



Using lignin to make batteries more sustainable

Commercialization of sodium-ion batteries

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Founder of ALTRIS AB

22/11/2021



Roughly 70-80 scientists from three different departments:

Chemistry, Physics and Engineering Sciences – an international environment

**50 international publications per year
3-5 dissertation per year and a number of master theses
Alumni in Swedish industry and international academia**

“Rechargeable Batteries Market to Reach \$150.0 Bn, Globally, by 2030”

by Bloomberg

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Business

Rechargeable Batteries Market to Reach \$150.0 Bn, Globally, by 2030 at 5.3% CAGR: Allied Market Research

27 October 2021, 15:01 CEST

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Business

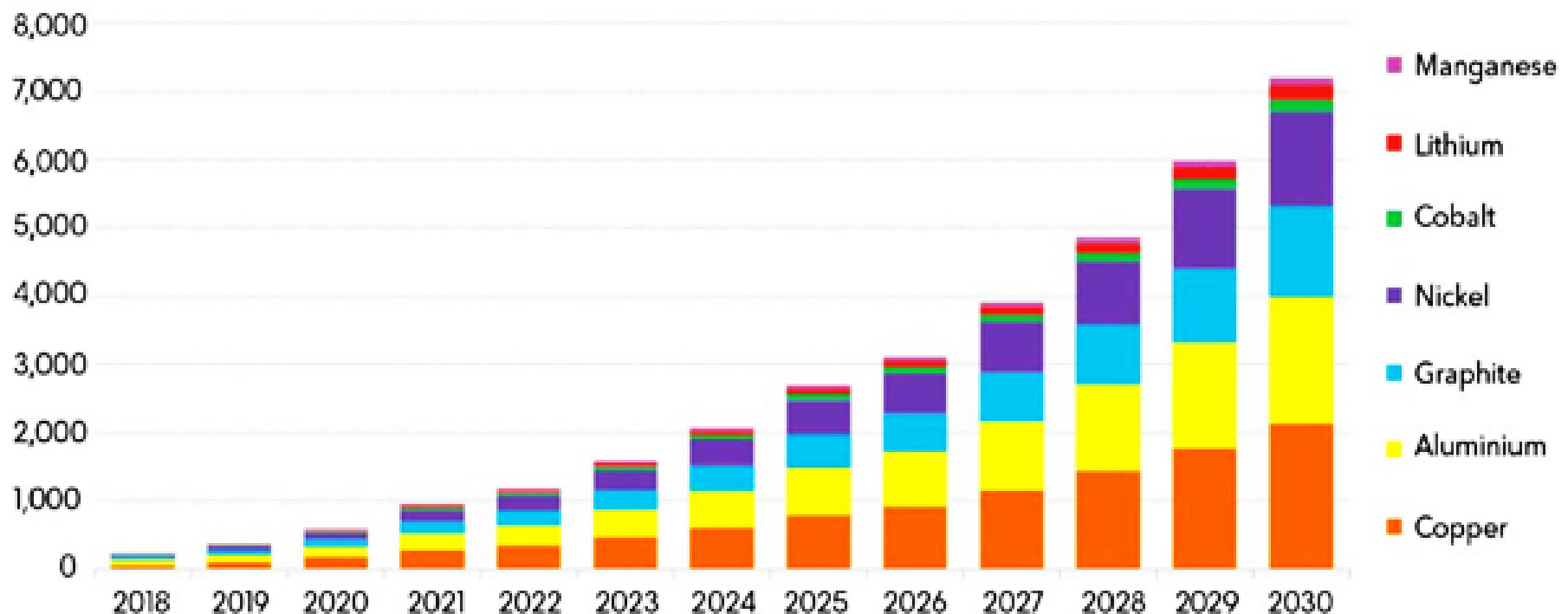
Global EV Battery Market Size Is Projected To Reach At \$84 Million By 2025 as Demand Climbs

