The Next Phase of Industrial Decarbonization is Here

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Our Mission:
Decarbonize industry with concentrated sunlight

At Heliogen, we are dedicated to decarbonizing industry in order to mitigate climate change. Our renewable energy technology is designed to generate carbon-free heat and steam, power, and hydrogen from the sun.

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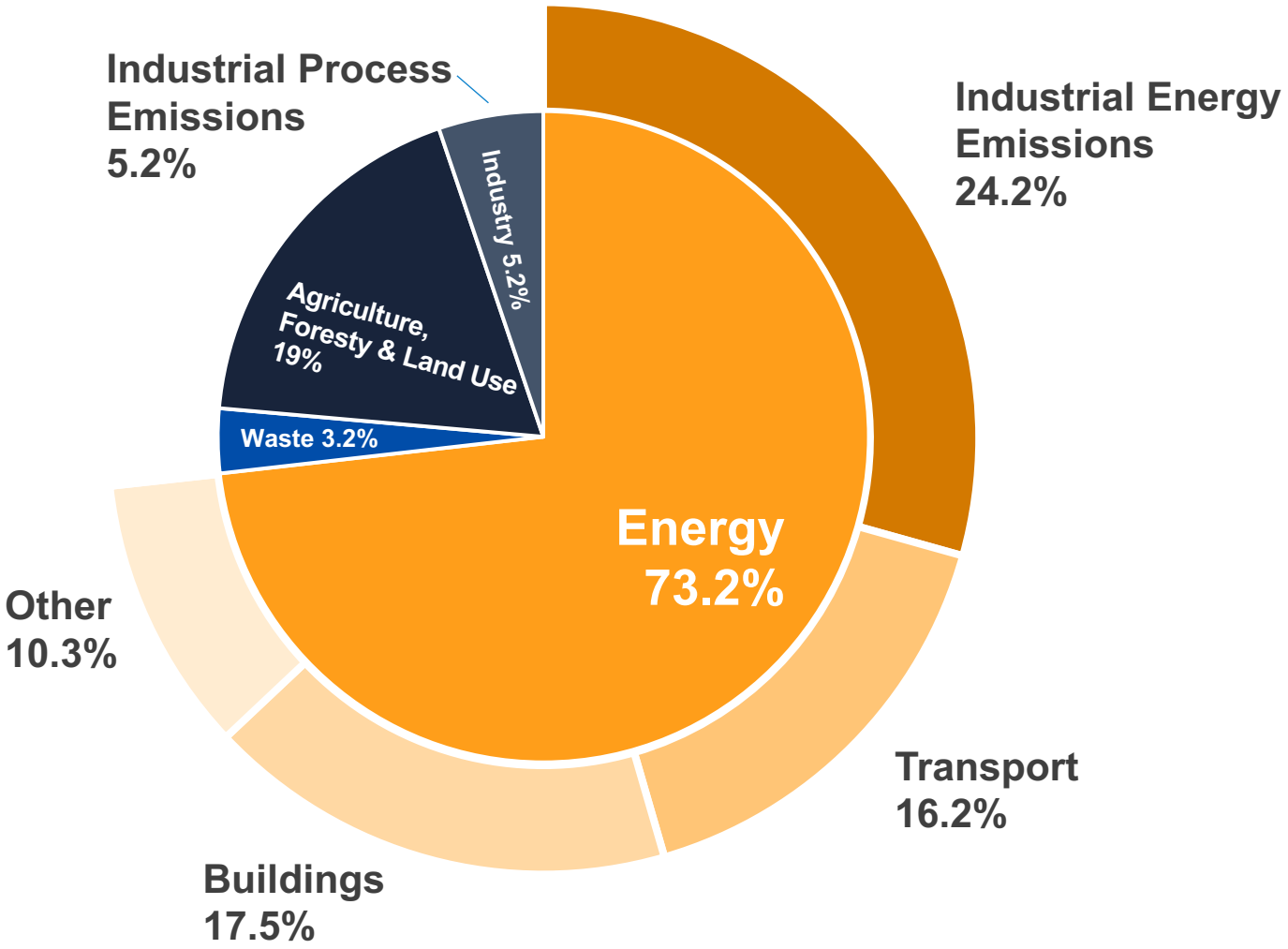
Global Greenhouse Emissions by Sector



