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Non-Woody Biomass (Brewery Spent Grain) Report

ABSTRACT:

Central Oregon Intergovernmental Council (COIC) has been researching and collecting data for different sources of woody and non-woody biomass in the Central Oregon area to create economic markets for waste materials. This collection of brewery spent grain (BSG) data will assist in feasibility reports of whether there are future markets in utilizing the biomass for many different projects (from biomass heat to biochemicals and others). This report discusses non-woody biomass sources in Central Oregon, in particular BSG (a byproduct of the beer fermentation process), and its feedstock availability for biomass projects in the future. BSG has the potential to be part of a profitable market in Central Oregon due to its high volume and low cost as well as an existing research and project framework base for biochemical products using BSG.

INTRODUCTION:

Biomass in Central Oregon

As development of woody biomass sources and projects evolve in Central Oregon, discussion over other sources of waste in the community that could be utilized for local market values coevolve as well. The biomass energy cluster project that includes the tri-counties of Crook, Deschutes and Jefferson all have ample wood quantities from prescription forest thinning as well as invasive juniper clearing and removal that can be used in this energy project, while non-woody sources are still being researched (Delaney, 2015).

The timeline for the biomass projects has been forecasted from July 2015 through June 30, 2018. The approach taken for the project as a whole is still in preliminary stages, but assessing and characterizing the biomass supply in terms of volume, sources and costs for current materials create the foundation for further project development and implementation. Creating a holistic and fully-understood local feedstock availability will allow for a market to develop slowly as well. Only after the feedstock evaluation, feasibility studies, financing and outreach will there be momentum for projects to be implemented.

The target markets for biomass (both woody and non-woody) include a variety of products that have the potential for sustainable values in our local vicinity, as well as competitive national, and possibly international value. These markets include biomass electrical power and heat (space heat or heat products- pellets, bricks, or firewood), biofuels, and biochemicals (naturally derived chemicals that substitute for petrochemicals currently used) (Delaney, 2015).

Communities and businesses in Central Oregon have already expressed interest in pursuing biomass projects as well. Currently proposed projects include; Oregon State University (OSU) Cascades

district heating; Deschutes County; Mt. Bachelor biomass heating; Intermountain Wood Energy; and a large private energy developer. As more projects become implemented and businesses see success through sustainably harvested/collected sources, the longevity of biomass usage in the area could persist and thrive.

Brewery Spent Grain Feedstock Availability

Bend, Oregon has become one of the craft beer meccas of the country in the last decade. As of 2015, there are 29 breweries in the Central Oregon area (beermebend.com, 2016). With the sheer abundance of breweries, the waste byproduct from the fermentation process is one of the largest waste products in the region. On average, the BSG from every batch of brewed beer equates to 85% of the total byproducts, which creates a problem of where and how to dispose the agricultural byproduct. A byproduct after the mashing process is called the brewers spent grain (BSG) which accounts on average for 31% of the original malt weight and is available year round (Musatto et al 2006). Therefore, as long as beer is being made, breweries will need to dispose of the BSG as well.

Traditionally, the BSG is simply given to ranchers and farmers in the local vicinity as a donation and there are no monetary costs on either side. Ranchers gladly pick up the BSG from the brewery and use it as cattle feed (a fermented wet protein concoction that tastes delicious to cows). Recently however, there has been a larger amount of research and development focused on recycling and creating new products from bioresources, such as BSG. With new naturally-derived biochemicals production, BSG can become second-generation value to a brewer, creating a market for BSG and extra revenue to breweries in the Central Oregon area. These projects can face barriers though because of the location and composition of feedstock, time, environmental effectiveness, technological feasibility, social acceptability and economic affordability (Salihu et al 2011).

Because projects that create biochemicals from BSG have been profitable on a national level, the BSG created in Central Oregon has a lot of potential for a future market value (Casey, 2012). Since the BSG is of a no-cost and no-revenue balance currently, commercial exploitation of BSG can lead to markets where not only is the BSG something that can be profitable for the brewery to dispose of, but the biochemical products made from BSG can be valued at a price higher than its current use as livestock feed (Kotlara et al).