17 August 2021, 14:40 CEST

Fast growth in battery market

Metals and materials demand from lithium-ion battery packs in passenger EVs

Thousand metric tons

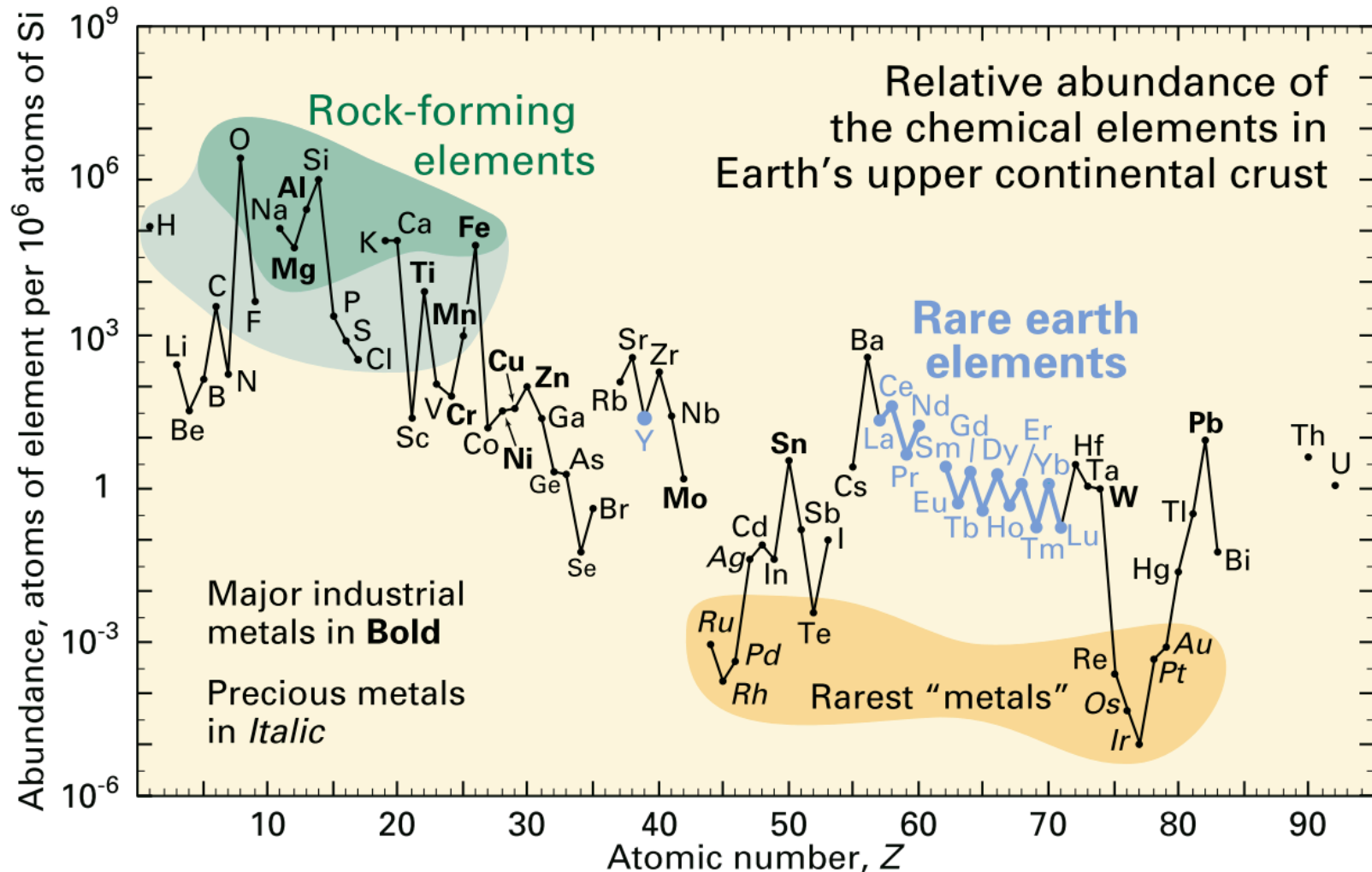


Source: Bloomberg NEF 2019 Electric Vehicle Outlook

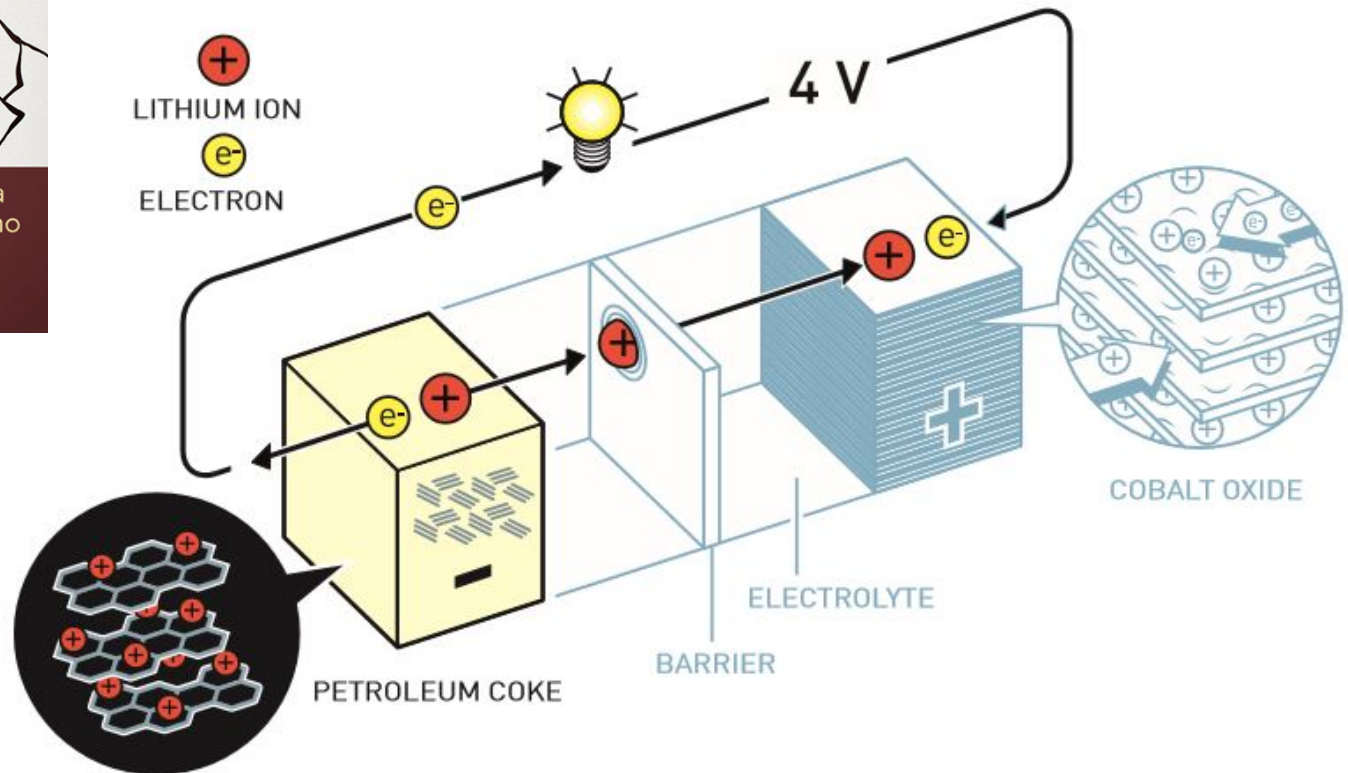
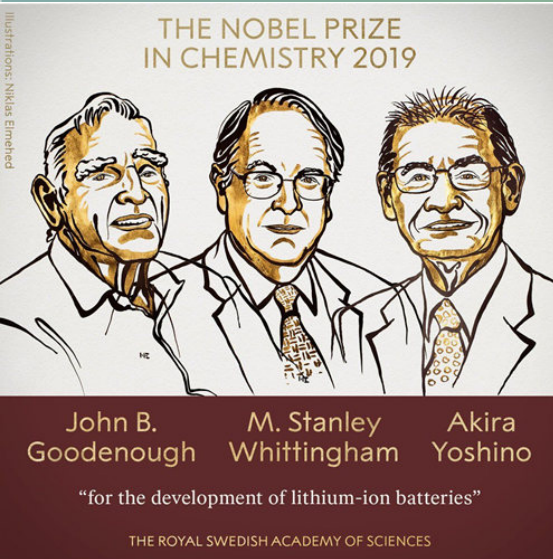
Issue of access to raw materials

- Li:** 75% of world's lithium resources in Argentina, Chile, Bolivia, and China
- Co:** 65% of all cobalt production from Congo
- C:** 65% of flake graphite is mined in China
- Ni:** In 2014, Indonesia banned export of nickel, which caused increased price of nearly 50%

Batteries based on naturally abundant elements



Lithium vs. sodium batteries



ALTRIS, a spin-off from Uppsala University since 2017

- ✓ Drop-in solution
- ✓ All naturally abundant elements
- ✓ Competitive to Li-ion batteries
- ✓ Positive societal affect
- ✓ Potential to lower cost of battery cells
- ✓ Wide temperature range