Energy emissions dominate the Net-Zero challenge

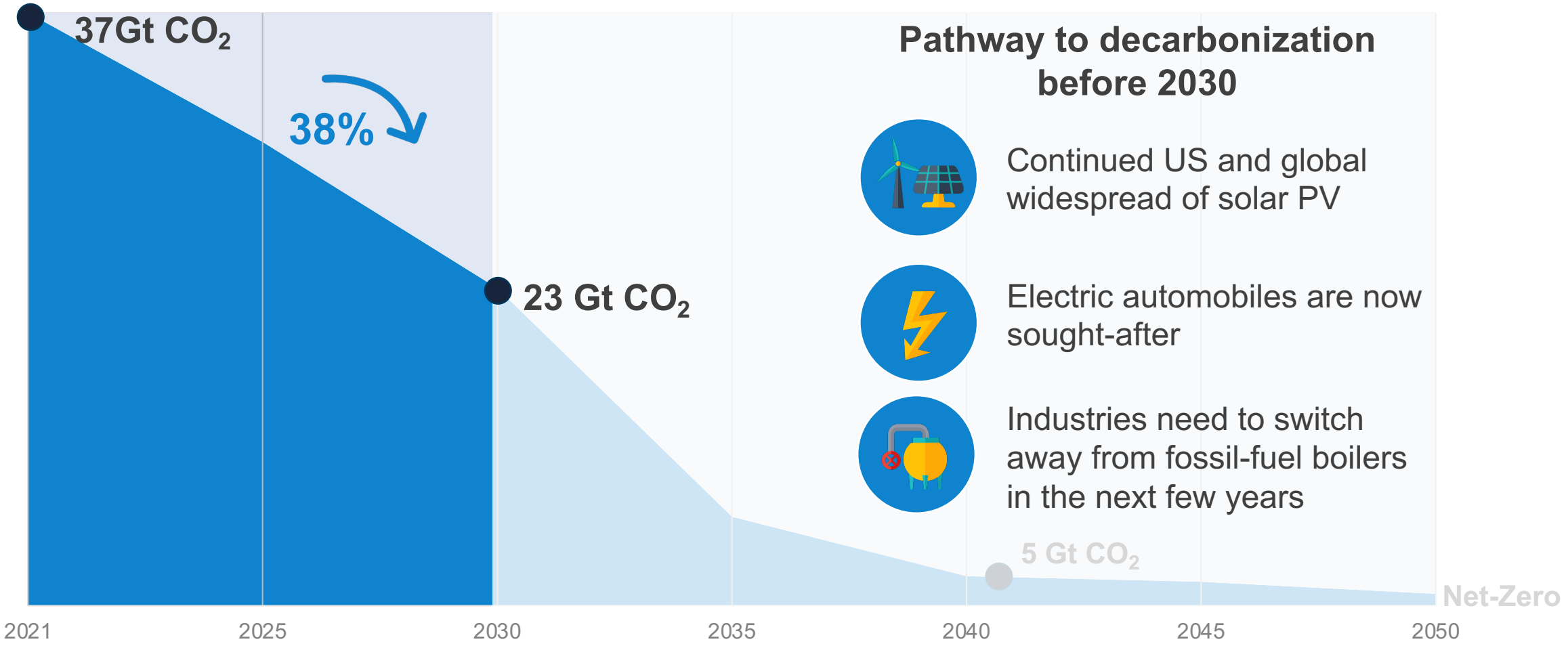
73% of GHG emissions are due to energy generated by burning fossil fuels. Energy is baked into everything around us – concrete, airplanes, our food.

