

# Decarbonization and the Role of Power Supply Industry

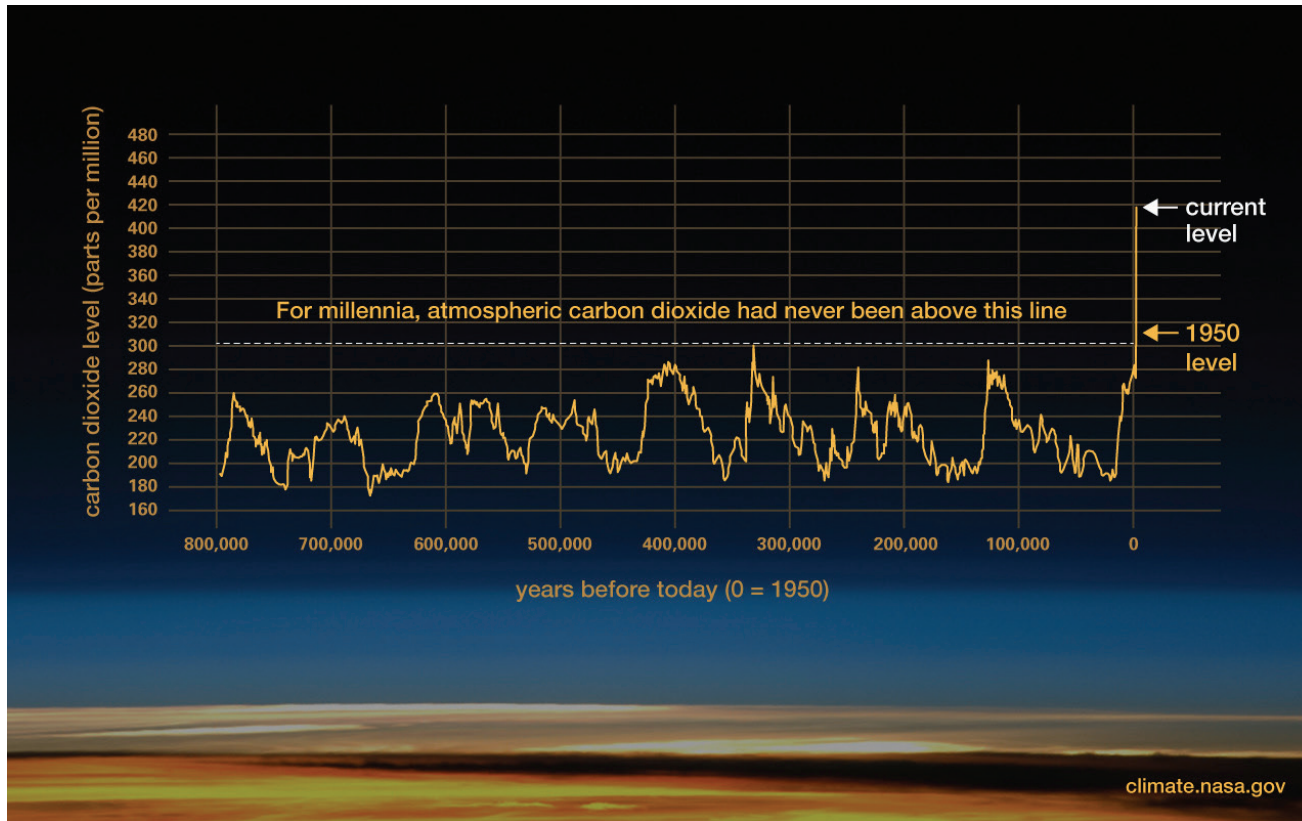


Prof. Saifur Rahman  
2023 IEEE President & CEO  
[www.srahman.org](http://www.srahman.org)

Keynote Speech  
24<sup>th</sup> CEPSI Conference  
20 October 2023  
Xiamen, China



