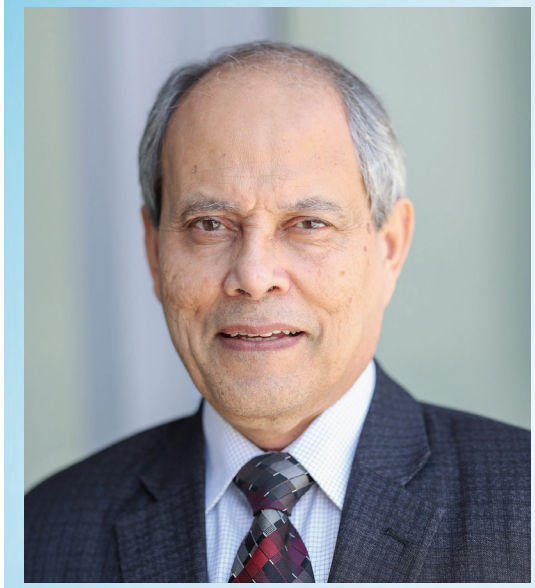
Promoting Clean-Tech Solutions for Climate Sustainability



Prof. Saifur Rahman

2023 IEEE President & CEO

www.srahman.org

Invited Talk

CleanTech Connect Program

Dubai Electricity & Water Authority

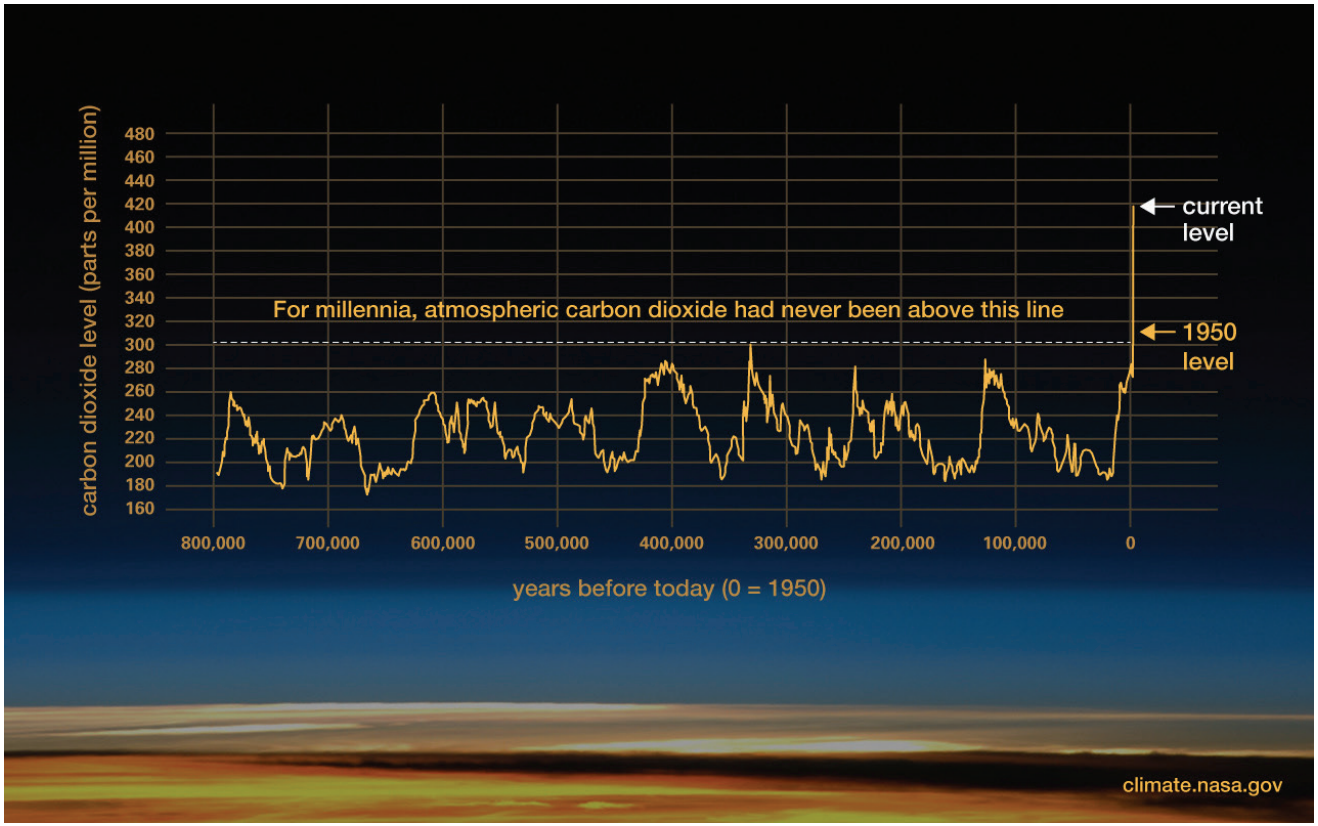
03 December 2023

Dubai, UAE

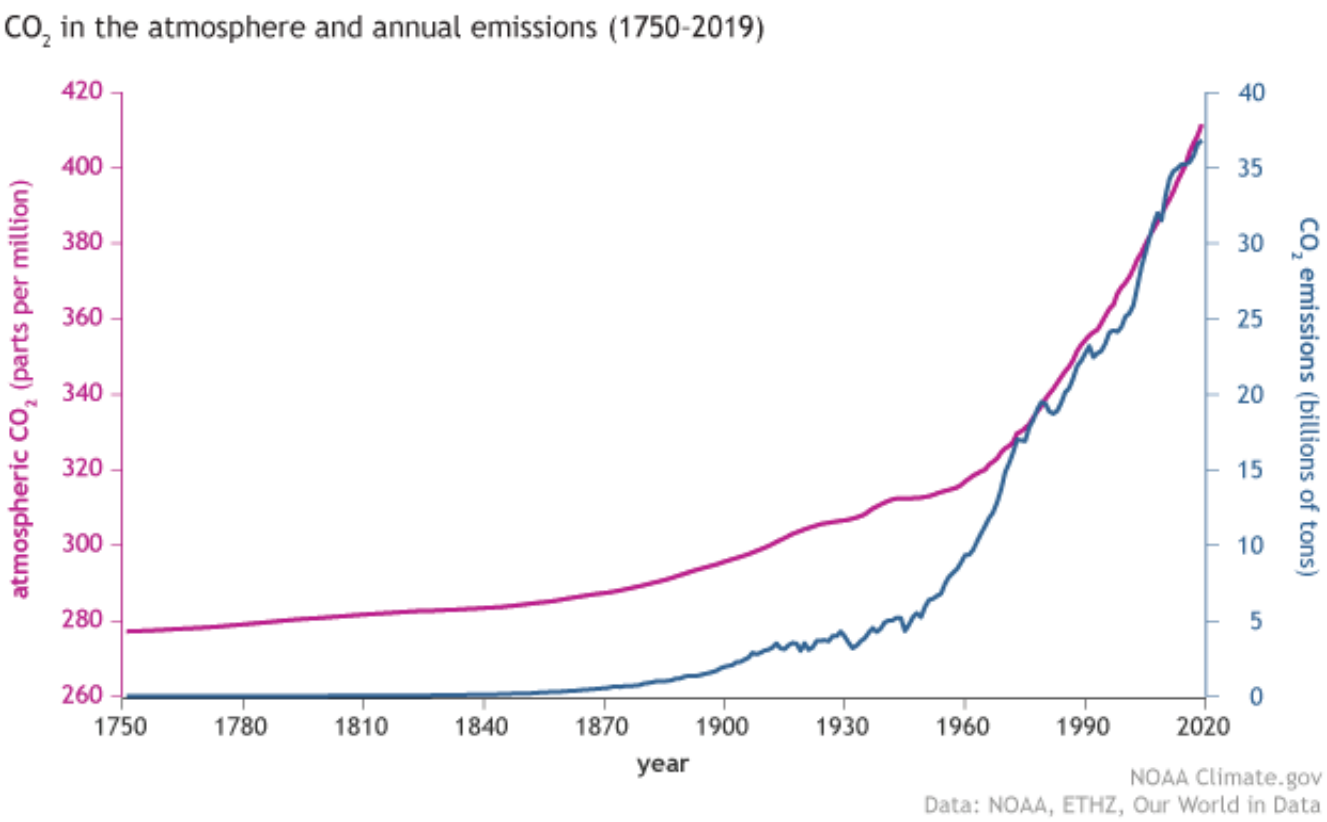
IEEE

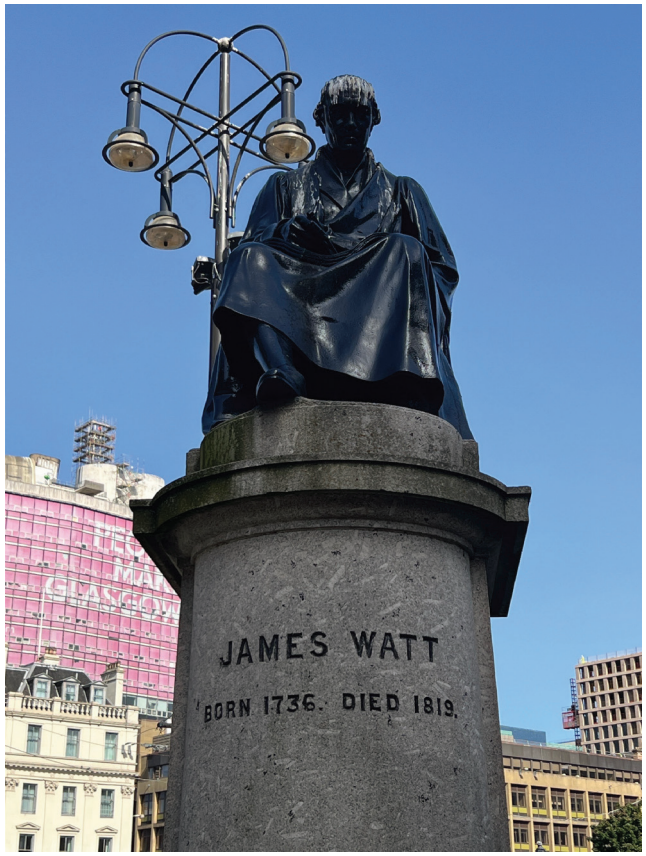
Advancing Technology for Humanity

