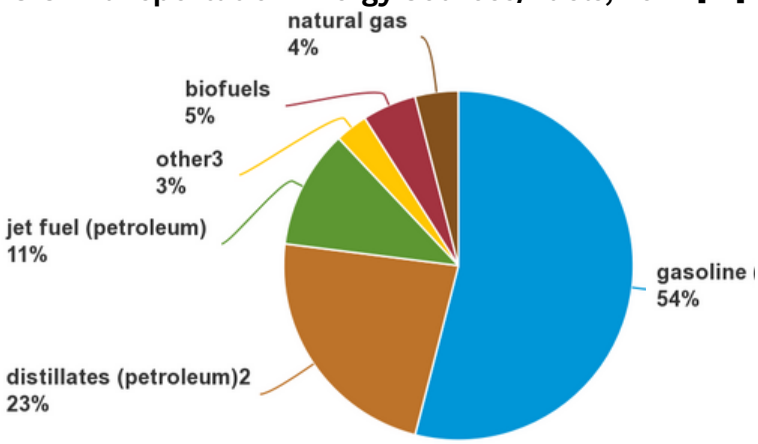
Alternative Fuel Sources

Alternative fuel sources can help electrify and decarbonize transportation industries [1]

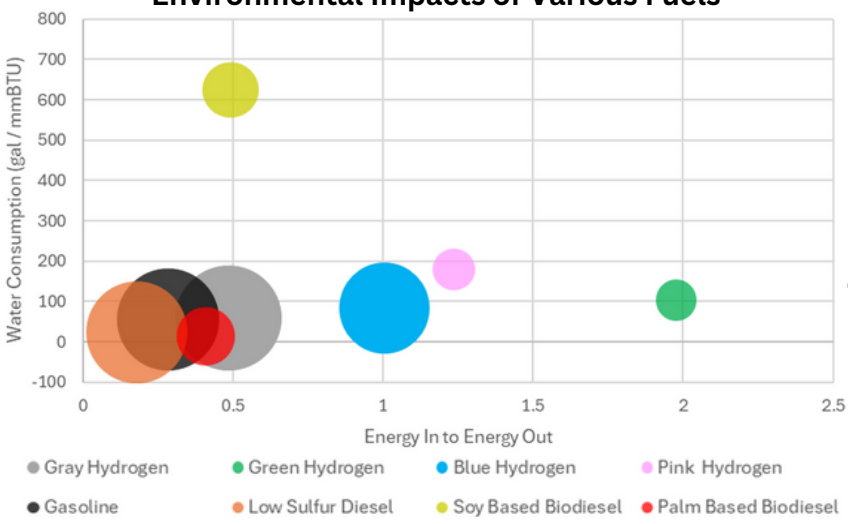
Common alternative fuels include hydrogen, biofuel, and biodiesel [1]

U.S. Transportation Energy Sources/Fuels, 2021 [17]



The Northwest Seaport Alliance, Port of Houston, and California have all begun efforts to reduce port emissions [14,15,16].

Environmental Impacts of Various Fuels



Bubble size represents the relative greenhouse gas intensity of each fuel, from extraction to processing to combustion. Hydrogen does not produce GHGs through combustion. Data collected from [18].

Hydrogen Fuels

Hydrogen can be used as a zero-emission fuel depending on production method [5].

Biofuels

Liquid biofuels are well adapted for use in transportation vehicles and emit fewer greenhouse gas emissions than fossil fuel [8].

Biodiesel

Unmodified diesel engines can be run on fuel blends containing up to 20% biodiesel [12].

Map showing regional clean hydrogen hubs, of which the Midwest Hydrogen Hub, which includes Illinois, Indiana, and Michigan, was selected in October 2023 [6].

