

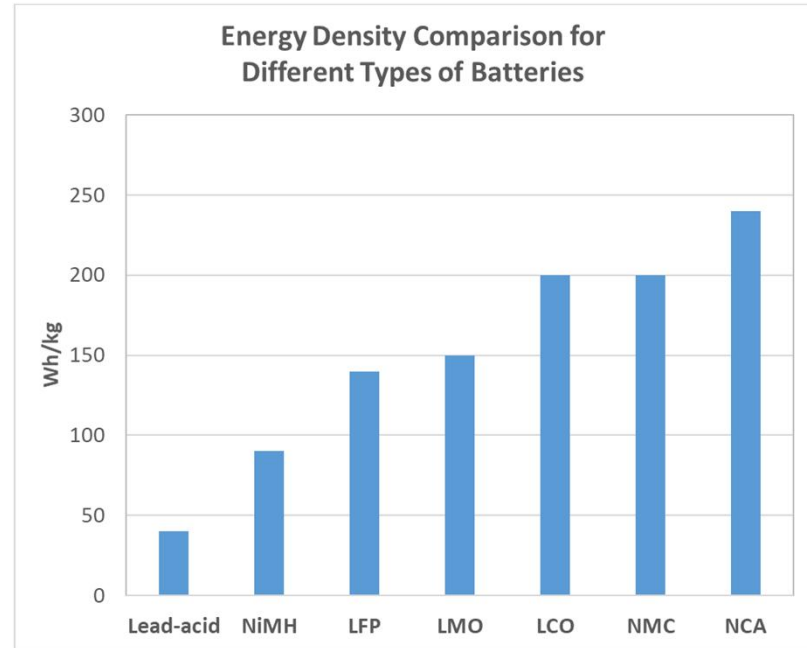
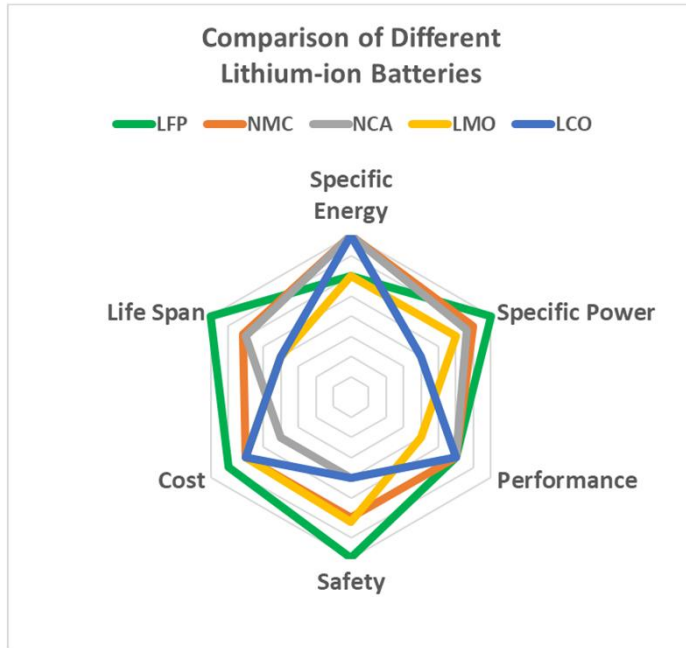


**EFORE**

**TRUSTED POWER PARTNER**

# Efore launches lithium-ion battery products for telecom applications in early 2021

# Lithium Iron Phosphate (LFP) Compared to Other Chemistries



# Comparison of Characteristics for Different Battery Types

Specifications	Lead-acid	LFP	NMC	NCA
Nominal voltage (V)	2	3.2	3.6 – 3.7	3.6 – 3.7
Typical operating range (V/cell)	1.6 – 2.4	2.5 – 3.6	2.5 – 4.2	2.5 – 4.2
Specific energy (Wh/kg)	30 – 50	90 – 150	150 – 220	200 – 260
Typical charge rate	0.1C	0.5C	0.5C	0.5C
Typical discharge rate	0.1-0.5C	1-2C	1-2C	1C
Charge temperature (°C)	-20 – 50	0 – 55	0 – 50	0 – 50
Discharge temperature (°C)	-20 – 50	-20 – 55	-20 – 50	-20 – 50
Cycle life (100%DOD)	200 – 300	1000 – 4000	500 – 2000	500 – 2000
Thermal runaway temperature (°C) and comment	100 – 150	270	210	150
	Plastic container softens and melts	Safe even when fully charged	High charge promotes thermal runaway	High charge promotes thermal runaway

