

Going Electric with Material Handling Equipment

Material handling equipment industry, electric forklift operations and what to expect when trying to electrify with your material handling equipment fleet.



Speaker -
Robert Bond
VP of Sales & Marketing
Tri-Lift Industries Inc



Tri-Lift Industries and Electrification

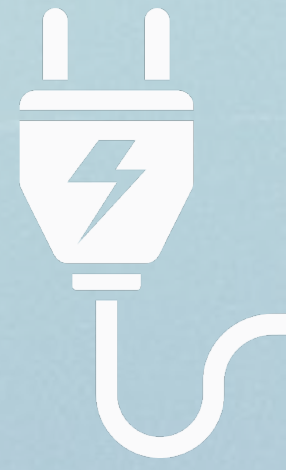
Tri-Lift Industries is a market leader in material handling equipment electrification efforts through deployment of electric forklift technology. Assisting companies with their efforts in fleet electrification for decades.

Who?/What? Tri-Lift Industries, Material handling equipment, market impact, future of material handling.

Goal Creating a pathway to sustainable material handling equipment that will drive a safer work environment, reduced carbon footprint and directly impact the bottom line.



Material Handling Equipment and N.C.



Market Size

North Carolina is one of the largest markets in the United States when it comes to forklift orders/ships. Manufacturing and distribution companies in North Carolina have tremendous cost exposure due to market mix of equipment and other factors.

Market Opportunity

A large portion of the material handling equipment in North Carolina is LP Gas or Diesel fuel driven. A focus on electric material handling equipment could save North Carolina based manufacturers hundreds of millions of dollars per year.

TLI and Programs for Conversion

Tri-Lift Industries (TLI) is a family business with a passion of our people and our mission, vision, and values. The idea of converting material handling equipment to electric can be daunting but there are numerous programs available to help companies through the process.



Primary I.C. Forklift Cost Drivers



Fuel Costs

In North Carolina, the average price per gallon of LP gas is between \$0.93-\$1.79 (Bulk/Wholesale) and the average price per gallon of diesel is \$4.18 as of 8/1/22. Fuel costs are one of the largest cost points for most forklift fleets.

Maintenance Costs

Maintenance costs on internal combustion equipment are inherently higher due to the higher wear and tear on equipment generated by all of the moving parts as well as the heat generated from engines.

Safety Costs

Emissions, warehouse safety, equipment safety, and employee/pedestrian safety costs are soft costs that can be hard to get a good grasp on but they can be huge cost drivers.



Electric Forklift Options



Lead Acid

Most common option for current market electric material handling equipment. Good option but has drawbacks to consider based on overall application and usage needs. Consider - runtime, charging, storage, maintenance, watering, support, lifecycle, and disposal needs.

Drop-In Lithium

Drop-in lithium battery solutions for material handling equipment are becoming more common. Currently there are options from several third party providers to fit into most major material handling equipment brands. Consider – chemical make up, voltage, kilo-watt capacity, charge/discharge rates, warranty, support, product ratings, and price.

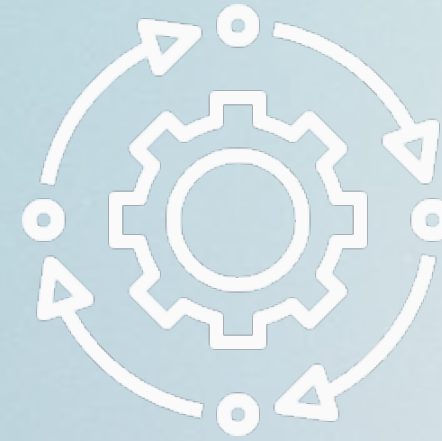
Integrated Lithium Iron Phosphate

Integrated lithium solutions are packages of material handling equipment where the forklift, the battery, and the charger are all manufactured by the same company so items are married perfectly. There is only one truly integrated lithium forklift currently available (BYD) but other third party-O.E.M. partnerships exist.

