



**Empa**

Materials Science and Technology

# Vom Rohstoff bis zur Entsorgung: Wissenswertes zu E-Auto-Batterien

## Webinar

16.08.2023

Martin Gasser

Charles Marmy

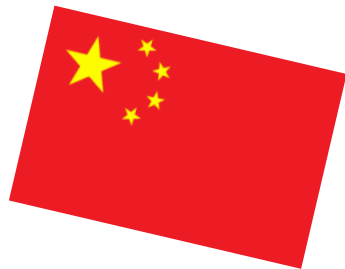
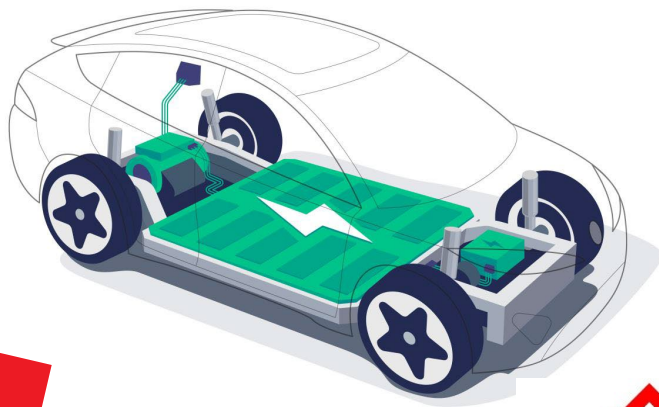
Andrin Büchel

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# Projektleitung:



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Bundesamt für Energie BFE  
Office fédéral de l'énergie OFEN

# Fachgremium:



Berner  
Fachhochschule



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Bundesamt für Umwelt BAFU  
Office fédéral de l'environnement OFEV  
Ufficio federale dell'ambiente UFAM  
Uffizi federal d'ambient UFAM

Für Mensch  
und Umwelt



Fastenaktion



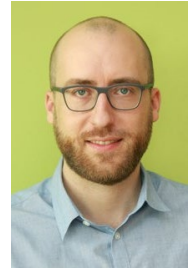
librec  
Closed-loop Battery Recycling



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# Autorenschaft:



