

Nuclear Beyond Electricity

Expanding Missions of Nuclear Energy for a Sustainable Future

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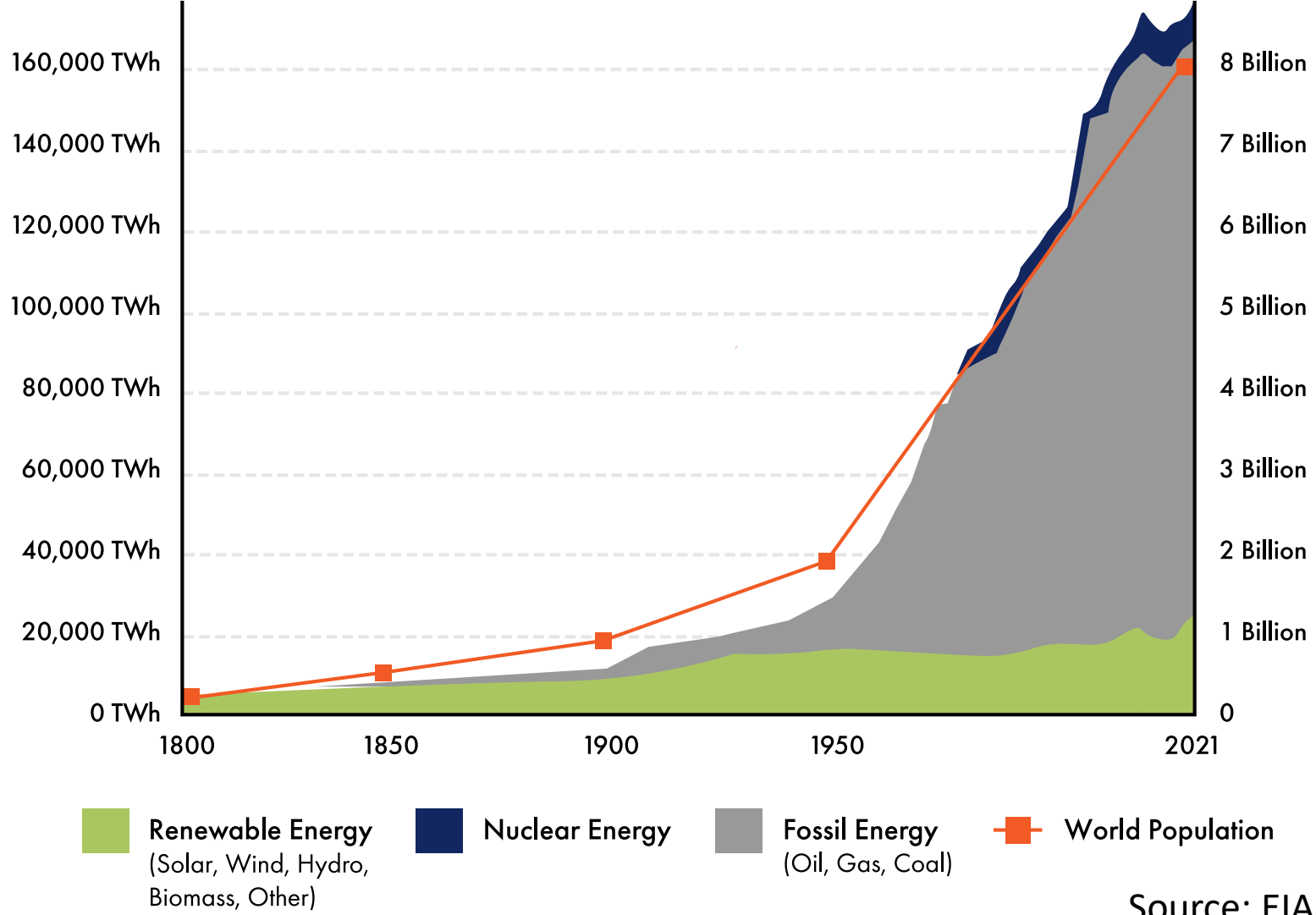
ARPA-E Nuclear Heat and Industrial Applications
Workshop
May 31st, 2023



