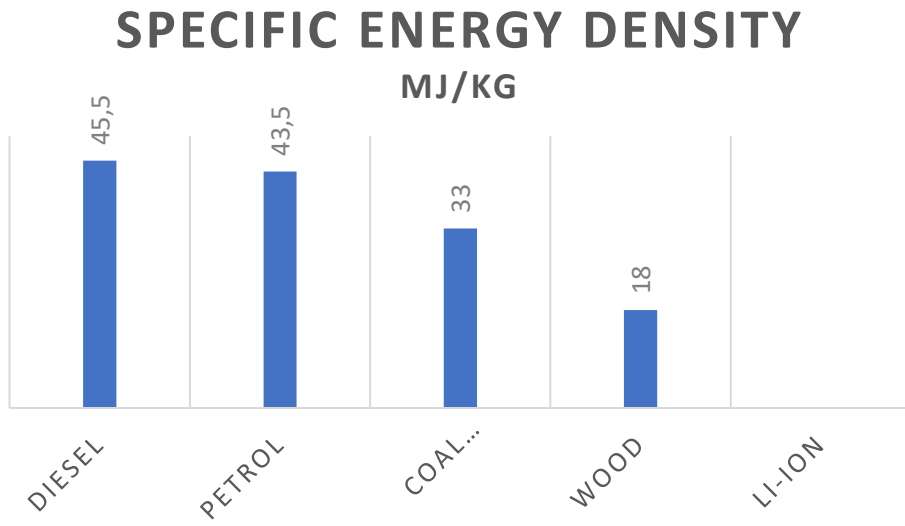


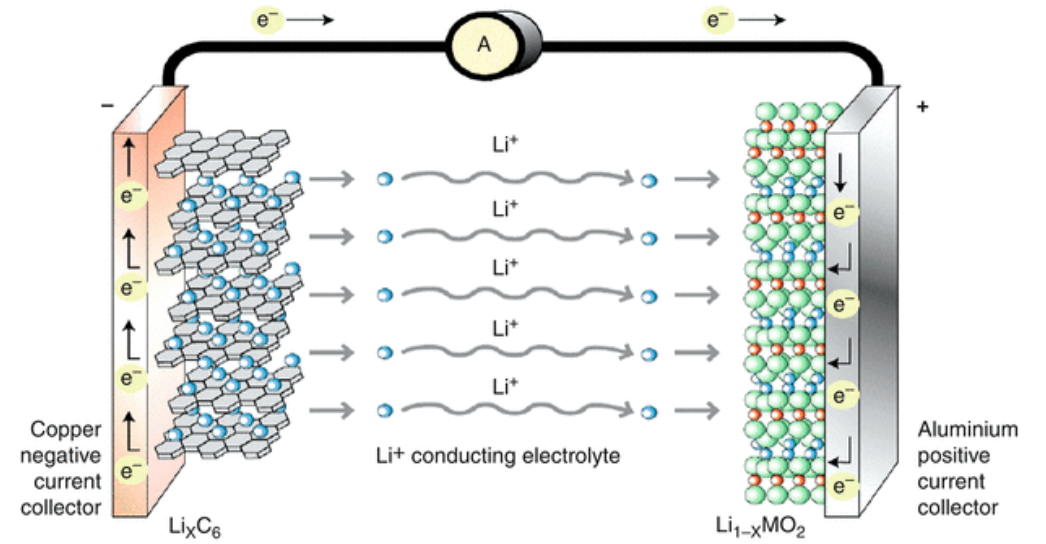
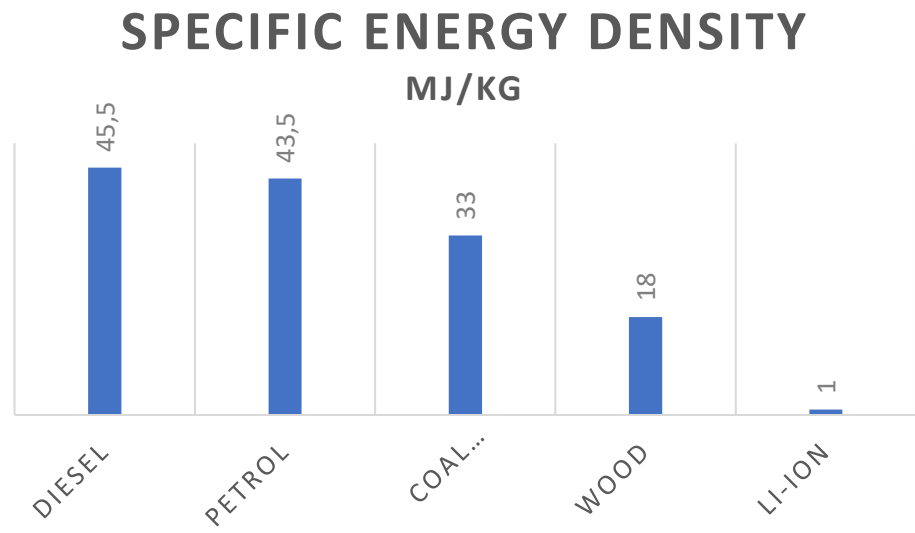
Better Batteries

