



# Lithium

# Locomotive

## R8- General Specification

# Agenda



- General Features
- Special Features
- General Spec.
- Technical Spec.
- Costs Structure





# General Features



- 80% Less Maintenance Sleep
- 50% Less Vibration vs Diesels
- 80% Less Noise vs Diesels



- 30% Less Investment
- 60% Less Vibration
- No air cable investment
- Close Stations Availability

# Special Features



	Special Features	Scheme	Inves.	Energy	Safety	Time	Comfort	Cost	Maint.
1	12 In-Wheel Motors		✓	✓	✓	-	✓	✓	✓
2	FOC Inverters		✓	✓	✓	-	-	✓	✓
3	High Cycle Battery		-	✓	✓	-	-	-	✓
4	Swappable Battery		✓	-	✓	-	-	✓	✓
5	Small Wheels		-	-	✓	-	✓	-	✓
6	1-3 Locomotives		✓	✓	-	-	-	✓	✓
7	X by Wire		-	✓	✓	-	✓	-	✓
	<b>Description</b>		Lower track/train Investment	Lower Energy consumption in journey	Higher Safety for passenger journey	Lower Time for journey or charging	Higher Comfort for passenger	Lower Cost on ticket for passengers	Lower Maintenance cost or time

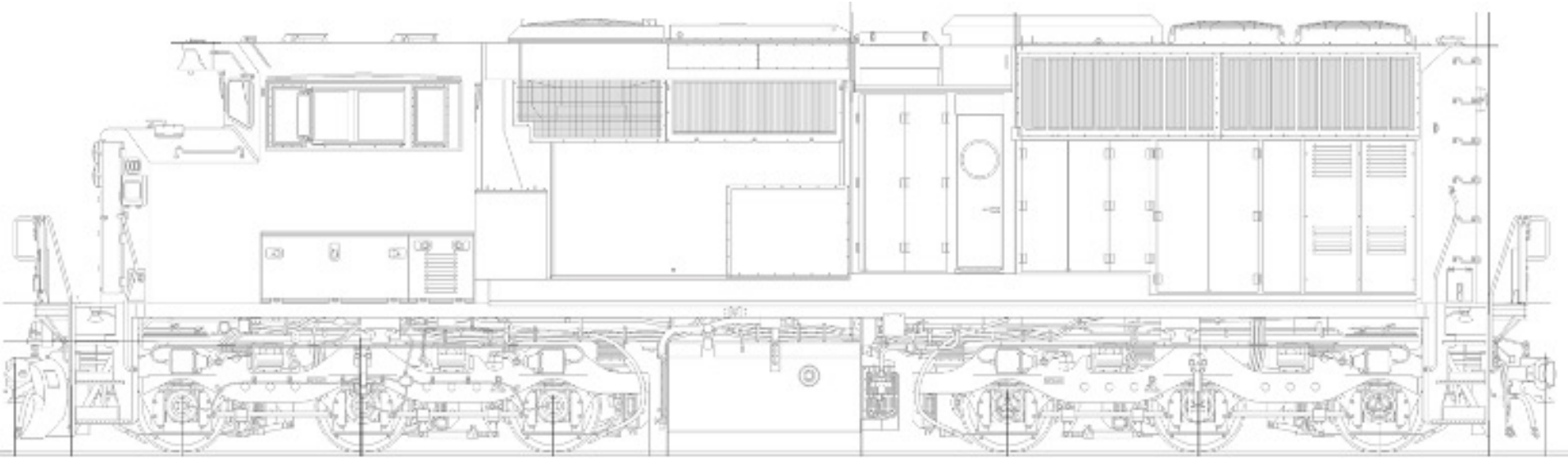
# General Spec.



## General Spec.

Type	Lithium Locomotive
Power	12x200 kW
Doors	1D
Empty Weight	27 Tons
Battery Weight	67-101 Tons
Max. Weight	128 Tons
Range	400-1600 km
Energy	8-12 MW
Max. Speed	160 km/h

# General Spec.



## Dimension

Length	14.80 m
Width	3.00 m
Height	4.40 m

## Dynamic

Max. Acceleration	0.7 m/s <sup>2</sup>
Max. Deceleration	0.5 m/s <sup>2</sup>
Emergency Brake	1.2 m/s <sup>2</sup>



