



**Prof. Saifur Rahman**

2023 IEEE President & CEO

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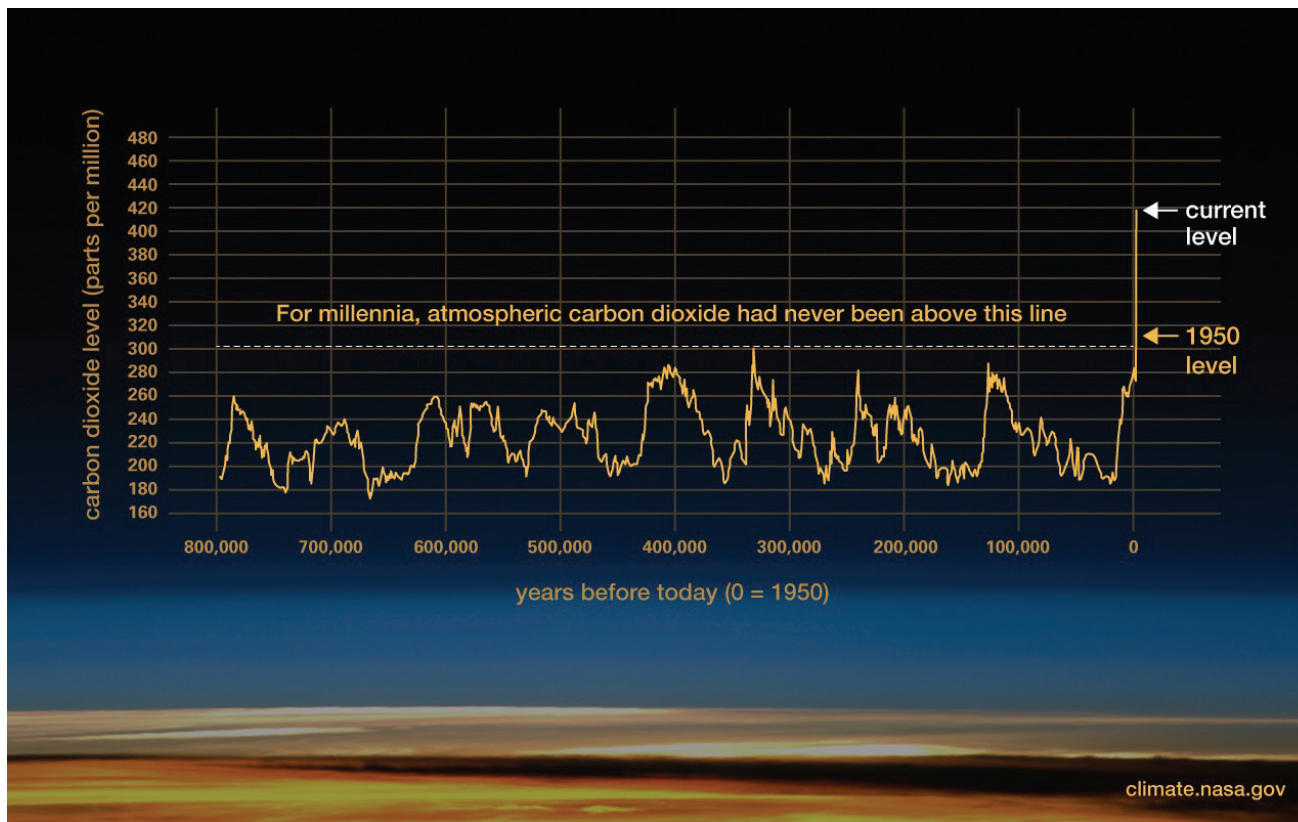
# Promoting Clean-tech Solutions for Climate Sustainability Challenges and Opportunities

