

Frequently Asked Questions about the Clean Fuels & Products Shot™

1 Why is an Energy Earthshot focused on Clean Fuels & Products needed?

- Many of our day-to-day activities and products rely on fuels and materials sourced from carbon, traditionally from fossil fuels. The transportation and industrial sectors produce many carbon-derived compounds and therefore are some of the most difficult to decarbonize.
- Aviation, marine, off-road, and rail transportation methods require energy dense liquid fuels for long-haul travel. Cleaner energy sources such as electrification and hydrogen remain impractical for these sectors today.
- Materials like polymer resins and industrial chemicals used as intermediates to make countless everyday products rely on carbon-rich compounds as critical building blocks. The bulk of these components are currently petroleum-derived and require energy intensive processing, which results in significant GHG emissions.

2 What will the Clean Fuels & Products Shot™ do?

- This Energy Earthshot will make major progress in decarbonizing the fuel and chemical industries through alternative sources of carbon and innovative process technology. The goal is to develop cost-effective fuels and products from sustainable carbon sources to achieve at least 85% lower net greenhouse gas (GHG) emissions by 2035.
- This new effort is aimed at reducing the negative impacts of GHGs by transforming waste and renewable carbon into fuels, materials, and products that are better for the environment than current petroleum-derived components.
- This Energy Earthshot specifically aims to meet 2050 projected demand for 100% of aviation fuel; 50% of maritime, rail, and off-road fuel; and 50% of carbon-based chemicals by using sustainable carbon resources.

3 How is the Clean Fuels & Products Shot™ different than other Energy Earthshots™ or Department of Energy Initiatives?

- This is the first Shot to address transforming waste and renewable carbon into fuels, materials, and products that are better for the environment than current petroleum-derived components. While it relies on advances from other Energy Earthshots™, the new technologies developed and deployed for fuels and products are uniquely positioned in the Earthshots portfolio to contribute to the Initiative's ambitious emissions reduction goals.
- Other Energy Earthshots™ focus on non-carbon fuel or energy sources (Hydrogen Shot™), new approaches for large-scale carbon dioxide removal (Carbon Negative Shot™), or reducing the energy-intensity of industrial heating (Industrial Heat Shot™).
- [The Sustainable Aviation Fuel \(SAF\) Grand Challenge](#) is a related government-wide Memorandum of Understanding (MOU) led by the U.S. Department of Energy (DOE) and other federal agencies that aims to reduce cost, enhance sustainability, and expand production of SAF while meeting 50% reduction in lifecycle GHG emissions relative to conventional fuel.
- This Shot aligns with SAF Grand Challenge goals but sets more aggressive targets for GHG emissions reduction on shorter time scales (85% reduction by 2035). Such ambitious goals require unique strategies and new technologies to meet desired timelines.

How does DOE intend to achieve this goal?

- Meeting the 2035 goal will require mobilization of new feedstocks, development of new processes, and cost-competitive technologies. The technologies developed in this Shot will also rely on successful energy developments in a clean grid, low carbon intensity hydrogen, and low carbon intensity heat. Meeting projected 2050 fuel demand in the transportation and industrial sectors is achievable based on resource assessments, according to the [Billion Ton Report](#).
- To focus the research and development needed to achieve the Clean Fuels & Products Shot™ goals, DOE has identified five critical research areas:
 1. New technologies to maximize carbon incorporation and retention for low-cost, low-emissions feedstocks at scale.
 2. Efficient gaseous waste capture and conversion, and new technologies to improve gaseous capture and catalytic conversion efficiency, including CO₂ to fuels and chemicals.
 3. Biomass and waste conversion technologies designed to use green electricity and hydrogen to maximize carbon retention in products.
 4. Integrated pilot and demonstration scale facilities to de-risk new feedstocks and conversion approaches.
 5. Life cycle analysis and sustainability modeling to prioritize impactful research and development.