Zdenek Kral

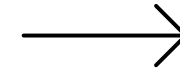
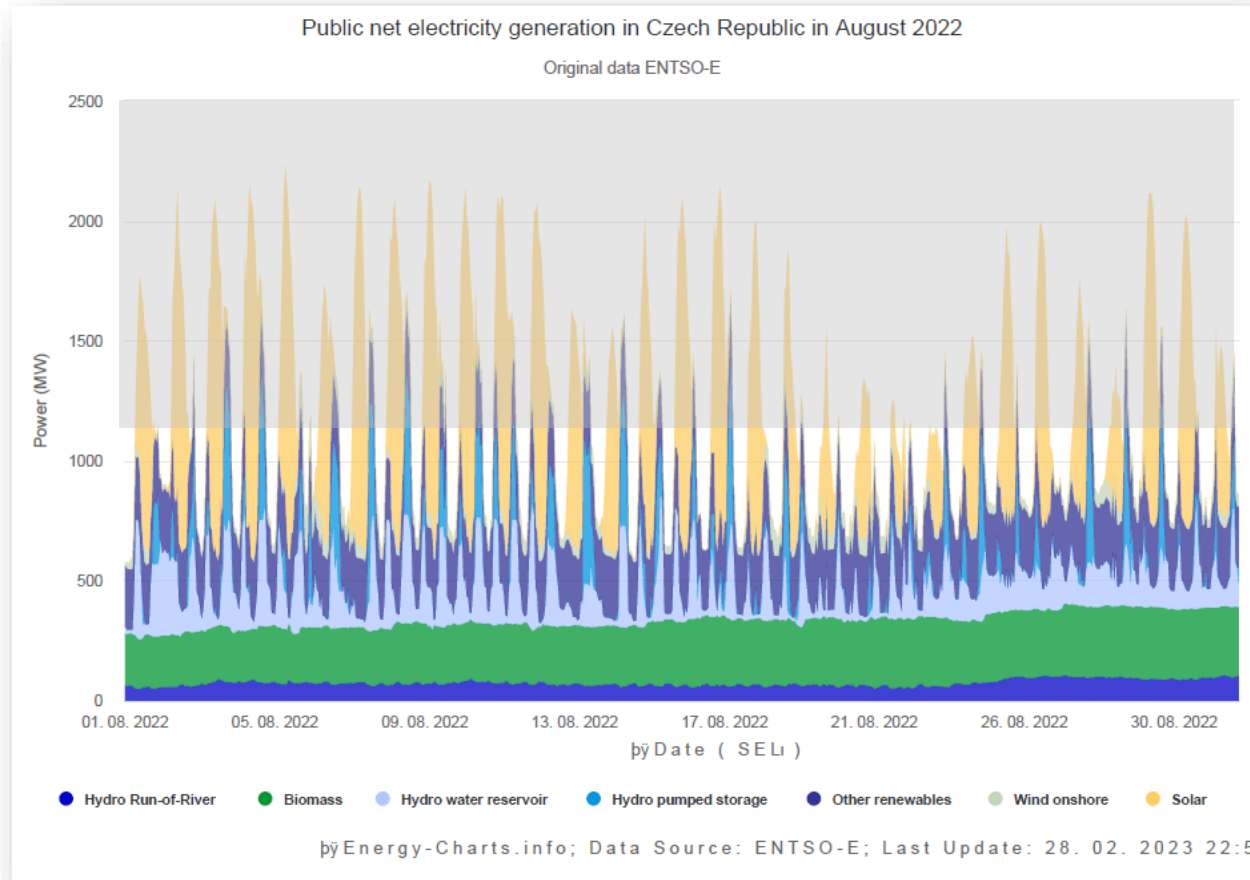
Li-ion Batteries



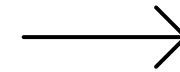
Li-ion Batteries



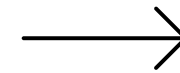
Do we need batteries?



Uphill water pumping
(potential energy)



