



IFDA 2023 SOLUTIONS CONFERENCE

The Premier Event for the Food Distribution Community

Lithium-ion batteries

A new ingredient to boost material handling efficiency in the food industry

Presented by

MHI's Advanced Energy Council



Jinger McPeak

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Ethium by Econtrols



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UgoWork

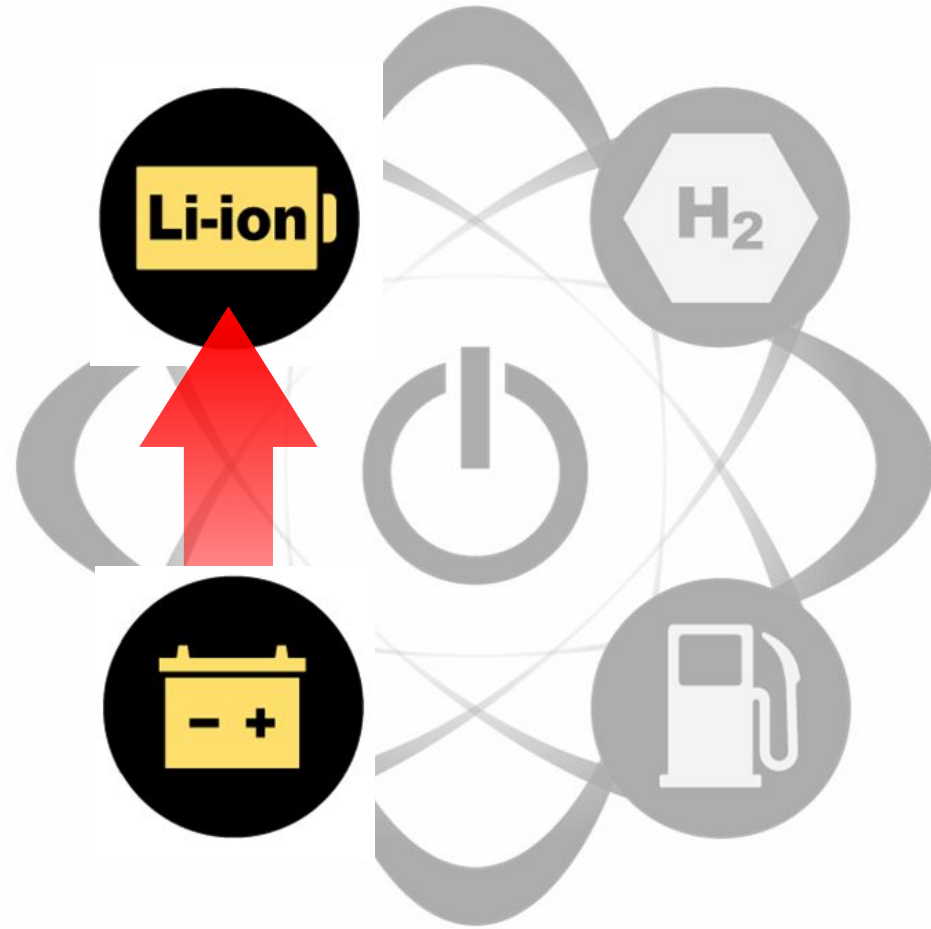
AGENDA

- Industrial Lift Truck Landscape
- MHI & Advanced Energy Council
- Lithium 101
 - *What is a lithium-ion battery*
 - *Safety*
 - *Temperature control*
 - *Data possibilities*
 - *Recycling*
 - *Pros and cons*
- Vehicle Integration
- Impacts of lithium-ion transition
 - *Return on investment | ROI*
 - *Energy savings*
- Lithium-ion conversion checklist

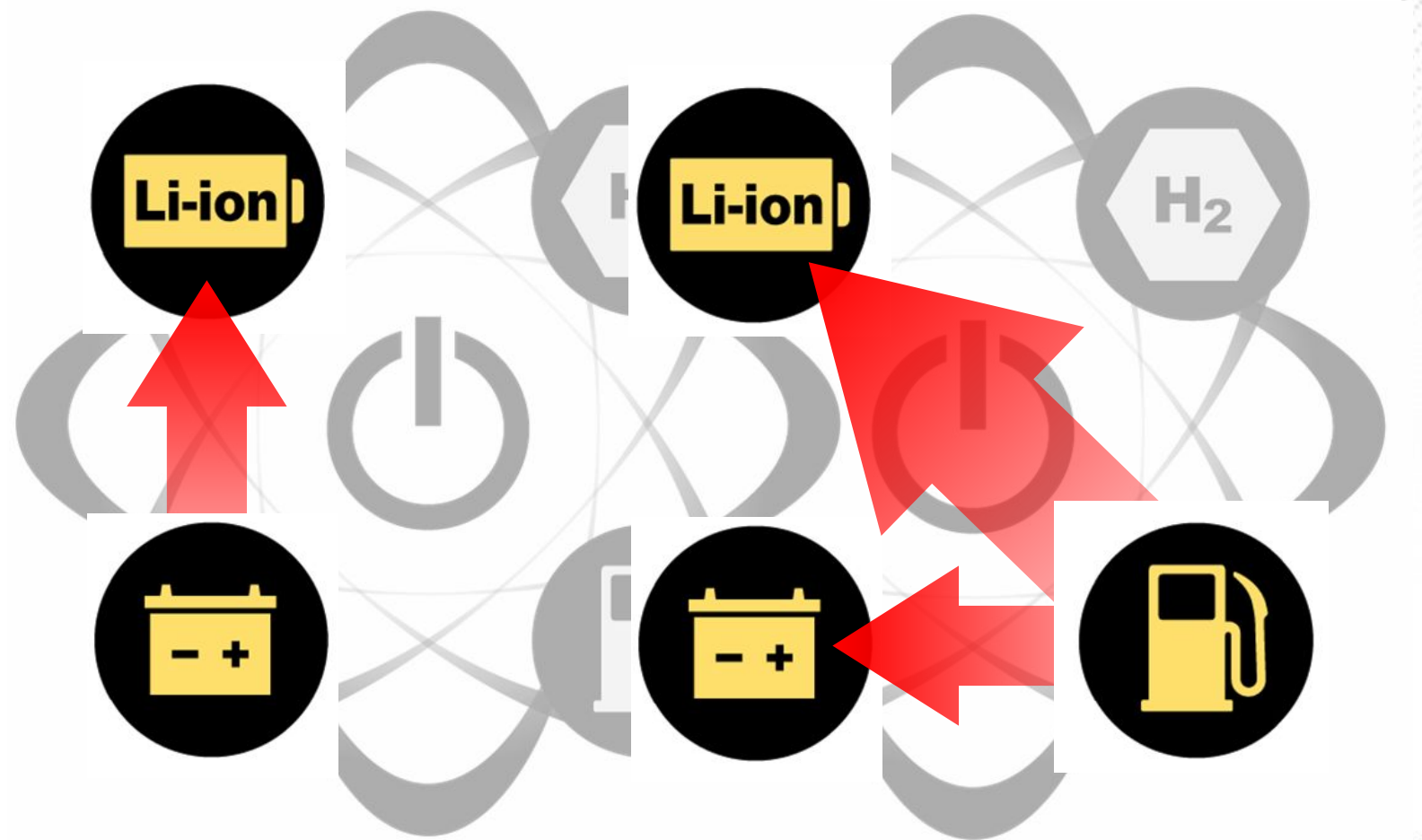


Industrial Lift Truck Landscape

Motive Power



Motive Power Electrification





ELECTRIC

1

COUNTERBALANCE
ELECTRIC



2

NARROW
AISLE



3

MOTORIZED
PALLET



Electric Warehouse
Lift Trucks!



I.C.E.

4

CUSHION
(INDOOR)



5

PNEUMATIC
(OUTDOOR)

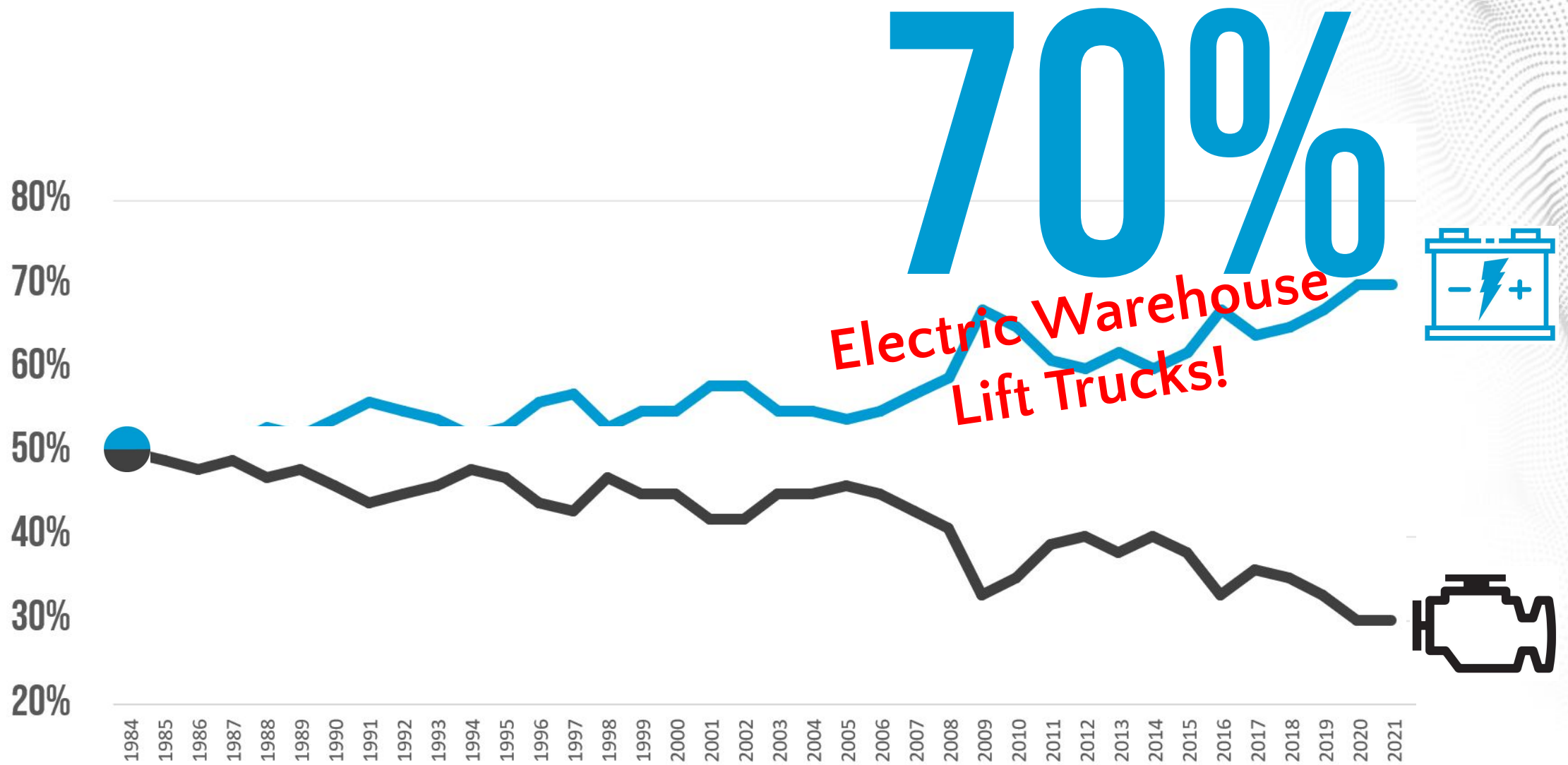




1984



Source: ITA factory order sales (percentage numbers are rounded and do not reflect the state of the market today)



