

Role of IEEE in Climate Actions for Green Energy



Prof. Saifur Rahman

2023 IEEE President & CEO

www.srahman.org



Invited Talk

Military Institute of Science & Technology
Dhaka, Bangladesh, 24 September 2023



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COORDINATE

*IEEE 2023
Board of Directors
Retreat Focus*



COMMUNICATE



COOPERATE

Synergy among IEEE's areas of focus

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and
Magazines
Published**

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**IEEE
Learning
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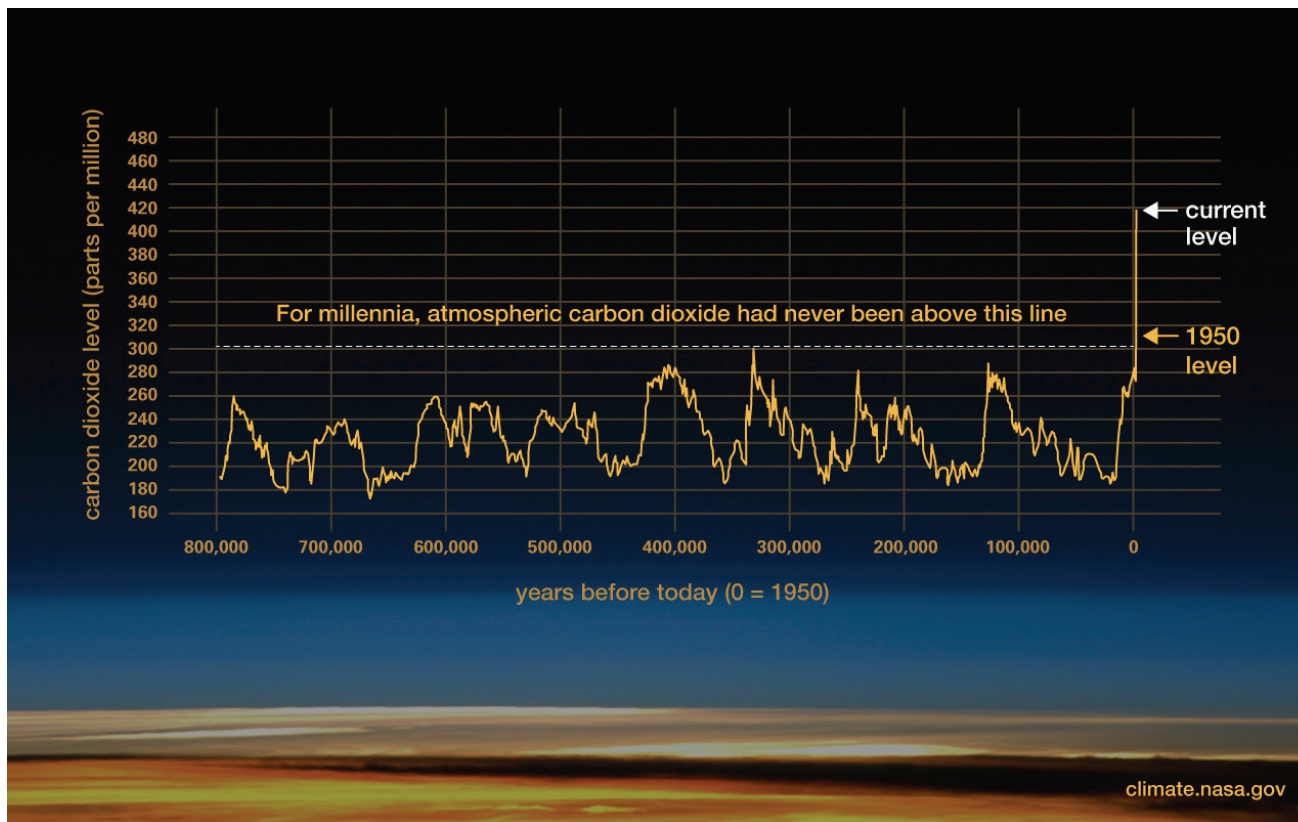
**Over 1300
Standards**

