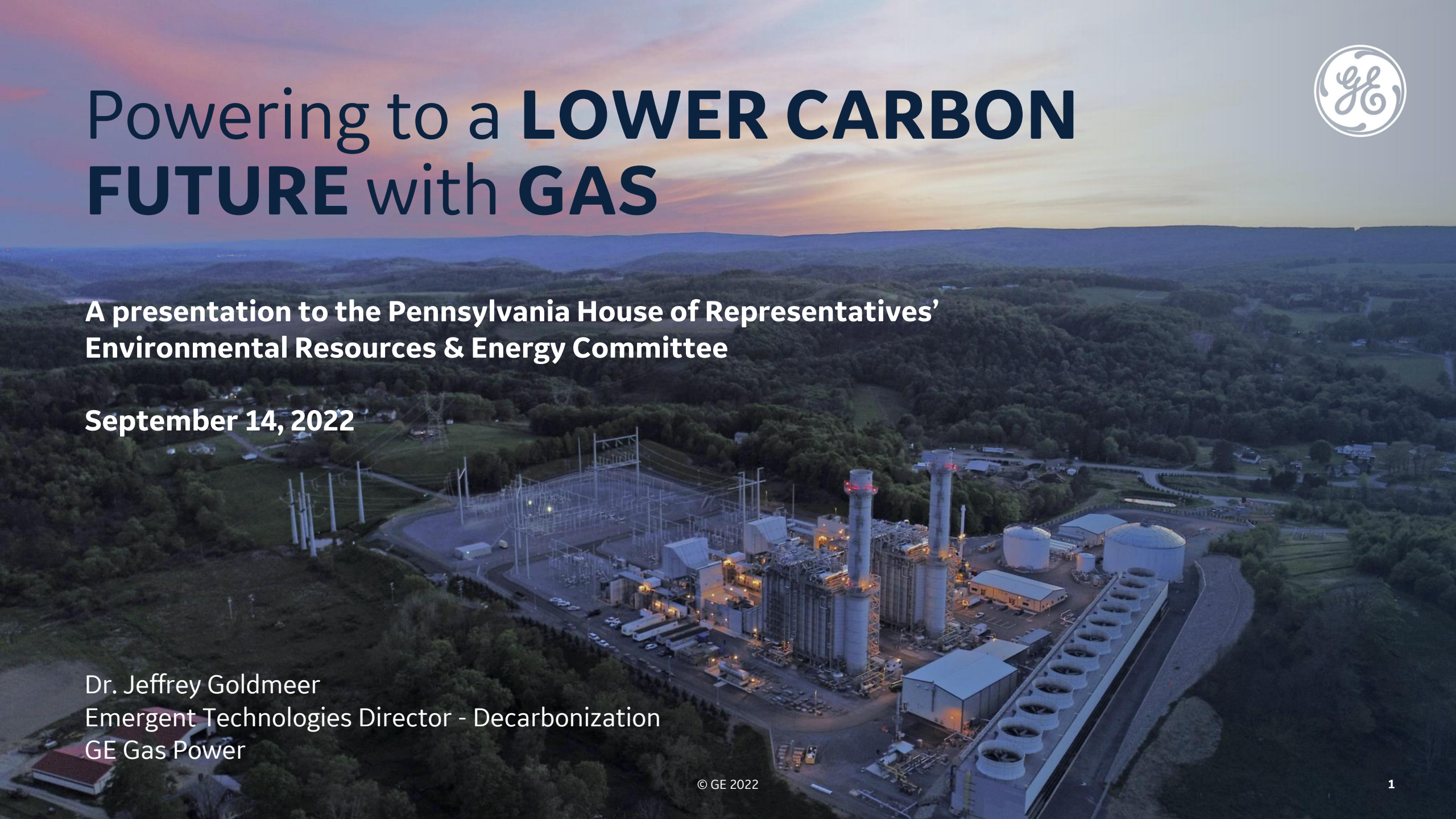
Powering to a **LOWER CARBON FUTURE** with **GAS**

A presentation to the Pennsylvania House of Representatives' Environmental Resources & Energy Committee

