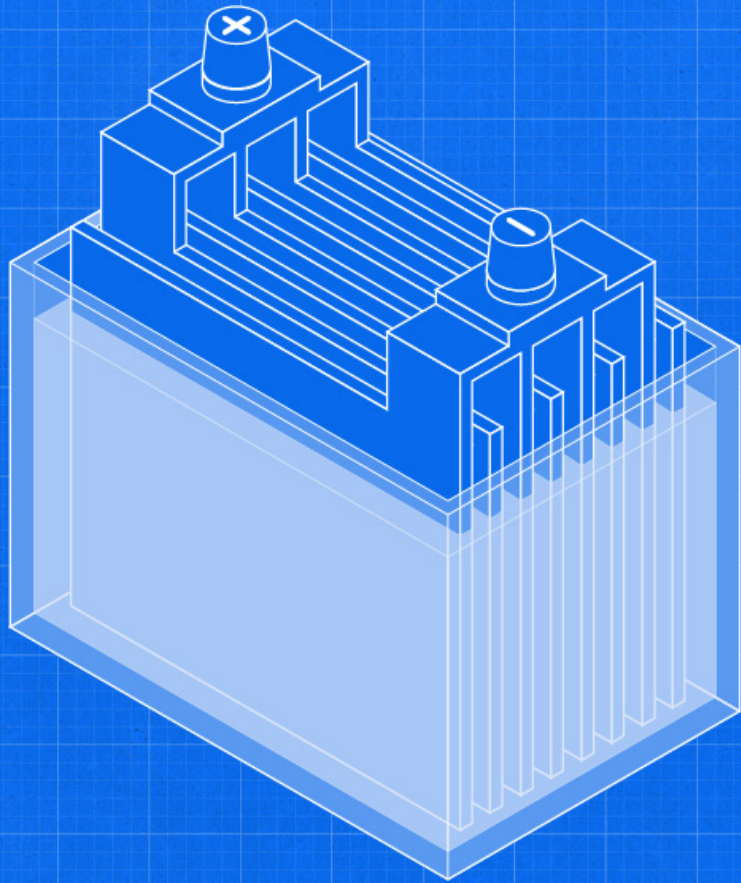


INSIDER



## How They Got Here: Battery Packs

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The innovations that transformed everyday items  
into sustainable solutions.

## Featuring Insights From

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Senior sustainability reporter **Karen K. Ho** and senior tech correspondent **Lisa Eadicicco** — who offers a glimpse at what battery packs might look like in the future.

## The Sustainable Side

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The ability to store power helped increase efficiency and reduce dependence on fossil fuels, especially from clean energy sources like solar, wind, and hydroelectricity. Battery packs are now essential for a growing number of electric vehicles and increasingly popular personal transportation options such as scooters and electric bikes.

# The Innovations

**Alessandro Volta** invents the first battery that can continuously provide an electric current to a circuit: the voltaic pile.

1800



1859

**Gaston Planté** invents the lead-acid battery, the first battery that can be recharged with a current.

# The Innovations

**Carl Gassner** obtains a German patent for the first dry cell battery.

1888

**Waldemar Junger** invents the nickel-cadmium storage battery, commonly known as an alkaline battery.

1899

1954

**Gerald Pearson, Calvin Fuller, and Daryl Chapin** invent the first solar cell that converts the sun's energy into electricity

# The Innovations

**Akira Yoshino** develops a prototype for the Lithium-ion battery based on earlier research by **John Goodenough, M. Stanley Whittingham, Rachid Yazami** and **Koichi Mizushima**.

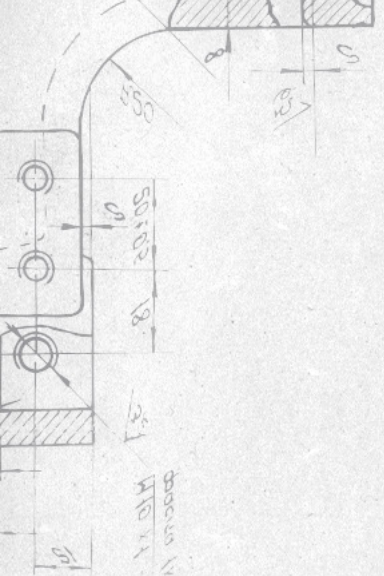
1985

**Tesla** unveils the Powerwall, a home energy storage unit that utilizes solar energy collected by panels.

2015

2003

**Tesla Motors** is incorporated by **Martin Eberhard** and **Marc Tarpenning** as “a car manufacturer that is also a technology company.” In 2004, **Elon Musk** provides \$6.5 million in series A funding (out of the \$7.5 million total raised) and becomes chairman of the company’s board of directors.