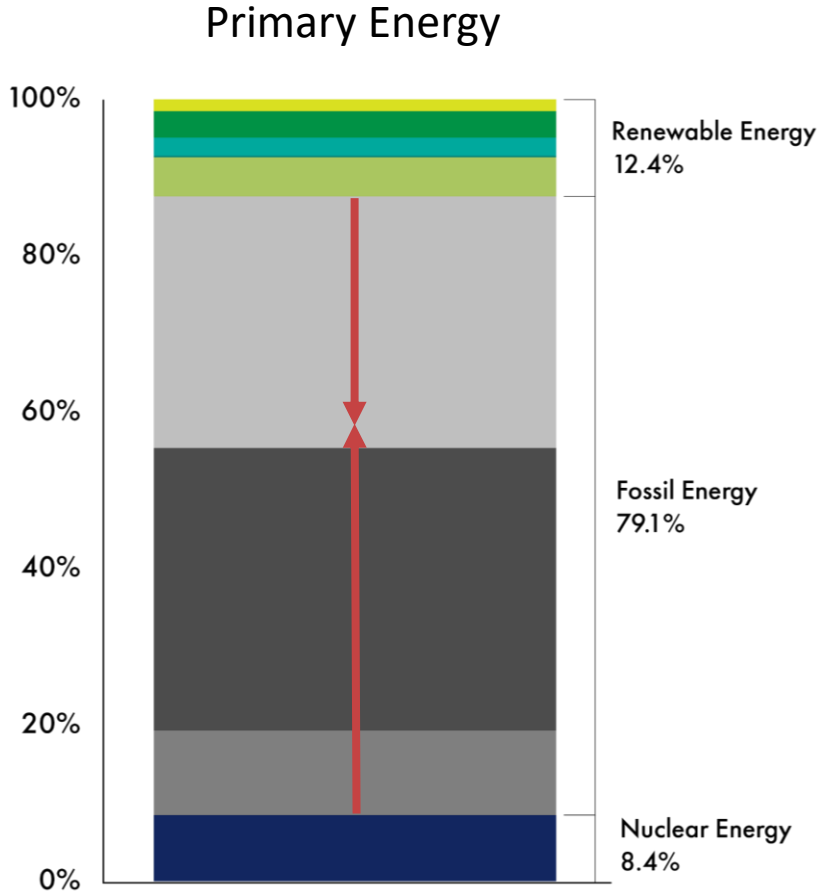
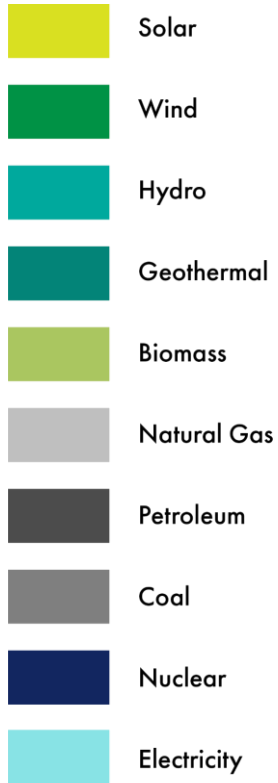