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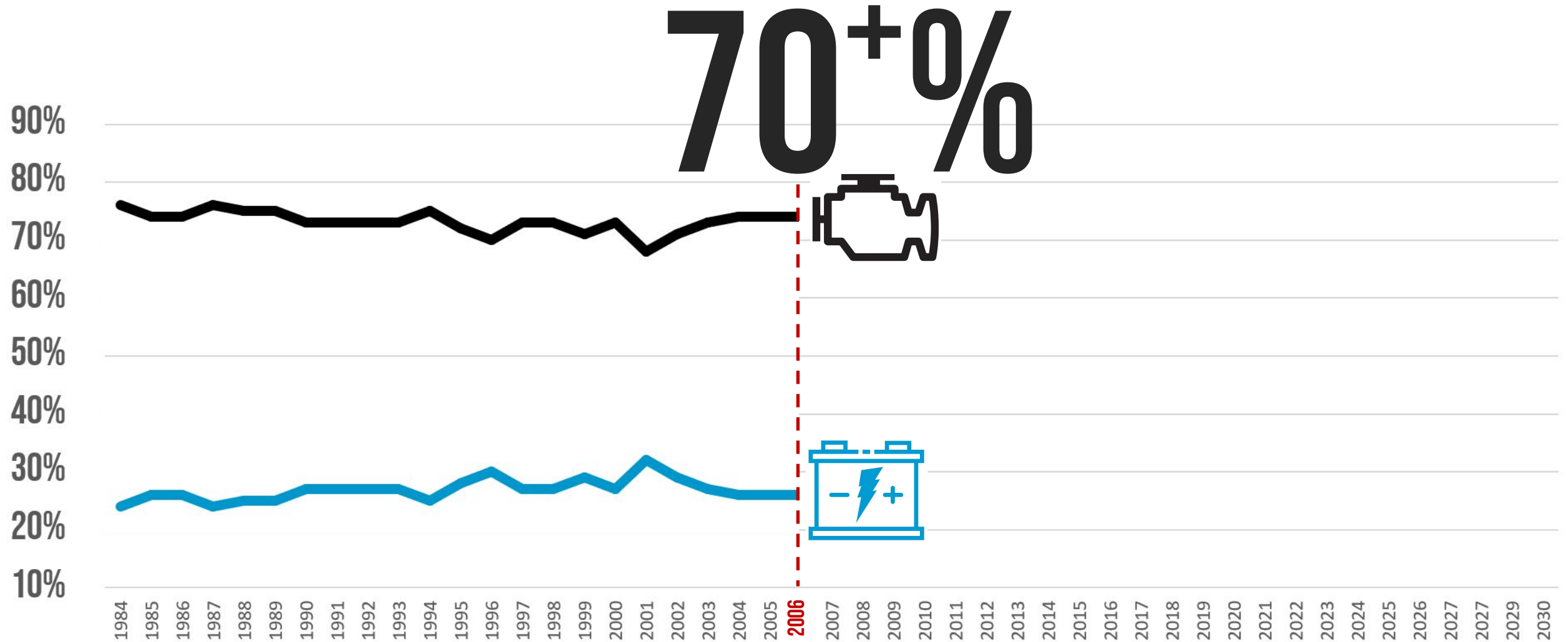


5

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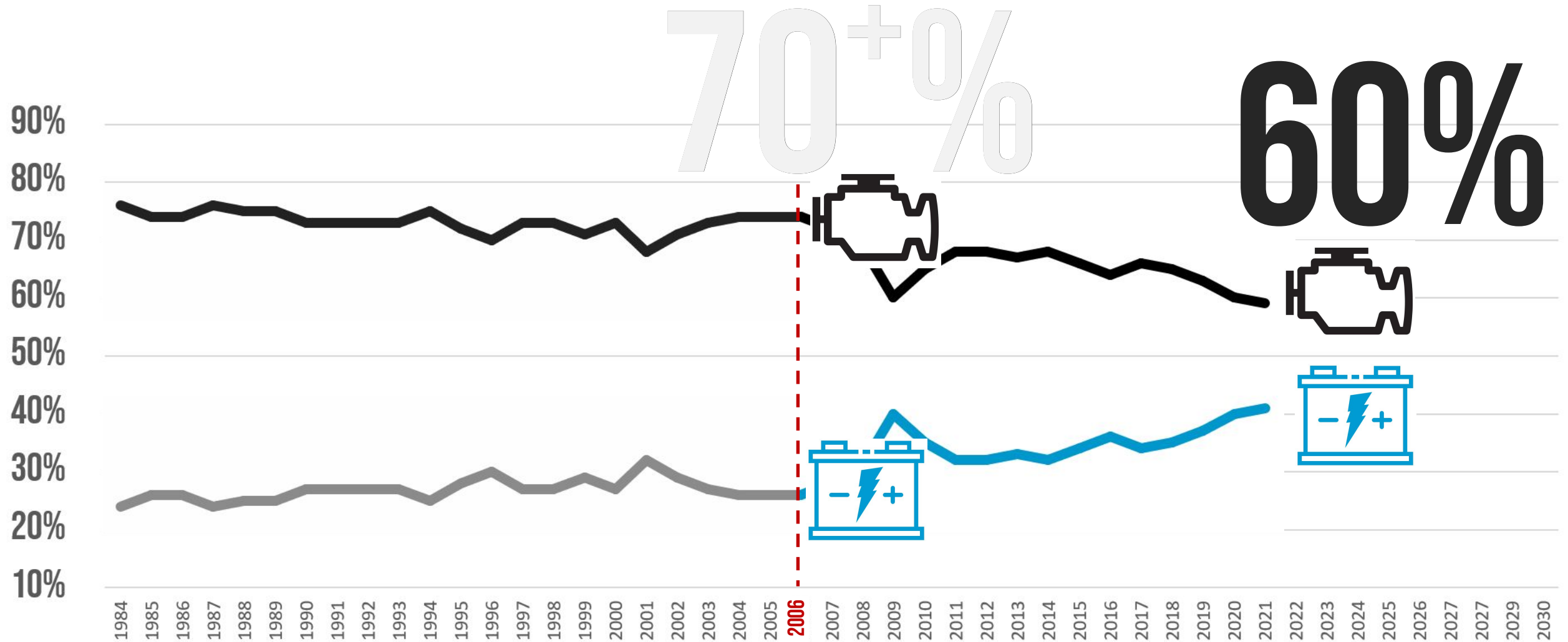


SIT DOWN COUNTERBALANCE MARKET



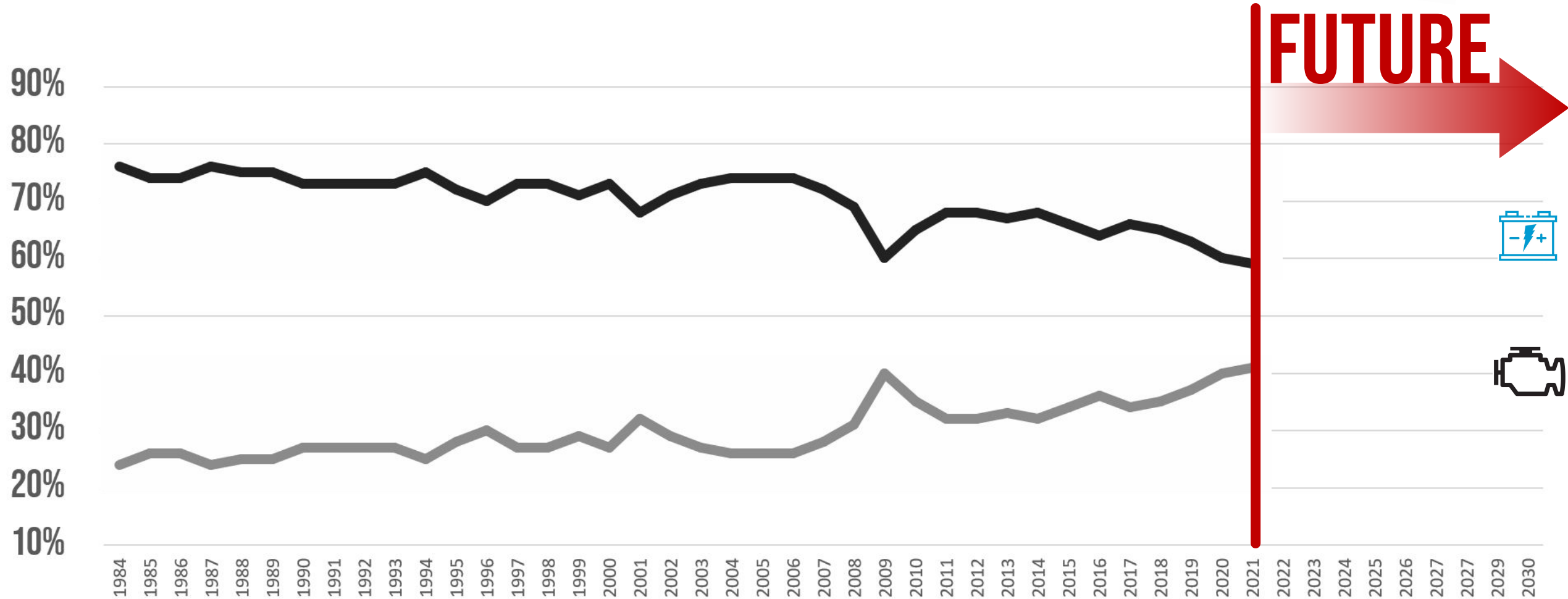
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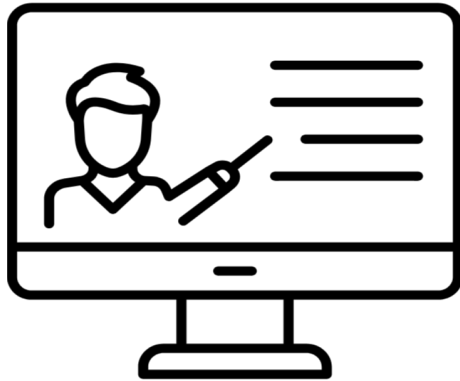


Source: ITA factory order sales (percentage numbers are rounded and do not reflect the state of the market today)

