MANAGING CARBON, GROWING ECONOMIES

Leveraging Clean Gases, Fuels, and Infrastructure for the Storage Solutions of Tomorrow

GTI's Vision for Transitioning to Low-Cost, Low-Carbon Energy Systems in 2030 and Beyond

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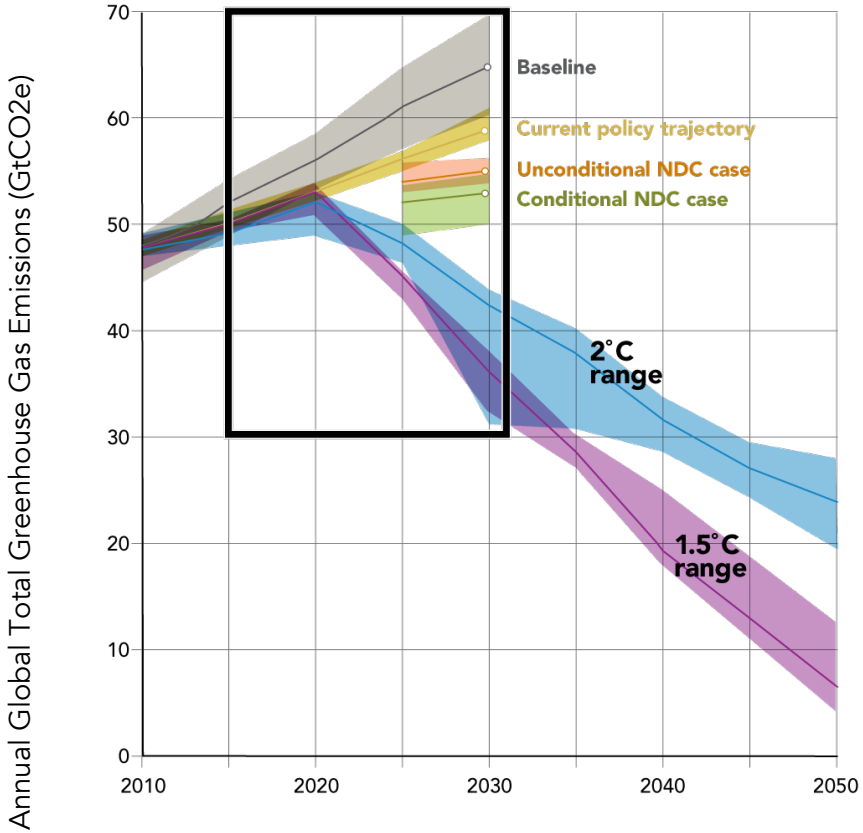
GTI is a not-for-profit R&D organization with a nearly 80-year history of developing clean energy technologies.

GTI envisions a carbon-managed future in which integrated energy systems leverage low-carbon or carbon-neutral fuels, gases, and infrastructure to limit global temperature rise.

DUAL IMPERATIVES

We must both decarbonize energy systems AND supply the energy needed to support economic growth around the world.



