



Fourth Industrial Revolution and Climate Change

Keynote Speech

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Saifur Rahman Is 2022 IEEE President-Elect > He is a professor of electrical and computer engineering at Virginia Tech

BY JOANNA GOODRICH | 14 OCT 2021 | 2 MIN READ | 



VIRGINIA TECH

What is 4th Industrial Revolution

Automation of traditional manufacturing and industrial processes, using modern smart technology.

Large-scale machine-to-machine communication (M2M) and the internet of things (IoT) help with increased automation, improved communication and self-monitoring.

Sustainable Development Through Technology

Applications in advanced computing, robotics, electronic chip manufacturing, energy production and delivery systems, telemedicine, electrification, 4IR can provide immense opportunities for industry-academia collaboration for meeting targeted national needs in Bangladesh

A role
IEEE can play

IEEE society distinguished lecture program can support
visits of industry/academic experts

IEEE Bangladesh section can organize workshops to build
awareness and facilitate industry participation

Tutorials and other learning materials from IEEE sources
can facilitate knowledge sharing

- Has 39 technical Societies and seven Technical Councils representing the wide range of IEEE technical interests
- Has more than 5 million documents in the IEEE *Xplore*[®] digital library, with more than 15 million downloads each month
- Has an active portfolio of nearly 1,200 standards and more than 900 projects under development
- Publishes approximately 200 transactions, journals, and magazines

Aerospace

Artificial Intelligence

Biomedical

Computing

Consumer Electronics

Energy

History of Technology

Robotics

Semiconductors

Sensors

Telecommunications

Transportation

IEEE's Role in Climate Change

- Ensuring our response to climate change **is substantial, appropriate, and properly engages IEEE**, our members, and the larger community of technical professions by:
 - Providing a neutral platform for discussions and action
 - Engaging and mobilizing the 400,000+ members throughout the world and locally around climate change issues and solutions
 - Bringing to bear the expertise of the communities of IEEE and their respective outputs
 - Serving as a technology solution provider
 - Working to engage and coordinate with cross-disciplinary engineering communities (civil, mechanical, chemical, mining, etc.) on a global scale



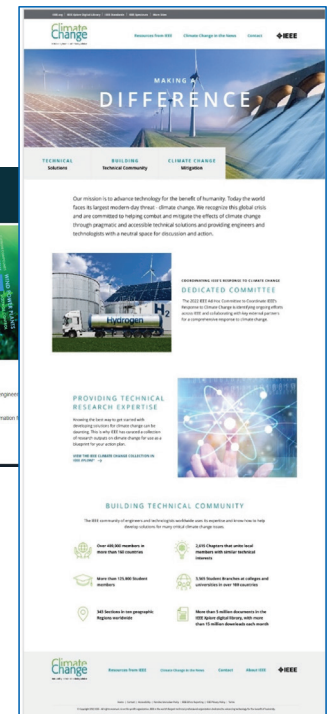
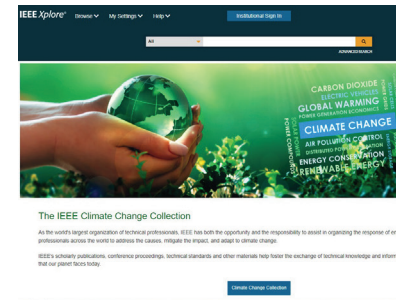
IEEE Climate Change Collection