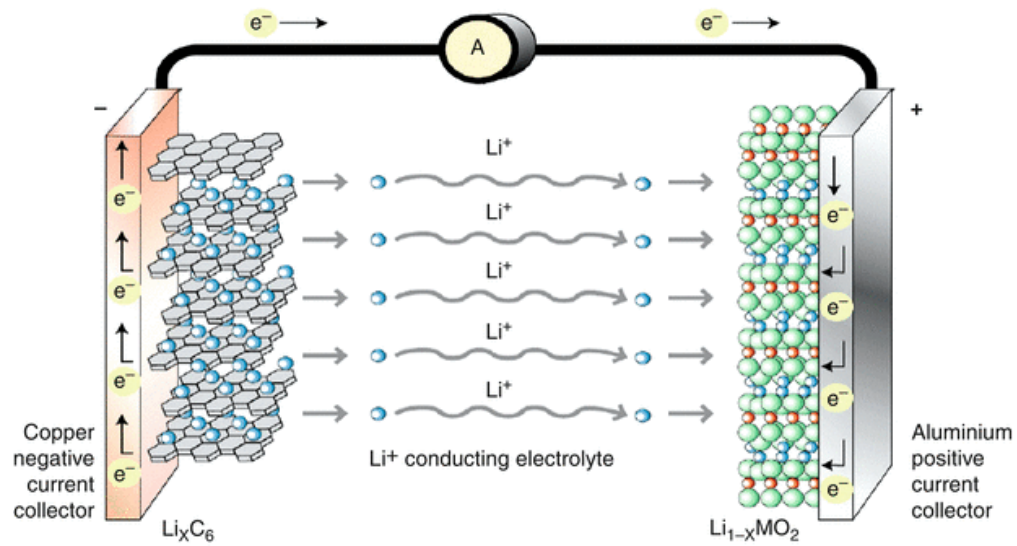
Hydrogen production



Electricity storage

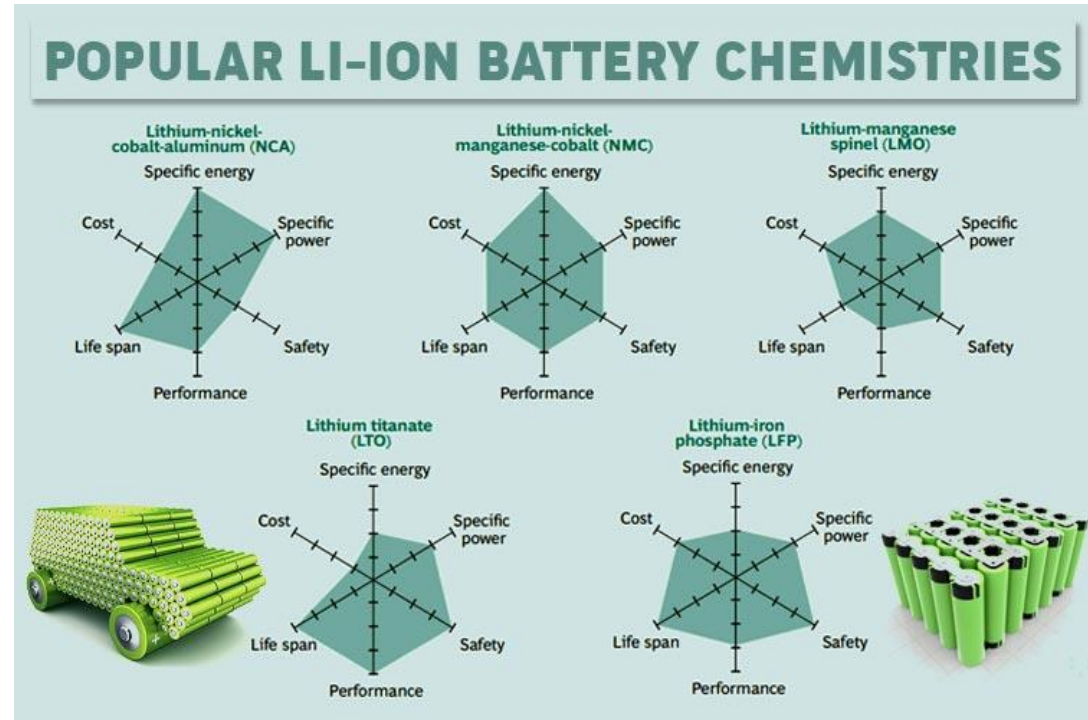


Li-ion Batteries



Basic Materials for Li-ion batteries

- Copper
- Aluminium
- Lithium



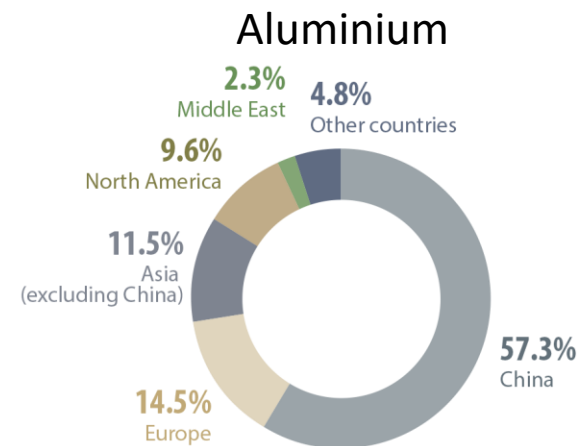
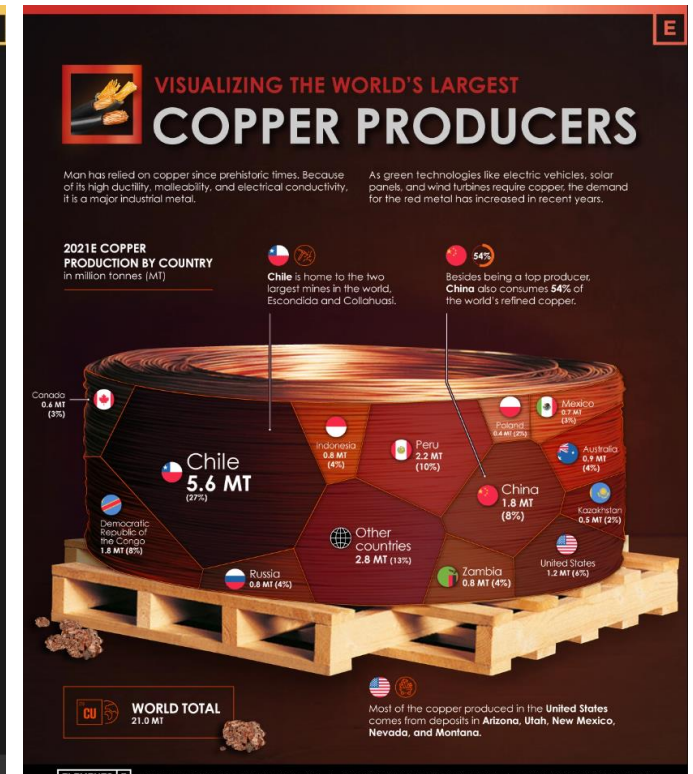
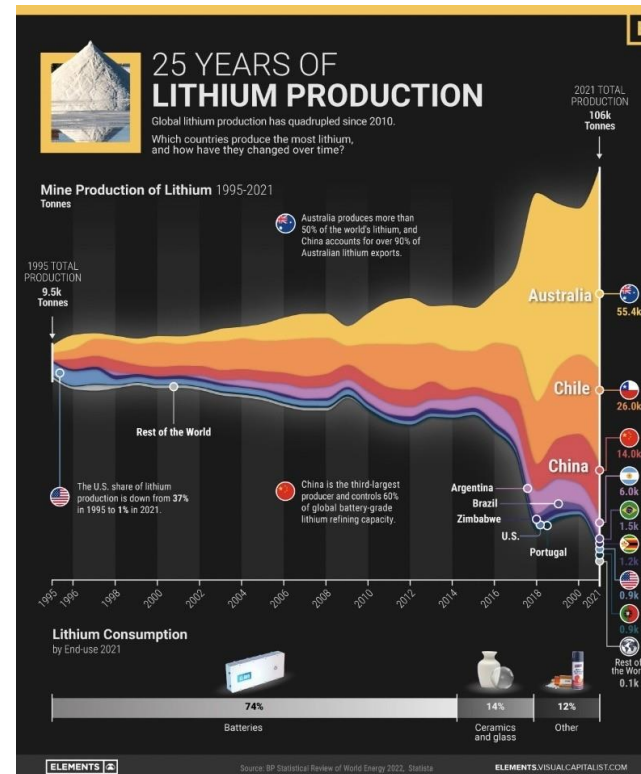
Other Materials for Li-ion batteries

