Strategic Implementation of Electric Energy Storage

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Progress Energy

Emerging Technology & Alternative Energy Section

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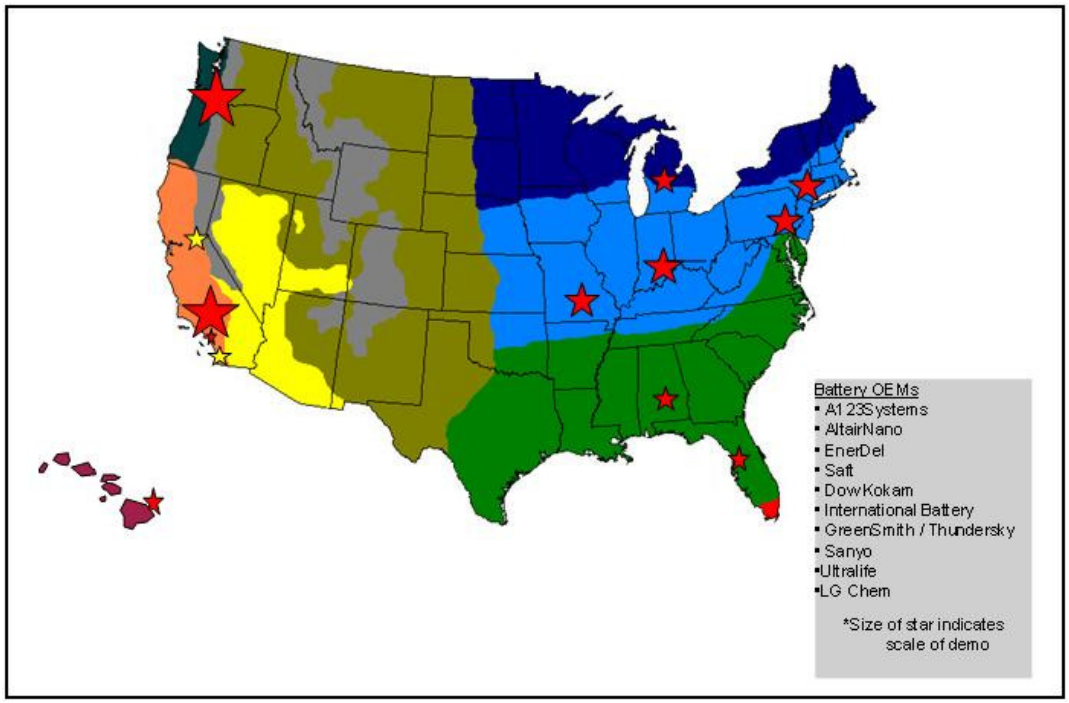
ENERGY EFFICIENCY
ALTERNATIVE ENERGY
STATE-OF-THE-ART POWER SYSTEM

Agenda

- Introduction and Background
- Energy Storage Technologies
- Applications
- Energy Storage Costs and Benefits
- Opportunities for Energy Storage at Progress Energy



Introduction

RATIONALE:

Progress Energy is interested in energy storage technologies in order to:

- Enable optimal power system operation.
- Manage system load peaks and other capacity shortfalls.
- Manage the addition of intermittent renewable energy systems (Solar PV, etc.).
- Capitalize on smart grid infrastructure to optimize system performance.

ENVIRONMENTAL SCAN:

Energy Storage technology is experiencing significant development and investment due to several industry drivers:

- Deployment of intermittent renewable generation.
- Investments in Smart Grid Technology.
- Battery technology improvement due to PHEV/EV development.
- Energy Storage provides means to manage system loading. Systems are being designed for application at all levels of the power system.
- Utilities see Energy Storage technologies as a potential solution to existing and emerging power system problems.

