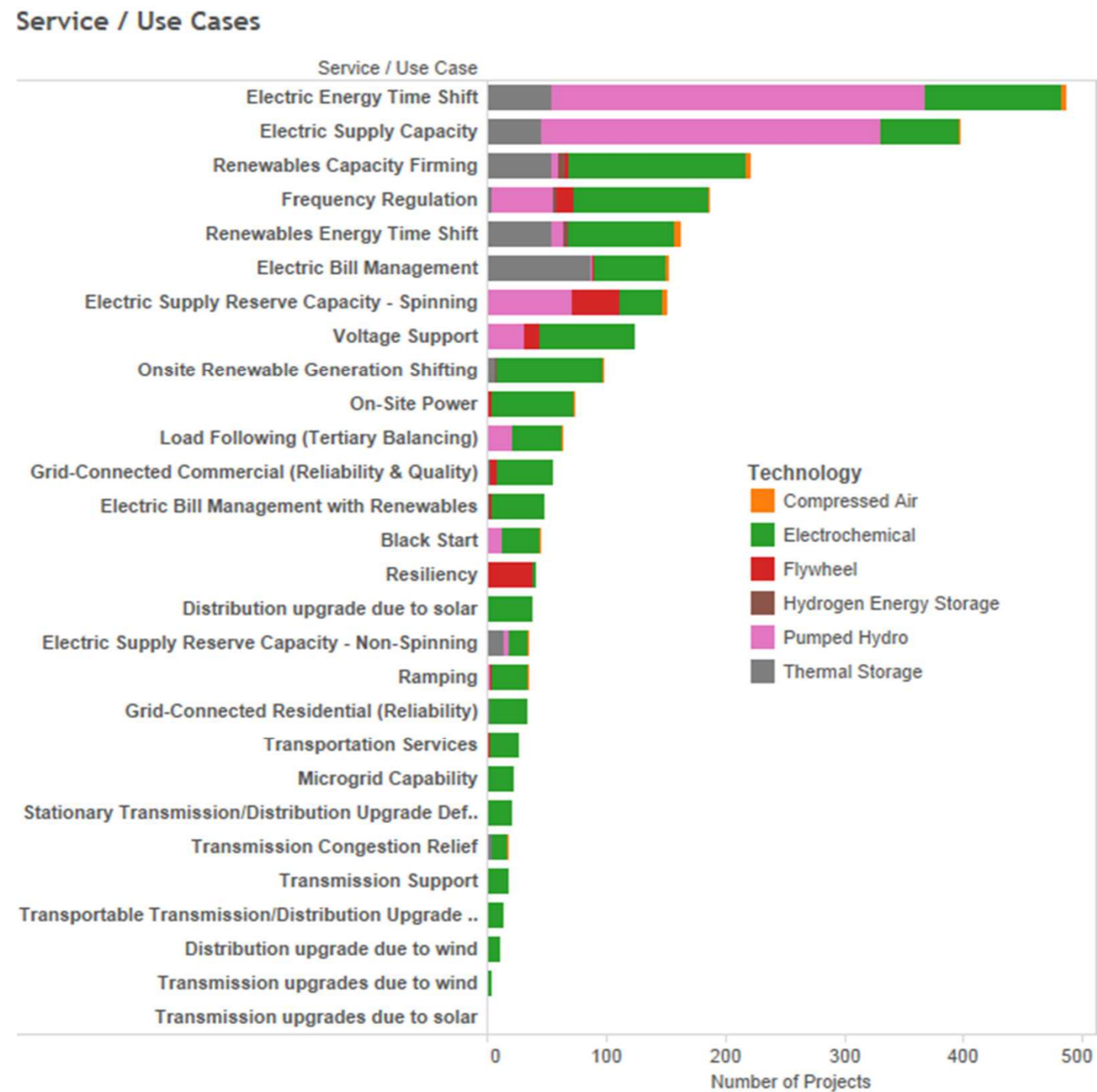
Last Updated
12/5/2014 3:16:43 PM

Global Project Installations Over Time



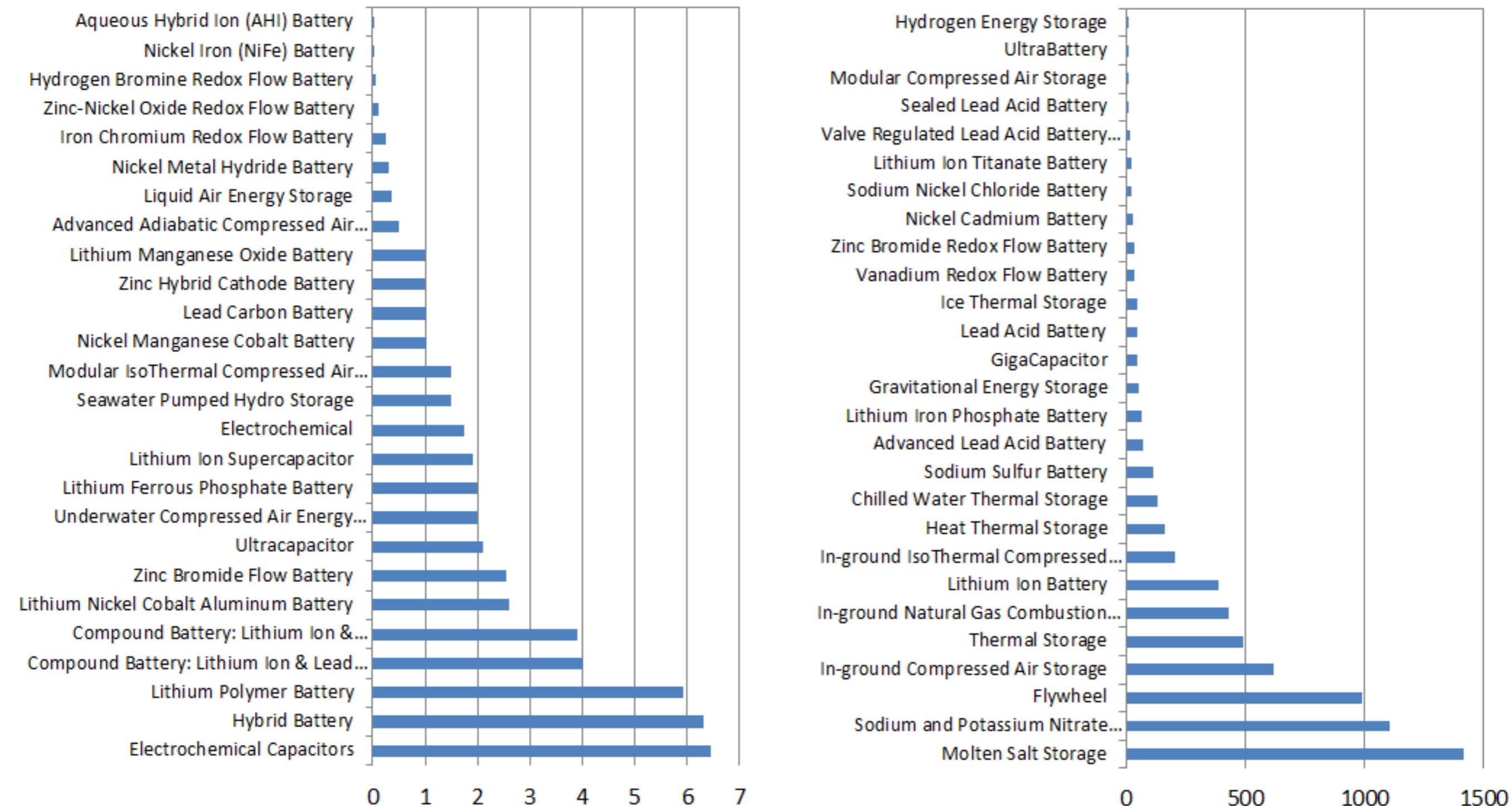
The DOE Global Energy Storage Database (<http://www.energystorageexchange.org/>) is powered by Sandia Corporation (<http://www.sandia.gov/>) and Strategen Consulting, LLC (<http://strategen.com/>)