**CLIMATE
CHANGE**

**IEEE
Climate
Change
Program**

IEEE

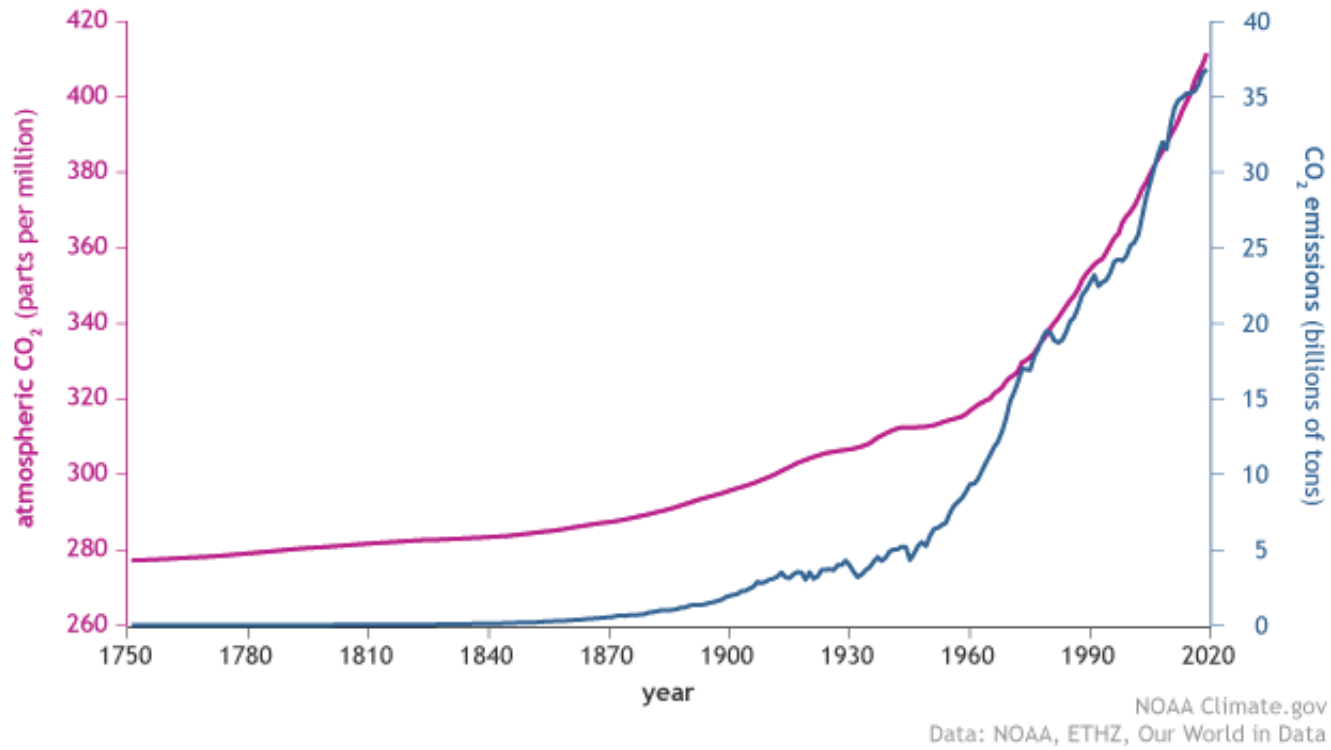
What is Carbonization ?



Source: NASA

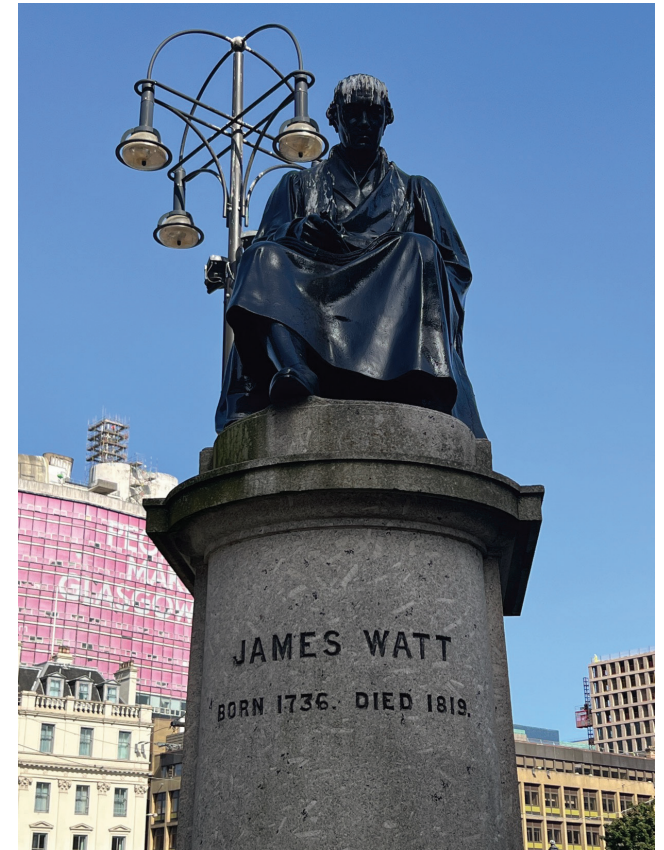
https://climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/

