

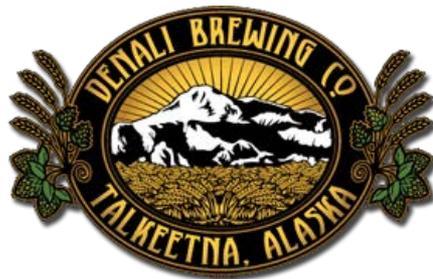
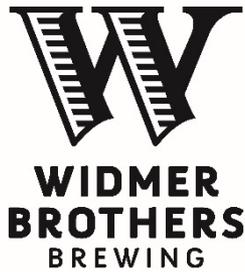


Craft Brewers: Froth with Opportunities



Pacific Northwest Pollution Prevention Resource Center (PPRC)
September 2016

Some of our Brewery Acquaintances



Some of our Technical Assistance Friends



College of Engineering

Energy Efficiency Center



DEPARTMENT OF ENVIRONMENTAL QUALITY



P2 Checklist for Craft Brewers (by CBA) (Excerpt)



6/1/2016
3

Total Score			
3	225	3	1

ENERGY

PDX	WD	PS	KO
V	M	N	

1=no progress; 2=underway; 3=complete

General

Submeter pub & office usage

3	3	3	1
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Status/Notes

Shutoff idling equipment during breaks & end of production

	1		
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Conveyors. Look at interlocking racking conveyors so go off auto

For upgrades & replacements, purchase energy efficient versions

	2		
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Clean heat exchangers periodically

	?		
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Check w/ Main't

Don't use hot water for cleaning when not necessary - lower temp where possible

	2		
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Don't use compressed air for cleaning when not necessary

	2		
--	---	--	--

Shade windows that may be causing heat gain to an area. Close shades in the evenings

	n/a		
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Shades in tour gallery

Insulation is in place and in good condition (steam, hot water, chilled water, & glycol)

	1		
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Areas that are damaged/missing - B1 boiler feedwater tank, CO2 (pipes were frozen in lower brewhouse),

Lighting

Prioritize T5s & LEDs. Replace HIDs, metals halides, T12s, T8s, incandescent, etc.

	3		
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Install photocells, occupancy sensors & timers, including on exterior fixtures

	2		
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Areas that need sensors: Hop cooler (need to check switches to s from malt storage), cellar, warehouse, etc. Check conveyor bridge

Maximize daylighting - skylights, photocells by window banks, solar tubes

	n/a		
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Delamp when light levels are adequate to perform tasks safely - check required

	?		
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bldgs - are lights left on? B1 dock lights can be turned off on brig

Resounding Environmental Priorities and Efforts

- ◆ Energy
- ◆ Water Consumption
(Reduce ratio of BBL water to BBL beer)
- ◆ Wastewater Reduction/ Management
- ◆ CO₂

- ◆ Organic & Solid Wastes
- ◆ Certifications: B Corp / Salmon Safe



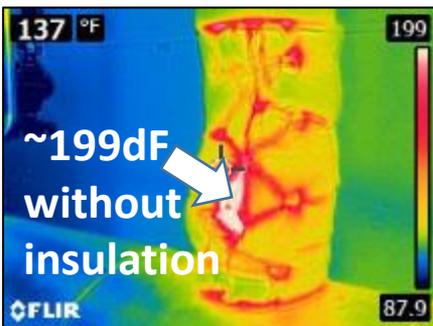
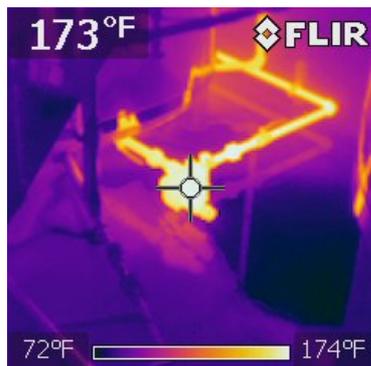
Energy