- Cobalt
- Nickel
- Manganese

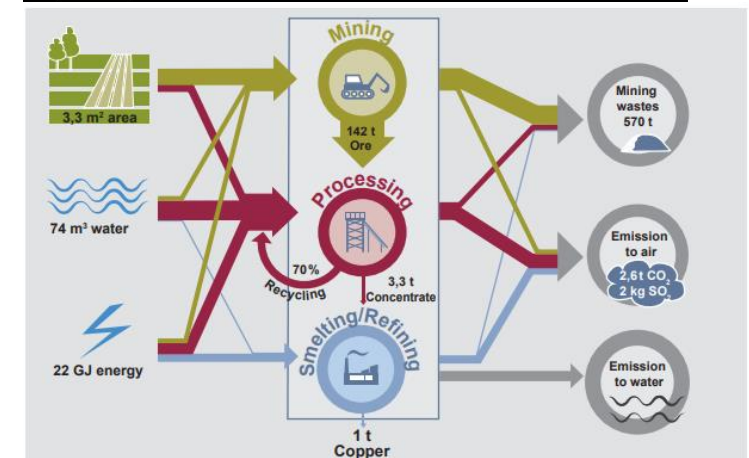
The Mining!

Basic Materials for Li-ion batteries

- Copper
- Aluminium
- Lithium



Source: Canda Government
<https://natural-resources.canada.ca/our-natural-resources/minerals-mining/minerals-metals-facts/aluminum-facts/20510>

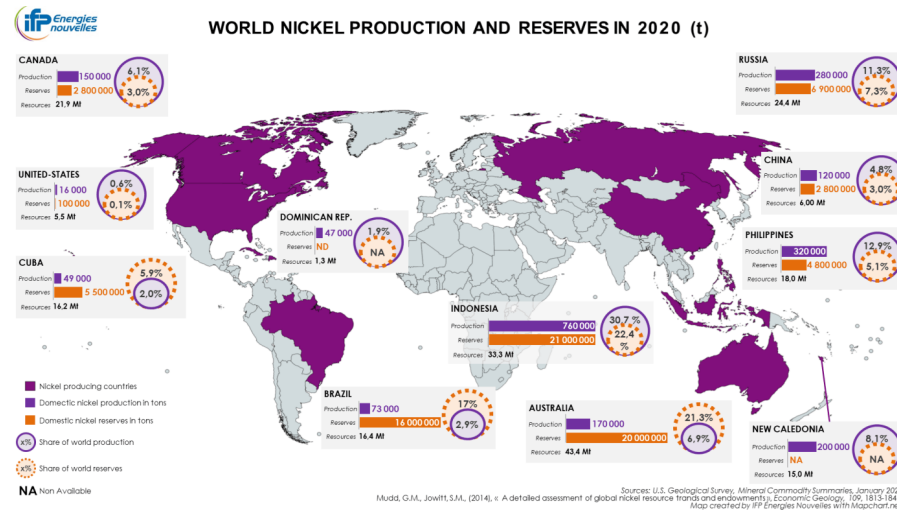
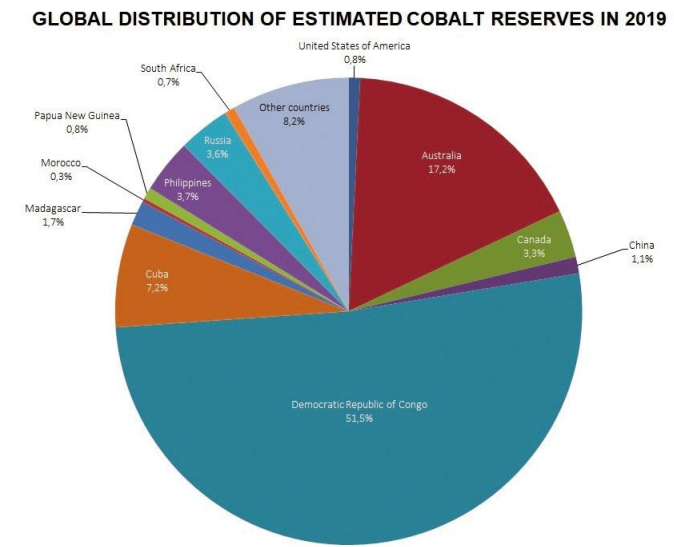
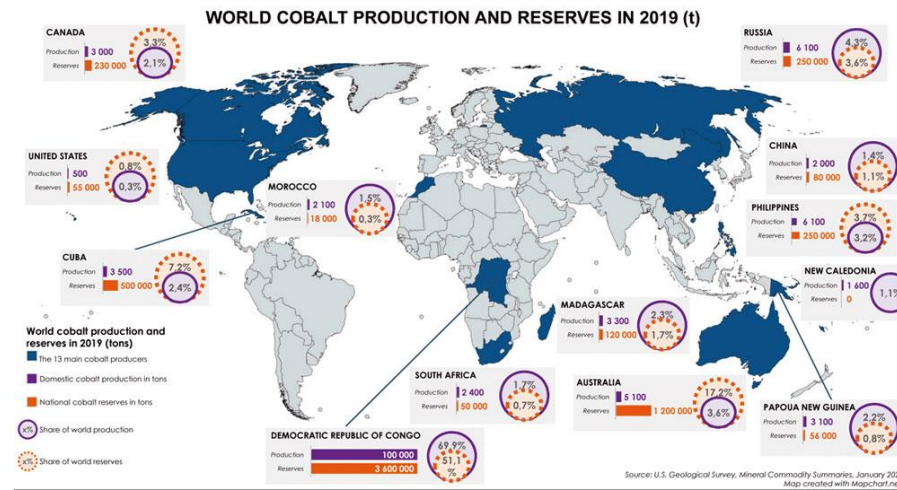


Source: Federal Institute for Geosciences and Natural Resources, Germany.