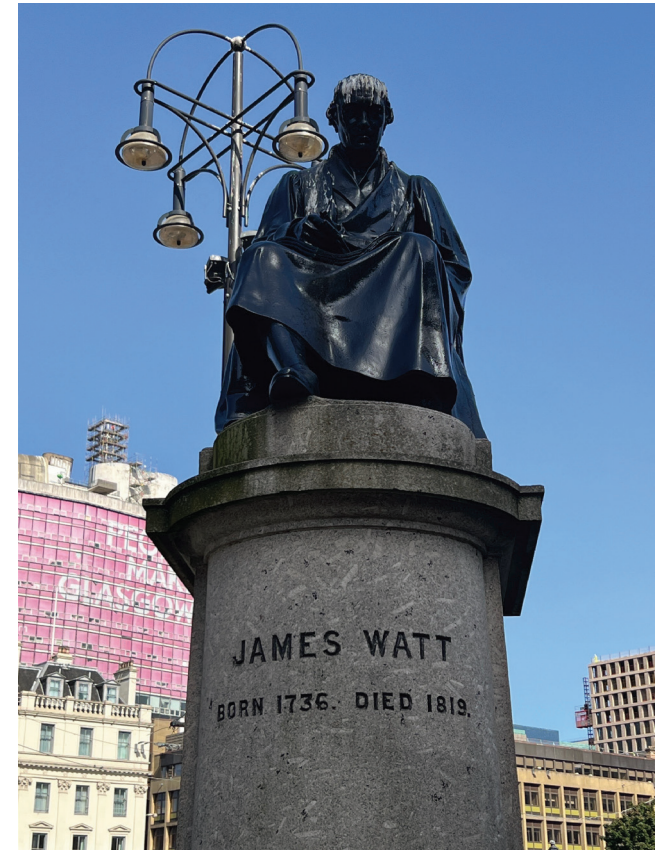
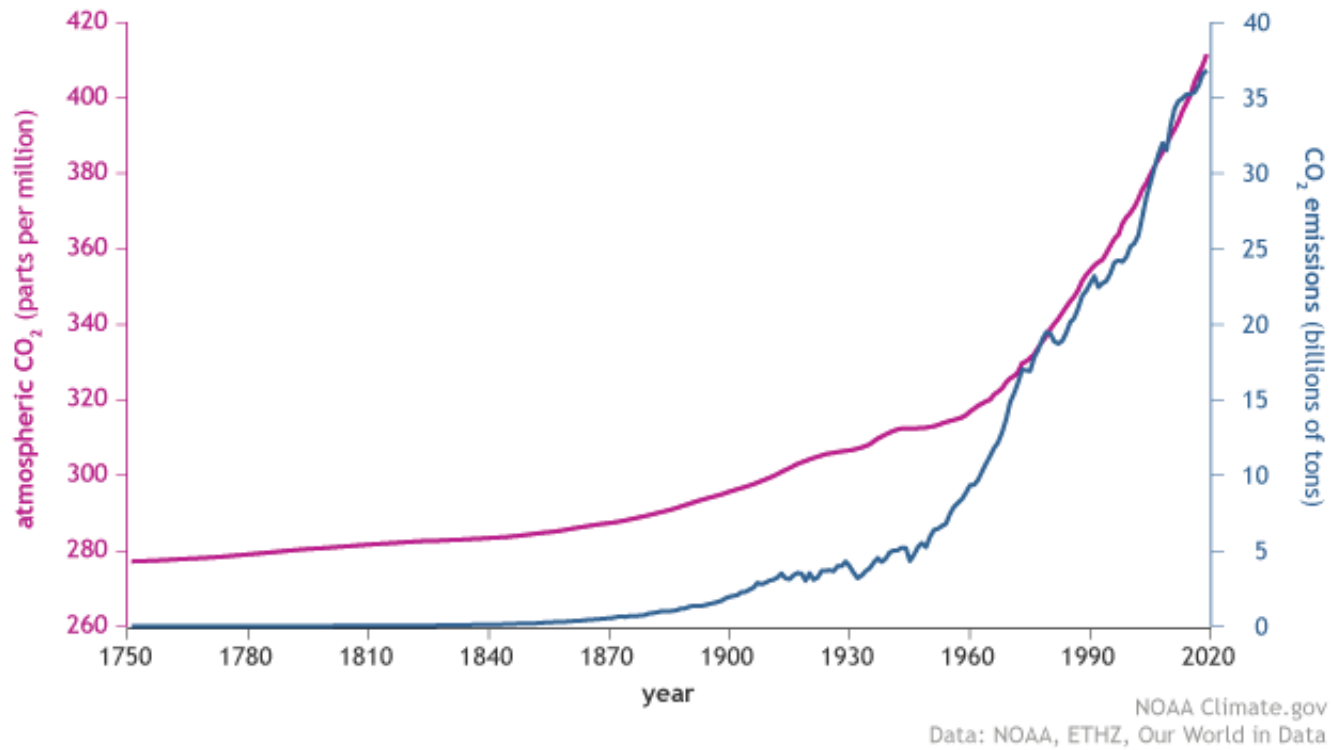
# What is Carbonization?