Invited Talk  
Climate Change Forum  
27 October 2023  
Jakarta, Indonesia



# What is Carbonization ?



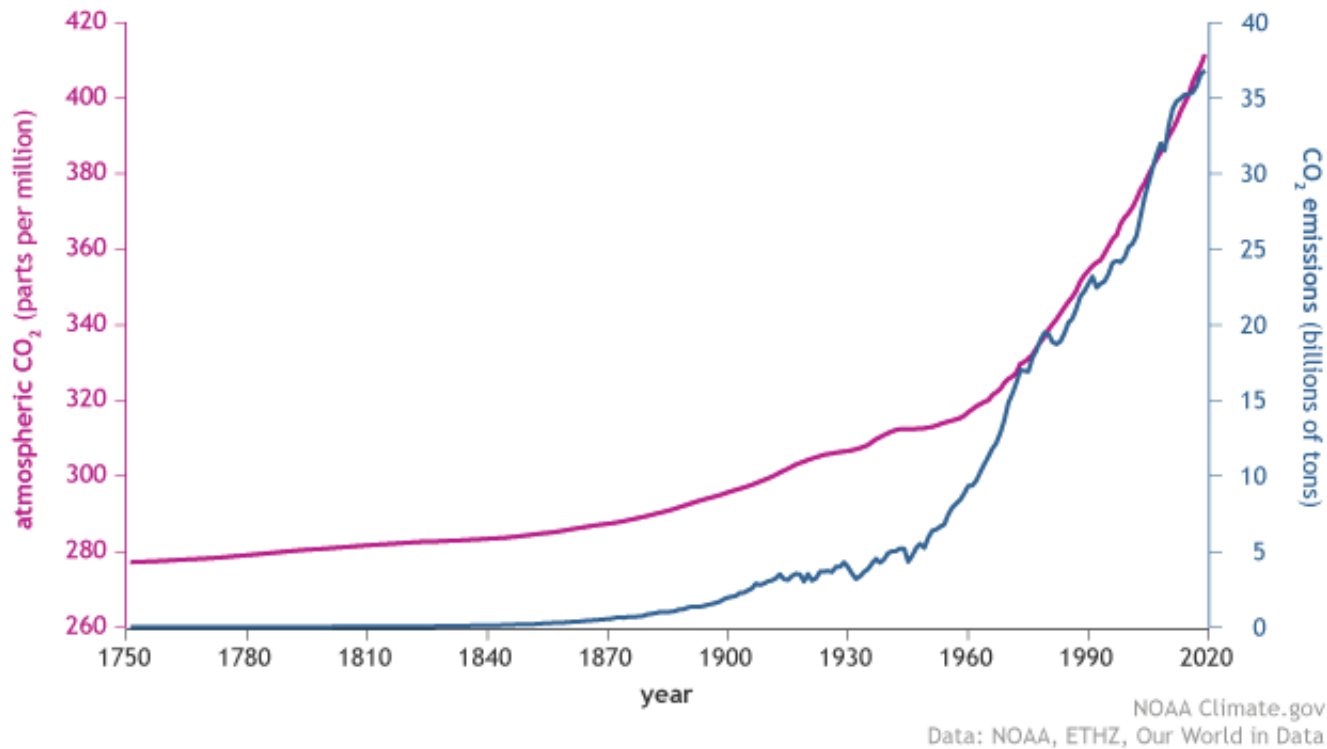


Source: NASA

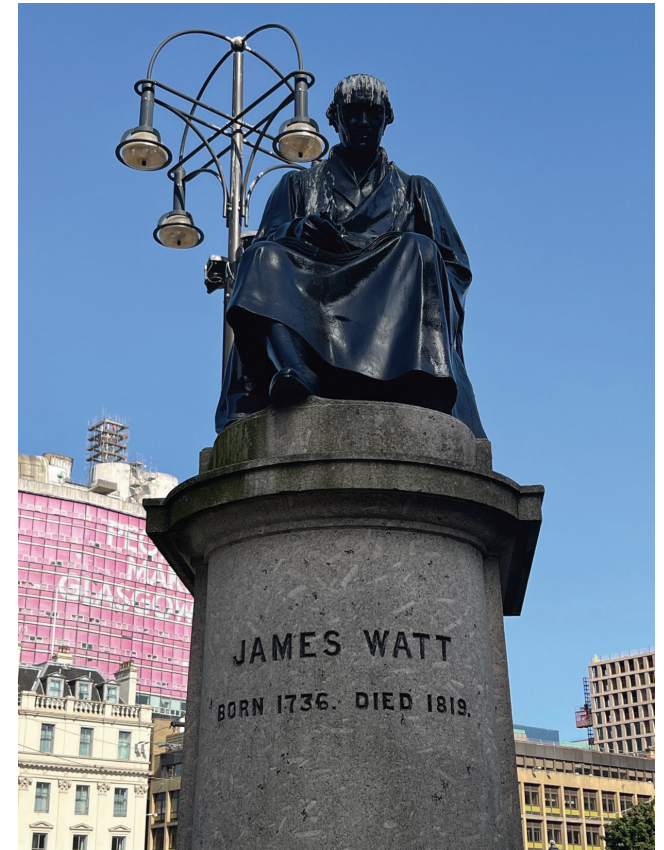
[https://climate.nasa.gov/climate\\_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/](https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/)