- ◆ High-efficiency HVAC / e.g. Smart chiller (with VFD “brain center”) & 95% efficiency boiler @Worthy
- ◆ Lighting retrofits
- ◆ Automated controls - conveyor shut-off, refrigeration, etc
- ◆ Compressed air leaks/optimization
 - \$19,000/year savings for Redhook (ultrasonic leak detect)
- ◆ Insulation of steam & glycol systems & lines
 - @Fort George/Payette
- ◆ Solar panels to preheat water @Worthy
- ◆ Separation & auto controls /seasonal
“air sharing” between climate control areas @ Summit
- ◆ Bike Friendly Work Place/incentives @Fort George

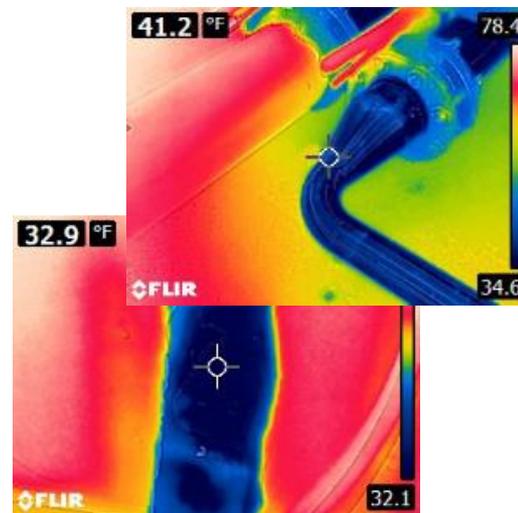


Steam Systems (Traps, Piping, Etc)



IR Audit Findings

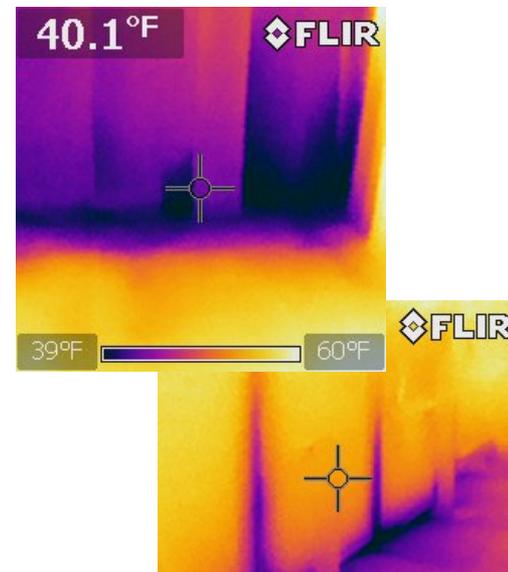
Glycol Lines



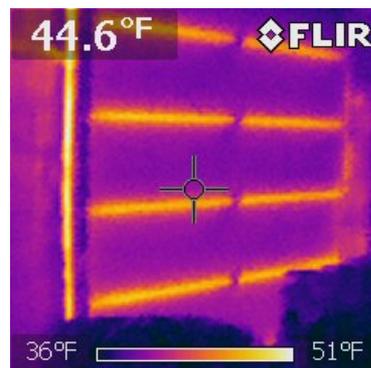
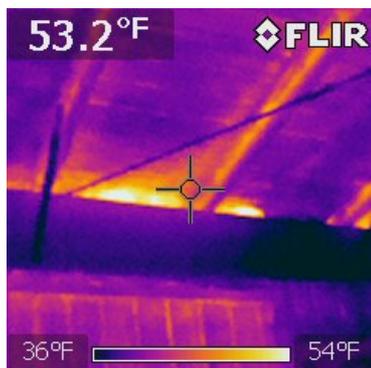
Motors/Pumps/Belts



Cold Storage & Climate Controlled Zones



Weatherization



Energy



AR No. 1, Lighting

Install an automated integrated lighting control system to control lighting schedules and replace incandescent lighting with more efficient lighting sources. This will increase lighting efficiency while reducing associated annual energy consumption by 61%.

AR No. 2, Insulation

Wrap exposed pipe, steam generator surface, and condensate tank shell with fiberglass and calcium silicate insulation. This will reduce heat loss from hot surfaces, lowering energy consumption by 87% per year.

