

Promoting Clean-Tech Solutions for Climate Sustainability



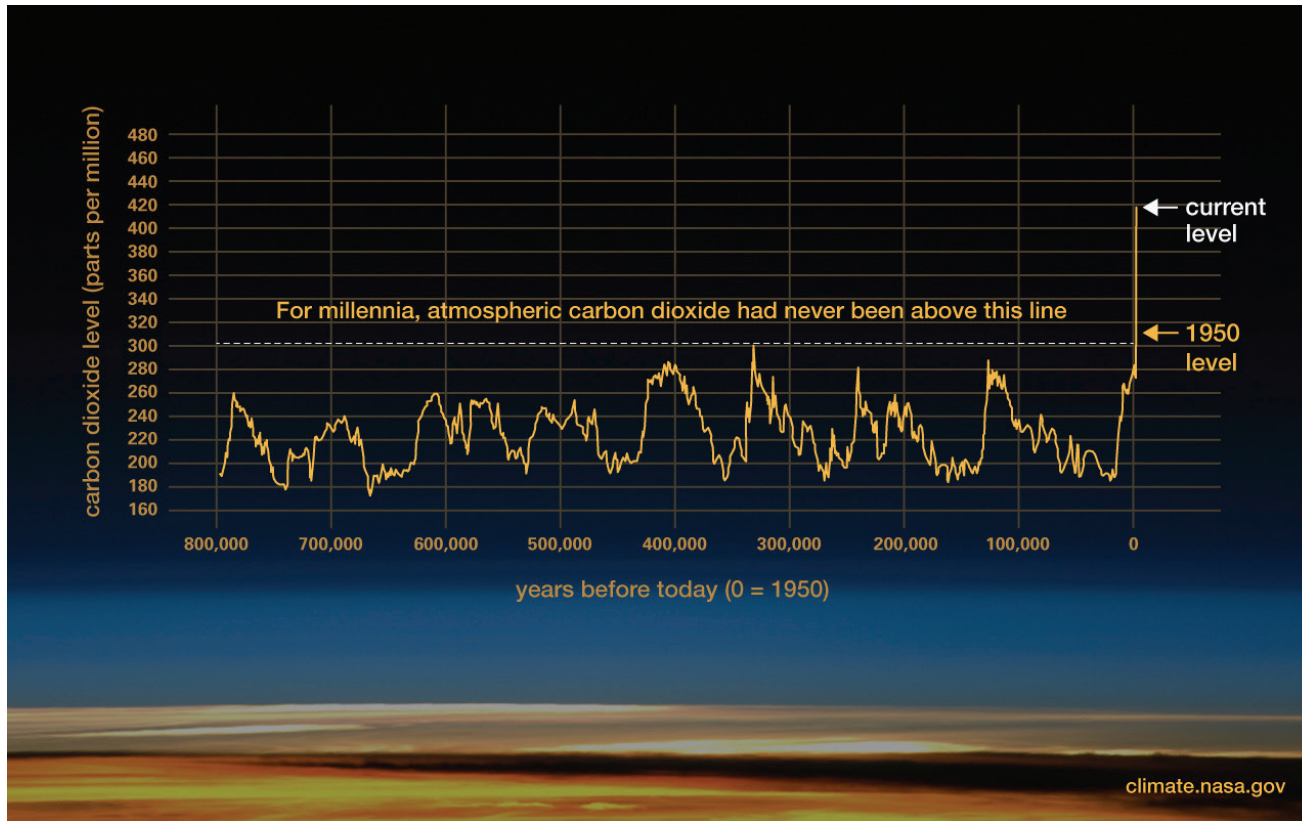
Prof. Saifur Rahman
2023 IEEE President & CEO
www.srahman.org

Invited Talk
CleanTech Connect Program
Dubai Electricity & Water Authority
03 December 2023
Dubai, UAE



