

JRC Memorial Lecture

BUET, Dhaka, Bangladesh  
22 December 2022

# The Climate Change and the Decarbonization Challenge

## The Role Smart Grid Can Play in Bangladesh

**Prof. Saifur Rahman**

2022 IEEE  
President-elect



Director, Virginia  
Tech Advanced  
Research Inst., USA  
[www.srahman.org](http://www.srahman.org)



## BUET Reunion Feb 2020





## **Dr. Jamilur Reza Chowdhury: My Neighbour, Teacher and Mentor**

We spent our childhood in the Elephant Road area in Dhaka

My mother and Dr. JRC's mother visited each other often

Mr. Abedur Reza Chowdhury was a civil engineer and a leader in the community

Dr. JRC's elder brother and my cousin brother were classmates

His younger brother Badal was junior to me at Notre Dame College and BUET

Dr. JRC taught us Strength of Materials in 1969

His son, Kaashif, was an MS student in our department at Virginia Tech in 2003

# Inauguration of the IEEE Student Branch @ BRAC University

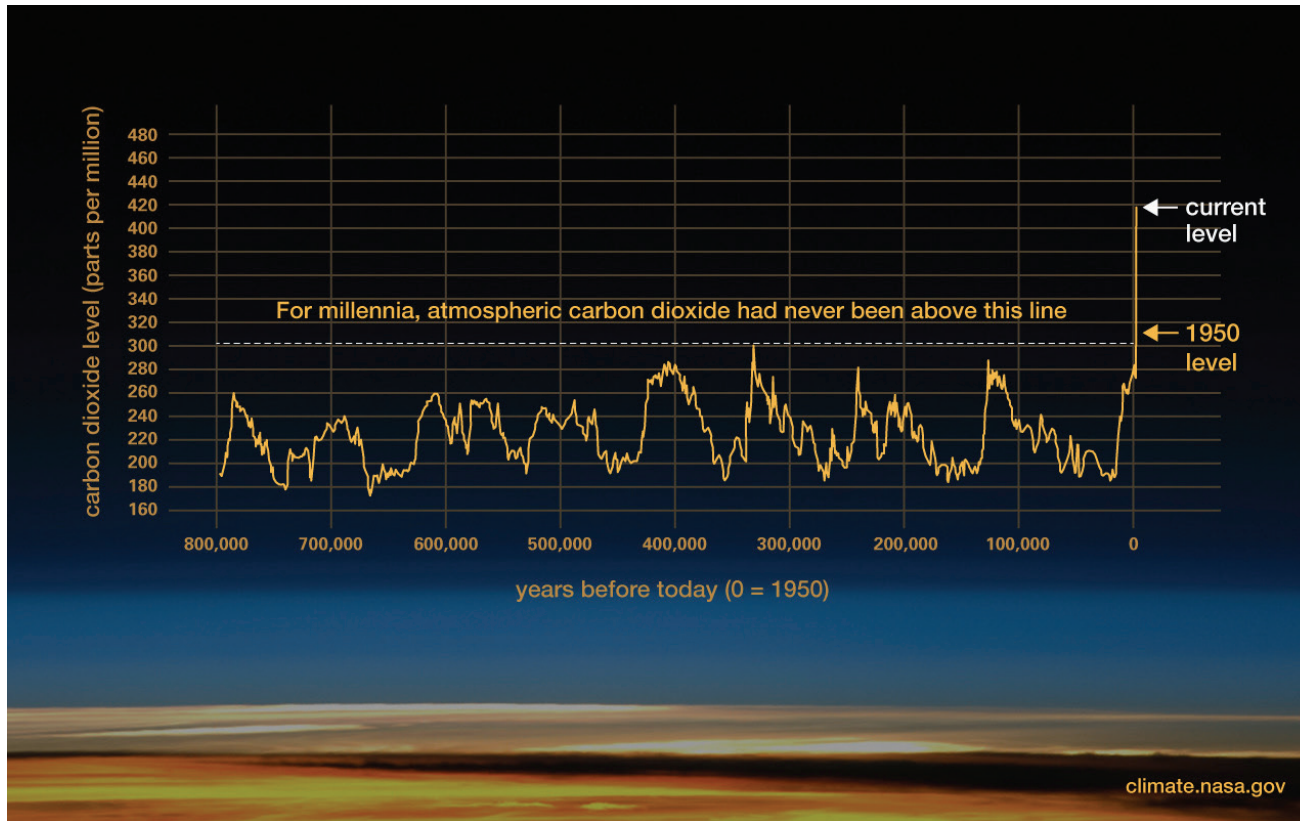
Publish Date: July 7th, 2008

The Inaugural Session of the IEEE (Institute of Electronics and Electrical Engineers) Student Branch at BRAC University was held on **July 06, 2008** at BRACU Indoor Games room.

The student branch was officially inaugurated when **Professor Saifur Rahman**, Chief Guest of the event, launched the student branch website.

