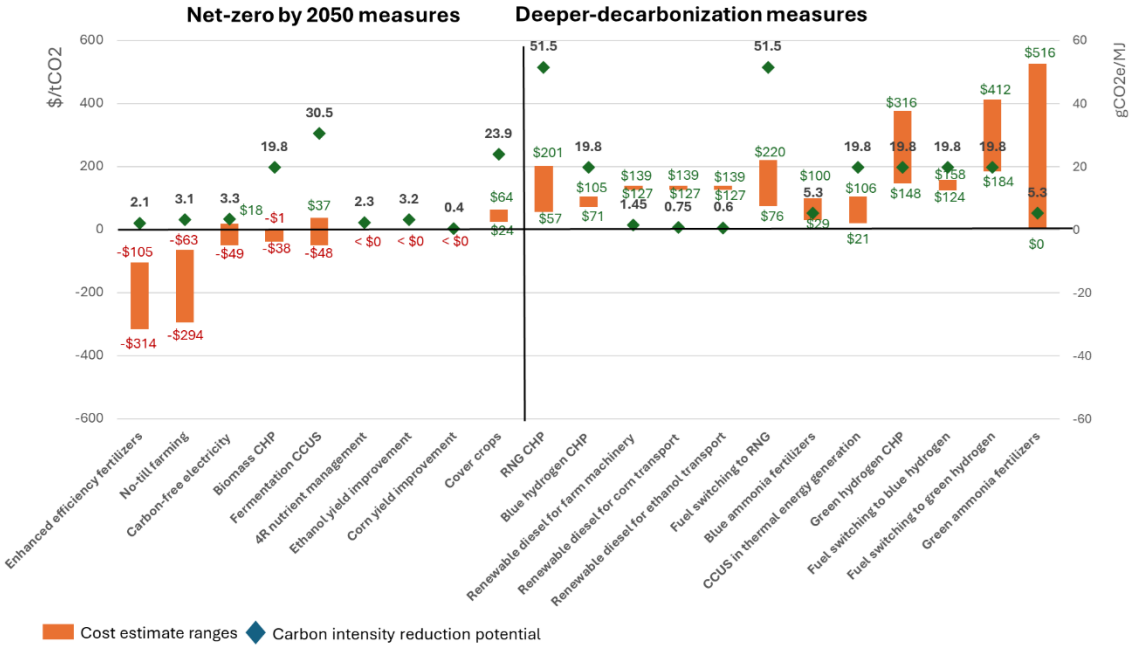
# A Strategic Roadmap for Decarbonizing Ethanol Fact Sheet

**What is the roadmap?** The strategic roadmap to decarbonize the U.S. ethanol industry includes a range of actions to reach net-zero carbon intensity (CI) by midcentury, with additional options to achieve net-negative CI.

**Why a roadmap?** The U.S. clean energy transition requires carbon-free electricity and fuels. Decarbonizing ethanol and increasing blend levels can complement the shift to electric vehicles (BEVs and PHEVs) to reduce emissions through 2030 and beyond. Converting ethanol into sustainable aviation fuel (SAF) will enable large-scale SAF blends. Further decarbonization will also boost the U.S. economy, especially in rural areas.

***Figure 1. Cost and carbon intensity reduction potential by decarbonization measure***




A negative cost means that the new measure costs less than the currently adopted measure due to reduced energy or fertilizer inputs (e.g., no-tillage farming, 4R nutrient management), a lower cost for securing energy (e.g., PPAs), policy incentives (e.g., fermentation CCUS), or additional electricity production (e.g., biomass CHP). Source: EFI Foundation analysis.

**The baseline:** The current life cycle CI of ethanol is 53.6 $gCO_2e/MJ$, which includes net emissions from corn farming, fuel production, and consumption.

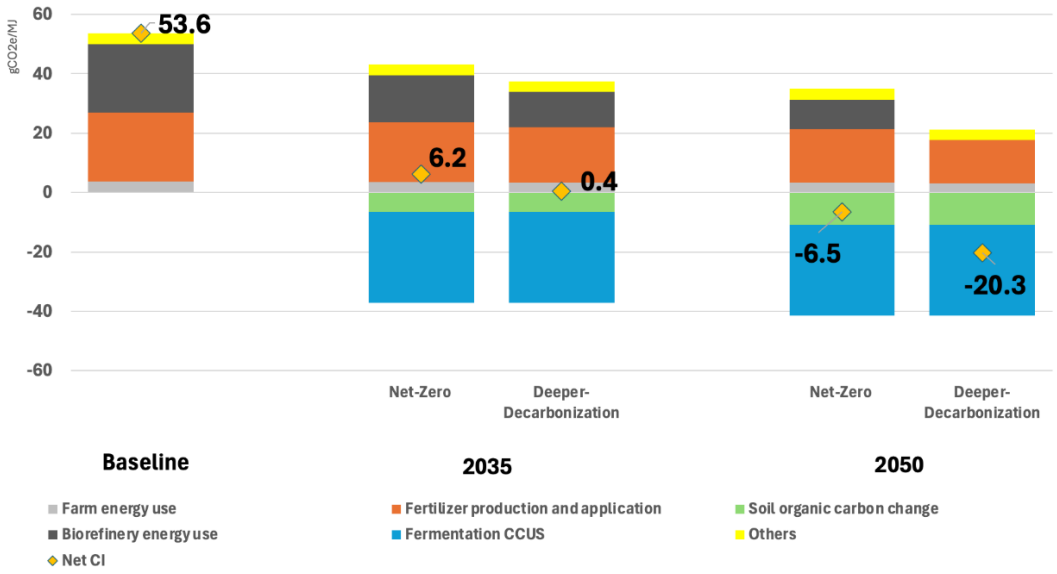
**What are the options for CI reduction?** 21 options were assessed for adoption readiness and feasibility, magnitude of CI reduction potential, and cost-effectiveness, measured in cost per ton (t) of $CO_2$ removed from the life cycle baseline (Figure 1).

