

# Decarbonization

## What Exactly Is It?



Presented by Brian Petermann, P.E.

# Agenda

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- » The “what” and “why” of decarbonization
- » Decarbonization landscape
- » Looking toward the future

# **The What and Why of Decarbonization**



**Reduce  
Climate  
Risks**

# Decarbonization: A Nexus of Purpose and Effect

**Coal Power Plant**

**Natural Gas Power Plant**

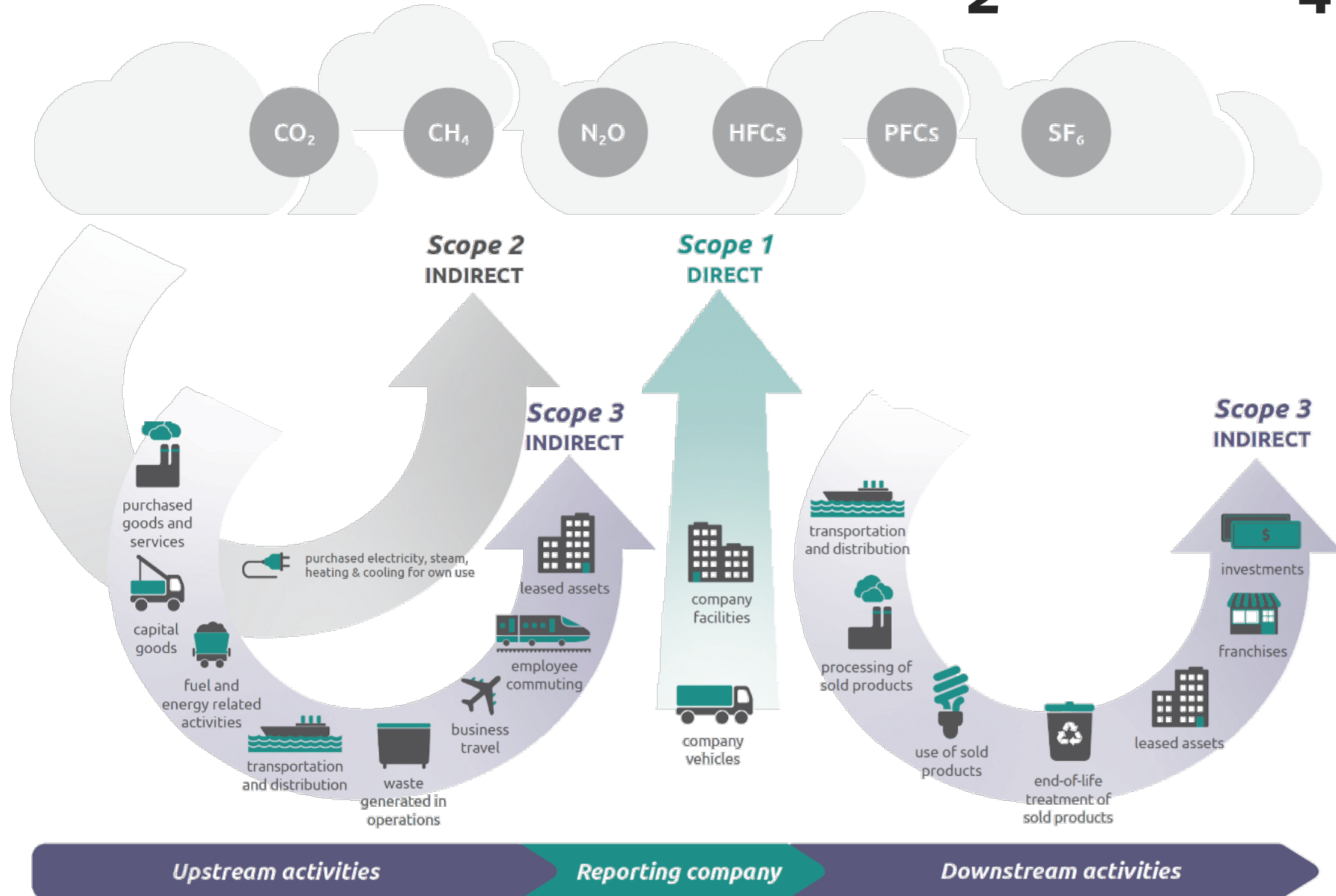