**Professor Jamilur Reza Choudhury**, VC, BRACU was also present in the event.

# 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/)

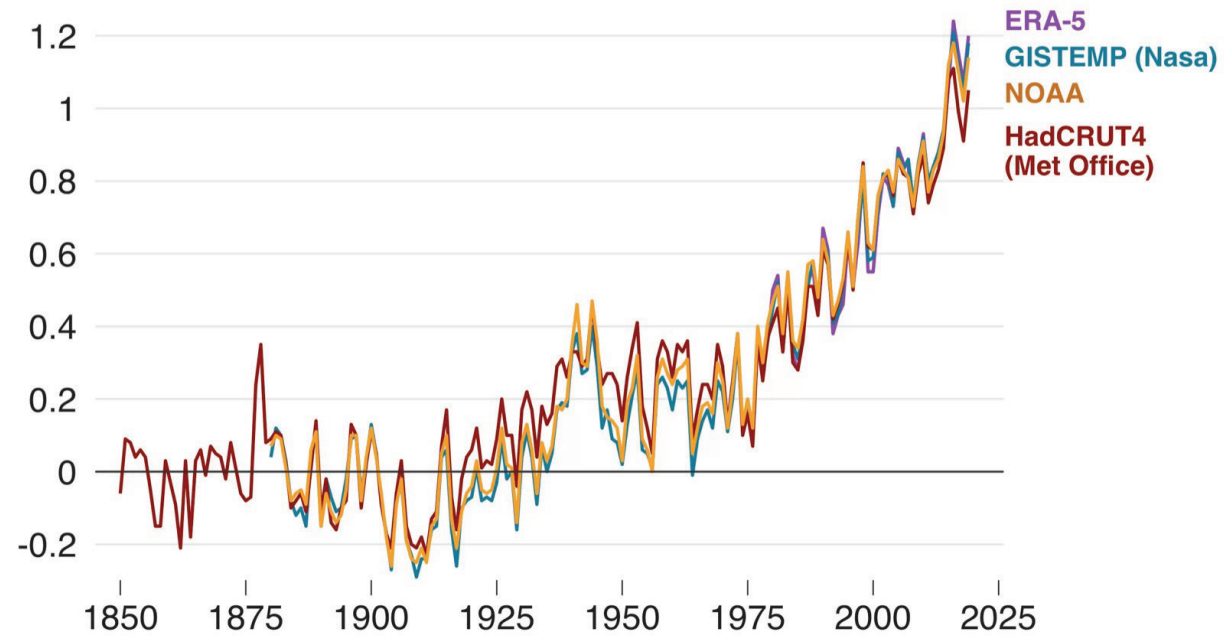
# Impacts of Carbonization





## 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 °C may be acceptable. But 2°C = Point of No Return

Climate Change Hits  
Poor and the Rich Alike

# Florida, China and Africa





Hurricane Isabel struck the US Mid-Atlantic region between Sept. 18-19, 2003

## 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>



China





# Hurricane Sandy

New York, New Jersey 2012



# Droughts in 2022



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

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

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  
June 13, 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](#)

# 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

# 2008 China Snowstorm

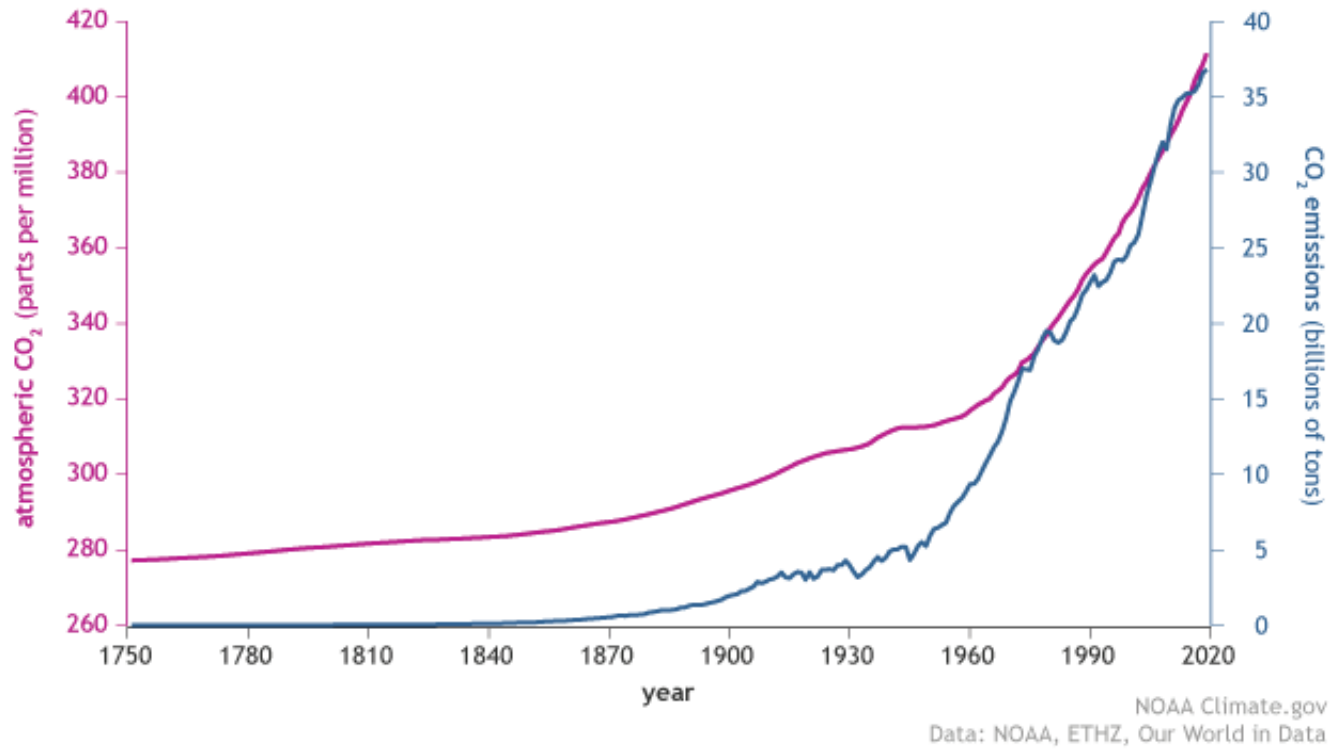




Source: Craig Dearden-Phillips: Don't be a polar bear  
<https://www.thirdsector.co.uk/craig-dearden-phillips-dont-polar-bear/management/article/1488091>