# Technical Spec., In-Wheel Traction

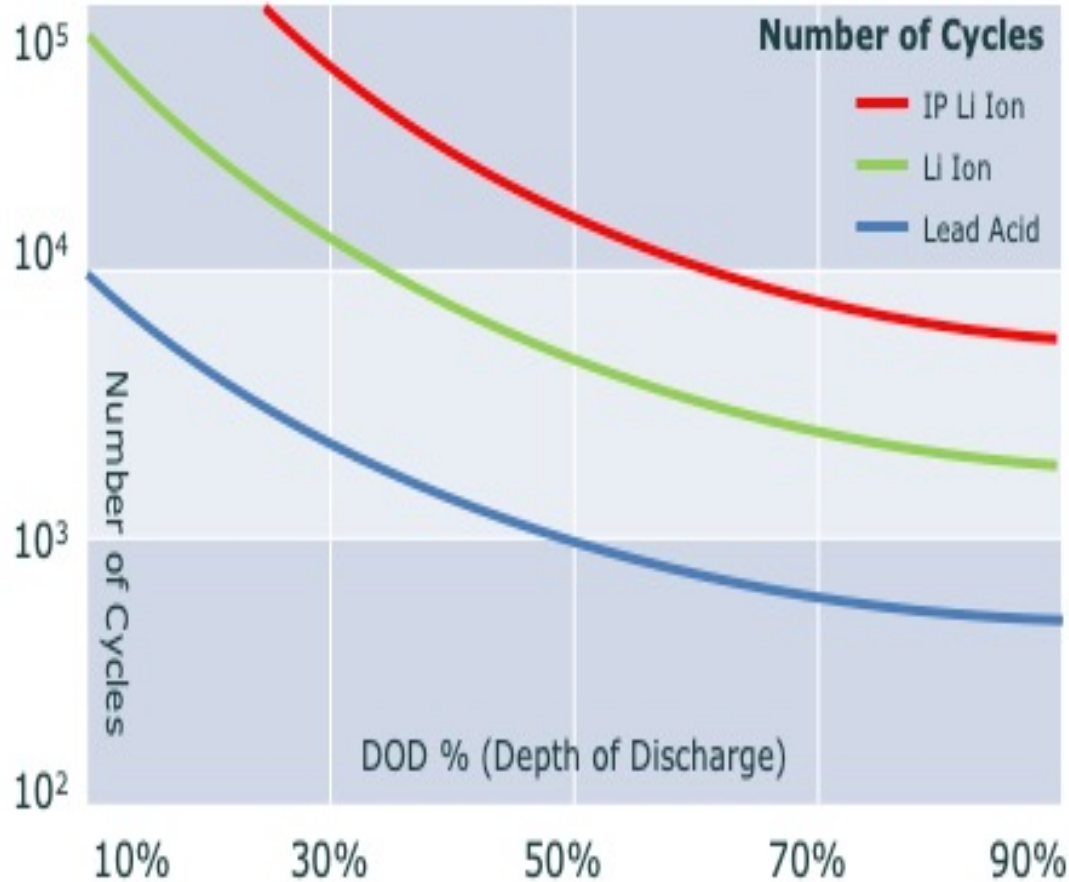


## Traction

In-Wheel Drive	12
Phase / Voltage	3 / 380 V
Type	Inductive
Size	$\phi 600 \times 320$
Power	200 kW
Max. RPM	1000 RPM
Con. Torque	2700 Nm
Max. Torque, 20s	5400 Nm