September 14, 2022

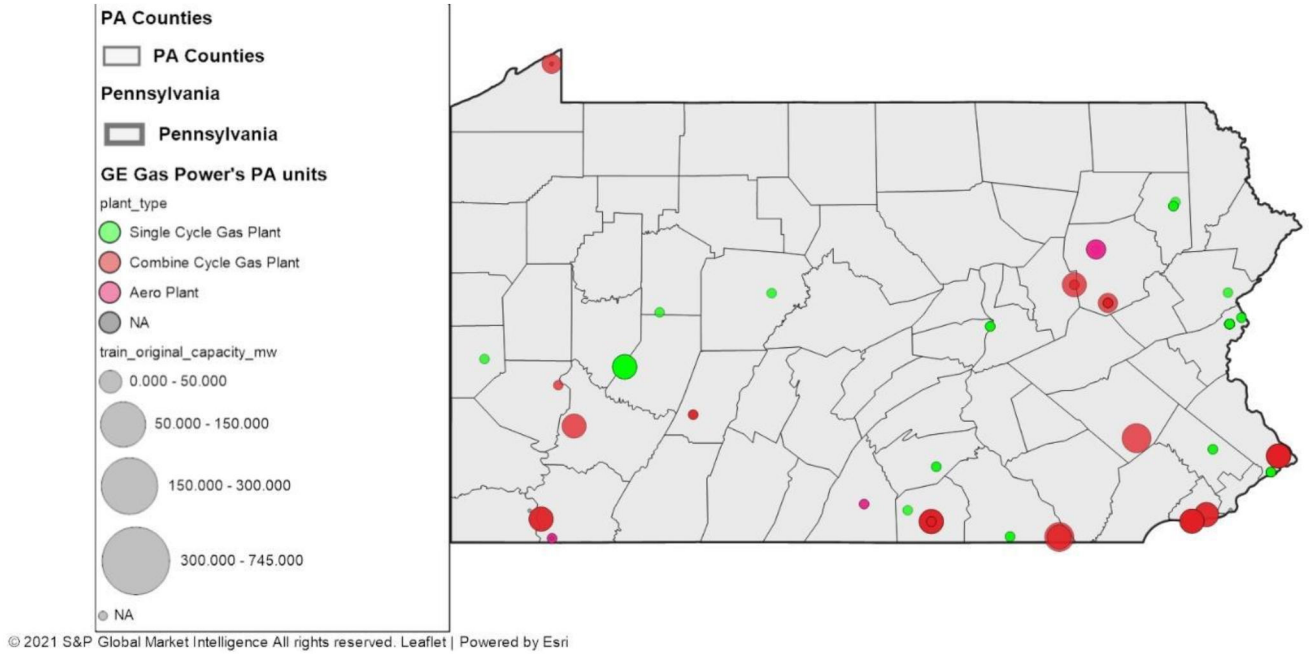


Dr. Jeffrey Goldmeer
Emergent Technologies Director - Decarbonization
GE Gas Power

GE in Pennsylvania

- GE gas turbines comprise 38.98% of the ~25 GW installed gas capacity
- GE reactors make up 53.96% of the 10 GW of installed nuclear capacity
- GE wind turbines comprise 34.41% of the ~1.5 GW of installed wind capacity

GE gas turbines in Pennsylvania



Energy landscape | Today and tomorrow

Wind and solar grow fastest over next decade driven by **LCOE**

Gas will play a vital but changing role, providing **flexible, dispatchable, affordable, reliable and lower CO_2** power

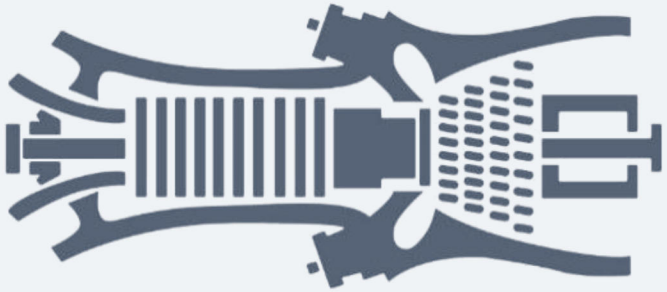
Storage and hybrid solutions emerge, **enabling baseload dispatchability** of renewables

Nuclear remains a **key source** of zero-carbon generation with small modular reactors expected to **bring costs down**

Grid will play a critical role in enabling a **diversified energy mix**

Digital technologies are the **enablers** tying it all together, **orchestrating** the world's energy through software

Multiple ways to decarbonize* existing and future gas power plants



Pre-combustion

Use a near zero or carbon neutral fuel

- Hydrogen (blue, green, pink)
- Synthetic (renewable) methane
- Ammonia (NH_3)
- Biofuels