How are others using Storage?



Data: https://public.tableausoftware.com/views/EnergyStorageUseCases/ServiceUseCases?:embed=y&:display_count=no

Total Power by Technology (MW)

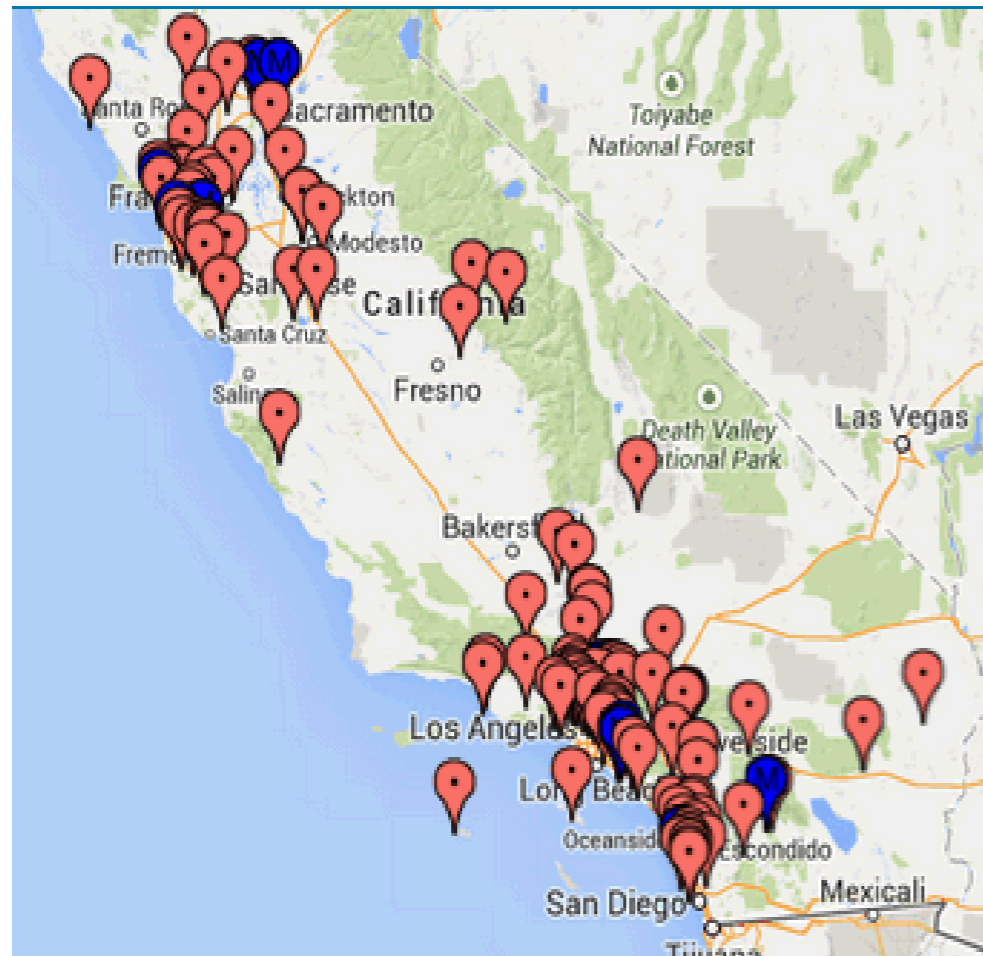


Not Shown on Graph
 Open Loop Pumped Hydro: 170.7 GW
 Closed Loop Pumped Hydro: 6.3 GW