Source: NASA  
[https://climate.nasa.gov/climate\\_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/](https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/)



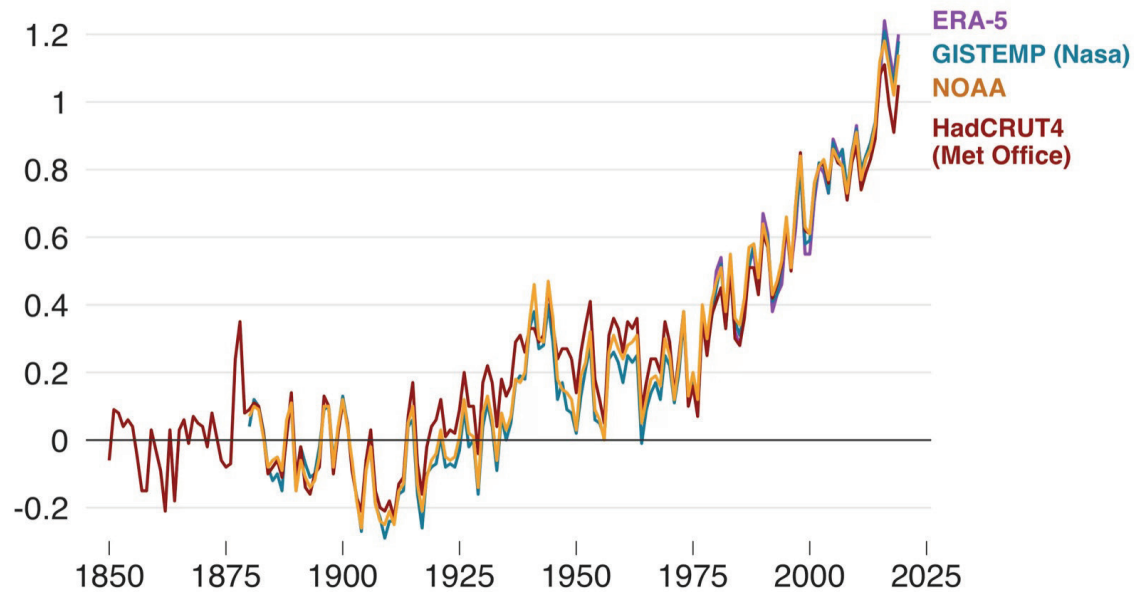
CO<sub>2</sub> in the atmosphere and annual emissions (1750-2019)