Roberto  
Bianchetti

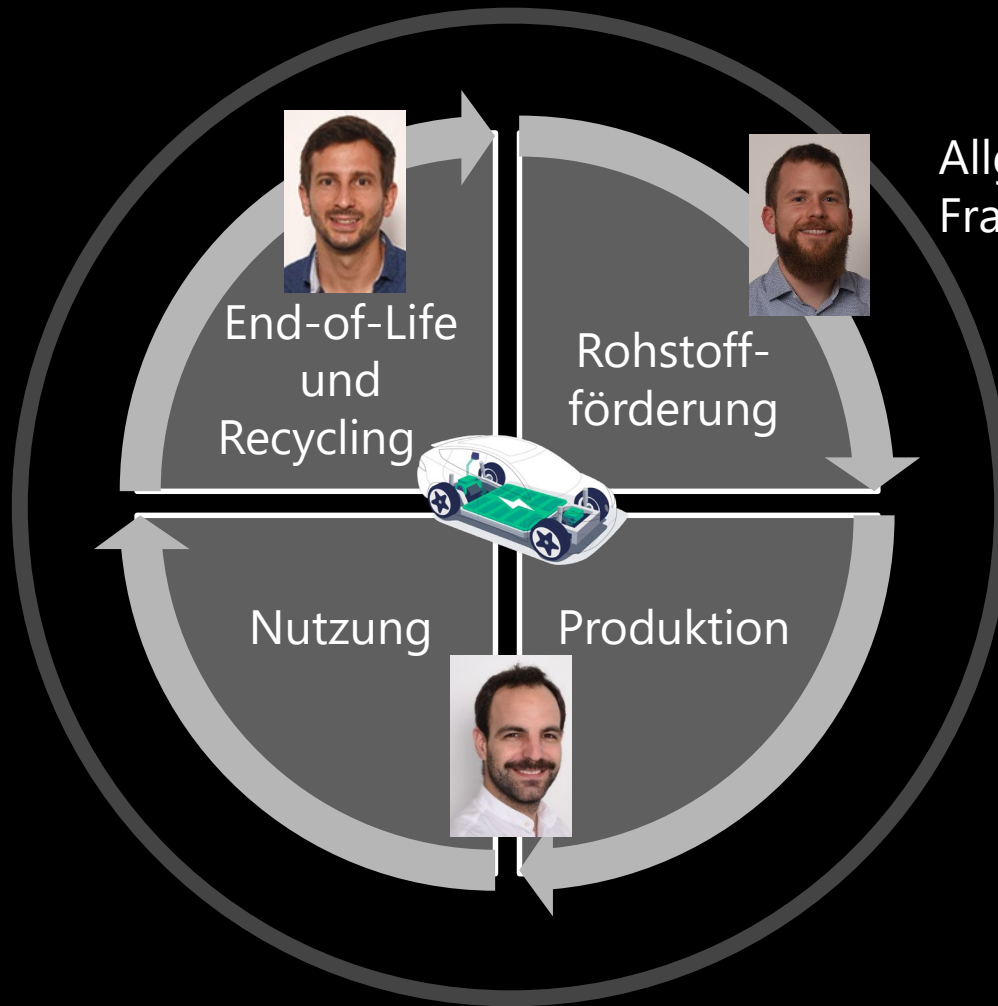


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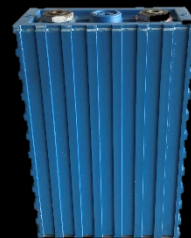
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<https://www.bfe.admin.ch/bfe/de/home/news-und-medien/medienmitteilungen/mm-test.msg-id-94311.html>