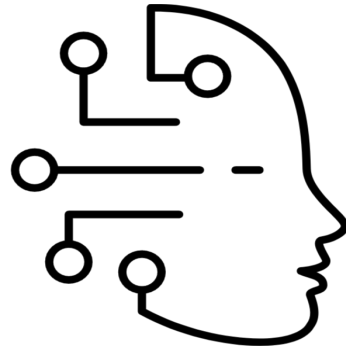
MHI and Advanced Energy Council



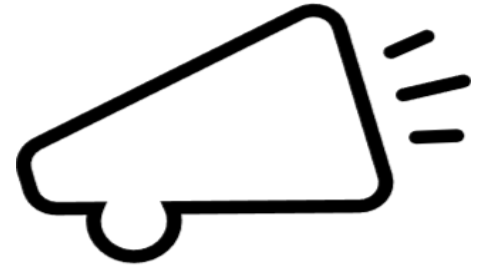
Education



Expertise



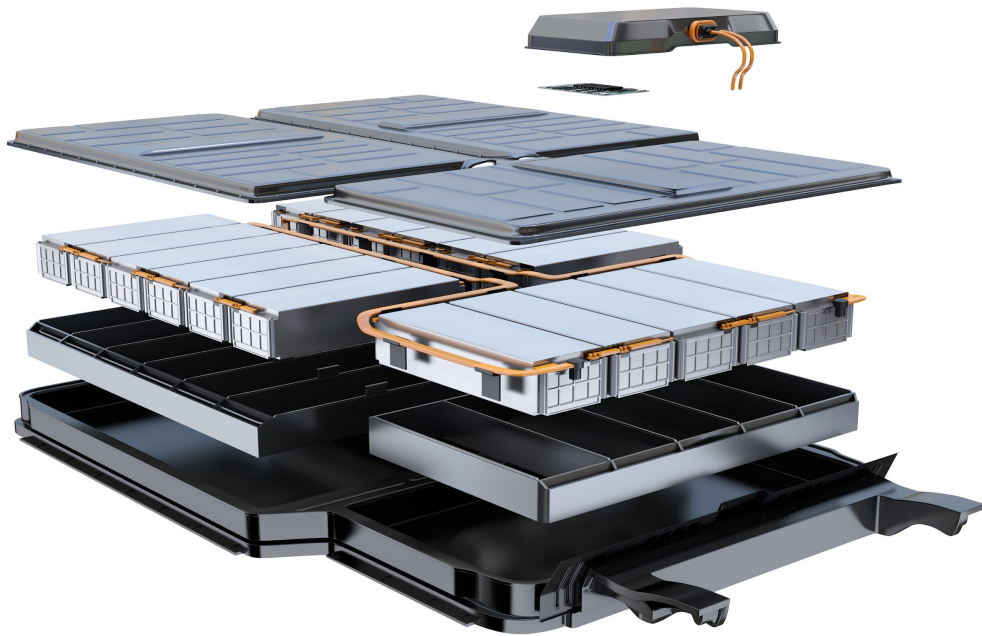
Promotion



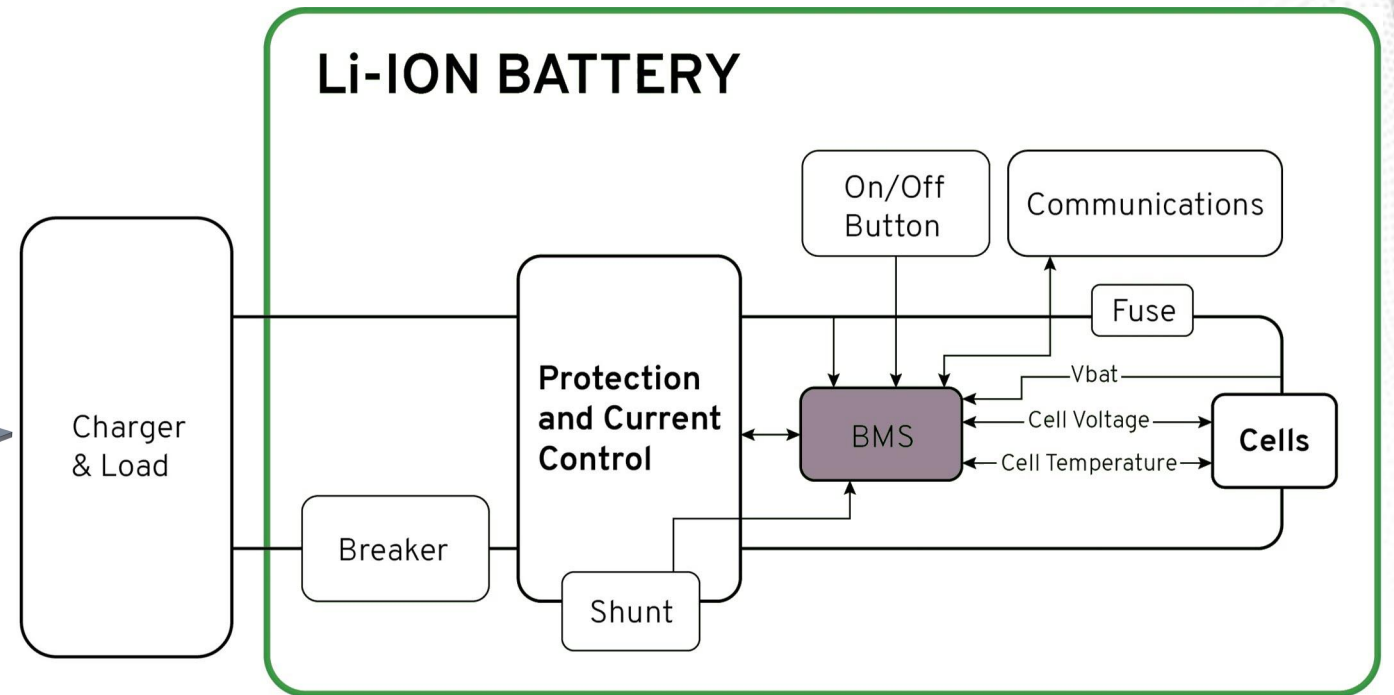


Lithium 101

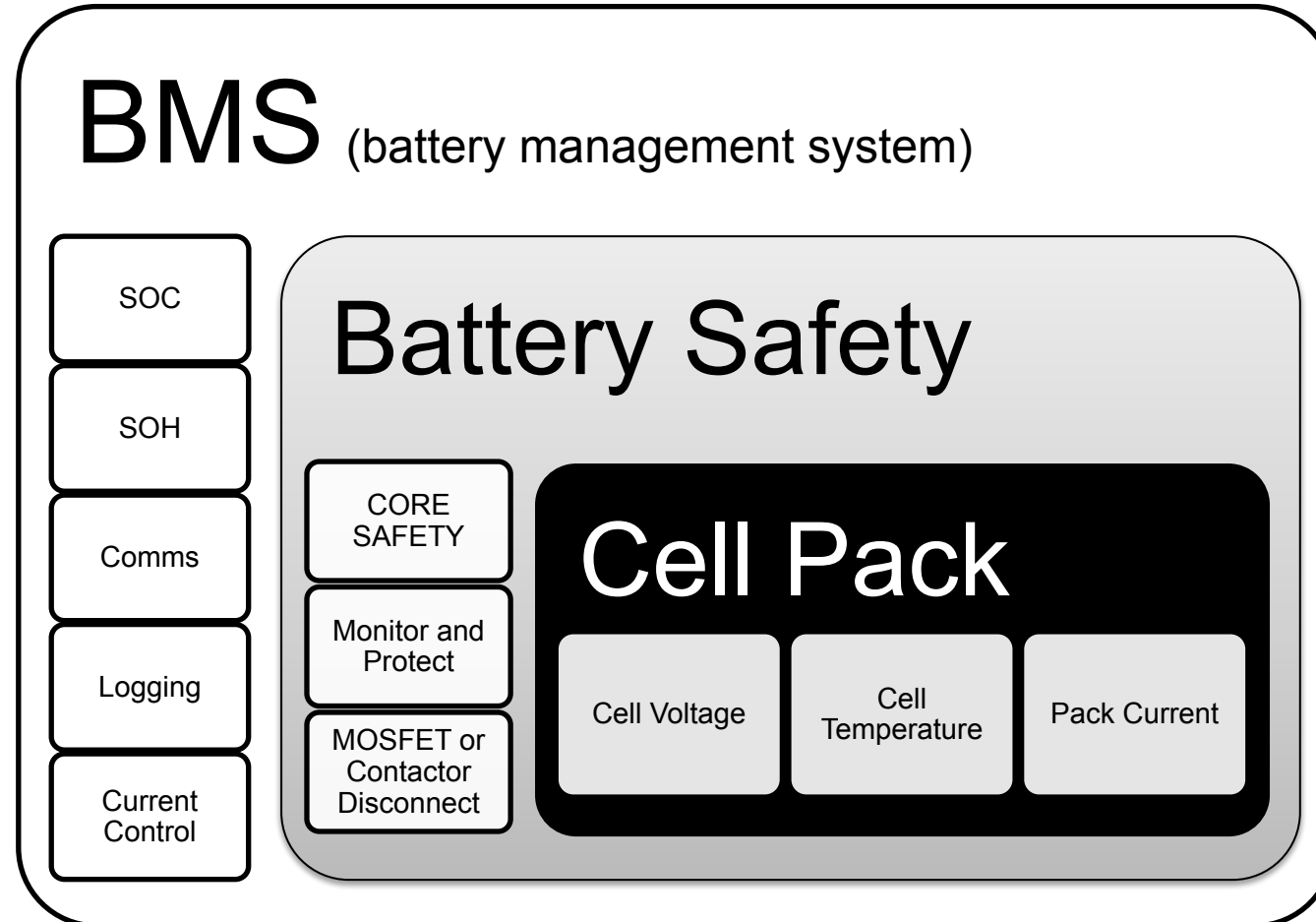
Lithium 101 | What is a lithium-ion battery