When we break this down, industry (energy and process emissions) and transportation account for nearly **50% of total emissions.**

"Heavy" is a problem. Decarbonization of heavy industry has scarcely been touched, and heavy transportation is a decade behind automotive.

Source: Our World in Data/Climate Watch, the World Resources Institute (2020)

Reaching 2030 – Initial transformations



Pathway to decarbonization before 2030

- Continued US and global widespread of solar PV
- Electric automobiles are now sought-after
- Industries need to switch away from fossil-fuel boilers in the next few years

Source: IEA World Energy Outlook 2022

Graphic is only a visual representation of IEA data points

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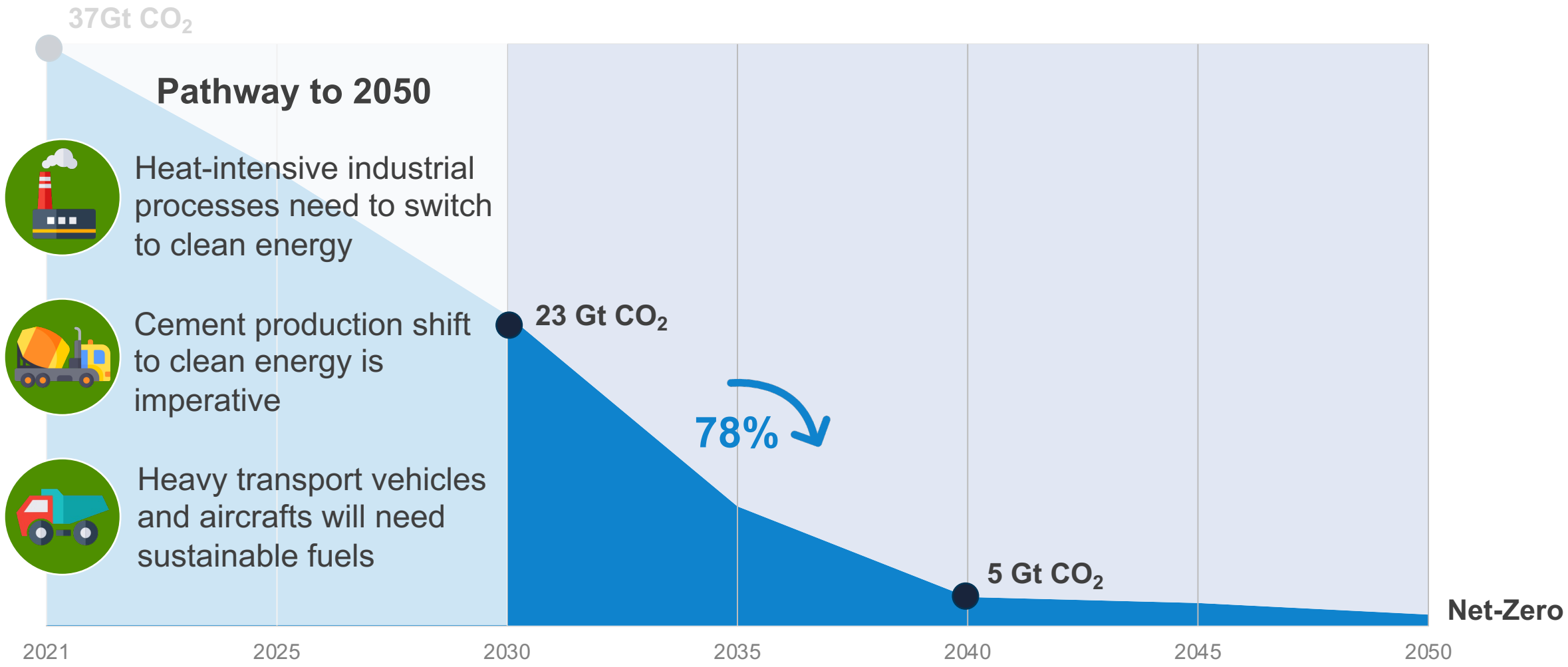
Beyond 2030 – “Heavy” work accelerates