What is Carbonization?



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



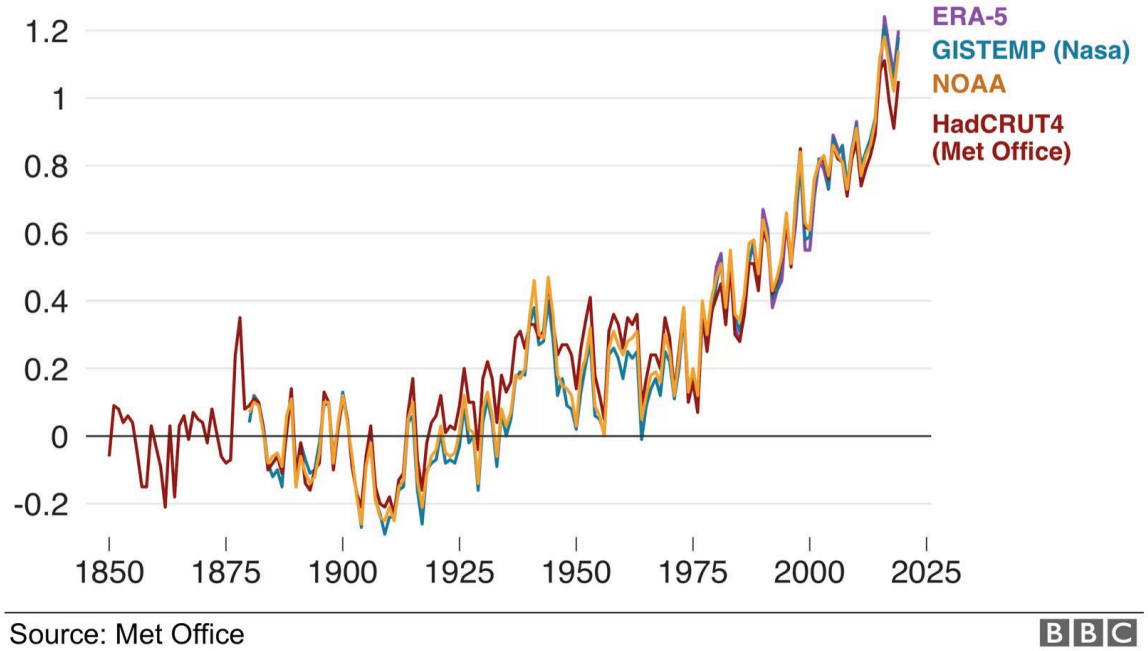


Source: State of the Planet
https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/