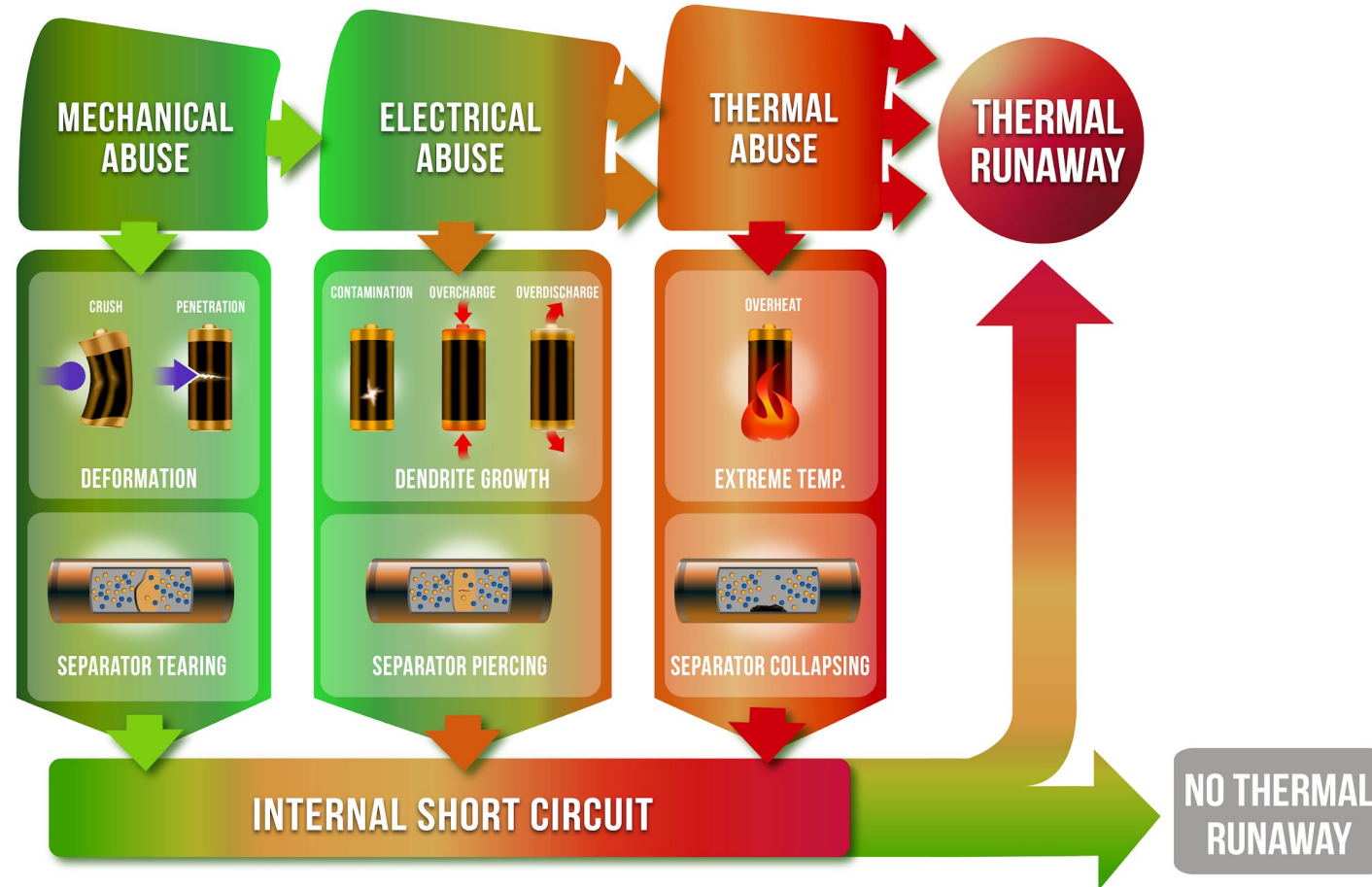
Ex. Battery pack



Lithium 101 | What is a lithium-ion battery



Lithium 101 | Safety

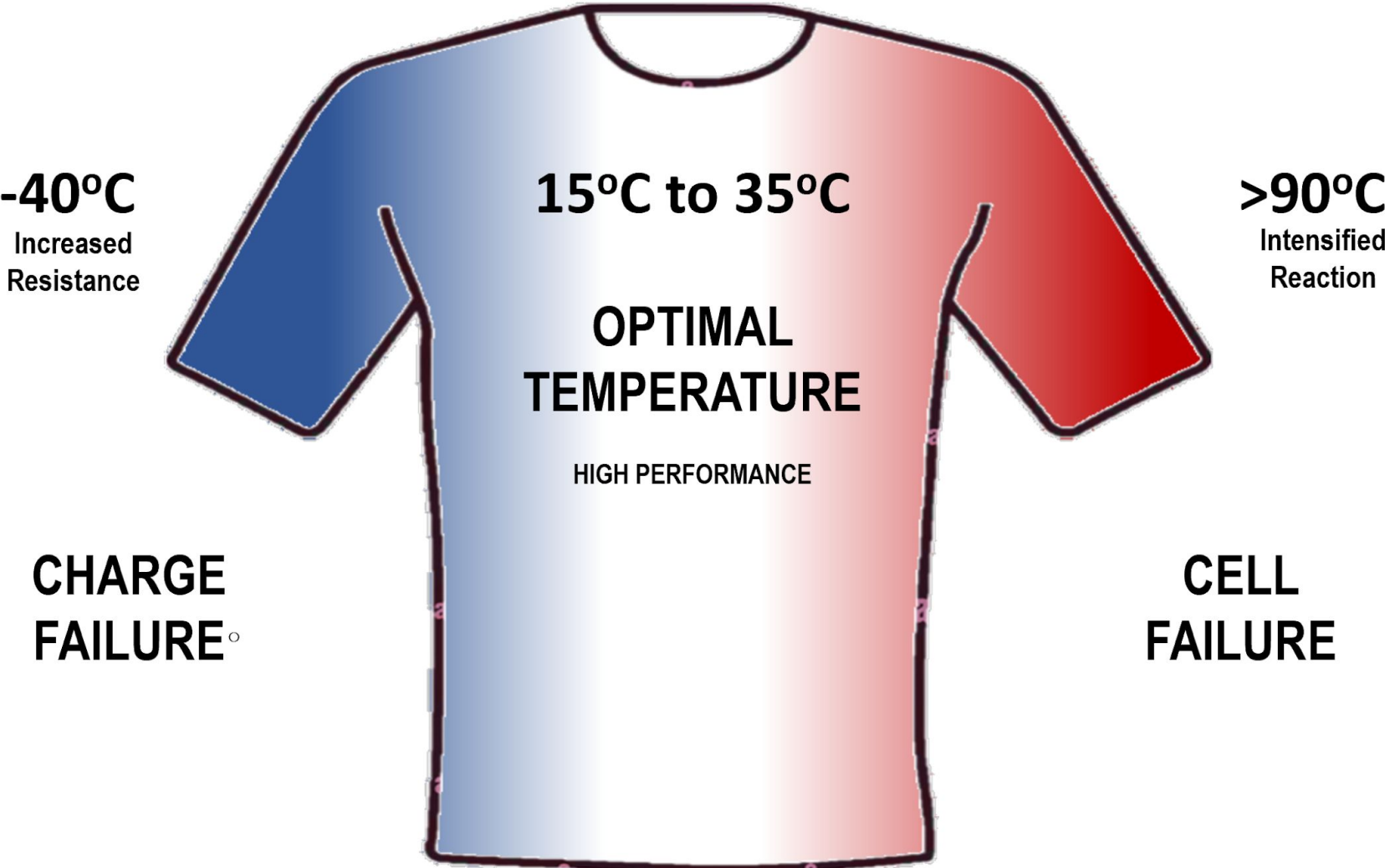


Lithium 101 | Third party certification

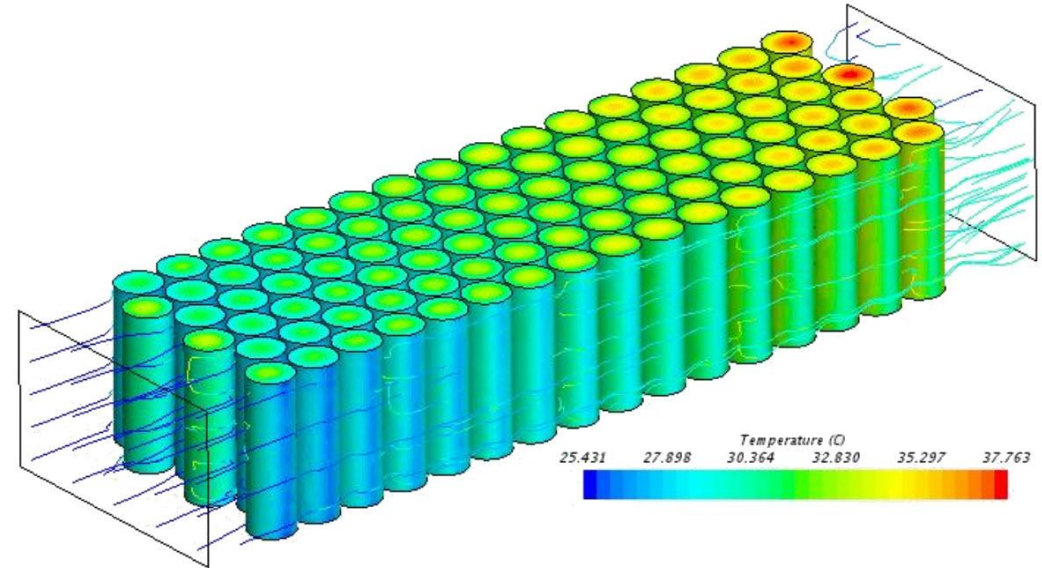
Example Tests	
Short Circuit	Electrical
Overcharging	
Overdischarge	
Imbalance Charging	
Dielectric Voltage Withstand	
Isolation Resistance	
Temperature	
Continuity	
Internal Short Circuit	
Failure of Cooling / Thermal Stability System	
Crush	Mechanical
Vibration	
Drop Impact/Shock	
Strain Relief (Cords)	
Handle Loading	
Temperature Cycling	Environmental
Immersion	
Salt Spray	
External Fire Exposure	
Internal Fire Exposure	



Lithium 101 | Temperature management



Lithium 101 | Temperature management



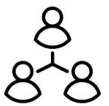
Lithium 101 | On-Board Data Acquisition



Real-Time Data



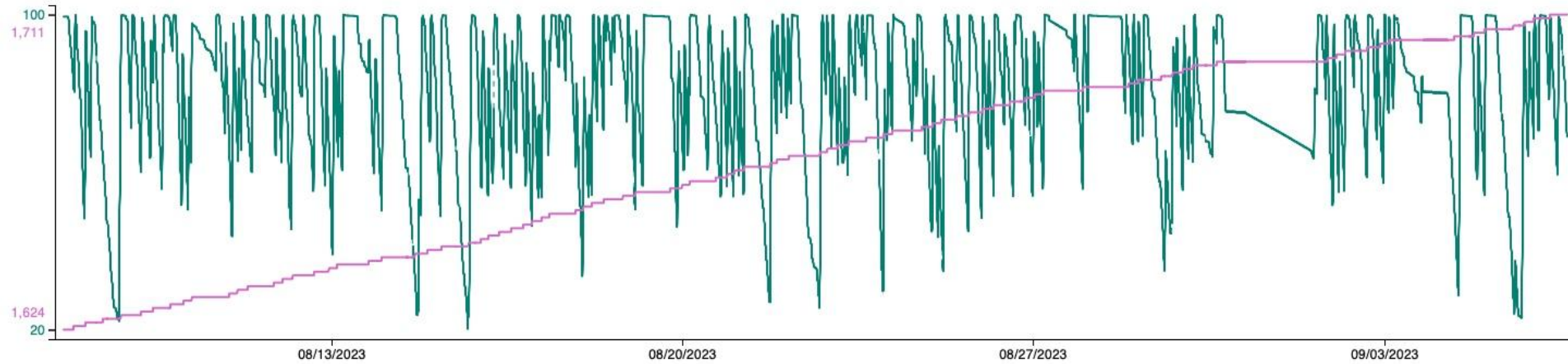
Fleet Management



Shift & Employee Incentivization/Shift Management



Lithium 101 | On-Board Data Acquisition



Timeline*
30 Days

Enter a date range*
8/7/2023 - 9/6/2023



Set Schedule

	Total (30 day(s))	Avg Daily	Avg Weekly	Avg Monthly
Avg SOC %	80.2	80.2	80.2	80.2
Max SOC %	100.0	100.0	100.0	100.0
Min SOC %	20.0	20.0	20.0	20.0
Cycle Count	87.0	2.9	20.3	87.0
Plug-in Count	148	5	35	148
Charge Time	3d 14h	2h 52m	20h 7m	3d 14h
Discharge Time	15d 20h	12h 40m	3d 16h	15d 20h
Extended Idle Time ?	8d 19h	7h 3m	2d 1h	8d 19h
Idle Time ?	1d 6h	1h 1m	7h 10m	1d 6h
Brief Idle Time ?	10h 33m	21m 6s	2h 27m	10h 33m
Fully Charged Idle Time ?	3d 3h	2h 31m	17h 38m	3d 3h
Avg Charge Amps	439.9	439.9	439.9	439.9
Avg Discharge Amps	99.5	99.5	99.5	99.5
Amp Hours Charging	37942.3	1264.7	8853.2	37942.3
Amp Hours Discharging	37854.8	1261.8	8832.8	37854.8