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



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

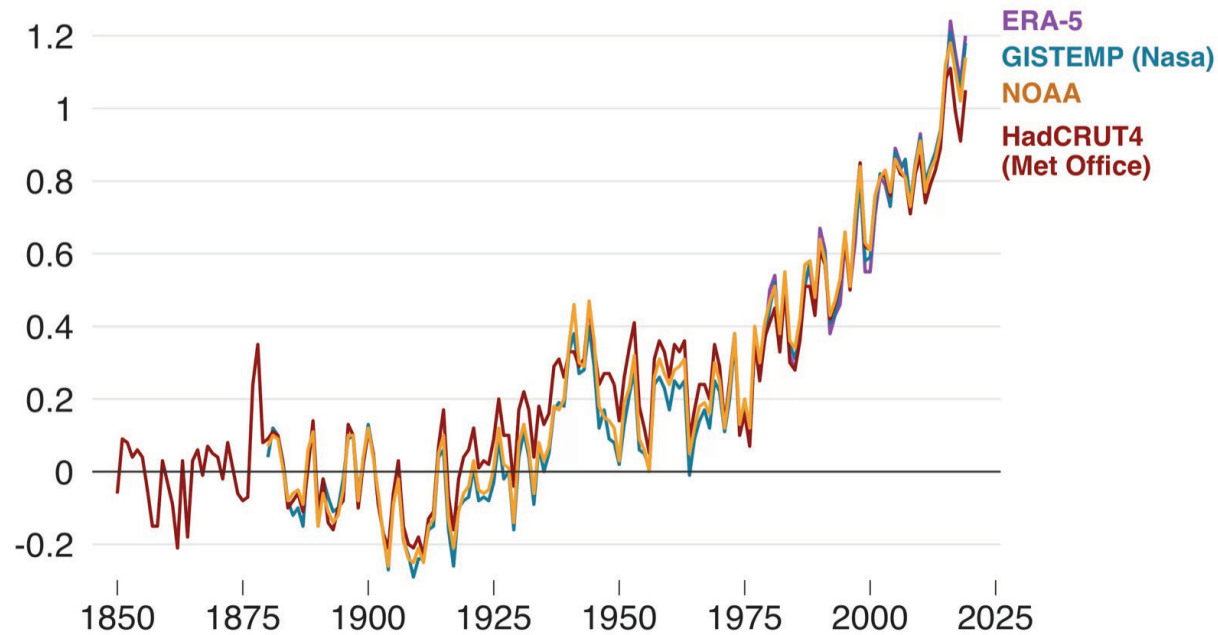


# Impacts of Carbonization



## Temperature rise since 1850

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



Source: Met Office

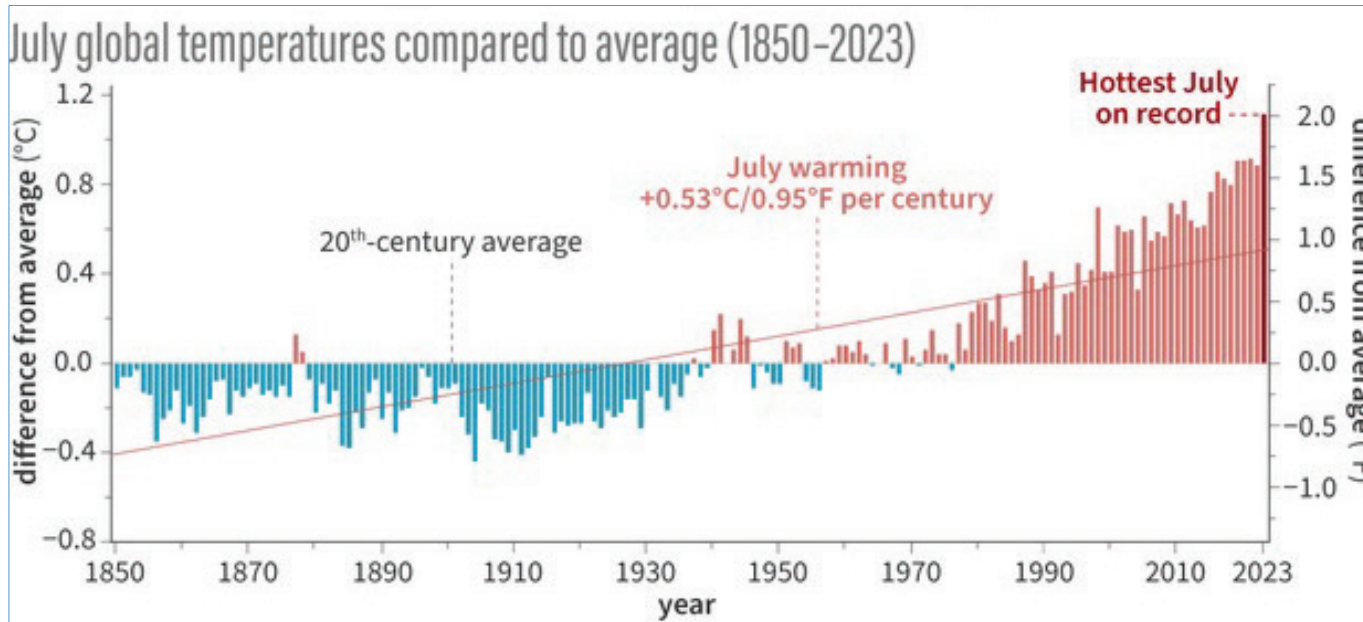
BBC

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

Temperature rise target is below 1.5. More than 2.0°C Point of No Return



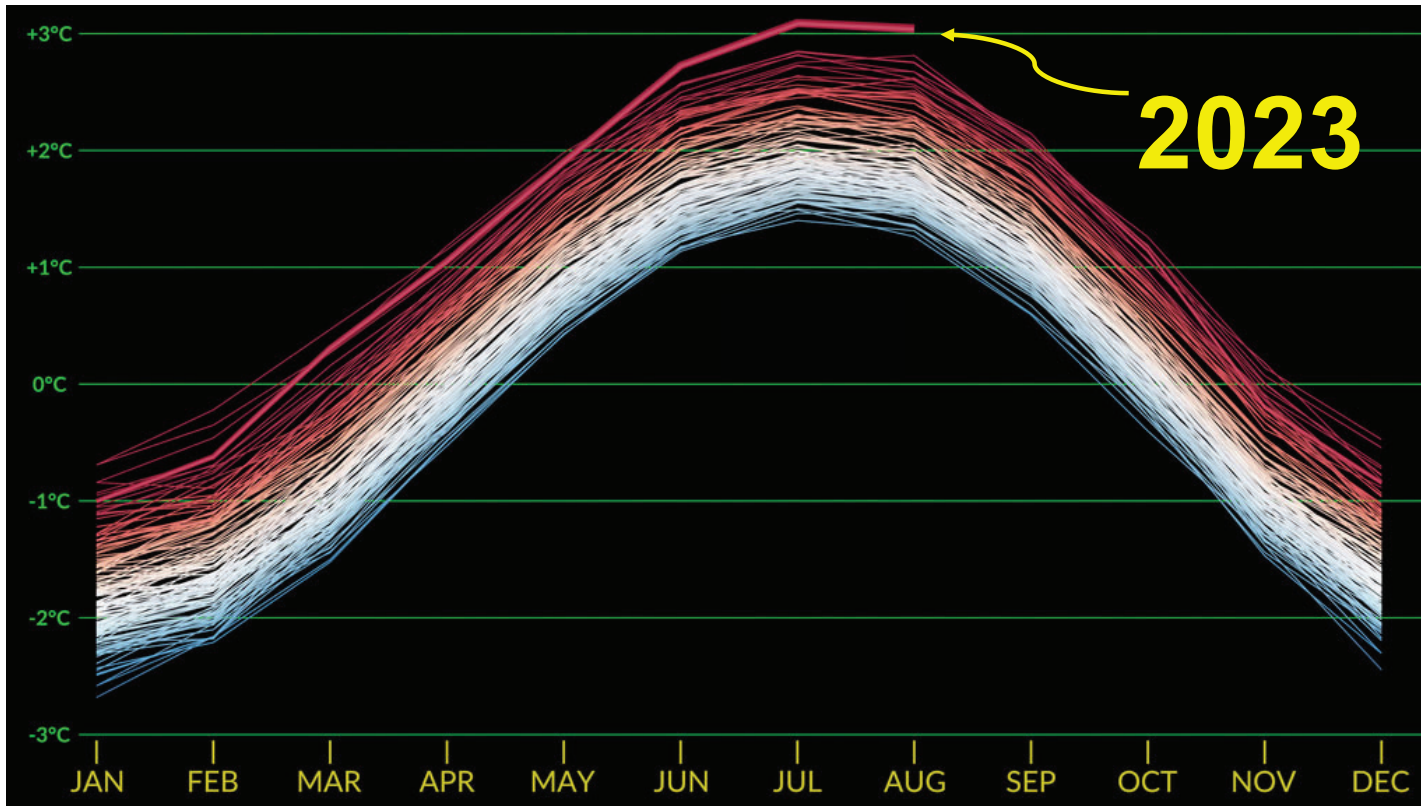
# Global Climate Summary for July 2023



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



# Beijing



Flooded street after heavy rains in Zhuozhou, in northern China's Hebei province August 2, 2023. (AFP)

Source: <https://english.aawsat.com/features/4470081-what-caused-record-rainfall-beijing-and-northern-china>



Residents are evacuated by rubber boats through flood waters in Zhuozhou in northern China's Hebei province, south of Beijing, Wednesday, Aug. 2, 2023. China's capital has recorded its heaviest rainfall in at least 140 years over the past few days. Among the hardest hit areas is Zhuozhou, a small city that borders Beijing's southwest. (Andy Wong/AP)

Source: [https://www.stripes.com/theaters/asia\\_pacific/2023-08-02/beijing-china-rainfall-deaths-10925575.html/](https://www.stripes.com/theaters/asia_pacific/2023-08-02/beijing-china-rainfall-deaths-10925575.html/)

# Flooding in Pakistan – August 2022



Source: <https://www.npr.org/sections/pictureshow/2022/08/30/1119979965/pakistan-floods-monsoon-climate>



Source: <https://www.nytimes.com/2022/09/07/briefing/climate-change-heat-waves-us-europe.html>



# Brazil



Aerial view of the area affected by an extratropical cyclone in Rio Grande do Sul State, Brazil **Sept 2023**  
(AGENCIA RBS/AFP via Getty Images)

# Flooding in Libya



Thousands of Lives Lost

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# Greece



A vehicle crosses a flooded road in the city of Volos, central Greece  
(AFP via Getty Images) Sept 2023