Notes:

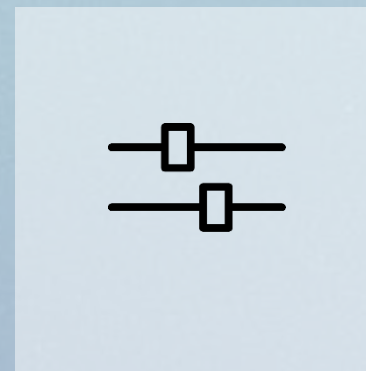
There are a number of different chemical compounds available when it comes to lithium batteries. The current market leading technology is lithium iron phosphate from BYD. The BYD LiFePO₄ battery differs chemically from the typical Lithium Cobalt Oxide (LiCoO₂) or Lithium Manganese Oxide and is thoroughly tested for safety.

Process



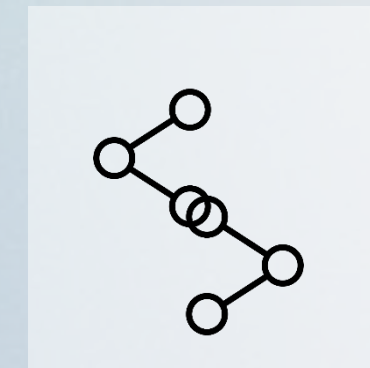
01. Survey/Document

Application survey, process documentation, justification building, and proposal construction.



02. Implement/Adjust

Equipment control implementation, process adjustments, service/support design, planning for next steps.



03. Connect and deploy

Control data used to create a plan for fleet conversion with financial justification across the board.



What to Expect

Planning

Going to electric material handling equipment doesn't need to be difficult but taking the time to properly plan for the transition and what it will mean for business is key to success. Charging location, equipment end of life planning, warehouse space configuration, etc.

Training

Operationally, electric material handling equipment functions the same as internal combustion but there will be a learning curve. Management must be onboard with the transition and make sure use and charging guidelines are followed.

Culture Shift

A culture shift must occur for a successful transition to electric. Opportunity charging equipment during breaks and lunches is required for optimal performance.

Savings

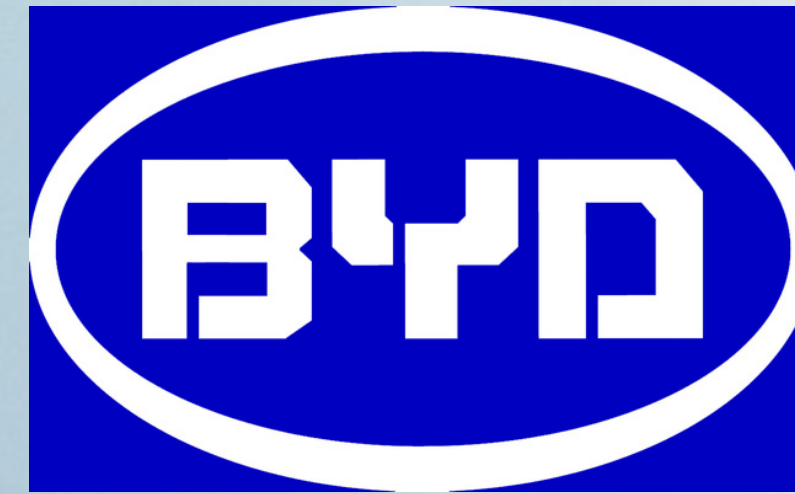
Like most things, it takes money to make money. Or in this case, to save money. Going to electric material handling equipment requires an upfront investment that generates long term returns. Most fleet return schedules average less than 24 months depending on fleet size, application, and runtime hours.



