Electric Trucks Batteries

Pierre Chaufour

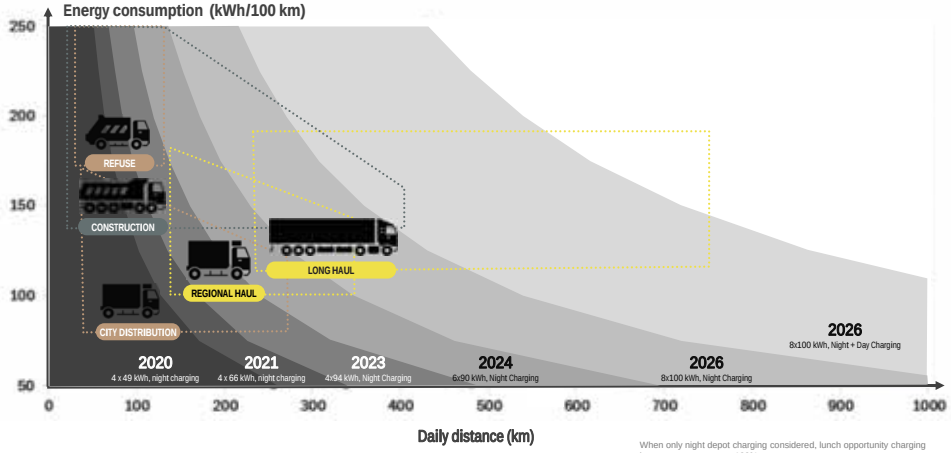
Maison de la Chimie

Paris, 2025 06 19

RENAULT TRUCKS

Range of Electric Trucks

Almost all carriers range need will be covered by Battery Electric Trucks



When only night depot charging considered, lunch opportunity charging increases range up to +100%.
Status at battery end of life. Additional range of 20% at battery begin of life

Our batteries

Flat packs on D/DW (16 t to 26 t)

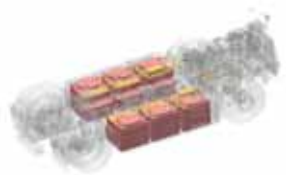
2020 4x49 kWh Prismatic NMC cells

2021 4x66 kWh Prismatic NMC cells

2023 4x94 kWh Cylindrical NCA cells

Cell supplier : Samsung SDI (Korea)
Pack supplier: BorgWarner (Germany)

Possibility to put 3 to 6 packs.

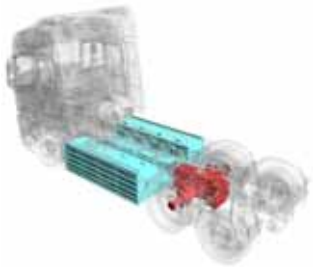


Cube packs on T/C (up to 44 t)

2024 6x90 kWh Cylindrical NCA cells

Cell supplier : Samsung SDI (Korea)
Pack supplier: Volvo Group (Belgium)

Possibility to put 4 or 6 packs.



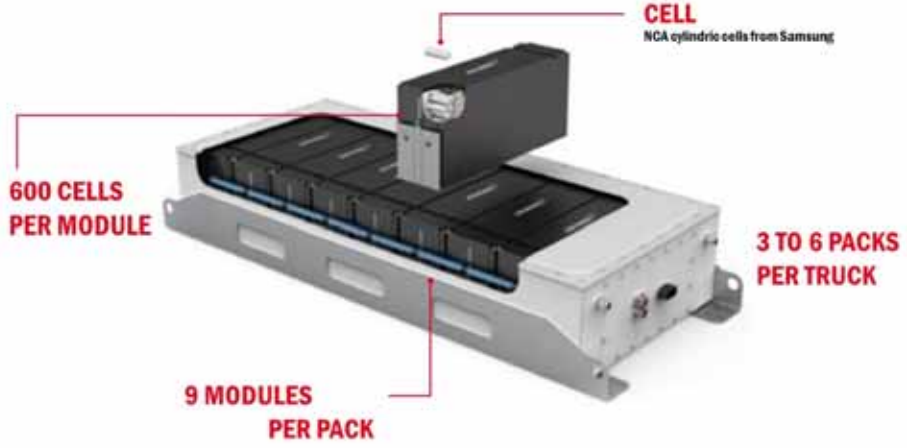
L packs on T (44 t)

2026 8x100 kWh Prismatic NCA cells

Cell supplier : Samsung SDI (Hungary)
Pack supplier: Volvo Group (Belgium)

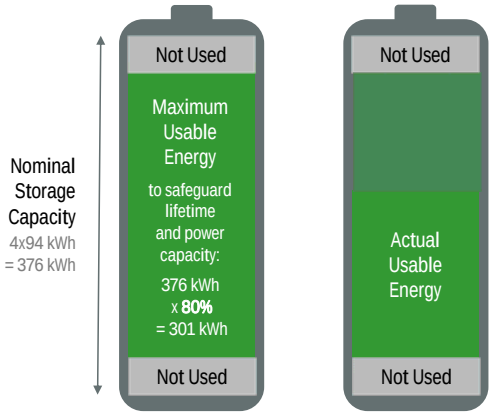
Possibility to put 6 or 8 packs.