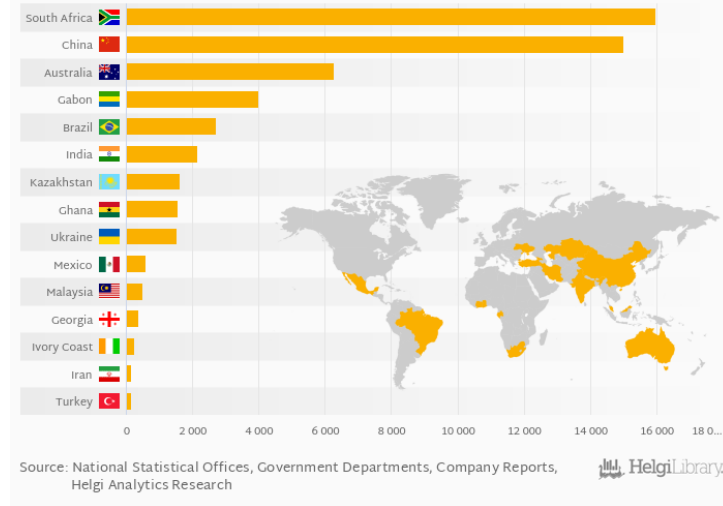
The Mining!

Other Materials for Li-ion batteries

- Cobalt
- Nickel
- Manganese



Manganese



The scale!

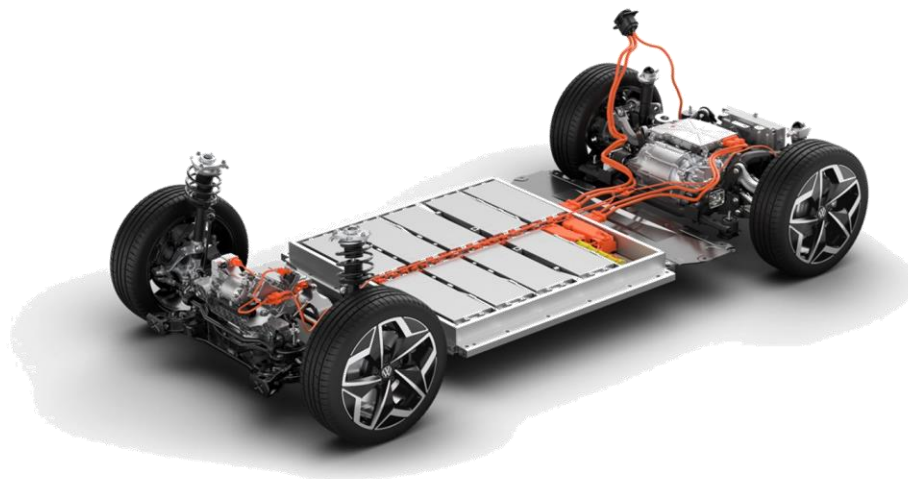


~ 5 Wh



~ 25 kWh

Equivalent of 5 000 iPhones



~ 80 kWh

Equivalent of 16 000 iPhones

2021: 14,5 mil. new vehicles registered in EU

Total 253 mil. passenger cars in the EU

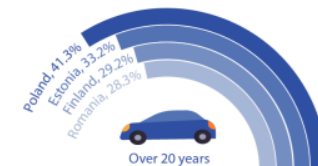
AGE OF PASSENGER CARS, 2021

(i.e. on 31 December 2021)

EU Member States with the highest shares of passenger cars younger than 2 years (% of total passenger cars)



EU Member States with the highest shares of passenger cars older than 20 years (% of total passenger cars)



eurostat

World passenger car production

1 April 2022

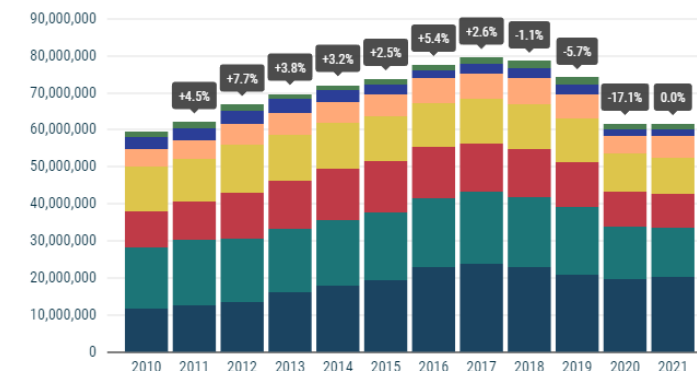


21% of all passenger cars produced worldwide are made in Europe. This interactive chart shows the number of cars produced per world region for the 2010-2021 period.