Advancing Technology for Humanity

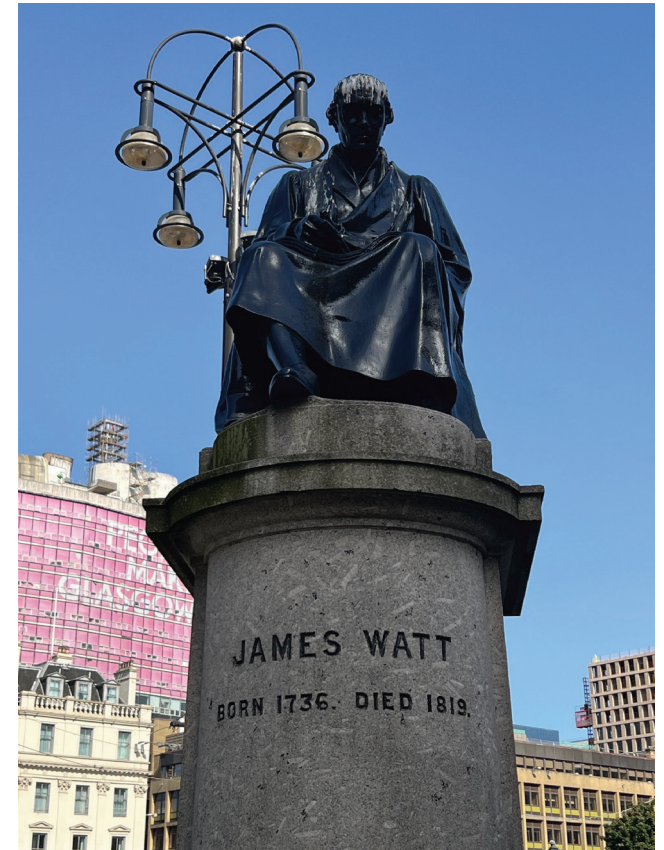
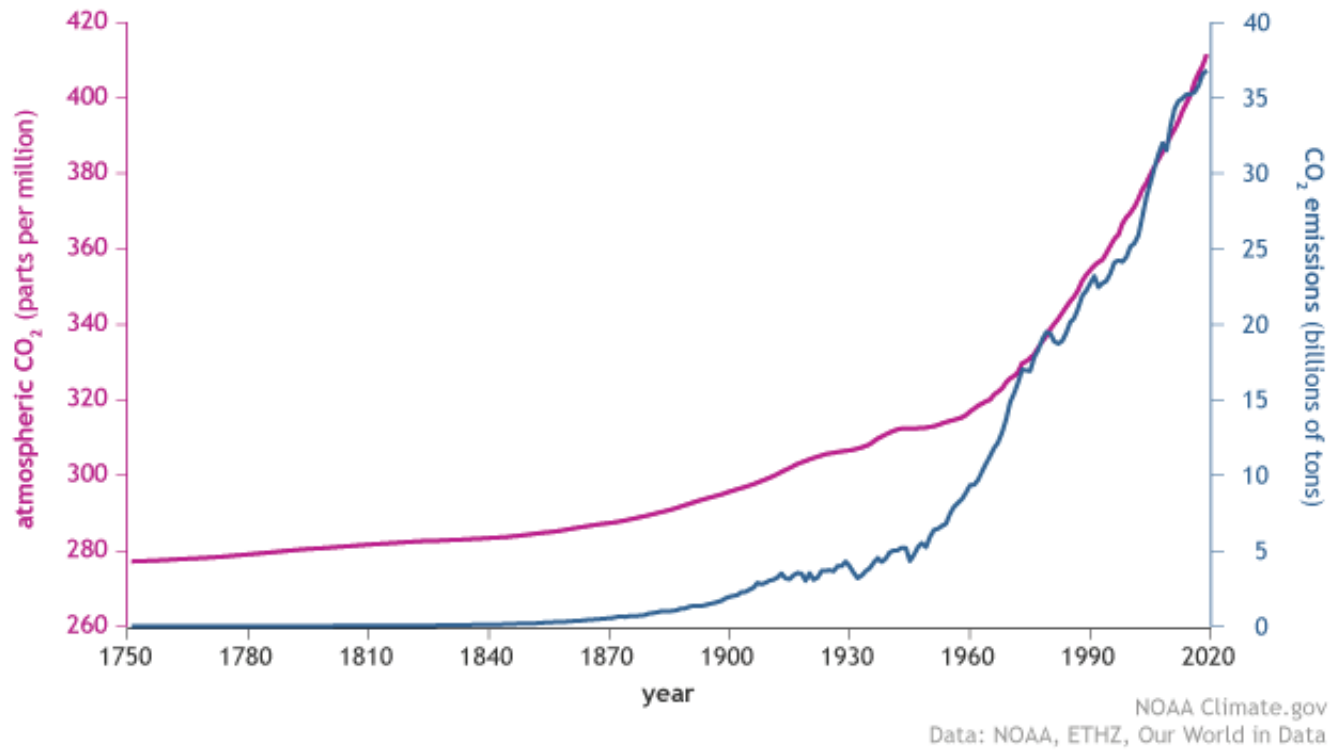
What is Carbonization?