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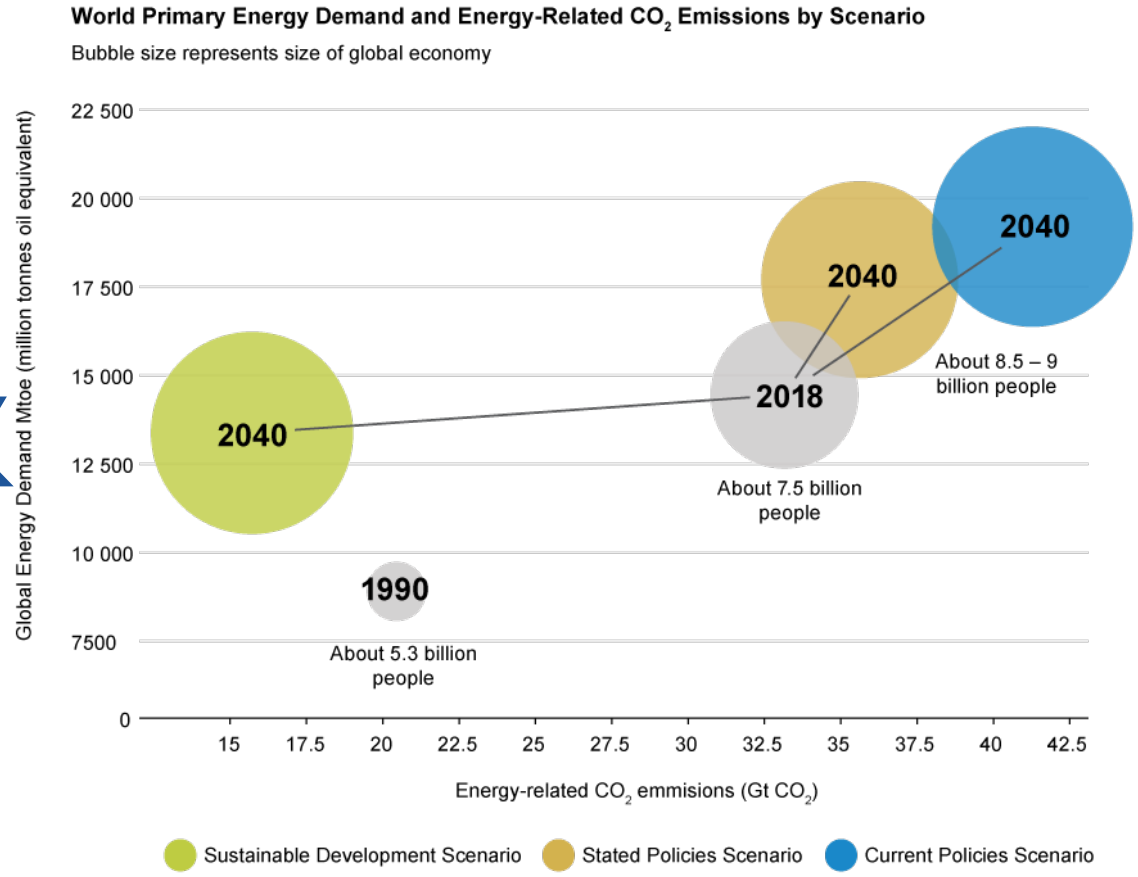
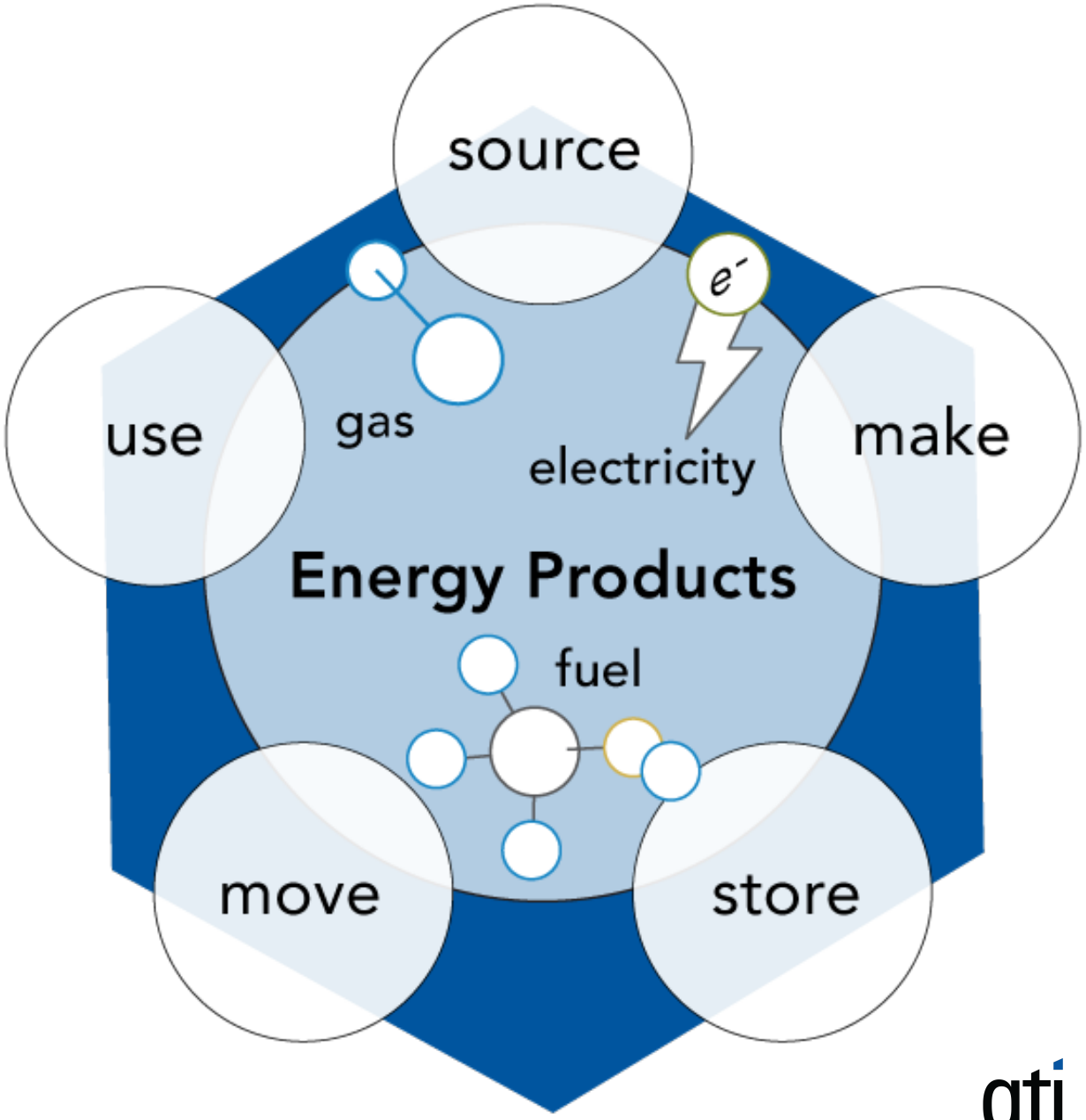


Sources: United Nations Environment Program (UNEP) 2017 Emissions Gap Report (left); International Energy Agency (right)

GUIDEPOST

The Whole Energy System

To manage this energy transition, we must apply systems thinking and consider the entire energy system. The ways we move and store energy as are important as the ways we make and use energy.