# Programm



Allgemeine  
Fragestellungen

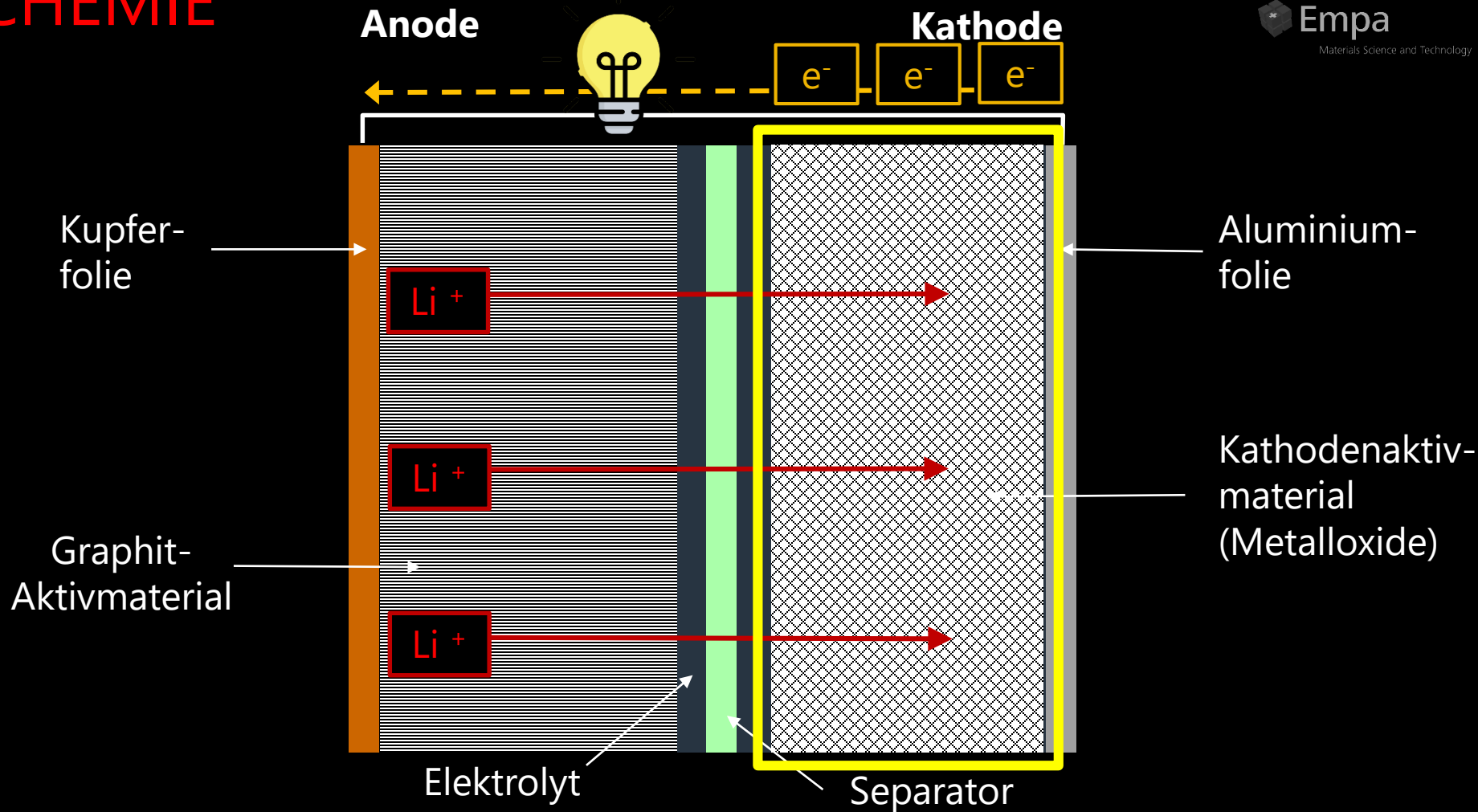


CHEMIE



FORM







Nickel



Mangan



Kobalt

NMC



Eisen



Phosphat

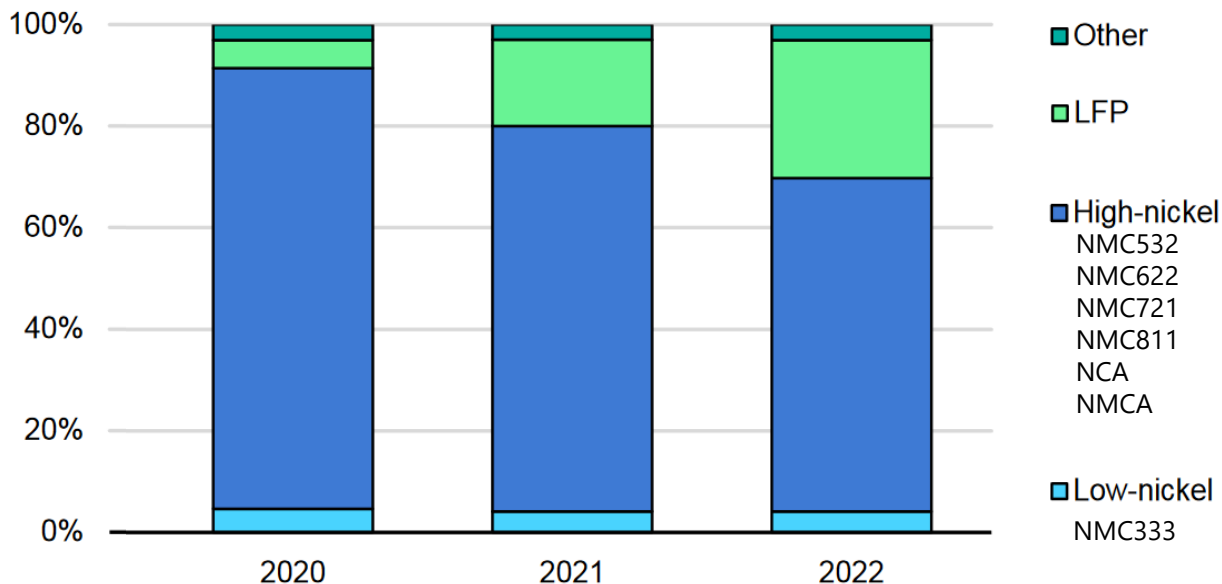
LFP

~250 Wh/kg  
~1'500 Ladezyklen



~180 Wh/kg  
~3'000 Ladezyklen