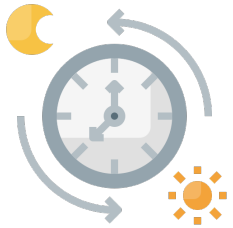
Source: IEA World Energy Outlook 2022
Graphic is only a visual representation of IEA data points

"Hard-to-abate" is exactly that

Heat-intensive applications

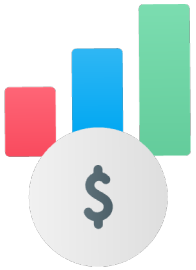
Process heat is generated today by fossil fuel fired boilers and kilns. Electrification is challenging and expensive for high temperature applications.

Industry needs something else.



Around the clock operations

Traditional renewables are intermittent, and while storage solutions are developing, most are prohibitively expensive for industry and will be for some time.



Cost competitive with fossil fuels

Fossil fuels are relatively cheap and embedded in equipment with 30-year lifespans.
Renewable options need to push costs down to make the switch desirable for industrial producers.

Heat unlocks industry opportunities

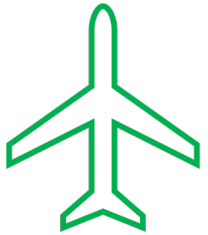
Minerals Processing
Lithium, Copper, Bauxite, Borax

Metals Processing
Steel, Iron, Aluminum

Cement & Calcined Minerals
Pre-heating process, Limestone, Magnesium, Phosphorus

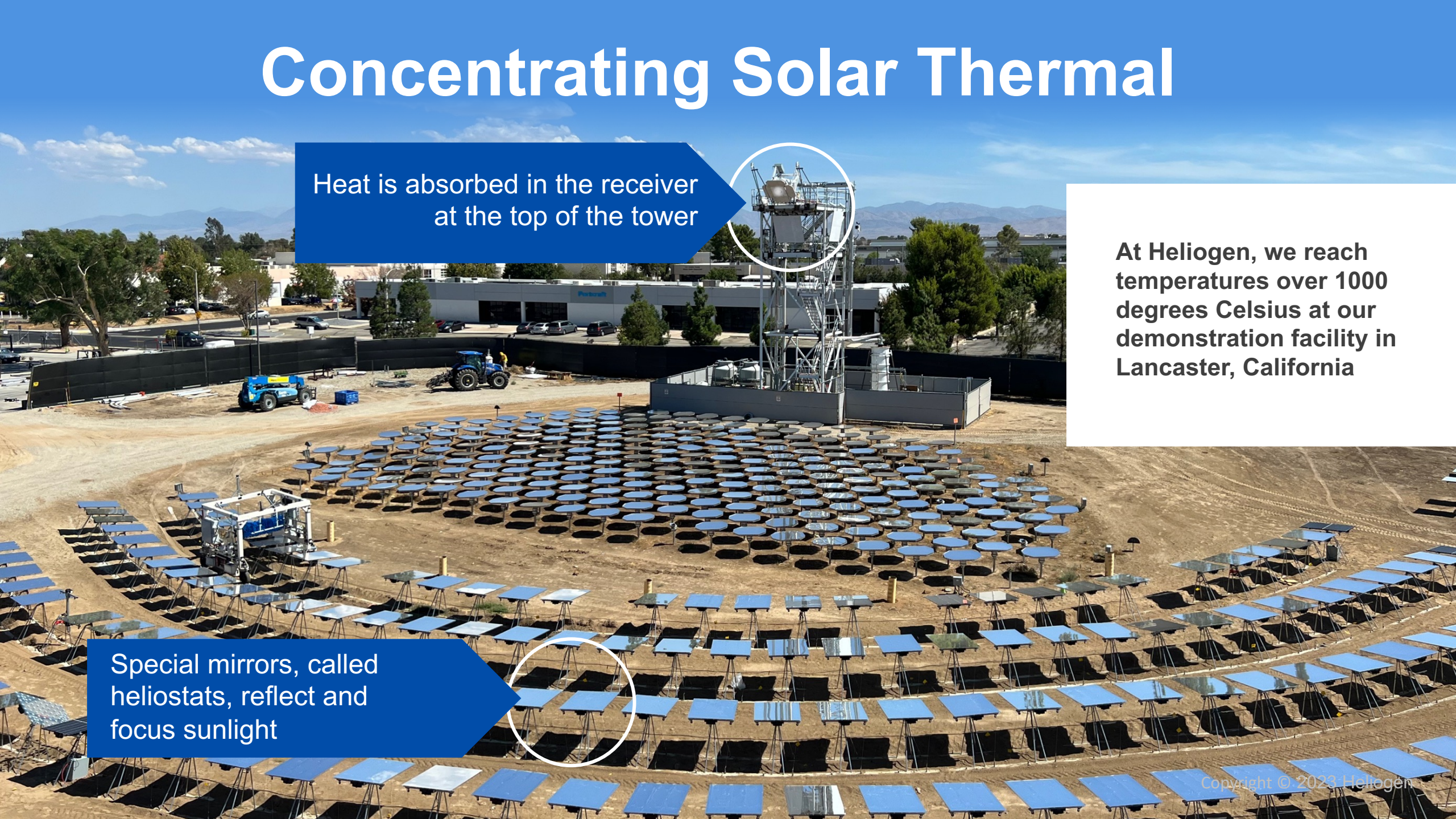
Food & Beverage
Grain milling, Food processing, preservation, and pasteurization