Impacts of Carbonization

Temperature rise since 1850

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



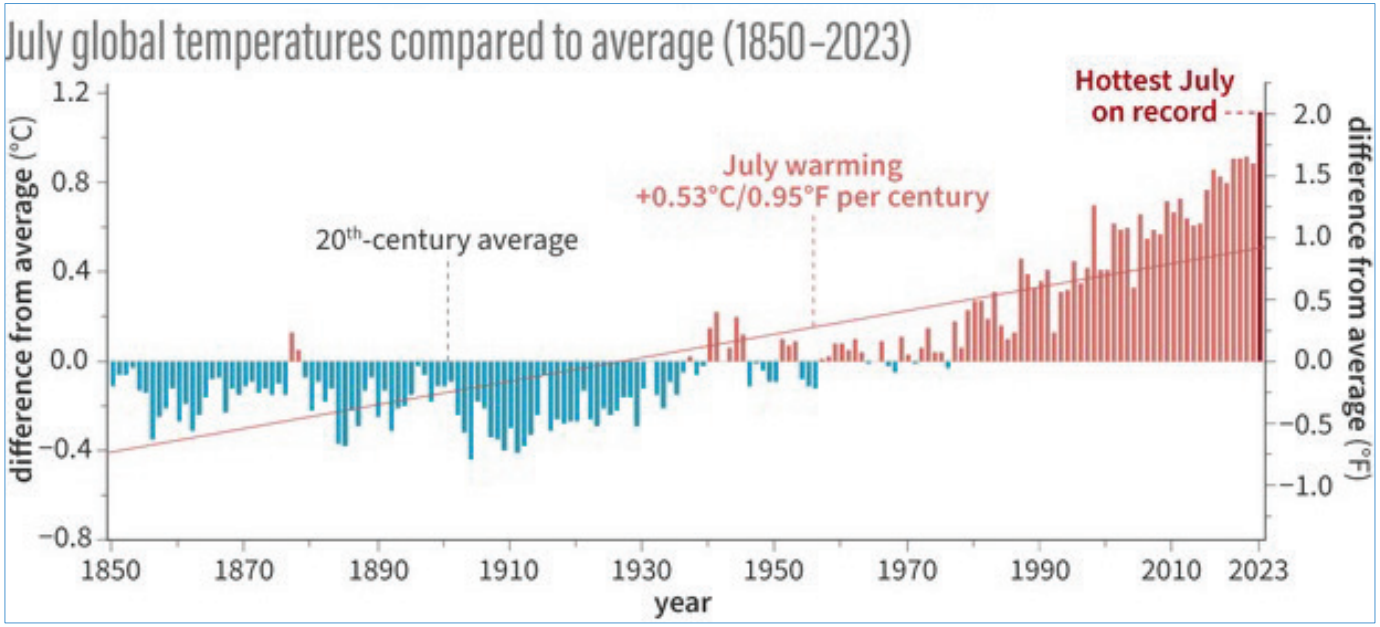
Source: Met Office

BBC

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

Temperature rise of 1.5 – 2.0 °C

Global Climate Summary for July 2023

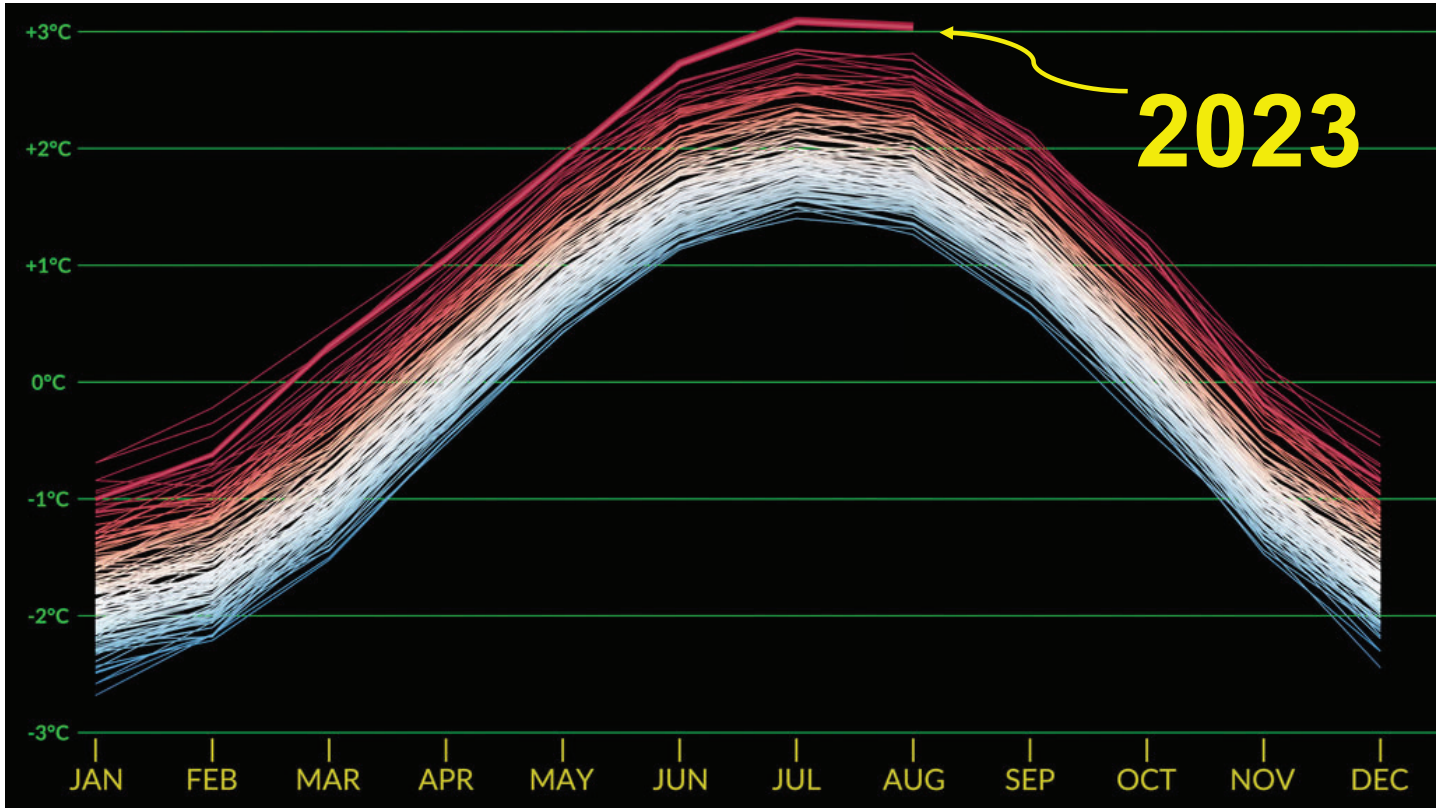


July temperatures compared to the 20th-century average for each year from 1850 through 2023, which set a new record for the hottest July. NOAA Climate.gov image, based on data from NOAA National Centers for Environmental Information.

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.

https://www.climate.gov/news-features/understanding-climate/global-climate-summary-july-2023



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.

Source: https://svs.gsfc.nasa.gov/14407

Climate-change Impacts

Fethi 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 H_2 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 (CO_2 levels, PM 2.5).