"[Renewables] will be critical components to get electricity to zero carbon. But we need, frankly, an assault across the board on all approaches. ***So renewables and batteries, yes. But we need storage for longer time periods than a few hours. … We need to start getting hydrogen really deployed."***

– Former U.S. Secretary of Energy Ernest J. Moniz

Source: Stanford Global Energy Forum. June 9, 2020.

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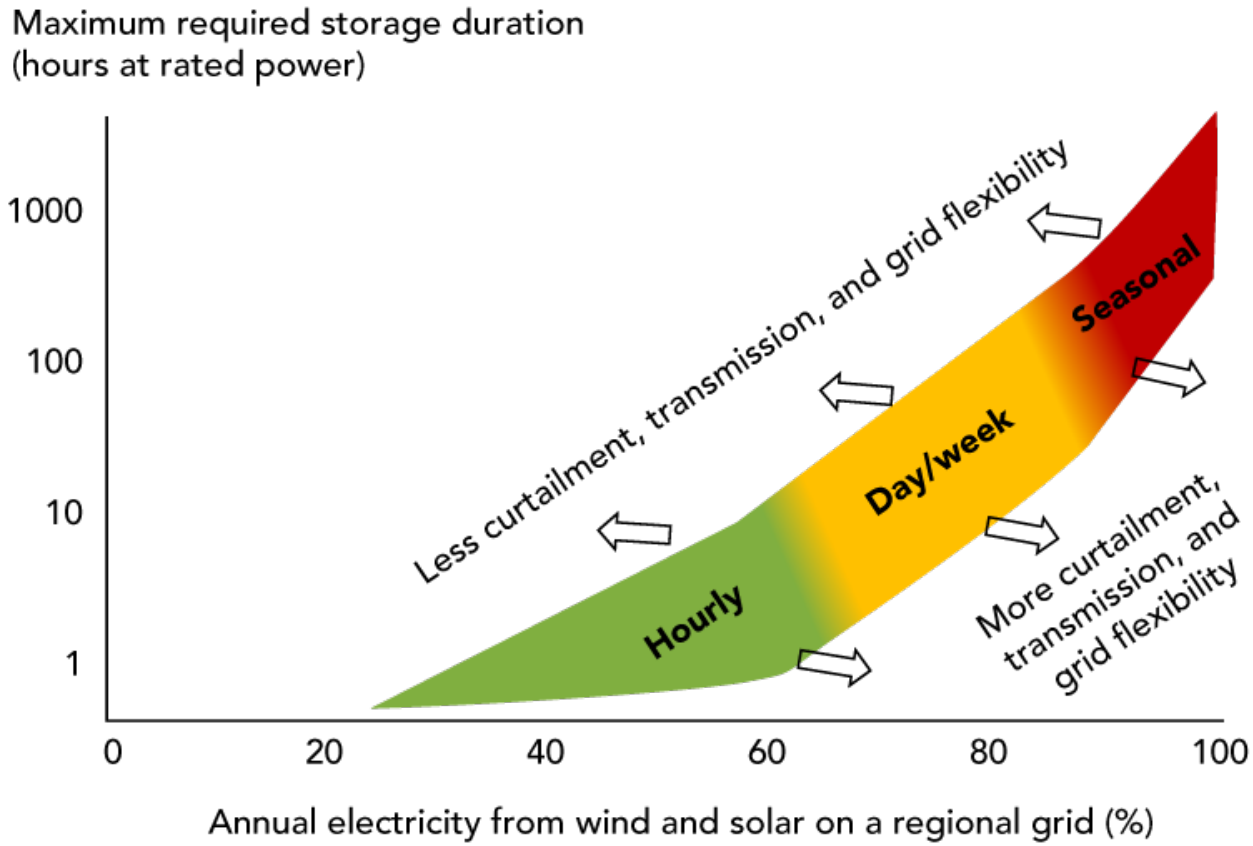
GUIDEPOST

Molecules – Gases and Fuels

Gases and fuels will continue to play a vital role in future decarbonized energy systems. The gas and fuel molecules we use—and the way we make them—will evolve as energy systems transition.