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



Source: State of the Planet

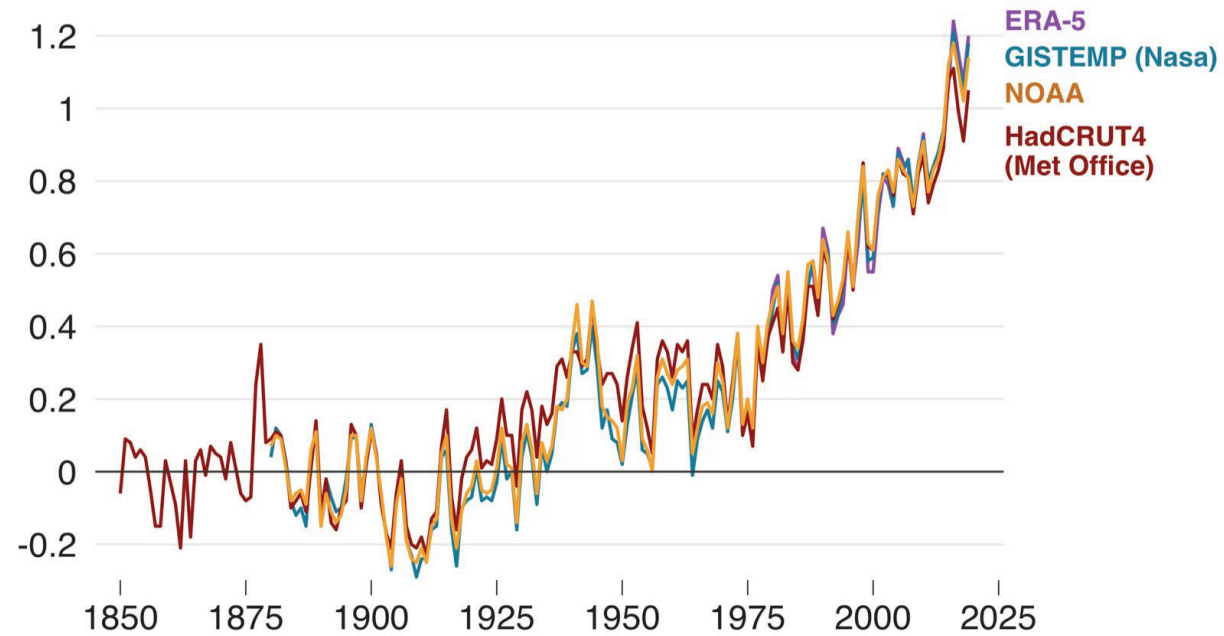
<https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/>



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 = Point of No Return

Climate Impacts

Floods

Droughts

Wildfires

Climate-change Impacts



Pethi Belaid/Agence France-Presse — Getty Images



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>

Beijing



Floods inundate a village in Baoding city, Hebei province, on 02 August 2023.

Source: <https://www.cnn.com/2023/08/04/china/china-northeast-hebei-beijing-flooding-recovery-intl-hnk/index.html>



Zhuozhou, north China's Hebei Province, 02 August 2023

Source: <https://english.aawsat.com/world/4466926-beijing-records-heaviest-rainfall-least-140-years-causing-severe-flooding-and-21>

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/

Brazil



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

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

Flooding in Libya



Thousands of Lives Lost

Flooding in Bangladesh



Flood Impacts in Bangladesh

Loss of Human Lives and Cattle is Minimal

Country Has an Effective Disaster Management Program

Anticipatory Action in the Country



Droughts in 2022



Dry river bed 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 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 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



Global CO₂ Emissions Due to Fossil Fuels in 2021

Coal	15.3 billion tons
Nat. Gas	7.5 billion tons
Oil	10.7 billion tons

Source: IEA Global Energy Review: CO₂ Emissions in 2021
<https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2>

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 H₂ & 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 (CO₂ levels, PM 2.5).