Recommendation - BYD



TRI-LIFT
INDUSTRIES



BYD Family of Products

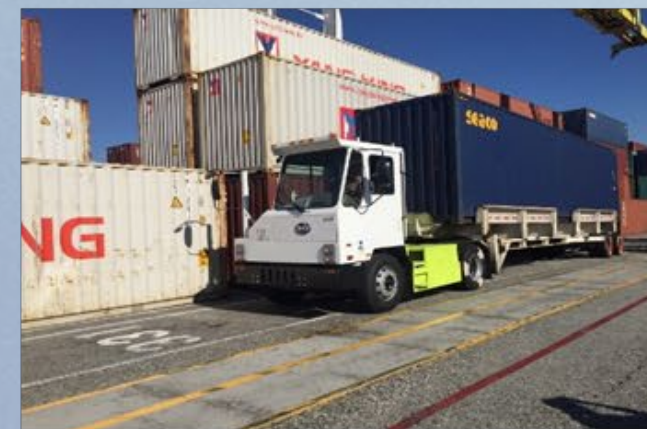
On-Road



MHE



Specialty



BYD Product Certifications

- ✓ QC/T 743
- ✓ UL 1642
- ✓ UL 2580
- ✓ UN 38.3
- ✓ UL 1973
- ✓ ISO 12405*
- ✓ IEC 62660*
- ✓ SAND 2005*

CERTIFICATE OF COMPLIANCE

Certificate Number: 20131230-MH47890
Report Reference: MH47890-20131227
Issue Date: 2013-DECEMBER-30

Issued to: BYD CO LTD
BAOLONG INDUSTRIAL TOWN
1 BAO PING RD LONGGANG SHENZHEN
GUANGDONG 518116 CHINA

UL 2580

COMPONENT - BATTERIES FOR USE IN ELECTRIC VEHICLES
USR Component, Electric Vehicles Battery Pack, Model(s): Pack

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL2580, the standard for batteries for use in electric vehicle
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Recognized Component Mark should be considered as being covered by UL's Recognition and Follow-Up Service.

The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark **UL** may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Recognized Component Mark on the product.

William R. Gray
Vice President, Global Services Certification Program
UL LLC

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CERTIFICATE OF COMPLIANCE

Certificate Number: 20121010-MH27673
Report Reference: MH27673-20090316
Issue Date: 2012-OCTOBER-10

Issued to: BYD CO LTD
YAN AN RD
LONGGANG, KUICHONG
SHENZHEN
GUANGDONG 518119 CHINA

UL 1642

COMPONENT - LITHIUM BATTERIES
Secondary, Lithium-ion cells, FP223496AP, FP223496P, FP223496A, FP223496T, FP223496PT, FP263470T, FP1880100T, FP261003765, FP58146410A

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: Safety for Lithium Batteries, UL 1642
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Recognized Component Mark should be considered as being covered by UL's Recognition and Follow-Up Service.

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William R. Gray
Vice President, Global Services Certification Program
UL LLC

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CERTIFICATE OF COMPLIANCE

Certificate Number: 20140821-MH60227
Report Reference: MH60227-20140731
Issue Date: 2014-AUGUST-21

Issued to: BYD CO LTD
BAOLONG INDUSTRIAL TOWN
1 BAO PING RD LONGGANG
SHENZHEN, GUANGDONG 518116 CHINA

UL 1973

Component - Batteries For Use In Light Electric Rail and Stationary Applications
Components - Battery Modules for Use in Stationary Applications Models C12_45I and C12_45T

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 1973 - Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Recognized Component Mark should be considered as being covered by UL's Recognition and Follow-Up Service.

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William R. Gray
Vice President, Global Services Certification Program
UL LLC

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Page 1 of 12 Pages
No. RZJ2013-3641

检验报告
TEST REPORT

UN 38.3

NAME OF SAMPLE: Li-ion Battery
产品名称: 锂离子电池

CLIENT: Huizhou BYD Battery Co., Ltd
委托单位: 惠州比亚迪电池有限公司

CLASSIFICATION OF TEST: Commission Test
检验类别: 委托测试

Vkan Certification & Testing Co., Ltd.