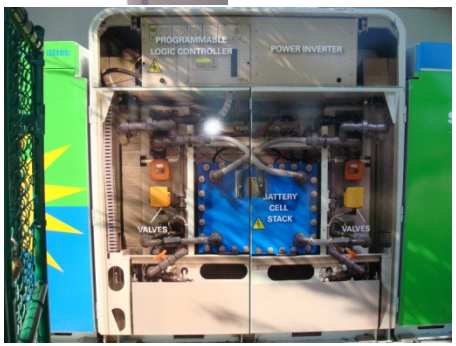
Progress Energy's Energy Storage Program

PROGRAM OBJECTIVES:

•Assess available energy storage technologies for application on Progress Energy power systems.
•Develop value proposition for energy storage applications.
•Forecast technology developments and PGN implementation timelines.
•Develop criteria for implementation of viable technologies.

PAST / CURRENT ACTIVITIES / PROJECTS:

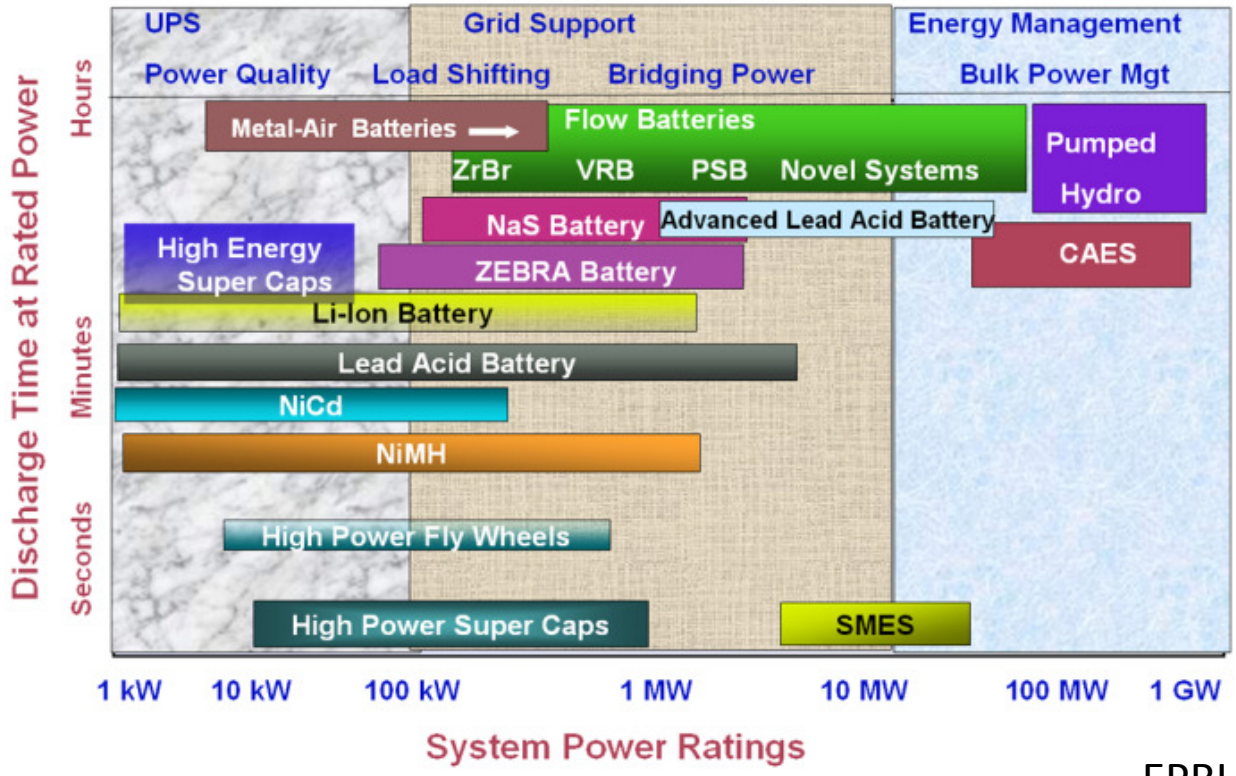
- CP&L studied pumped hydro at Blewett Falls Lake, CAES, and Wind storage.
- PEF Homosassa Fuel Cell Project – 5 kW solar PV array energy stored as hydrogen gas for later fuel cell use.
- PEF SEEDS Program (with USF) – 2 kW PV system coupled with 5 kW, 20 kWh battery system to store intermittent solar energy and off-peak grid power for use on-peak. Two energy storage systems tested , so far (VRB, and Li Ion Phosphate).
- PGN EPRI Mobile Energy Storage Project – 500 kW, 2 MWh, ZnBr Flow battery system in mobile trailer configuration. Unit will be integrated with an existing distribution transformer. (277/480V, 3 Phase).
- EPRI Programs: P94 (Energy Storage), P161D (Intelligrid), P174A, High Penetration PV Study.
- Proposed technology demonstrations.