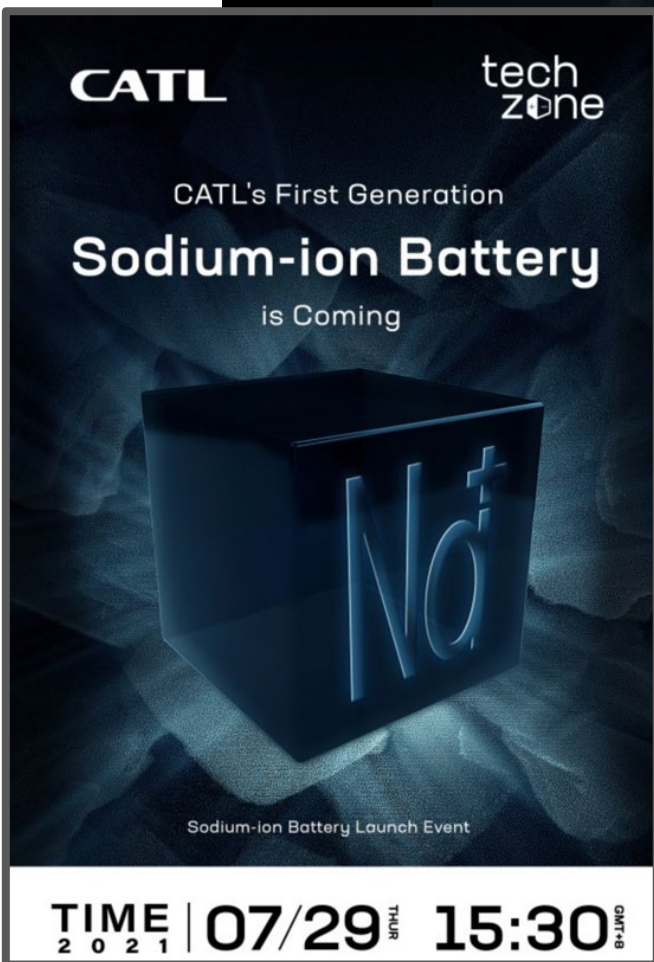
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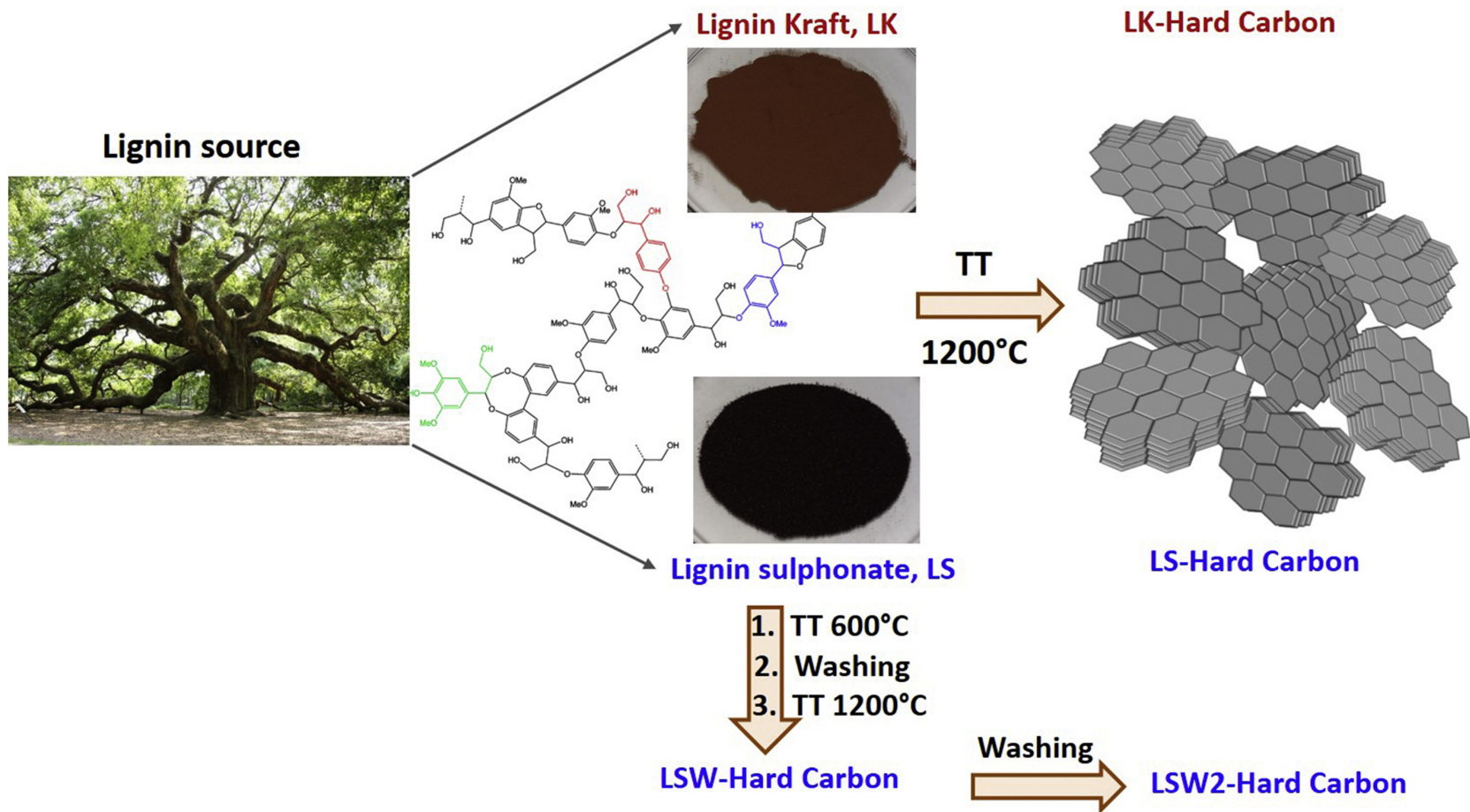
ALTRIS