Future Needs for Nuclear Energy

Energy is Fundamental to Modern Civilization

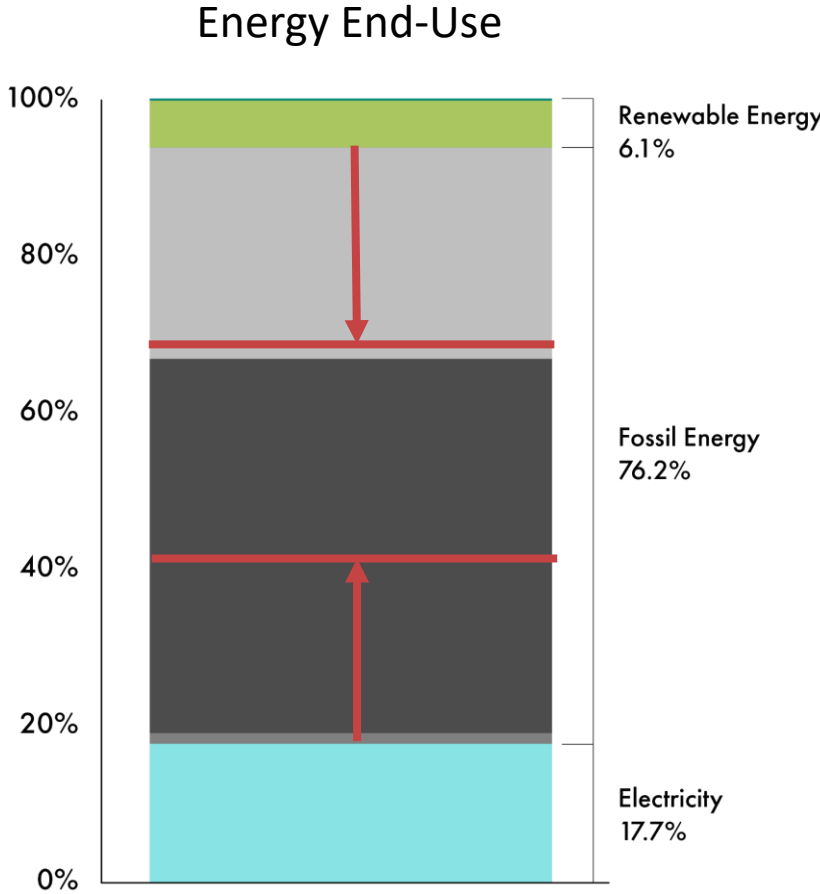


Our Sustainability