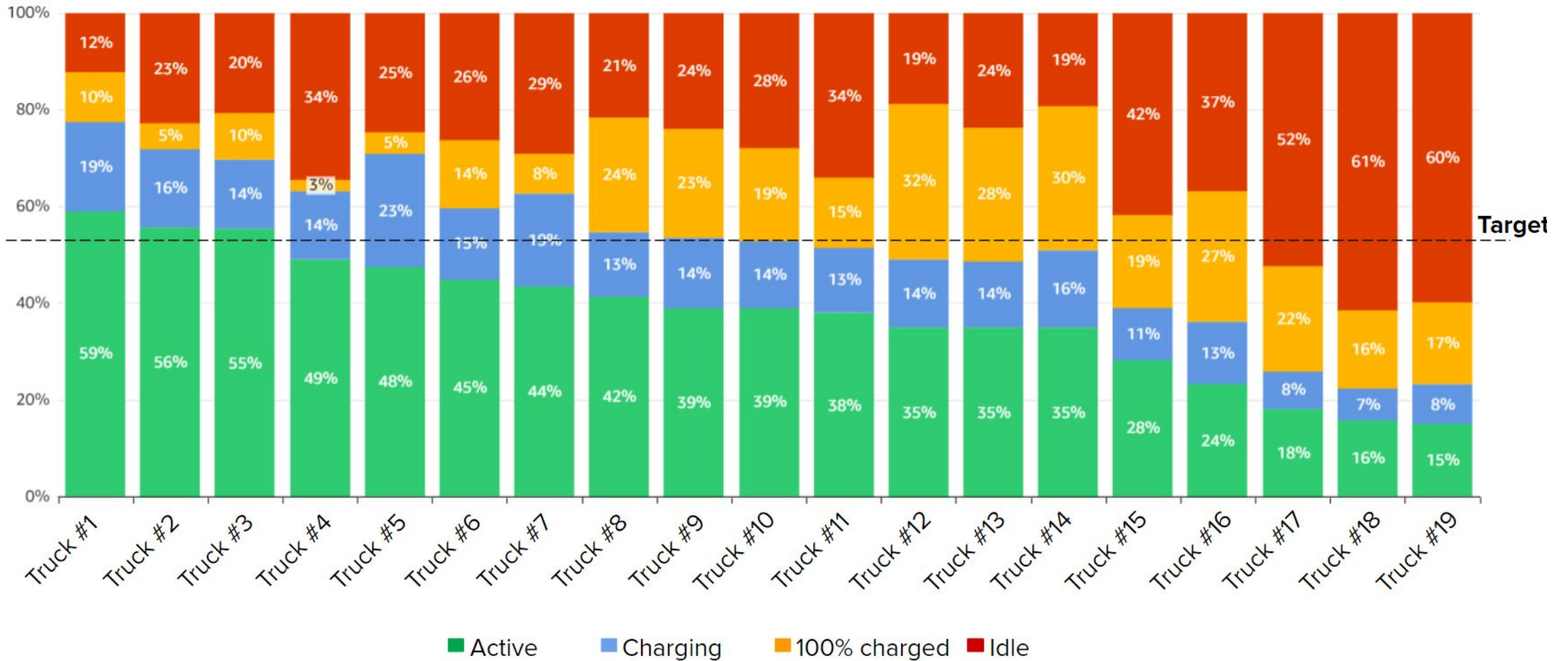
Showing analytics based on data from 8/7/23, 3:44:52 PM to 9/6/23, 3:44:52 PM

* extrapolated data ?

Export

Lithium 101 | | On-Board Data Acquisition

Day shift activity analysis - Sector X



Lithium 101 | Recycling and repurposing, is it a thing?

MONTREAL and DETROIT, Sept. 22, 2022

GM and **Lithion** Announce an Investment and Strategic Partnership Agreement to Pursue a Circular EV Battery Ecosystem



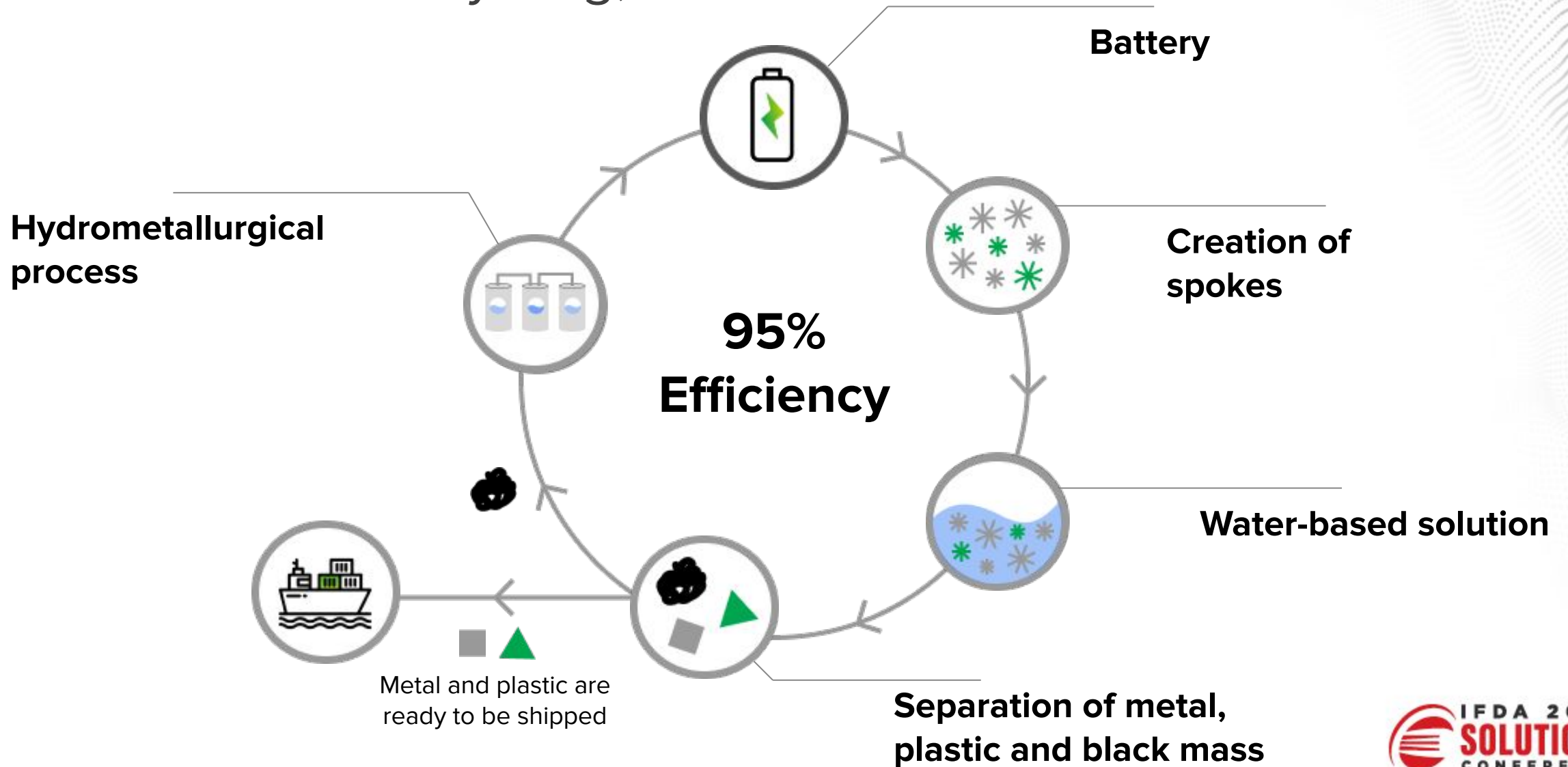
BAAR, Switzerland, May 5, 2022

Glencore and **Li-Cycle** announce innovative partnership to advance circularity in battery raw material supply chains