报告编号: QJ1301103013

试验报告

QC/T 743

产品名称: 磷酸铁锂电池
产品型号: FADMOZ315
受检单位: 惠州比亚迪电池有限公司
检验类别: 强制性检测

北方汽车质量检验检测鉴定试验所

PRODUCT CERTIFICATE

No.: CQC1301000001

NAME AND ADDRESS OF THE APPLICANT
Huizhou BYD Battery Co., Ltd
Wengchun Road, Shaohe, Huizhou, Guangdong, China

NAME AND ADDRESS OF THE MANUFACTURER
Huizhou BYD Battery Co., Ltd
Wengchun Road, Shaohe, Huizhou, Guangdong, China

ADDRESS OF THE FACTORY
Huizhou BYD Co., Ltd, Economic Development Zone, Shaohe, Huizhou, Guangdong

NAME, MODEL AND SPECIFICATION
Battery
FADMOZ315/磷酸铁锂电池

THE STANDARDS AND TECHNICAL REQUIREMENTS FOR THE PRODUCTS
QC/T743.2008

CERTIFICATION MODEL
Type Testing of Product + Initial Factory Inspection + Follow-up Factory Inspection

This is to certify that the above mentioned products have met the requirements of certification under QC/T743.2008.

Date of Issue: Mar 27, 2013 Date of expiry: Mar 27, 2015
Validity of this certificate is subject to positive result of the regular follow-up inspection by issuing certification body until the expiry date.

President: Wang Xujun

CHINA QUALITY CERTIFICATION CENTRE
Southern 4th 188, Nanshan Road, Beijing 100070 P.R. China
http://www.cqc.com.cn

SHENZHEN HUATONGWEI INTERNATIONAL INSPECTION Co., Ltd.

Declaration of Conformity

Certificate No. JCTE 13-000076 RUC: 37661
Issued Date: Nov 6, 2013

In accordance with the following Applicable Directives:
2004/109/EC
Electromagnetic Compatibility

The device, as described herein, was tested pursuant to applicable test procedures and complies with the requirements of
EN 61000-6-3, EN IEC 61010-1, EN IEC 61010-2-101, EN 61010-2-102, EN 61010-2-103

The test results are in accordance to the international or national standards.
Applicant: Huizhou BYD Battery Co., Ltd
Shaohe Road, Shaohe, Huizhou, Guangdong

Manufacturer: Huizhou BYD Battery Co., Ltd
Shaohe Road, Shaohe, Huizhou, Guangdong

EUT Name: Lithium Ion Battery
Model number: C12_45I
Listed Model(s): -

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
402, Huaqiangbei 2nd Road, Huaqiang North, Shenzhen, China
Tel: 86 755 26764000 Fax: 86 755 26764001
http://www.cqh.com.cn E-mail: cqh@qh.com.cn

Note:
This certificate is only valid for the equipment and configuration described in accordance with the test data. Any change in the design or configuration of the equipment or the manufacturer, after installation of the equipment, may affect the conformity of the equipment with the requirements of the standards.

For and on behalf of:
Shenzhen Huatongwei International Inspection Co., Ltd.
Authorized by: *Tong Jiang*

Clear-View Mast



Great visibility through the mast; The low profile front cowl also provides enhanced forward visibility.

Larger Operator Assist Grips



Designed to meet diverse operator needs.

Soft Lowering



Give operators speed control of the heaviest and lightest loads.

Clean & Easy Charging



No acid vapor released during the charging process.

Optional Fingertip Controls

Optional fingertip controls increase productivity and reduce operator fatigue.



Dual 3-Phase AC Brushless Motors

Weather proof dual 3-phase AC brushless motors; produce high power and torque and allow greater maneuverability.



Iron-Phosphate Battery

BYD's world leading Iron-Phosphate Battery is green, long-lasting and the most reliable battery that can withstand the toughest working conditions.



Solid Pneumatic Tire

Solid pneumatic tires are ideal for even the harshest terrains.



