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With biomass energy, weighing forest restoration and carbon emissions

- EMERY COWAN Sun Staff Reporter

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A feller buncher gathers cut logs in a section of the forest off Elden Lookout Road near Flagstaff in this file photo. A major hurdle for forest restoration in northern Arizona is figuring out what to do with the biomass produced by tree thinning.

- Jake Bacon, Arizona Daily Sun

When state utility regulators held a workshop last month about increasing the use of forest biomass for power, one topic did not make it into the discussion: the emissions produced from burning small trees, branches and treetops hauled from Arizona's forests.

Compared to coal, burning biomass emits lower amounts of key pollutants like sulfur dioxide and nitrogen oxides, but it generally equals or surpasses coal in the amount of carbon dioxide it emits per unit of heat.

Bioenergy supporters, and many government agencies, have deemed the energy source carbon neutral, because trees grow back to replace ones that were cut, reabsorbing the carbon emitted by burning the woody matter.

But many forest researchers say that description ignores the time it takes for trees that are cut down to be replaced by new ones, or the possibility that replacements won't grow back at all. In the meantime, the

capacity for a logged, or thinned, forest to absorb carbon dioxide from the atmosphere is reduced, which means it can take decades to centuries for new trees to reabsorb the amount of carbon emitted in the burning of their predecessors.

“You need time to pay the debt back, it doesn't get paid back instantly,” said Mark Harmon, a professor emeritus at Oregon State University who works on the movement of carbon in and out of forests.

It’s that longer payback period that can make the fuel source problematic for climate change targets that call for reducing greenhouse gas emissions in the shorter term.

In Arizona, the calculation is even more complex because biomass power is being considered not only as an energy source but as an integral part of much-needed restoration of the state’s ponderosa pine forests.

Supporters see bioenergy as a vehicle to speed up forest thinning work on the Four Forest Restoration Initiative, or 4FRI, by creating a valuable use for forest residues, thus making the work more attractive to logging companies.

But as regulators, utilities and land managers consider throwing their support behind forest-based biomass energy linked to 4FRI, it begs the question: in a project meant, in part, to thin trees in order to make the ponderosa forest more resilient to climate change, does it make sense to promote energy that adds more planet-warming gases to the atmosphere?

At least three environmental groups involved in 4FRI are split.

The Sierra Club would rather see the forest slash used to make wood products that would sequester, or store, carbon rather than having it be burned, the nonprofit’s Arizona director Sandy Bahr wrote in an email.

She questioned what kinds of pollution controls would be installed on any new biomass plant and the potential for a net increase in carbon emissions.

In the eyes of the Grand Canyon Trust, the small size of any new biomass plant and the pressing need to clear built-up fuels from the region’s forest outweigh potential emissions concerns, said Travis Bruner, the Trust’s Arizona forests program director. The Center for Biological Diversity’s Todd Schulke said he too would be “cautiously positive” about a biomass plant that was appropriately sized to support 4FRI's ponderosa pine thinning.

Outside of biomass energy, there simply isn’t another alternative use for those forest residues that is economic and scalable, Bruner said.

"Part of our calculous is informed by that, part of it is informed by the carbon released by pile burning or wildfire if we don't do (forest thinning)," he said. "Here, (biomass power) is an ancillary to forest restoration."

BIOPOWER BENEFITS

Arizona already has one utility-scale biomass power plant in Snowflake, on the east side of the state.

The facility uses up woody biomass from 15,000 to 20,000 acres per year, Novo BioPower CEO Brad Worsley said. In addition to the fact that trees grow back, Worsley said his fuel source is renewable and carbon-neutral because it's using carbon, stored in the tree, that is already part of the carbon cycle and would otherwise burn up or decay in tens or hundreds of years. Fossil fuels, on the other hand, are reintroducing carbon that has been buried for millions of years.

Worsley said that what he burns in his power plant is the bark, limbs and small trees that can't be made into many other wood products that would sequester carbon, as Bahr had mentioned.

While his plant does burn forest material and produces emissions, it also helps make the forest less prone to catastrophic wildfires that would burn through, and emit, much more, Worsley said.

"We are protecting the large, healthy, fire-resistant carbon receptors," he said, referring to the types of trees that loggers are generally required to leave in the forest.

Burning woody biomass in a wildfire or a pile burn also produces more particulate matter and carbon monoxide than burning it in a biomass plant.

The Center for Biological Diversity isn't unconcerned with carbon emissions from biomass energy, but is also considering other factors, Schulke said.

"If we do restoration properly and burn in a controlled environment, it still creates carbon but it's a lot cleaner and contributes positively to our ability to do restoration," he said. "It's kind of a balancing act that we're doing."

STILL SKEPTICAL

A brief from Washington State's Department of Natural Resources describes biomass as carbon neutral because while carbon dioxide is being emitted from burning biomass, the gas is "simultaneously being reabsorbed by growing forests."

But Harmon said that math doesn't work out if one thinks about a single forest. In a simplistic scenario, if half of the trees in a forest are harvested and burned for biomass energy and it takes two years for the forest to grow back to its original capacity to sequester carbon, its per-year sequestration average will be

less than a forest where all of the trees remained for all three years. Even though the trees grew back, there was a period when carbon sequestration was reduced, bringing down the average.

And in thinning projects where the idea is to reduce tree density in the long run, total carbon storage will permanently be lower than pre-thinning, also challenging the notion of carbon neutrality, he said.

Studies Harmon has done of forests burned by wildfires also show that even high-severity fires burn only about 30 percent of the biomass in a forest, releasing only that amount of stored carbon back into the atmosphere. That means that the benefits of forest thinning as a means to prevent the possibility of even more carbon release during wildfires is often overstated, Harmon said.

Sami Yassa, a senior scientist with the Natural Resources Defense Council, has written critically about assumptions of bioenergy's carbon neutrality as well.

In a modeling study, Yassa found that the biomass was, in many cases, comparable to coal in total, life-cycle carbon emissions for at least the first three to four decades before replacement forests grew back. Letting that forest material break down naturally instead of burning it would keep carbon stored for much longer, Yassa said.

But leaving the biomass on the forest floor to decompose isn't what is called for in the 4FRI plan.

On about a quarter of the acreage under contract in 4FRI, the loggers can leave piles of biomass, but those are later burned by the Forest Service, spokeswoman Brienne Pettit wrote in an email. Everywhere else, the material has to be removed. Besides trucking chipped woody biomass to Novo BioPower, 4FRI contractors also sell the chipped material as landscaping material or for heating pellets, Pettit wrote.

WHAT TO DO?

Figuring out the emissions equation for forest biomass is a complex question without simple answers, said Gregg Marland, a research professor with the Research Institute for Environment, Energy and Economics at Appalachian State University.

In his view, if the wood is going to either be burned in big piles or left to decay anyhow, then "I think you gain by using some of the wood to displace coal or natural gas," Marland said.

But if the question is between burning the forest material and making a longer-lived product out of it, Marland and Yassa agreed it's the latter.

"We think if you can capture that carbon in long-lived product you're doing better for the climate," Yassa said.

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