# Brewing Byproduct and Wastewater Management

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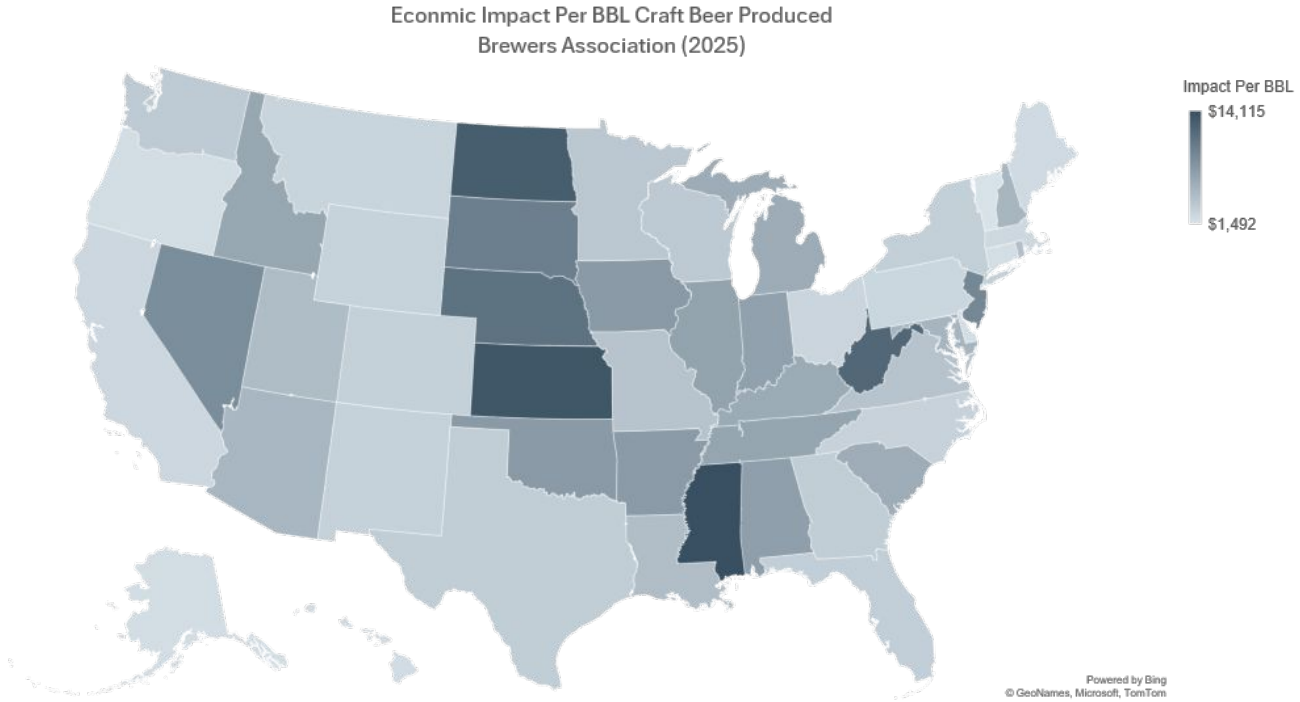
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NEEFC/BetterBev