Source: NASA
https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/



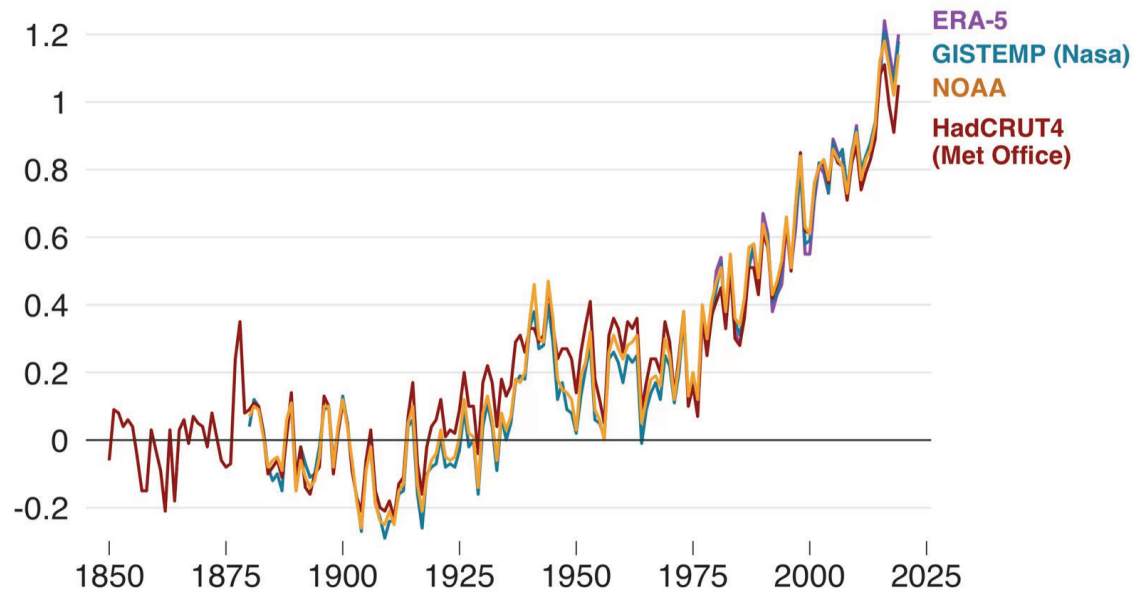
CO₂ in the atmosphere and annual emissions (1750-2019)