Chemicals
Ethylene, Ammonia, Chlorine, Soda Ash, Petroleum Products



Transportation
Fuel Cell Electric Vehicles, Sustainable Aviation Fuels

Concentrating Solar Thermal



At Heliogen, we reach temperatures over 1000 degrees Celsius at our demonstration facility in Lancaster, California

Generating energy from concentrated sunlight has many advantages, especially when you want to use it for heat

The technology is mature and has evolved

The shortfalls of the early generations have been identified and dealt with, and the materials needed – steel, glass, ceramics – are readily available.

No heat conversion loss

Concentrating sunlight directly into heat avoids the conversion loss that would occur if converting electricity into heat.

CST offers an efficient, cost-effective solution

to decarbonize previously untouched stages throughout industrial operations

Now is the time for industry to leverage a new generation of concentrated solar

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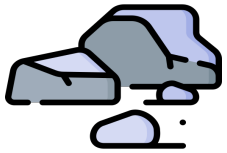
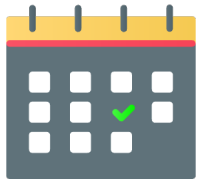
Thermal storage for dispatchable heat



Uses lower cost, more easily accessible materials for heat storage

Thermal storage can be long-duration and lower cost than power storage solutions



Heat can be retained at process temperature to dispatch at night