Cars in a flooded road in the city of Volos, central Greece  
(AFP via Getty Images) Sept 2023

# Droughts in 2022



Dry riverbed in **Italy** (Po River) due to worst drought in 70 years, June 2022

<https://idsb.tmgrup.com.tr/ly/uploads/images/2022/07/08/217454.jpg>

The Jialing Riverbed at the confluence with the Yangtze River is exposed due to drought on August 18, 2022 in **Chongqing, China**.

<https://image.cnbcfm.com/>



# Wildfires in the US



July 2021 - The Dixie fire burned close to a million acres in **California's** Lassen county over three months and became the first fire to cross the Sierra Nevada. Photograph: Noah Berger/AP

Peaks glowing with thousands of spot fires on 13 June 2022, in Flagstaff, **Arizona**. Schumacher/The Republic





# Wildfires in Europe - Summer of 2022



Southwestern France, July 17, 2022



Central Portugal, July 13, 2022



Brandenburg, Germany, August 2022



Greece, July 2022



Northern Spain, June 2022



Central Italy, July 2022

**“The number of wildfires in 2022 in the EU have nearly quadrupled the 15-year average”**

Source: CNN according to Copernicus, EU Earth observation program



# Algeria/Tunisia



Burnt vehicles are pictured in the aftermath of a wildfire in Bejaia, Algeria July 25. REUTERS/Ramzi Boudina

Source: <https://www.reuters.com/world/africa/deadly-fires-rage-along-algeria-coast-spread-tunisia-2023-07-25/>

- Death toll at least 34 fatalities, including 10 firefighters in Algeria
- At least 26 others have been injured.
- Over 1,500 people evacuated in Bejaia, Bouira, and Jijel, Algeria
- Over 2500 evacuated from Maloula and Tabarka in Tunisia

Source: Crisi24

<https://crisis24.garda.com/>

Wednesday 26/07/2023



A man inspects the remains of a burnt vehicle in the aftermath of a forest fire near the town of Melloula in northwestern Tunisia close to the border with Algeria, July 26, 2023. (AFP)

Source: <https://thearabweekly.com/tunisia-algeria-contain-wildfires-heatwave-sweeps-across-north-africa>