Impacts of Carbonization

Temperature rise since 1850

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



Source: Met Office

BBC

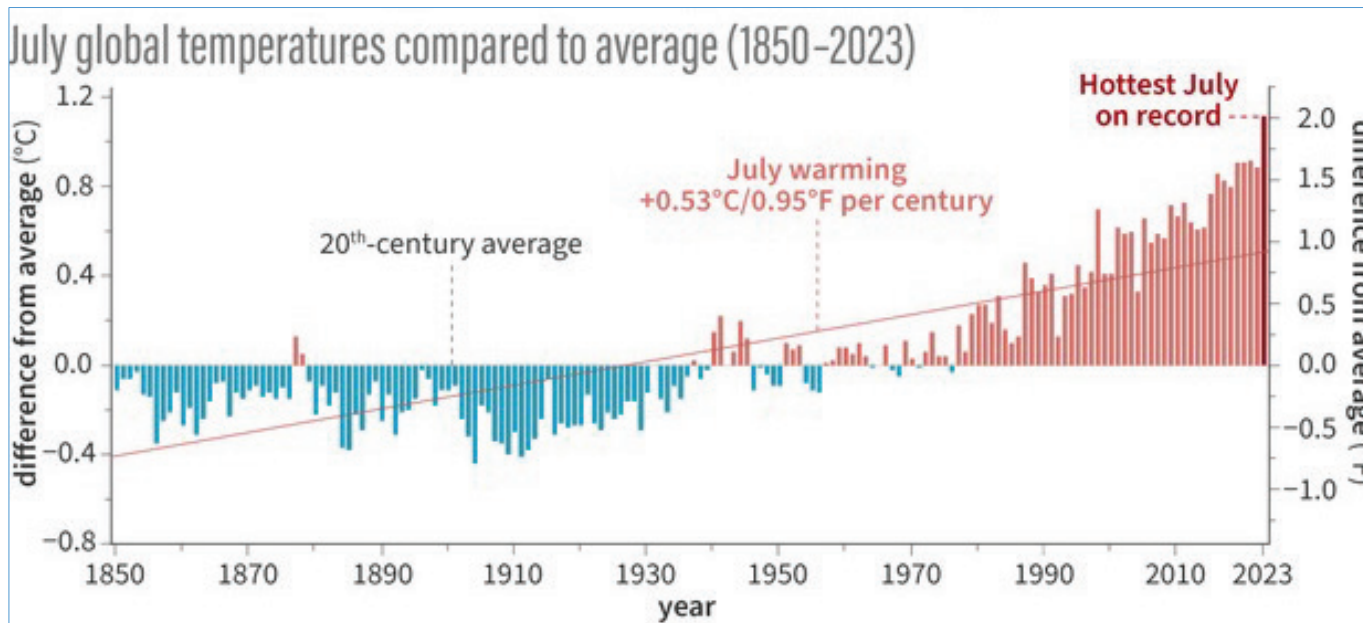
Source: <https://www.bbc.com/news/science-environment-51111176>