Maine Beer Company
*Do what's right.*

New England neefc Environmental Finance Center

GREEN CRAFT BEVERAGE BETTER BEV RECOGNITION

# Per Barrel Economic Impact



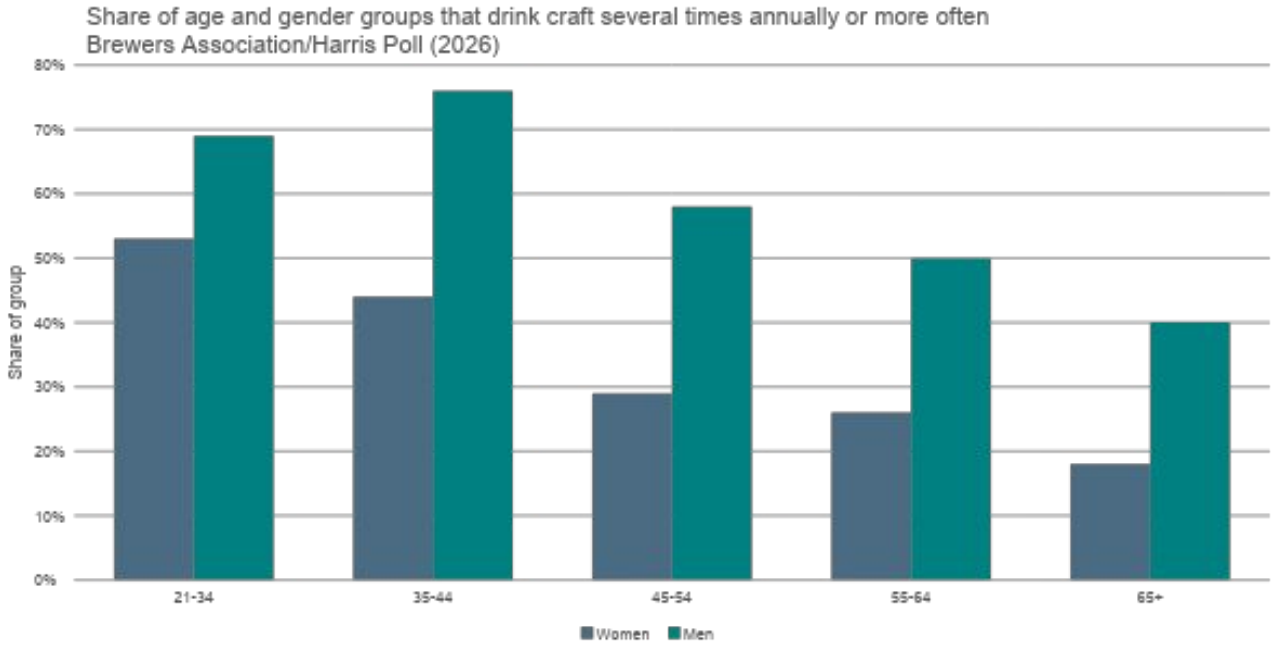

Source: Brewers Association

# A Closer Look at New England

| State | Impact/BBL | State | Impact/BBL | State | Impact/BBL |
|---|---|---|---|---|---|
| Alabama | $7,227 | Kentucky | $6,197 | North Dakota | $12,937 |
| Alaska | $1,942 | Louisiana | $4,590 | Ohio | $2,597 |
| Arizona | $5,179 | Maine | $2,175 | Oklahoma | $7,683 |
| Arkansas | $7,549 | Maryland | $5,408 | Oregon | $1,942 |
| California | $2,408 | Massachusetts | $2,324 | Pennsylvania | $2,480 |
| Colorado | $2,955 | Michigan | $6,183 | Rhode Island | $4,497 |
| Connecticut | $1,854 | Minnesota | $3,713 | South Carolina | $6,037 |
| Delaware | $1,855 | Mississippi | $14,115 | South Dakota | $10,026 |
| District of Columbia | $5,632 | Missouri | $4,096 | Tennessee | $6,700 |
| Florida | $3,123 | Montana | $2,645 | Texas | $3,249 |
| Georgia | $3,225 | Nebraska | $11,131 | Utah | $4,688 |
| Hawaii | $1,995 | Nevada | $8,791 | Vermont | $1,492 |
| Idaho | $6,517 | New Hampshire | $5,303 | Virginia | $4,121 |
| Illinois | $6,883 | New Jersey | $9,284 | Washington | $3,468 |
| Indiana | $7,082 | New Mexico | $2,881 | West Virginia | $12,051 |
| Iowa | $7,671 | New York | $3,075 | Wisconsin | $3,525 |
| Kansas | $13,519 | North Carolina | $2,853 | Wyoming | $2,815 |