94 kWh battery pack



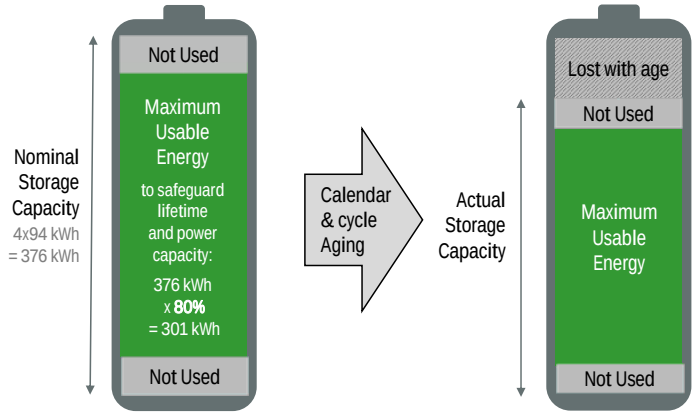
State of Charge (SOC) on dashboard = Actual Usable Energy / Maximum Usable Energy

Begin Of Life



State of Health (SOH) = Actual Storage Capacity / Nominal Storage Capacity

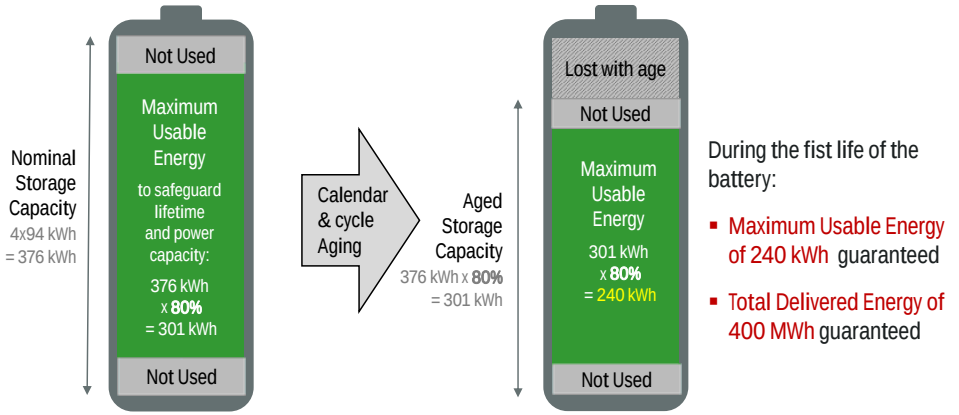
Begin Of Life



END OF FIRST LIFE WHEN SOH = 80%

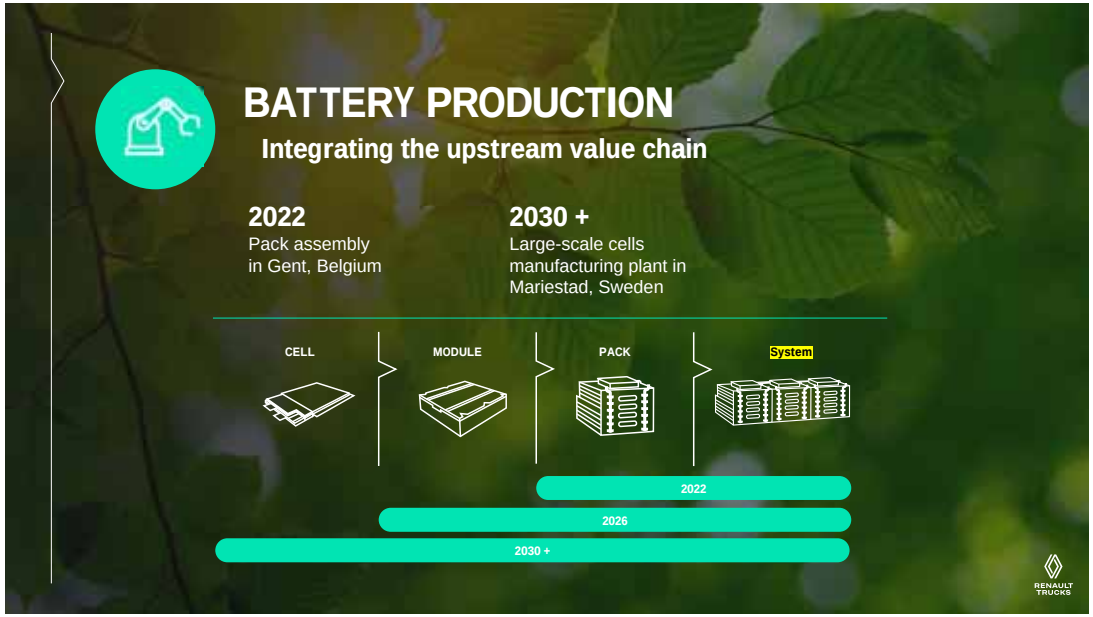
Begin Of Life

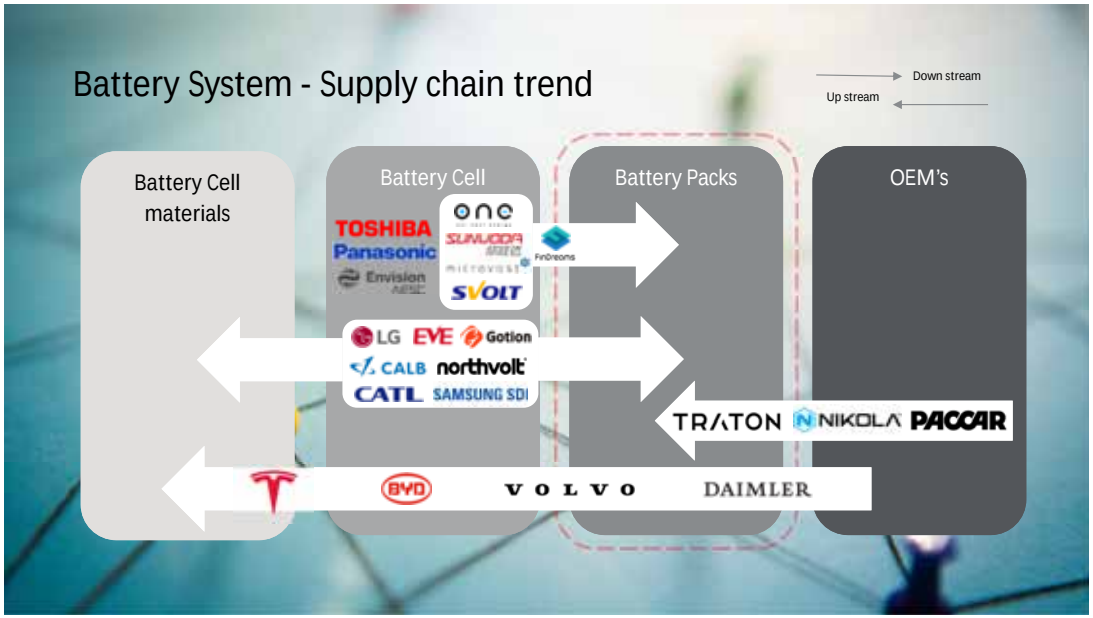
End of First Life
up to10 years depending of usage