Temperature rise of 1.5 – 2.0 °C



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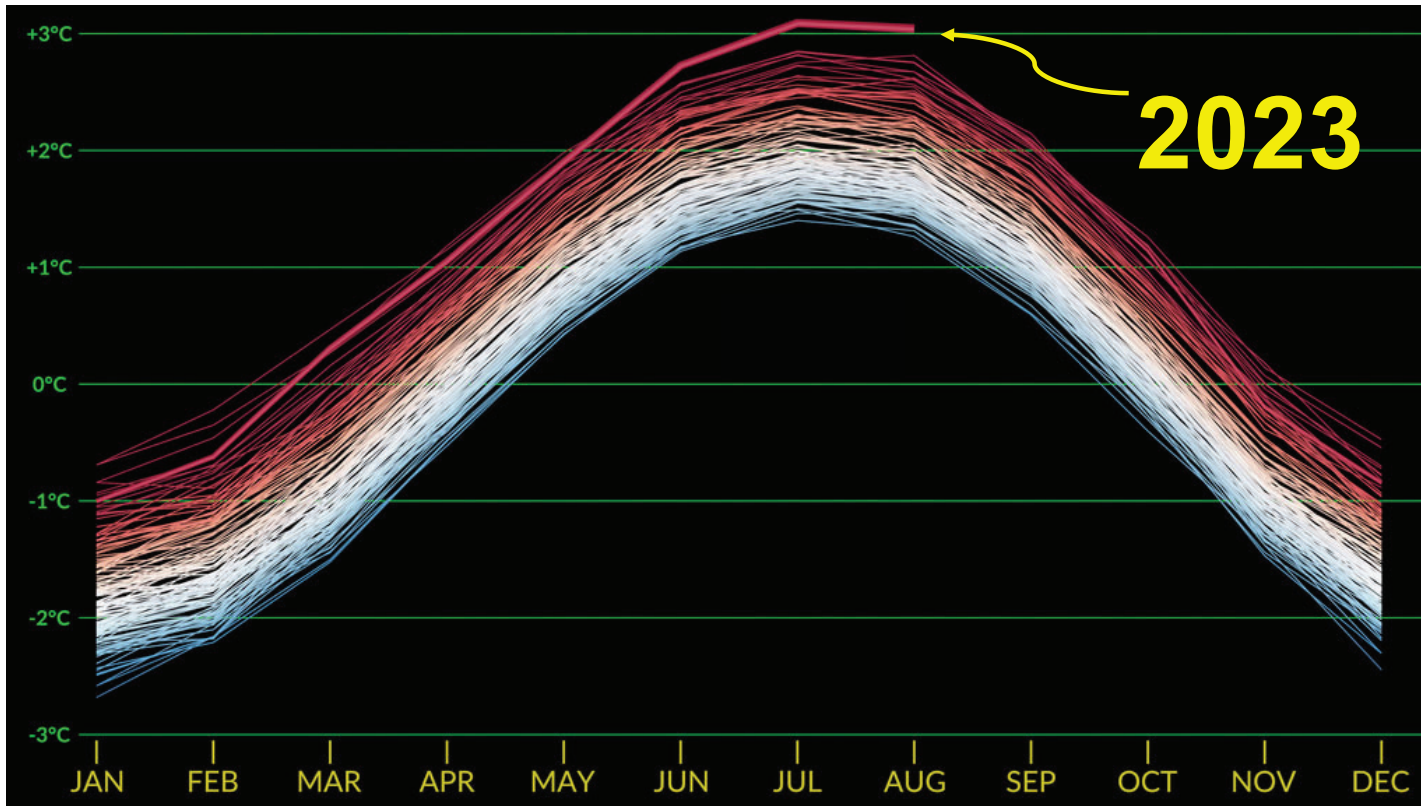
Global Climate Summary for July 2023



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



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 H₂ and carbon capture & storage
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 (CO₂ levels, PM 2.5).