METHODS:

There were many different modes of collection for data on spent grain resources in the Central Oregon region. First, there were three questions asked to every brewery- the quantity of spent grain produced at the brewery (the brewery was allowed whatever timescale was most convenient for them- most breweries answered by weekly production); the disposal method for the spent grain; and lastly the costs involved with disposing the spent grain. Most of the answers provided were from the head brewer or brewery owner. Other employees, like quality assurance managers or tap room managers were able to answer for the breweries as well. Many times these questions were answered quickly with approximates instead of paper-derived data. The survey interview occurred in the first two weeks of

April 2016. To collect the data, there were phone interviews, email interviews, and in-person visits to the brewery site to collect the answers to the three questions.



Personal photo: Borlen Farms' co-company Agri-Cycle (Alfalfa, OR) picking up BSG from Boneyard Brewery while visiting for an interview.

After obtaining the raw data from the breweries, formatting answers for quantities and disposal methods began. For the BSG quantity results produced for each brewery, the quantity answer was calculated per week in pounds, and then the annual quantity in tons. To convert the answer given in dry grain quantities to wet grain, (most breweries answered in dry grain quantities) the 1:1.7 ratio was calculated using Kotlara's article for the ratio, "one hundred kilograms of barley produces 170kg of wet brewers' grains (having 80-85% moisture)". After finding the weekly pounds of BSG, the product was multiplied by 52 for weeks per year and divided by 2,000 referring to the amount of pounds in one ton, which produced the tons per year.

RESULTS:

The amounts collected from each brewery were approximates, thus a collection of approximate answers combined can be far from the true amount of feedstock available. Table 1 exhibits the list of breweries that were willing to provide information. Out of the 29 breweries located in Central Oregon, only half of the breweries were willing to disclose quantities and disposal methods for their BSG. To ensure that an even assortment of breweries were sampled, there were three categories to differentiate breweries due to the quantity amounts of spent grains. The small breweries produced 0-3,000 pounds BSG per week, the mid-sized breweries produced 3,001-20,000 pounds weekly, and large breweries produced 20,000 pounds and above. From this separation method, the total breweries in Central Oregon has 15 small sized breweries, 8 mid-sized, and 6 large breweries. The breweries that disclosed information though were evenly collected in all size groups.

Tons of BSG range from 8 tons to 22,100 tons annually, depending on the production size of the brewery. The disposal method of a brewery-ranch relationship was a commonality among all the breweries. Deschutes Brewery and Three Creeks Brewing were the only breweries that were paid for their spent grain (most likely due to their larger quantities). The remaining breweries had a strictly donation basis or mutual benefit agreement where there would be no money transactions. Breweries that donated spent grain have different agreements about who supplies the clean plastic containers

(totes) for transport from brewery to ranch. Some breweries were able to have a closed-loop agreement that the beef raised on the spent grains would be sold in the brewpubs, but many breweries do not have brewpubs to use the meat.

Brewery Title	Quantity BSG Lbs/Week	Quantity BSG Tons/Year	Disposal Method	Costs Associated with Disposal
Ale Apothecary	900	23.4	Rancher (unnamed)	Donation (sometimes exchange meat/beer)
Bend Brewing Company	17,600	457.6	Rancher (Unnamed)	Donation
Boneyard Beer	47,500	1,235	Borlen Farms (rancher)	Donation (farm gifts beef sometimes)
Bridge 99 Brewery	765	20	Rancher (ostrich)	Donation
Cascade Lakes Brewery	25,500	663	Rancher (Unnamed)	Donation
Crux Fermentation Project	12,240	318.24	Rancher ("Carl")	Donation
Deschutes Brewery	852,941	22,176	Distributor collects	Received ~\$14.00/ton
Goodlife Brewing	44,200	1,149.20	Rancher (Dave from Anchor Heart Ranch)	Donation (pub uses meat sometimes)
Kobold Brewing	340	8.84	Rancher (unnamed)	Donation
McMenamins Old St. Francis	22,950	596.7	Borlen Fams/small urban farmers/Village Baker	Donation
North Rim Brewing	1,100	28.6	Rancher (unnamed)	Donation
Sunriver Brewing	12,000	312	Rancher (from LaPine)	Donation
Three Creeks Brewery	15,725	408.8	Rancher/Cascade Disposal	Rancher pays per tote/Pays Disposal
Wild Ride Brew	2,975	77.4	Rancher (Piggyback Ranch)	Donation
SUM TOTAL:	1,055,836	27451.27		

Table 1: Results from survey interviews for approximate BSG quantities, disposal methods and costs associated with disposal method. Colors represent small breweries (0-3,000lbs/week) in blue, midsized (3,001-20,000lbs/week) in green, and large (20,001-900,000lbs/week) in blue.

