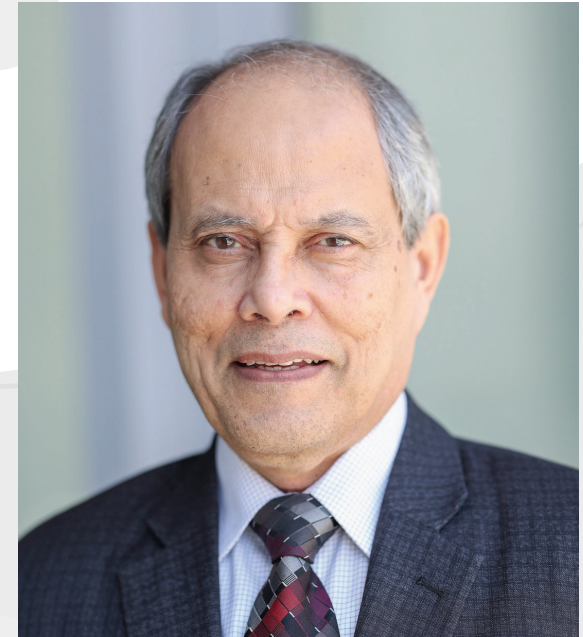


Smart Bangladesh with a Sustainable Climate

Prof. Saifur Rahman

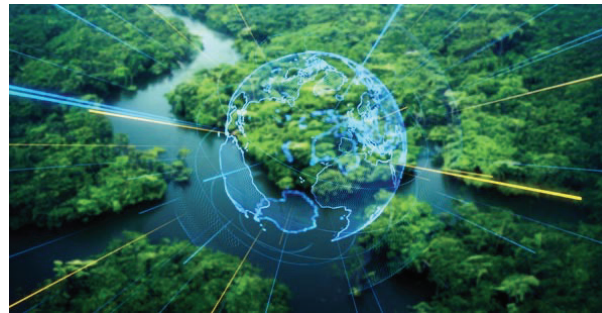