# Impacts of Carbonization

## Temperature rise since 1850

Global mean temperature change from pre-industrial levels, °C



Source: Met Office

BBC

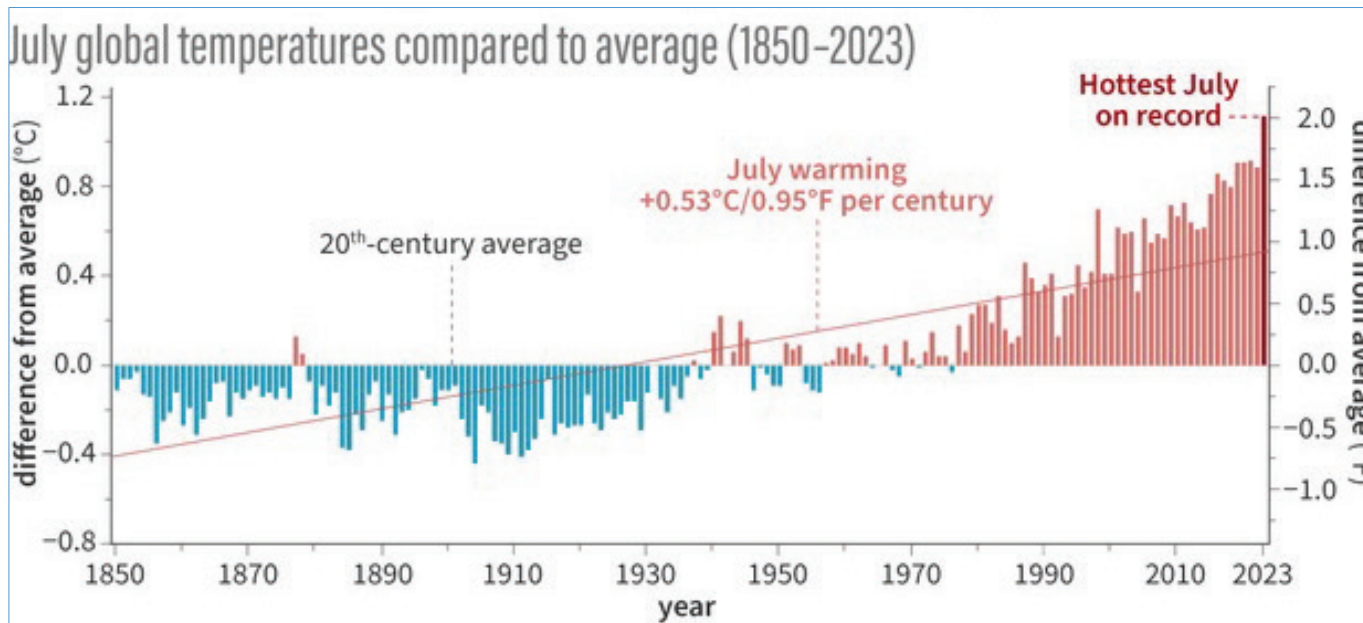
Source: <https://www.bbc.com/news/science-environment-51111176>