Advanced computing unlocks superior results

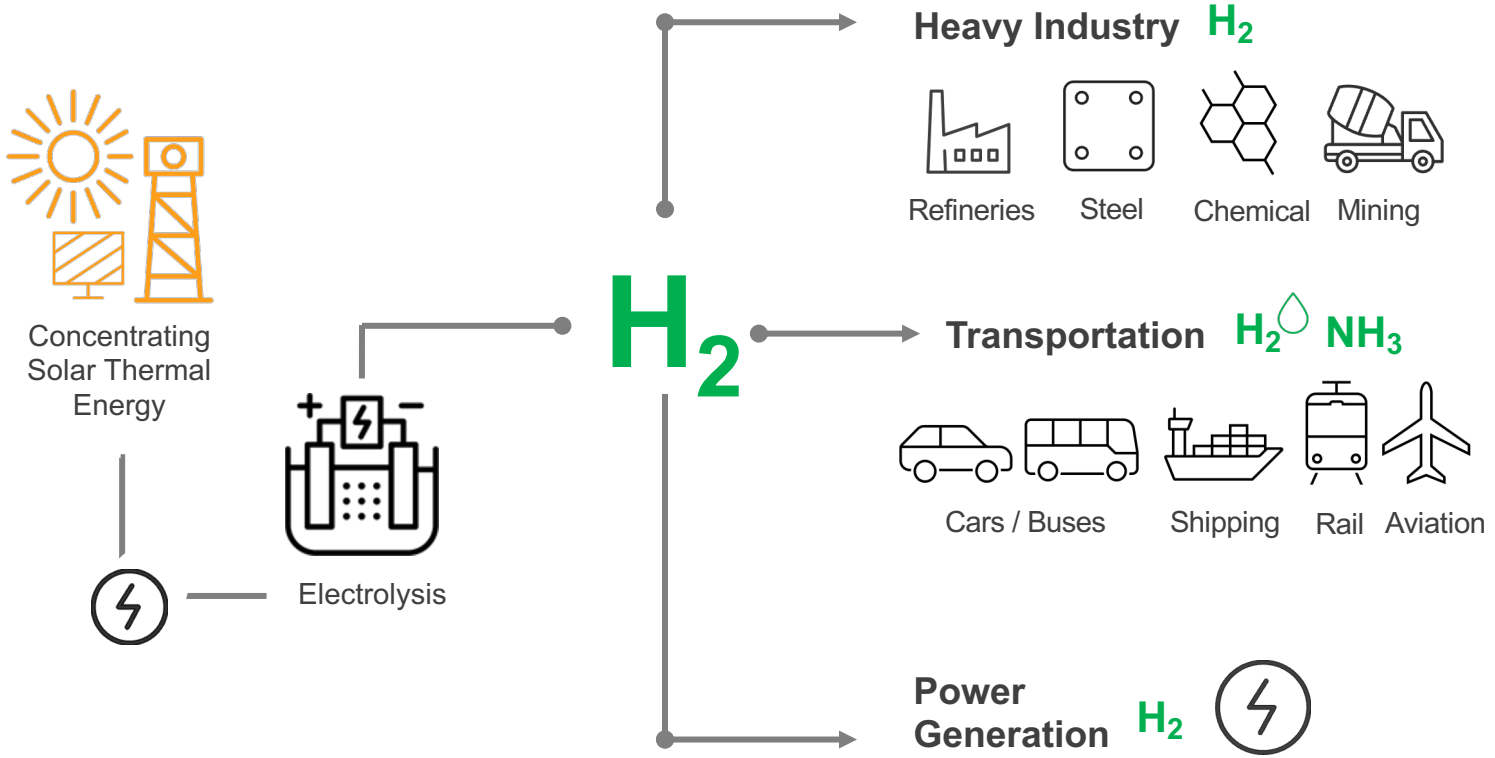
- A.I. & machine vision continuously observe the sun’s position
- Closed-loop tracking to reposition heliostats in response to environment
- Allows use of small, simple hardware that can be mass produced

Automation & robotics drive down costs

Automated manufacturing plants produce more for less. Smaller, lighter parts can be shipped in a crate, and installed quickly.

Autonomous vehicles can take care of maintenance with no operational disruption. Smart, automated, mass-produced renewable energy systems become an easy decision for cost-conscious industrial buyers.

Enable a green hydrogen value chain



Industrial uses for hydrogen are developing, and producing **green hydrogen or sustainable fuels at costs that rival fossil fuels** will make it easier for corporate buyers to choose green.

Trucks, airplanes, and other heavy transportation are harder to electrify and need lower-cost solutions for green hydrogen and carbon-neutral alternatives, such as sustainable aviation fuel for aircraft, made from **carbon-free hydrogen.**

Concentrated solar with thermal energy storage should be a compelling option on the path to decarbonization especially for industrial processes that need dispatchable heat, or power, or fuel.