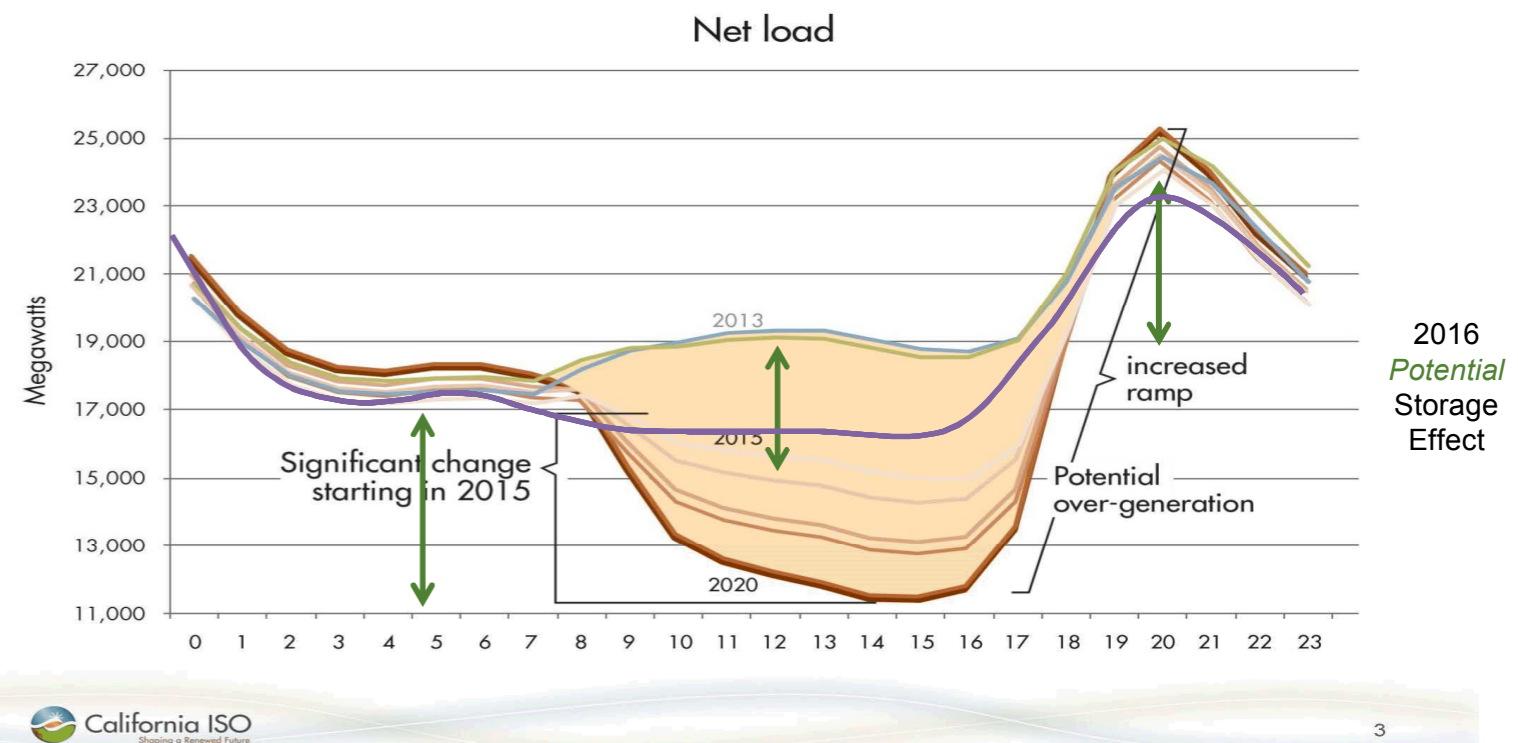
Use Cases by System Operator

Service / Use Case	Iso/Rto				
	CAISO	FERC	ERCOT	MISO	PJM
Electric Bill Management	35		11	6	9
Electric Energy Time Shift	31		13	12	22
Grid-Connected Commercial (Reliability & Quality)	22		2	1	4
Electric Bill Management with Renewables	20		1	2	2
Renewables Capacity Firming	20		3	8	3
Onsite Renewable Generation Shifting	17		1	1	6
Transportation Services	13				3
Renewables Energy Time Shift	12		1	7	2
Electric Supply Capacity	11		1	3	2
Electric Supply Reserve Capacity - Non-Spinning	11		2	3	4
Grid-Connected Residential (Reliability)	10			7	2
Electric Supply Reserve Capacity - Spinning	9		9	2	11
Load Following (Tertiary Balancing)	9			1	1
Frequency Regulation	7		3	1	19
On-Site Power	7			1	2
Voltage Support	7		2	2	5
Microgrid Capability	6				2
Stationary Transmission/Distribution Upgrade Deferral	6				
Transmission Congestion Relief	6				1
Resiliency	4		8	1	3
Transportable Transmission/Distribution Upgrade Deferral	3				4
Distribution upgrade due to solar	2				
Ramping	2		1	1	2
Black Start	1				1
Transmission Support					2

What effect is Storage Policy having?



Growing need for flexibility starting 2015



California Assembly Bill 2514	<p>This law requires the California Public Utilities Commission (CPUC) to open a proceeding to determine appropriate utility procurement targets, if any, for energy storage systems that are commercially available and cost-effective.</p> <p>The CPUC opened the rulemaking (R.10-12-007) on December 19, 2010. The rulemaking consisted of several phases of workshops, modeling of energy systems, staff reports, proposed decisions, and stakeholder input. The full timeline of the rulemaking process, as well as many pieces of documentation, can be found at http://www.cpuc.ca.gov/PUC/energy</p>	AB 2514	California Legislature	Jan 2011	
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Media uses

