Woody Biomass Industry in Utah

The Story of the Utah Biomass Resources Group

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The Utah Biomass Resources Group (UBRG) has a mission to facilitate the development of a woody biomass industry in Utah and to promote public biomass education and outreach. Part of that mission is being accomplished with music. The UBRG hosted Utah’s first-ever wood fired concert in September of 2012 under the pavilion on Main Street in Beaver, Utah. The Dragon Wagon, Utah State University’s mobile gasification demonstration unit, supplied power for the concert. The Muddy Boots Band played country rock for 150 people while USU Extension Agent Mark Nelson cooked burgers for the crowd. This was part of the third annual Southern Utah Biomass field days, co-hosted by Southern Utah Biomass, USU Beaver County Extension and the UBRG.

The Dragon Wagon is a former Air Force delivery van that was retrofitted to haul a gasification reactor and electric generator. This unit is designed to demonstrate how woody biomass can be converted directly into electricity. The project is funded by a USDA Forest Service “Fuels for Schools” grant that was awarded to the UBRG by the Utah Department of Agriculture and Food.

In gasification, a controlled amount of oxygen reacts with the biomass at a high temperature, 800 degrees C. When the wood is cooked in this fashion, gasses are released and captured. Under these controlled conditions, there are very few emissions from the process. The gasses produced from the wood chips are piped into a standard propane generator that produces electricity. This system makes about 8 kilowatts of power, approximately enough for one or two homes, or one loud country rock band.
UBRG Goals, Partnerships, and Strategies
The UBRG’s goals include seeing woody biomass markets established and available to Utah landowners and land managers in Utah while improving the economy of forest management activities. This will allow more acres to be restored to a more resilient form while adding jobs and value to rural economies. The UBRG is taking a variety of approaches toward meeting those goals including the development of gasification and pyrolysis technologies, promotion of biochemical and conventional products, and the advancement of cofiring and educational opportunities. Led by Utah State University Extension, the project partners include the Bureau of Land Management, the USDA Forest Service, the Utah Department of Agriculture and Food, Amaron Energy, the Utah Division of Forestry, Fire and State Lands, the Utah Office of Energy Development, and others.

Part of the UBRG’s strategy is to initially focus efforts on Pinyon Juniper (PJ) woodlands and branch out to include upland forests and other biomass feedstocks. PJ is plentiful and available and currently has limited commercial value. PJ covers some 100 million acres in the Western U.S. (Romme et al., 2008), and in many cases this resource is in need of thinning. PJ covers ten times the number of acres that it did at the time of European settlement in America (Miller and Tausch, 2002), due to a combination of fire suppression, grazing, and favorable weather patterns. This is referred to as PJ expansion. An additional concern is PJ densification, in which the trees fill in until there is no open space between them, the woodland growing thicker and more impenetrable all the time. This density is expected to triple in the coming decades (Tausch, 1999). The result is a less diverse and less resilient landscape that offers little in the way of biodiversity or forage but offers significant potential for a wildland fire catastrophe.

The BLM is treating 40,000 acres of PJ annually in Utah, but the pace of restoration is limited by money. If the PJ resource had value, it could finance the cost of restoration activities, allowing land managers to treat more acres. This effort will require a tremendous amount of labor, creating jobs in the process. The result can be a Great Basin landscape that is more resistant to weeds and wildfires and communities that are more resilient to economic fluctuations.

Applying Available Technologies to the Biomass Challenge
Perhaps the biggest challenge of working with woody biomass is its high air and water content. A truckload of wood, even when chipped up, is mostly air and water. This severely limits the distance it can be economically trucked. The challenge therefore is to densify the product before hauling it out of the woods as a valuable product. Mobile pyrolysis may be one of the keys to densification.

The UBRG is partners in a mobile pyrolysis unit: a self-contained trailer that converts woody debris into densified biomass. Pyrolysis cooks the wood in the absence of oxygen at lower temperatures than gasification to produce three products: producer gas, biochar, and bio-oil. The producer gas is used to keep the process going, sustaining its own system once up and running. Biochar is sometimes defined as charcoal engineered for agriculture and it carries a high value as a soil amendment and offers soil carbon storage potential. Bio oils can be used in traditional fuel oil heating applications and can be converted into biochemical products and fuel.

The UBRG has also contracted with two Utah entities to assess the potential of mixing wood with coal, known as cofiring, in Utah power plants. This included a series of cofiring tests and an exhaustive review of the scientific literature on the topic.

The bottom line of the potential for cofiring at Utah power plants is that it can be done physically, and PJ is a good feedstock for the purpose, but in Utah there are no economic incentives such as tax credits, nor are there regulations to encourage power production from renewable sources, as exist in some other states. Adding wood to the coal presents a wide variety of potential pitfalls, and the utility operators have little incentive to do so under current conditions.

Another path the UBRG is pursuing includes making
high-value biochemical products, such as plastics and adhesives, from woody biomass. UBRG member Dr. Foster Agblevor, USTAR Endowed Professor at Utah State University, has been making plastic from wood biomass bio oils for months now and says that PJ is ‘Good stuff’ for making plastics.

If making plastic from wood seems like a distant goal for the UBRG, take heart in the fact that it is simultaneously promoting more conventional woody biomass products such as firewood harvesting, post and pole manufacturing, animal bed shavings, and more.

**Education**

From wood-fired concerts to presenting at a variety of scientific conferences, the UBRG is helping to spread the word about biomass utilization in Utah. The UBRG has co-hosted annual field days and biomass summits, published a variety of articles in the Utah Forest News and other publications, presented on radio and TV and hosts the website utahbiomassresources.org. In 2011, the UBRG co-hosted the Restoring the West Conference. The conference title neatly sums up the UBRG’s goals and plans for promoting biomass utilization in Utah: “Sustaining Forests, Woodlands, and Communities through Biomass Use” (see restoringthewest.org).

**Comparisons Between Technologies and Renewables**

It has been our experience that gasification of wood in the field is possible but challenging. We set out with the Dragon Wagon project to demonstrate that a farmer or rancher could use this technology to create mobile, remote, economical power. We are learning however, that it requires a full time person with a wide complement of technical skills to produce consistent power. This requirement negates the economic and practical advantages of producing electricity with wood in this manner. Cofiring on one hand makes a lot of sense, especially considering the vast sums of material that could be utilized. However, it adds considerable complication to a coal based system and without external pressures to use wood, such as incentives or regulations, cofiring is unlikely to happen.

We are therefore focusing our attention on mobile pyrolysis and its ability to produce a marketable, densified biomass product in the field, such as biochar. A fleet of self-contained mobile pyrolysis trailers could largely replace the need for open burning in the forestry and agricultural sectors. This level of biomass utilization can provide other societal benefits such as offsetting the costs of wildland fire hazard reduction projects, removing nuisance smoke from the air, and improving wildlife habitat.

Even with these advantages perhaps the greatest argument for utilizing woody biomass becomes more apparent after comparing it to other energy feedstocks. Woody biomass is not a fossil fuel and it is not food. It is one of the few renewables that offers the potential to produce power regardless of whether the wind is blowing or the sun is shining. Given the energy challenges we face as a nation it makes sense to use this waste product to produce needed energy commodities such as bio oils and soil amendment products such as biochar. Woody biomass is stored solar energy – local, organic, and secure.