Forklift / Stationary Battery Solutions 2014

10 - 20 kWh useable stored power comparisons for electric forklifts and stationary battery storage.
Nominal system voltage is 48 Vdc. All prices include estimated/average, or included shipping costs, but not sales taxes.
Life time costs do not include effects of sales tax, charging / discharging efficiencies / losses, which increase real life time storage costs.

Battery Type Application Manufacture Notes	A-h	Retail Price	Weight #	Volume in**3	Average Dis-charge voltage	Depth of Discharge (D.O.D.)	Available Energy at DOD kWh	Life Time Cycles	Up Front Cost per 1 kWh Stored	Life Time Cost of 1 kWh Stored	Life Time Cost % of STD. Case
Flooded Lead-Acid Forklift / Stationary MFG: GB STD. for comparison.	595	$5,176	2,494	20,378	46	70%	19.2	1,500	$270.	$0.180	100%
LiFePO4, Li-Ion Stationary MFG: Balqon/Winston 16 cells, $450 shipping	400	$7,490	480	7,493	48	80%	15.4	2,200	$488	0.222	123%
LiFePO4, Li-Ion Forklift replacement MFG: Balqon/Winston 16 cells, $450 shipping Add $1,500 for C.W.	400	$8,990	480	7,493	48	80%	15.4	2,200	$585	0.266	148%
Nickel-Iron Forklift / Stationary MFG: Iron-Edison 40 Cells, $800 shipping 10 year life cycle	400	$16,000	2,024	41,774	48	70%	13.4	3,600	$1,190	$0.331	184%
Nickel-Iron Forklift / Stationary MFG: Iron-Edison 40 Cells, $800 shipping 30 year life cycle $2,000 for 2X electrolyte Changes	400	$18,000	2,024	41,774	48	70%	13.4	10,800	$1,190	$0.124	68.9%

Currently there is no way to beat lowest up-front cost of a Lead acid battery for forklifts / stationary battery storage applications.
The life time cost of LiFePO4 batteries for stationary applications at 23% higher may still be as cost effective as Lead acid battery in real life applications. Lead acid batteries have a memory effect, Li-Ion batteries have little memory effect. Most real life situation do not involve full cycles. So under real life applications Li-Ion batteries will typically have more cycles than expected, so in real life they will be cheaper in the long run. Only Nickel-Iron batteries kept in service for 30 years can beat Lead acid batteries for life time cost of stored power.

Forklift / Stationary Battery Possible Future Solutions

Properties same as page #1.

Battery Type Application Manufacture Notes	A-h	Retail Price	Weight #	Volume in**3	Average Dis-charge Voltage	Depth of Discharge (D.O.D.)	Available Energy at DOD kWh	Life Time Cycles	Up Front Cost per 1 kWh Stored	Life Time Cost of 1 kWh Stored	Life Time Cost % of STD. Case
Flooded Lead-Acid Forklift / Stationary MFG: GB STD. for comparison.	595	$5,176	2,494	20,378	46	70%	19.2	1,500	$270	$0.180	100%
LiFePO4, Li-Ion Stationary MFG: Future Company 16 cells, $200 each. $450 shipping	400	$3,650	480	7,493	48	80%	15.4	2,200	$238	0.108	60.0%
LiFePO4, Li-Ion Forklift replacement MFG: Future Company 16 cells, $200 each. $450 shipping Add $1,500 for C.W.	400	$5,150	480	7,493	48	80%	15.4	2,200	$335	0.152	84.6%
Nickel-Iron Forklift / Stationary MFG: Future Company 40 Cells, $240 each. $800 shipping 10 year life cycle	400	$10,400	2,024	30,000	48	70%	13.4	3,600	$774	$0.215	119%
Nickel-Iron Forklift / Stationary MFG: Future Company 40 Cells, $240 each. $800 shipping 30 year life cycle $2,000 for 2X electrolyte Changes	400	$12,400	2,024	30,000	48	70%	13.4	10,800	$774	$0.085	47.4%

Conclusion: Some opportunity exists for Li-Ion batteries where weight is not a concern, volume is a small concern, and price is the biggest issue. A 400 A-h, Li-Ion battery with 2,200 cycles at 80% DOD selling for $200 would take over the forklift and stationary battery market, wiping out large Lead acid battery production. Only an improved Nickel-Iron battery with a cost of $240 per 400 A-h cell would compete, and then only for 30 year life projects.