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
- Providing developing nations with lightbulbs that are more energy efficient can ensure that energy consumption and carbon emissions are being reduced requiring lesser investments in power generation, transmission & distribution



Highly Efficient Fossil-fuel Power Plants

Carbon Capture and Storage

- Combined Cycle Gas/Steam Power Plant
- Ultra-supercritical steam power plant

Eemshaven ultra-supercritical steam power plant, The Netherlands



Power Plant: Two units rated 800MW each

Efficiency: 46.2%

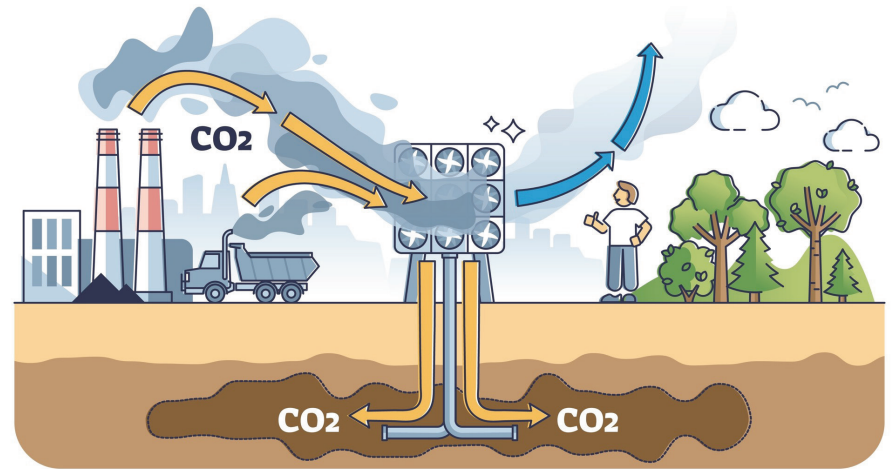
Temp: 609 deg C

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 and Storage



Whitelee Windfarm, Glasgow, Scotland



Wildorado Wind Ranch-Siemens



LOCATION: Wildorado, TX

25 miles west of Amarillo in
Oldham, Potter and Randall
Counties

SIZE: 161 MW

COMMERCIAL OPERATIONS

DATE: April 2007

UTILITY: Xcel Energy

(Southwestern Public Service
Company)

TURBINE EQUIPMENT:

70 Siemens 2.3 MW Mk II

Source: <http://www.nikkiphotography.com/category/environmental-issues/>
<http://www.cielowind.com/projects/completed-developments/wildorado-wind-ranc>