CO_2 Emissions for Coal and Combined Cycle Power Plants

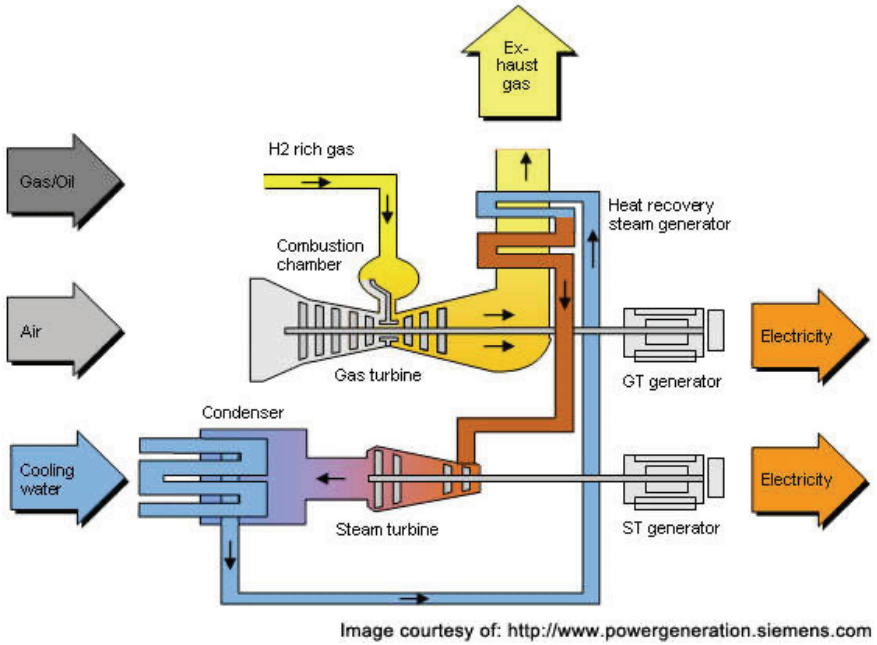


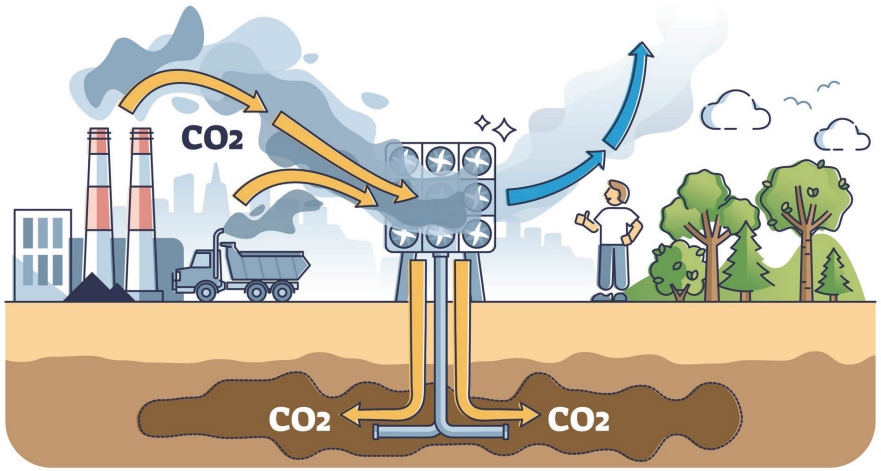
Image courtesy of: http://www.powergeneration.siemens.com

Coal power plant emission: 950g of CO2 per kWh

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

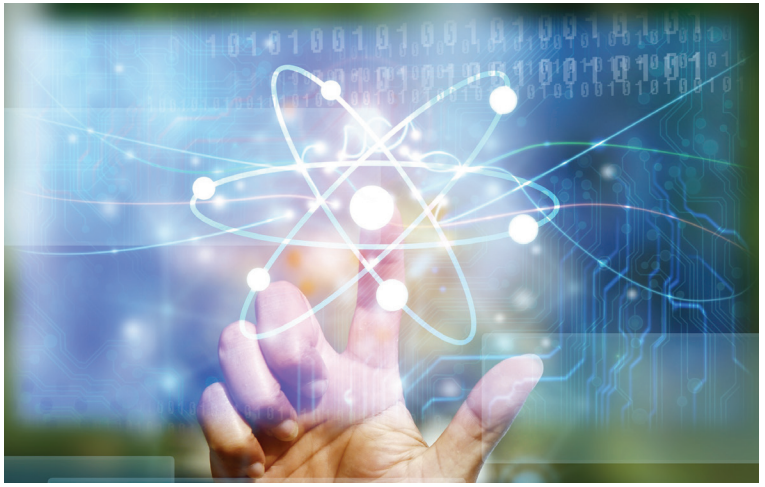
- Low-carbon hydrogen will help emerging economies to meet climate goals in and of itself
  - Provide for diverse energy portfolios
  - Improving resilience
  - Lowering costs
- Storage solutions serve as optimizers for other renewable energy solutions
  - Ensure that electricity generated during off-peak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

