An Introduction to the Energy Storage and Stationary Battery Committee [ESSB]

Paving the way to integrating legacy, renewables, and distributed grid infrastructure with a reliable backup and energy storage solution.

Town Hall Meeting
Wednesday
July 29 2015
10:00a – 12:00 noon
Terrace

Figure 3-10 | NaS battery units – 34 MW *(Japan Wind Development Co.)*

Chris Searles
Acting Chair
ESSB Committee

Bill Cantor
Acting Vice Chair
ESSB Committee

Rick Tressler
Chair Stationary Battery Committee/ Subcommittee

So What is Electrical Energy Storage?

Definition:

"The general method and specific techniques for storing electrical energy from a primary source in a form convenient for use at a later time."

Note: The Stationary Lead Acid (and Nickel Cadmium) Battery have been and still are excellent examples of Electrical Energy Storage devices.

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Categories of Electrical Energy Systems (EES)

Mechanical

- Pumped Hydro –(PHS)
- Compressed Air-(CAES)
- Flywheel – (FES)

Thermal

- Molten Salt
- A-CAES

Electrochemical

- Lead Acid – (LA)
- Nickel Cadmium – (NiCd)
- Nickel Metal Hydride – (NiMH)
- Lithium – (Li)
- Sodium Sulphur– (NaS)
- Redox Flow Battery – (RFB)
- Hybrid Flow Battery – (HFB)

Electrical

- e-layer Capacitor – (DLC)
- Superconducting Magnetic Coil – (SMES)

Chemical

- Fuel Cell – (FC)
- Synthetic Natural Gas – (SNG)

Figure 3-1 | Variable-speed PHS operated by TEPCO *(TEPCO)*

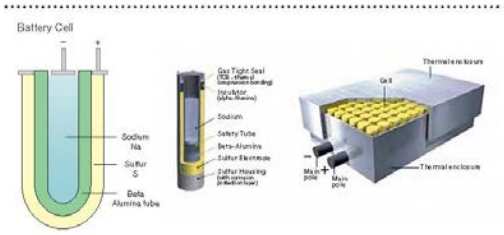

Figure 2-6 | NaS Battery: Cell design and 60 kW module *(NGK, IEC MSB/EES Workshop 2011)*

Comparison of EES Technologies

[Rated Power vs Rated Energy & Discharge Time]