Energy Storage Technologies

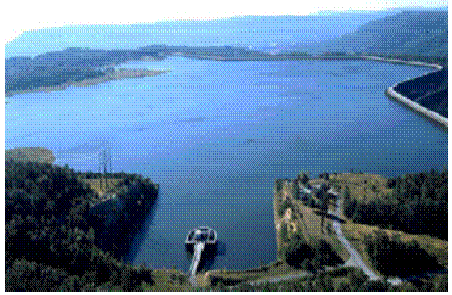
ENERGY STORAGE TECHNOLOGIES:

- Pumped Hydro Energy Storage
- Compressed Air Energy Storage (CAES)
- Flow Batteries
- Molten Salt Batteries
- Electrochemical Cell Based Batteries
- Flywheel, Super Capacitors, SMES



EPRI

Bulk to Distributed Storage Solutions in the Smart Grid

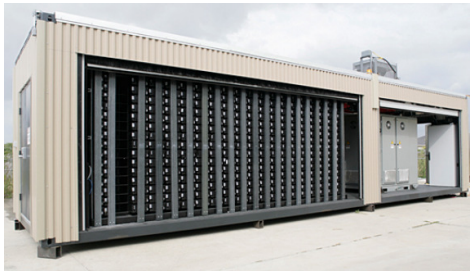


Pumped Hydo

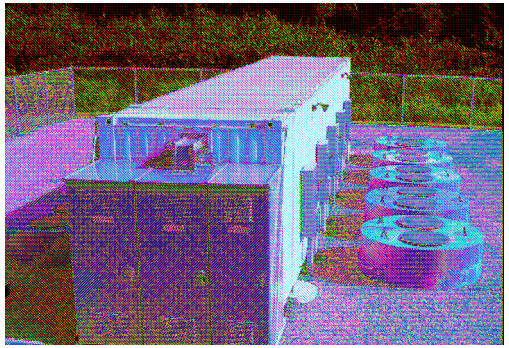
CAES Plant

NAS battery

ZnBr Flow Battery

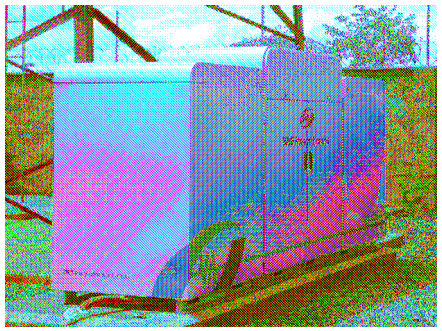