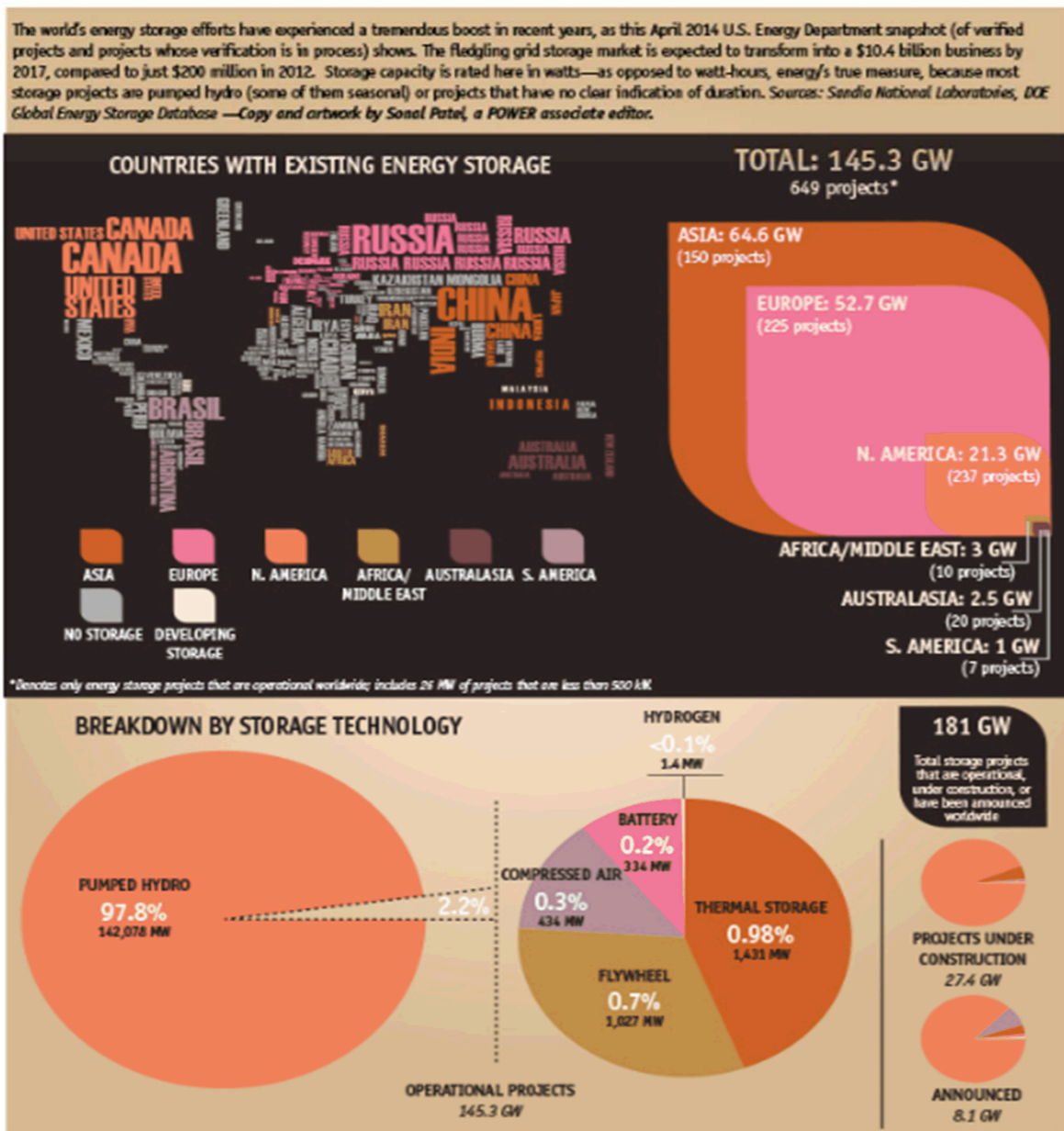
[Home](#) / [Energy Storage](#) / THE BIG PICTURE: Storage Snapshot

THE BIG PICTURE: Storage Snapshot

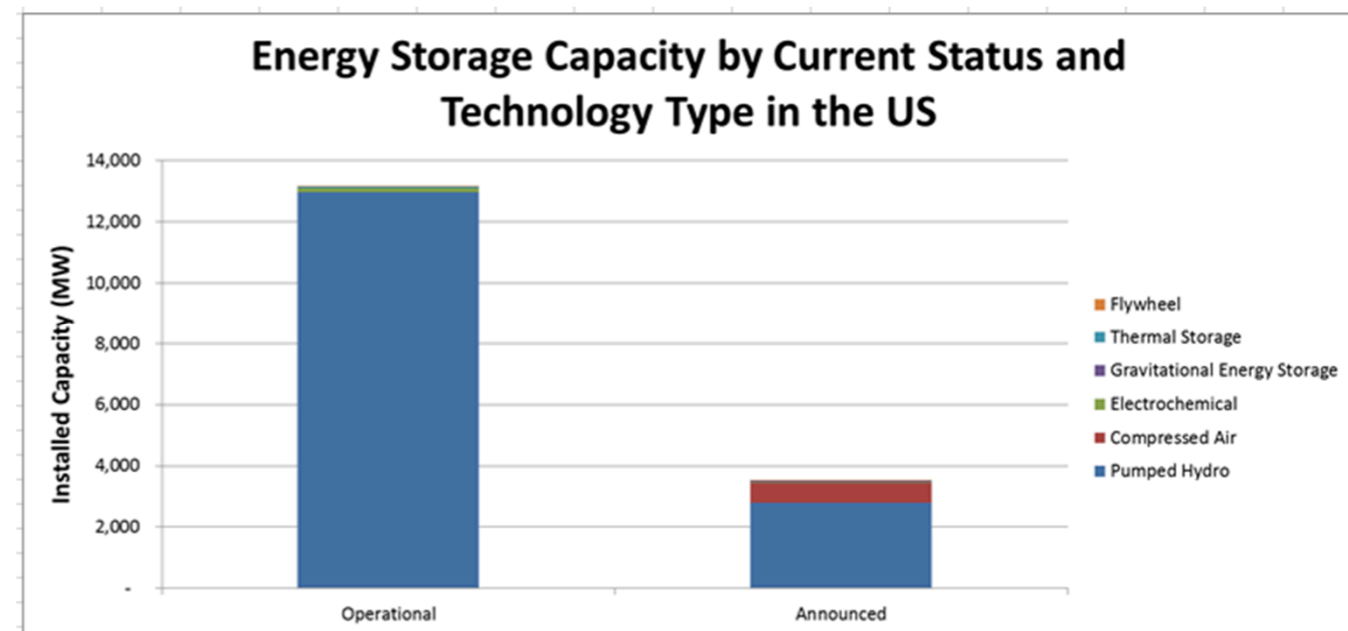
04/30/2014 | Sonal Patel

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Magazines, Blogs and other reports