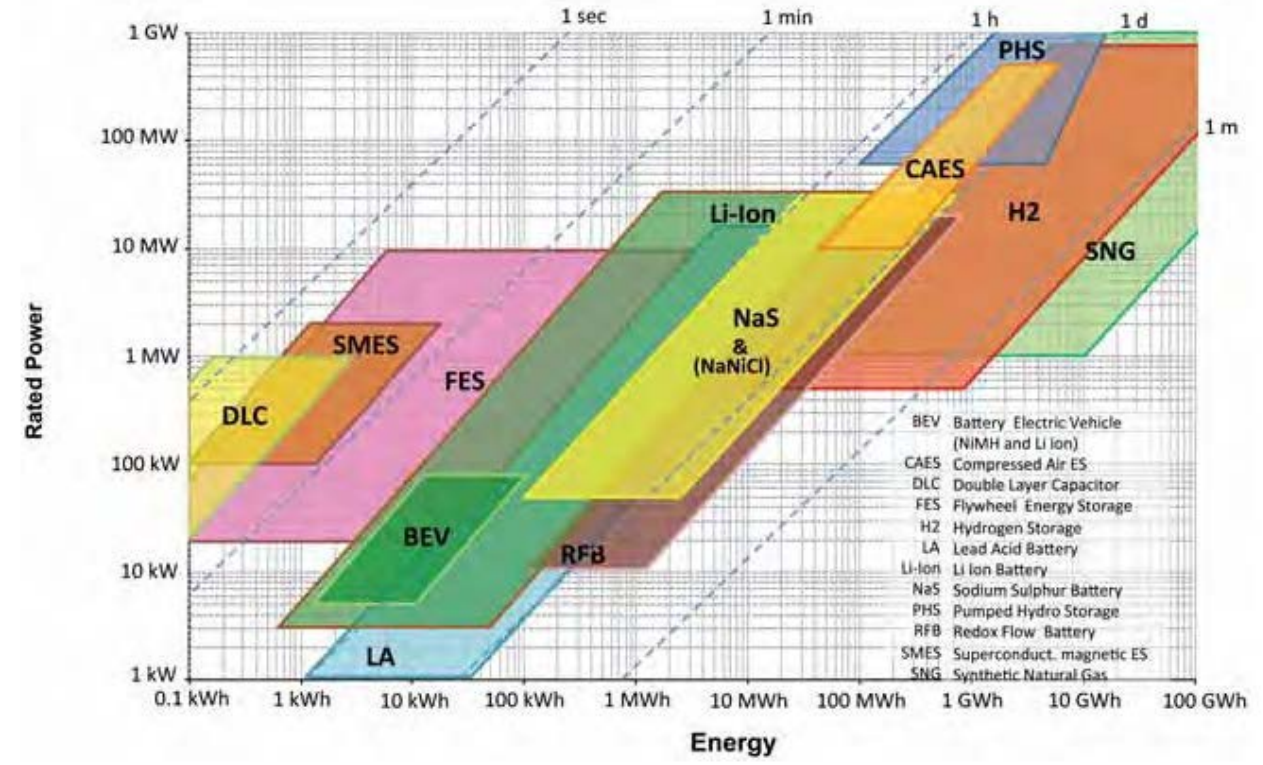

Figure 2-9 | Comparison of rated power, energy content and discharge time of different EES technologies *(Fraunhofer ISE)*

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Comparison of EES Technologies

[Power Density vs Energy Density (in relation to Volume)]

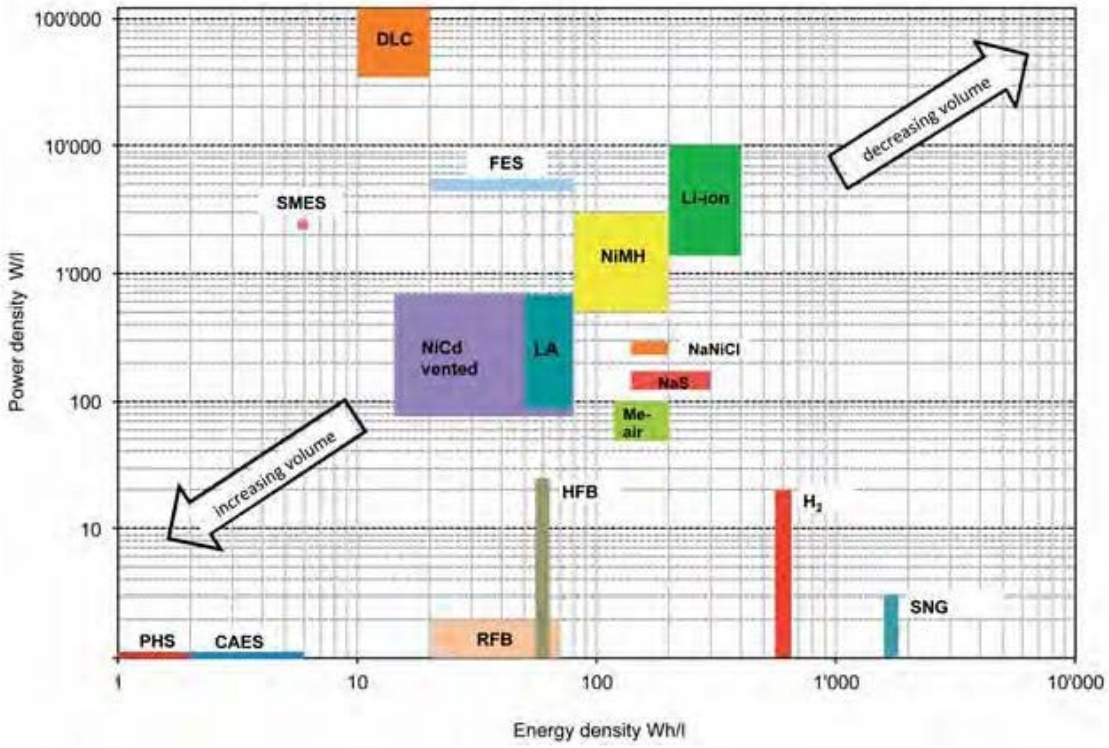

Figure 2-10 | Comparison of power density and energy density (in relation to volume) of EES technologies *(Fraunhofer ISE)*