Challenge: Replacing Fossil Fuels



Source: EIA

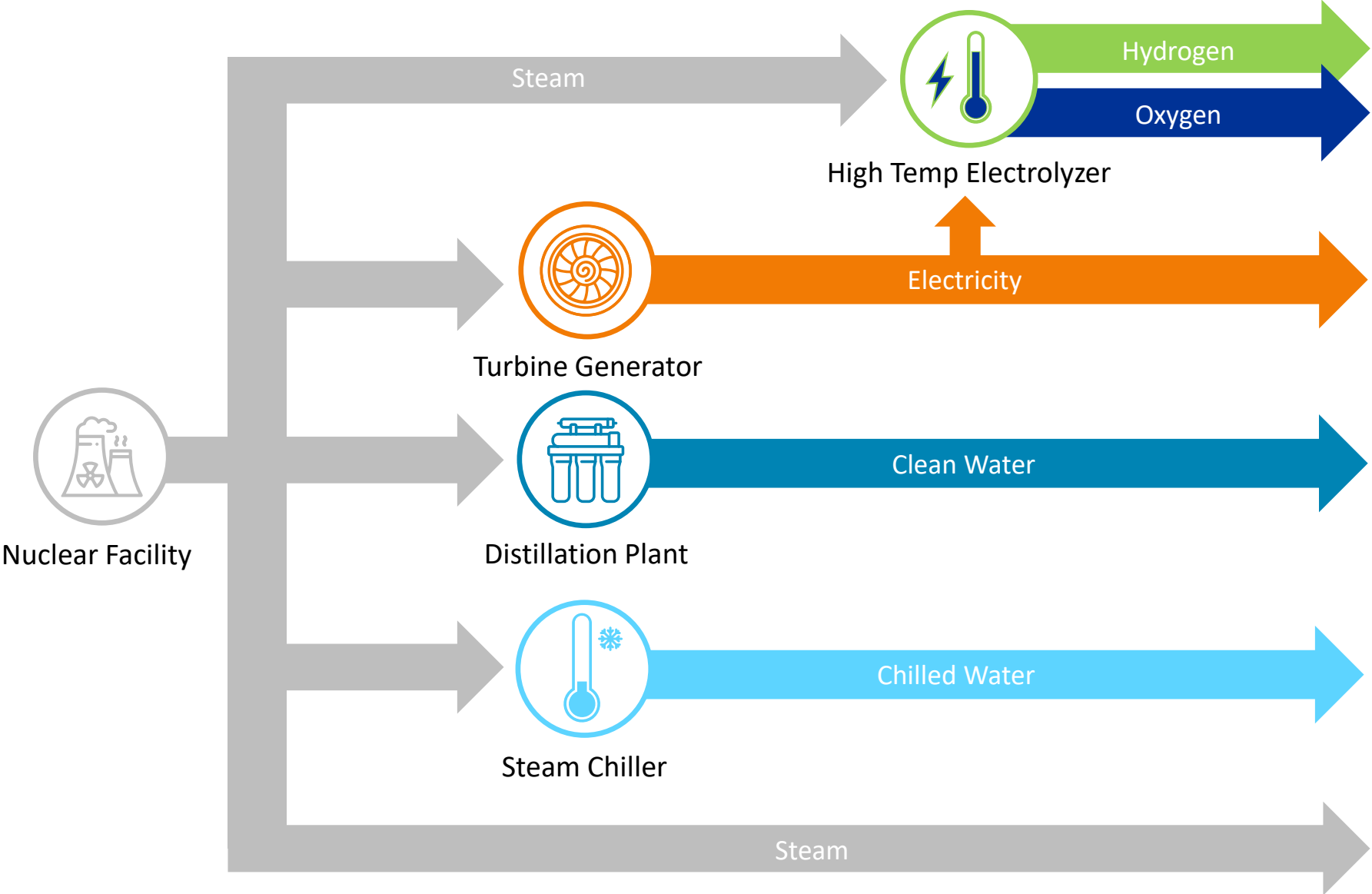
Nuclear and Renewable Energy Will Have to Fill the Gap