GLENCORE



Lithium 101 | Recycling, how it works



Lithium 101 | Pros vs lead-acid



Temperature
management



up to **71%**
more efficient



up to **5x**
faster charging



Low
maintenance



up to **5x**
longer lifetime



Higher recycling
value



Lithium 101 | Cons vs lead-acid



**Upfront
cost**



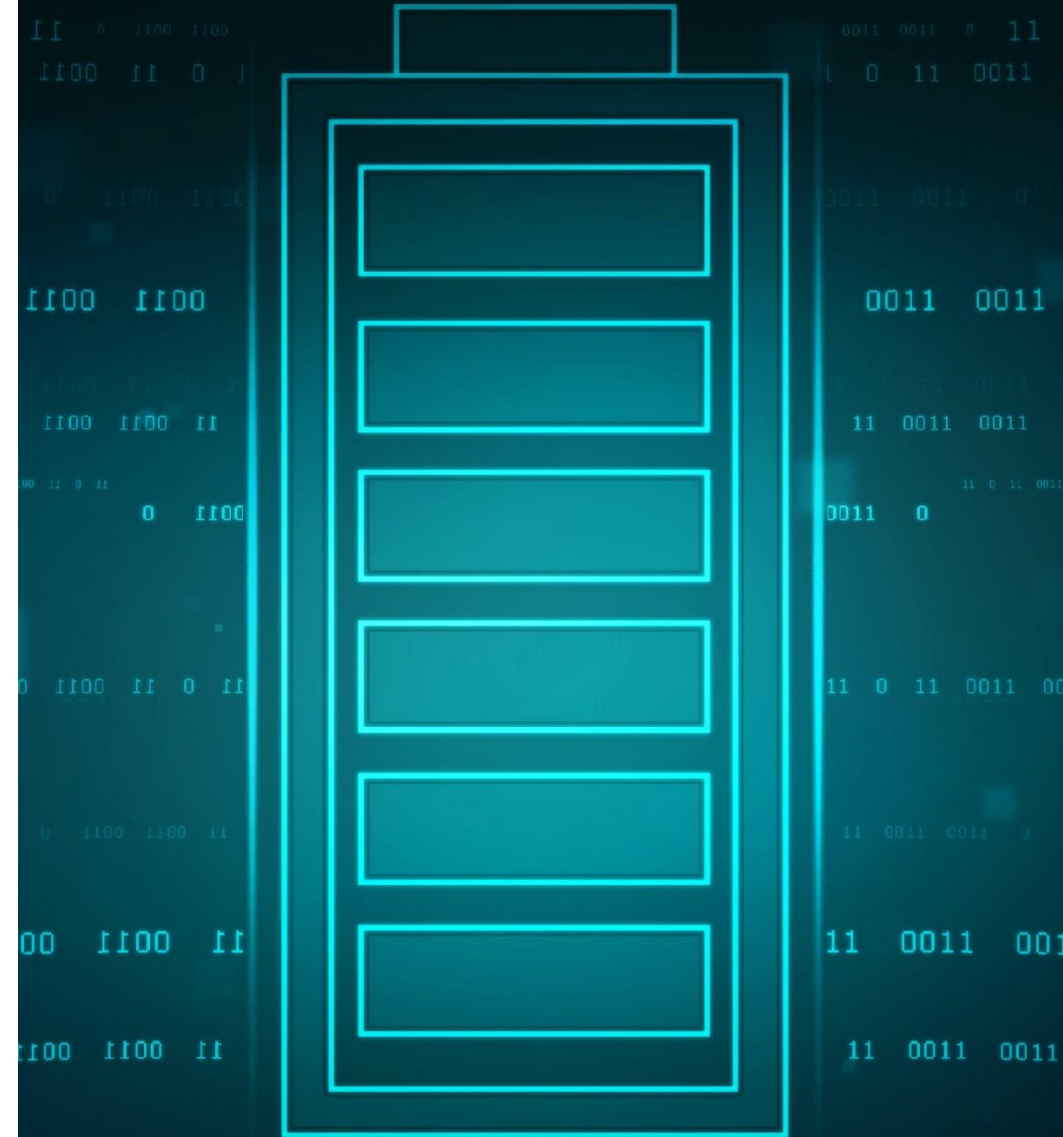
**Monitoring
requirement**



**Change
management**

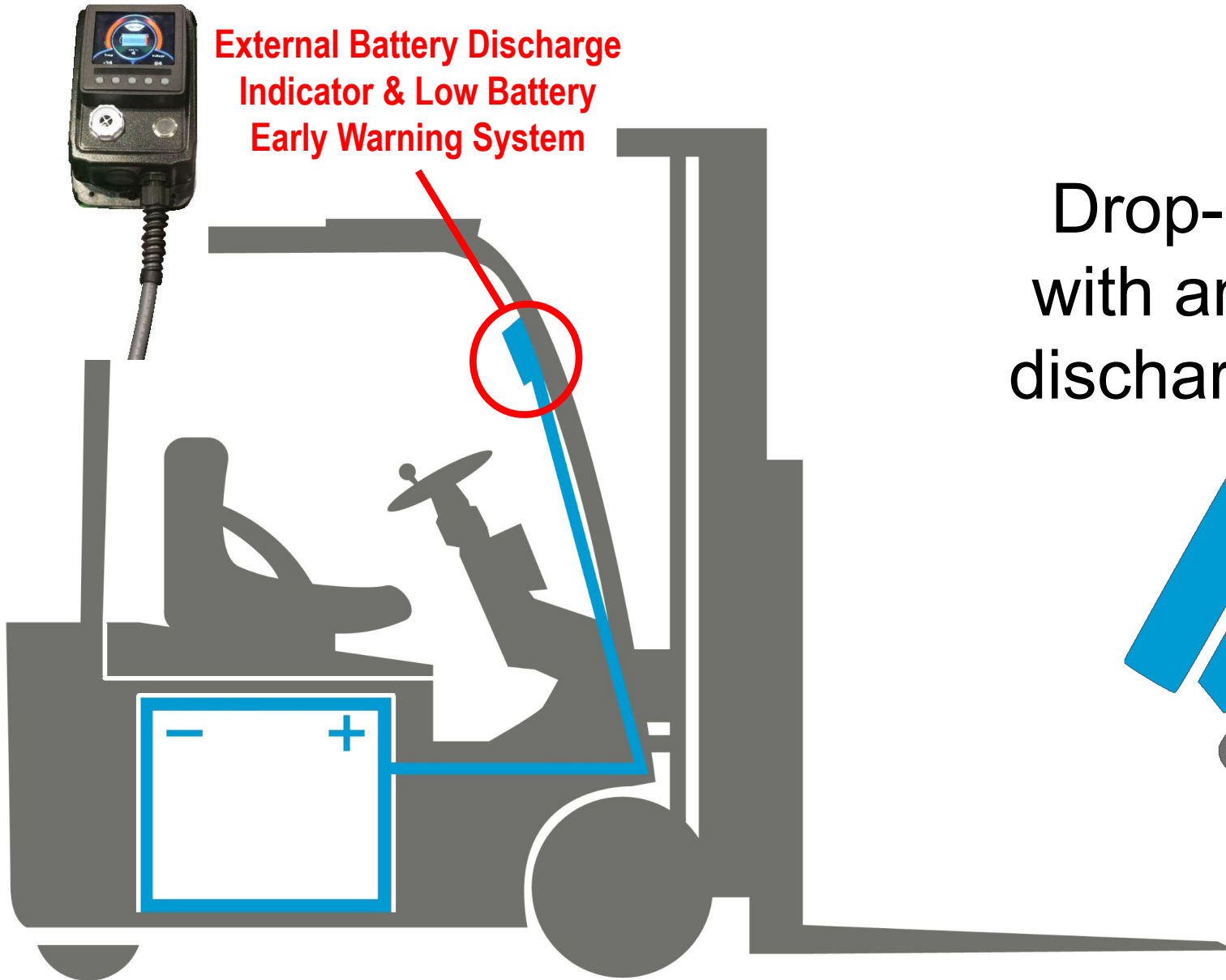


**Recycling partners
availability**



Vehicle Integration

Types of Lithium Battery Integration with Forklifts



External Battery Discharge Indicator & Low Battery Early Warning System

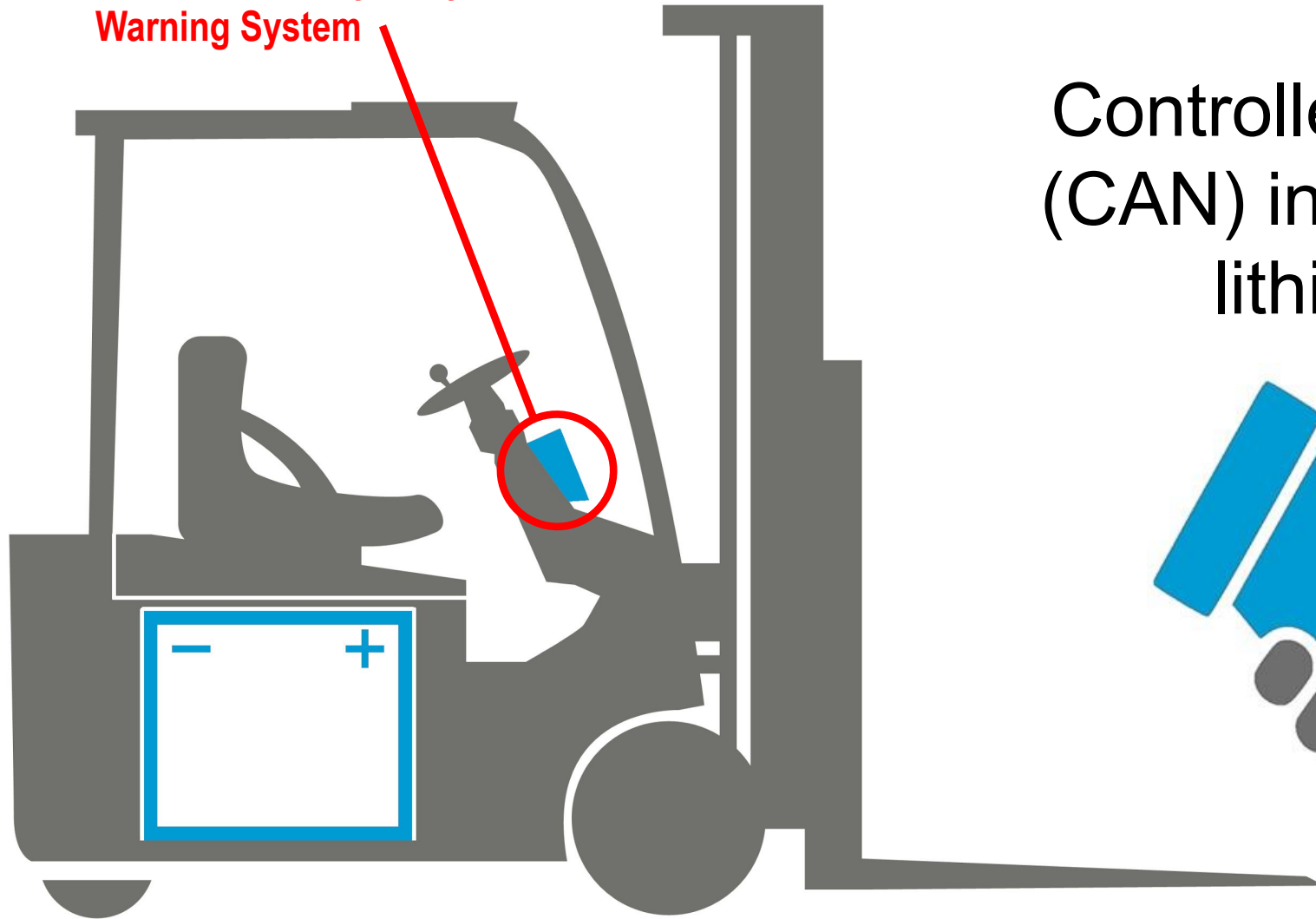
1

Drop-in lithium battery with an external battery discharge indicator (BDI)