# Technical Spec., Battery



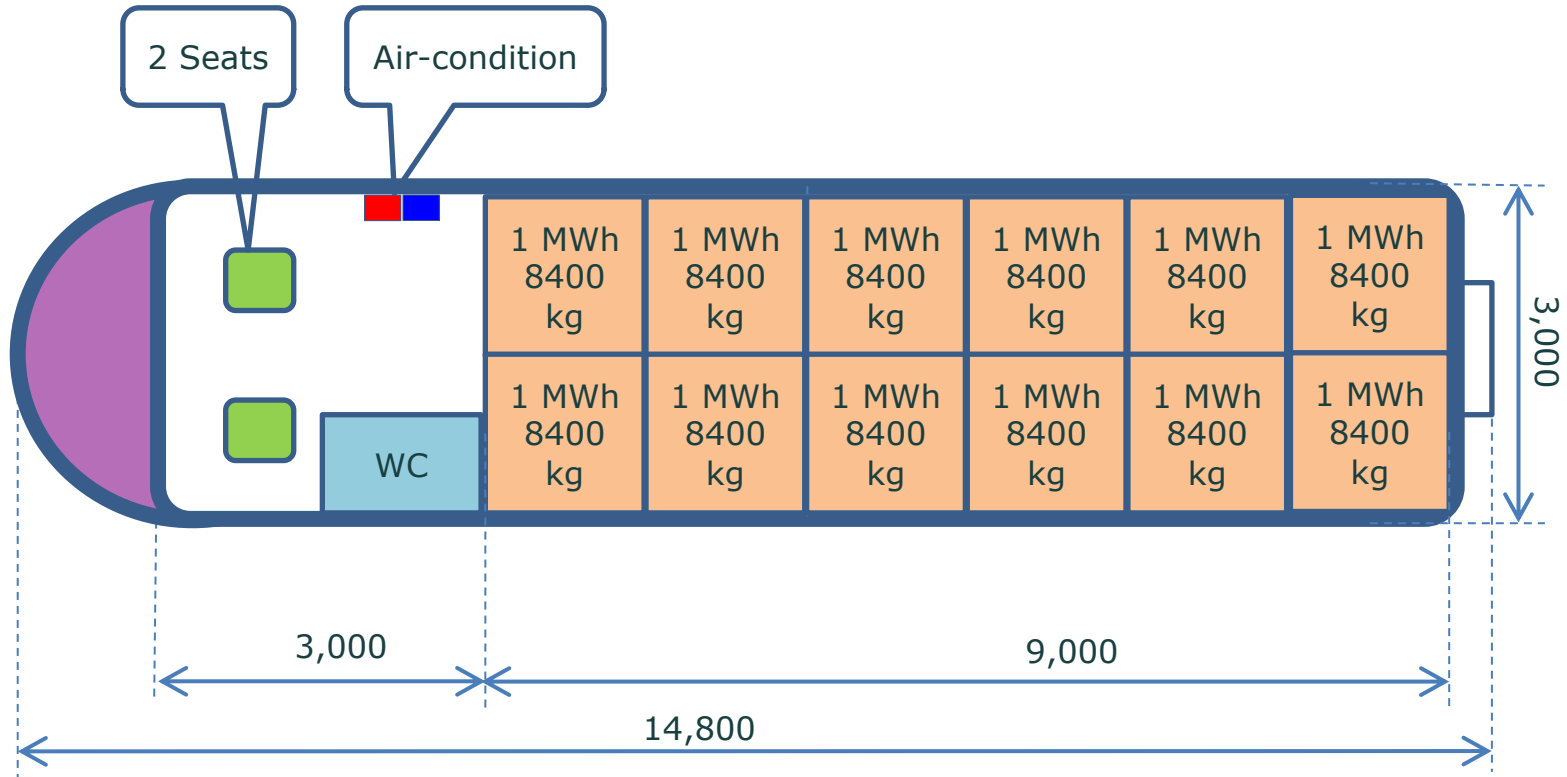
	Lithium IP	Lithium Ion	Lead Acid
Energy	1 MWh	1 MWh	1 MWh
Weight	11000 kg	8400 kg	26000 kg
Volume	6.3 m <sup>3</sup>	7.2 m <sup>3</sup>	12 m <sup>3</sup>
Range, <sub>500Tons</sub>	125 km	130 km	450 km
Slow Charge	5 Hours	8 Hours	10 Hours
Normal Charge	2 Hours	4 Hours	5 Hours
Fast Charge	1 Hour	2 Hours	2 Hours
Life	5000 Cycles	1500 Cycles	700 Cycles
Price	220 k€	160 k€	27 k€

Each 1 MWh "Battery Box" have an onboard "Normal Charger".

Box: L1500xW1500xH3200, 6x2x35=420 Packs  
Charger: 3 Phase, 400 Volt, 400 A, 50/60 Hz



# Technical Spec., Battery Layout



# Costs Structure, Investment



<b>Total Energy</b>	<b>8 MWh</b>	<b>10 MWh</b>	<b>12 MWh</b>
<b>Total Weight</b>	94 Tons	111 Tons	128 Tons
<b>Range, 500 Tons</b>	1060 km	1330 km	1600 km
<b>Range, 2000 Tons</b>	266 km	330 km	400 km
<b>Battery Price</b>	8x160 k€	10x160 k€	12x160 k€
<b>Empty Price</b>	440 k€	440 k€	440 k€
<b>Total Price</b>	<b>1720 k€</b>	<b>2040 k€</b>	<b>2360 k€</b>

# Costs Structure, 5 Years Comparison

\*Mkm = 1,000,000 km



<b>Total Energy</b> 1 Lit Gasoline = 4 kWh	<b>Diesel</b> <b>P=2400 kW</b>		<b>LL 12MWh</b> <b>P=2400 kW</b>	
<b>Investment</b>	3400 k€		2360 k€	
<b>Usage</b>	Cargo	Passenger	Cargo	Passenger
<b>Travel / 5 Years</b>	0.6 Mkm*	1.5 Mkm*	0.5 Mkm*	1.8 Mkm*
<b>Battery Cost, €/km</b>	0.05	0.02	0.75	0.61
<b>Energy Cost, €/km</b>	0.12	0.12	0.05	0.05
<b>Maintenance Cost, €/km</b>	1.10	0.73	0.17	0.11
<b>Repair Cost, €/km</b>	0.30	0.20	0.08	0.06
<b>Total Cost, €/km</b>	<b>1.57</b>	<b>1.07</b>	<b>1.05</b>	<b>0.83</b>