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## Grid-Based Energy Storage; A \$200 Billion Opportunity

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Yesterday a reader sent me a copy of an exhaustive new study titled "[Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide](#)" that was commissioned by the [DOE's Energy Storage Systems Program](#) and prepared by Jim Eyer and Garth Corey. I've been following the work in progress on this report since last summer and have eagerly awaited an opportunity to shift away from the overhyped electric vehicle market and focus instead on a far larger market where cost, performance and substantive business merit will be the only drivers. It looks like my time has finally come. For technology aficionados that want a detailed understanding of what the various grid-based storage applications are, the entire report (232 pages including appendices) is a must read. Over the next few weeks I'll try to extract some high-level technical and market data and translate that information into a form that will be useful to energy storage investors.

The Eyer-Corey Report identifies 17 discrete grid-based energy storage applications, discusses the performance requirements of each application and assesses the 10-year economic potential for each application. The Report also includes a great summary that condenses a couple hundred pages of detail into a single table.

#	Benefit Type	Discharge Duration*		Capacity (Power: kW, MW)		Benefit (\$/kW)**		Potential (MW, 10 Years)		Economy (\$Million)†	
		Low	High	Low	High	Low	High	CA	U.S.	CA	U.S.
1	Electric Energy Time-shift	2	8	1 MW	500 MW	400	700	1,445	18,417	795	10,129
2	Electric Supply Capacity	4	6	1 MW	500 MW	359	710	1,445	18,417	772	9,838
3	Load Following	2	4	1 MW	500 MW	600	1,000	2,889	36,834	2,312	29,467
4	Area Regulation	15 min.	30 min.	1 MW	40 MW	785	2,010	80	1,012	112	1,415
5	Electric Supply Reserve Capacity	1	2	1 MW	500 MW	57	225	636	5,986	90	844
6	Voltage Support	15 min.	1	1 MW	10 MW	400		722	9,209	433	5,525
7	Transmission Support	2 sec.	5 sec.	10 MW	100 MW	192		1,084	13,813	208	2,646
8	Transmission Congestion Relief	3	6	1 MW	100 MW	31	141	2,889	36,834	248	3,168
9.1	T&D Upgrade Deferral 50th percentile††	3	6	250 kW	5 MW	481	687	386	4,986	226	2,912
9.2	T&D Upgrade Deferral 90th percentile††	3	6	250 kW	2 MW	759	1,079	77	997	71	916
10	Substation On-site Power	8	16	1.5 kW	5 kW	1,800	3,000	20	250	47	600
11	Time-of-use Energy Cost Management	4	6	1 kW	1 MW	1,226		5,038	64,228	6,177	78,743
12	Demand Charge Management	5	11	50 kW	10 MW	582		2,519	32,111	1,466	18,695
13	Electric Service Reliability	5 min.	1	0.2 kW	10 MW	359	978	722	9,209	483	6,154
14	Electric Service Power Quality	10 sec.	1 min.	0.2 kW	10 MW	359	978	722	9,209	483	6,154
15	Renewables Energy Time-shift	3	5	1 kW	500 MW	233	389	2,889	36,834	899	11,455
16	Renewables Capacity Firming	2	4	1 kW	500 MW	709	915	2,889	36,834	2,346	29,909
17.1	Wind Generation Grid Integration, Short Duration	10 sec.	15 min.	0.2 kW	500 MW	500	1,000	181	2,302	135	1,727
17.2	Wind Generation Grid Integration, Long Duration	1	6	0.2 kW	500 MW	100	782	1,445	18,417	637	8,122

\*Hours unless indicated otherwise. min. = minutes. sec. = seconds.  
 \*\*Lifecycle, 10 years, 2.5% escalation, 10.0% discount rate.  
 †Based on potential (MW, 10 years) times average of low and high benefit (\$/kW).  
 †† Benefit for one year. However, storage could be used at more than one location at different times for similar benefits.

From an investor's perspective, the problem with the summary table is that it focuses on the needs of utilities instead of economic opportunities for storage device manufacturers. As a result the summary table uses a range of discharge durations, a range of power capacities and a range of economic benefits per kW of nameplate power capacity. Since investors typically think in terms of megawatt-hours of potential demand and economic benefit per kilowatt hour of storage, we have to take the Eyer-Corey calculations a couple steps further to arrive at a simple translation that fits an investor's perspective.

In an effort to translate the summary table data into terms investors will understand, I've calculated an average discharge duration and an average economic benefit for each grid-scale application identified in the Report. I've then used those averages to calculate potential demand in MWh, economic benefit per kWh and revenue opportunity to manufacturers. I've also reordered the data based on declining economic benefit per kWh to highlight the inverse relationship between economic benefit per kWh and potential demand in MWh. If you're interested in more detail, I've posted a copy of my Excel spreadsheet [here](#). I've discussed this methodology with Mr. Eyer and feel comfortable that my potential demand, economic benefit per kWh and revenue opportunity calculations are at least in the ballpark. Since we're dealing with averages of values that covered a wide range to start with, my numbers are best characterized as rough estimates, but they're certainly good enough for a first pass. The summary results of my calculations are set forth below.

	Potential Demand (MWh)	Economic Benefit (per kWh)	Revenue Opportunity (millions)
7 Transmission Support	13	\$197,486	\$2,652

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