# Carbon Emissions and Temperature Rise

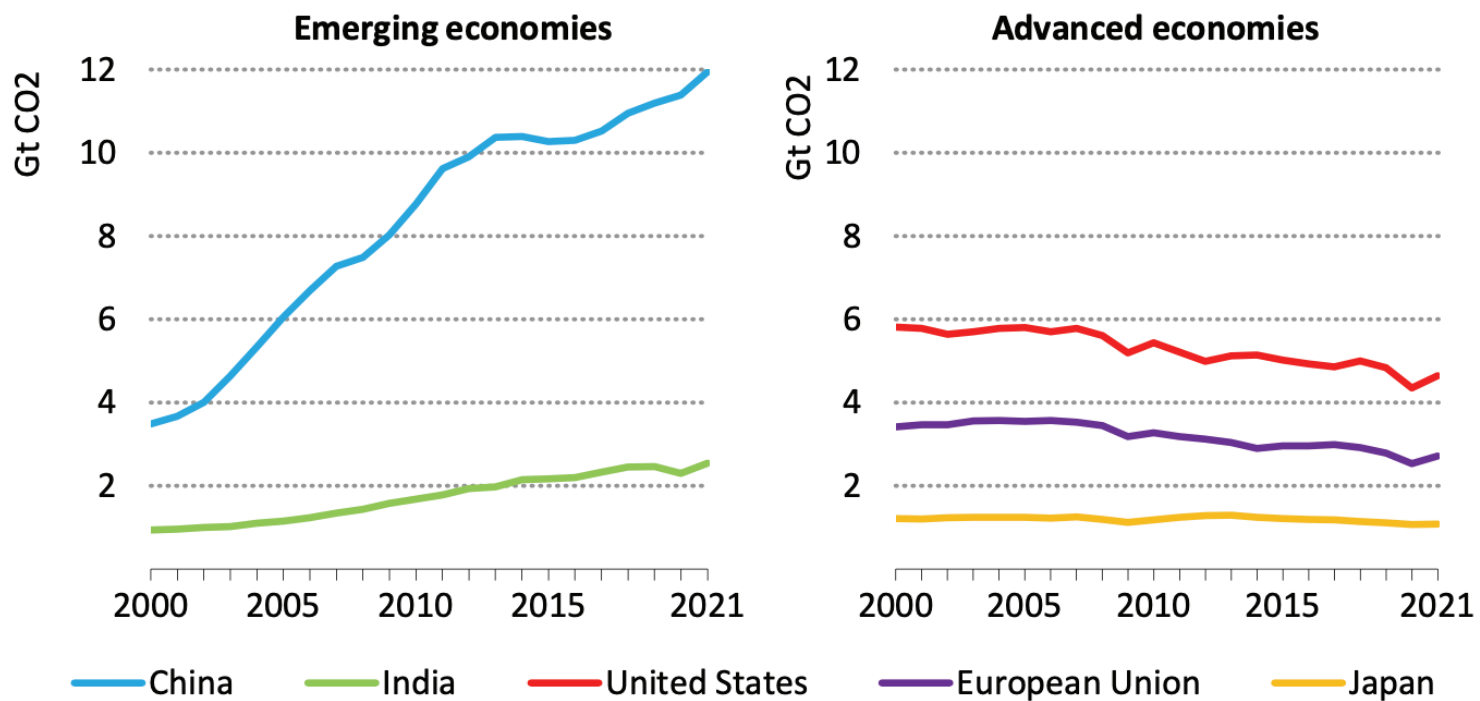
CO<sub>2</sub> in the atmosphere and annual emissions (1750-2019)



Source: State of the Planet

<https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/>

## CO2 emissions in selected emerging and advanced economies, 2000-2021

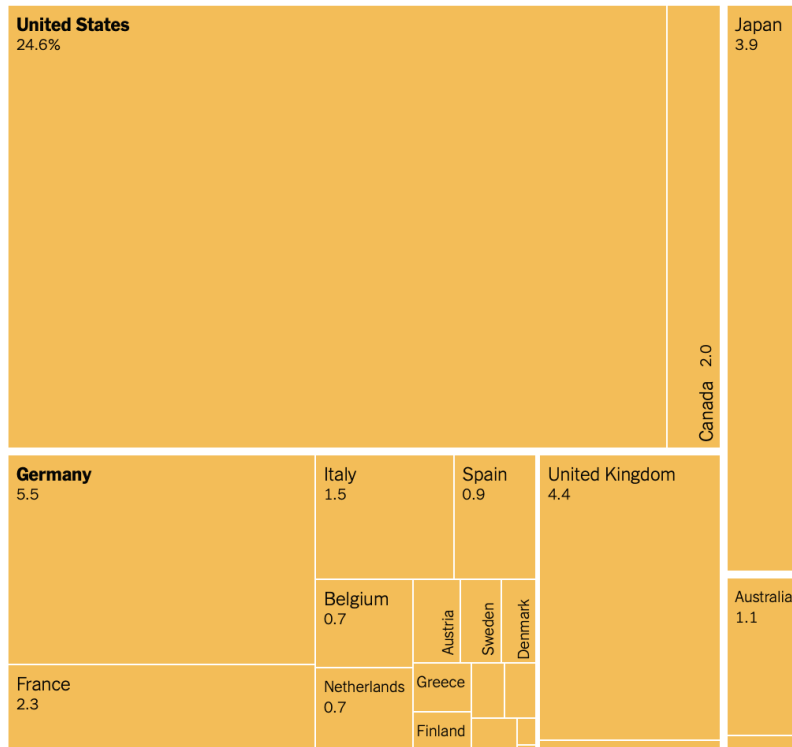


IEA. All rights reserved.