<http://energytopicstrends.blogspot.com>

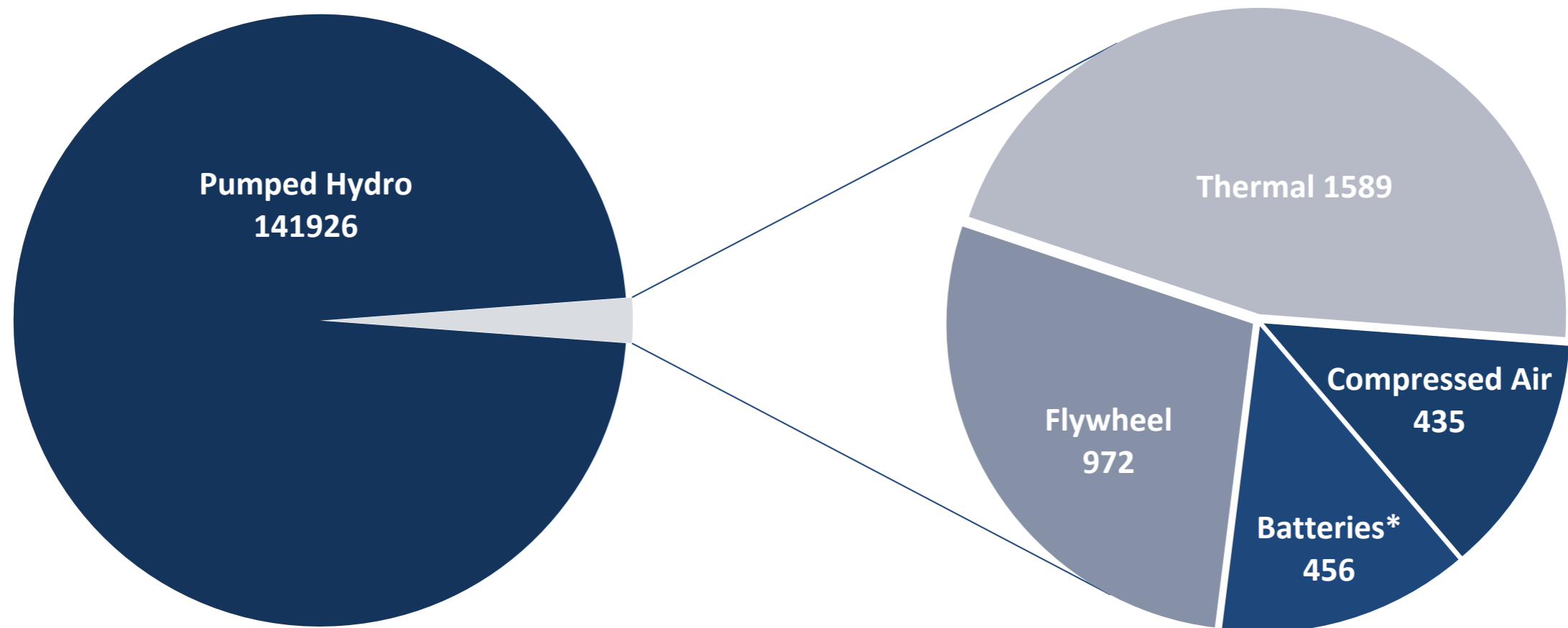
<http://www.powermag.com/the-big-picture-storage-snapshot/>

The Role of Storage in Energy System Flexibility

- *Which electricity storage technologies are currently used ...?*
- *What are the ways in which such devices be integrated into the energy market?*
- *How is energy storage handled in different countries?*
- *How is Renewable Energy Sources are Being Integrated with Storage?*

Which electricity storage technologies are currently used ...?