Temperature rise of 1.5 – 2°C = Point of No Return



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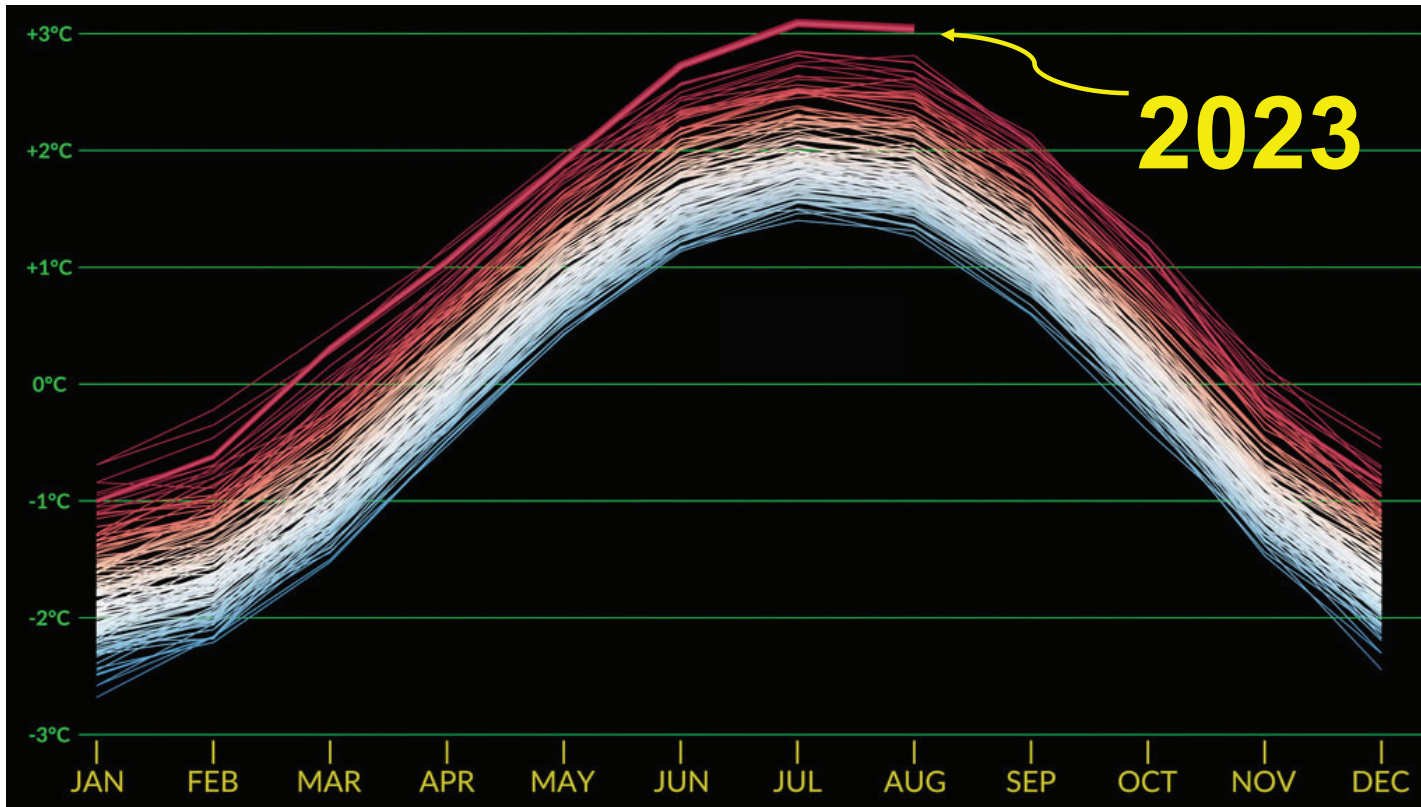
# Global Climate Summary for July 2023



July temperatures compared to the 20th-century average for each year from 1850 through 2023, which set a new record for the hottest July. NOAA Climate.gov image, based on data from NOAA National Centers for Environmental Information.

The July global surface temperature was 1.12°C (2.02°F) above the 20th-century average of 15.8°C (60.4°F), making it the warmest July on record. This marked the first time a July temperature exceeded 1.0°C (1.8°F) above the long-term average.

July 2023 was 0.20°C (0.36°F) warmer than the previous July record from 2021. July 2023 marked the 47th-consecutive July and the 533rd-consecutive month with temperatures at least nominally above the 20th-century average.



Monthly temperature anomalies from 1880 to August 2023 measured with respect to the baseline period 1951-1980.

This graph includes the seasonal cycle showing that June 2023, July 2023, and August 2023 were each consecutively the warmest month on record.



# Climate-change Impacts



Pethi Belaid/Agence France-Presse — Getty Images





**24th Conference of the Electricity Power Supply Industry (CEPSI 2023 CHINA)**  
**2023•10•20-22 , Xiamen ,PR China**  
Xiamen International Conference & Exhibition Center

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主办：



**东亚及西太平洋电力工业协会**  
THE ASSOCIATION OF THE ELECTRICITY SUPPLY INDUSTRY OF  
EAST ASIA AND THE WESTERN PACIFIC ( AESIEAP )



**中国电力企业联合会**  
CHINA ELECTRICITY COUNCIL

# Opportunities of Decarbonization in the Electric Power Supply Industry

Source: IEEE Spectrum, Jan 2023



## Reduce Carbon Emissions

1. Use less electricity, energy efficiency
2. Use low carbon fossil fuel power plants
3. Use H<sub>2</sub> & other storage technologies
4. Promote more renewables
5. Accept some nuclear
6. Promote cross-border power transfer

# Customers Controlling Buildings Optimized for Savings

## Measured energy savings across deployments

**20%** HVAC Energy Savings

**25%** Lighting Energy Savings

**Occupant satisfaction:** spaces controlled by a building automation systems are more comfortable due to more consistent temperature profiles and healthier air quality through consistent monitoring of environmental factors (CO<sub>2</sub> levels, PM 2.5).