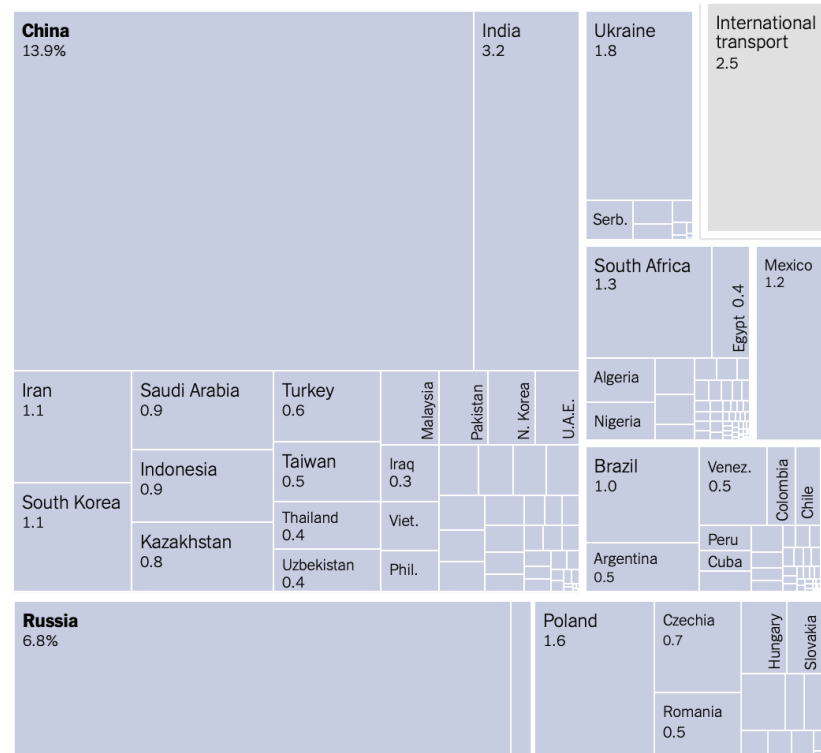


# Who Has The Most Historical Responsibility for Carbonization

**23 rich, developed countries** are responsible for half of all historical CO<sub>2</sub> emissions.



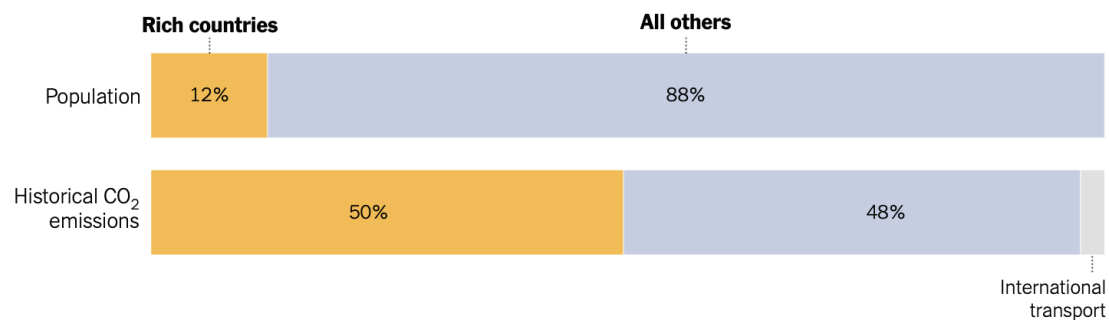
**More than 150 countries** are responsible for the other half.



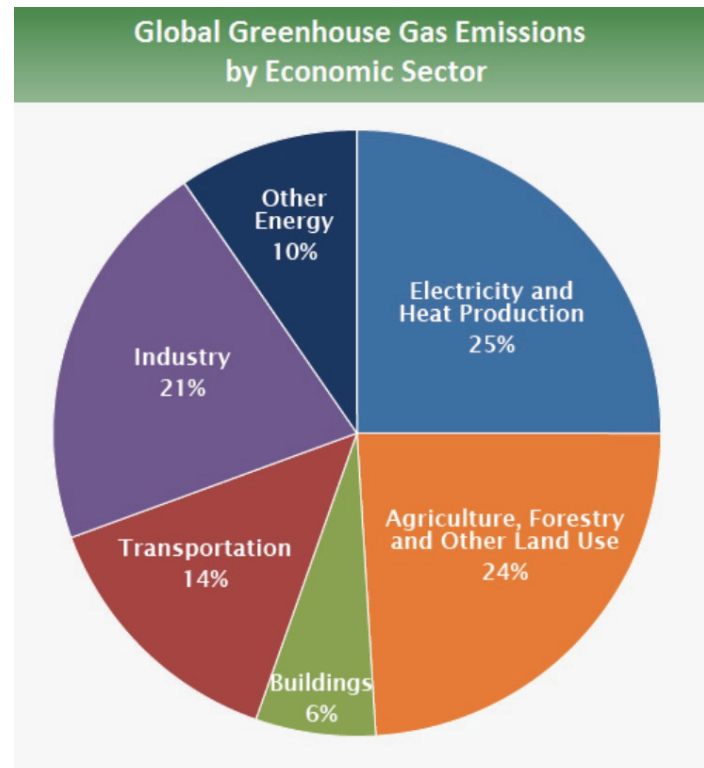
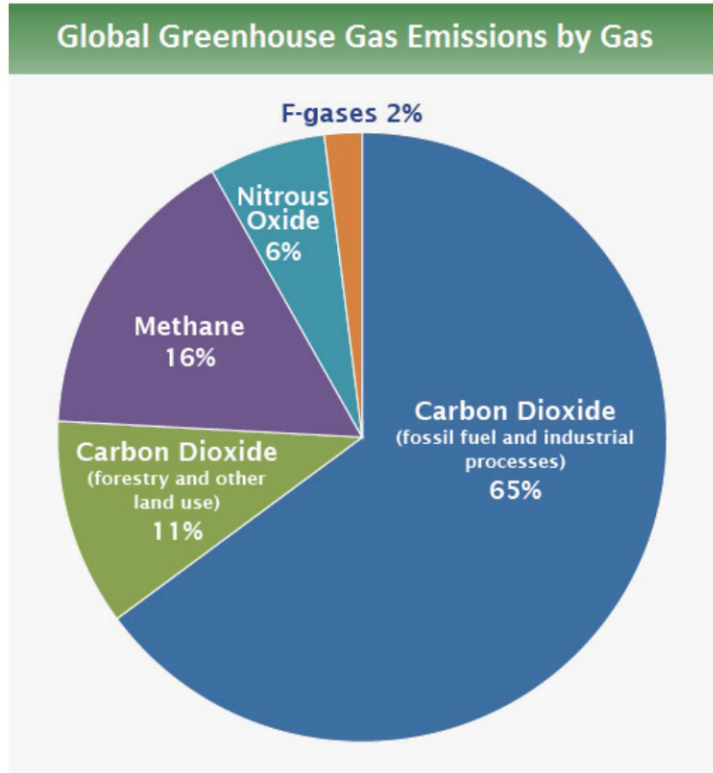
Source: The New York Times article "Who Has The Most Historical Responsibility for Climate Change?" by [Nadja Popovich](#) and [Brad Plumer](#), Nov. 12, 2021 (<https://www.nytimes.com/interactive/2021/11/12/climate/cop26-emissions-compensation.html>)