Advanced Lead Acid Battery



Flywheel Energy Storage

Li Ion Battery



Vanadium Flow Battery

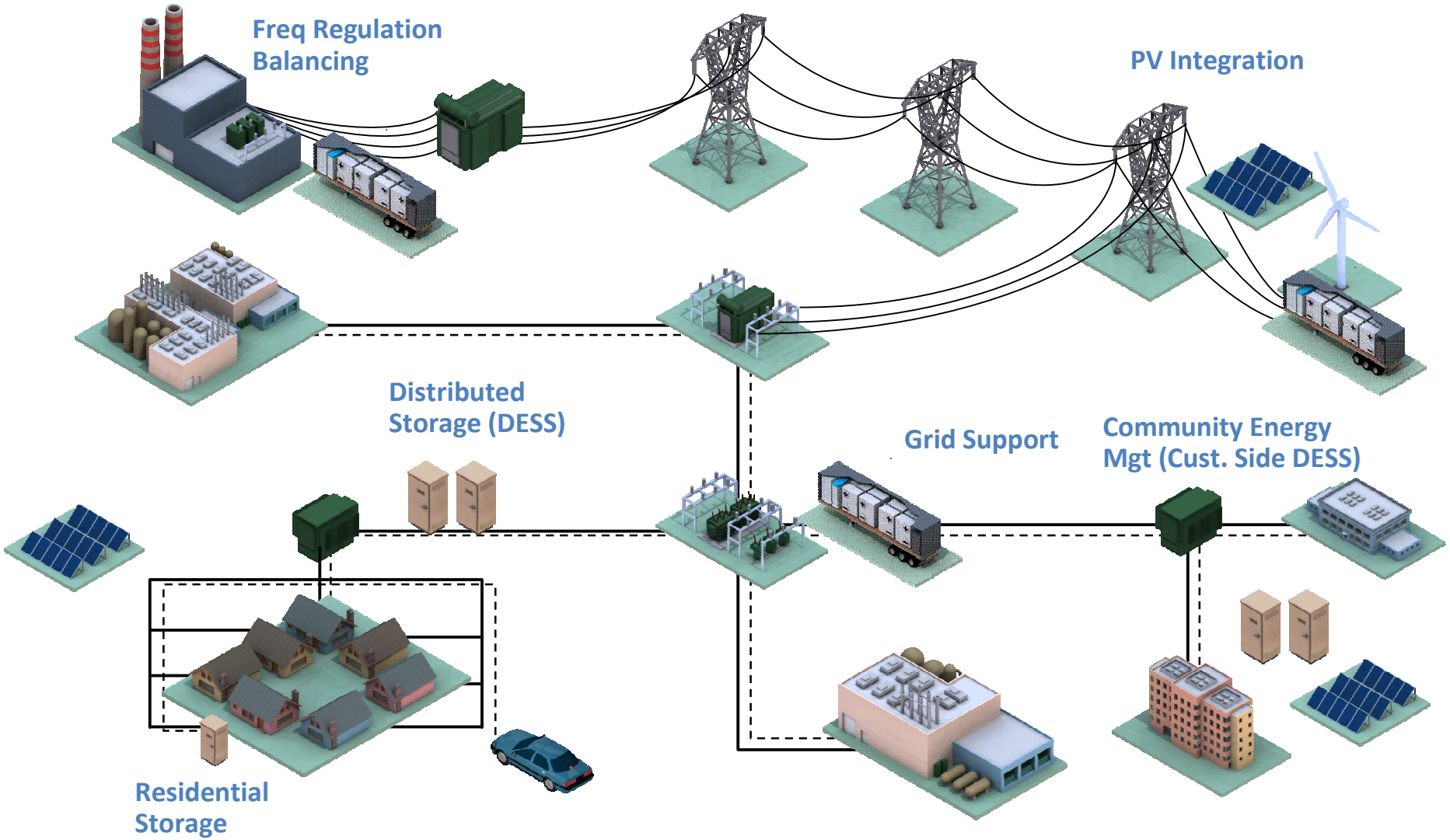
ZnBr Flow Battery

Li Ion Battery

MWs to kWs: seconds, min, hours of energy duration

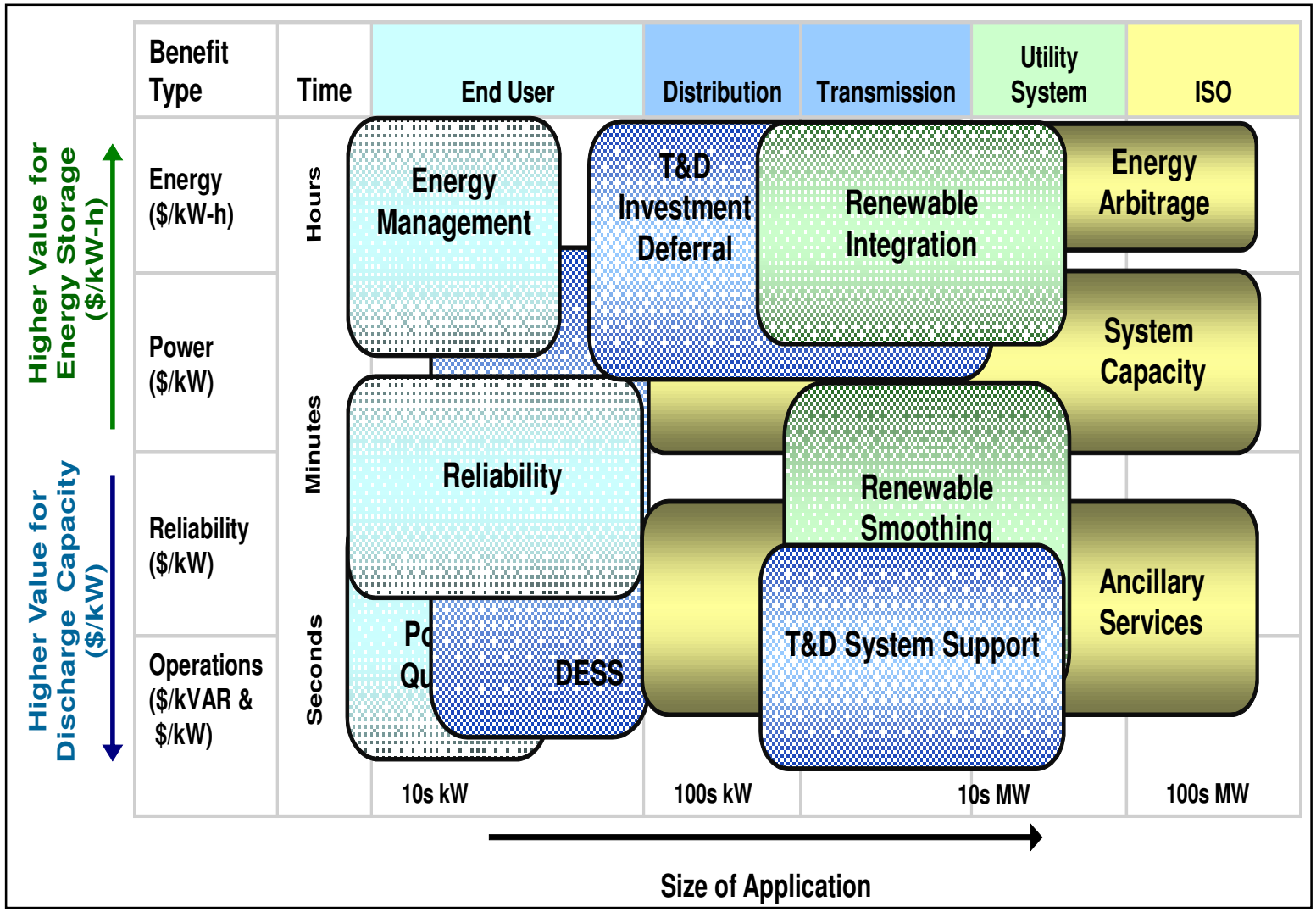
EPRI

Applications for Storage on the Grid

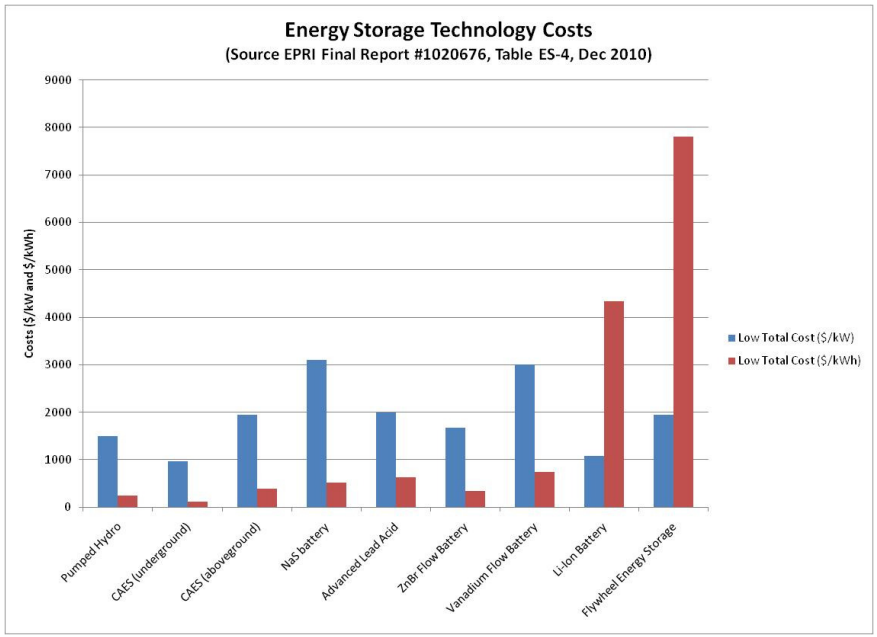


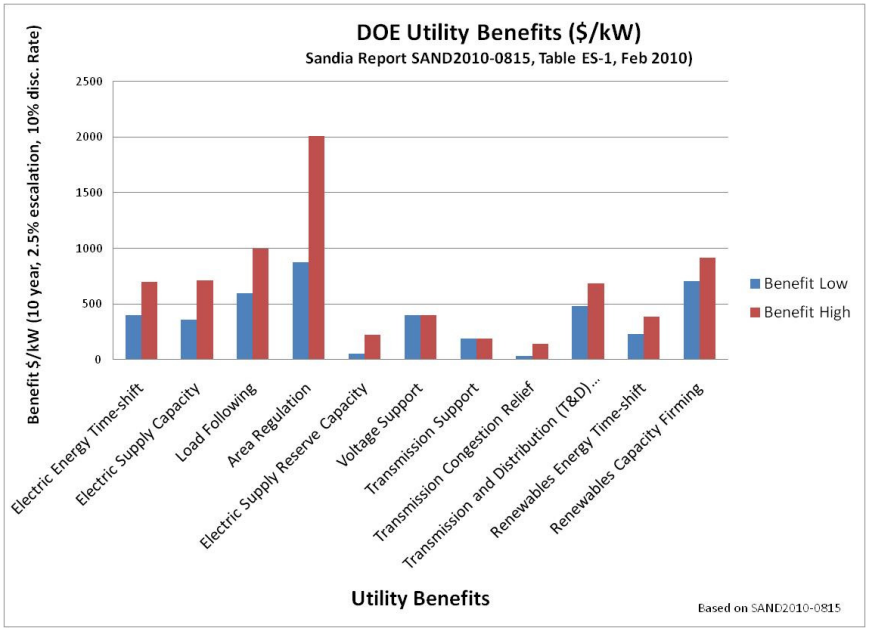
EPRI

Energy Storage Can Realize Multiple Applications

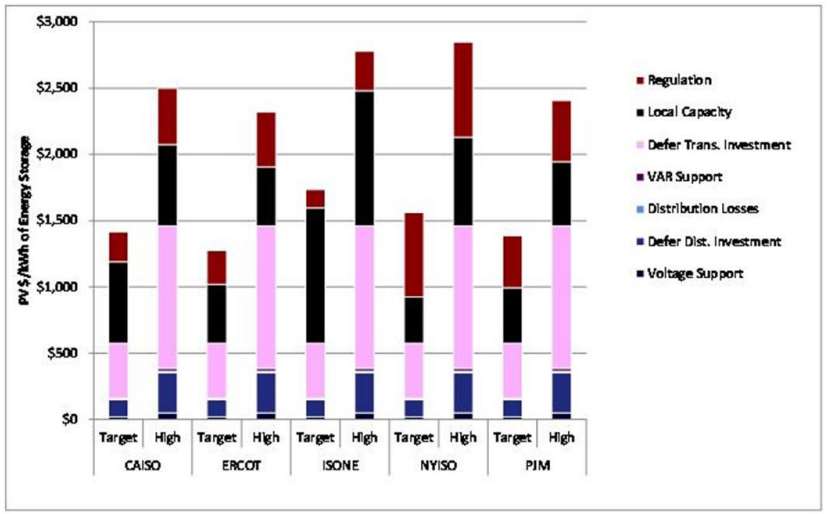


Energy Storage Costs, Benefits and Value

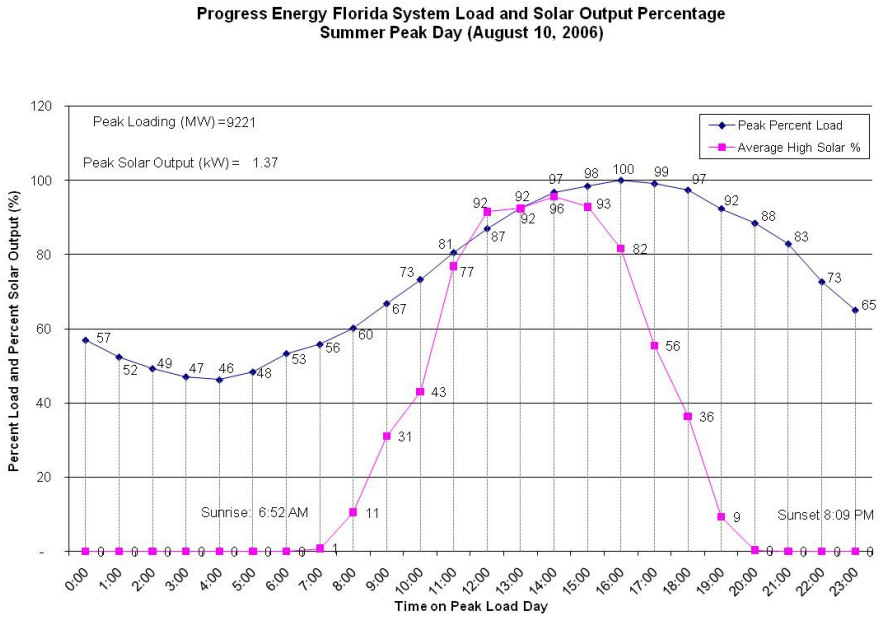