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Comparison of EES Technologies

[State of Various ESS Technologies]

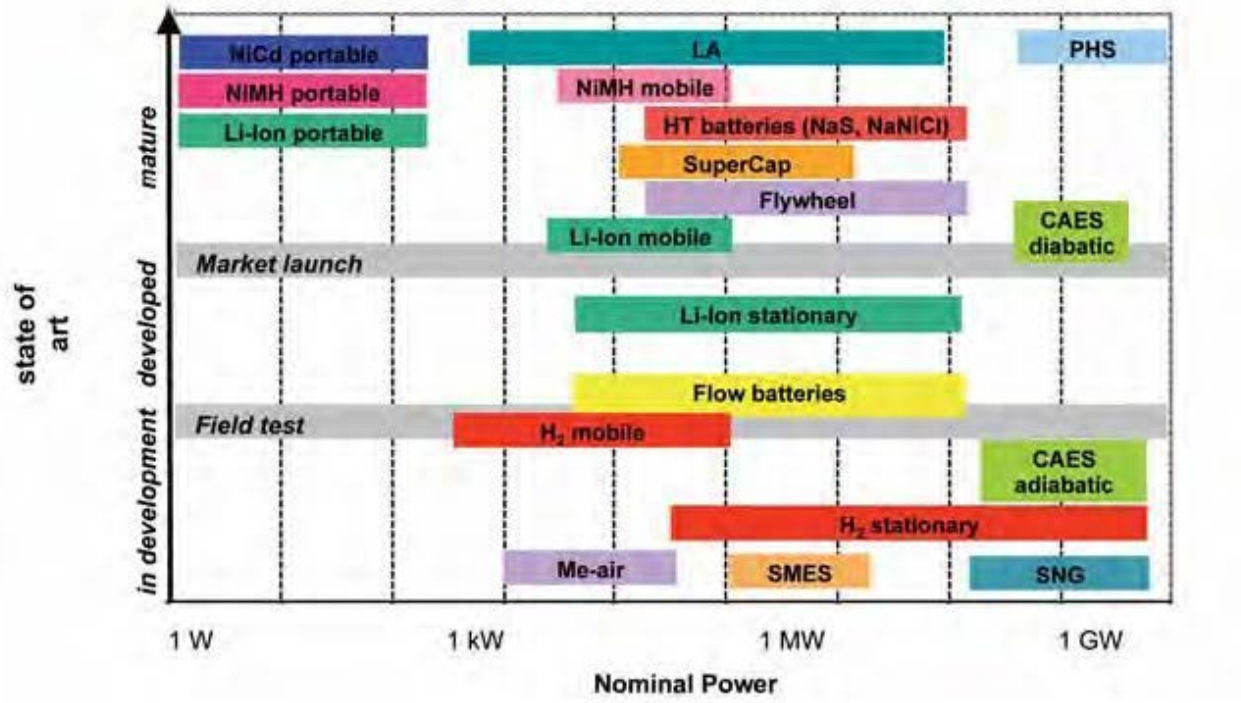


Figure 2-11 | Maturity and state of the art of storage systems for electrical energy *(Fraunhofer ISE)*