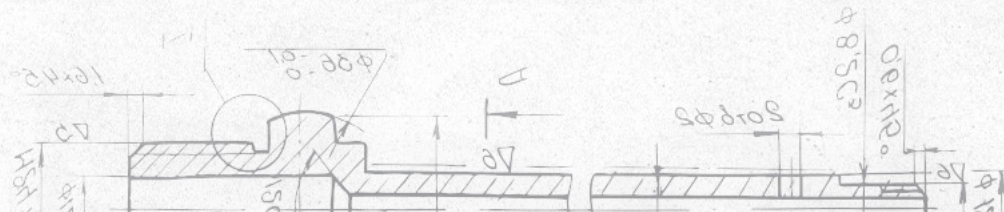


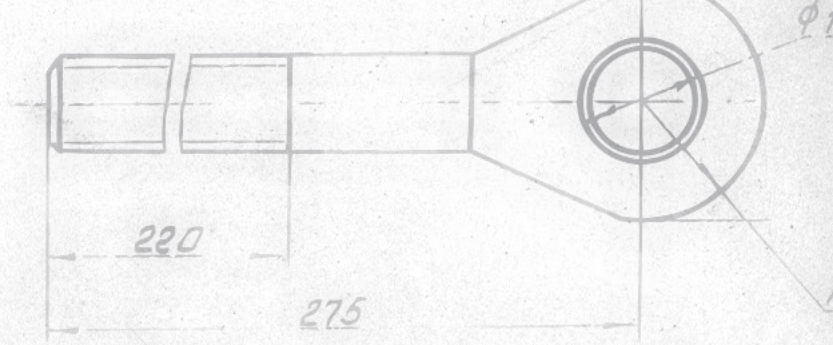
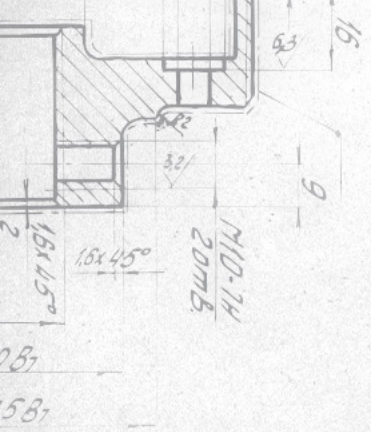
## The Unsustainable Side

There is a “growing mineral crisis” in the search and mining practices for **several key ingredients** found in the batteries powering many electric vehicles. The process to extract lithium is water-intensive, invasive, and highly pollutive. There is also the issue of e-waste: a dismal estimate of 2% of it being recycled in Australia.

### Human Rights

Cobalt is found in huge quantities in the **Democratic Republic of Congo**, but is often mined by hand using child labor and without protective equipment.





## A prediction for tomorrow's battery packs:

Lithium ion batteries power everything from smartphones to electric vehicles, but they still come with limitations, especially when it comes to capacity. Enter the **solid state battery**.

Solid state batteries promise to deliver a longer range while also cutting down on charging time and reducing the risk of overheating.

These types of batteries aren't available in cars just yet, but they're most certainly a key part of how electric vehicles will operate in the future.

### Companies Making Moves

Ford and BMW have invested \$130 million in the solid state battery startup Solid Power to bring the technology to vehicles by 2030. Toyota aims to release a vehicle with a solid state battery by 2025.





## About Karen K. Ho

Karen is a senior sustainability reporter at the helm of our Sustainability Newsletter. She was previously a global finance and business reporter for Quartz, and she has covered cultural topics for Time, the Columbia Journalism Review, FiveThirtyEight, and other publications.

## About Lisa Eadicicco

Lisa is a senior tech correspondent for Business Insider's Reviews team, where she helps lead our coverage of the latest tech products from Apple, Google, Microsoft, Amazon, and other major tech companies. She previously served as Time magazine's tech columnist.

### See Her Work



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