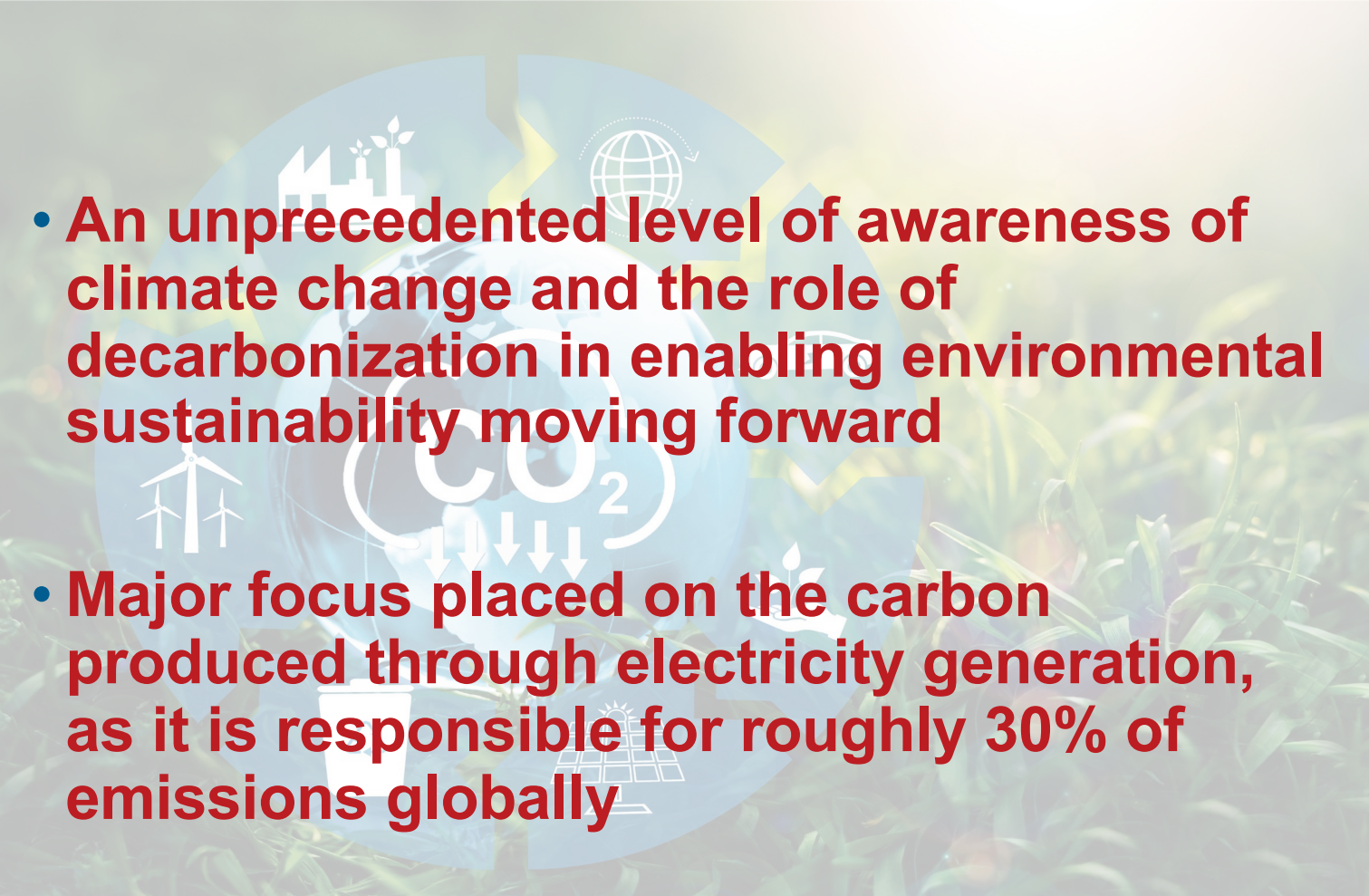
- As the world's largest organization of technical professionals, IEEE has both the opportunity and the responsibility to assist in organizing the response of engineers, scientists, and technical professionals around the world to address the causes, mitigate the impact, and adapt to climate change.


- IEEE Climate Change Collection: IEEE publications with relevance to addressing the impact of climate change available on IEEE *Xplore* and the new Climate Change website.