Renewable Energy Integration

Advanced Nuclear Technologies

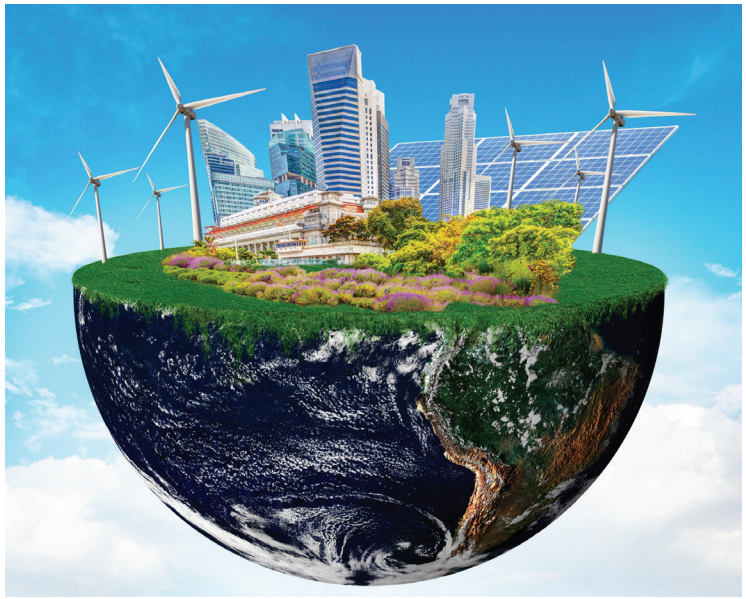
Diverse solutions to address climate change

- 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



Advancing Technology for Humanity

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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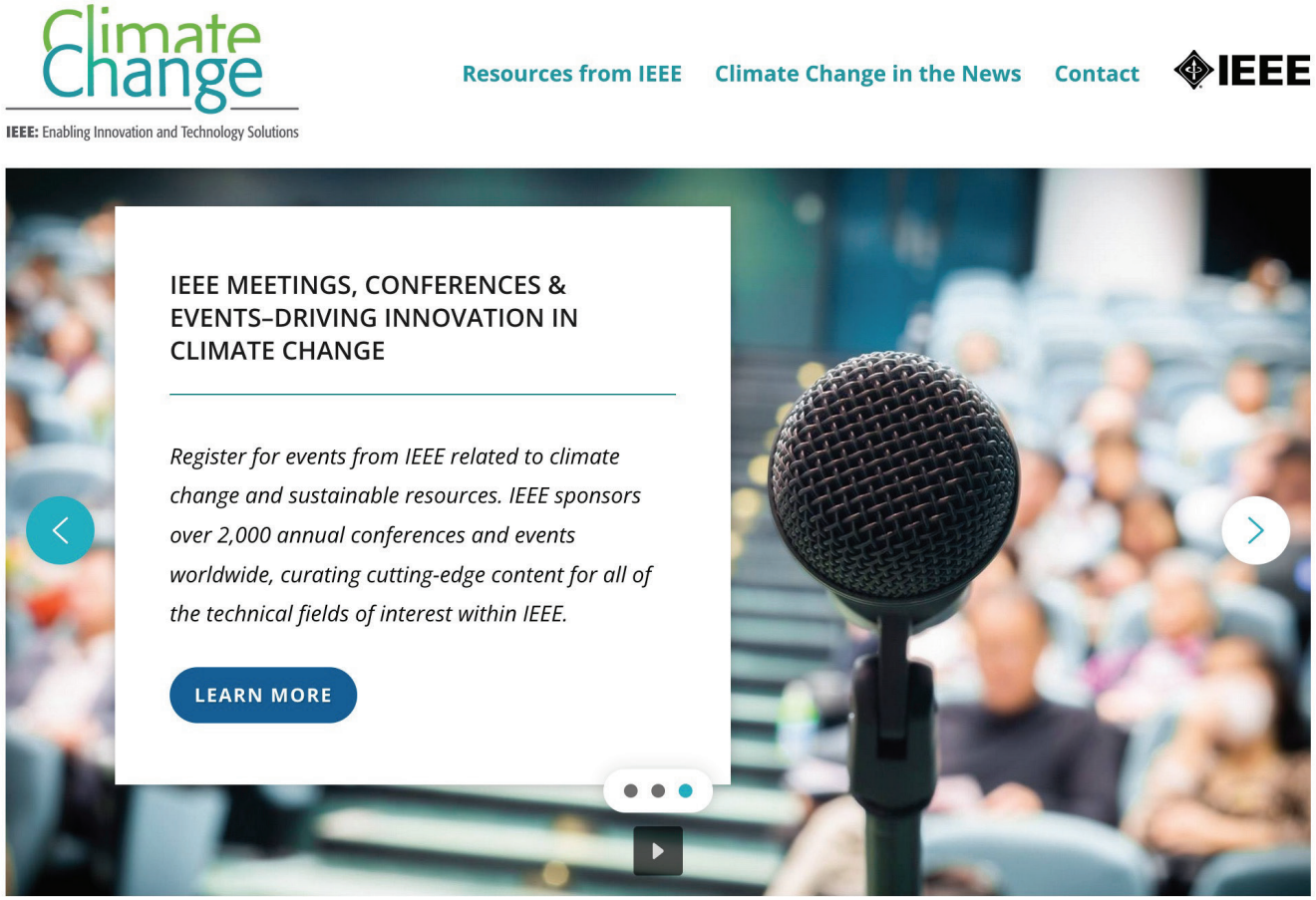