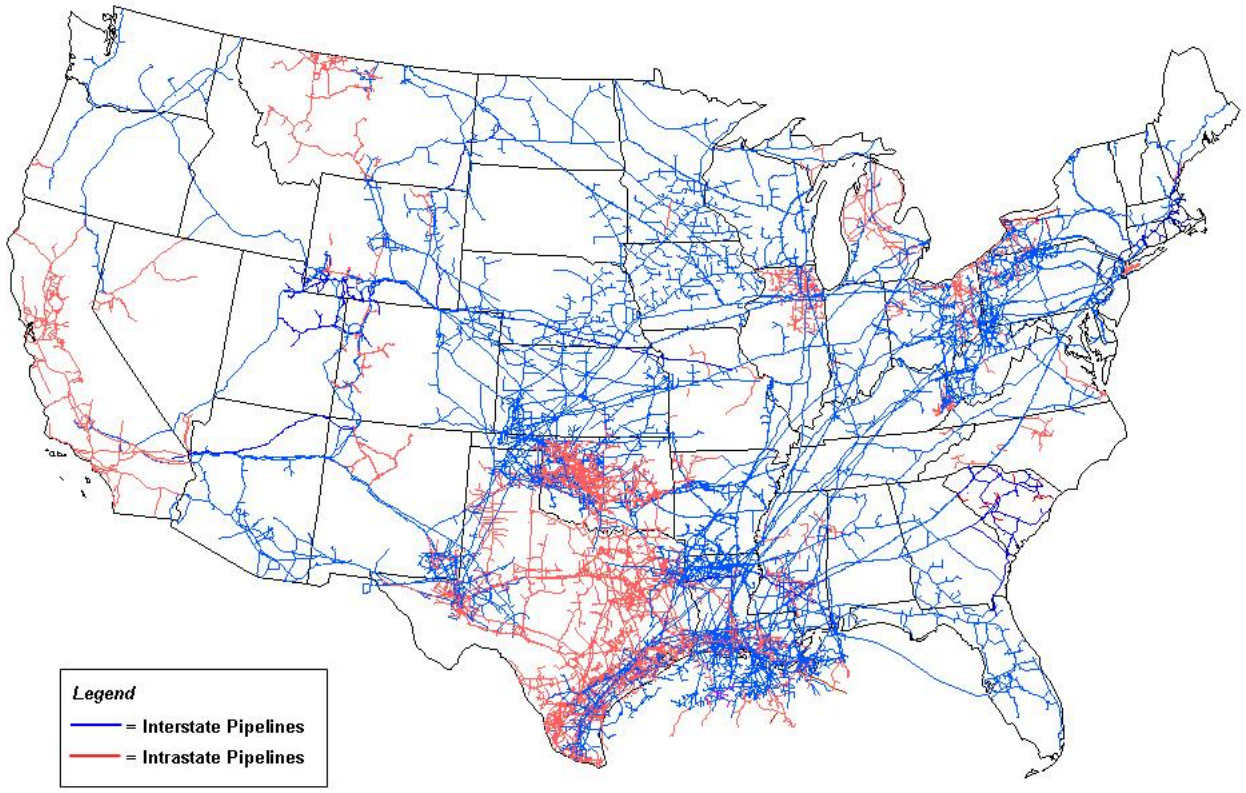


Source: Albertus, Manser, Litzelman. Long-Duration Electricity Storage Applications, Economics, and Technologies. Joule. Vol 4, No 1, January 2020.