During the fist life of the battery:

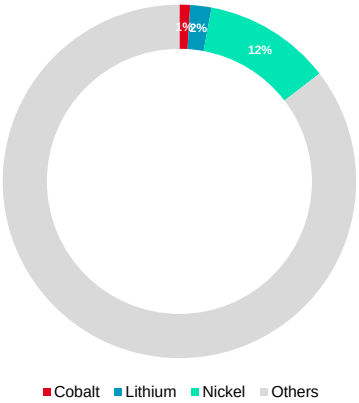
- Maximum Usable Energy of 240 kWh guaranteed
- Total Delivered Energy of 400 MWh guaranteed





Battery Minerals

Key minerals represents 15% of our 94 kWh batteries pack by weight



Massic content of the Renault Trucks 94 kWh battery pack

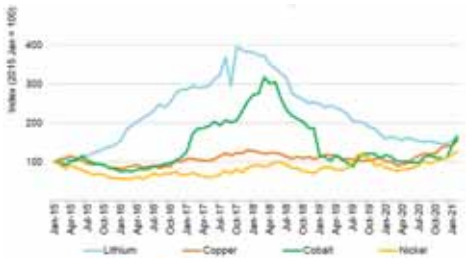
Based on the estimation of a NMC 6.2.2. battery in "World Energy Outlook - Special Report Minerals in Clean Energy Transitions", IEA, 2021 (link)