Climate Change

IEEE: Enabling Innovation and Technology Solutions



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- The background features a semi-transparent blue circular graphic. Inside the circle, there are several white icons: a factory with smokestacks, a globe with a circular arrow, two wind turbines, and the chemical formula CO
- ₂
- with three downward-pointing arrows. The entire graphic is set against a blurred background of green grass.
- **An unprecedented level of awareness of climate change and the role of decarbonization in enabling environmental sustainability moving forward**
 - **Major focus placed on the carbon produced through electricity generation, as it is responsible for roughly 30% of emissions globally**

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- A central graphic of a globe is surrounded by various blue-toned icons. These icons include a laptop, a smartphone, a magnifying glass, a factory, a television, a lightbulb, a gear, a leaf, a water drop, a bar chart, a line graph, a rocket, a person, and a globe. The globe itself shows the continents of North and South America.
- **Navigating the tension between industrialized nations and emerging economies for global decarbonization efforts requires a diverse portfolio of 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 renewable energy adoption, the following six areas should be our priority.**

Reduce Carbon Emissions from Electricity Production



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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



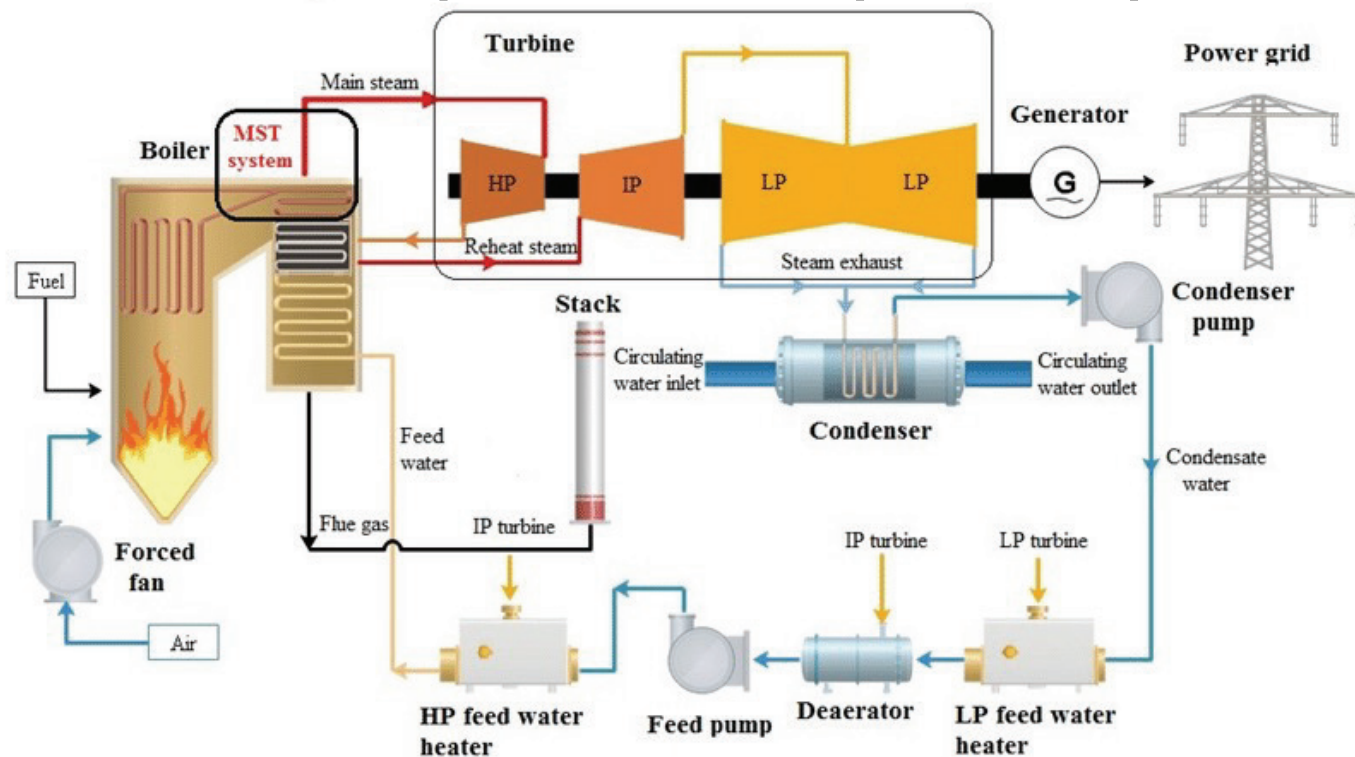
Highly Efficient Fossil-fuel Power Plants