CO₂ Emissions for Coal and Combined Cycle Power Plants



Coal power plant emission: 950g of CO₂ per kWh

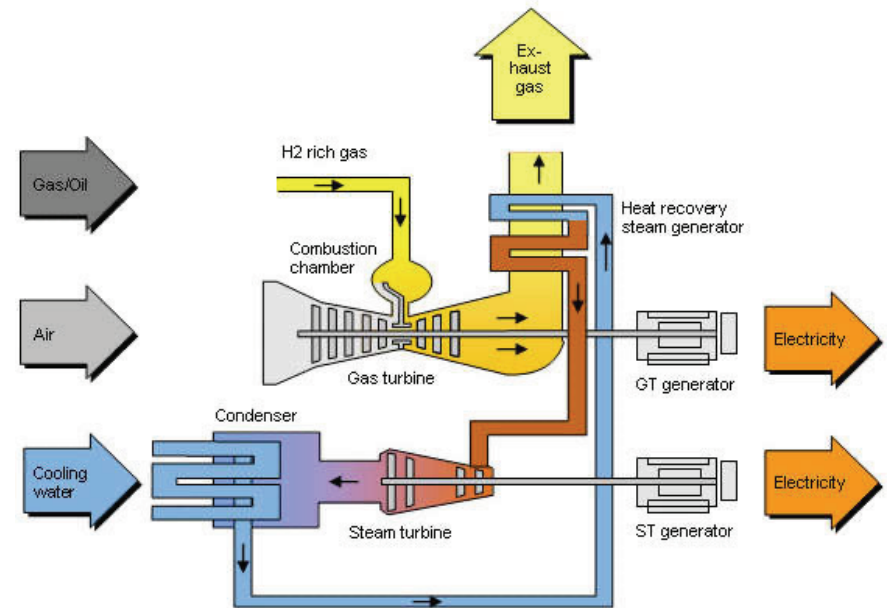


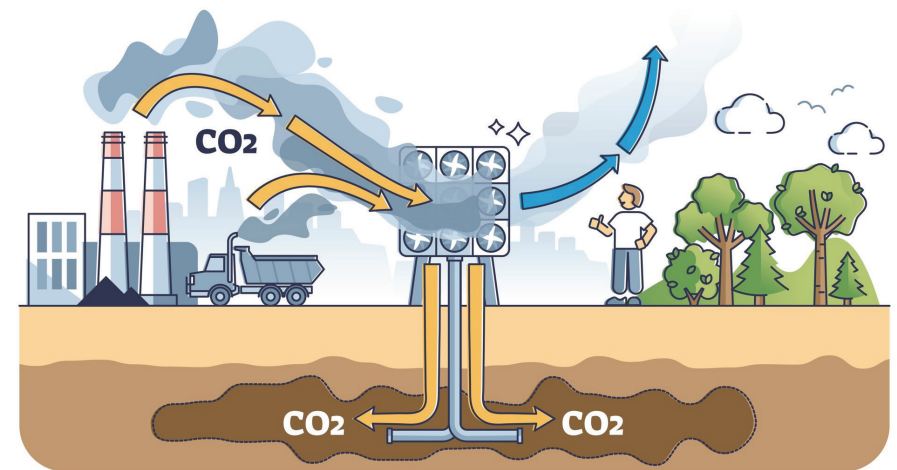
Image courtesy of: <http://www.powergeneration.siemens.com>

Combined cycle power plant emission: 350g of CO₂ per kWh



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

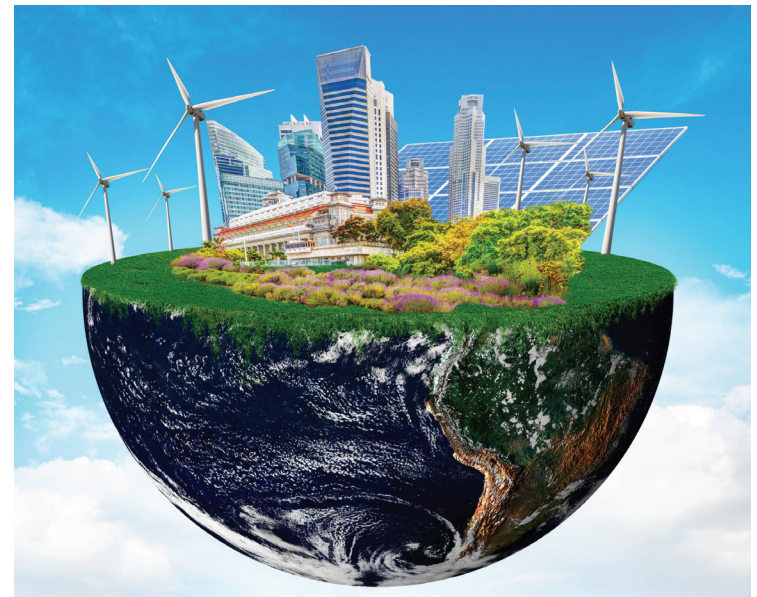
Diverse solutions to address climate change

- ▶ 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





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Clean-tech Solutions for Climate Sustainability

Climate Change

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



IEEE Climate Change Program

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



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Climate Change in the News

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email: ccircc@ieee.org



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RESOURCES FROM IEEE

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As the world's largest organization of technical professionals, IEEE has both the opportunity and the responsibility to assist in organizing the response of engineers, scientists, and technical professionals across the world to address the causes, mitigate the impact, and adapt to climate change.