Types of Lithium Battery Integration with Forklifts

Truck Side Battery Discharge Indicator & Low Battery Early Warning System



2

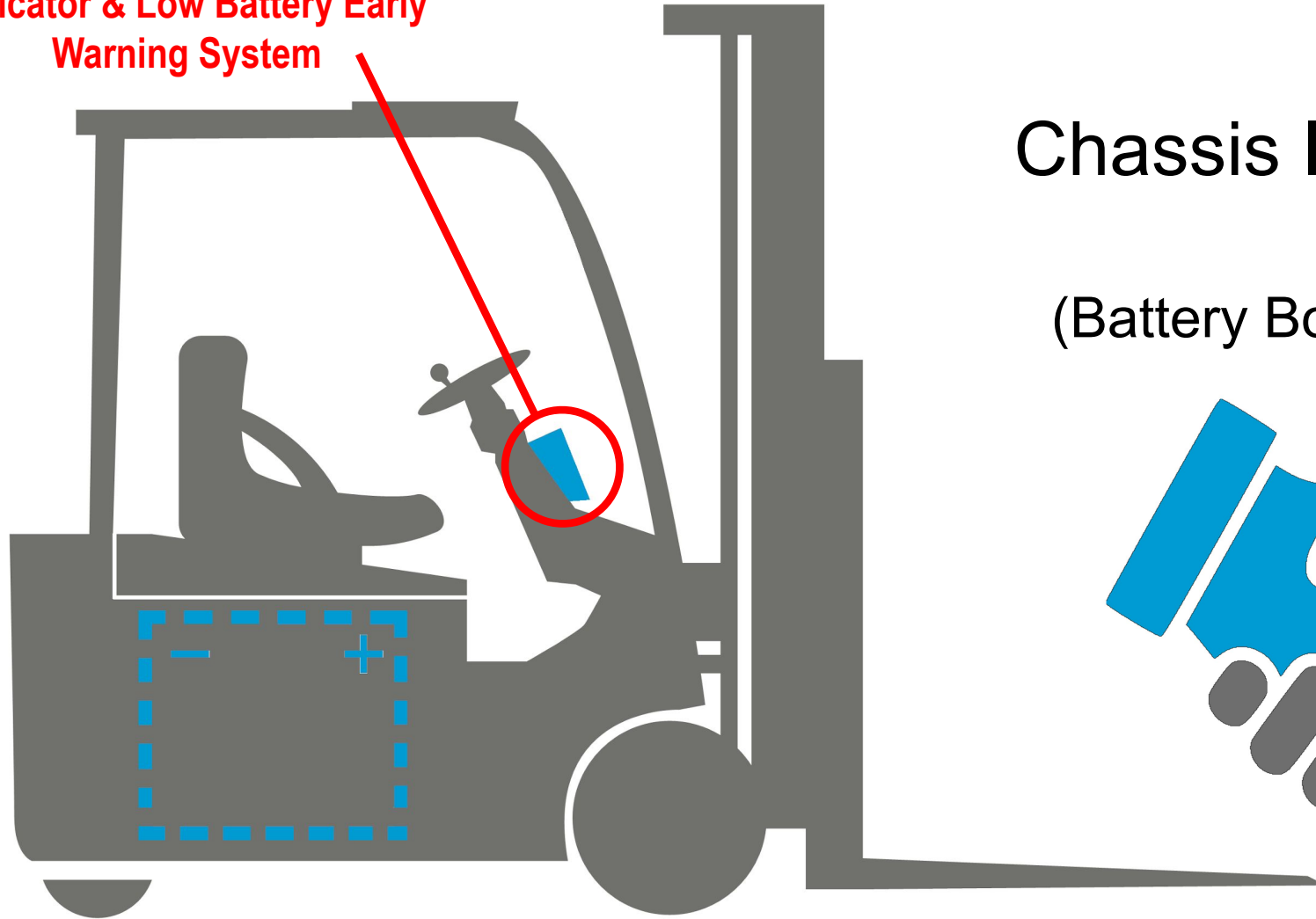
Controller Area Network (CAN) integrated drop-in lithium battery





Types of Lithium Battery Integration with Forklifts

Truck Side Battery Discharge Indicator & Low Battery Early Warning System



3

Chassis Integrated Lithium Battery

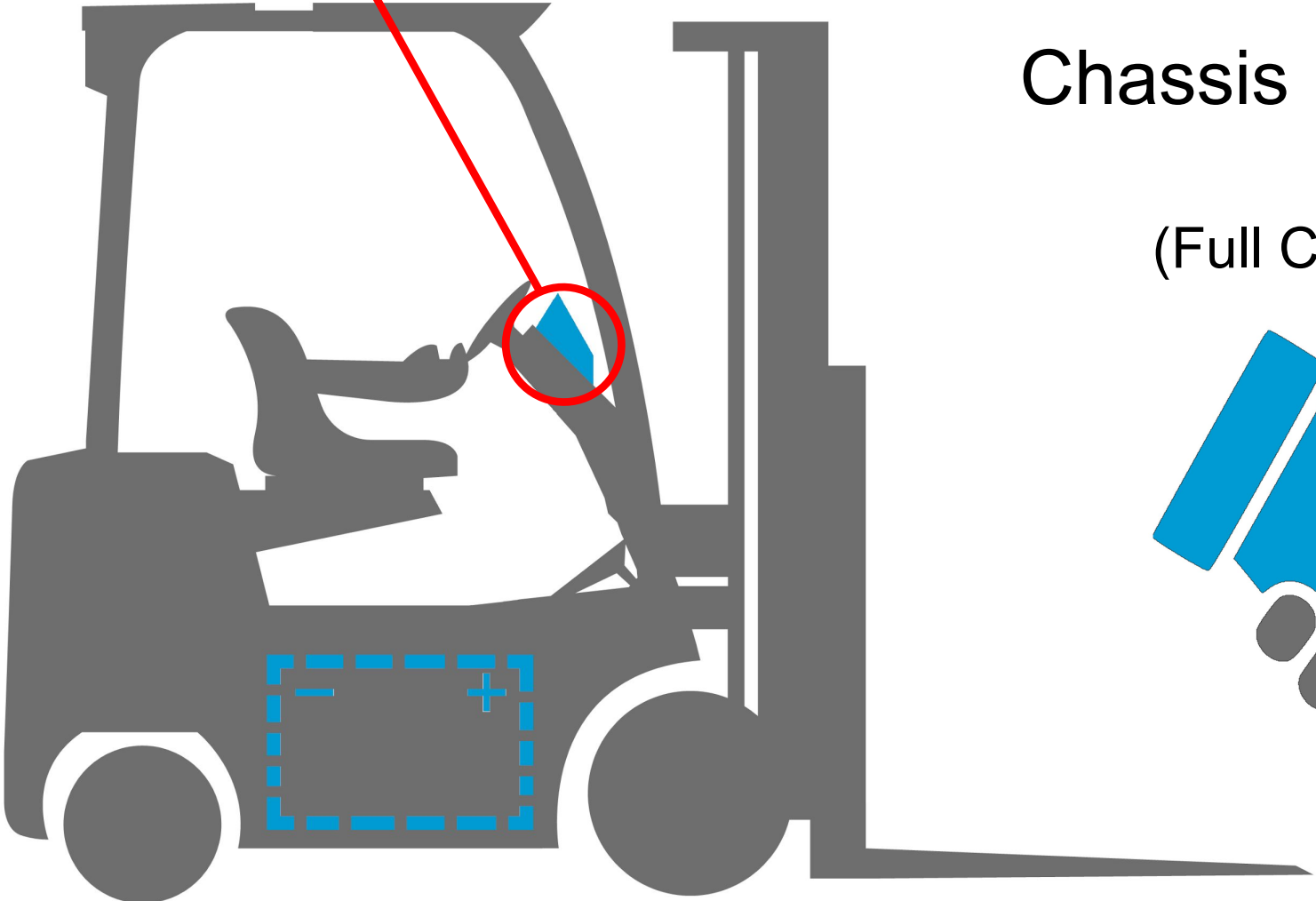
(Battery Box Integrated Chassis)





Types of Lithium Battery Integration with Forklifts

Truck Side Battery Discharge Indicator & Low Battery Early Warning System



4

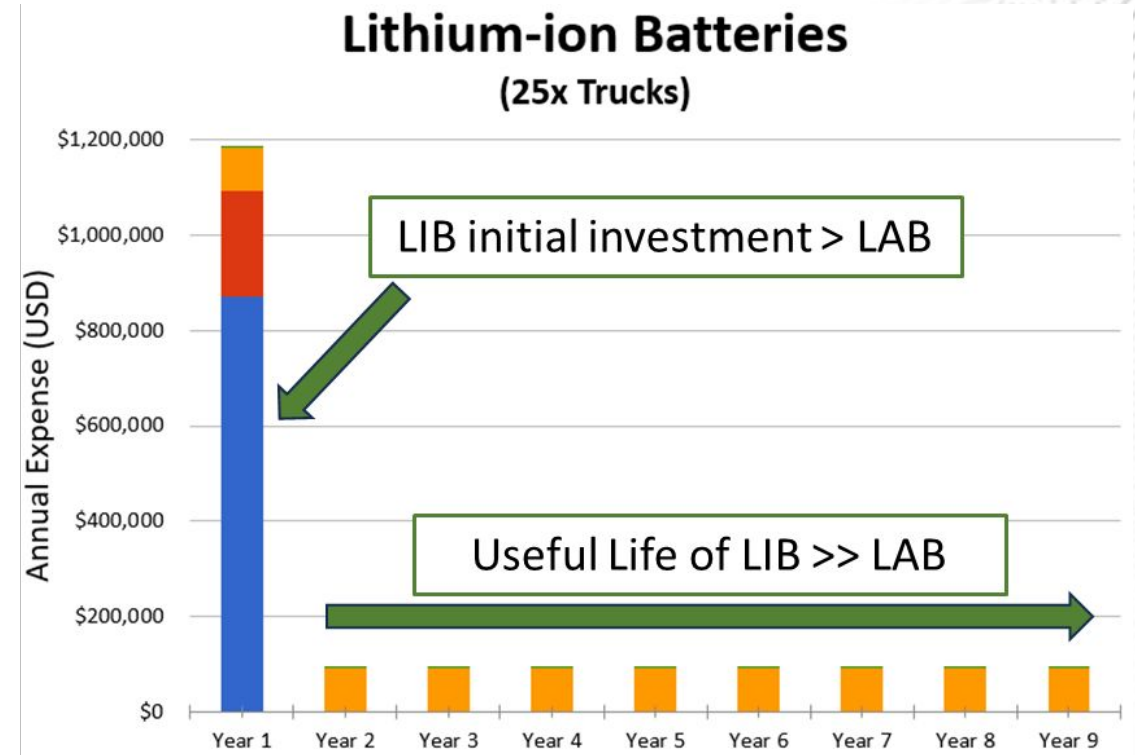
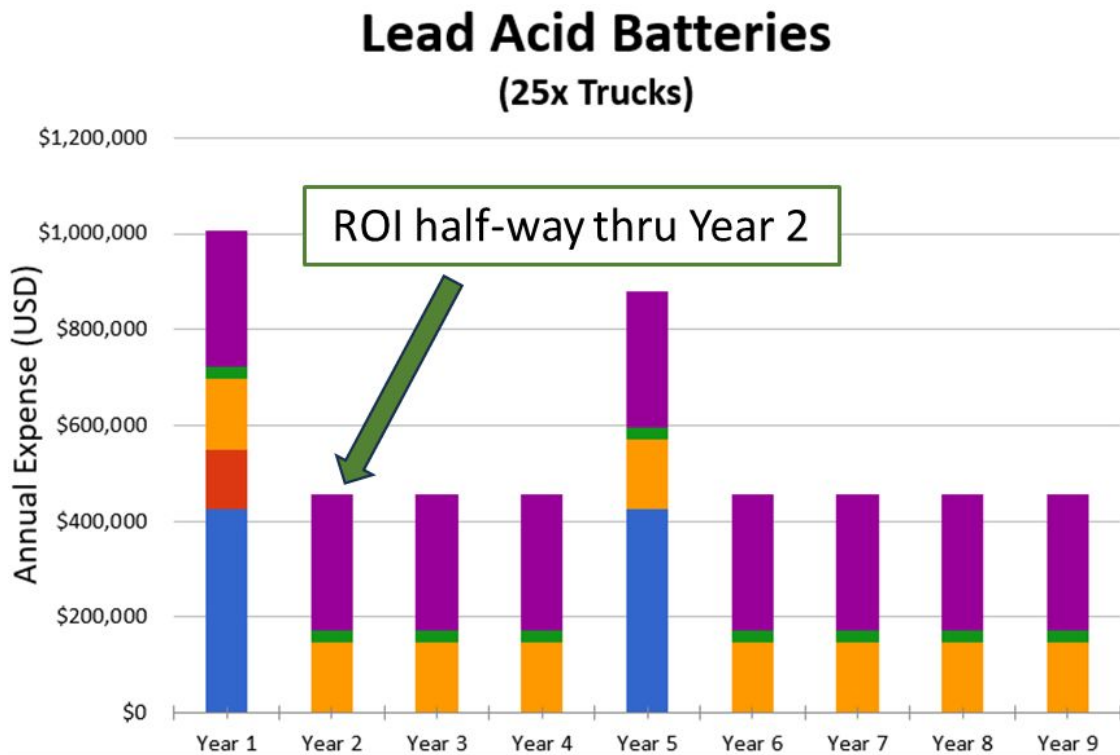
Chassis Integrated Lithium Battery
(Full Chassis Integration)