AR No. 3, Expansion Analysis

During a planned upcoming pub house expansion, install compact fluorescent lighting instead of traditional incandescent. This will use 67% less energy and require 75% less maintenance.

Assessment Recommendation Summary

#	Description	Percent Savings	Energy Savings (MMBtu/yr.)	Cost Savings (\$USD/yr.)	Total Cost (\$USD)	Payback (years)
1	Lighting	13.0%	74.1	\$1,439	\$9,079	6.3
2	Insulation	76.4%	434.0	\$4,050	\$3,100	0.8
3	Expansion Analysis	10.5%	59.8	\$2,676	\$437	0.2
Totals		100.0%	567.8	\$8,165	\$12,616	1.5



~220' of exposed pipe + boiler & condensate shell tank

Source: OSU EEC Energy Analysis, 2006.

Water

- ◆ Reclaim (e.g., capture wort-cooling water -1500 gal tank allows reuse of almost all KO water @MSBC)

- ◆ Ionized air “rinse” for cans @Redhook Portsmouth

- ◆ Water broom

- **Use a water broom.** This device connects to a hose and is driven by standard water pressure. It can use 10% of the water of a hose alone.



Source: City of Portland
Cleaning & Sanitation Factsheet

<https://www.portlandoregon.gov/water/article/372813>

- ◆ Lube-free conveyors avoids lube @Redhook



Water

Pilot Projects (*Goal: Reduce heated water and sanitation chemicals*)

- ◆ Pending: Fog-In-Place sanitation (using PAA) (@Widmer Brothers)
Estimate reduction in water use by over 90%: technology currently used in some beverage production (e.g., OJ)
- ◆ Electrochemically Activated Water Sanitation (@Merrimack Ales)

Material	Units	Old Process	ECA Process	Reduction
Cleaner (PBW)	lb/week	10.77	5.387	50% reduction
Acid (Nitric/ Phosphoric) Cleaner	Gal/week	4.14	0.78	Eliminated except for special quarterly process
Sanitizer	Gal/week	0.673	0.048	Eliminated except for special quarterly process

Proposed ECA Process & Operating Costs				
Tank	Steps	Materials Used	Weekly Cost for chemicals, water and energy	Weekly Cost for chemicals, water and energy
Mash Tun	Rinse	Water	\$12.53	\$25.13
	Wash	50% reduced PBW + 30% catholyte		
	Sanitize	20% anolyte		
	Final Rinse	Water		
Brew Kettle	Rinse	Water	\$11.80	\$25.86
	Wash	50% reduced PBW + 30% catholyte		
	Sanitize	20% anolyte		
	Rinse	Water		
Fermenters	Rinse	Cold Water	\$28.56	\$50.26
	Rinse	Hot Water		
	Wash	50% reduced PBW + 30% catholyte		
	Sanitize	20% anolyte		
	Final Rinse	Cold Water		
Fermenters & Bright Beer*	Rinse	Hot Water	\$7.51	\$7.51
	Wash	PBW		
	Acid	Nitric/Phosphoric		
	Sanitize	StarSan/Saniclean		
Bright Beer	Rinse	Cold Water	\$2.19	\$11.47
	Sanitize	20% anolyte		
	Rinse	Cold Water		
Total Weekly Cost:			\$62.59	\$120.22
Total Monthly Cost:			\$266.03	\$510.95

- ◆ Pending: Electrostatic Spray Sanitation (using hypochlorus) (@Merrimack Ales)
Merrimack Ales/Toxics Use Reduction Institute (TURI)

Wastewater



Water conservation = Less Wastewater

(e.g., suggestions on previous slide)

- ◆ Determine highest strength streams (beer & yeast loss, trub, tank heel, beer in returned kegs/bottles, DE, etc) – segregate/pull
- ◆ Automatic pH monitor/adjust system @ Fremont Brewing
- ◆ Solids interceptor
- ◆ Cyclone - 5 -10% reduction in beer loss @Payette
- ◆ Some larger breweries turning wastewater into biogas and /or water
 - ◆ Co-gen system offset 10% of natural gas @Redhook NH
 - ◆ Bio-electric system provides energy and water recovery/reuse @Bear Republic 50% (estimate) offset of energy use @Lagunitas Brewing 40% reduced water footprint