GUIDEPOST

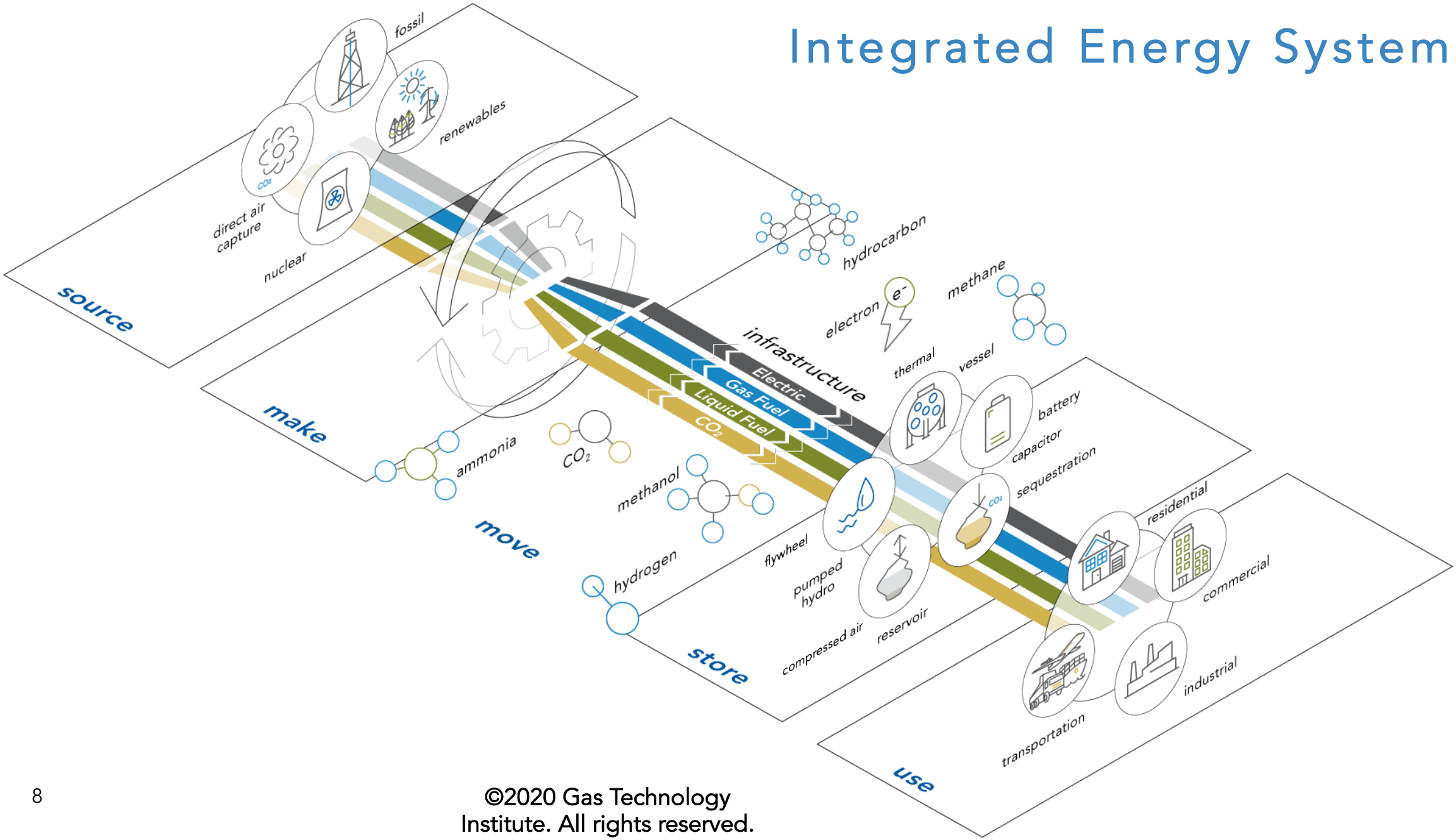
Infrastructure and Storage

Infrastructure and storage are fundamental to the low-carbon transition—enabling connections between elements of energy system to deliver energy where it's needed, when it's needed.