Battery Minerals Need

- **There are enough minerals on earth for the take-off of e-mobility**
- **Lithium is relatively abundant on earth**
- **There is no rare earth in batteries**

- **Fluctuating mining investment will continue to generates price volatility (1)**

Mineral	World production incl. e-mobility (Mt/year) (1)		Need (Mt)	Reserves (Mt) (7)	Resource (Mt) (6)
	2019	2040	2020-40		
Lithium	0.08	1.2	13	21 (1)	86 (2)
Nickel	2.4	6.1	85	89 (3)	300 (4)
Cobalt	0.15	0.65	8	7 (5)	25 (5)
Copper	24	33	285	870 (5)	5 000 (5)



(1) World Energy Outlook Special Report Minerals in Clean Energy Transitions, IEA, 2021 (link)

(2) USGS (link)

(3) USGS 2019 (link)

(4) Mudd G., Jowitt S., 2014, A Detailed Assessment of Global Nickel Resource Trends and Endowments. Economic Geology 109:1813-184

(5) USGS

(6) A resource is the amount of a geologic commodity that exists in both discovered and undiscovered deposits.

(7) Reserves are the subgroup of a resource that have been discovered, have a known size, and can be extracted at a profit.

Battery Minerals Impact Minimizing

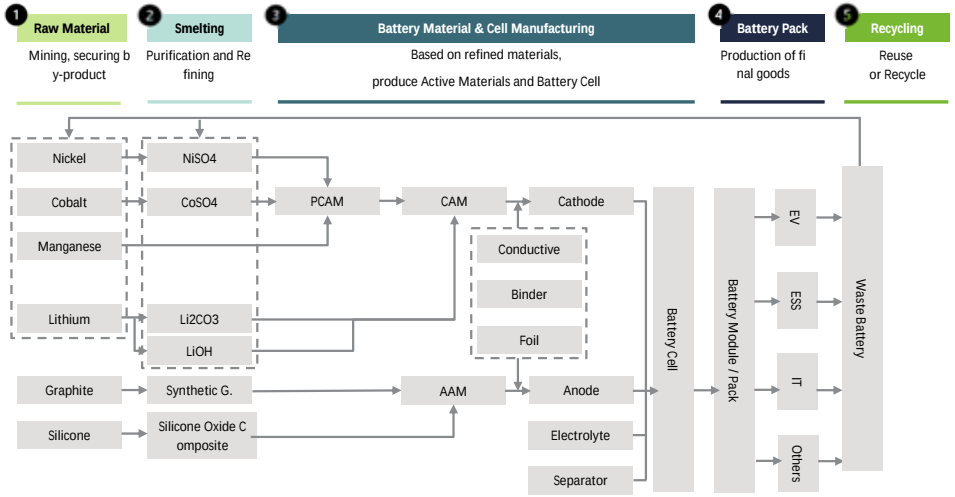
Conducting **due diligences** up-stream the supply chain

Establishing labels for a future **battery passport**

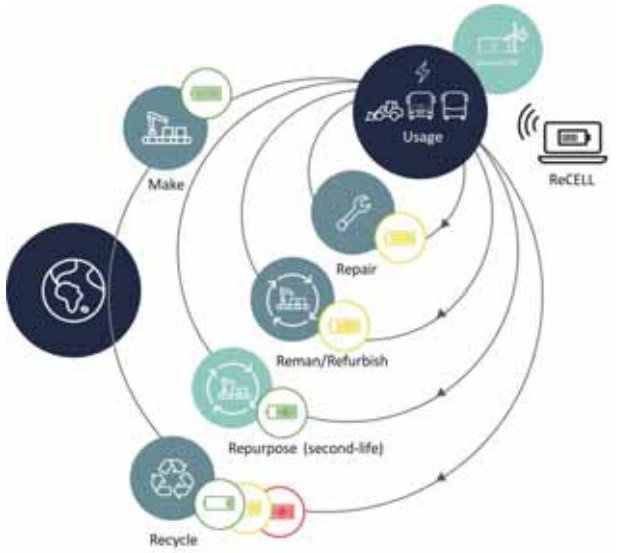
Committing for a **moratorium on deep sea mining**