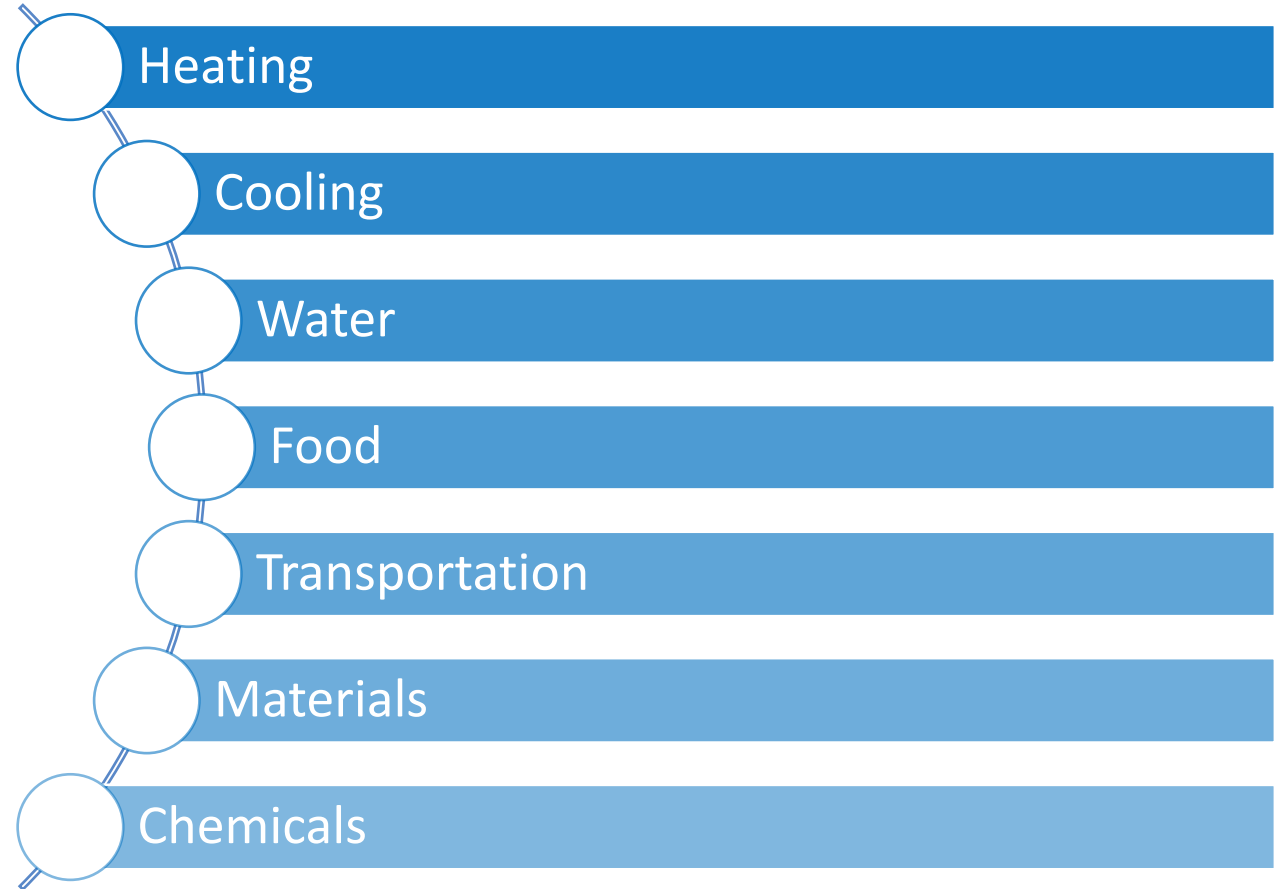
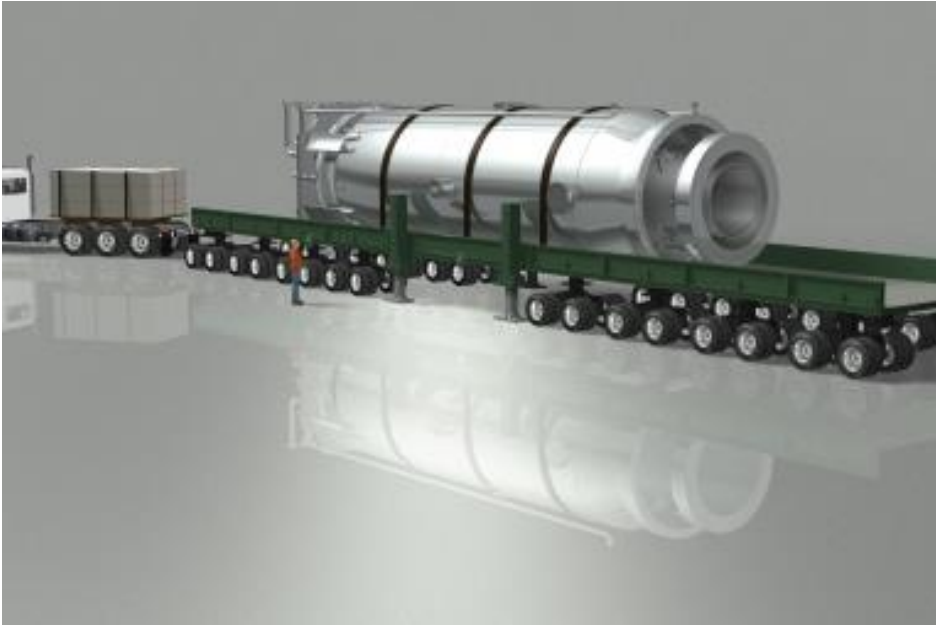
Source: EIA