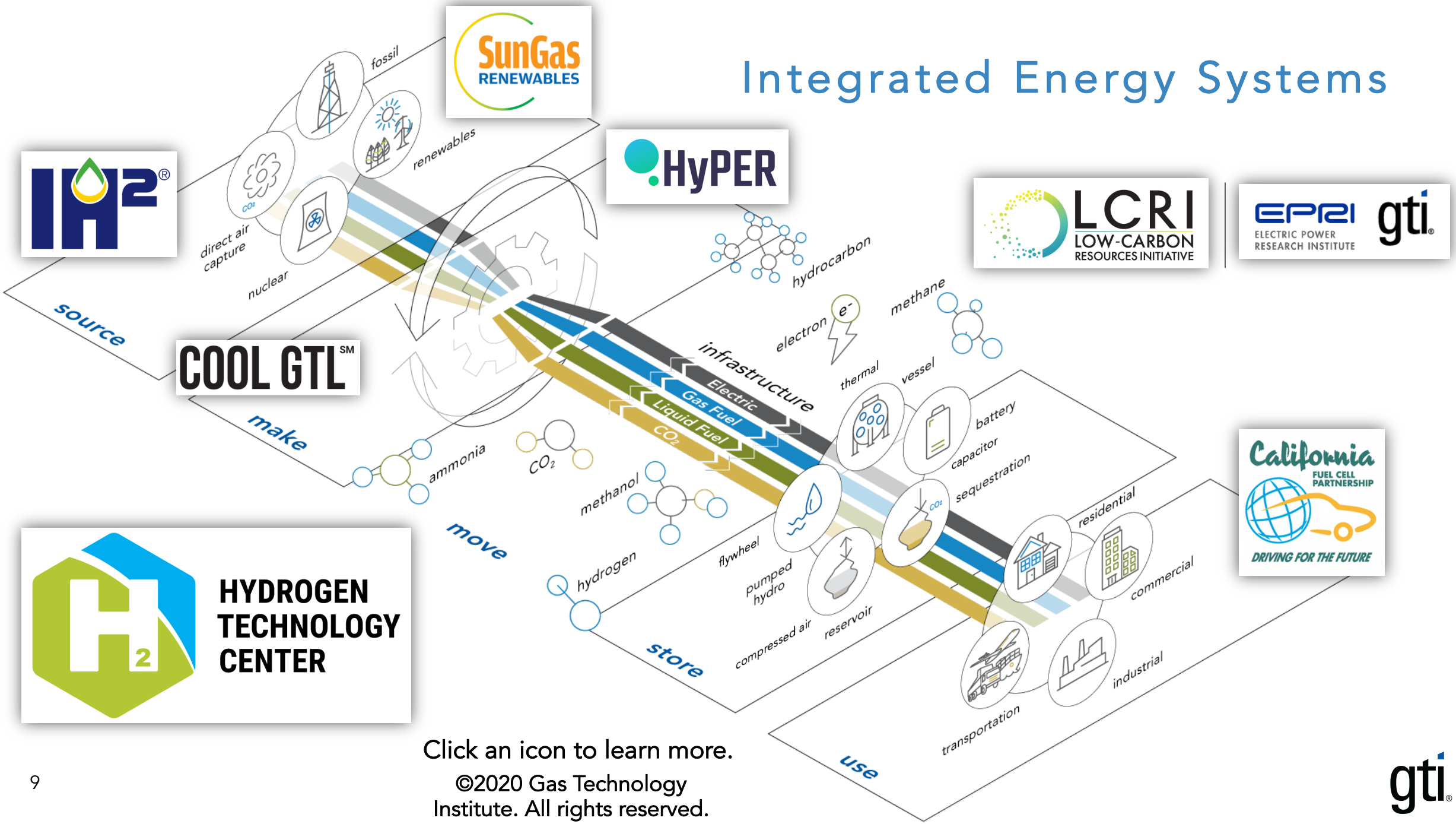


Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Integrated Energy Systems



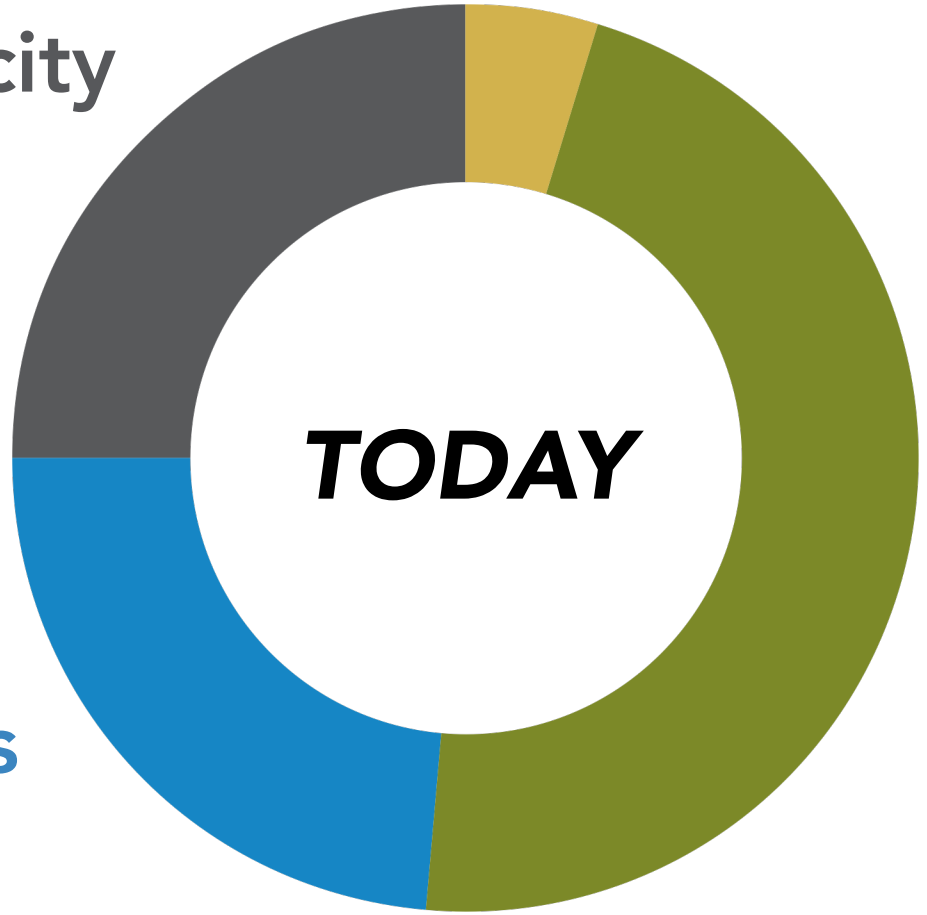
Integrated Energy Systems



Click an icon to learn more.

LAUNCH POINT

The Whole Energy System



Total U.S. Delivered Energy

Source: GTI analysis of EIA and IEA data

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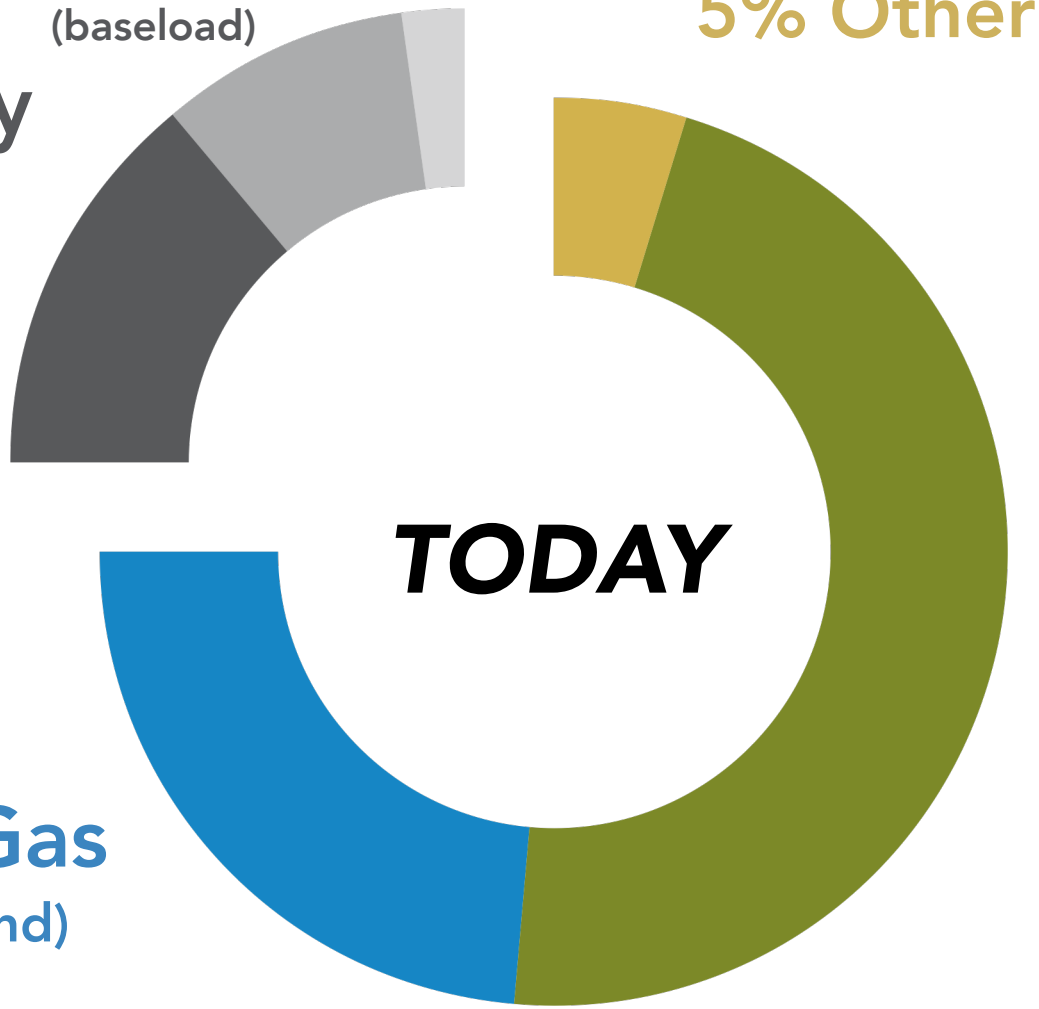