2023 IEEE President & CEO

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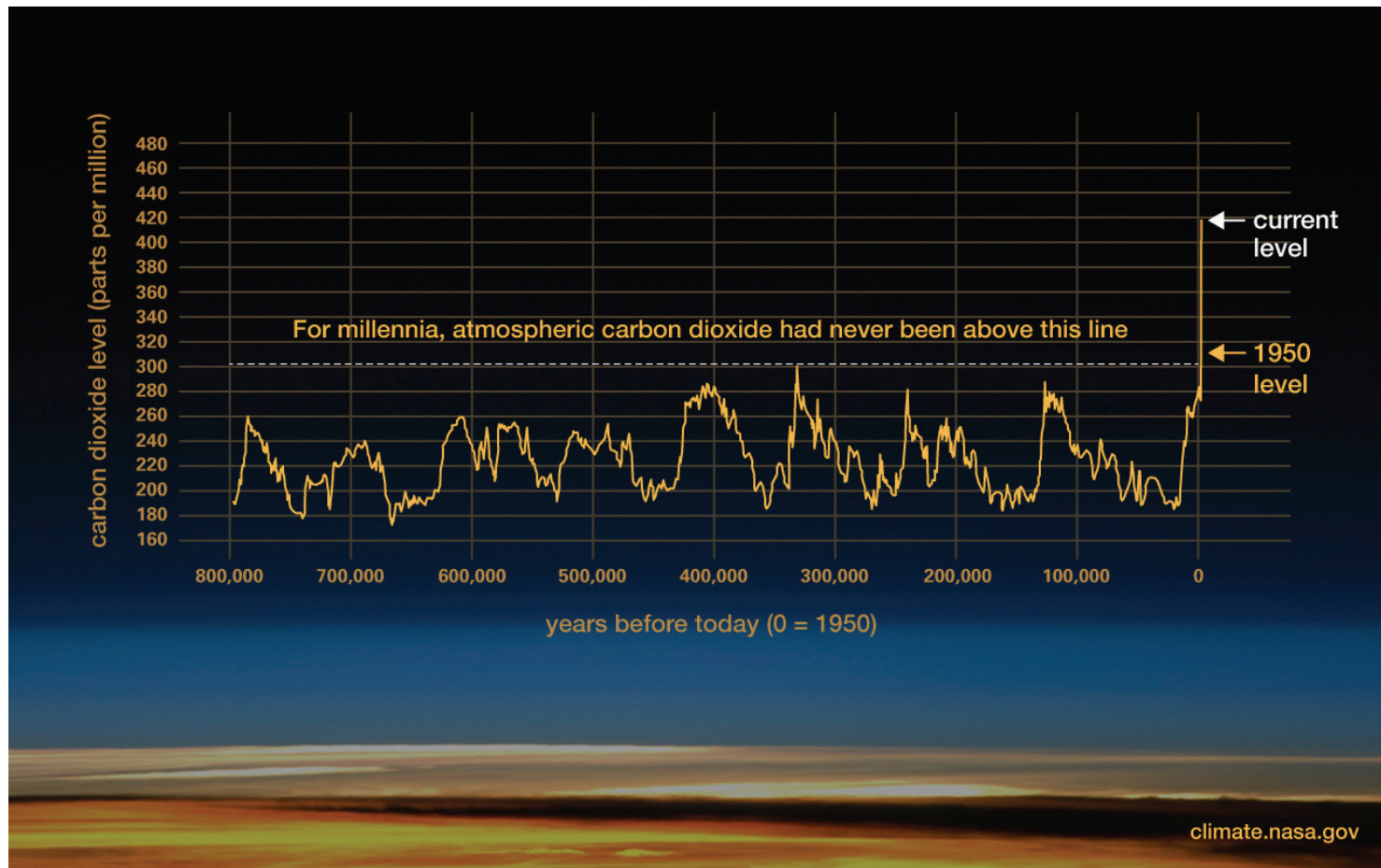