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# Siberia: Wildfires in June 2020 and June 2021



The Greenpeace Russia team has documented forest fires in the Krasnoyarsk region.  
JULIA PETRENKO / GREENPEACE



In this June 16, 2021 photo, firefighters work at the scene of forest fire near Andreyevsky village outside Tyumen, western Siberia, Russia. -  
Copyright AP Photo/Maksim Slutsky, File



# Greece



Before/After image of Fire Damage in Kiotari Rhodes, Greece  
Source: Maxar Technologies via BBC. July 2023

# 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

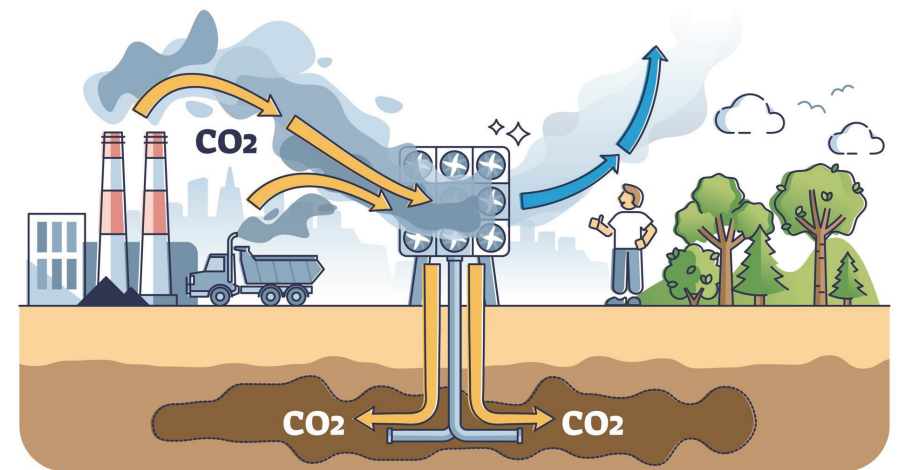
Steam Turbine: Siemens SST5-6000