145 GW installed
50 Technologies Represented



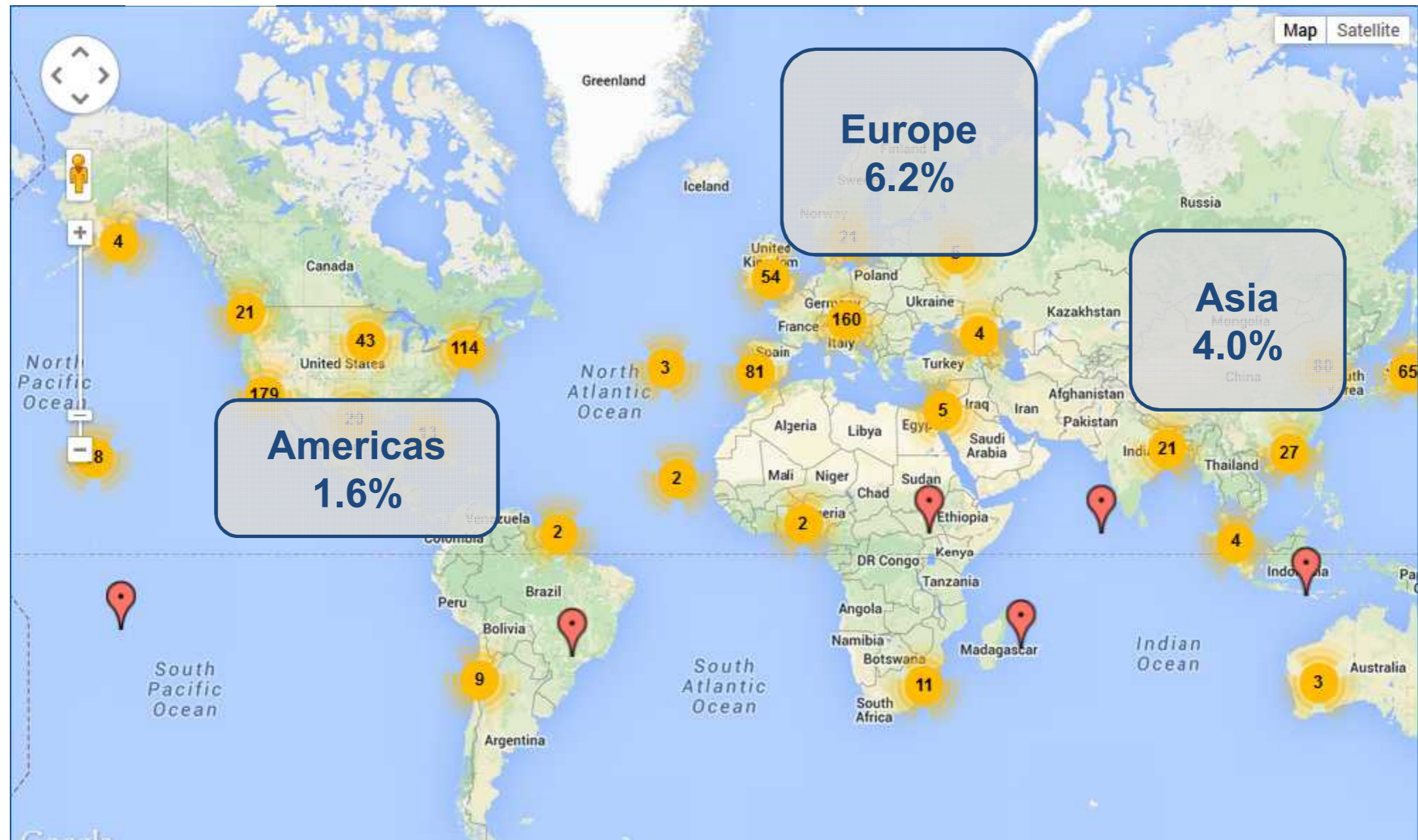
Source: Based on **DOE Global Energy Storage Database** (<http://www.energystorageexchange.org>)
August 2014

*Batteries include Flow, Lithium Ion, Sodium Sulfur, Nickel Cadmium, Lead Acid, Electrochemical Capacitors, and Ultra Batteries

1.8 % of the Total Electric Capacity

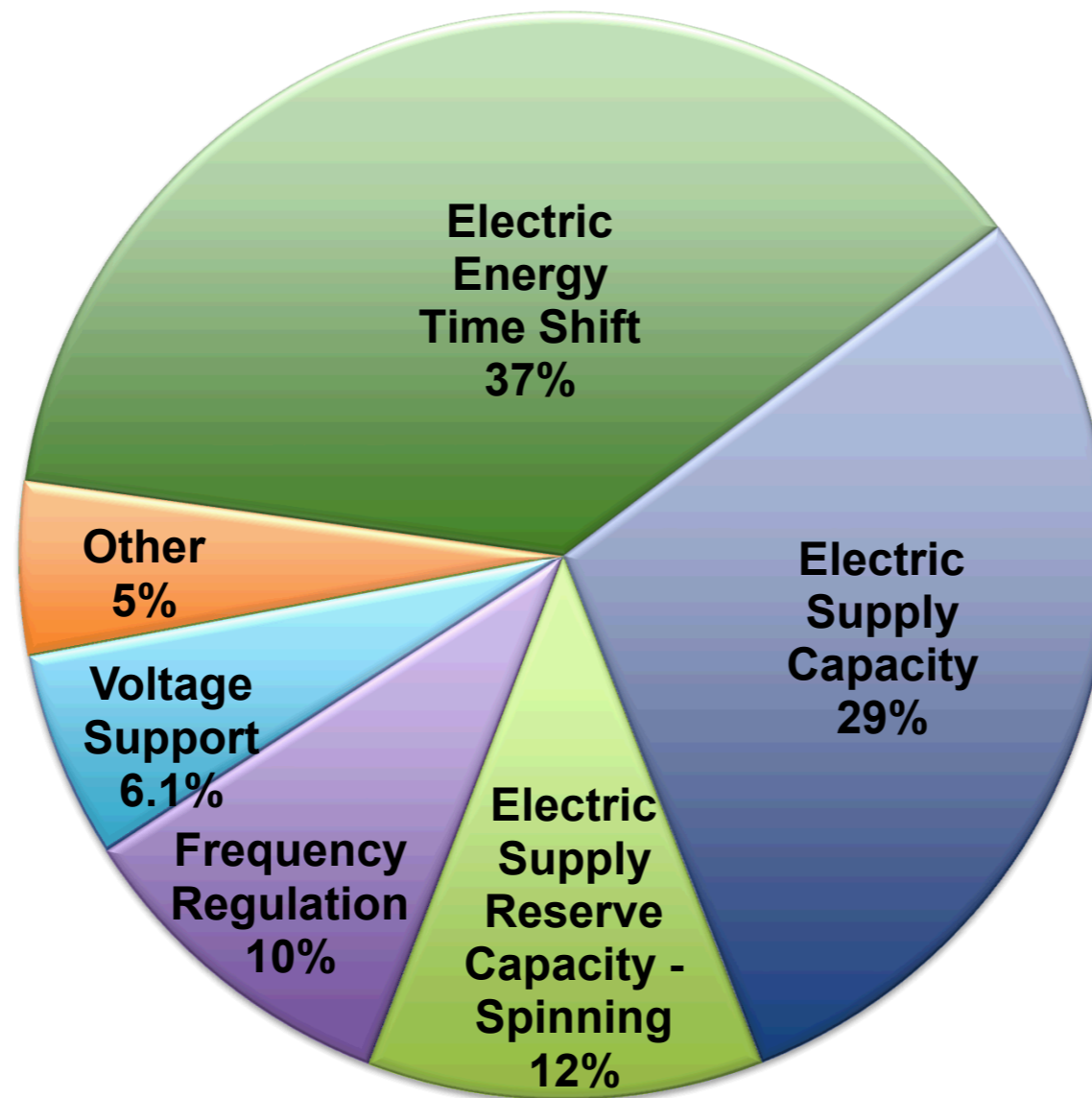


World wide is Stored!



