Economics of using mesquite for electricity dependent on outside factors

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Mesquite biomass could be feasible for electricity generation things like grass production were factored in. Credit: Texas A&M AgriLife Research photo

Using mesquite biomass for electricity generation may become economically feasible if ecological and agricultural factors are considered, according to a Texas A&M AgriLife Research paper being published in the *BioEnergy Research* journal.

"Economic Feasibility of Mesquite Biomass for Electricity Production: Projections of the Long-term Sustainability of Two Harvest Options" will appear in the April issue of the journal.

The paper was written by AgriLife Research personnel Dr. Jaesung Cho, postdoctoral associate; Dr. Seong Park, economist; Dr. Jim Ansley, rangeland ecologist; and Dr. Mustafa Mirik, associate research scientist, all in Vernon.

Their study estimated the long-term economic feasibility of mesquite biomass in electricity production under five different harvest scenarios, Park said. They examined variations in rates of standing biomass accumulation and tree density re-establishment after harvest using an above-ground-only or whole-plant harvest option.

Other work by Ansley has shown the heating value of mesquite is nearly equal to low grade coal.

The ecological and agricultural benefits of harvesting mesquite for bioenergy make it a potentially viable alternative to coal, Park said. More traditional income from these lands, such as livestock grazing and hunting, would be enhanced, and mesquite control costs would be reduced.

Current control methods of mesquite include herbicide sprays, mechanical treatments and prescribed fire, Ansley said. Herbicides and mechanical treatments can be costly for landowners. And prescribed fire, the least expensive option, has limited use due to the smoke distribution and higher risk of damage to non-target areas, especially during drought.

Increased grass production would lead directly to increased agricultural income through grazing by cattle, and leaving patches or strips of unharvested mesquite among harvested areas would increase wildlife habitat, he said. Mesquite reduction also could lower soil erosion due to the increased grass cover and increase off-site water yields into rivers and streams.

However, the researchers found some drawbacks to using mesquite as a bioenergy feedstock for electricity production. Re-growth and harvesting costs vary greatly, depending on the harvesting methods, rainfall and soil type. This can disrupt the supply of mesquite biomass for a power plant.

A previous study showed the re-establishment of mesquite biomass from emerging seedlings following whole-plant harvest would take considerably longer than regrowth from a plant with above-ground only harvest, Park said. The whole-plant harvest technique is considered to be less expensive compared to the above-ground harvest due to the difference in harvesting procedures.

However, the much greater re-establishment rate that occurs with the above-ground harvest options makes this more economically viable than the whole-plant harvest option, he said.

Mesquite also has a low applicability in existing power plants due to the high lignin content and its fibrous structure, Ansley said. Due to this structural limitation, mesquite biomass cannot be burned completely in the conventional firebox of existing power plants because coal mills cannot effectively produce a powder from the woody biomass.

The study determined pre-treatment techniques, such as torrefaction, which is a roasting of the wood to dry it down, and pelletization, may be required to increase the grindability, combustibility, uniformity, density, handling ability and energy efficiency of mesquite biomass during the electricity generation process, he said. This generates additional production costs.

Park said they concluded that, given the regrowth characteristic of mesquite and structural limitation of the biomass, a cost-effective processing method must be determined before recommending mesquite as a potential bioenergy feedstock.

Overall, he said, the study determined the above-ground harvest method, with 17 years of rotation length before re-harvest of the brushy regrowth, generated the largest economic returns to a power plant. It was more economically viable than a whole-plant harvest plan because of the much faster re-establishment rate before the next harvest. Frequency in the whole-plant harvest option could be as long as 40-50 years.

In addition, the above-ground harvest option was more viable because tree density would never decline – essentially all trees would re-establish shoots immediately after harvest – whereas, in the whole-plant option, the tree density level would have to be re-established from new seedlings, Ansley said.

"Regarding the economically optimum 17-year rotation for re-harvest in the above-ground scenario, this might be too long for ranchers interested in livestock grazing," he said. "Typically, grass used for grazing will flourish for seven to eight years after mesquite is harvested, but at about 10 years, mesquite regrowth begins to out-compete grasses for water and light."

So from a livestock production standpoint – and a selling point for ranchers to commit their pastures to periodic mesquite harvest in the above-ground scenario – harvesting every 10-12 years would be more attractive, he said.

Therefore, a biomass operation based on the above-ground harvest scenario may have to settle for a less-than-optimum harvest cycle to meet the needs of other income streams on a particular property, but would still be better in the long run economically than the whole-plant harvest option, Ansley said.

More information: "Biomass for Electricity Production: Projections of the Long-Term Sustainability of Two Harvest Options." Jaesung Cho, Seong C. Park, R. James Ansley, Seung-Churl Choi, Mustafa Mirik, Taewoo Kim *BioEnergy Research*. March 2014. link.springer.com/article/10.1007%2Fs12155-014-9447-3#page-1

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