Carbon Capture and Storage

- Combined cycle gas/steam power plant
- Ultra-supercritical steam power plant



Simplified layout of a 1000 MW coal-fired ultra-supercritical power plant



Eemshaven Ultra-supercritical Steam Power Plant *The Netherlands*



Power Plant: Two units rated 800MW each

Efficiency: 46.2%

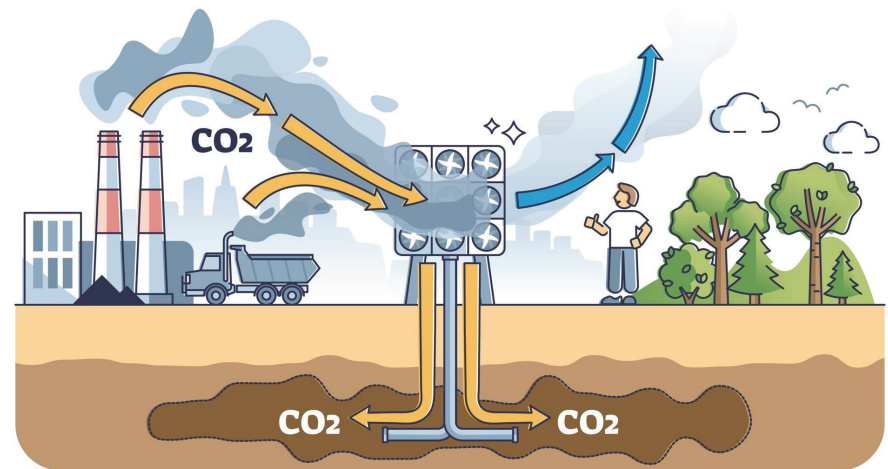
Temp: 609 deg C