IEEE Bangladesh Section
Institution of Engineers Bangladesh
Dhaka, Bangladesh, 23 Sep 2023

Carbonization is Challenging Climate Sustainability

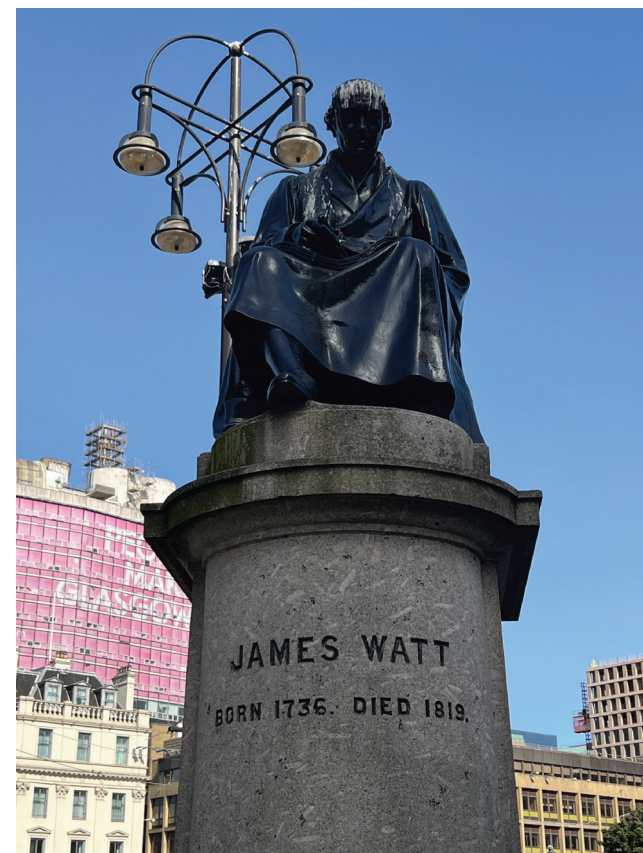
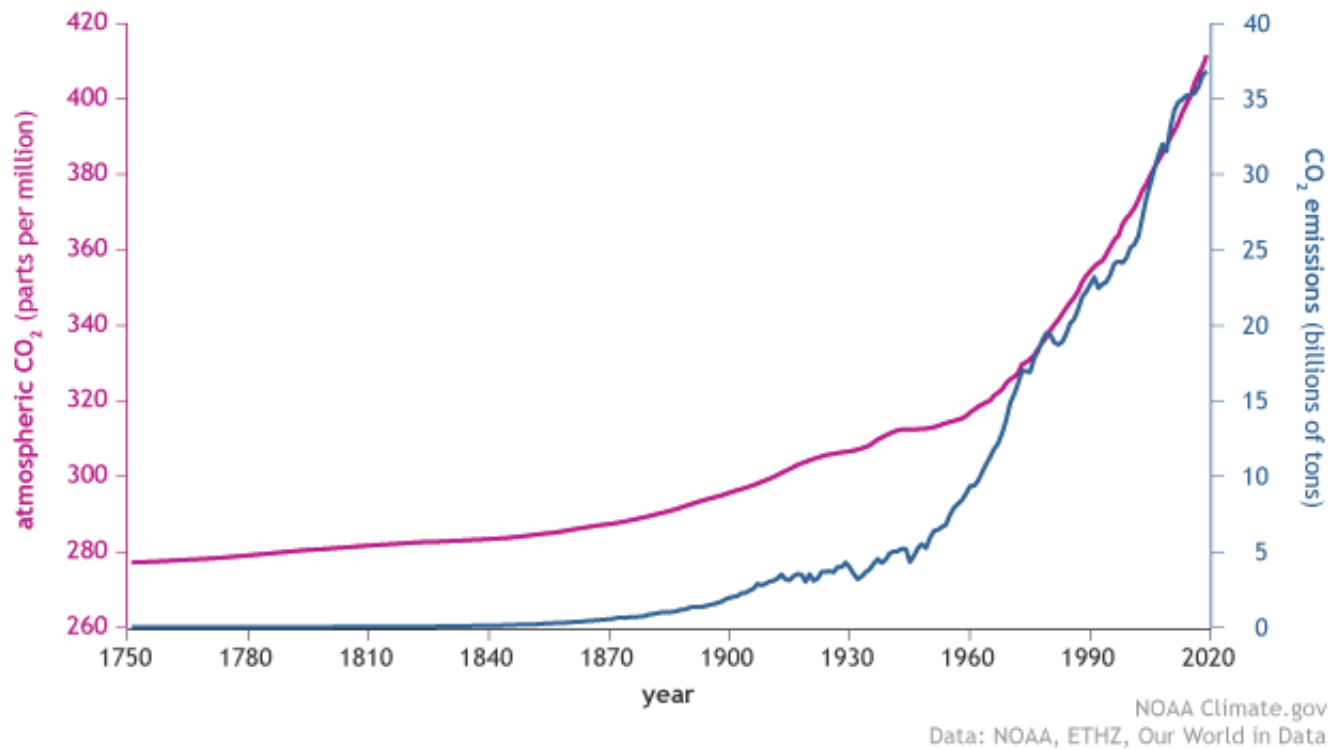


What is Carbonization?



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)