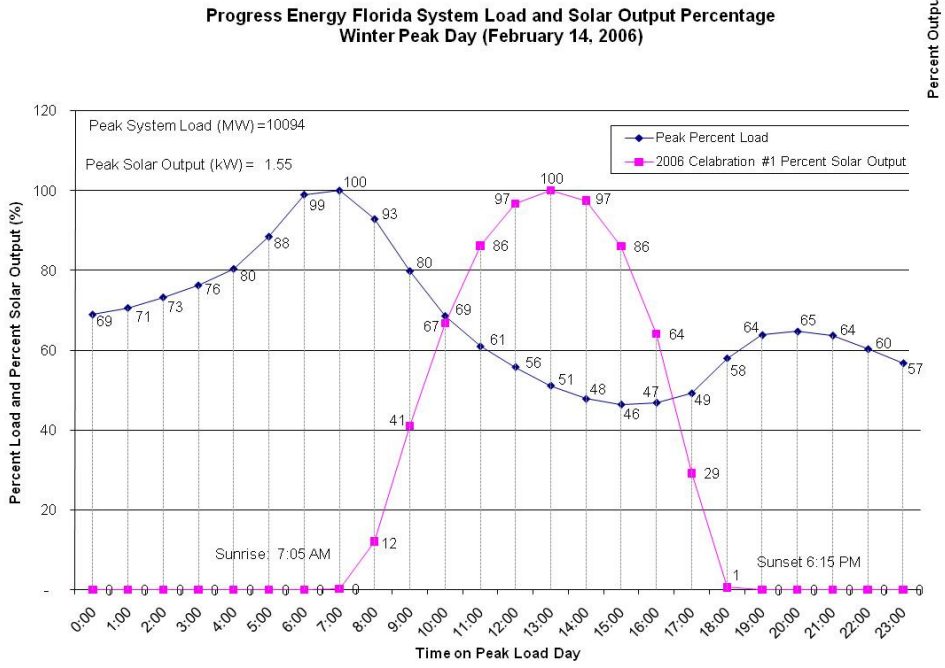


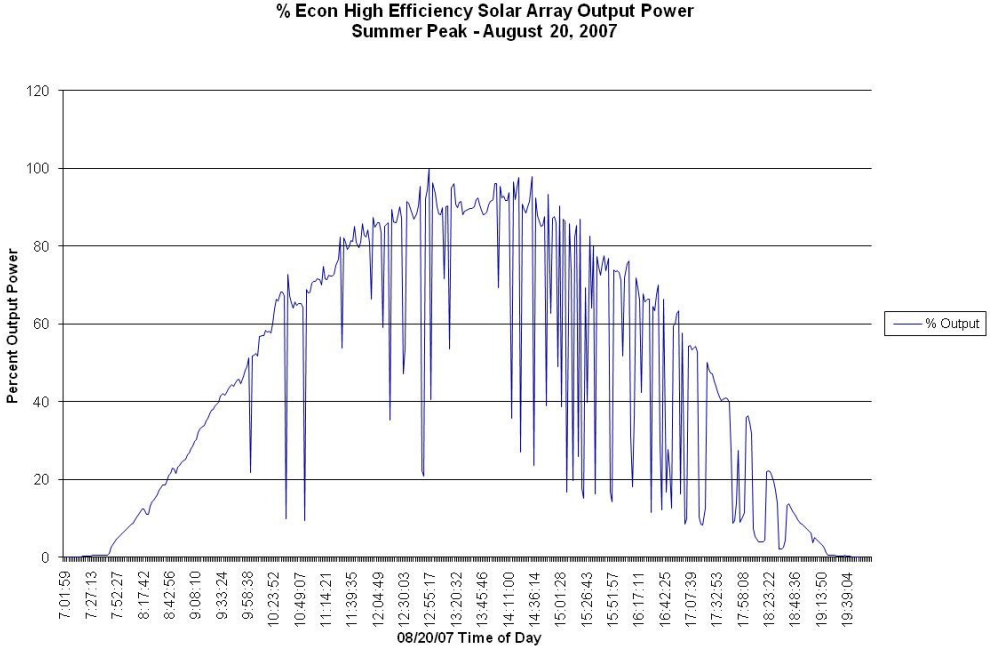
Value for Stationary Energy Storage Systems for T&D Deferral with Regulation
(Source EPRI Final Report #1020676, Figure 2-4, Dec 2010)



Renewable Energy Opportunities Vary







Opportunities for Integration of Energy Storage

TECHNOLOGY GAPS:

•Current costs appear to be in excess of benefits.

•Energy Storage Technologies and applications are developing.

•The durability and reliability of many technologies are undocumented.