## Anteil verschiedener Batteriechemien am Traktionsbatteriemarkt weltweit







Silizium-Anoden-  
Batterien

Graphen-Anoden  
Batterien

Lithium-Luft-  
Batterie

Solid-State-  
Batterien

Natrium-Ionen-  
Batterien





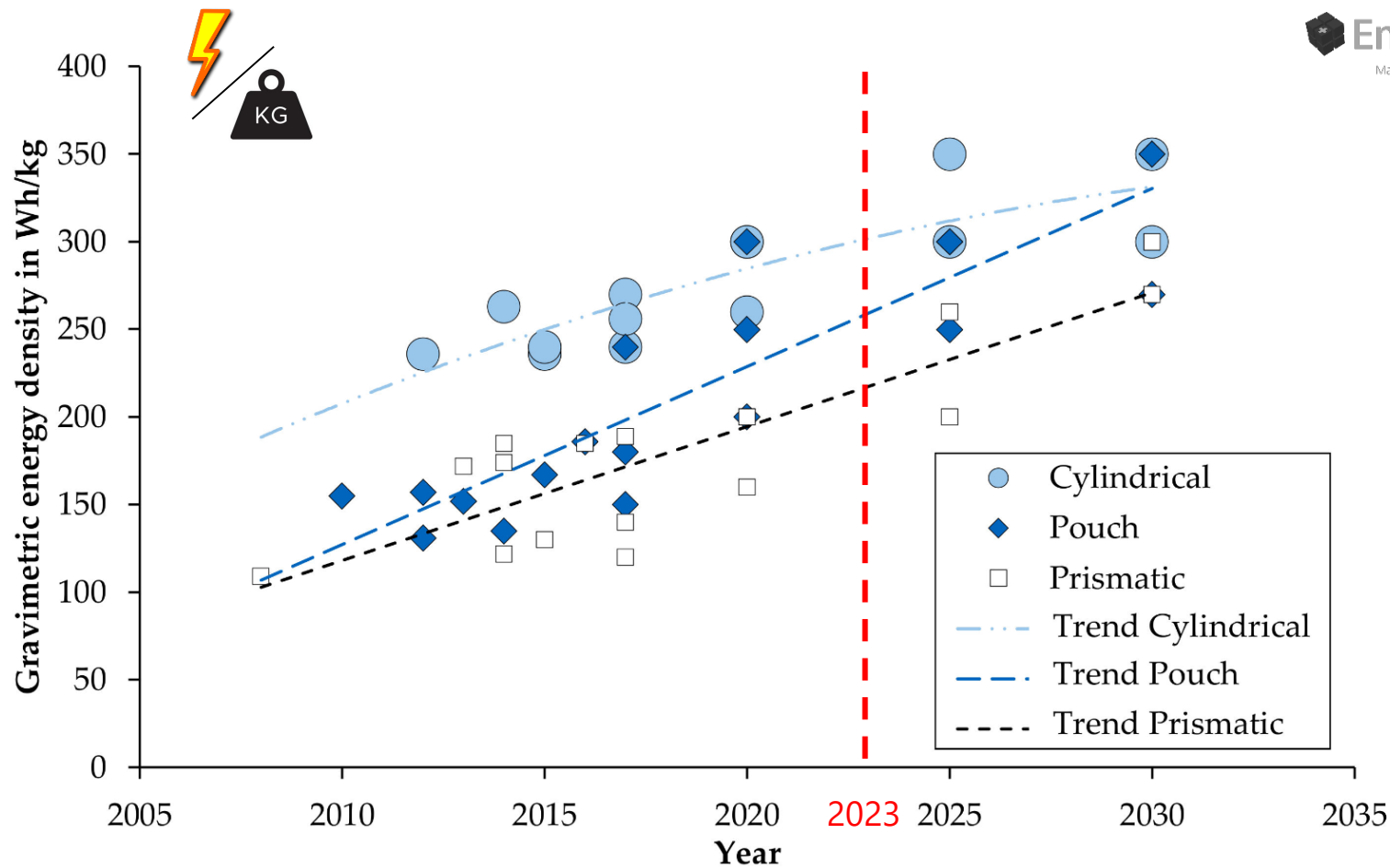
Silizium-Anoden-  
Batterien

Solid-State-  
Batterien

Graphen-Anoden  
Batterien

Natrium-Ionen-  
Batterien