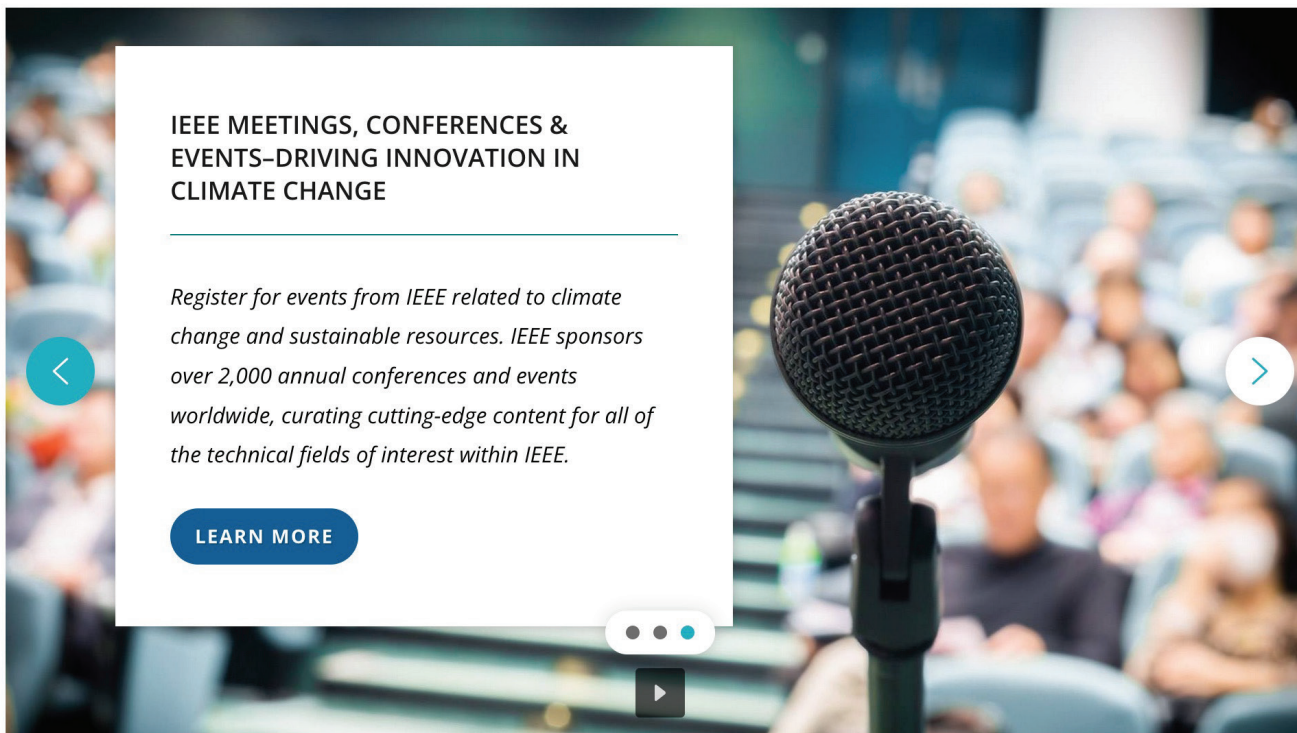
IEEE's scholarly publications, events, conference proceedings, technical standards, and other materials help foster the exchange of technical knowledge and information for the critical climate issues that our planet faces today.



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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

Wenbin X. Ye, Davide Scaramuzza, and Di (Fred) Wang

Climate Change

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.

Jobs From IEEE Job Site

IEEE JOB Site

FEATURED JOBS

- Deep Electronics Scientist
- Senior Design Engineer
- Senior Design Engineer
- Senior Design Engineer

Conferences



Standards

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Newsletters

IEEE Spectrum

Tech Alert

Here's How Apophis is Making Their Humaneoid 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

IEEE Technology Center for Climate

ITCC Files

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.

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Thank you

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