MINING → REFINING → PRECURSOR PRODUCTION → ELECTRODS PRODUCTION → CELL PRODUCTION → BATTERY PACK PRODUCTION

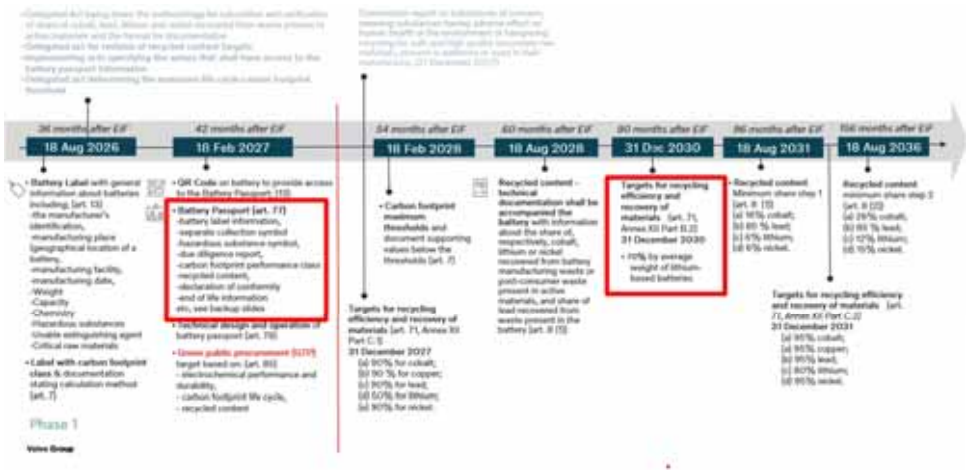
Supply Chain Overview



Battery Circularity

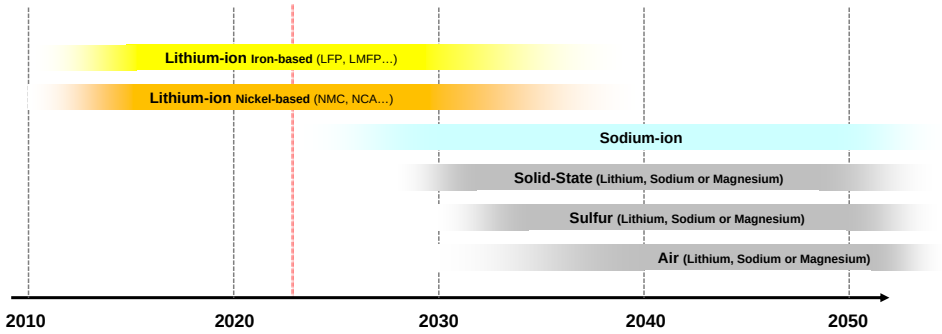


EU Battery Regulation



Battery Chemistry Evolution for Trucks

- Today's Lithium-ion technology will continue throughout the decade in the new gigafactories
- OEMs will continue to navigate between the possible cathode chemistries guided by minerals availability and price (Ni, Co, M, Al, Fe, P…)
- Sodium-ion might come in the second part of the decade for low-cost or low-range trucks
- Solid-State, Sulfur and Air are more likely for the next decade

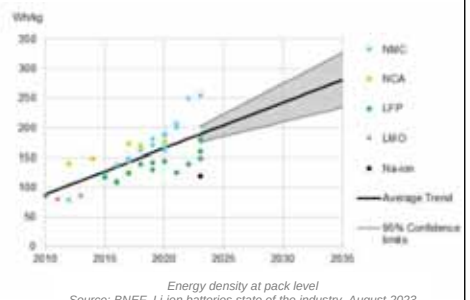


Energy density and impact on battery weight

- **The average pack energy density doubled since 2010**

  The upward trend is expected to continue with design optimization, and an increasing share of new mid-term chemistries described in the graph.

- **Impact in 2035**
  - **Today, our batteries are at 170 Wh/kg, which means 530 kg per 90 kWh pack.**
  - **BNEF predicts that in 2035, pack energy density will be between 240 and 320 Wh/kg (280 to 380 kg per pack). With 4 packs per truck, it means a weight gain compared to today between 600 and 1000 kg per truck.**



Energy density at pack level
Source: BNEF, Li-ion batteries state of the industry, August 2023

Take away

- Almost the entire range of carrier needs will be met by Battery Electric Trucks.
- The Earth has sufficient mineral resources to support battery production. OEMs chemistry choice and mining investment are closely related.
- Battery circularity maximize the full potential of batteries while it is essential to minimize impact during the production phase.
- Over the next decade, the demand for newly extracted minerals will begin to decline thanks to recycling, further accelerated by EU battery regulations.
- Europe is steadily moving toward self-sufficiency in battery cell manufacturing. We will open our first Gigafactory in Mariestad (Sweden) after 2030.
- Nickel and iron will remain dominant for the cathode chemistry throughout this decade, although new chemistry are emerging (sodium-ion, solid-state…).
- Energy density is expected to continue improving, driven by ongoing design optimization.