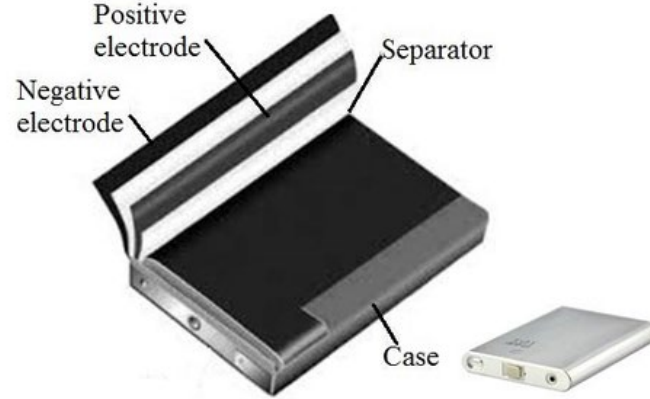
Lithium-Luft-  
Batterie



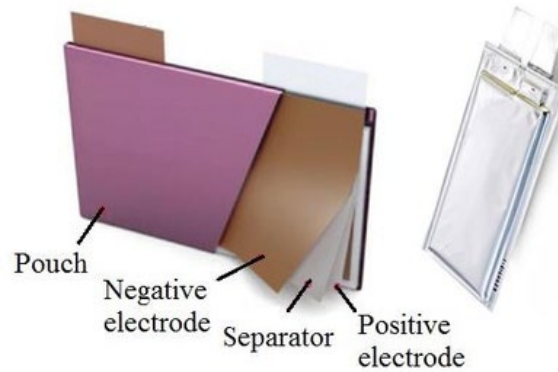
**Cylindrical cell**



**Prismatic cell**



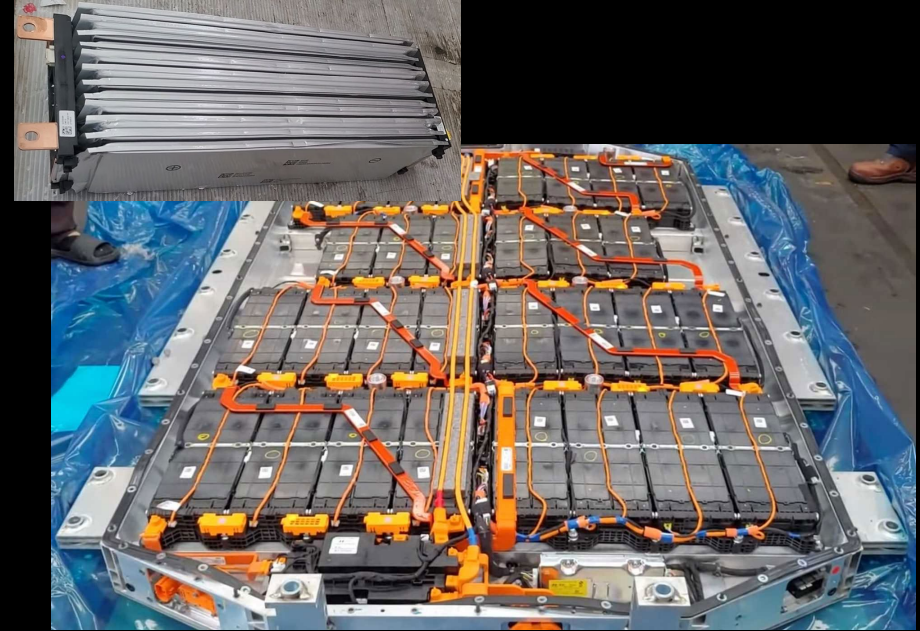
**Pouch cell**







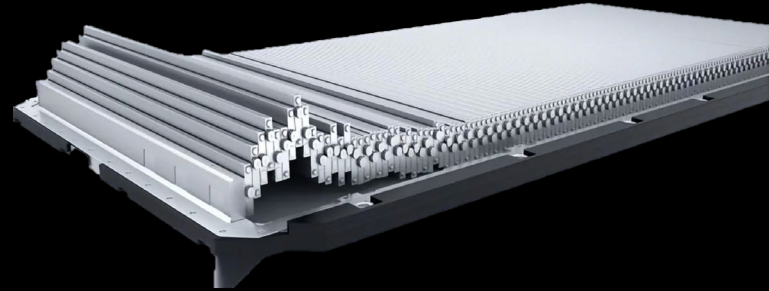
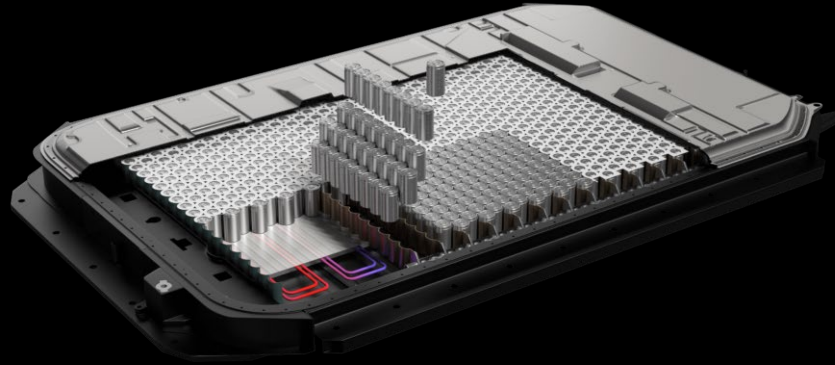
TESLA Model S