Wastewater BMPs

- ◆ King County issuing BMPs for craft brewers in jurisdiction
 - <3,000 BBL expected to implement BMPs, no permit
 - >3,000 BBL expected to implement BMPs, permit pH & solids
- ◆ Brewer's Association – New wastewater BMP manual pending
- ◆ Look to cities/counties for assistance – Collaborative effort

Reno, NV: *“Lately we are the land of microbrewerys. We issue a permit stating that they have to put filters on floor drains and no disposal of material in sewers”.*

Bloomington, IN *“We do not design any part of the system for them, but we do make them submit engineer-stamped drawings of pretreatment system, ensuring sizing is adequate for their projected flow. We sample each alcohol manufacturer for BOD & TSS surcharges monthly. We find high and low pH, BOD as high as 20,000 ppm and as low as 700 ppm. We have seen good solids removal with solids interceptors. Because of BOD and pH fluctuations, we permitted our largest brewery”.*

Bend, OR - *“high strength” wastewater – defined by the City of Bend = over 2,000 mg per liter– can pose a problem for POTWs. ...can be extremely variable in pH, corroding pipes and water collection systems. As more Bend breweries produce higher volumes of beer and waste, they increasingly need to think about managing high strength waste.”*

Wastewater BMPs



Here's an out-of-control fermenter's blow off entering the drains. This material should be side streamed and land applied as fertilizer.

10 BARREL BREWING CO

Current BMP examples:

- Capturing water from heat exchange in hot liquor tank
- Increasing number of high strength lines to side-stream tank
- Standardizing brewing and cellaring procedures
 - Reduce chemical usage
 - Side-streaming practices
 - Pin point water saving opportunities

Near future equipment improvements:

- Centrifuge
- New packing equipment
- Replacing cascading spray balls

10 Barrel Goals:

- Reduce overall water consumption
- Reduce organic loading
- Reduce chemical use

CO2

- ◆ Address leaks and losses in lines and storage
 - CO2 subject to volume loss during transport and storage
- ◆ Pinpoint Carbonator @ Hopworks Urban Brewery saves \$5k /year
- ◆ Hard lines @MSBC
 - Flexible/soft tubing more subject to leaks, friction loss
- ◆ CO2 recovery (*according to our current knowledge, this is still only cost-effective for larger operations, but even small breweries emit a large amount of CO2 at around 8-10 pounds per barrel of wort produced ([Energy Star](#))).*
- ◆ Nitrogen (N2) generators @Mac & Jack's, Midnight Sun Brewing Company (MSBC)

Uses for N2

- Cover headspace of stored ingredients, tanks
- Purge kegs, cans, bottles
- Reduce fobbing when discharging beer from storage to filtration
- Purge equipment and pipelines