Net-zero Campus

Hashemite University in Amman Jordan



Roof-mounted Solar in a School in Morocco



Roof-top Solar Photovoltaics



Virginia



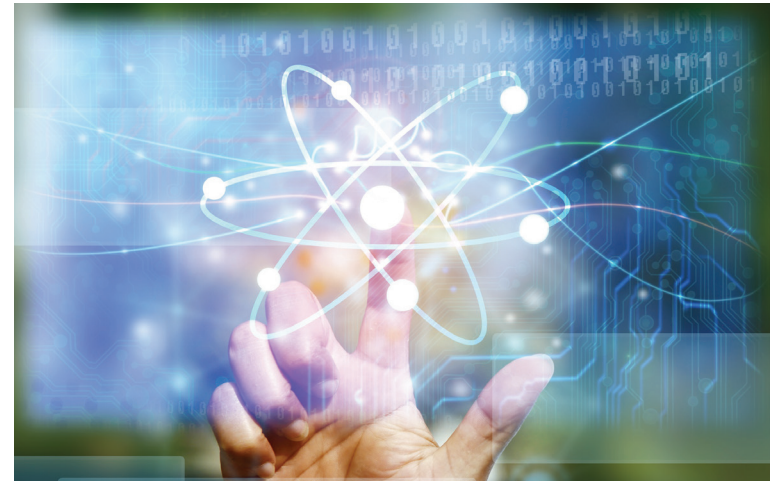
Dhaka City

Kenya School of Monetary Studies, Nairobi

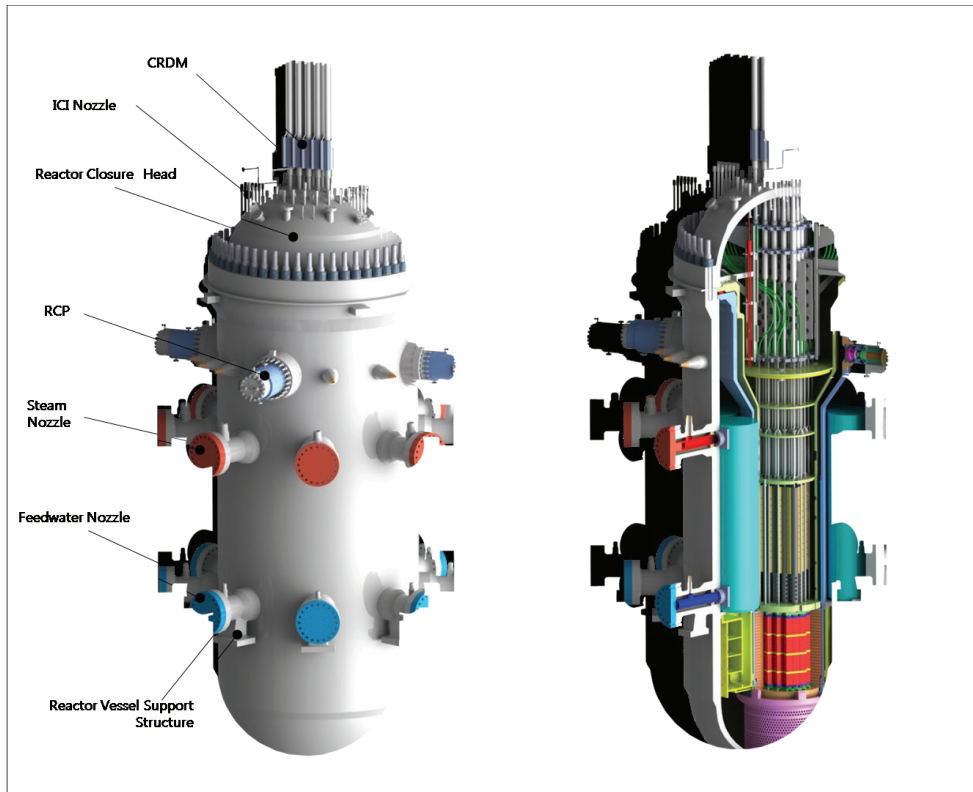


Advanced Nuclear Technologies

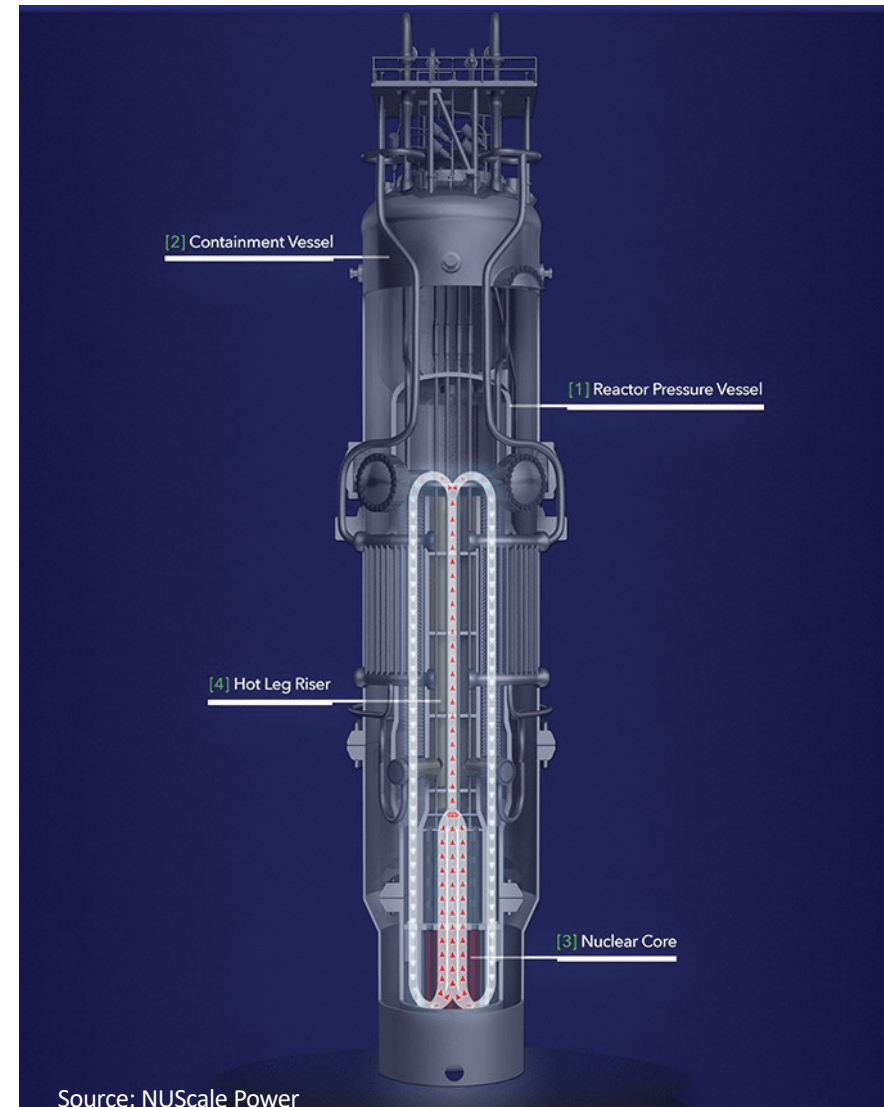
- Advanced nuclear technologies, such as small modular reactors (SMRs), can play a role
 - Smaller and can be built more quickly than more traditional nuclear reactors
- Ramping up the development of SMRs can help to produce energy when and where needed
- This energy could be integrated into existing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



Small Modular Reactor



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



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

IEEE: Enabling Innovation and Technology Solutions

IEEE at UN Climate Change Conference



Global Alliance of Universities on Climate



Presentation at GAUC