DISCUSSION:

Creating biochemicals in the Central Oregon area has potential to be successful because of the quantities of BSG, the steady amount of BSG throughout the year, and the support of a local economy ethos. Not only are there more breweries opening than closing every year, but the majority of breweries are producing more beer each year as well. With the growing popularity and expanding marketplace for Central Oregon craft beer, BSG will be an abundant and stable product that can be perhaps as marketable as the beer is. From a culture where both the local populace and visitors are increasingly more concerned with how businesses are environmentally sustainable, making a cooperative of breweries that can boast a net negative waste stream could have large marketing values added as well.

Commercial opportunities for using BSG to produce biochemical products will need a steady supply of feedstock and an organized collection process from the breweries in the region. In the past, Blue Marble Biomaterials has partnered with Anheuser-Busch (AB-InBev) in using BSG to manufacture shaving creams, additives to candy, and soaps (Great Lakes Echo, 2012). The substitution from a donation economy of BSG for livestock feed to a profitable market for BSG that lessens the need for petrochemicals in food and health products could benefit the whole community.

Barriers to the creation of a BSG biochemical market in Central Oregon include the creative incentives that would substitute the traditional relationship between breweries and the ranching community. In order for biochemical companies to have constant supply, there needs to be enough breweries committed to the biochemical company year-round. Potential problems can also stem from larger breweries demanding different payment or having the most power in the rules and payments for the total brewery cooperative.

Significant information is still needed to create feasibility assessments for BSG in Central Oregon. Out of the fifteen breweries that did not reply information about quantities or where their

spent grains are disposed of, three breweries are of the largest size of brewery (producing over 20,000 pounds of BSG on weekly basis). With complete information provided by all the larger-sized breweries, the total amount would not only be significantly larger than 27,000 tons annually, but create a much closer approximate number for quantity analysis. Ten of the breweries that did not disclose information were of the much smaller scale breweries, where batches of beer are infrequent and produce much less BSG.

There are also other sources of biomass in the region that are not yet being used to its fullest efficiency that could produce more market opportunities. Biomass sources that have been used in successful biomass heat and energy projects elsewhere in the world could also have a potential place in Central Oregon. Using grass clippings and landscape woody debris from golf courses for biomass heating on-site at the club houses is one option that is being done in England. Multiple golf courses in Europe have converted electric heating of club houses to biomass heat by creating on-site or buying biomass pellets that are used in the boiler system (Golf Club Management, 2012). As of 2015, there are 25 golf courses in the Central Oregon region. The opportunity to make cooperatives using larger biomass sources in the community for energy has been successful in Florida. The Sunshine State Biomass Cooperative has 105 members that include landscaping, tree trimming, golf courses, and land clearing businesses and has been able to reduce disposal costs and make the material into valuable agricultural products, all while sharing the profits (Sunshine State Biomass, 2016).

Cannabis production in Central Oregon has also grown extensively since recreational legalization in 2015. Compared to smaller indoor growing operations and smaller outdoor operations, much of the unusable biomass (stems, roots, and fan leaves) are either thrown away, composted on-site, or paid for yard debris at the Deschutes County Landfill. After discussion with Oregrown, one of the largest single-source dispensaries in Central Oregon, they disclosed that currently all of the biomass is composted on-site at their 84 acre property in Tumalo, but when their outdoor recreational licenses are approved this spring, there will be five times the amount of biomass and this will most likely end up going to yard debris landfill. Dylan Delveccio, a manager at the dispensary said that the company would be very interested in working with the community to find different ways to use the biomass for projects.

CONCLUSION:

The organization of collaborative waste projects can create markets for our local economy. Through the collection of quantity sources of BSG in the Central Oregon area, there would be over 30,000 tons annually of BSG that is currently donated to ranchers and used as feed substitute, into a profitable market creating biochemicals that can reduce our dependence on petrochemicals.

Even without the addition of large brewery data that is missing currently, the report can give the biomass projects in the region a better understanding of the immense amount of BSG that can be used as material for biochemical products. Alluding to the fact that the total amounts of BSG produced from the combination of breweries in Central Oregon is far above what is needed for a biochemical plant, the next steps would be to confer with a biochemical company and depending on quantity of feedstock for a biochemical plant in the Central Oregon region, give enough value to BSG that there is enough to

provide a switch for breweries to choose between a donation-based BSG market, and a paid cooperative market.

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