Sources: 2014 EIA - Total Capacity est. and
DOE Global Energy Storage Database

What are the ways in which such devices be integrated into the energy market?

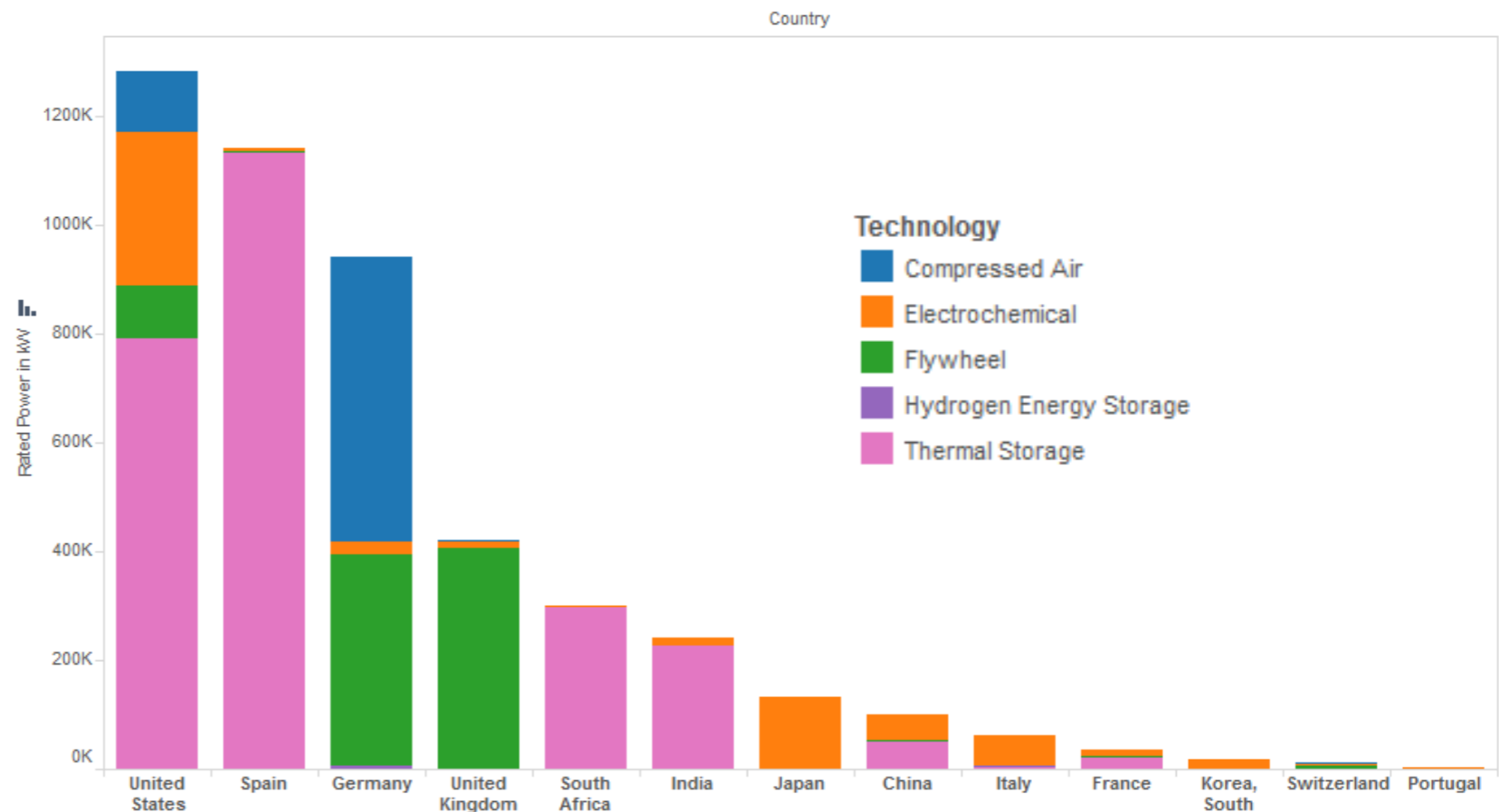


145 GW of Global Energy Storage

How is energy storage handled in different countries?

ES Technology by Country

Technology	China	Japan	United States	Italy	Spain	India	Switzerland	Germany	France
Compressed Air			113,580				500	521,000	
Electrochemical	45,990	130,921	280,415	55,777	6,326	15,045	1,110	24,377	11,042
Flywheel	2,000		97,575		2,100		9,000	389,400	700
Hydrogen Energy Storage				1,200				3,520	150
Pumped Hydro	33,199,000	28,651,780	21,682,700	7,484,700	6,889,200	6,772,000	6,427,000	6,228,420	5,812,000
Thermal Storage	51,500		790,751	4,720	1,131,800	226,175		1,500	23,500