Partnership with International Renewable Energy Agency (IRENA)

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 (إيرينا)**

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

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

 **IEEE**
Advancing Technology for Humanity

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IEEE Climate Change Program

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



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

Ecosystem for IEEE's Climate Sustainability Work

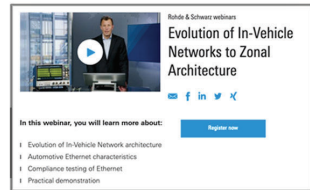
IEEE Spectrum: Climate Change News Feed; Podcasts; Features; Archives; Journal Watch Posts (Xplore); The Institute (Engineers of Climate Change); Coverage of Conferences and Standards



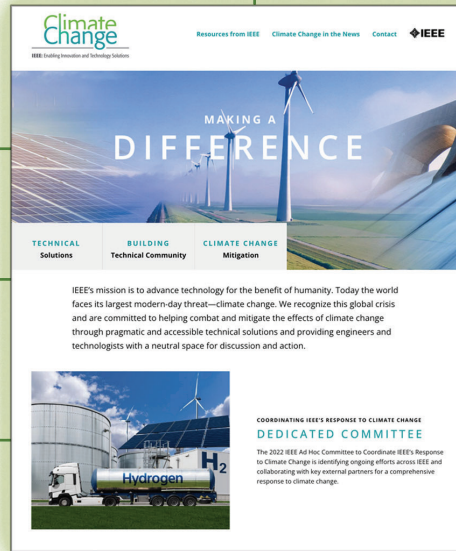
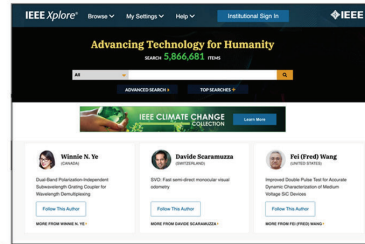
Social Media



Sponsored Content From Industry



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



Jobs From IEEE Job Site



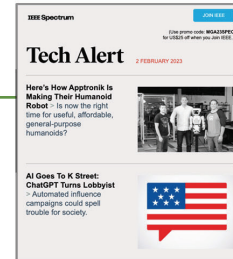
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