Hyundai IONIQ 5



*cell-to-pack  
design*







85 kWh  
540 kg



TESLA Model S



72 kWh  
450 kg



Hyundai IONIQ 5



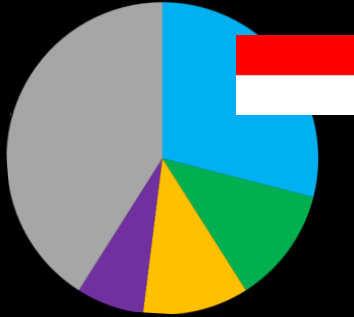




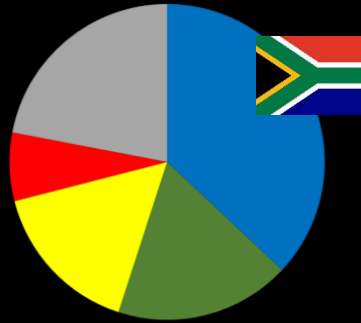




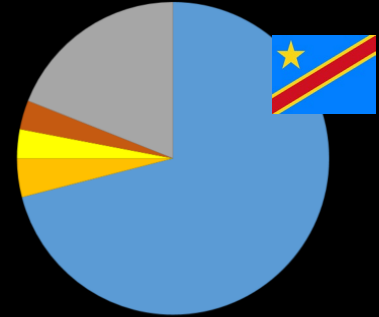
Nickel



Mangan



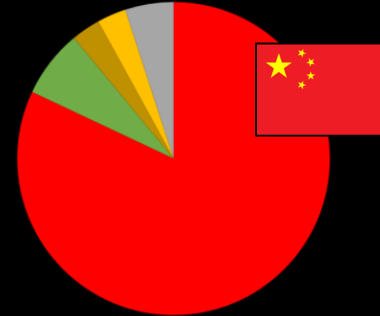
Kobalt



Lithium



Graphit

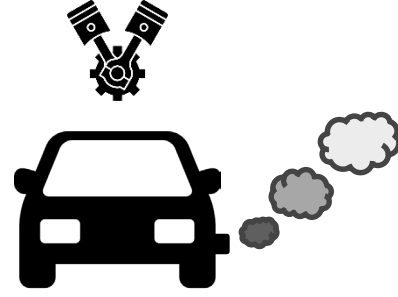
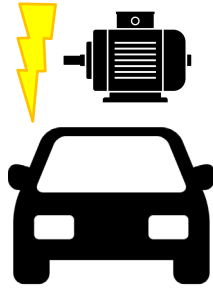






<https://www.miningscout.de/blog/2023/07/11/phosphat-lagerstaette-in-norwegen-reicht-fuer-50-jahre/>

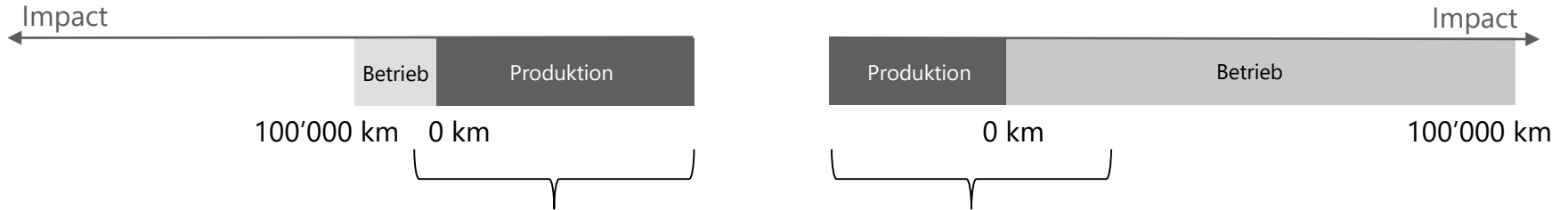
<https://www.umweltnetz-schweiz.ch/themen/ressourcen/3788-deutschlands-lithium-vorkommen-genug-fuer-400-millionen-e-autos.html>



Fahrzeugkategorie

Grösse, Chemie und Herkunft  
der Batterie

Stromherkunft für den  
Fahrzeugbetrieb



Ökologische Amortisation nach  
**25'000 – 50'000 km**