**Solar Power Plant**

**Wind Power Plant**

**Nuclear Power Plant**



# Greenhouse Gases: CO<sub>2</sub> and CH<sub>4</sub>



# Decarbonization Defined

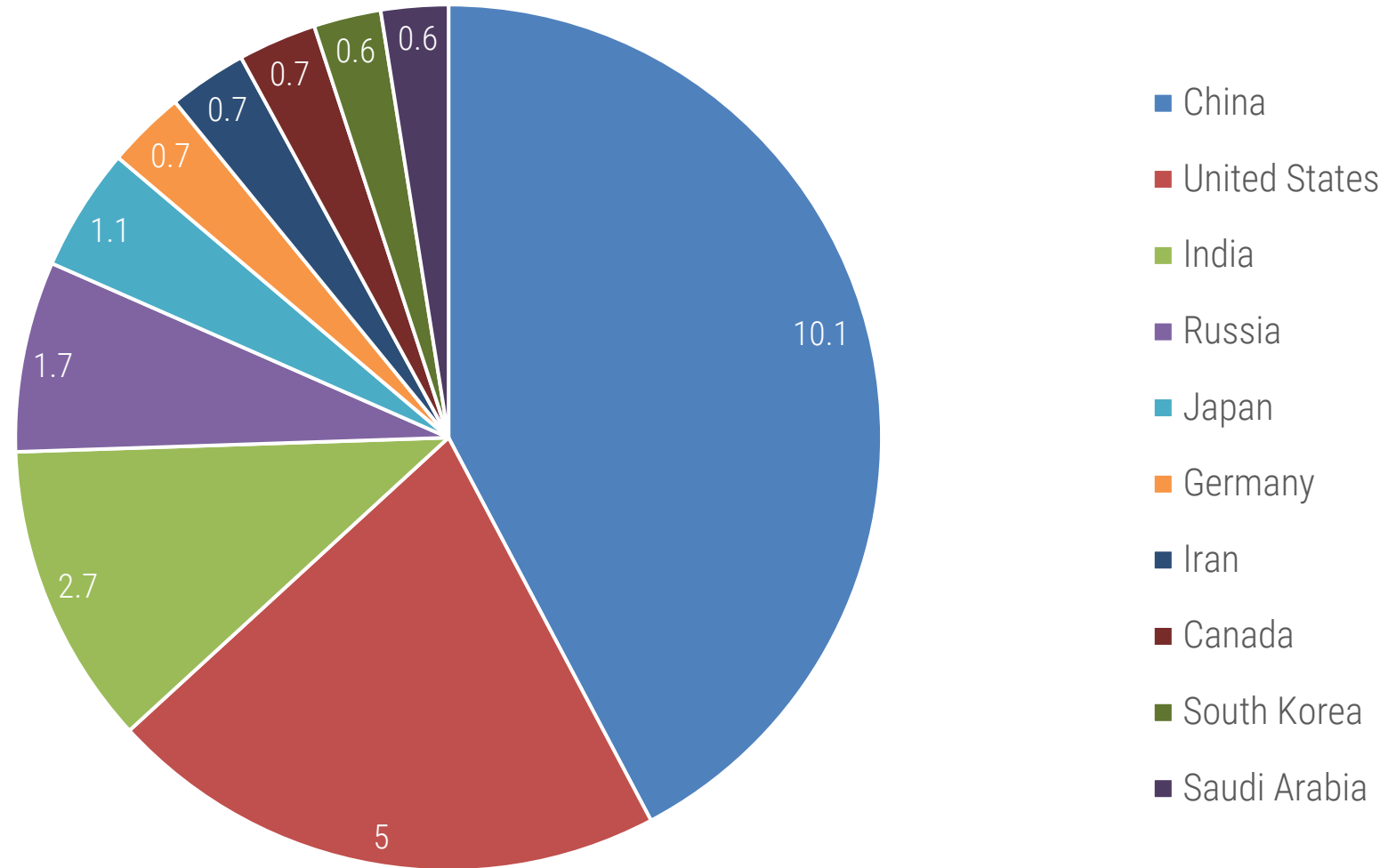
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The process of **reducing greenhouse gas (GHG) emissions resulting from human activities**—particularly those associated with fossil fuel combustion and industrial processes—required for energy production, transportation, material processing, construction, agricultural and other sectors.