LOWEST OPERATING COSTS

\$ >50%

Lower operating costs as compared to diesel, gas or lead acid forklifts

EXCELLENT TEMPERATURE PERFORMANCE

🌡️ -40°C to +60°C

Normal use when the temperature is between -40°C to +60°C. At -40°C, the discharging rate of the iron battery remains over 60%, WHEREAS LEAD-ACID IS ALMOST 0.

LONG LIFE

📈 4,000+

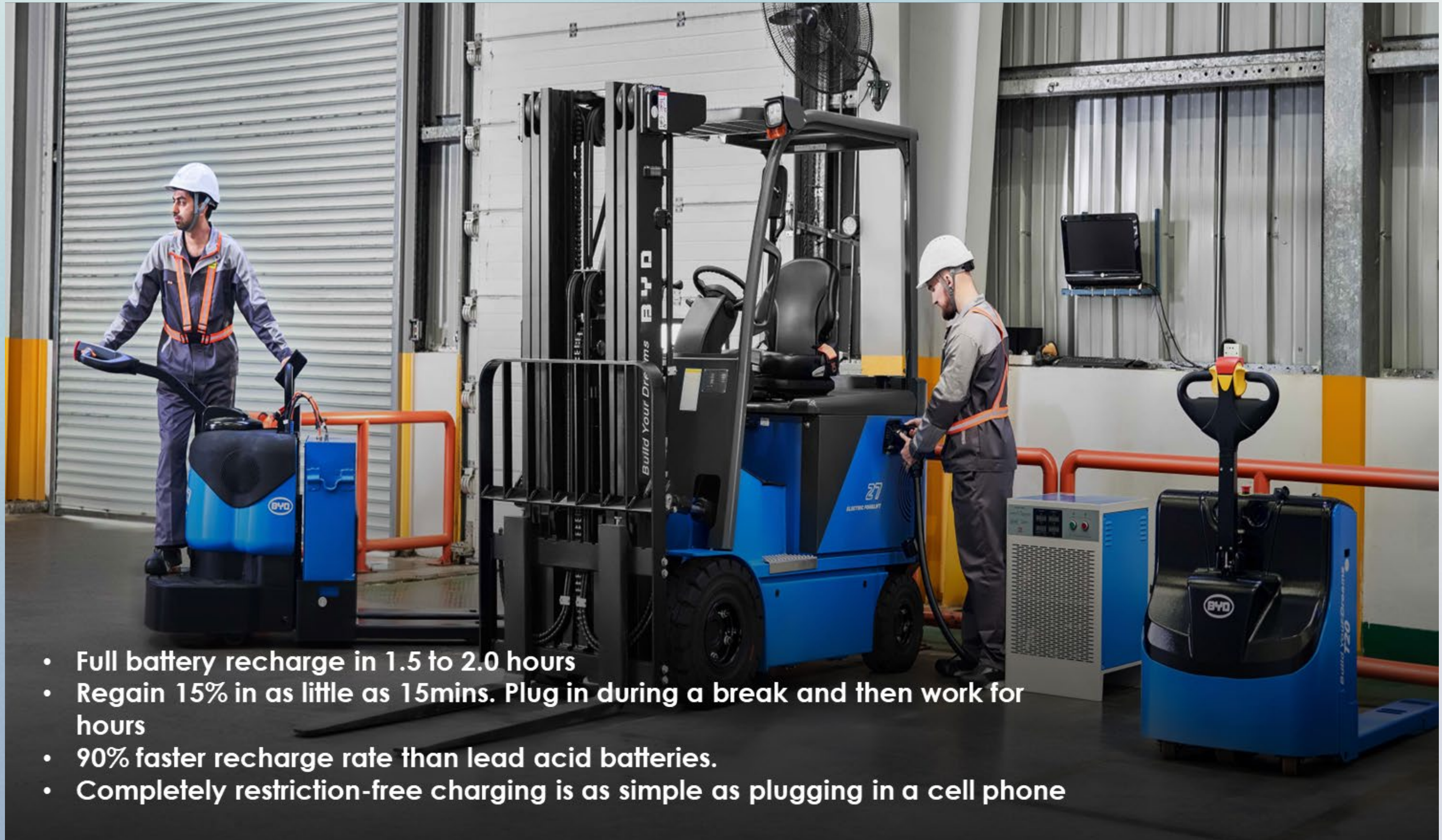
After 4,000 cycles, the battery retains 80% of its original capacity. 4,000 cycles mean around 12 years' operation, considering once a day charging.