## Population vs. Historical Carbon Emissions

Rich countries, including the United States, Canada, Japan and much of western Europe, account for just 12 percent of the global population today but are responsible for 50 percent of all the planet-warming greenhouse gases released from fossil fuels and industry over the past 170 years.



Source: The New York Times article "Who Has The Most Historical Responsibility for Climate Change?" by [Nadja Popovich](#) and [Brad Plumer](#), Nov. 12, 2021 (<https://www.nytimes.com/interactive/2021/11/12/climate/cop26-emissions-compensation.html>)



Source: [IPCC \(2014\)](https://www.ipcc.ch/)

<https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>



# Reduce Carbon Emissions from Electricity Production



## 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





## Air conditioning and Lighting

Increasing the AC temp setting by  
2 deg F can save 10% electricity



# Energy Efficiency Applications

## *Consider light bulbs*

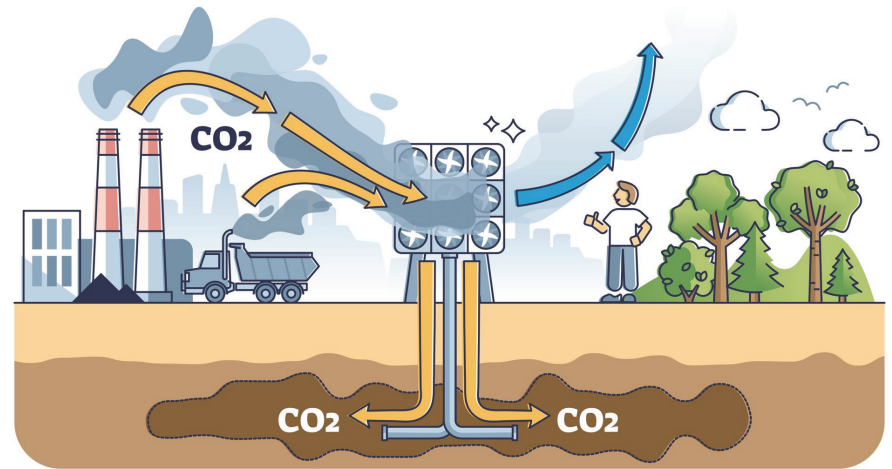
- Provide more energy efficient applications and tools globally
- The amount of electricity required to run an **LED light bulb is less than 15% of what is needed to run an incandescent light bulb** producing the same amount of light
- In industrial applications, **LED bulbs use 25% electricity compared to sodium-sulfur bulbs**





# 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



# Renewable Energy Integration

*Build more strategically from the start*

- Focus on where energy is needed most, via three core components:
  - Energy generation
  - Transmission
  - Distribution



# Hydrogen and Storage Solutions

*Optimize renewable energy solutions being integrated into energy grids*

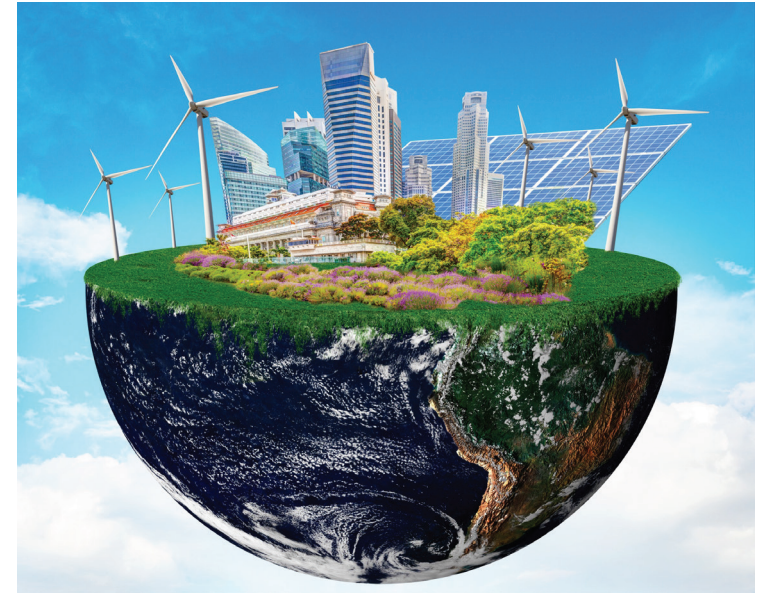


- Low-carbon hydrogen will help emerging economies to meet climate goals in and of itself
  - Provide for diverse energy portfolios
  - Improving resilience
  - Lowering costs
- Storage solutions serve as optimizers for other renewable energy solutions
  - Ensure that electricity generated during off-peak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