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



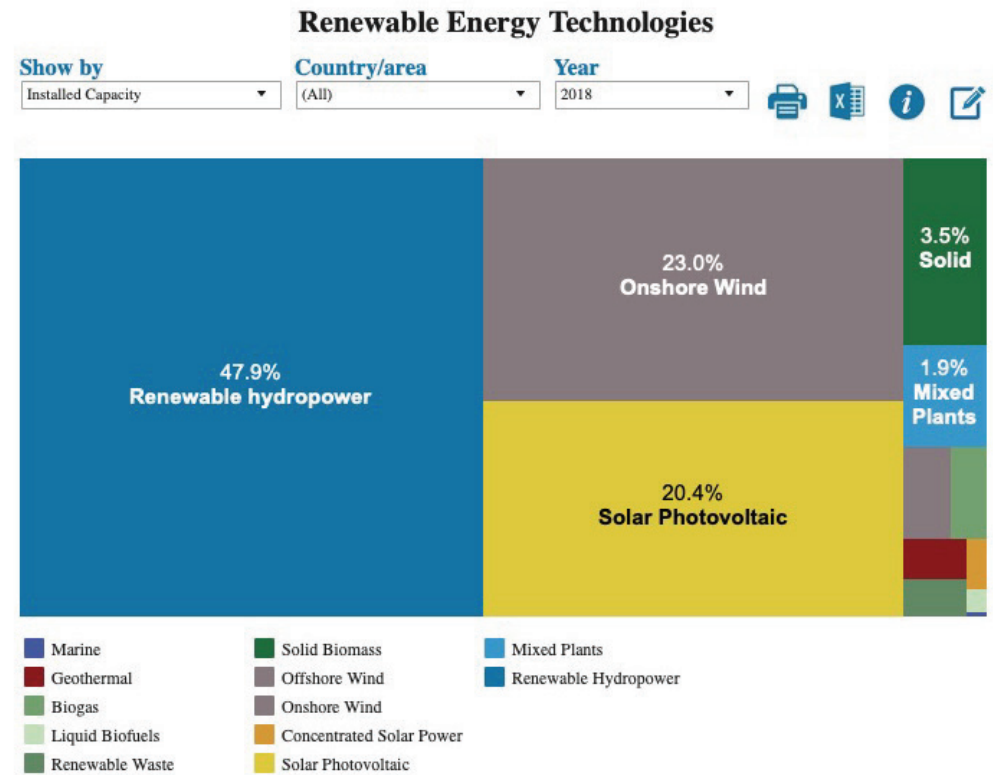
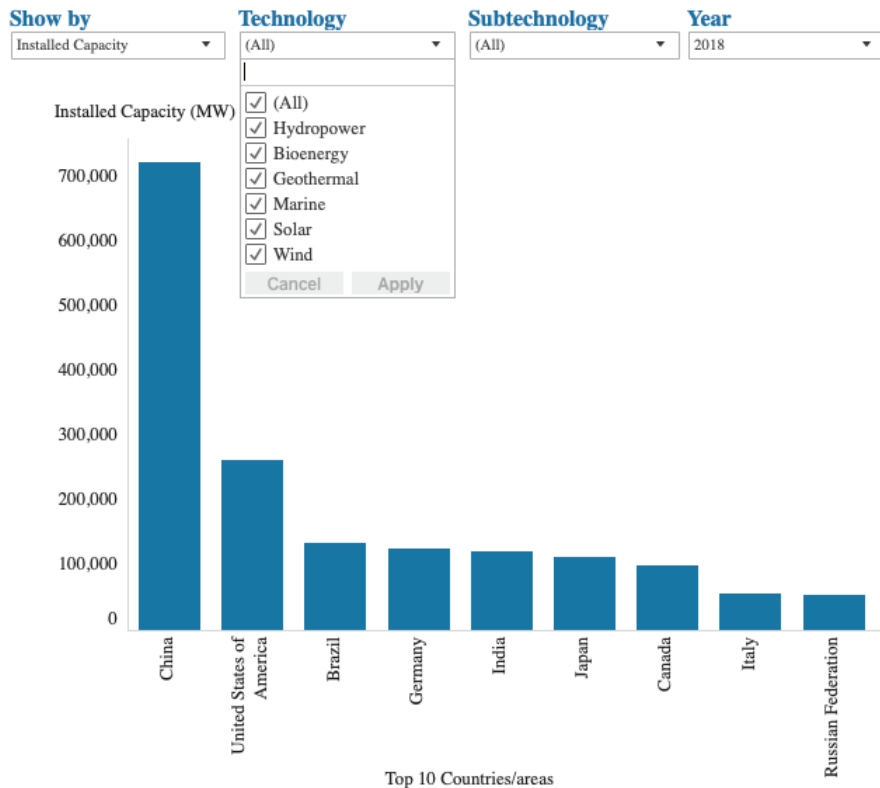
Renewable Energy Integration

Build more strategically from the start

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



Total Installed Renewable Energy Capacity Top Ten Countries (2018)




Source: International Renewable Energy Agency IRENA
<https://www.irena.org/Statistics/>