## Eemshaven ultra-supercritical steam power plant, The Netherlands



Power Plant: Two units rated 800MW each

Efficiency: 46.2%

Temp: 609 deg C

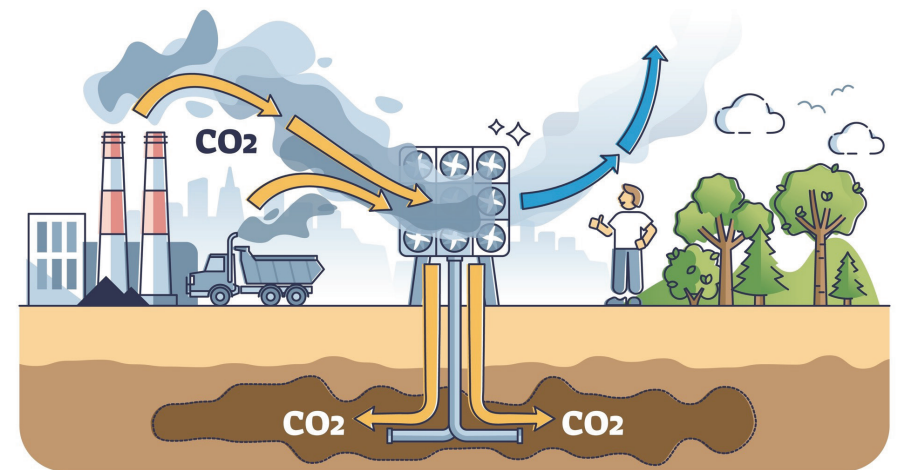
Steam Turbine: Siemens SST5-6000

Built: 2014



# Carbon Capture & Storage Systems (CCS)

- Can help ensure that emissions created during the energy generation phase will not be emitted into the atmosphere
- These technologies have the potential to significantly reduce carbon emissions in energy systems across the board



# Hydrogen and Storage Solutions

*Optimize renewable energy solutions being integrated into energy grids*



- Low-carbon hydrogen will help emerging economies to meet climate goals in and of itself
  - Provide for diverse energy portfolios
  - Improving resilience
  - Lowering costs
- Storage solutions serve as optimizers for other renewable energy solutions
  - Ensure that electricity generated during off-peak hours does not go to waste

# Renewable Energy Integration





# Advanced Nuclear Technologies

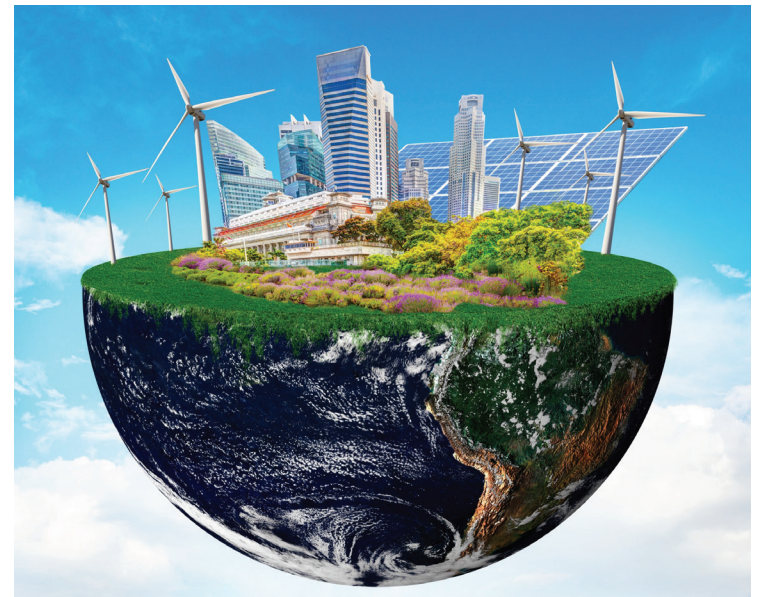
## *Diverse solutions to address climate change*