# Cross-Border Energy Transfer

*We all are impacted by climate change*

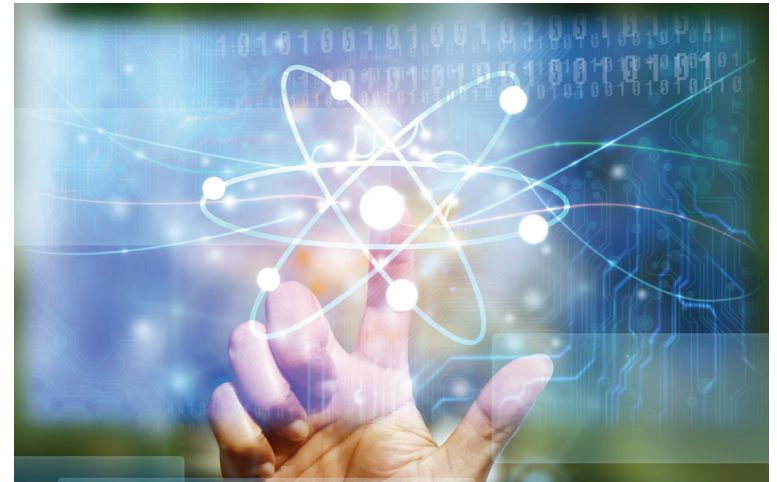
- As we are in this fight together, our solutions should be collaborative to secure better outcomes for all countries, regardless of location
- The International Energy Agency (IEA) has identified three main modes of cross-border energy integration:
  - Bilateral
  - Multilateral
  - Unified



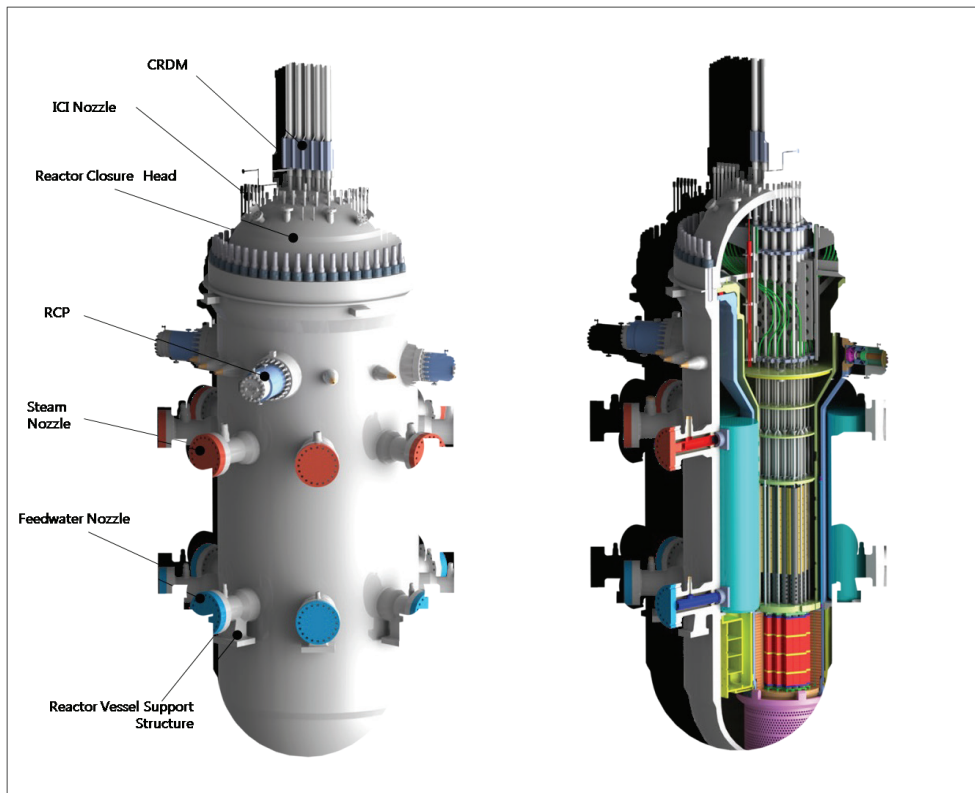
# Advanced Nuclear Technologies

*Diverse solutions to address climate change*

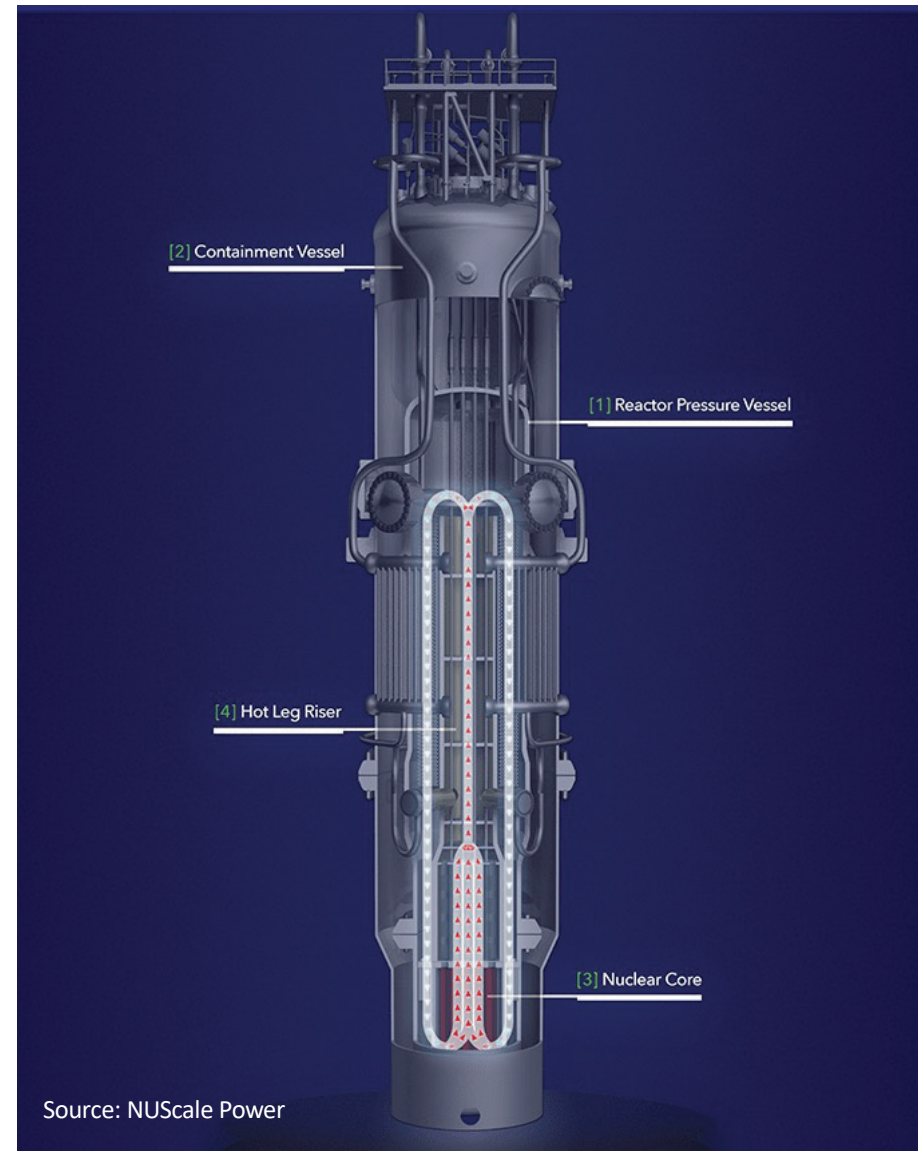
- Advanced nuclear technologies, such as small modular reactors (SMRs), can play a role
  - Smaller and can be built more quickly than more traditional nuclear reactors
- Ramping up the development of SMRs can help to produce energy when and where needed
- This energy could be integrated into existing 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