# General Parameters of Efore 100Ah LFP Battery

## Efore IBUK-48/100 - 19" 4U Indoor Battery Unit



Lithium Chemistry	LFP (Lithium Iron Phosphate)
Nominal Voltage	51.2 V
Rated Capacity	100 Ah
Rated Energy	5120 Wh
Cycle Life	3000 @ 100%DOD
Maximum Charge Voltage	57.6 V
Maximum Charge Current	100 A
Charge Current Limit Function	20 A
Maximum Discharge Current	100 A
End of Discharge Voltage	40 V
Charge Temperature	0 °C to +55 °C
Discharge Temperature	-20 °C to +55 °C

# Key Features

- n Safety LFP is one of the safest chemistry (thermal stability) among different Li-ion batteries, e.g. NMC, NCA, LCO etc.
- n Long cycle life IBUK-48/100 has 3000 cycles for 100%DOD at room temperature, the best cycle performance among similar products in the market. More than 10 times compared to VRLA batteries.
- n High capacity 5120Wh, one of the highest capacities for 100Ah batteries.
- n Fast charging Maximum 1C charging for 100Ah, i.e. fully charged in one hour. The fastest among similar products in the market.
- n Cost effective Lower cost compared to other Li-ion batteries, e.g. NMC, NCA.
- n Conformity Compatible with telecom power systems and compliant with all relevant IEC and transportation standards.

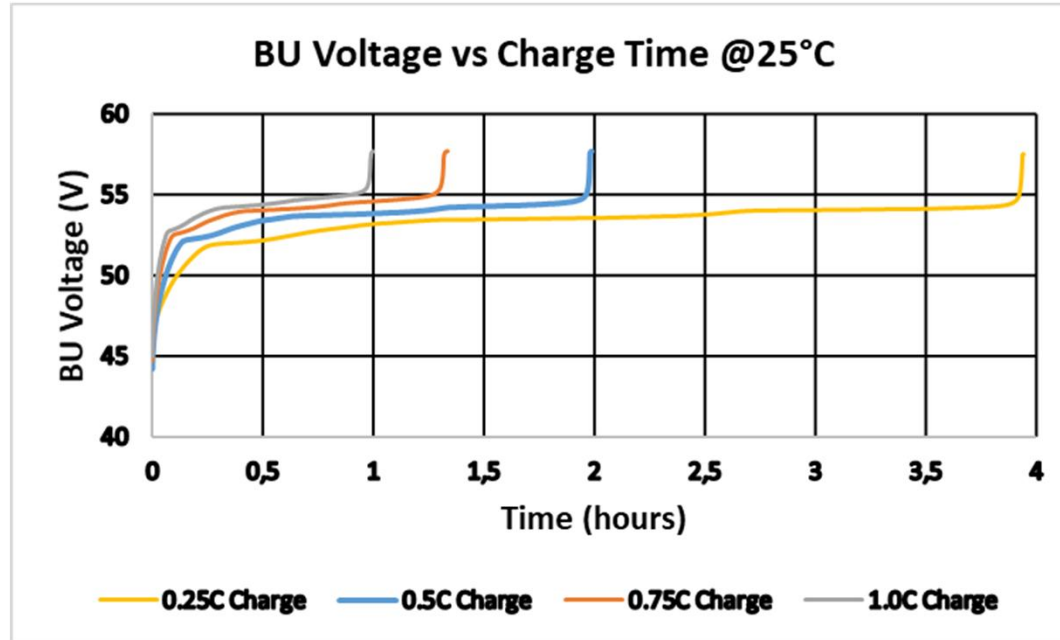
# Business Case for Cyclic Applications

Battery type	Capacity	Cycle number	Ratio of initial investment	Ratio of cost per cycle	Cost in 15 years (200 cycles/year)	Cost saving
VRLA 100Ah	4800Wh	200	1	0.5%	15	
Efore LFP 100Ah	5120Wh	3000	2.2	0.07%	2.2	582%
VRLA 190Ah	9120Wh	200	1	0.5%	15	
2x Efore LFP 100Ah	10240Wh	3000	2.4	0.08%	2.4	525%