Areas where EES will Serve the Grid

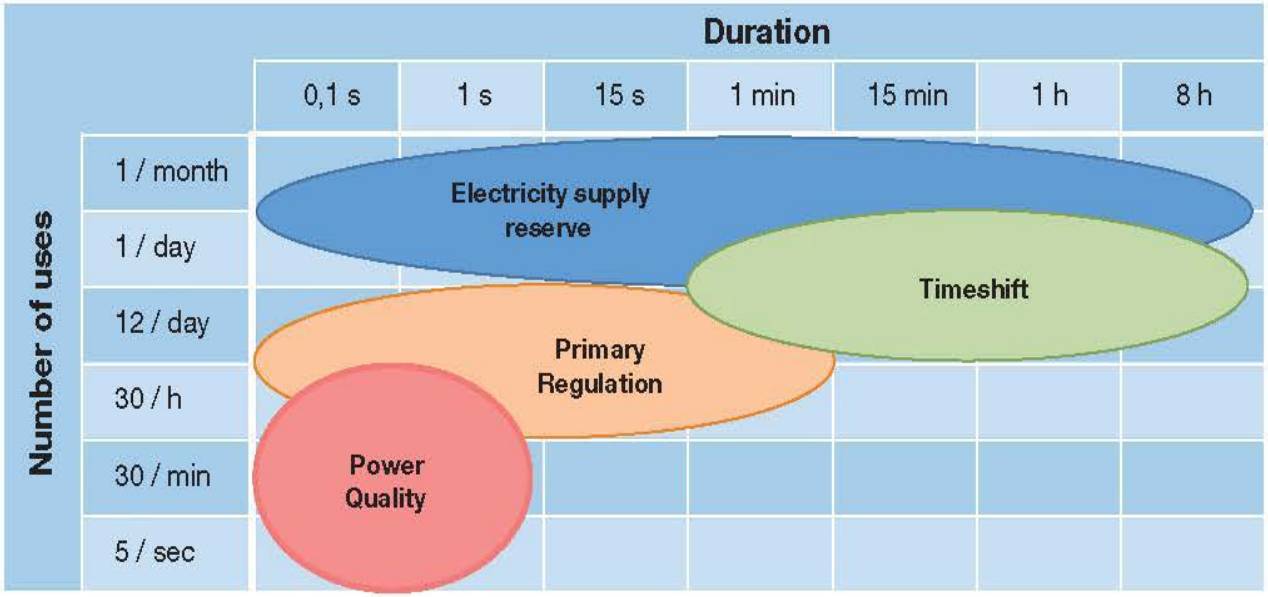
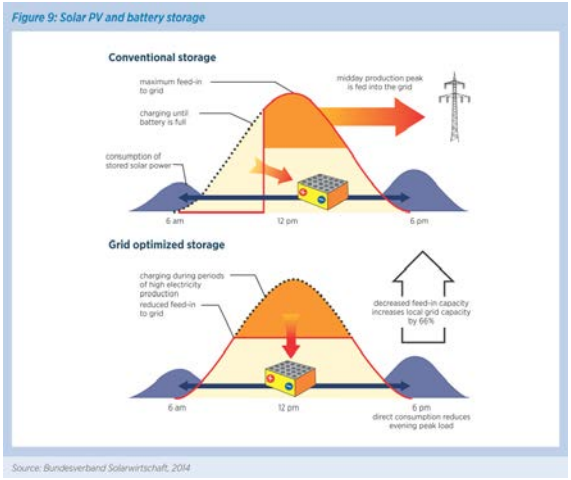
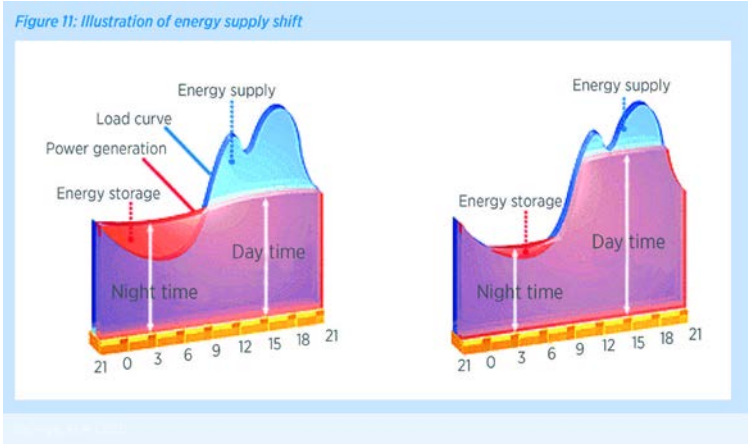


Figure 1-3 | Different uses of electrical energy storage in grids, depending on the frequency and duration of use [eus06]

Areas where EES will Serve the Grid

1. Energy Time Shifting
2. Peaker Plant Replacements/Additions
3. Energy Smoothing (RES)
4. Consumer/Commercial Uses
    1) Off-grid Photovoltaic (PV)
    2) Electric Vehicle (EV)
    3) Net Metering
    4) Behind the Meter





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Projects Planned for US Energy Storage