# US Chief Climate Negotiator Senator John Kerry at COP27



# Electrification to Reduce Fossil Fuel Use



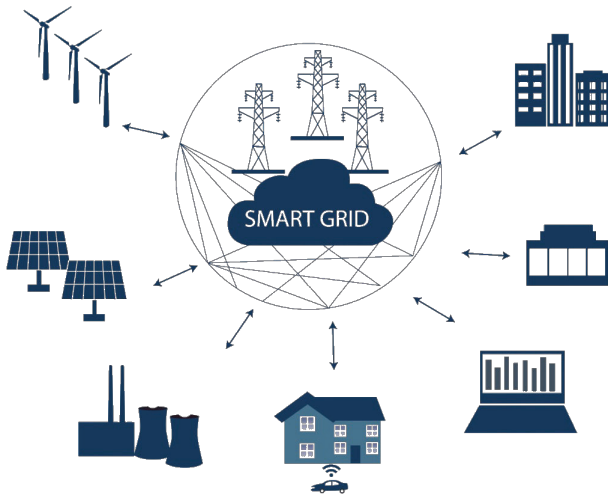
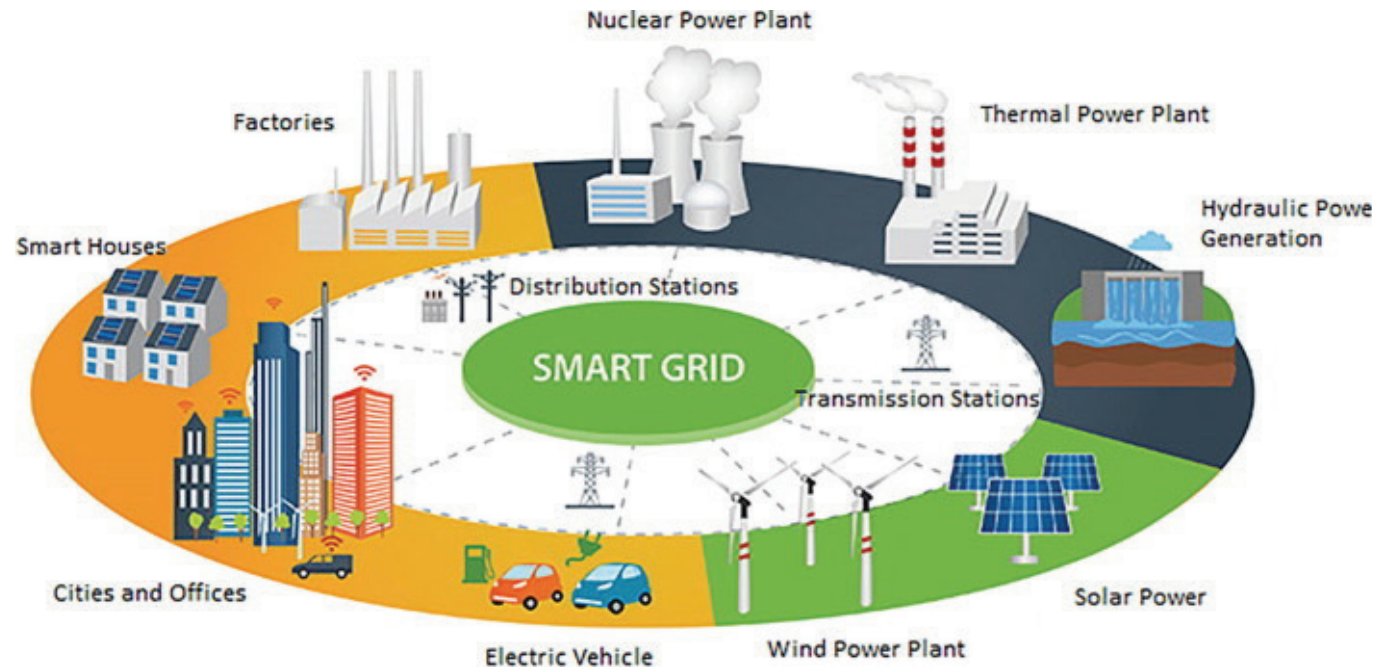


## Electric Vehicle



# How Can the Smart Grid Help?

# What is a Smart Grid



"Smart grid" is a concept with many elements where monitoring and control of each element in the chain of **generation, transmission, distribution and end-use** allow the electricity delivery and use to be more efficient.