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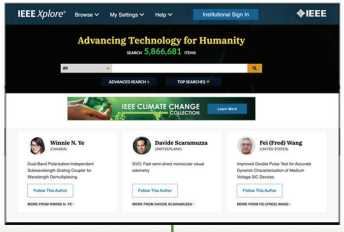
Ecosystem for IEEE's Climate Sustainability Work

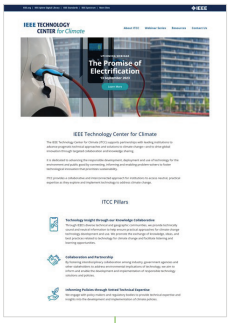
IEEE Spectrum: Climate Change News Feed; Podcasts; Features; Archives; Journal Watch Posts (Xplore); The Institute (Engineers of Climate Change; Coverage of Conferences and Standards)

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



Jobs From IEEE Job Site

IEEE Technology Center for Climate



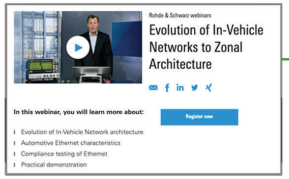
Conferences

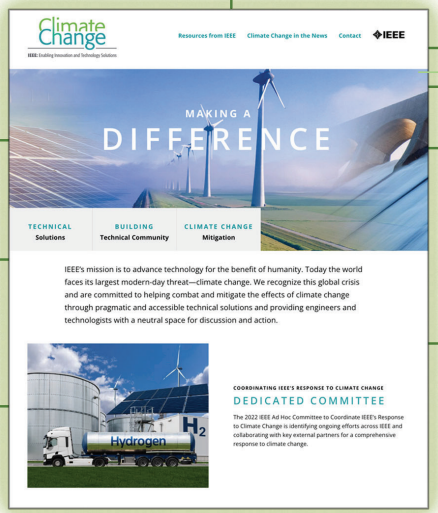
Standards

IEEE SA STANDARDS ASSOCIATION

Social Media

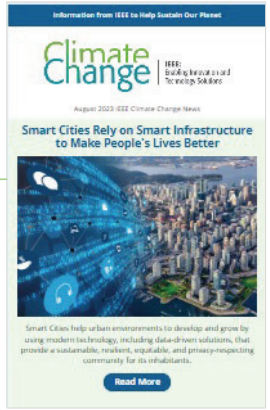
Sponsored Content From Industry





Newsletters

IEEE Climate Change newsletter



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Thank you

web: www.srahman.org