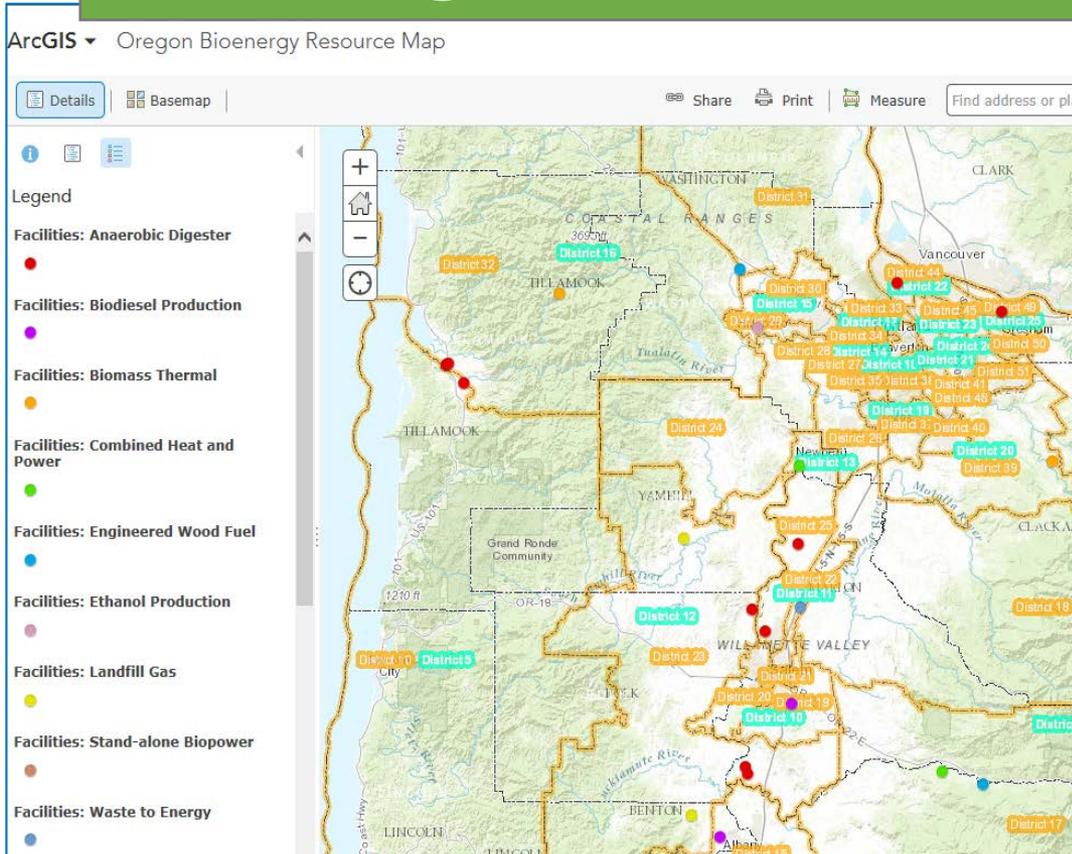


Nitrogen Generator

- MSBC (8500 BBL) was spending \$60k-\$70k on CO₂
- Installed 15 hp N₂ generator (+air compressor)
- \$60k full install
- Purity level important, 99.5% pure nitrogen
- ROI 2 years
 - After two years will save:
 - \$30-35K in annual CO₂ purchases
 - \$3-4K when brought online as a compressor
- Mac & Jack's (Seattle) report good success and much less CO₂ usage with their new N₂ system



Organic Wastes



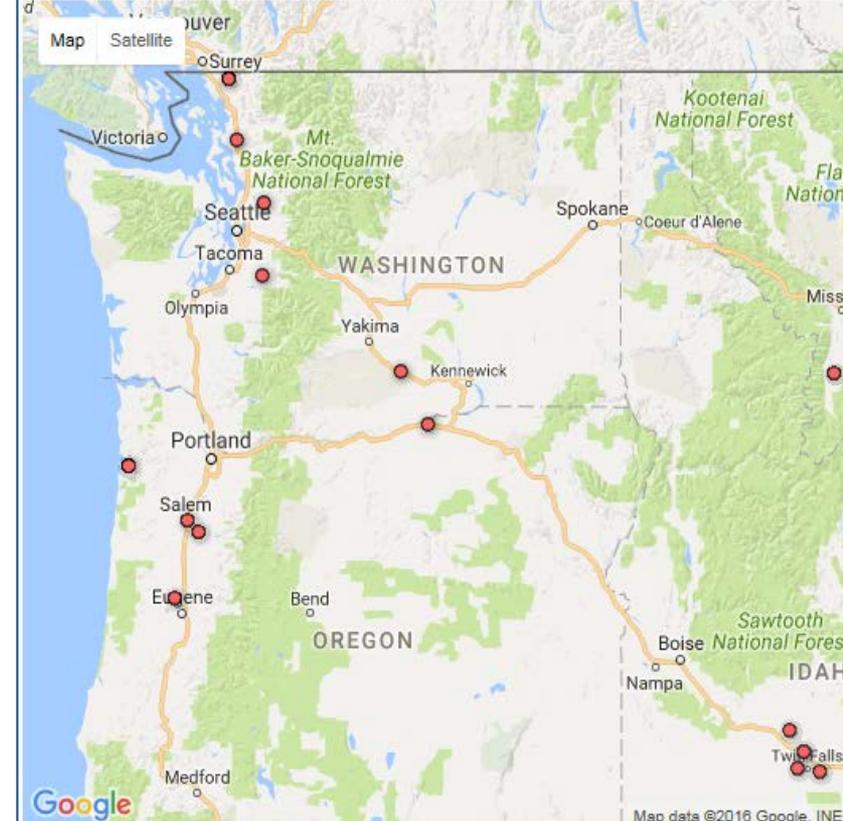
Operational Biogas Systems in the U.S.