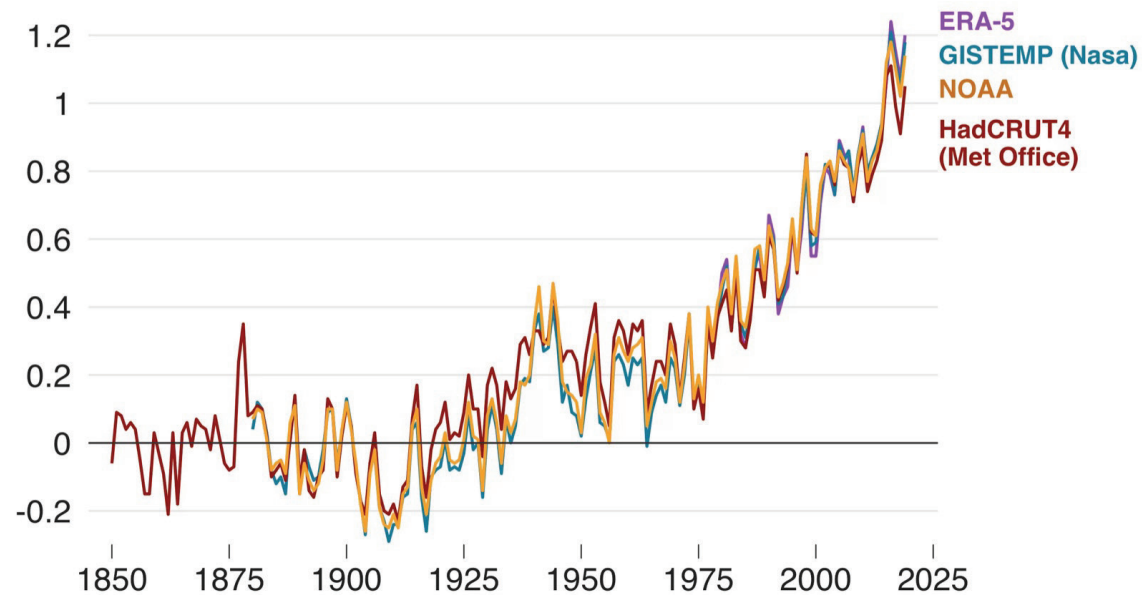


Source: State of the Planet
<https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/>

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>

Paris Climate Sustainability Goal: Limit to 1.5 deg C Rise

Temperature rise of 2.0 deg C ➡ Point of No Return

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



A Smart Bangladesh needs sustainable, affordable, and accessible energy sources



We Need Energy Transition But From Whose Perspective?



Navigating the tension between industrialized nations and emerging economies for global decarbonization efforts requires a diverse portfolio of clean-tech solutions for low-carbon generation, storage and demand side management with advanced technology focusing on energy efficiency.



To more efficiently facilitate the global shift towards low-carbon electricity, the following six areas should be our priority.

Opportunities to reduce Carbon Emissions in Bangladesh

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



Energy Efficiency Applications

- 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



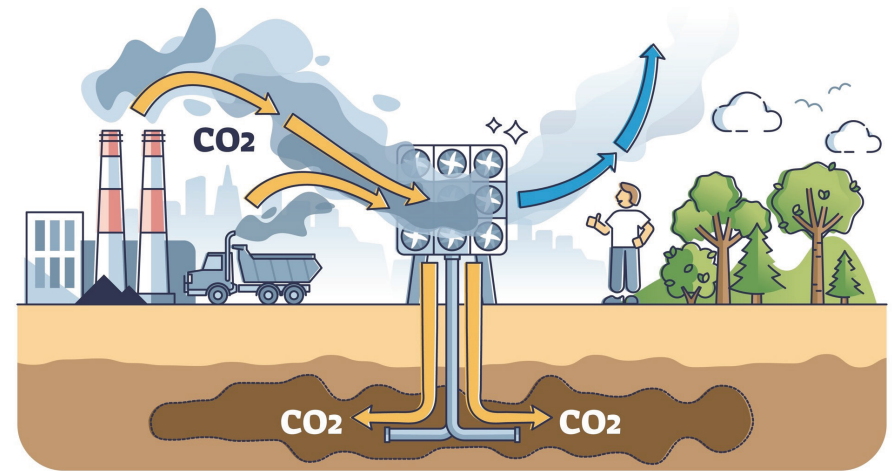
Highly Efficient Fossil-fuel Power Plants



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

Carbon Capture and Sequestration

- Direct Air Capture (DAC) 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



Large Scale Storage Solutions



- 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



Wind Energy Development

Whitelee Windfarm, Glasgow, Scotland



Limited Opportunities for Off-shore Wind Energy Development in Bangladesh

Opportunities for Solar Photovoltaics

Roof-mounted Solar in a School in Morocco



Roof-top Solar Photovoltaics



Virginia



Dhaka City

Kenya School of Monetary Studies, Nairobi



How About Hydro?