By State

State	No of Projects	% of Projects	% of Capacity
California	165	36.3	22.8
Texas	30	6.6	1.6
New York	7	5.9%	5
Hawaii	20	4.4	0.2
Pennsylvania	19	4.2	6.4
Washington	16	3.5	1.1
Colorado	12	2.6	1.9
Illinois	12	2.6	0.1
Minnesota	10	2.2	0.1

By Project

Technology	No. of Projects	% of Projects
Lithium-ion Battery	145	31.9
Pumped Hydro Storage	45	9.9
Flywheel	32	7.0
Lead-Acid Battery	40	8.8
Flow Battery	29	6.4
Sodium Based Battery	21	4.6
Chilled Water Storage	16	3.5
Compressed Air Storage	8	1.8
Nickel Based Battery	4	0.9

Data from DoE Energy Storage Database and Energy Storage USA – US Energy Storage Outlook

What is the New EES Paradigm ?

Drivers
- Renewable Energies
- Distributed Generation
- Smart Grid
- Micro Grid

Objectives (Goals)
- Reduce CO_2 Emissions
- Provide More Efficient/Reliable Energy
- Meet Needs of the new Drivers

Market Needs
- Short Term but Instant Storage
- Medium Term Storage
- Long Term Storage
- Dispersed (Distributed) Storage

Technical & Practical Implications
- Batteries will play a Large Role
- Other EES Alternatives based on Lifetime Costs

The Suggested Path Forward
- Standards/Guidelines are Essential
- R&D Incentives are Valid
- A Cohesive National Policy is needed

What should be the Scope of the ESSB?

- ✓ Provide a means for the IEEE PES (and affected industries) to develop and publish standards that define recommended industry practices for the health, safety, performance and maintenance of the integrated parts of both stationary battery and energy storage in both static and renewable states.

- ✓ Conduct technical sessions and webinars; publish articles, papers and technical reports; and participate in forums and conferences to inform the industry of milestone progress as the Electrical Energy Storage (EES) industry evolves.

- ✓ Aggressively engage participants involved in EES industry to join the ESSB Committee, and its subcommittees and working groups, to accomplish the development of standards, guides, best practices and technical reports.

General Discussion Points

- Energy storage scope residing in EDPG will move from Energy Development & Power Generation Committee (EDPG) to participate in a new Subcommittee within the Energy Storage & Stationary Battery (ESSB) Committee.
- Distributed Generation and Energy Storage Subcommittee in EDPG will be renamed Distributed Energy Resources and will revise it's scope.
- Possibly rename the Stationary Battery Committee to be called the Stationary Standby Power Subcommittee within the new ESSB Committee (needs discussion and approval of Stationary Battery Subcommittee).
- Establish the Electric Energy Storage (EES) Subcommittee within the new ESSB Committee

General Discussion Points

- Move the Lithium and Sodium WG's from the SBC into the EES Subcommittee.
- Solicit existing SBC members and leaders within EES community to assume positions of leadership within the ESSB Committee and/or the EES Subcommittee.
- Revise/Write appropriate Technical Committee Organization & Procedure (O&P) Manuals and Committee Policies & Procedures (P&P) for Standards Development.

Short Term Objectives

- ✓ Recommended Baseline for Beginning Separate Subcommittees
  - Run both Subcommittee Meetings Concurrently
    - January 2016 – Memphis TN (at IEEE PES TC Mtg)
    - June 2016 – Chicago IL
    - January 2017 – TBD
  - Revisit IEEE 1660 (expires Dec 2018)
    - Open PAR at Jan 2016 Meeting
    - Make 1st standard under EES subcommittee
  - Establish ESSB Website (requires webmaster)
  - Confirm Officers for ESSB Committee
  - Address O&P for submission to PES Technical Council
  - Address Standards P&P for submission to IEEE-SA

Final General Discussion Points

Questions?

Comments?

Additional thoughts for consideration?

CONCLUSIONS

- ✓ There is an evolution occurring within the electric utility industry
  - Distributed Generation and “Smart Grid.”
  - Push by Governments to find renewable energy sources and new energy storage means.
- ✓ There is no magic bullet or one technology solution.
- ✓ Lead-acid batteries are not going away, but other battery types as well as other EES technologies will gain traction and play a part in the new energy paradigm.
- ✓ All EES groups agree that there is a need for new standards/guidelines/best practices to address this growing field.