Expect Limits To Electrification and Renewable Energy in End Use Applications

Nuclear Energy Enables Multiple Missions



Nuclear Energy Will Need to Play a Vital Role in Our Future



Sustainability Requires That We Think Big!



EPRI's Nuclear Beyond Electricity Research Area

Nuclear Beyond Electricity Research Area

Enable **existing** and **future** nuclear plants to participate in energy markets beyond the practice of generating baseload electricity.



Flexible
Electric Grid



Low Carbon
Fuels



Process
Manufacturing



District
Energy

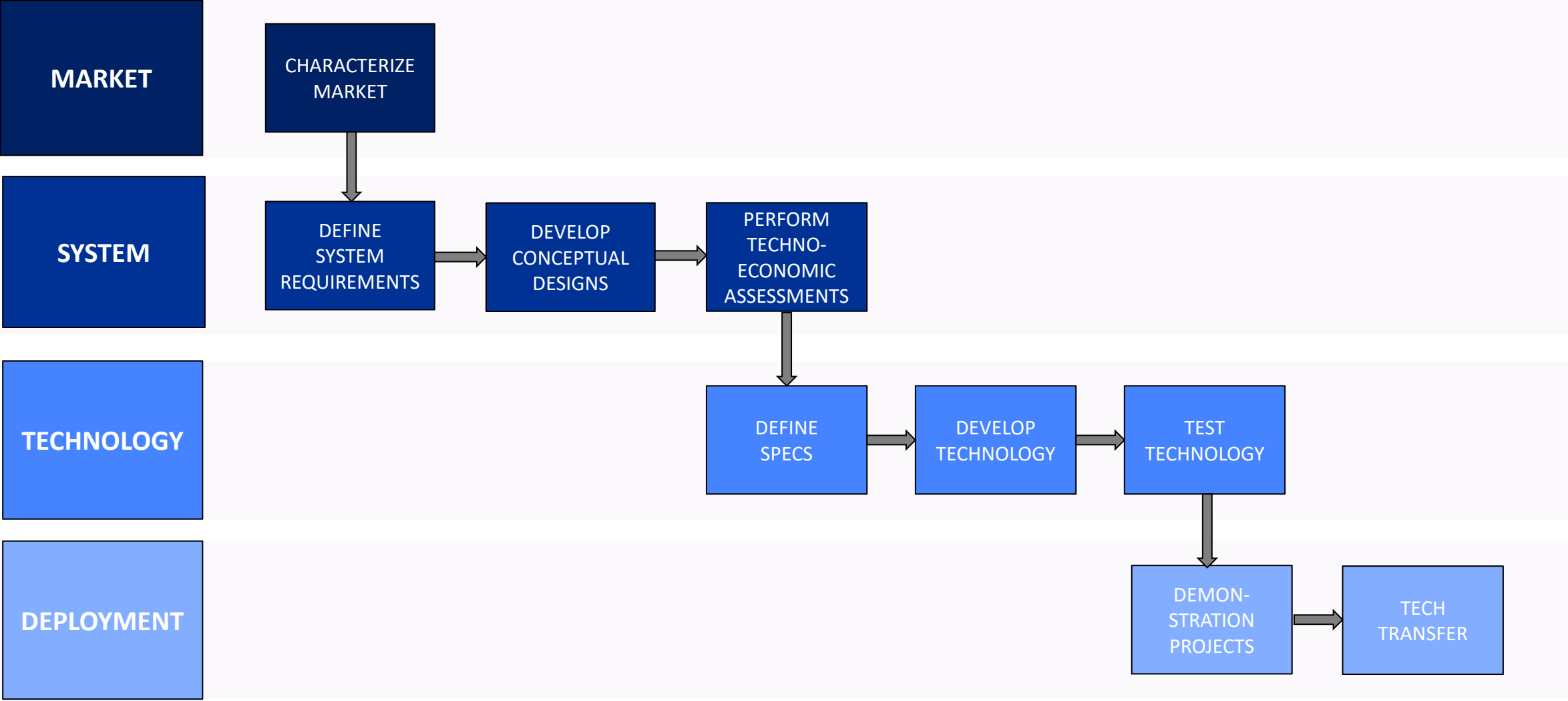


Data
Centers

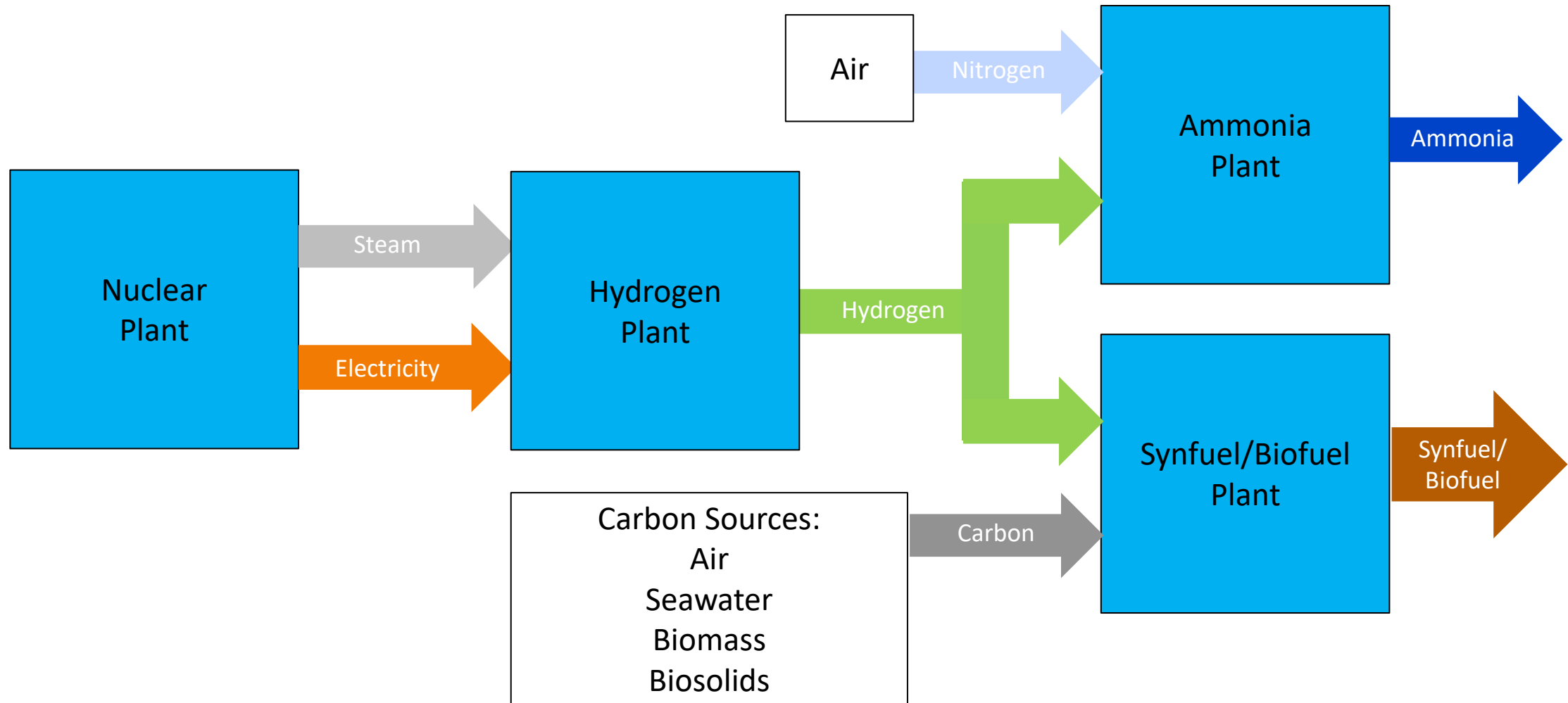


Water &
Wastewater

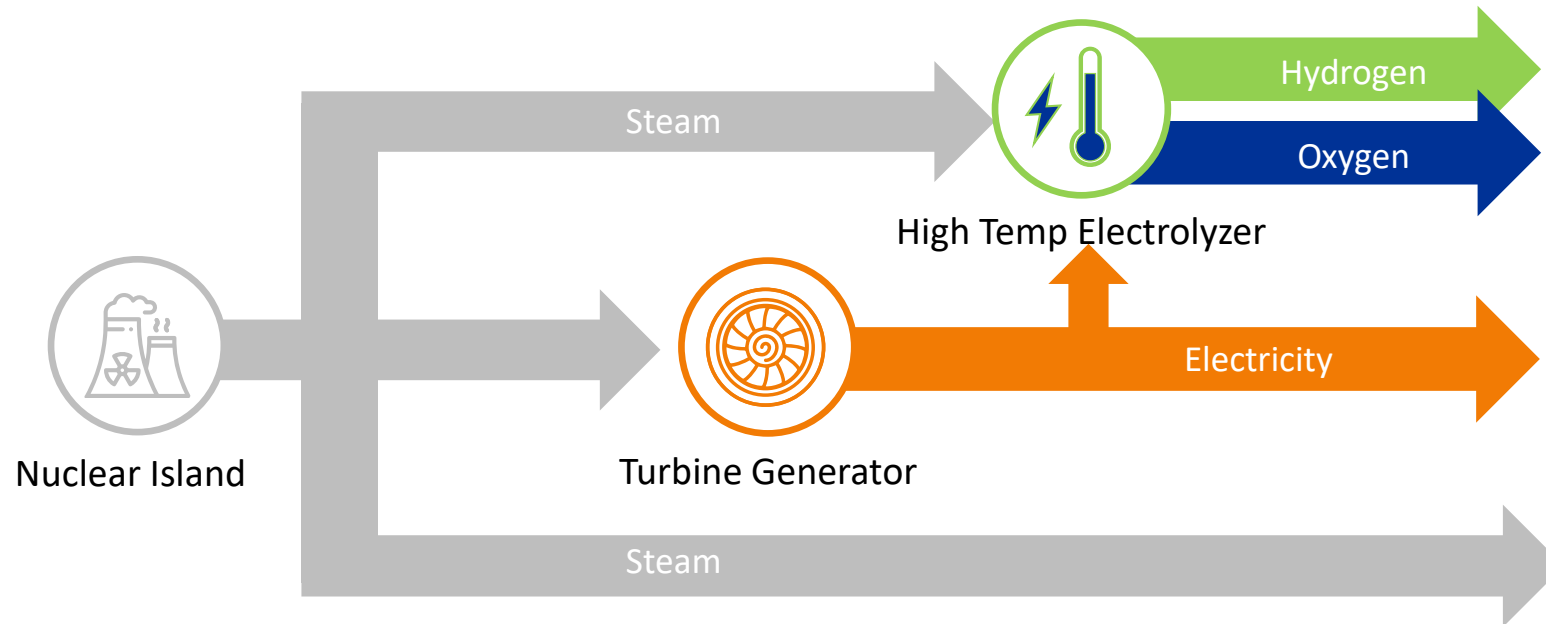
Research Approach



Industrial Uses for Nuclear Energy: Low Carbon Fuel Production



Industrial Uses for Nuclear Energy: Process Manufacturing



	Electricity	Heat/Steam	Hydrogen
Metals	X		X
Pulp and Paper	X	X	?
Chemicals	X	X	X
Plastics & Polymers	X	X	X
Petroleum Refining	X	X	X
Cement	X	X	
Glass	X		

Nuclear Energy in Pulp and Paper Workshop

WHY?

Explore Benefits and Opportunities Utilizing Nuclear Energy for Pulp and Paper

WHEN?

July 25th - 26th

WHERE?

Charlotte, NC