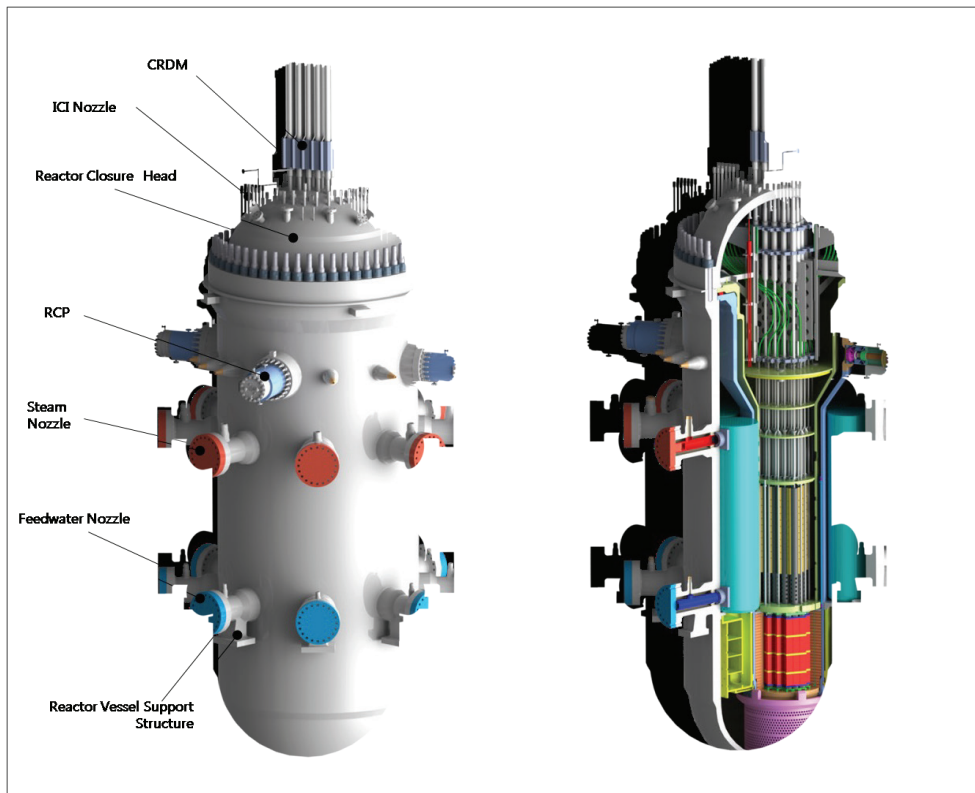
**Large Hydro is already fully developed
in Bangladesh**