*(Purpose factors in, too.)*

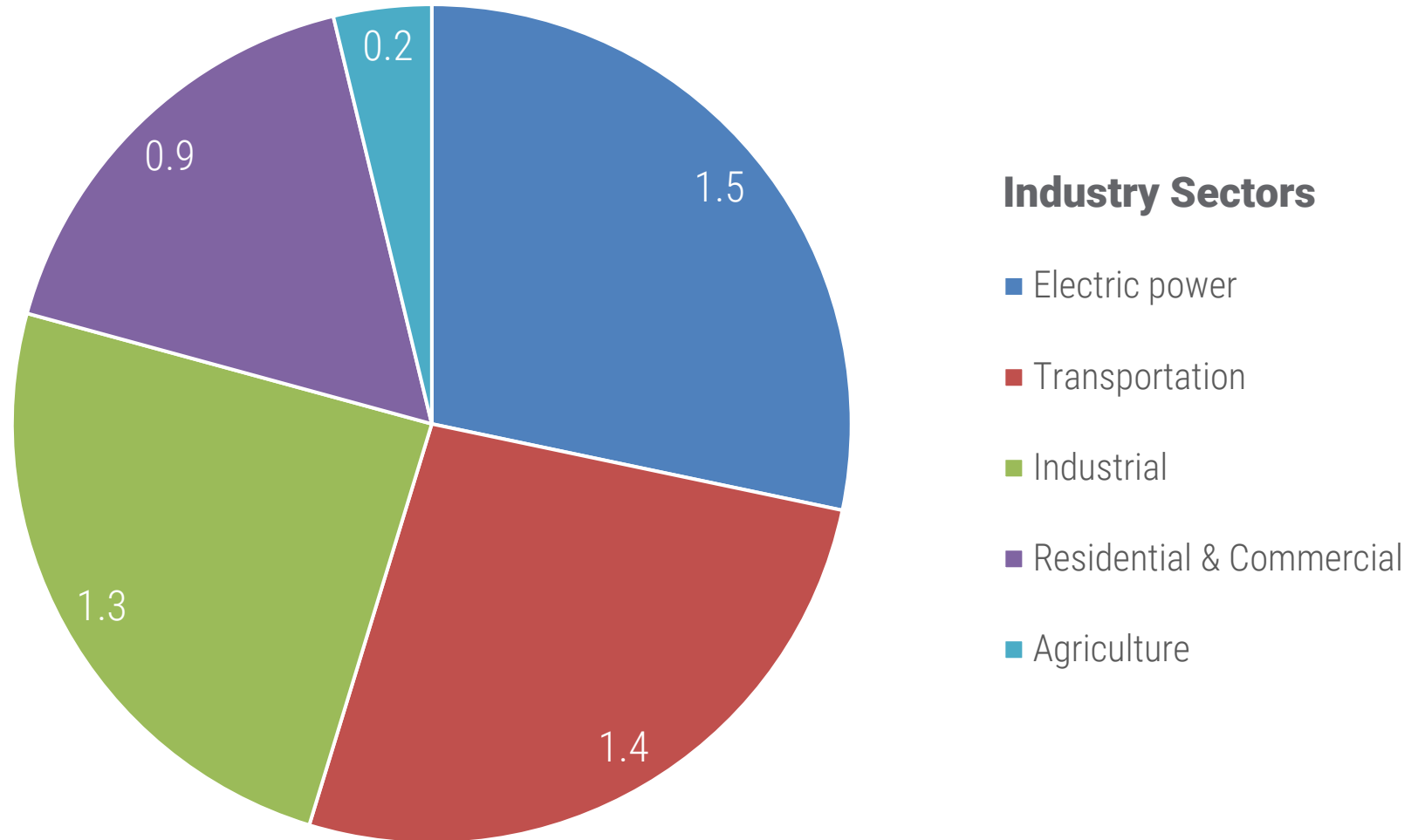
# Decarbonization Landscape

# Top CO<sub>2</sub> Emitting Countries (BMT/Yr)



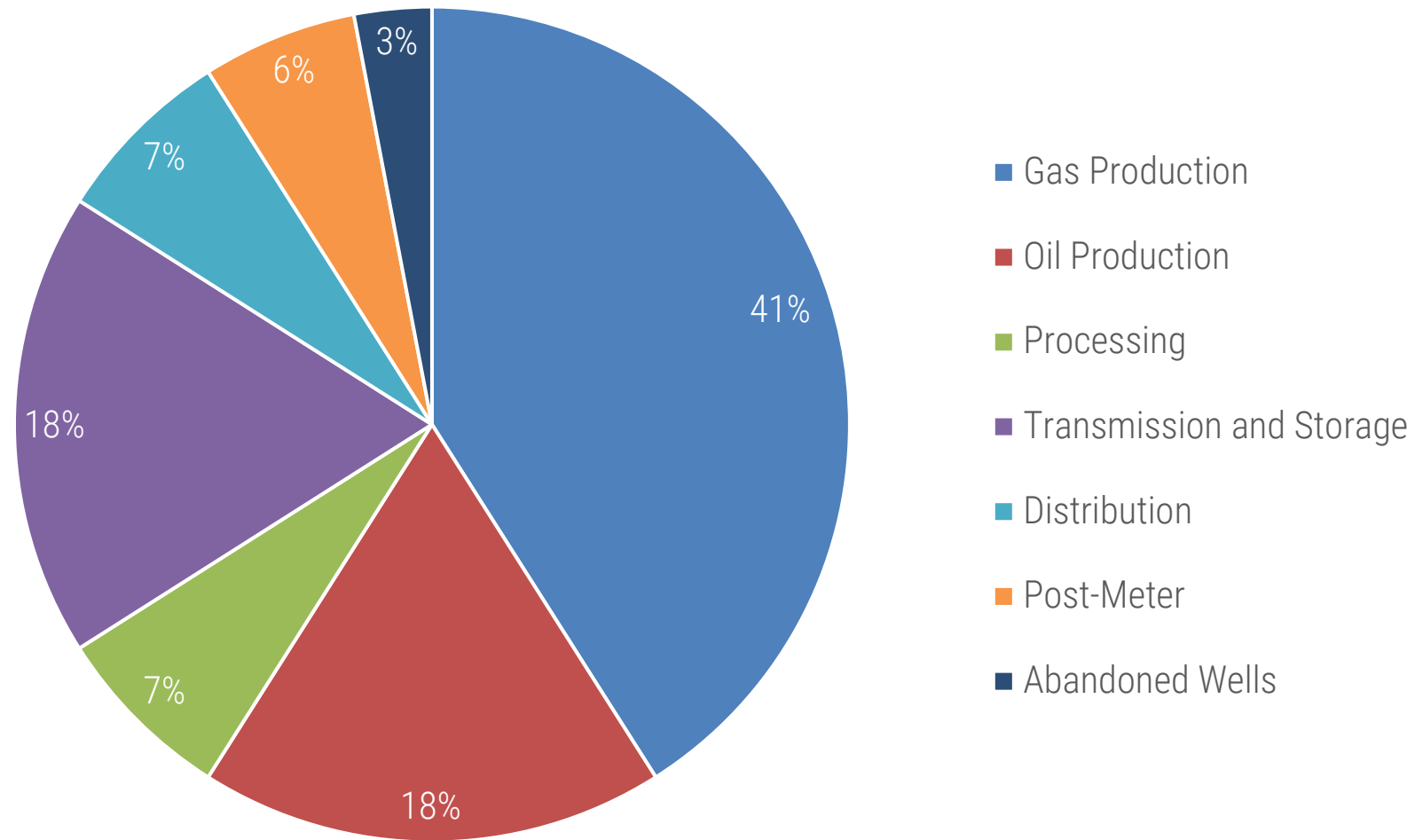
Source: Global Carbon Project

# U.S. Industrial CO<sub>2</sub> Emissions (4.9 BMT/Yr)



Source: Global Carbon Project

# U.S. Oil & Gas CO<sub>2</sub>e Emissions (220 MMT/Yr)



Source: Global Carbon Project

**Looking Toward the Future**

# Gigatons CO<sub>2</sub> Equivalent Reduced (2020–2050)

Sector	Solution	Scenario 1 2°C temp rise (by 2100)	Scenario 2 1.5°C temp rise (by 2100)
Electricity, Buildings and Industry	Distributed solar photovoltaics	26.65	64.86
	Onshore wind turbines	46.95	143.56
	Utility-scale solar photovoltaics	40.83	111.59
	Insulation	15.38	18.4
Food, Agriculture and Land Use/Sinks	Plant-rich diets	78.33	103.11
	Reduced food waste	88.50	102.20
Industry/Buildings	Alternative refrigerants	42.73	48.75
	Refrigerant management	57.15	57.15
Transportation	Carpooling	9.06	11.07
	Electric cars	7.66	9.76