World passenger car production

IN UNITS, % CHANGE / 2010 - 2021

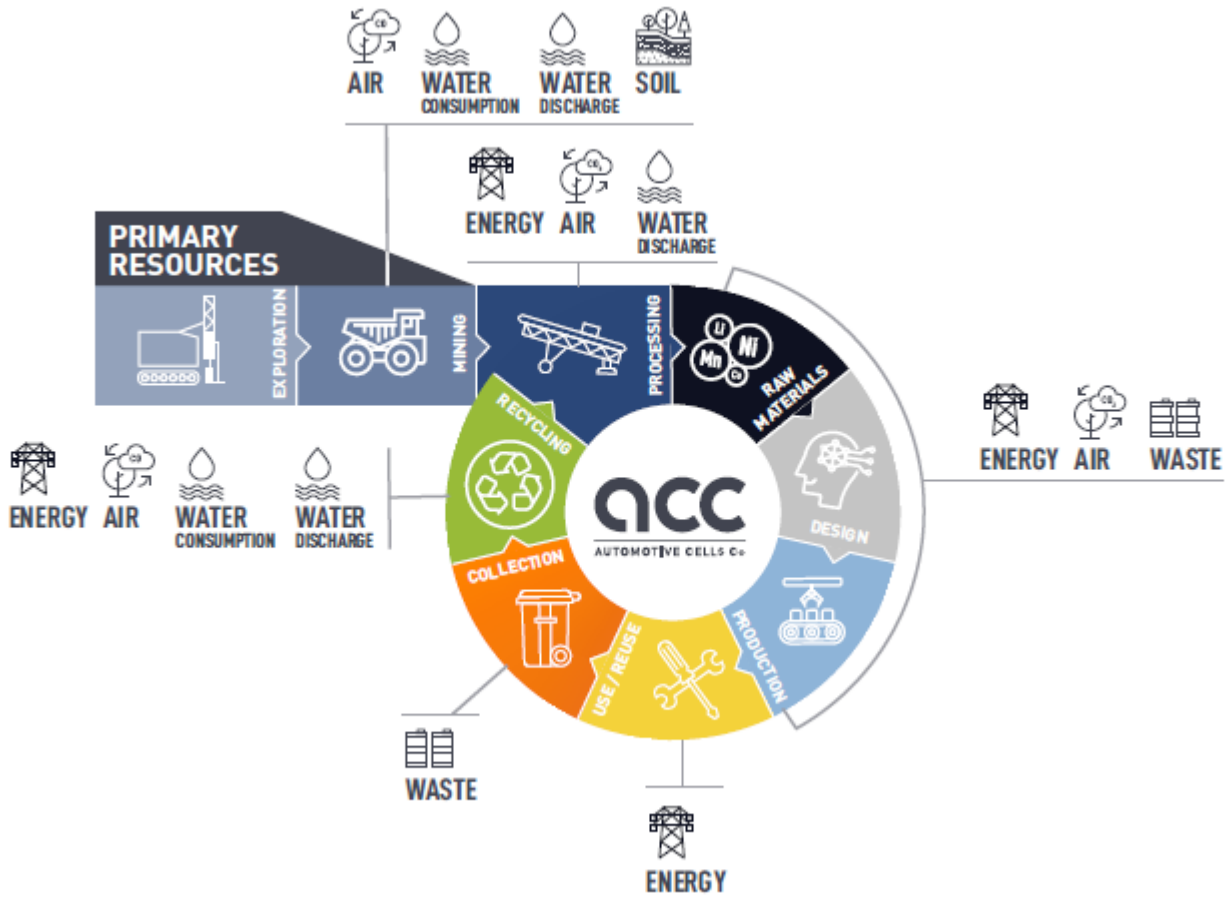
■ Greater China
 ■ Europe
 ■ North America
 ■ Japan/Korea
 ■ South Asia
 ■ South America
 ■ Middle East/Africa



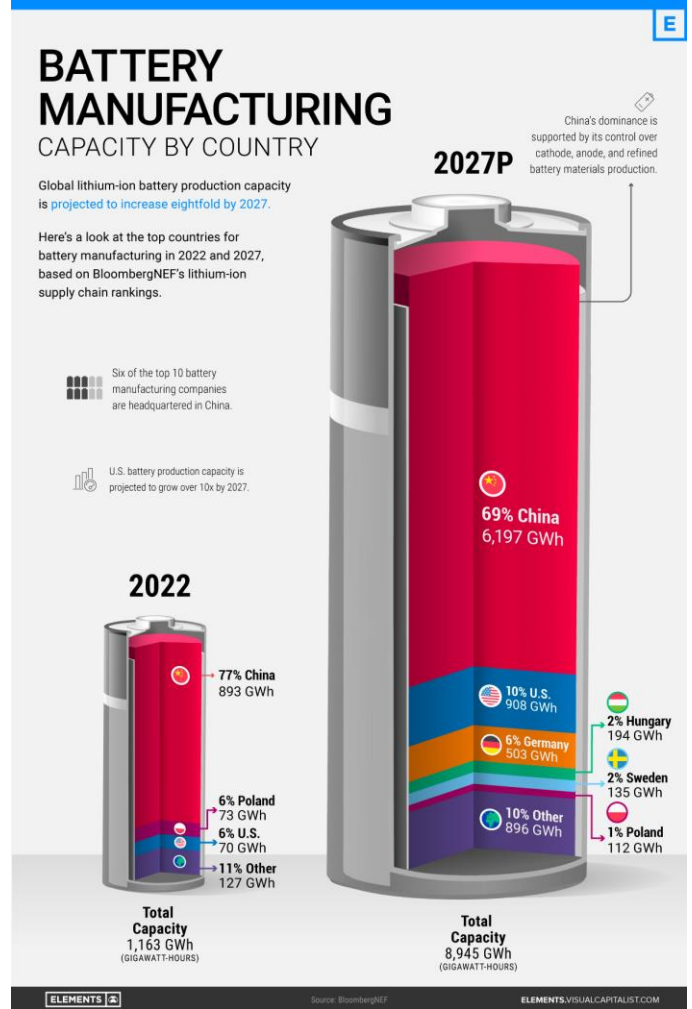
Created with LocalFocus

Source: IHS MARKIT

Better processes!