WHO?

Nuclear Plant Owner-Operators, Pulp and Paper Companies, Architect-Engineering Firms, Reactor OEMs, NGOs





Path Forward For Using Nuclear Energy Industrial Applications

Challenges to Be Addressed



Policy



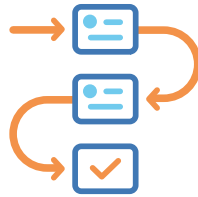
Insurance



Permitting



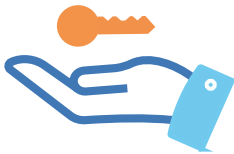
Public
Acceptance



Project
Development
and Execution



O&M



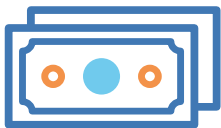
Ownership
Models



Technical



Security



Finance



Regulatory

Reactor Technology Is Not The Hard Part

Keys to Success for Industrial End Users

RECOGNIZE NUCLEAR IS UNIQUE



Nuclear is a special technology that has hazards requiring oversight to ensure safe operation and thus public acceptance.

LEARN THE TECHNOLOGY



Nuclear reactors are highly engineered systems with many dependent subsystems and components.

BUILD ORGANIZATIONAL CAPABILITY



Nuclear technology requires an organizational commitment to effectively manage the nuclear asset.

Need to Approach Nuclear Differently Than Conventional Technologies

Keys to Success for Reactor OEMs

UNDERSTAND THE INDUSTRIAL MARKETS



Instead of one homogenous electric market, there are tens of unique industrial markets and thousands of unique industrial facilities.

CONSIDER A PRODUCT PORTFOLIO



Most steam plants utilize packaged boilers and HRSGs, which are engineered-to-order products. A one-size fits all approach may result in poor economics.

DELIVER STANDARD HEAT SOURCES, NOT PLANTS



Nuclear steam supply systems will need to be standardized building blocks for unique central utilities plants.

Industrial Markets Have Different and Diverse Needs Than The Electric Market



Summary

SUMMARY

**Modern
Civilization
Will Require
Significant
Amounts Of Energy
To Replace
Fossil Fuels**

**Nuclear Energy
Can Be Used
In Many
Different Ways
To Help Fill
This Need**

**Need To Have
A Grounded
Approach To
Application Of
Nuclear Energy
In Industrial
Applications**

A blue-tinted photograph of four people standing in a row. From left to right: a man with curly hair and glasses wearing a white lab coat; a man with glasses wearing a white lab coat; a woman wearing a white hard hat and a dark polo shirt; and a man with glasses and a beard wearing a light-colored button-down shirt. The background is a solid blue color.

Together...Shaping the Future of Energy®