•Advanced control adds Cyber Security Risk.

•Data quantifying utility benefits from DOE / EPRI and other utilities may not adequately represent Progress Energy system benefits.

•Available industry data is not specific to opportunities and challenges in Progress Energy territories.

OPPORTUNITIES TO CLOSE GAP:

•Assess technologies for specific Progress Energy benefit.

- Engage stakeholders including system planning, transmission / substation, distribution engineering, ECC/DCC, etc.
- Quantify synergies of energy storage applications that can accrue benefits in several areas with each installation.

•Track ongoing energy storage development by others to evaluate technology suitability , reliability, costs, and benefits.

•Assess customer energy storage implementations that could also serve compatible grid applications with advanced control.

Conclusions

- Costs and Benefits vary with technology, application and potential for aggregation.
- Potential energy storage applications need to be assessed considering specific technical, environmental, and economic characteristics of the site.
- Results from the large number of demonstration projects should reveal real world performance of new energy storage technologies.
- Energy storage technology is constantly changing due to drivers like demand for more renewable energy, additional applications made possible using new smart grid controls, etc.

References

- EPRI Energy Storage Technology Options (A White Paper on Applications, Costs and Benefits, (EPRI Final Report 1020676, Dec 2010)
- Sandia Report: Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide (SAND2010-0815, Feb 2010)