Source: <https://www.acc-emotion.com/about-acc>

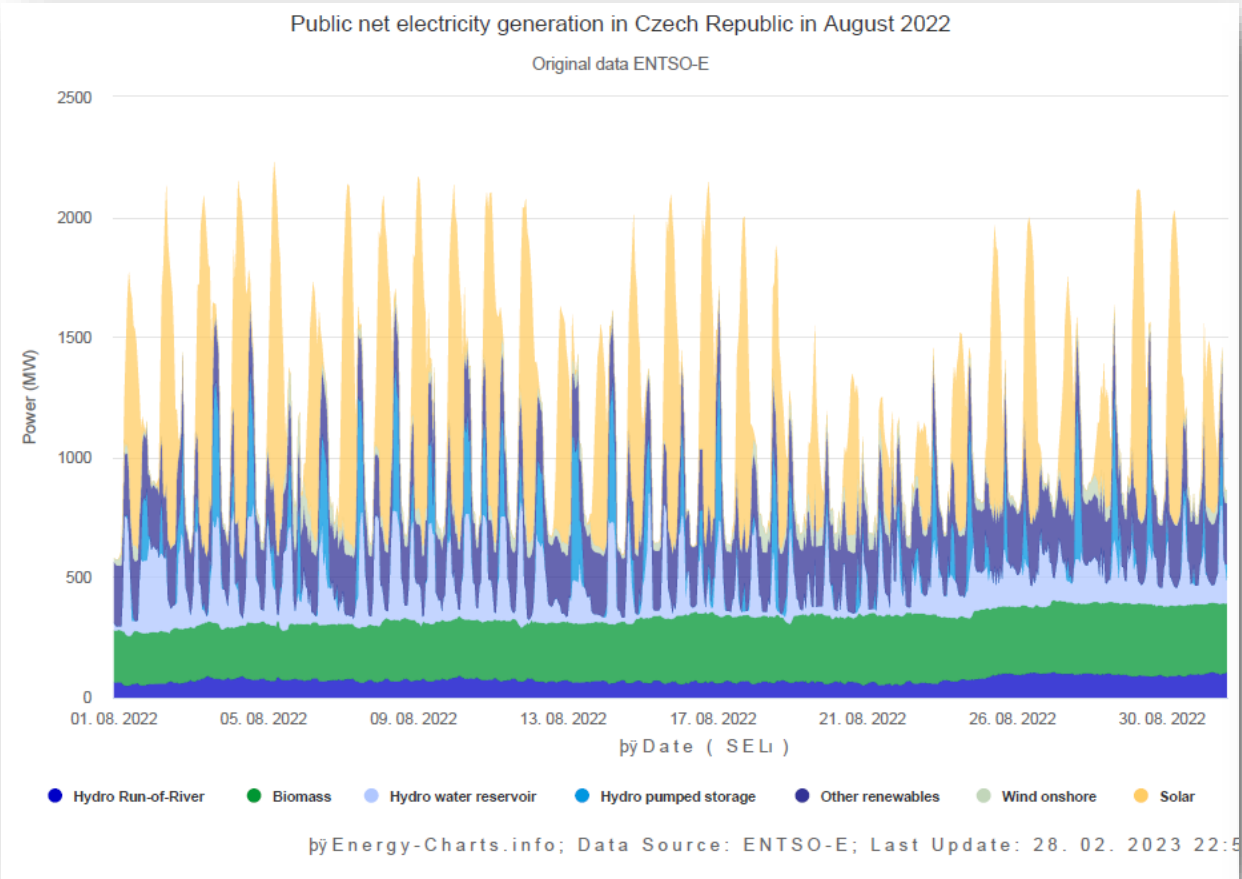


7 90 Th 232.0381	2 7 N 14.00674	4 19 K 39.0983	5 39 Y 88.90585	2 8 O 15.9994	7 92 U 238.0289
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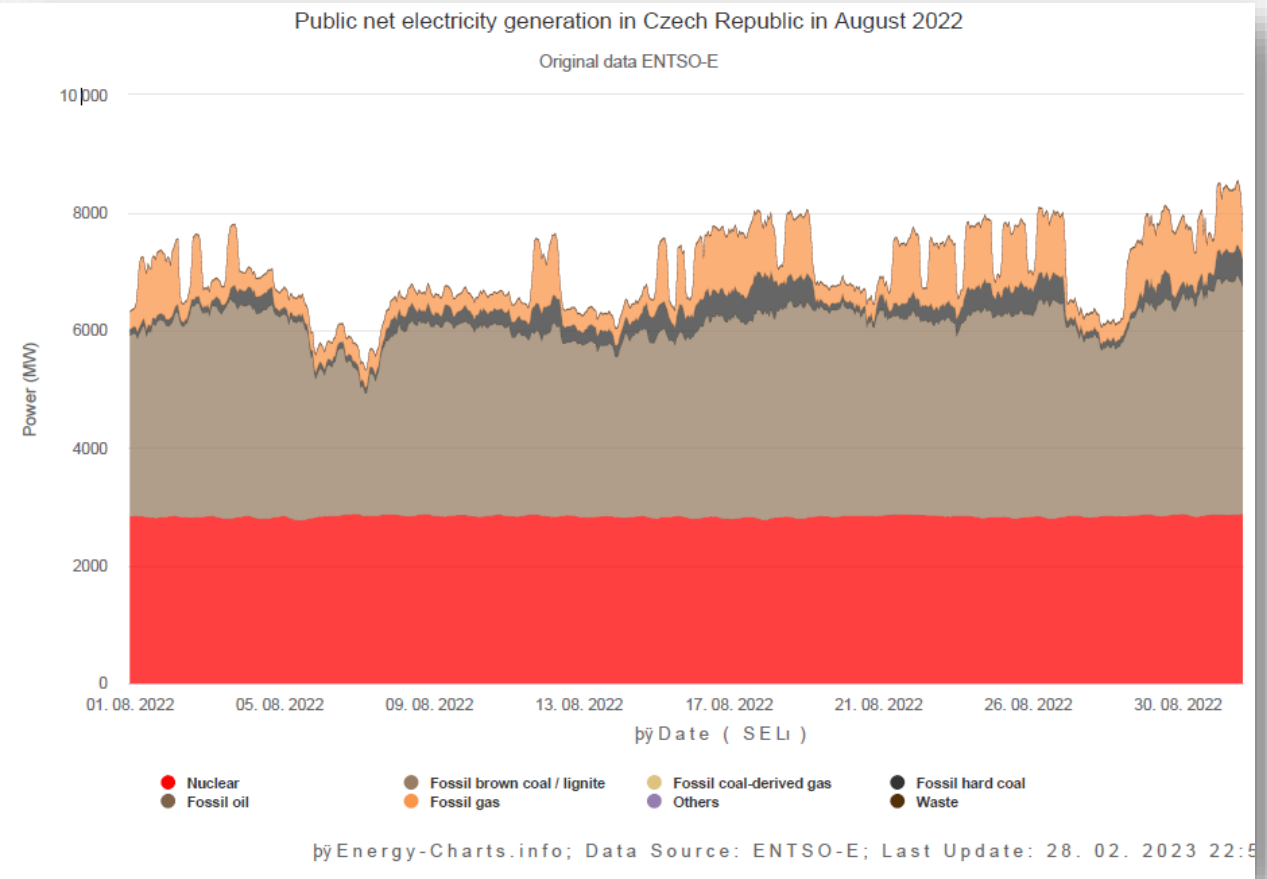