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

*Whitelee Windfarm, Glasgow, Scotland*



# Kenya School of Monetary Studies, Nairobi



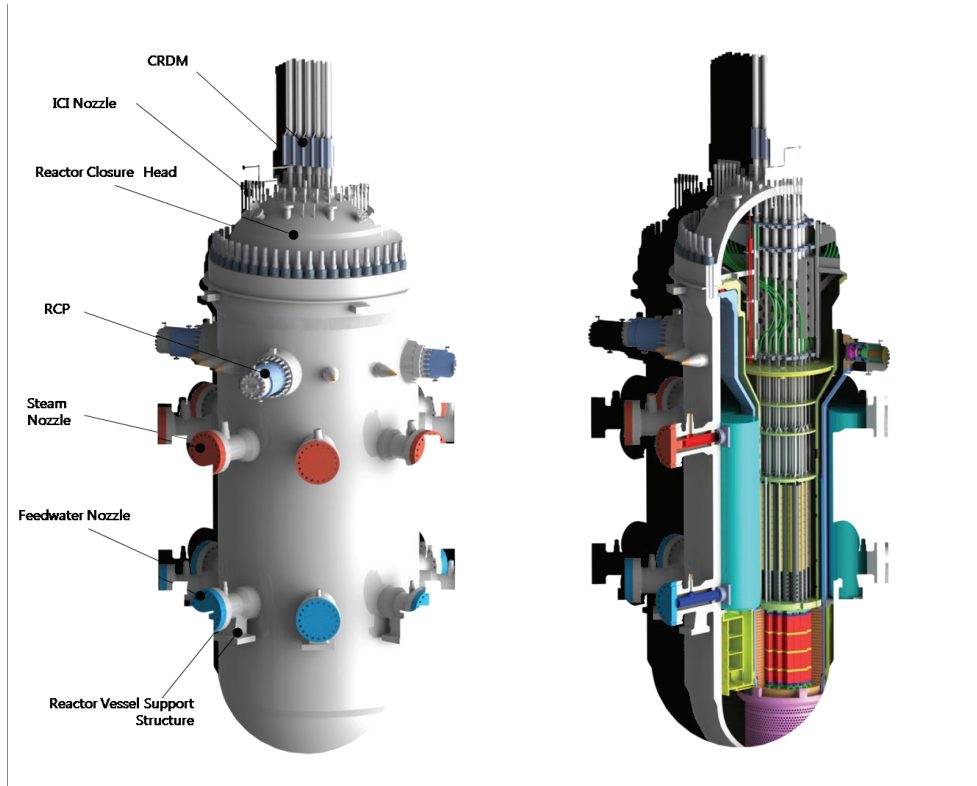
# Advanced Nuclear Technologies

## *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

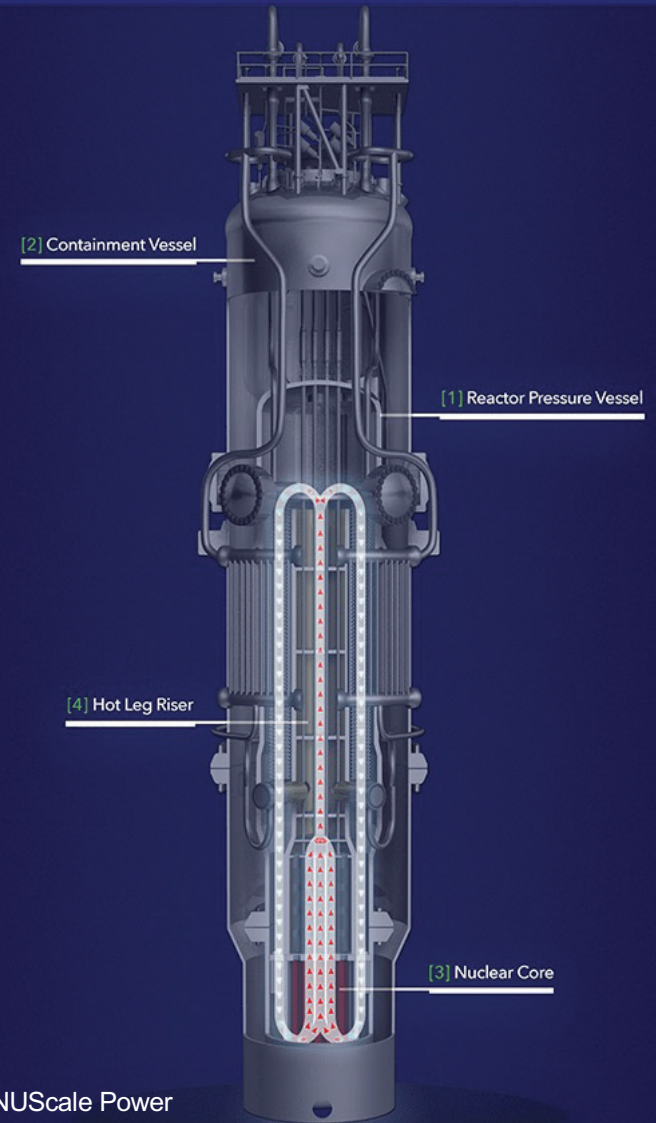


# Small Modular Reactors (SMR)



20m tall, 2.7m dia. 590 tons LWR  
4.95% enrichment. 50 – 60 MWe

Advancing Technology for



Source: NUScale Power

# Cross-Border Energy Transfer

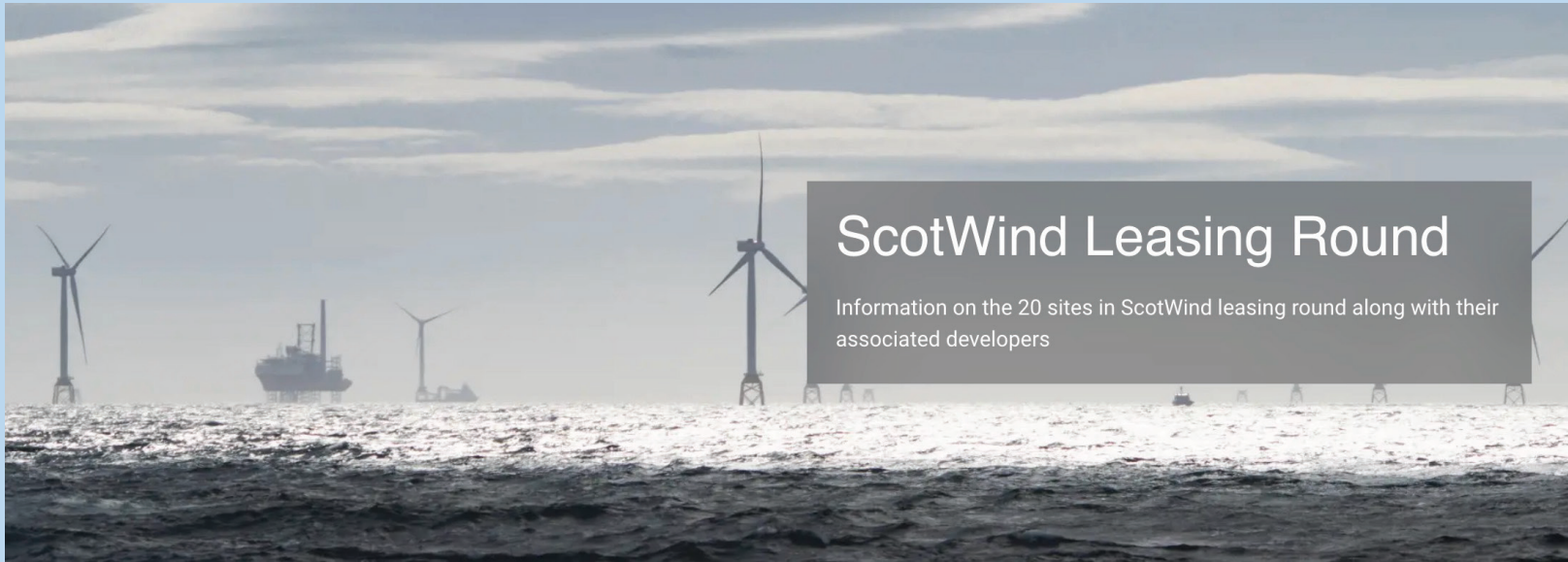
## *No Transition without Transmission*

- 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



# Some Case-specific Examples





ScotWind leasing round on the 17th of January 2022: **25 GW**