## Note:

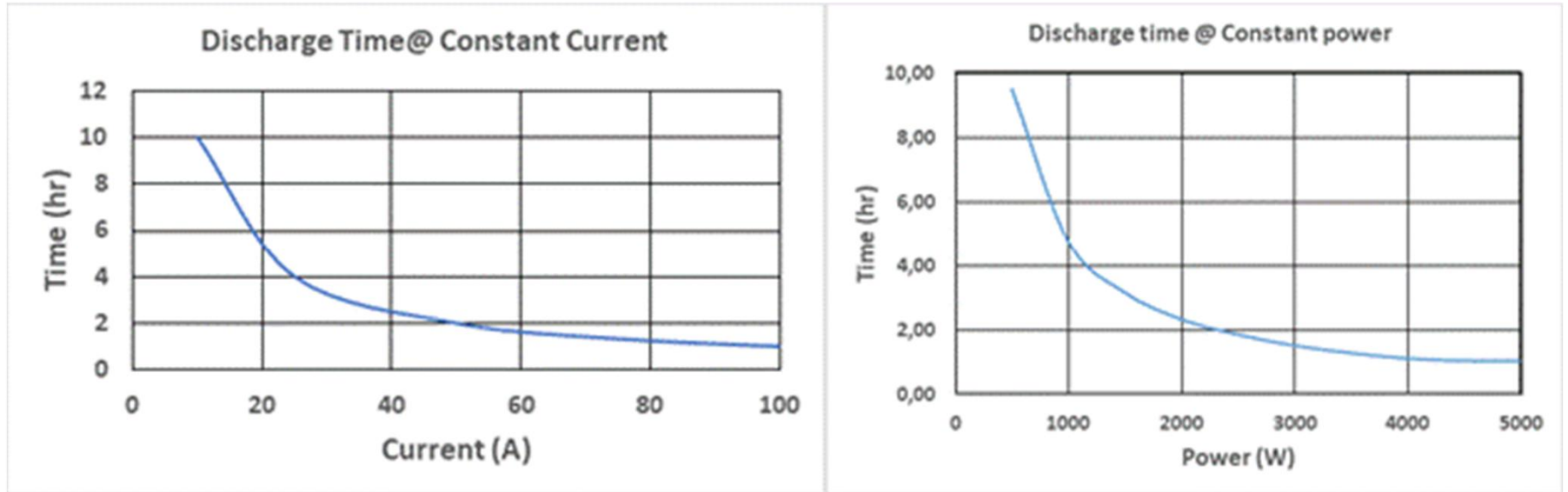
- § Assuming that initial investment for VRLA (valve regulated lead-acid) batteries is 1.
- § Cost saving is calculated by the cost difference in 15 years.
- § Besides lower cost, the Efore LFP battery also has many more technical advantages such as fast charging, high power discharge, lower weight and smaller footprint.
- § The comparison is done under ideal operational conditions (around 25°C). The actual performance of batteries may vary under different operational conditions such as high temperature. In this case, however, the service life of VRLA batteries would suffer more compared to LFP batteries.