- ▶ Advanced nuclear technologies, such as small modular reactors (SMRs), can play a role
  - Smaller and can be built more quickly than more traditional nuclear reactors
- ▶ Ramping up the development of SMRs can help to produce energy when and where needed
- ▶ This energy could be integrated into existing power grids
  - helping to provide improved resiliency while simultaneously reducing emissions



# Cross-border Power Transfer

- As we are in this fight together, our solutions should be collaborative to secure better outcomes for all countries, regardless of location
- The International Energy Agency (IEA) has identified three main modes of cross-border energy integration:
  - Bilateral
  - Multilateral
  - Unified



# Technology Innovation in Power Systems

*Unleashing the potential of clean energy development*

- The key for achieving net-zero electricity is to build a modern power system which adapts large-scale development of clean energy.
- Sharing of resources among countries is a major step forward in achieving decarbonization in the electric power sector.





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## Clean-tech Solutions for Climate Sustainability

# Climate Change

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**IEEE:** Enabling Innovation and Technology Solutions

*<https://climate-change.ieee.org>*



# Ecosystem for IEEE's Climate Sustainability Work

**IEEE Spectrum:** Climate Change News Feed; Podcasts; Features; Archives; Journal Watch Posts (Xplore); The Institute (Engineers of Climate Change); Coverage of Conferences and Standards

IEEE Discusses 6 Simple Solutions to Climate Change at COP27. They include switching to LEDs and making coal plants more efficient.

Simple, effective solutions that can help lessen the impact of climate change already exist. Some of them still need to be implemented, though, while others need to be improved.

## Social Media

## Sponsored Content From Industry

Evolution of In-Vehicle Networks to Zonal Architecture

In this webinar, you will learn more about:

- Evolution of In-Vehicle Network architecture
- Automated Ethernet characteristics
- Compliance testing of Ethernet
- Practical demonstration

**Xplore:** Engineers to Follow; Journal Watch Articles (free); Climate Change Articles

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IEEE CLIMATE CHANGE SOLUTIONS

MAKING A DIFFERENCE

TECHNICAL SOLUTIONS BUILDING TECHNICAL COMMUNITY CLIMATE CHANGE MITIGATION

IEEE's mission is to advance technology for the benefit of humanity. Today the world faces its largest modern-day threat—climate change. We recognize this global crisis and are committed to helping combat and mitigate the effects of climate change through pragmatic and accessible technical solutions and providing engineers and technologists with a neutral space for discussion and action.

COORDINATING IEEE'S RESPONSE TO CLIMATE CHANGE DEDICATED COMMITTEE

The 2022 IEEE Ad Hoc Committee to Coordinate IEEE's Response to Climate Change is identifying ongoing efforts across IEEE and collaborating with key external partners for a comprehensive response to climate change.

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IEEE Spectrum

Tech Alert

Here's How AI is Making Their Household Robot - Is now the right time for useful, affordable, general-purpose humanoid?

AI Goes To K Street: ChatGPT Turns Lobbyist - Automated influence campaigns could spell trouble for society.

**IEEE Technology Center for Climate**

IEEE TECHNOLOGY CENTER FOR CLIMATE

The Promise of Electrification

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**IEEE Climate Change newsletter**

Climate Change

Smart Cities Rely on Smart Infrastructure to Make People's Lives Better

Smart Cities help urban environments to develop and grow by using modern technology, including data-driven solutions, that provide a sustainable, resilient, equitable, and privacy-respecting community for its inhabitants.

<https://climate-change.ieee.org>

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Thank you

web: [www.srahman.org](http://www.srahman.org)