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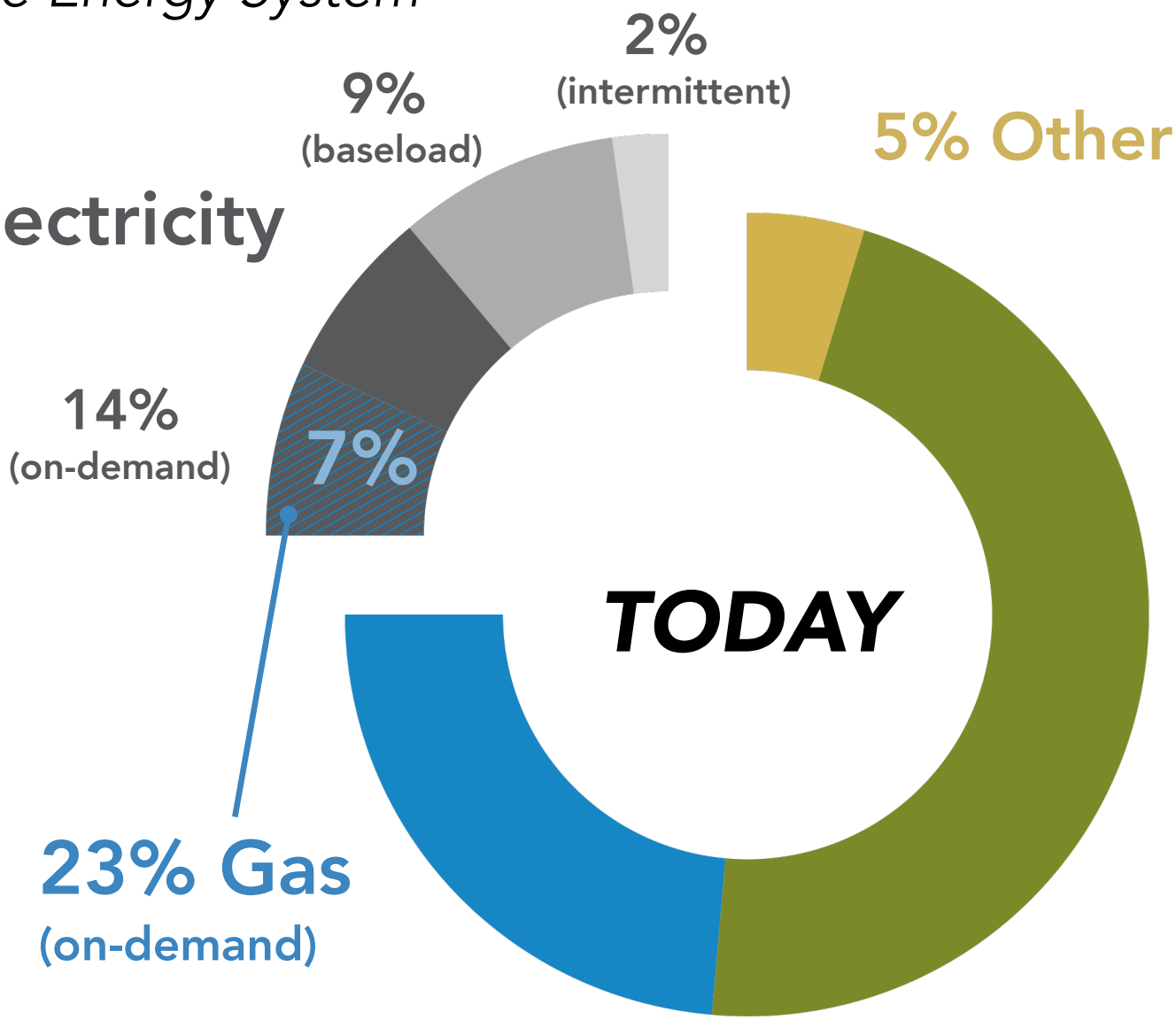