Post-combustion

Remove carbon from the plant exhaust

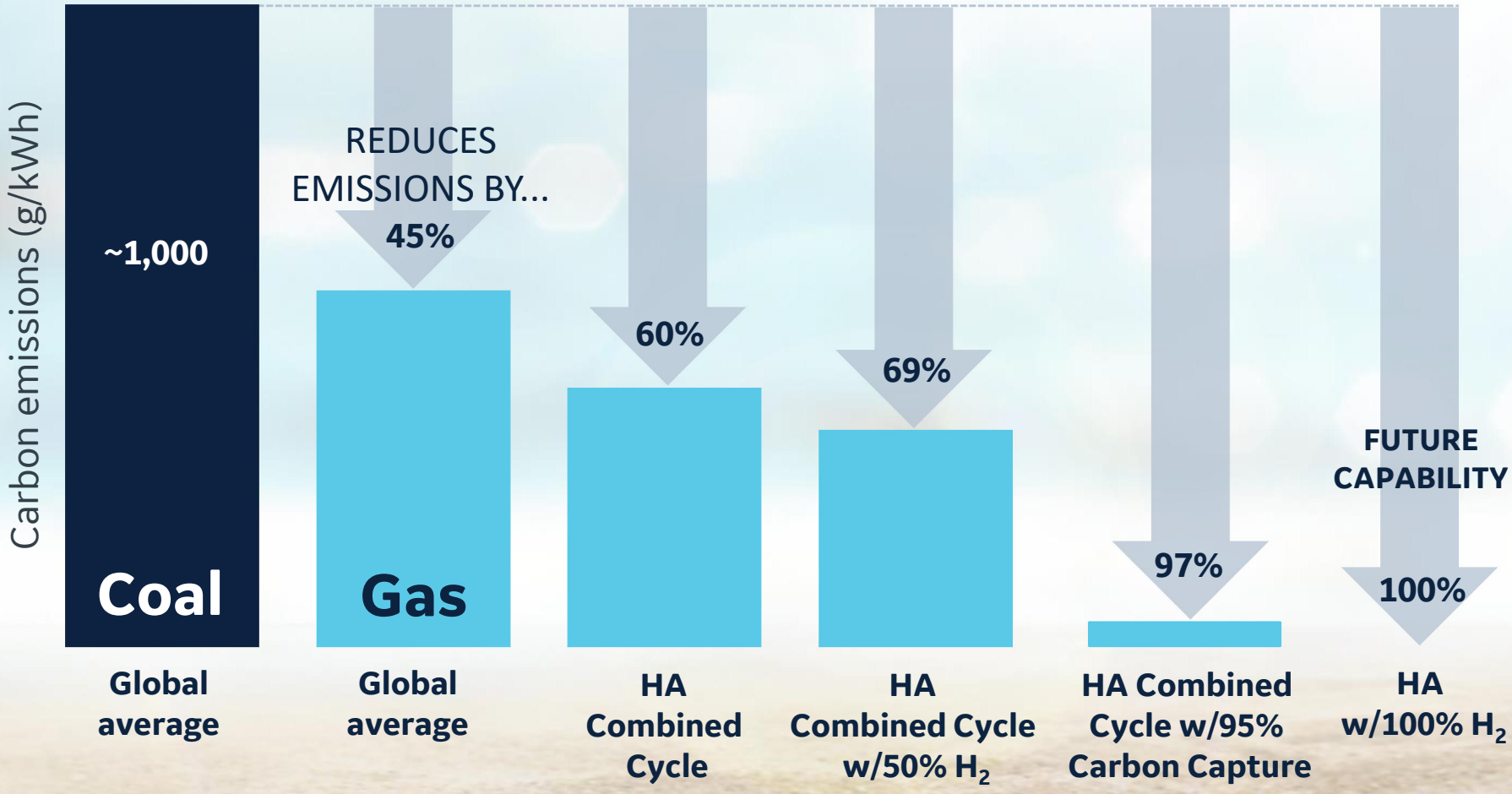
- Carbon capture (liquid solvents)

*Decarbonization as used herein is intended to mean the reduction of carbon emissions on a kilogram per megawatt hour basis.

Hydrogen production technologies

HYDROGEN COLOR	TECHNOLOGY READINESS
GREY/BLACK: Gasification of **coal or reforming natural gas** without Carbon Capture & Storage	Mature Today's standard
BLUE: Grey + Carbon Capture & Storage (CCS)	Mature (SMR)
TURQUOISE: **Pyrolysis of methane** which produces H2 and solid carbon	Early tech development
GREEN: Electrolysis of water using **renewable power;** zero carbon from process	Available
RED/PINK: Electrolysis of water using **nuclear power;** zero carbon from process	High temp electrolysis in development
WHITE: Gasification of **100% biomass**	Available (limited)

A decade of action | Pathway to low or near-zero carbon power



Coal-to-Gas Switching, Hydrogen, Carbon Capture and Sequestration

are viable pathways to low or zero carbon power

Source: GE Future of Energy White Paper Dec 2020

Decades of experience with hydrogen fuel

1x7F
IGCC (USA)

1x7F
IGCC (USA)

1x6B
IGCC (Europe)

2x6F
Refinery (USA)

2x6F Syngas
Refinery (Asia)

1xGE10 High H_2
(Europe)

2x7F Syngas
coal IGCC (USA)

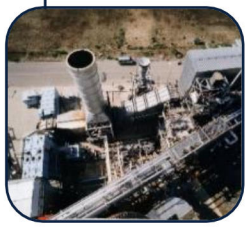
2x9E
Refinery (India)