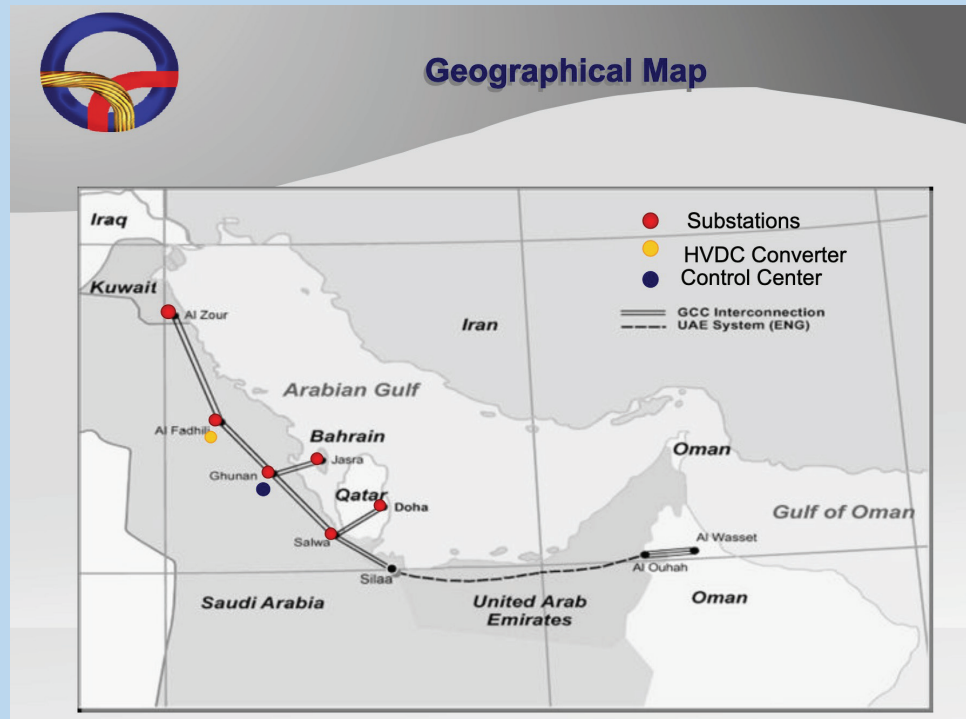
Demand for Electricity in Scotland in 2030: **6 GW**



LONDON, Aug 24 (Reuters) - British authorities have given planning consent for a new 2 gigawatt (GW) subsea power link between Scotland and England

The Eastern Green Link 2 will be developed by National Grid and Scottish and Southern Electricity Networks Transmission.

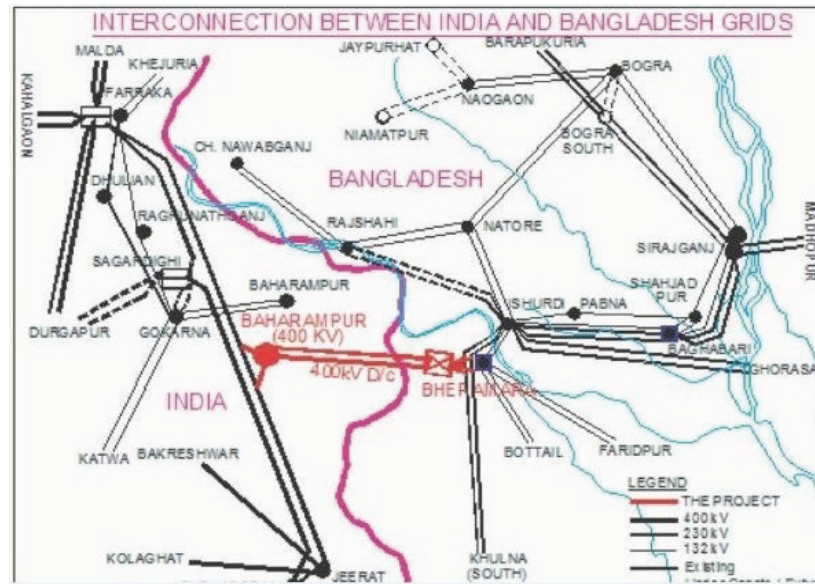
# Gulf Coordination Council Interconnection



Major Benefit: Reduction of Reserve Requirements  
Also Helpful in Dealing with Intermittent Sources (PV)



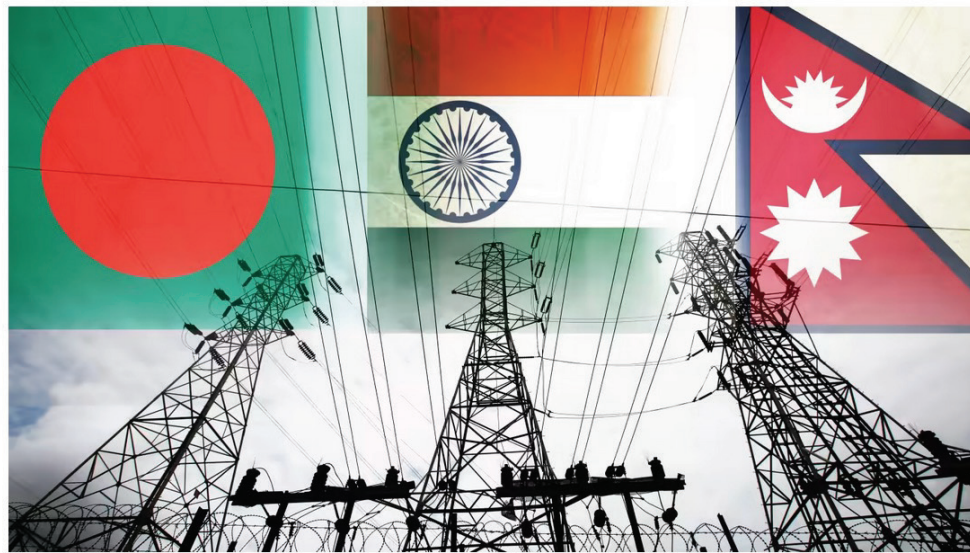
## Bangladesh-India Interconnection (HVDC link)