**Strategic Decarbonization Pathways:** The 21 options were grouped into two strategic pathways that the ethanol industry could take to achieve net-zero or even negative emissions by midcentury (Figure 2):

- ***Net-Zero by 2050 Pathway***: ready to adopt and relatively low cost/$tCO_2$ removed core measures to reach net-zero emissions by midcentury, with substantial progress toward that goal by 2035.
- ***Deeper-Decarbonization Options***: additional measures with relatively higher or uncertain costs, with a wide range of estimates, or not yet ready-to-adopt, to reach almost net-zero emissions by 2035 and negative emissions by 2050.

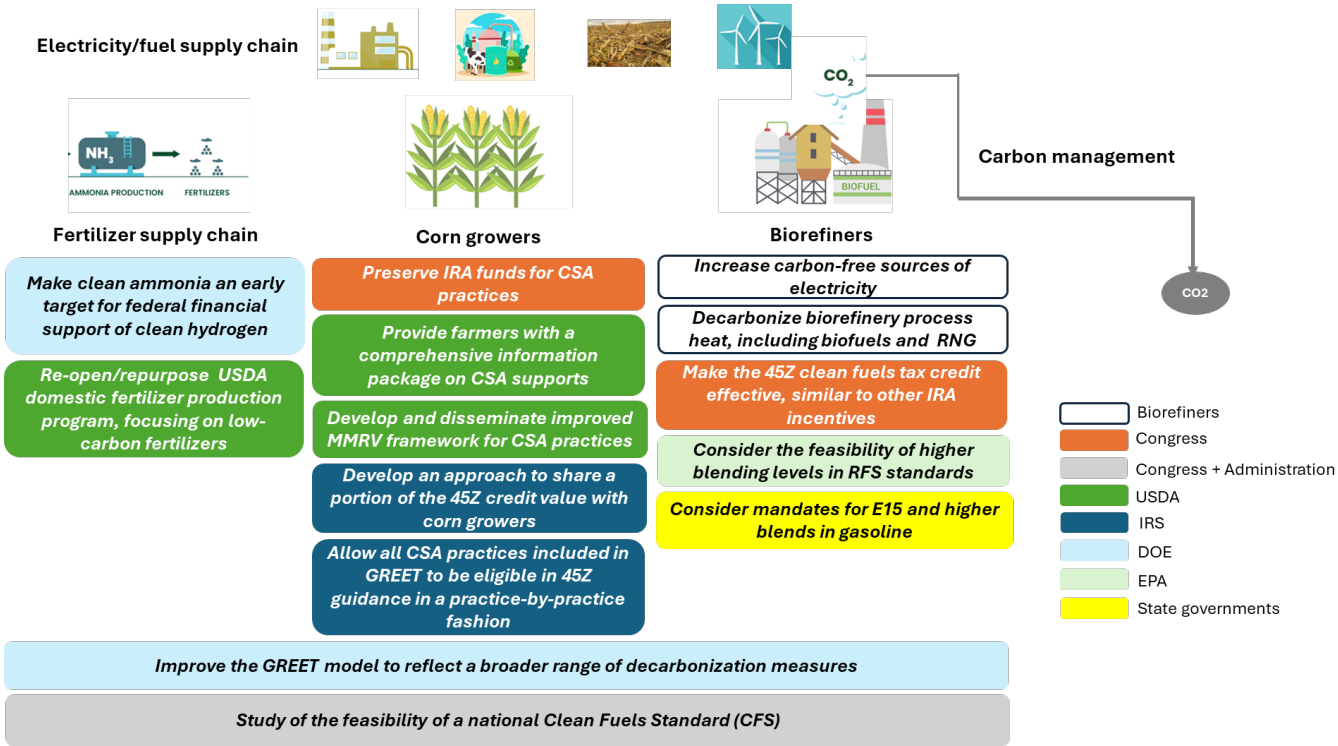
Current incentives provide a foundation for ethanol decarbonization but are not enough. Additional policies are necessary, and the recommendations in Figure 3 are intended to accelerate ethanol decarbonization.

***Figure 2. Ethanol carbon intensity in the Baseline, Net-Zero by 2050 Pathway, and Deeper-Decarbonization, 2035, and 2050***




Under the Net-Zero by 2050 Pathway, a biorefinery can reduce almost 90% of its ethanol CI by 2035 and reach net-zero emissions by 2050. With the Deeper-Decarbonization options, a biorefinery can reach almost net-zero by 2035 and negative emissions in 2050. Source: EFI Foundation analysis.

***Figure 3. Whole of government recommendations to implement the Ethanol Decarbonization Strategic Roadmap***




The ethanol life cycle is complex, and the implementation of a strategic decarbonization roadmap requires coordinated action among corn growers, ethanol biorefiners, energy suppliers (electricity and fuels), fertilizer producers, and an emerging carbon management industry, with support from Congress, the Administration, USDA, IRS, DOE, EPA, and State governments. Source: EFI Foundation analysis.