Who is involved in the Clean Fuels & Products Shot™?

Several DOE offices are supporting this Shot, including:

- **Bioenergy Technologies Office** - Research, development, and demonstration (RD&D) of processing alternative feedstocks for SAF and chemical production.
- **Industrial Efficiency and Decarbonization Office** - RD&D in technology innovation to drive energy, materials, and production efficiency to enable cost-effective GHG emission reduction and decarbonization across the industrial sector including the chemical subsector - the highest GHG emitting industrial subsector.
- **Advanced Materials and Manufacturing Technology Office** - RD&D in support of domestic manufacturing critical to achieving a decarbonized economy.
- **The Office of Fossil Energy and Carbon Management** - RD&D on developing solutions to capture and convert CO₂ into chemicals and products.
- **Solar Energy Technologies Office** - RD&D in concentrated solar thermal conversion and thermal storage technologies.
- **Hydrogen and Fuel Cell Technology Office** - RD&D of clean hydrogen technologies for production of low-carbon feedstocks and fuels.
- **Office of Science (SC)** - Conducts basic research in the biological, chemical and materials sciences related to conversion of alternative feedstocks to fuels and chemicals; Provides access to capabilities at the SC User Facilities, including high-performance and exascale computing resources.
- **Office of Clean Energy Demonstrations** - Delivers clean demonstrations at scale, in partnership with the private sector to accelerate deployment and market adoption of a decarbonized energy system.
- **Advanced Research Projects Agency-Energy Office** - Advances high-potential, high-impact energy technologies related to fuels and products production too early for private-sector adoption.

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How will the Clean Fuels & Products Shot™ impact disadvantaged communities?

- With the shift from fossil fuel feedstocks to other abundant resources delocalized throughout the country, there are new opportunities to stimulate job growth.
- Significant carbon pollution reductions, like those proposed in this Energy Earthshot, and associated reductions of other pollutants, positively impact community health outcomes.
- By encouraging full life cycle analysis, R&D of clean fuels and products can put greater attention on the inputs being used to create the materials we use every day and give manufacturers incentives to transition away from petroleum-based sources.

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How would an 85% reduction in GHG emissions from fuels and products affect the average American?

- The average American will benefit from cost-competitive, cleaner fuels and products for use in their daily lives.
- American workers will benefit from the competitive advantage these innovations give U.S. manufacturers and the potential for job creation as alternative feedstock markets and new conversion technologies evolve.
- Lower greenhouse gas emissions are associated with better health outcomes for communities across the country.

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How does the Clean Fuel & Product Shot™ improve energy security?

- Petroleum remains the dominant source for fuels and chemical intermediates. This exposes the United States to market volatility through dramatic changes in fuel prices. For example, within the aviation sector, the cost of fuel has increased by more than 90% since the beginning of 2022 and can account for 25% of total operating costs ([McKinsey & Company](#)).
- By implementing this Shot, the U.S. can bolster energy security by diversifying supply chains needed for fuels and products while decreasing reliance on fossil fuel markets. By using alternative feedstock sources across the country, a more robust and versatile domestic supply chain can be established to help meet America's energy needs while dramatically lowering the U.S. GHG footprint.

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How does this Energy Earthshot™ align with the Biden-Harris administration's climate goals?

- The White House has set a goal to reach net zero emissions economy-wide by 2050, with a 50% to 52% reduction in GHG emissions from 2005 levels by 2030. This Shot seeks to reduce GHG emissions in the fuel and chemical industry—historically hard-to-decarbonize sectors of the economy—by at least 85% by 2035, and to achieve a 100% net GHG emissions reduction compared to fossil fuels by 2050. This mirrors the net-zero emissions timeline of the Biden-Harris administration. This Shot also embraces the [Justice40 Initiative](#), [White House Executive Order 13985](#), and [White House Executive Order 14091](#) to ensure the benefits of the clean energy economy impact all U.S. communities.