1x7HA
H2 blend (US)

1990 **2000** **2010** **2020**

1x7E
IGCC (USA)

1x6B Refinery
(Europe)



1x6B Refinery
(S. Korea)

1xGT13E2
Refinery (Europe)

3x9E Refinery
(Europe)

2xGT11N2
Steel mill (Brazil)

2xLM2500
Steel Mill (China)

1x7F Syngas
IGCC (Korea)

1XLM6000
H2 blend (US)

GE has more than 100 gas turbines with more than 8 million operating hours on fuels containing hydrogen

7HA Hydrogen Blending & Operation Demonstration
Long Ridge Energy Terminal, Hannibal, OH – April 22, 2022

We engineer cleaner, more accessible energy that people depend on, powering growth and prosperity everywhere.

Green Hydrogen Demonstration Project Kick-off at Brentwood Power Station on Long Island, NY – Oct 2021

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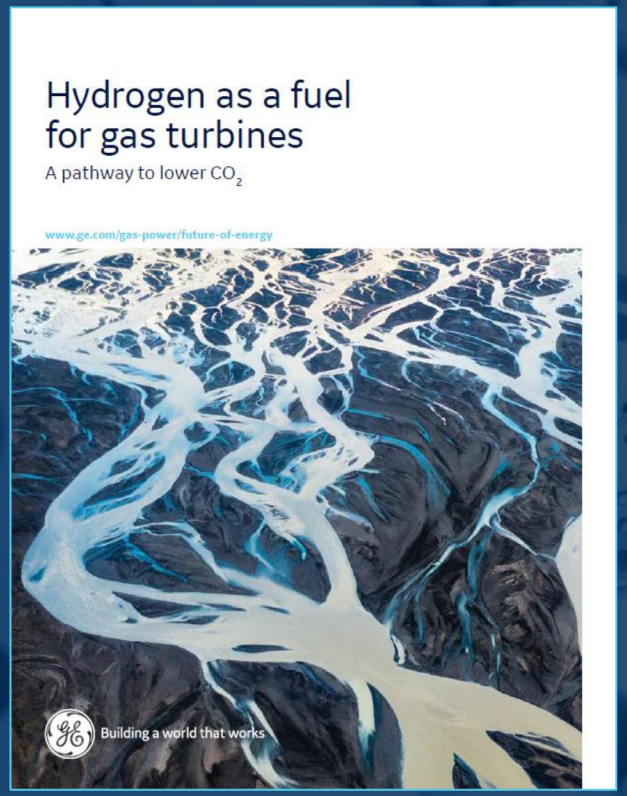
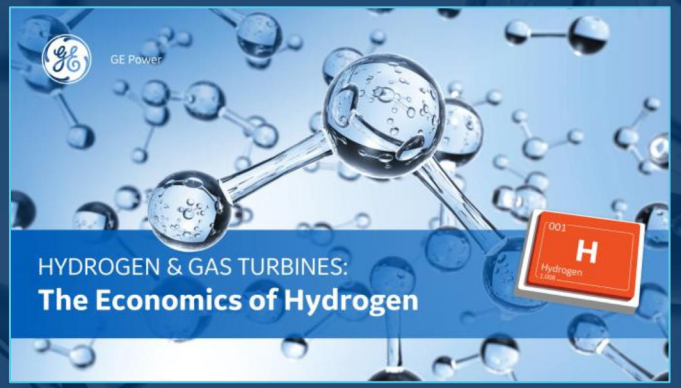
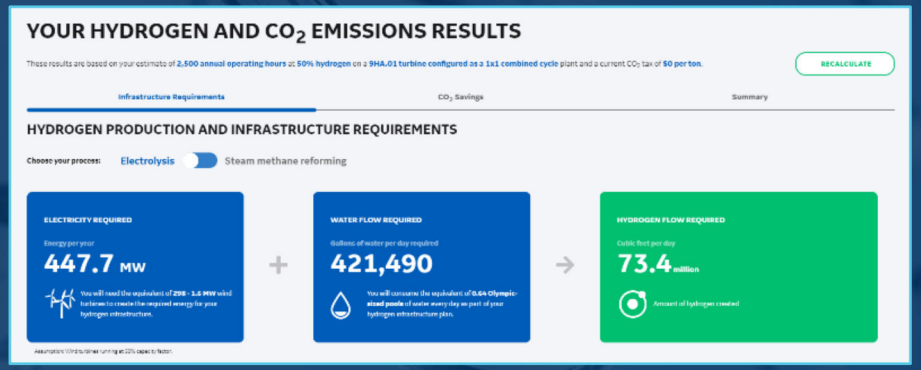
For more information: www.gepower.com/hydrogen



White paper



Webinars



Carbon emissions calculator