Display/Hide Feedstock Maps

TIP: Select a single feedstock for detailed information on each site.

Agriculture
 Landfill
 Wastewater

Agriculture (updated 9/11/14) [view full screen]



- Solids (and yeast) to livestock feed
- Food scrap collection (prep/waste) to compost or feed @Fort George
- Anaerobic digesters
- WiserG (expanding to VanCouver)

Solid Wastes

Work on increased recycling for customers and staff

SIGNAGE IS PROVEN TO INCREASE DIVERSION

Contact Sustainable Connections for help with troublesome recyclables.



Multi-layer hops storage bags,
Crosby is testing a PP bag
which would be recyclable



Solid Wastes



- Eliminated disposable cups for in house use (primarily kids' drinks)
- Waste sort/increased recycling
- Establish baseline for benchmark
- Food scraps to farms



Safety /PPE equipment recycling program



NOW WE ZERO RECYCLING IS NOW

ORDER ZERO WASTE BOXES | HOW IT WORKS | CONTACT US

Search



Safety Equipment and Protective Gear - Zero Waste Box™

Size
Small Shipping Box ▾

\$106.00 USD

Add to Cart

DESCRIPTION
Use this box to recycle safety products.

WHAT IS INCLUDED
Shipping Box with 4 colored stickers
Pre-paid UPS return shipping label
Processing and Recycling of waste

ACCEPTABLE WASTE
Please send us your used safety equipment and protective gear including earplugs, beard nets, hair nets, gloves and safety glasses.

@ All Craft Brew Alliance breweries

Stormwater



Galvanized HVAC and roof & siding → ZINC in stormwater.

- Coatings (zinc free)
- Filtration at downspouts from roof.



DIY filtration box at downspout

Source: Washington Stormwater Center/Port of Vancouver

<https://www.youtube.com/watch?v=COib6WLxTNE>

Parking lot filtration pond at HUB.



More Information & Contacts

Join Sustainable Craft Brew ListServ - Share learnings and successes with other brewers so we can all learn from each other.

Send email to craftbrewenvirolistserv-subscribe@yahoogroups.com.

New Sustainability Coordinator /Mentor @ Brewer's Association

John Stier - sustainabilitymentor@brewersassociation.org

Sustainability Dashboard App, Sustainability Benchmarking Report

Release After GABF

Wastewater Manual (Release ~Nov)

PPRC Craft Brew Topic Hub

http://pprc.org/wp-content/uploads/2016/09/craft-brew-th_update-9-8-16.pdf

Contacts: PPRC mgaither@pprc.org

Puget Sound Energy, Hunter Hassig

Washington Department of Ecology – Tony Cooper (360-584-2479)

Sustainable Connections – Mark Peterson

City of Bellingham – Caanan Cowles

Hopworks – Continuous Improvement

Lean/Continuous Improvement

Manufacturing Matters (consultant, along with ODEQ & OSU Energy Efficient Center)

Warehouse Optimizations

Reduced number of can pallets in inventory

Reduce glass breakage (conveyors)

Annual Savings: \$35,128

Seasonal Transitions

Reprioritized operation activities; improved “on time” delivery.

Increased Revenue: \$35,230

Culture Change and Quality Assurance –

Continuous improvement – weekly meetings – staff involvement/ownership of problem solving

Annual Savings: Priceless

Certifications

- Salmon Safe - facility
- B Corporation