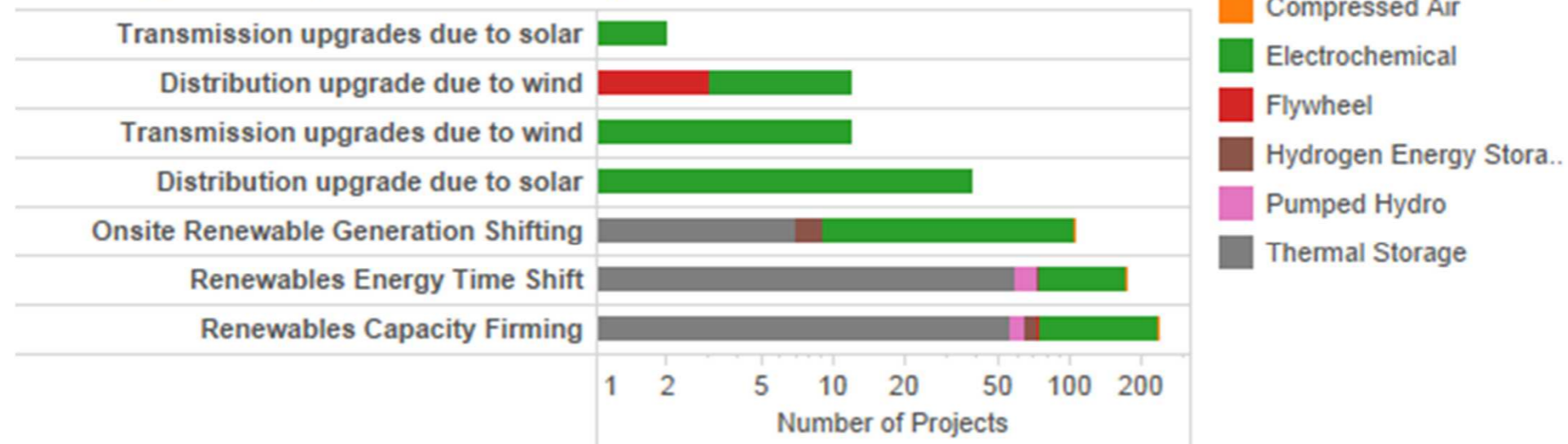


Without pumped hydro

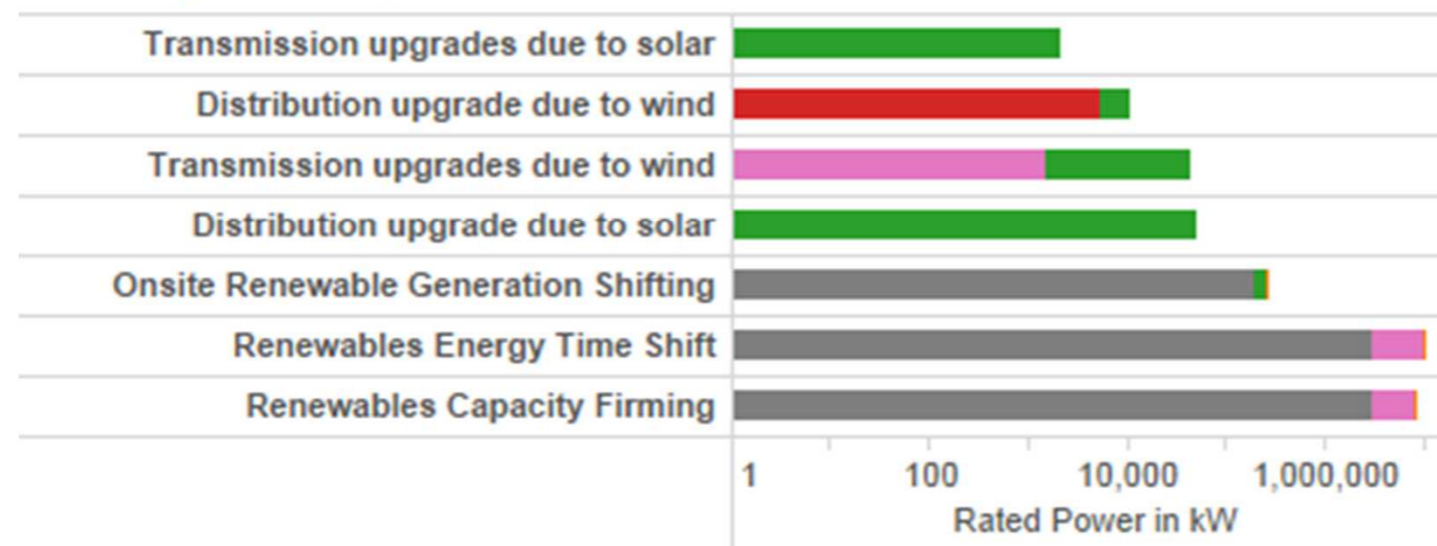
Data and charts: https://public.tableausoftware.com/views/EnergyStorageByCountry/ESTechnologybyCountry?:embed=y&:display_count=no
https://public.tableausoftware.com/views/EnergyStorageByCountry/ESTechnologyWithoutHydro?:embed=y&:display_count=no

How is Renewable Energy Sources are Being Integrated with Storage?

RE Integration by Number of Projects



RE Integration by Rated Power



https://public.tableausoftware.com/views/EnergyStorageUseCases/REIntegrationUseCases?:embed=y&:display_count=n

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DOE Global Energy Storage Database



2015 Plans

- Build out the Policy section
- International partnerships
- Create Codes, Standards and Regulations section
- Provide Data visualization tools
- Increase publicity and visibility
- Improve usability
- Maintenance and Project verification



www.sandia.gov/ess/database

Summary

- Database went live in May 2012
- 1088 Total Projects = 183.5 GW (145 GW Operational)
- Tool designed to be accessible to a wide variety of stakeholders
- Help grow ES industry - providing data

Users: 41,000 visitors
161 Countries
635,000 page views
October 2014



Acknowledgement

Thank You to the DOE OE and especially
Dr. Imre Gyuk for his dedication and support
to the ES industry and Sandia's ES Program.

Questions?

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Thank You...