Overview
1. Sustainably-produced biomass converted to transportation fuels at facilities with CO₂ capture and storage provides net negative GHG emission energy carriers. The negative emissions can help offset positive emissions from fossil fuel supplies.
2. Integrated assessment models project that negative emissions will be needed before mid-century to keep atmospheric CO₂ below a dangerous level.
3. There is much marginal land worldwide. Growing biomass for BECCS on such lands can minimize competition with food crops. Also, marginal lands are often carbon-poor. Establishing annually-harvested grasses can build carbon stores in the soil and roots, contributing additional negative emissions.

A Thought Experiment is developed to explore the extent to which negative emissions via BECCS plus soil/root carbon (SRC) storage might help reduce U.S. GHG emissions from transportation 83% by 2050 (relative to 2005), an aspirational target. EIA-based projections of demands for gasoline for light-duty vehicles, diesel for trucks, and jet fuel for aviation set the demand levels to be satisfied.

BECCS-based Fischer-Tropsch (BTL-CCS) projects in sub-Saharan Africa are imagined to supply, via blending with crude oil-derived jet fuel, ⅓ of U.S. jet fuel in 2050. And emissions credits are purchased from African producers of both CTL via BTL-CCS and gasoline via BTG-CCS to offset emissions from petroleum fuels used to meet US transport fuel demand.

The BECCS projects supply Africa with gasoline and clean cooking fuel. Why Africa?
1. Africa is land rich, including considerable marginal land that might be well-suited for biomass energy.
2. Preliminary indications are that there is substantial capacity for underground storage of CO₂ in Africa.
3. Africa’s economy would benefit from a major new industry like BECCS, and foreign exchange expenditures for fuel imports could be reduced.
4. Hundreds of millions of people in Africa rely on solid fuels for cooking, and suffer severe negative health and other impacts. Clean cooking fuels provided via BECCS could help alleviate these problems.

Potential Biomass Supply in the Thought Experiment
Sustainable supply of grasses grown on marginal lands:
1. NO SRC storage. (SRC = soil/root carbon)
2. With SRC of 0.3 tC stored per tonne of harvested biomass (based on work of Tilman, et al.)

CO₂ storage potential in Africa
Detailed information on CO₂ storage potential in Africa.

Thought Experiment Results

Discussion
The US could meet a stringent 2050 GHG emission target by buying offsets from BECCS projects in Africa that deliver decarbonized gasoline and LPG cooking fuel to Africa. The task is made easier if soil/root carbon (SRC) storage augments geological CO₂ storage. A carbon price about ~$70 would make the economics work, assuming a $90/bbl oil price. For a BECCS investor, the present value of carbon credits received over the life of a project would represent about 80% of the upfront capital invested if no SRC storage is used, or more than 180% with SRC storage.

In anticipation of post-2030 BECCS economic viability, the building blocks for supporting such an industry would need to be laid in the interim. Priority tasks would be to:
- Quantify sustainable biomass supply options, including understanding in detail the potential for SRC storage.
- Quantify geological CO₂ storage opportunities and their proximity to potential biomass supplies.
- Begin to develop requisite physical infrastructures and human capacities to support a BECCS industry.

This Thought Experiment suggests a way economically poor, but biomass-rich countries might become interested in a strong carbon policy with global emissions trading.