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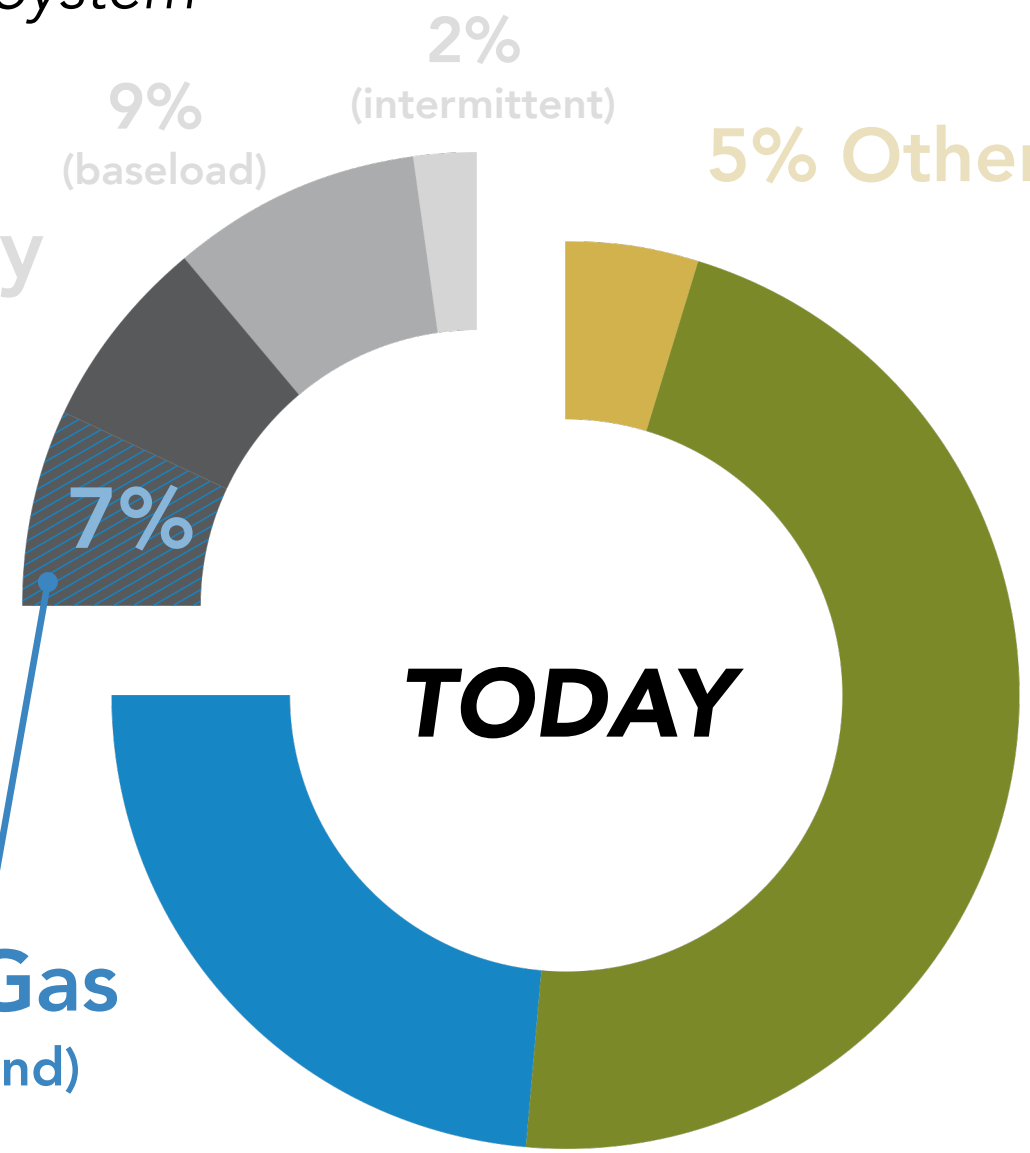

7 weeks storage capacity

47% Liquid Fuel
(on-demand)

8 weeks storage capacity

23% Gas
(on-demand)

Total U.S. Delivered Energy

Source: GTI analysis of EIA and IEA data

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WHAT'S NEXT

The Future – an Integrated Energy Systems Approach

Planning, investment, and R&D must consider:

- **the whole energy SYSTEM**

  not just a particular energy product, sector, or source

- **gas and liquid fuels will evolve and play a vital role**

  grid-scale, long-duration storage, long-distance energy transport, and difficult-to-decarbonize sectors

- **INFRASTRUCTURE is fundamental and near-term decisions have long-term impact**

  enable energy systems integration to deliver energy where we need it, when we need it

- **storage must balance both demand and supply**

  address seasonal variations, reliability, resiliency, and price volatility

Thank You

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