What Is The Report?
The Energy Futures Initiative surveyed literature on bioenergy with carbon capture and storage (BECCS) to establish a foundational understanding of BECCS as the first study in a series examining opportunities and challenges related to BECCS.

What Is "BECCS"?
BECCS is one of several carbon dioxide removal (CDR) methods. It is made up of a set of systems that produces energy from biological material while also capturing carbon from processes like energy production and either storing it safely in the Earth or repurposing it.

Why Is Any of This Important?
- Studies by climate and energy experts show that removing existing carbon dioxide from the atmosphere is necessary to successfully combat climate change by limiting warming to 1.5 or 2 degrees Celsius at most, a goal outlined by the Paris Agreement in 2019 to stave off even worst harm from climate change.
- CDR is important for two reasons:
  1. Scientists have shown it’s needed to remove historical emissions, emissions accumulated in the atmosphere form hundreds of years of burning fossil fuels.
  2. It can help offset sectors that are harder to decarbonize, like the industrial sector.
- Scaling up BECCS could be a promising avenue for decarbonization when executed properly, but it needs further study.

How BECCS Works
BECCS pathways present opportunities for rural economic development.

BECCS encompasses a range of technologies; numerous underexplored BECCS pathways are worthy of consideration.

BECCS pathways face opposition; there’s a need for approaches to BECCS that address environmental justice concerns.

Current greenhouse gas accounting rules are limited in fully capturing the life cycle emissions and removal from BECCS.

Captured carbon in a gaseous form is stored in geologic formations for thousands of years. In a solid form (biochar), carbon can be used as a soil amendment and can stay in the ground for centuries.

Carbon is captured either during the energy conversion process, from biomass itself, or from the facility’s exhaust.

Biomass in this context includes forestry and agricultural byproducts, organic waste, animal waste, and purpose-grown crops.

Energy products, like electricity or ethanol (biofuel) are produced that can be used to do things like fuel transportation and heat buildings. The CO₂ from the ethanol is returned to the atmosphere.

Energy conversion occurs through combustion, thermochemical, or biochemical conversion.

Plants store carbon as they grow. Later, biomass is harvested and transported to a BECCS facility.

Scientists advise that BECCS projects remove 6%-36% of the way to its net zero by 2050 goal.

BECCS ranges from $20-$400 per metric ton of carbon.

Climate change modeling includes significant CDR from BECCS, but the actual achievable level is less certain.

Key Findings
Not all BECCS is necessarily carbon-negative, and emission reductions and environmental impacts are project-specific.

A national BECCS industry would require expanded biomass supply chains and CO₂ infrastructure.

There is an opportunity to advance BECCS through existing programs and policies.

Next Steps
In the next part of its series, EFI plans to study the following and opportunities and challenges of BECCS in more detail:

1. The opportunities for BECCS to contribute to sustainable and resilient forests in the Western United States.

2. An evaluation of the socioeconomic and environmental justice impacts of the BECCS industry.

3. An exploration of greenhouse gas accounting issues and ways to ensure BECCS contributes to net-zero or net-negative emissions.

4. A deep dive into sustainable sourcing practices of U.S. biomass feedstocks for BECCS projects.