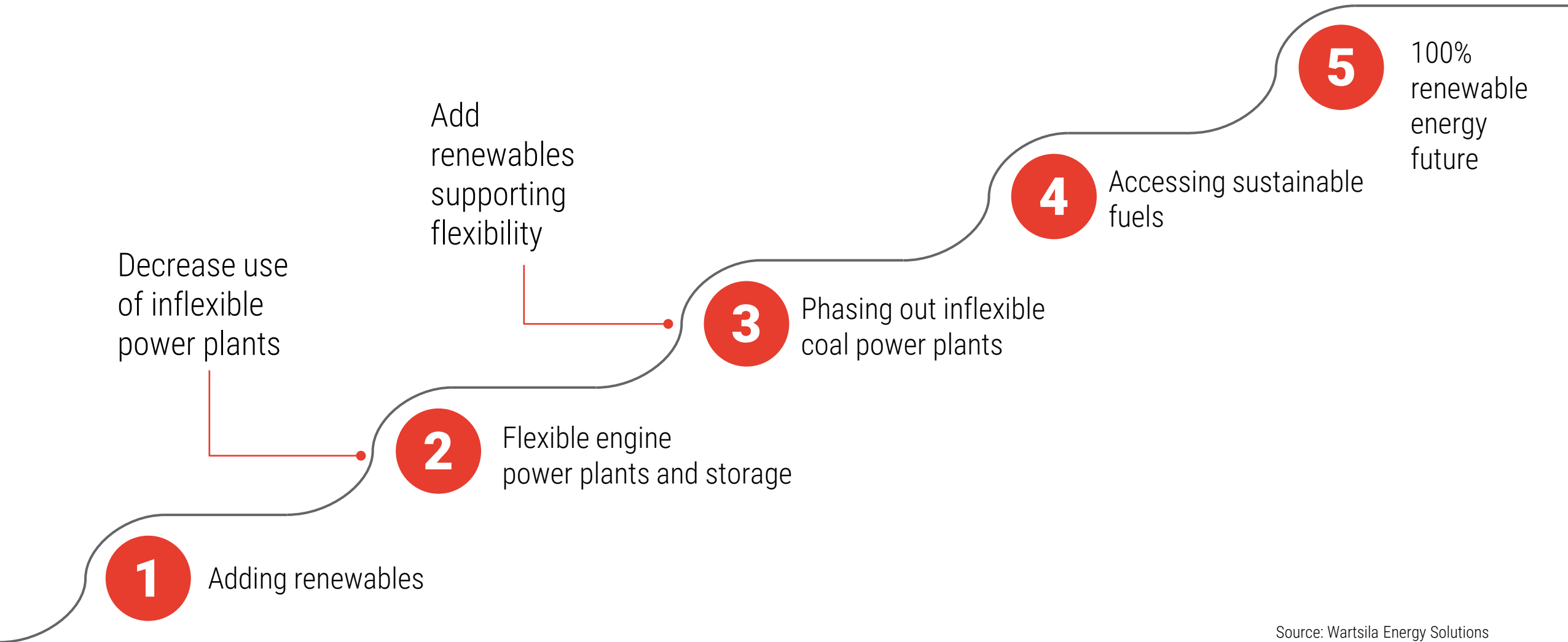
Source: Drawdown.org

# Technologies and Implementation

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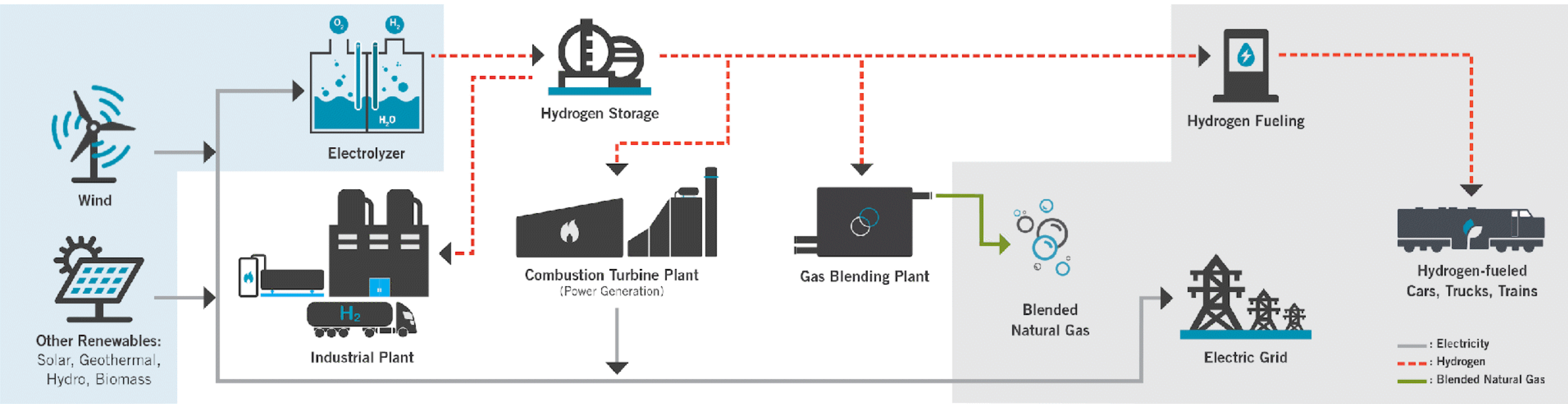
- » Hydrogen
- » Sustainable Aviation Fuel (SAF)
- » Renewable Natural Gas (RNG)
- » Carbon Capture, Utilization and Storage (CCUS)
- » Energy storage technologies
- » Wind power
- » Solar power
- » Geothermal technologies
- » Small Modular Reactors (SMR)
- » Chemical carriers
- » Non-carbon GHG alternatives

# Decarbonization and Renewable Energy



Source: Wartsila Energy Solutions

# Sun + Wind + Water = Clean Energy



Key = **Infrastructure** (*Technology + \$ + Time*)

# Key Takeaways

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- » Decarbonization involves purpose and effect
- » The world has a long and expensive journey to meet GHG reduction goals
- » Technology is being developed; but it will take time and money (and continued purpose and focus)

# Questions

# Thank You



**Brian Petermann, P.E.**

(913) 402-4217

[brian.petermann@powereng.com](mailto:brian.petermann@powereng.com)