(Why) Do we need batteries?

Energy production in August 2022 – Czech republic

Renewable energy



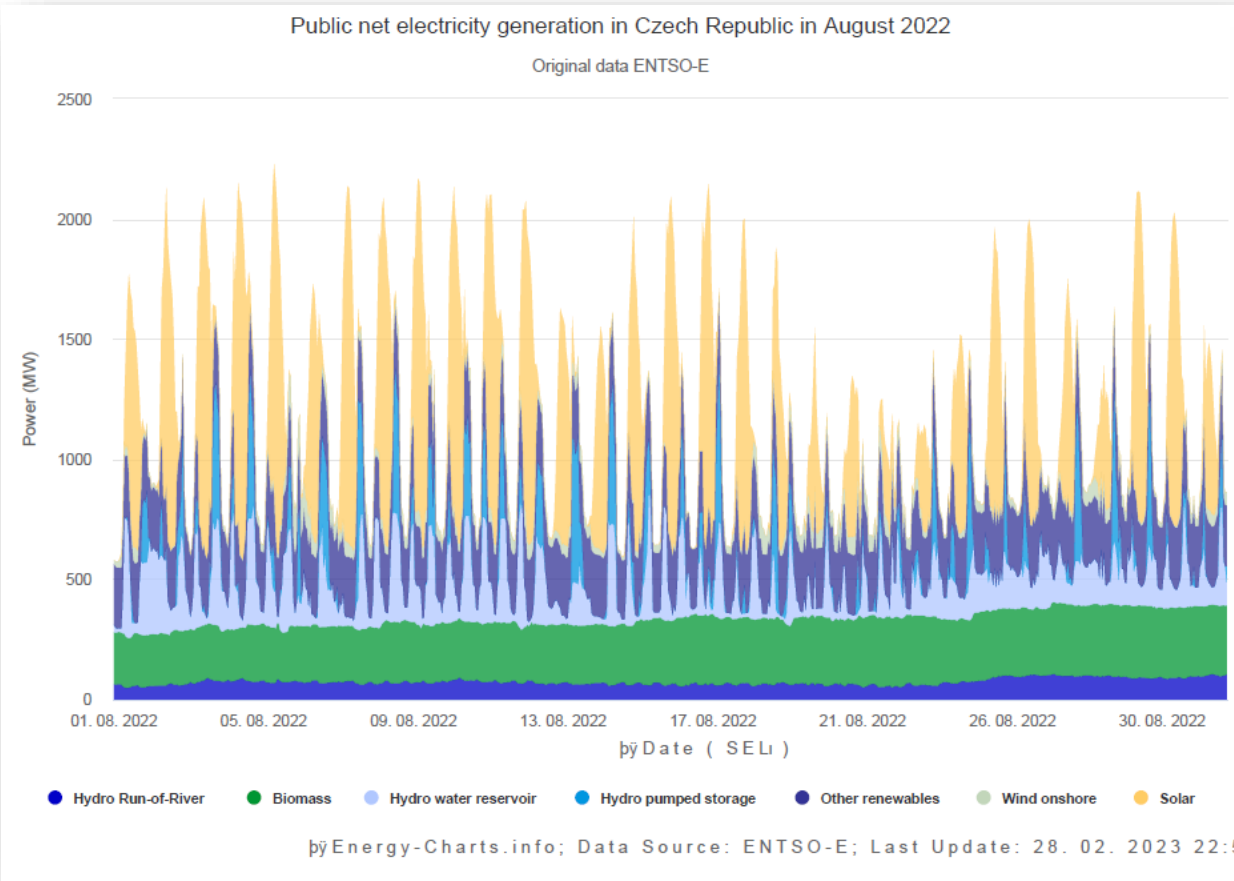
Fossil energy



How to solve peaks?

Energy production in August 2022 – Czech republic

Renewable energy



Hydro pumping energy balance