References and additional resources:

1. Kennedy K, Feldmann J. Decarbonizing Freight: Opportunities and Obstacles for Clean Fuels. 2023 Sep 18 [accessed 2024 Mar 31]. https://www.wri.org/insights/decarbonizing-freight-clean-fuels
2. Sustainable Marine Fuels. Energy.gov. [accessed 2024 Mar 31]. https://www.energy.gov/eere/bioenergy/sustainable-marine-fuels
3. US EPA O. Clean Ports Program. 2023 Feb 9 [accessed 2024 Mar 31]. https://www.epa.gov/ports-initiative/cleanports
4. Lanz A, Heffel J, Messer C. Hydrogen Fuel Cell Engines and Related Technologies. *Hydrogen Fuel*. 2001.
5. Marchant N. Grey, blue, green – why are there so many colours of hydrogen? World Economic Forum. 2021 Jul 27 [accessed 2024 Mar 31]. https://www.weforum.org/agenda/2021/07/clean-energy-green-hydrogen/
6. Regional Clean Hydrogen Hubs Selections for Award Negotiations. Energy.gov. 2023 Oct 13 [accessed 2024 Mar 31]. https://www.energy.gov/oced/regional-clean-hydrogen-hubs-selections-award-negotiations
7. Bioenergy Basics. Energy.gov. [accessed 2024 Mar 31]. https://www.energy.gov/eere/bioenergy/bioenergy-basics
8. Cavelius P, Engelhart-Straub S, Mehlmer N, Lercher J, Awad D, Brück T. The potential of biofuels from first to fourth generation. *PLOS Biology*. 2023;21(3):e3002063. doi:10.1371/journal.pbio.3002063
9. Ambaye TG, Vaccari M, Bonilla-Petriciolet A, Prasad S, van Hullebusch ED, Rtimi S. Emerging technologies for biofuel production: A critical review on recent progress, challenges and perspectives. *Journal of Environmental Management*. 2021;290:112627. doi:10.1016/j.jenvman.2021.112627
10. Biofuel Basics. Energy.gov. [accessed 2024 Mar 31]. https://www.energy.gov/eere/bioenergy/biofuel-basics
11. Malode SJ, Prabhu KK, Mascarenhas RJ, Shetti NP, Aminabhavi TM. Recent advances and viability in biofuel production. *Energy Conversion and Management: X*. 2021;10:100070. doi:10.1016/j.ecmx.2020.100070
12. Biodiesel Handling and Use Guide: Fourth Edition (Revised). 2009. p. DOE/GO-102008-2658, NREL/TP-540-43672, 938562. Report No.: DOE/GO-102008-2658, NREL/TP-540-43672, 938562. http://www.osti.gov/servlets/purl/938562/. doi:10.2172/938562
13. Landwehr KR, Hillas J, Mead-Hunter R, King A, O'Leary RA, Kicic A, Mullins BJ, Larcombe AN. Biodiesel feedstock determines exhaust toxicity in 20% biodiesel: 80% mineral diesel blends. *Chemosphere*. 2023;310:136873. doi:10.1016/j.chemosphere.2022.136873
14. Northwest Ports Clean Air Strategy 2020. 2020. https://www.portseattle.org/sites/default/files/2021-04/NWP_CAS_Report_2012_WEB%20%28002%29.pdf
15. Port Houston Clean Air Strategy Plan. p. 78. Report No.: 20211220. https://www.porthouston.com/wp-content/uploads/2022/11/2021-Clean-Air-Strategy-Plan-Update_Final.pdf
16. Alternative Fuels Data Center: Biodiesel Laws and Incentives in California. [accessed 2024 Mar 31]. https://afdc.energy.gov/fuels/laws/BIOD?state=CA
17. Transportation Fuels. Energy.gov. [accessed 2024 Mar 31]. https://www.energy.gov/energysaver/transportation-fuels
18. Argonne GREET R&D Model. [accessed 2024 Mar 31]. https://greet.anl.gov/index.php

This document was compiled by the Science Policy Outreach Task Force (SPOT). SPOT is a nonpartisan organization of Northwestern University researchers focused on advocating for science, evidence-based reasoning, and scientifically-sound policy to the voting-aged public and policymakers. This document does not represent an official statement by Northwestern University. It does not contain an exhaustive summary of all scientific issues but rather is intended to provide background information relative to the topic.

April 2024

For more information, contact: spotforcenu@gmail.com