Impacts of Li-ion Transition

Impacts of li-ion transition | Return on investment (ROI)



■ Battery Change Labor (Yr)
 ■ Maintenance Cost (Yr)
 ■ Charging Cost (yr)
 ■ Charger Purchases
 ■ Battery Purchases

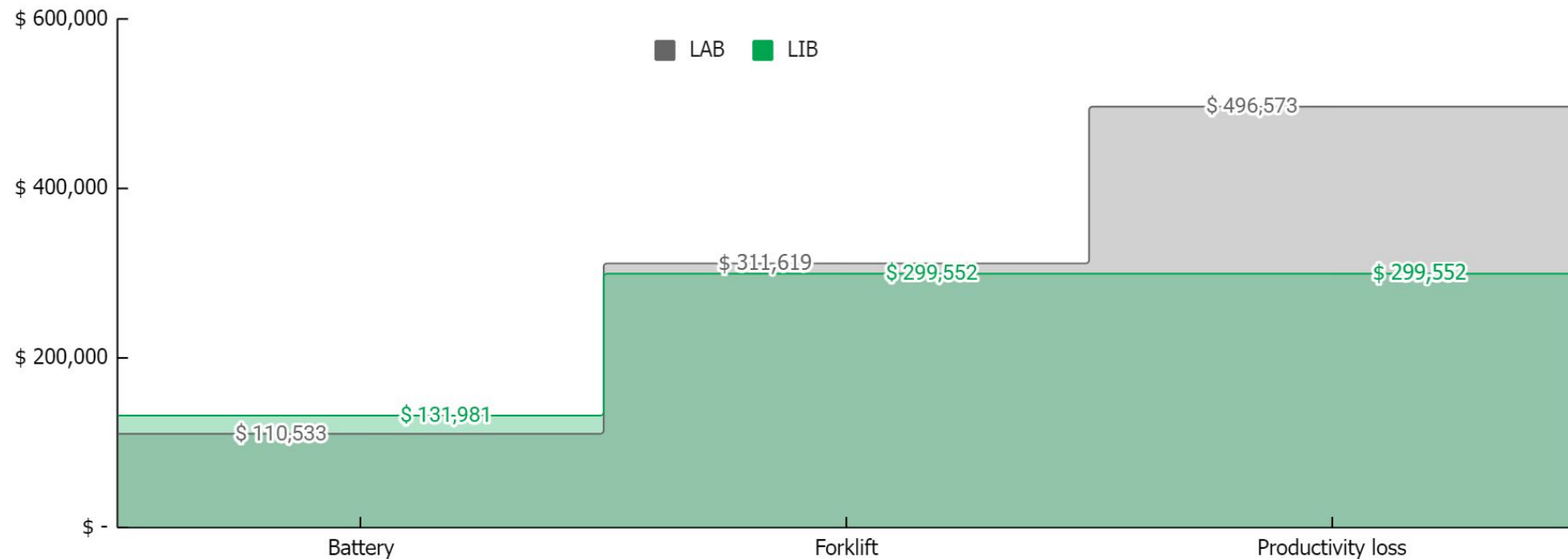
*Specific Food Industry Customer Data - Ethium by EControls 2022

Impacts of li-ion transition | Return on investment (ROI)

Business case | Initial situation

3 shifts operation
Freezer application
Lead-acid fast charge
12 trucks in sector

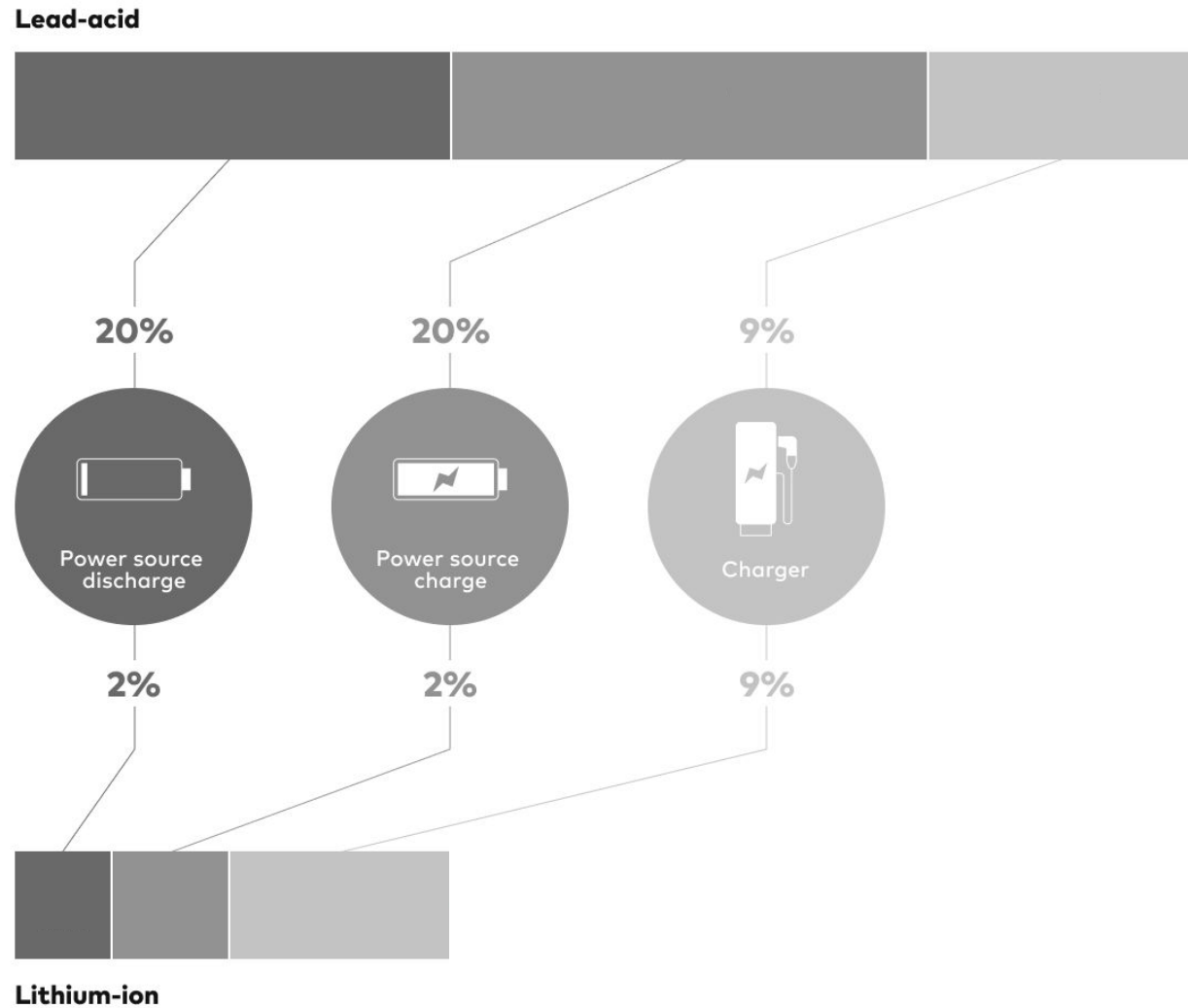
Annual Cost (5Y period)	LAB
Battery	\$ 110,533
Forklift	\$ 201,086
Productivity loss	\$ 184,954
Total Annual Cost	\$ 496,572
# of batteries in service	12



*Specific Food Industry Customer Data – UgoWork 2022

Impacts of li-ion transition | Energy savings

Energy losses (heat and other sources)



Use case

Energy for MHE operations

- 100 vehicles
- 3 kWh/h
- 16 hours a day
- 365 days a year

1,752 MWh

Location

Florida, USA

- Electricity cost: 0.96 \$/kWh¹
- Carbon intensity: 652 g/kWh²

Impacts of li-ion transition | ROI business cases



Global food producer

Baseline Lead-acid, 2 shifts per day

Goals Transition to lithium
Fleet size reduction

Results 38% fleet reduction
100% conversion, 14 months

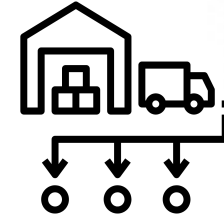


Fresh fruits and vegetables

Baseline Lead-acid infrastructure,
maintenance and CO₂
emissions issues

Goals Improve productivity
Reduce CO₂ emissions

Results -38.5% CO₂ emissions
+45% productivity



3PL - Cold storage

Baseline Lead-acid fast charge.
Batteries lasting less than
2 years

Goals Increase productivity
and eliminate traditional
infrastructure

Results +7% in productivity
-27% in TCO

*Specific Food Industry Customer Data – UgoWork 20223

Lithium-ion conversion checklist

- ✓ Power Study
- ✓ Facility Review
- ✓ Infrastructure Review
- ✓ Battery Sizing
- ✓ Charger Sizing
- ✓ Charger locations
- ✓ Charger installation
- ✓ Charging Discipline
- ✓ ROI Study
- ✓ Customer Options



On behalf of the



Thank you