Sodium-ion batteries by CATL

- CATL announced;
 - There will be a value chain for Sodium-ion batteries from 2023
 - Sodium-ion batteries is better than LFP in almost everything. Similar conclusions as Altris
 - CATL choice of cathode material is Prussian White
 - Sodium-ion batteries suitable for both stationary storage and electric vehicles



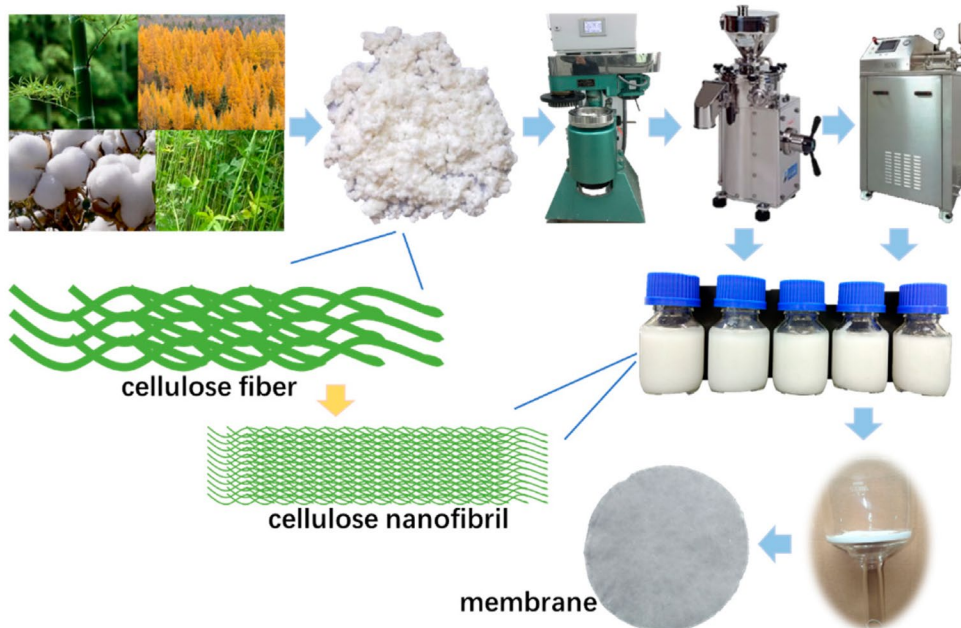
Hard carbon produced from forest



Source: Ghimbeu et al., *Carbon*, 153, 2019, 634-647

battery components from forest

Separators



source: Sheng et al.; *Materials* 12, 2019

Binders



source: Gond et al., *ACS Sustain. Chem. Eng.* 2021, 9, 12708.

Sodium-ion battery market



Global Sodium-Ion Batteries Market Size to Grow at a CAGR of 19.3% from ...

Global Sodium-Ion Batteries Market Size to Grow at a CAGR of 19.3% from 2021 to 2030

The global sodium-ion batteries market has been estimated to reach a value of USD 1.01 billion in 2021, and it is projected to grow at a CAGR of 19.3% during the forecast period from 2021-2030.

June 30, 2021 07:00 ET | Source: [Quince Market Insights](#)

CATL's sodium ion batteries threaten to take over world market from lithium





THANK YOU

Reza Younesi
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22 Nov. 2021