Hydrogen and Storage Solutions

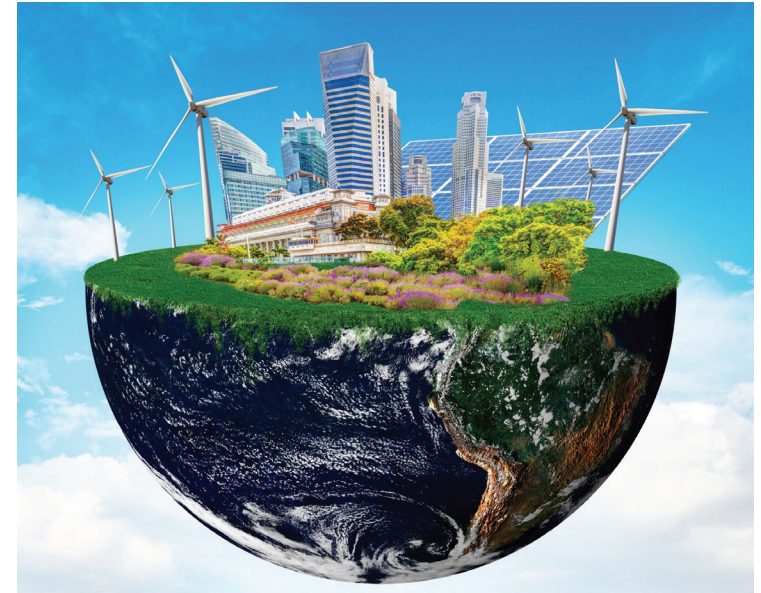
- Low-carbon hydrogen will help emerging economies to meet climate goals in and of itself
 - Provide for diverse energy portfolios
 - Improving resilience
 - Lowering costs
- Storage solutions serve as optimizers for other renewable energy solutions
 - Ensure that electricity generated during off-peak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



Cross-Border Energy Transfer

We all are impacted by climate change

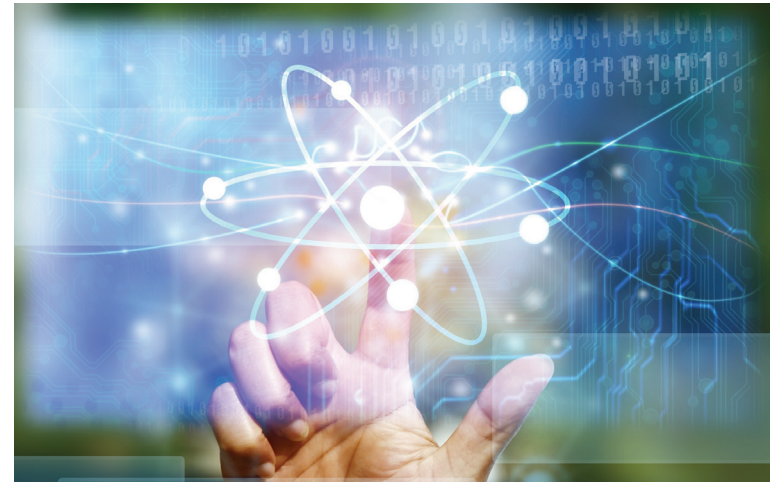
- As we are in this fight together, our solutions should be collaborative to secure better outcomes for all countries, regardless of location
- The International Energy Agency (IEA) has identified three main modes of cross-border energy integration:
 - Bilateral
 - Multilateral
 - Unified