Advanced Nuclear Reactors

- 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

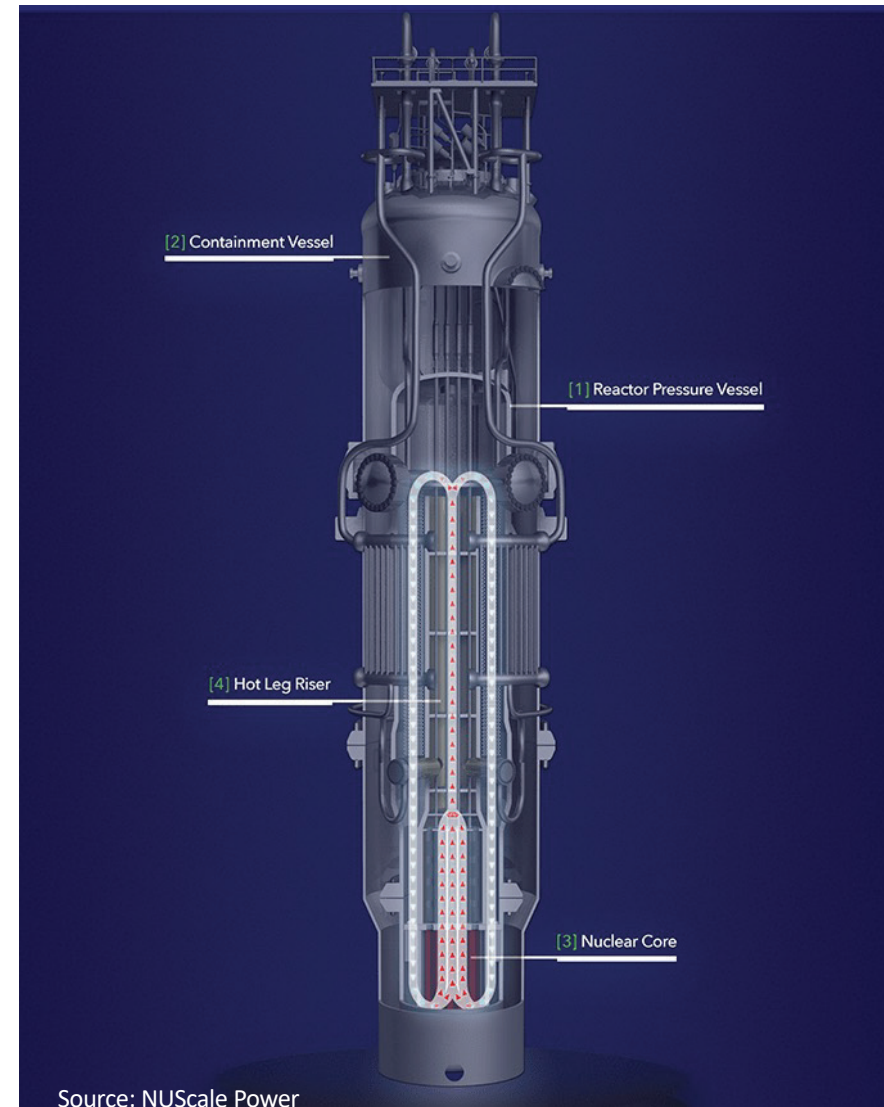


A Typical SMR



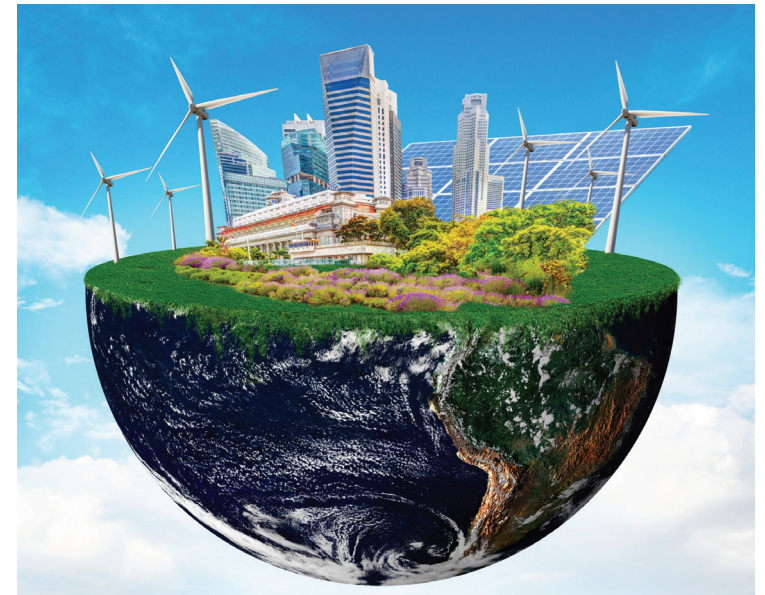
20m tall, 2.7m dia. 590 tons LWR
4.95% enrichment 50 – 60 MWe

34



Cross-Border Electricity 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



Mitigation or Adaptation?

Some believe the time for mitigation is over
Only approach left is adaptation

In a Smart Bangladesh mitigation will allow more time
for technology development and adaptation



Thank you
web: www.srahman.org