Bangladesh-India 400 KV Double-Circuit 1,000 MW Line

Allows Bangladesh to buy cheaper electricity  
and solar electricity when available





Bangladesh, India and Nepal are expected to soon finalize an agreement that would allow power sharing across Indian transmission lines. (Source photos by AP and Reuters)

Nepal needs to attract investment by developing a market outside  
In Nepal electricity demand is less in summer than in winter  
It is opposite in India and Bangladesh due to high air conditioning load

Industry tends to locate in areas of low-carbon electricity to help meet their own net-zero targets for scope II and scope III emissions

## Low-carbon, cheaper and non-intermittent electricity

545 km of underwater-underground transmission line  
from Québec, Canada to New York City



## Vietnam has opted to boost hydroelectricity imports from Laos

The limited electricity transmission capacity from the South to the North poses a major challenge.

It is easier to import hydro-electricity from Laos to shore up power supply for the North, given the shorter transmission distance.





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**Clean-tech Solutions for Climate Sustainability**



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# Climate Change

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**IEEE:** Enabling Innovation and Technology Solutions

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





# IEEE Climate Change Program

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



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Technical Community

**CLIMATE CHANGE**  
Mitigation

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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.

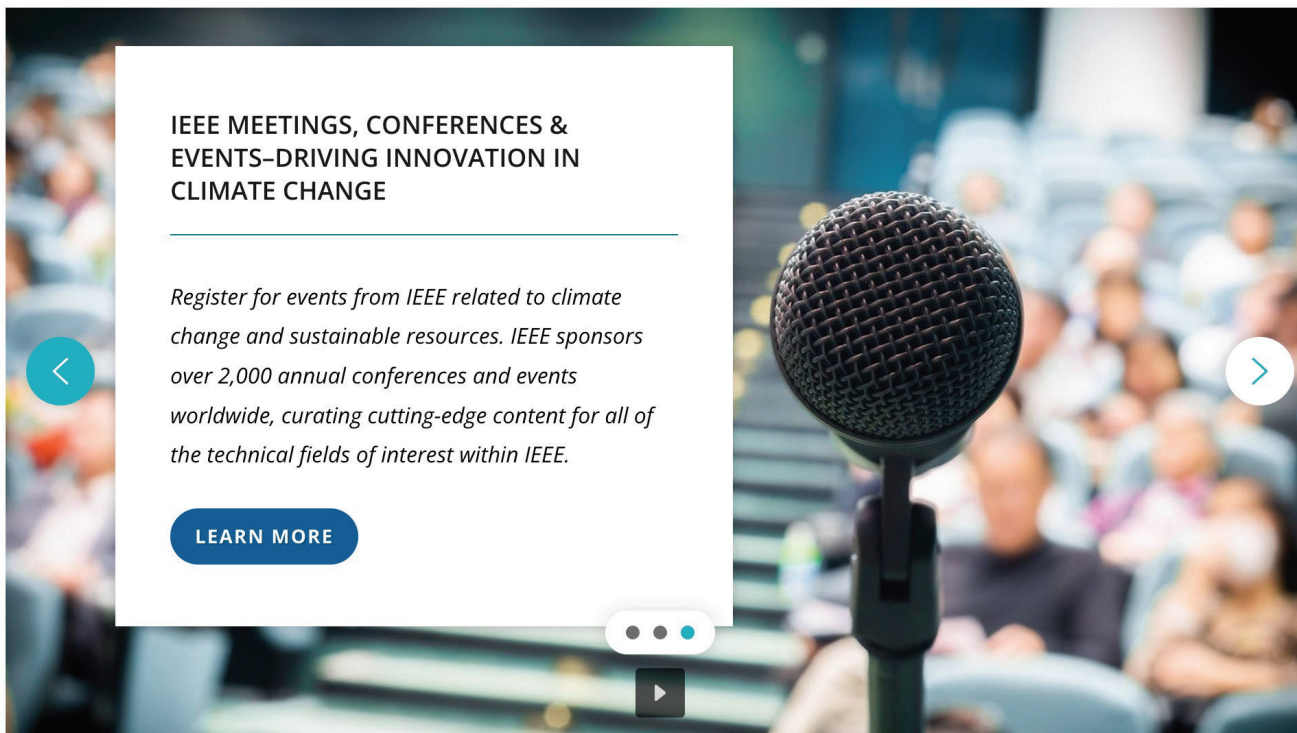
IEEE's scholarly publications, events, conference proceedings, technical standards, and other materials help foster the exchange of technical knowledge and information for the critical climate issues that our planet faces today.



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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**

- Wanda X. Ye
- Davide Scaramuzza
- Didi Fred Wang

**Climate Change**  
IEEE Building Connected and Smart 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.

**Jobs From IEEE Job Site**

**IEEE JOB Site**

**FEATURED JOBS**

- Deep Electronics Scientist
- Senior Research Scientist
- Senior Research Scientist
- Senior Research Scientist

## Conferences



## Standards

**IEEE SA**  
STANDARDS ASSOCIATION

## Newsletters

**IEEE Spectrum**

**Tech Alert**

Here's How Aporknis is Making Their Humane 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

- Technology through Knowledge Advancements
- Leadership and Innovation
- Advancing Through Smart Infrastructure

**IEEE Climate Change newsletter**

**Climate Change**

August 2023 IEEE Climate Change News

**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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