EXCELLENT ROI AND PAYBACK

\$ Superior ROI and Payback as compared to any other forklift technology.

After 4,000 cycles, the battery retains 80% of its original capacity. 4,000 cycles mean around 12 years' operation, considering once a day charging.

Ultrafast, Unlimited Recharging



- Full battery recharge in 1.5 to 2.0 hours
- Regain 15% in as little as 15mins. Plug in during a break and then work for hours
- 90% faster recharge rate than lead acid batteries.
- Completely restriction-free charging is as simple as plugging in a cell phone

MORE POWER



**BYD's Chemistry-Density-and 80 volt Platform combined =
More Power and Runtime and faster charging cycles
PERIOD!**

- 240AH X 80 VOLT = 19.2 KWH**
- 460AH X 80 VOLT = 36.8 KWH**
- 540AH X 80 VOLT = 43.2 KWH**
- 600AH X 80 VOLT = 48.0 KWH (2018)**



LITHIUM COMPETITORS

- | | |
|-----------------------------------|-----------------------------------|
| 240AH X 48 VOLT = 11.5 KWH | 240AH X 36 VOLT = 8.64 KWH |
| 460AH X 48 VOLT = 22.1 KWH | 460AH X 36 VOLT = 16.6 KWH |
| 540AH X 48 VOLT = 25.9 KWH | 540AH X 36 VOLT = 19.4 KWH |

NOTE: KWH = AH X VOLTAGE DIVIDED BY 1000

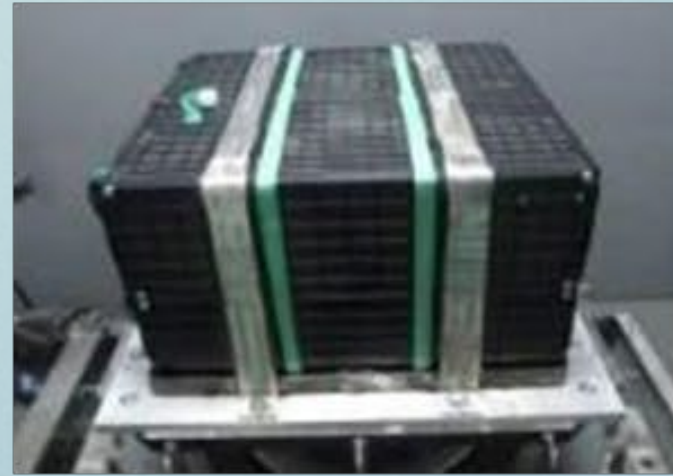
LiFePo4 Comparison

Safe, Stable, Sustainable Chemistry

BYD batteries put to the test



Batteries still operational after these tests. No damage to the modules and no leaks, ruptures, or fires.



Vibration Testing
10-2000 Hz range, 8hrs



Thermal Testing
-40°C to 85°C, 5 cycles of 6 hrs each



Salt Spray (simulate ocean or road salt)
56 continuous days

No fires or explosions in any of the following tests



Short Circuit
Bypassed protections



Crush Testing
100kN force



Piercing



Collision Testing
Different speeds



Oven



Fire simulation
1 hr



Gas flame
continuous engulfing





TRI-LIFT

INDUSTRIES



Converting material handling equipment to electric power can be a very rewarding process. Business profits as well as employee safety and overall quality of life will improve dramatically in the long run. Tri-Lift Industries is providing free application surveys, safety audits, and entire fleet Return on Investment studies for local businesses, free of charge. Contact information below or ask for a copy of this presentation.

866-393-9833

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Email