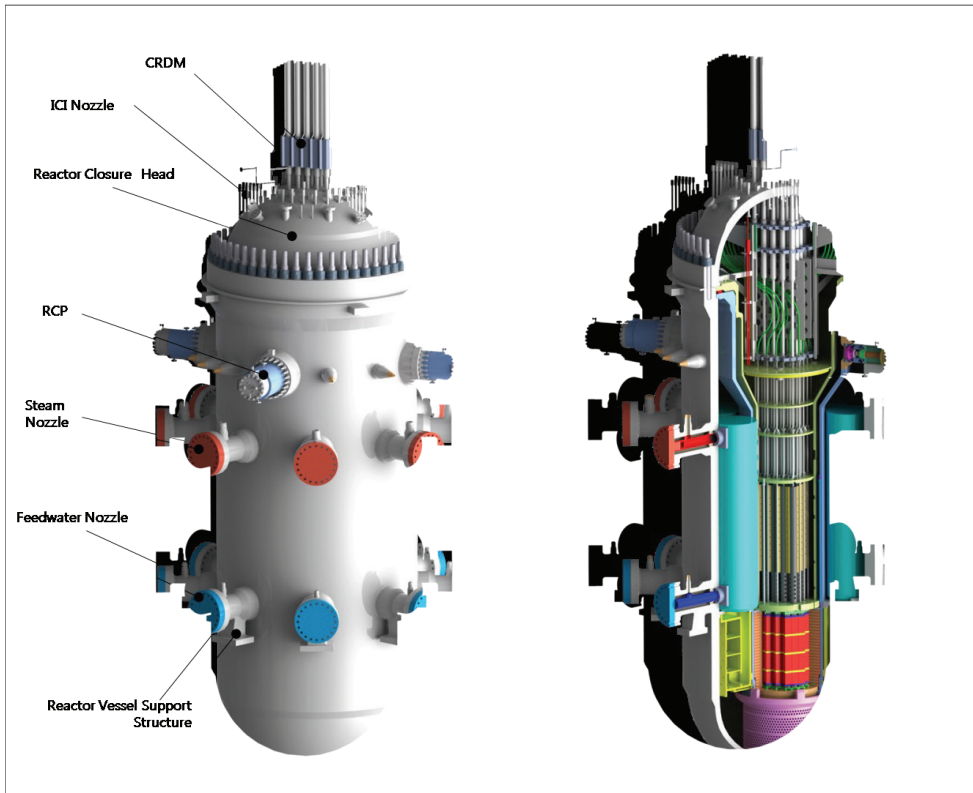
Advanced Nuclear Technologies

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

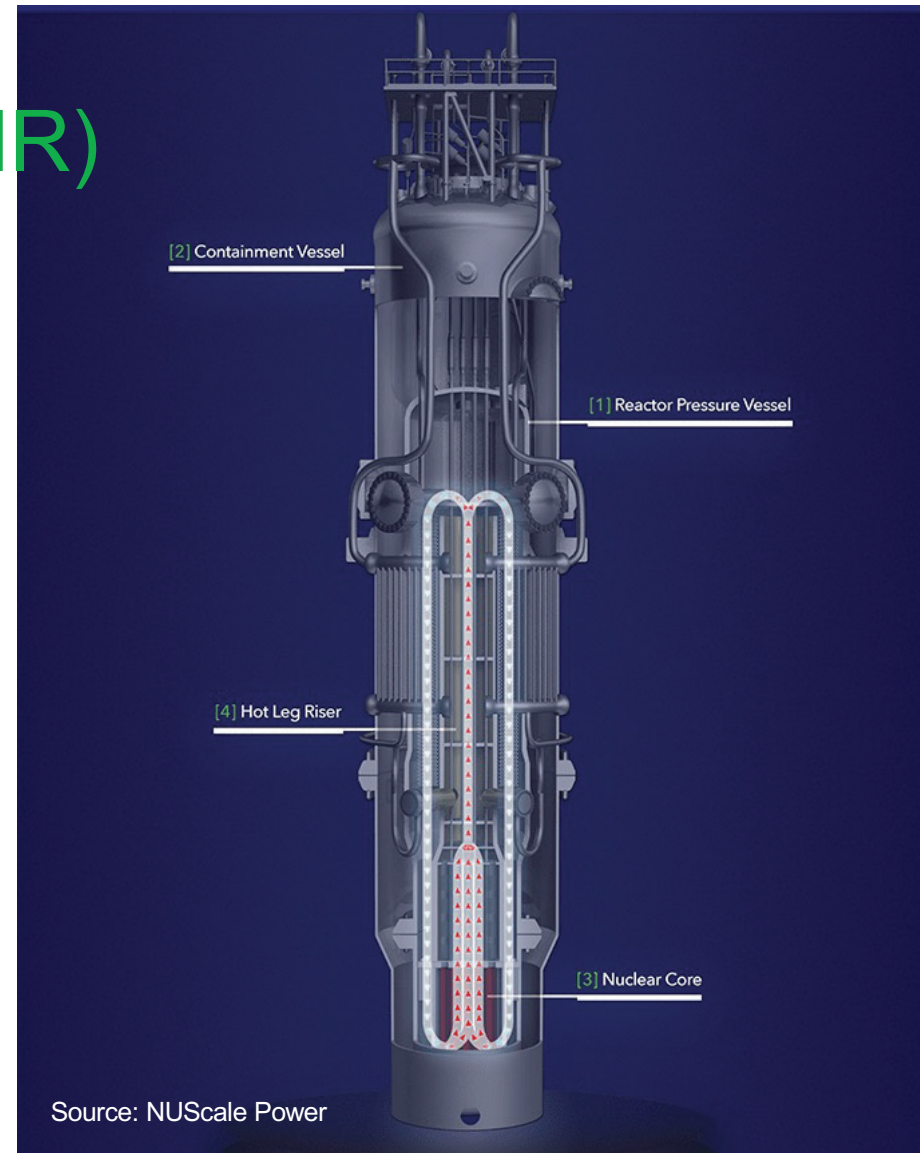


Small Modular Reactors (SMR)



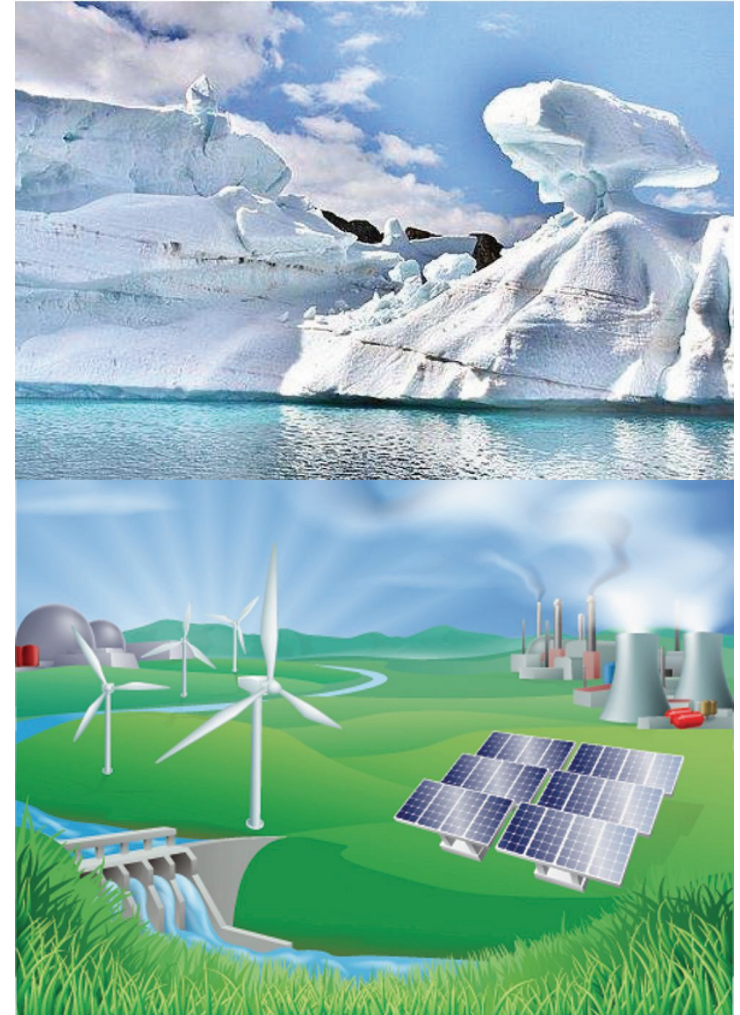
20m tall, 2.7m dia. 590 tons LWR
4.95% enrichment 50 – 60 MWe

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So, What is the Bottom Line?

- Efforts in the electric power sector to replace fossil fuel with renewables and nuclear will help
- But if emission from the transportation sector continues to rise, the power sector contributions will not be enough
- Large scale Electric Vehicle deployment will help, but question remains – how will the EV be powered?



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Questions