# Charge Profile





# Discharge Profile



# SOC vs. Battery Voltage During Discharge

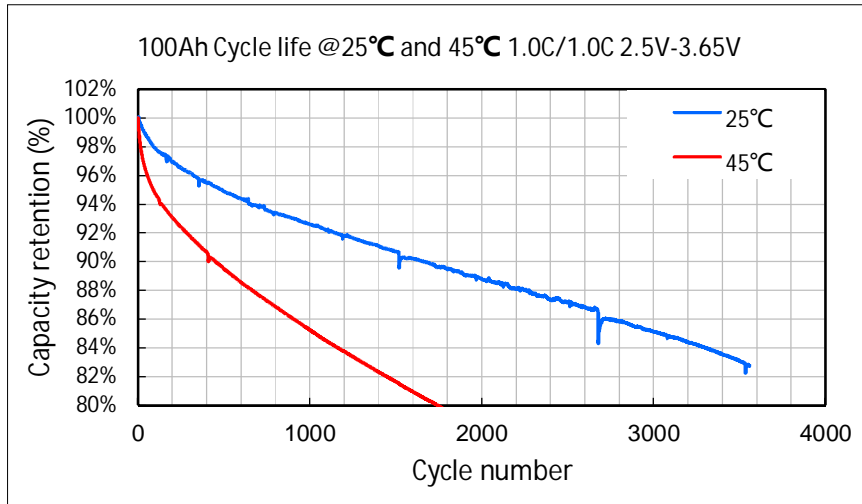
SOC (%)	Voltage (V)			
	0.25C	0.5C	0.75C	1C
100	56.366	55.028	54.281	54.241
90	52.608	52.165	51.700	51.331
80	52.537	52.079	51.590	51.202
70	52.359	51.882	51.387	50.990
60	52.026	51.614	51.165	50.728
50	51.934	51.513	51.036	50.525
40	51.833	51.377	50.873	50.356
30	51.507	51.048	50.556	50.015
20	51.018	50.562	50.079	49.526
10	50.326	49.886	49.406	48.892

# Discharge Time vs. Battery Voltage During Discharge

Battery Voltage (V)	Discharge Time (min)			
	0.25C (25A)	0.5C (50A)	0.75C (75A)	1C (100A)
50.0	225	104	65	42
49.0	230	114	75	52
48.0	234	116	76	57
47.0	236	117	77	57
46.0	238	118	78	58
45.0	239	119	79	59
44.0	240	119	79	59
43.0	241	120	80	60

# Battery Cycle Life

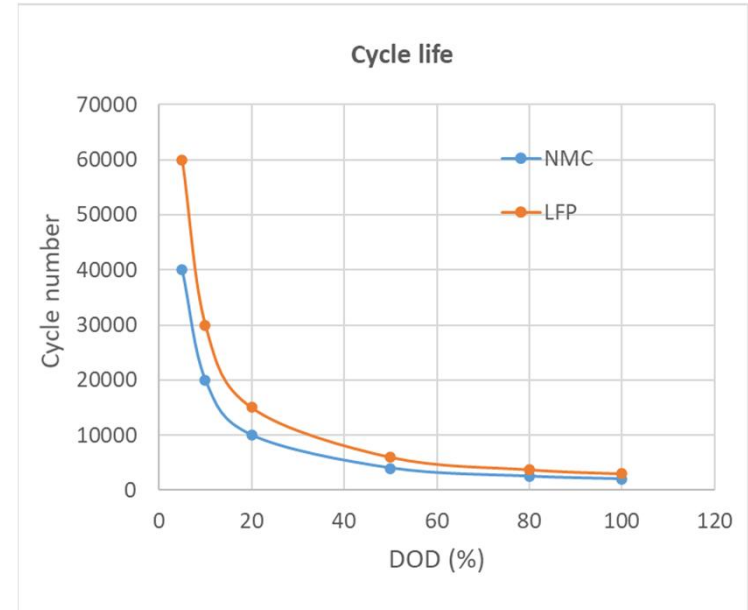
## Cycling test



Cycle number @100%DOD

LFP 3000

NMC 2000



# Compliant with Standards

- n IEC 62619 Safety cells/batteries for industrial applications
- n IEC 62368-1 Electrical safety
- n ETSI 300 386 EMC, safety
- n CE RoHS Directive 2011/65/EU
- n UN 38.3 Test report for transportation

# Efore Cabinets

Outdoor Equipment Cabinet  
Model: OSPK-A30L



Indoor Integrated Cabinet  
Model: ISPK-B80L



Indoor Integrated Cabinet  
Model: ISPK-B40M



# New Products

Efore also offers an outdoor li-ion battery and an integrated power and battery product:

## § Outdoor pole/wall mounted battery unit OBUK-48/50

Capacity	50Ah, 2650 Wh
Voltage	57.6V – 40.0 V
Temperature	-40 °C to +55 °C
Weight and IP	26.5 kg, IP65

## § Outdoor pole/wall mounted micro power 3kW with battery backup MPSK-4860 (coming soon)

Max. Power	3000 W
Standard voltage	57.6 V
Current output	40 A (x4)
Battery backup	50 Ah (LFP)
Weight and IP	15 + 26.5 kg, IP65





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