

## European Solar and Energy Storage Solutions

# Use new energy storage devices to convert CO2



**Application scenarios of energy storage battery products**



## Overview

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In a study appearing today in ACS Catalysis, the researchers reveal the hidden functioning of how carbon dioxide can be both captured and converted through a single electrochemical process. The process involves using an electrode to attract carbon dioxide released from a sorbent, and to convert it into a reduced, reusable form.

In a study appearing today in ACS Catalysis, the researchers reveal the hidden functioning of how carbon dioxide can be both captured and converted through a single electrochemical process. The process involves using an electrode to attract carbon dioxide released from a sorbent, and to convert it into a reduced, reusable form.

Our findings suggest that by fundamentally taming the asymmetric reactions, aqueous batteries are viable tools to achieve integrated energy storage and CO<sub>2</sub> conversion that is economical.

The MIT team is looking to combine the two processes into one integrated and far more energy-efficient system that could potentially run on renewable energy to both capture and convert CO<sub>2</sub> from concentrated, industrial sources. In a study reported in ACS Catalysis, the researchers reveal the hidden functioning of how CO<sub>2</sub> can be both captured .

Researchers at the Department of Energy's Oak Ridge National Laboratory are developing battery technologies to fight climate change in two ways, by expanding the use of renewable energy and capturing airborne carbon dioxide. This type of battery stores the renewable energy generated by solar panels or wind turbines.

Carbon capture and storage (CCS) technologies must be part of the portfolio of solutions to decrease emissions from energy-intensive sectors and existing infrastructure, as well as. Can a battery convert CO<sub>2</sub> from a stationary source?

Unlike cell phone or car batteries, those designed for grid energy storage do not have to function as a portable, closed system. This allowed ORNL researchers to create and test two types of batteries that could convert CO<sub>2</sub>

from stationary, industrial sources.

Can energy storage and CO<sub>2</sub> conversion be integrated in an aqueous battery?

A system integrating CO<sub>2</sub> conversion and energy storage holds great promise, but faces a major challenge due to degraded catalysts on charge. Here, the authors present a highly efficient energy storage and CO<sub>2</sub> reduction method in an aqueous battery, achieved through oxidation of reducing molecules.

Is CO<sub>2</sub> conversion a primary energy contributor?

Our results identified that the electrochemical CO<sub>2</sub> conversion is the primary energy contributor for both sequential and integrated CO<sub>2</sub> capture and electrochemical conversion process. The reported energy efficiency of the integrated electrolyser is generally lower than the gas-fed CO<sub>2</sub> electrolysis.

Do CO<sub>2</sub> batteries release carbon dioxide?

However, the CO<sub>2</sub> batteries developed at ORNL do not release carbon dioxide. Instead, the carbonate byproduct dissolves in the liquid electrolyte. The byproduct either continuously enriches the liquid to enhance battery performance, or it can be filtered from the bottom of the container without interrupting battery operation.

How is CO<sub>2</sub> converted into a gas?

In the sequential route, the captured CO<sub>2</sub> is released at high purity via an amine-scrubbing step and then compressed and fed as a gas to a CO<sub>2</sub> electrolyser unit. Product separation and (bi)carbonate regeneration processes are included in the conversion step.

How do low-temperature CO<sub>2</sub> electrolysers convert CO<sub>2</sub> to feedstocks?

On the conversion side, low-temperature CO<sub>2</sub> electrolysers using pure CO<sub>2</sub> feeds have achieved a current density beyond 1 A cm<sup>-2</sup> to convert CO<sub>2</sub> selectively to feedstocks (e.g., carbon monoxide (CO) and ethylene (C<sub>2</sub>H<sub>4</sub>))  
7, 8, 9, 10.

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### Study suggests energy-efficient route to capturing and converting ...

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### Carbon-capture batteries developed to store renewable energy, ...

Researchers recently created and tested two different formulations for batteries that store renewable energy; when the energy is later used, an electrochemical reaction converts ...



#### Applications



### Electrochemical Energy Storage and Conversion Devices--Types ...

The use of fossil fuels results in major production of carbon dioxide and further gases broadly identified Landolt-Börnstein: Numerical Data and Functional Relationships in ...

## 3 Energy Sources, Conversion Devices, and Storage

Energy Sources, Conversion Devices, and

Storage ENERGY SOURCES, CONVERSION DEVICES, AND STORAGE. Power and energy (P&E) technology in its most basic form centers on energy sources, energy storage, conversion, ...



## New route to carbon-neutral fuels from CO2 discovered by

A new, practical starting point for converting carbon dioxide into sustainable liquid fuels could lead to fuels for heavier vehicles difficult to electrify, like airplanes, ships and ...

## Advancements and assessment of compressed carbon dioxide energy storage

Global energy storage demands are rising sharply, making the development of sustainable and efficient technologies critical. Compressed carbon dioxide energy storage (CCES) addresses ...



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...

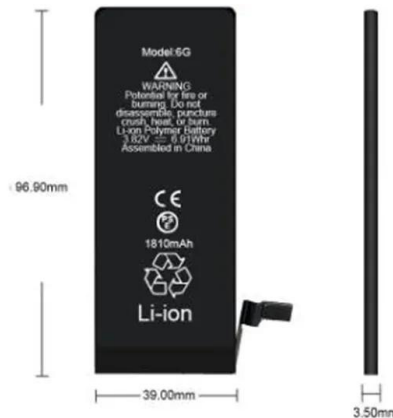
Carbon capture and storage (CCS) technologies must be part of the portfolio of solutions to decrease emissions from energy-intensive sectors and existing infrastructure, as well as

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## Green Genius: MIT and Harvard Engineers Transform ...

Breakthrough in CO<sub>2</sub> to Fuel Conversion. Now, researchers at MIT and Harvard University have developed an efficient process that can convert carbon dioxide into formate, a liquid or solid material that can be used like ...



## Turning CO<sub>2</sub> from the atmosphere into sustainable fuel

The use of fossil fuels in energy production is by far the biggest contributor to greenhouse gas emissions worldwide, primarily in the form of carbon dioxide (CO<sub>2</sub>). In 2021, following a rare ...



## Turning carbon dioxide into valuable products , MIT Energy ...

Carbon dioxide (CO<sub>2</sub>) is a major contributor to climate change and a significant product of many human activities, notably industrial manufacturing. A major goal in the energy field has been to ...



## 3D printed energy devices: generation, conversion, and ...

The energy devices for generation, conversion, and storage of electricity are widely used across diverse aspects of human life and various industry. Three-dimensional (3D) printing has ...

## Study suggests energy-efficient route to capturing and ...

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