# Global Alliance of Universities on Climate



# International Renewable Energy Agency

## Energy Transition Education Network

**ETEN Founding Partners**

**Convened by:**  **IRENA**  
International Renewable Energy Agency

**PERMANENT MISSION OF THE UNITED ARAB EMIRATES INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)**  **البعثة الدائمة الإمارات العربية المتحدة الوكالة الدولية للطاقة المتجددة (أيرينا)**

**Partners:**  **unesco** **Teach For All**  
A Global Network

 **for every child**  **Higher Education Sustainability Initiative**  **HESI+10**  
Celebrating 10 years with Higher Education Sustainability Impact

 **IEEE**  
Advancing Technology for Humanity

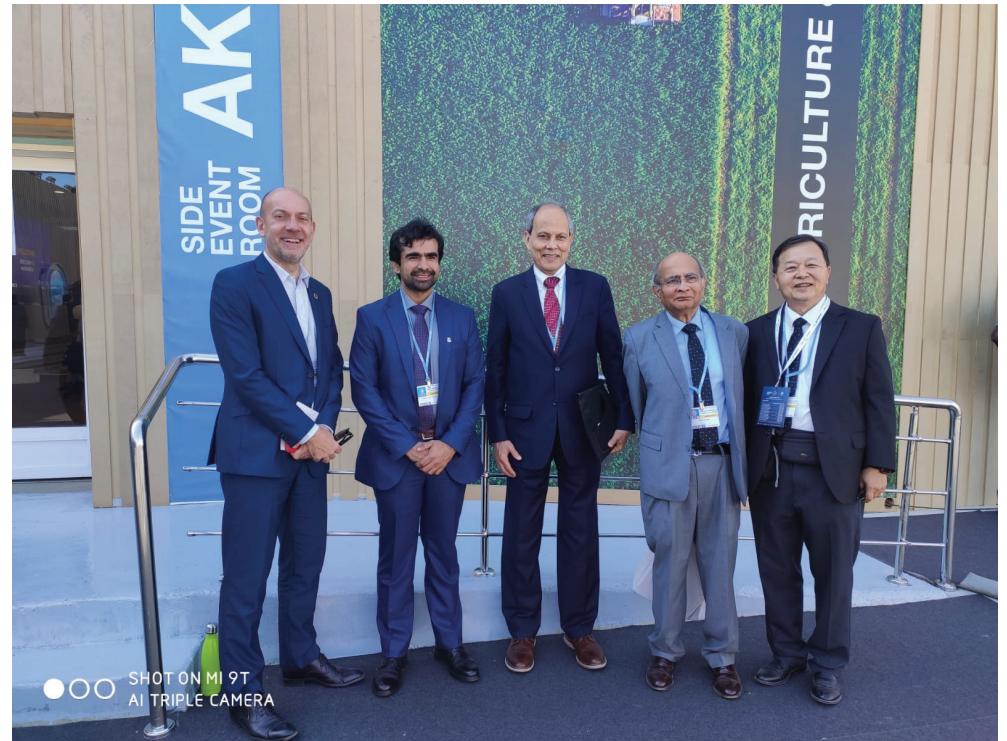
 **ENERGY TRANSITION EDUCATION NETWORK**  **IRENA at COP27**

# Speech at IRENA COP27 Event

*Energy Transition Education Network*



# WFEO/EIC/IEEE Participants at COP27





# Energy Day 15 Nov 2022



# Bangladesh Pavilion at COP27



**FRIENDSHIP** MEET US AT  
**COP27**  
10 November at 15:30 to 17:00 (GMT+2) EGY/EET  
Experience of Integrated approach of Adaptation and Mitigation in Bangladesh  
**BANGLADESH PAVILION**

**CHIEF GUEST:**  
**SHAHAB UDDIN, MP**  
Hon'ble Minister, Ministry of Environment  
Forests and Climate Change, Government of the People's Republic of Bangladesh

**SPECIAL GUEST:**  
**HABIBUN NAHAR M.P**  
Hon'ble Deputy Minister, Ministry of Environment  
Forests and Climate Change, Government of the People's Republic of Bangladesh

**GUEST OF HONOR:** **HRH PRINCESS MARIE-ESMÉRALDA**  
Chair Friendship Belgium, Journalist, Writer, Environmentalist

**CHAIR & MODERATOR:** **RUNA KHAN**  
Founder, Friendship

**COP27**  
SHARAH EL-SAYED  
EGYPT 2022  
#TogetherForClimateAction



Bangladesh contributes a miniscule amount in the global CO2 budget

Bangladesh can continue to grow with coal-based power sector

Or, Bangladesh can be an example of emerging low-carbon economy

US has agreed to provide USD 20 billion in public and private funds to Indonesia to help the country reduce its future coal-fired generation

News > COP27 Reaches Breakthrough Agreement on Ne...

[← Back](#)

## COP27 Reaches Breakthrough Agreement on New “Loss and Damage” Fund for Vulnerable Countries

20 November 2022

[UN Climate Press Release](#)

Share the article



Credit: Kiara Worth

# IEEE Climate Change Website

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



Resources from IEEE   Climate Change in the News   Contact   



MAKING A  
**DIFFERENCE**

<b>TECHNICAL</b> Solutions	<b>BUILDING</b> Technical Community	<b>CLIMATE CHANGE</b> Mitigation
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Email: [ccircc@ieee.org](mailto:ccircc@ieee.org)

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Climate  
Change

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[Resources from IEEE](#)

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## RESOURCES FROM IEEE

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, 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.

[View the IEEE Climate Change Collection in IEEE Xplore®](#)

# THANK YOU!

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