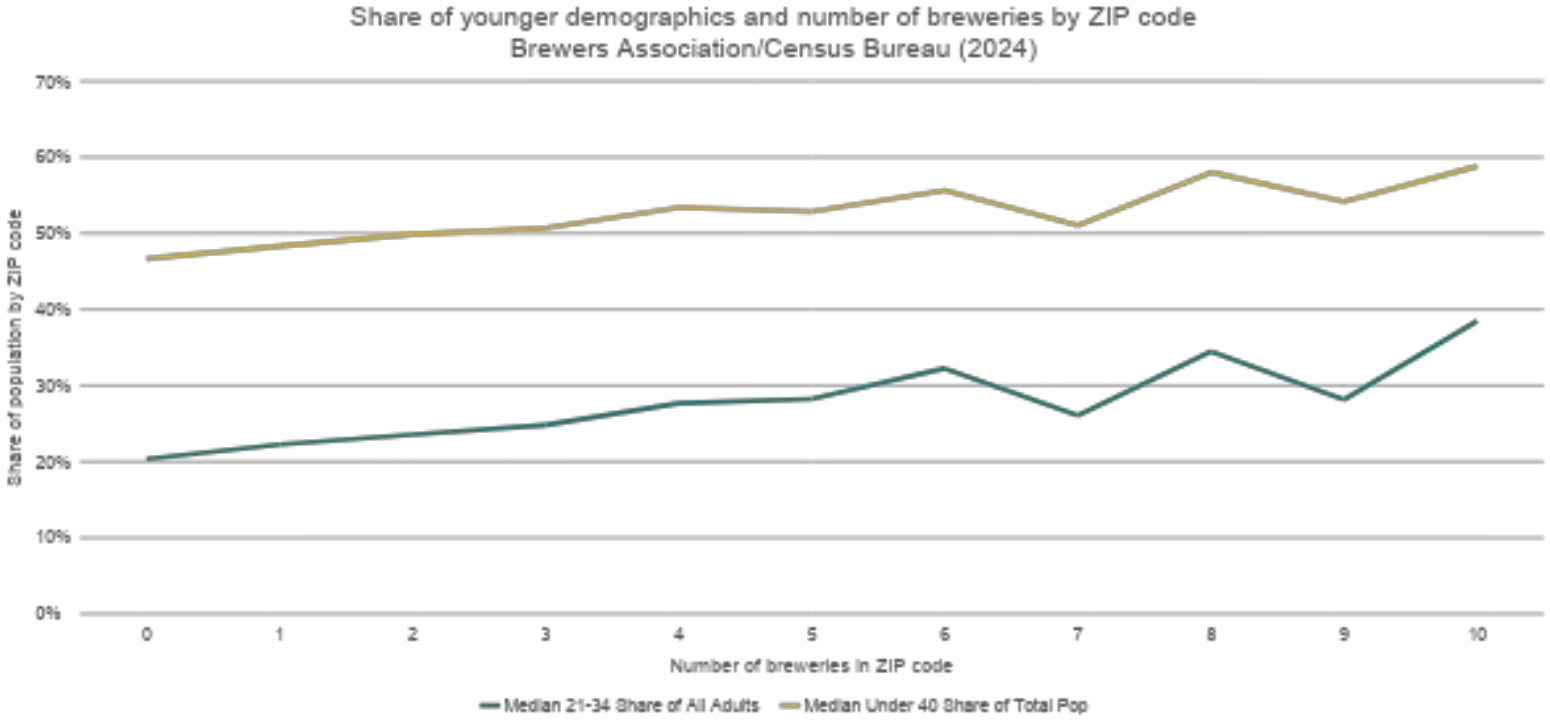
Source: Brewers Association

# Who Drinks Craft Beer




Source: Brewers Association

# Age Demographics and Craft Breweries




Source: Brewers Association

# Breweries and Pretreatment

A few things to consider:

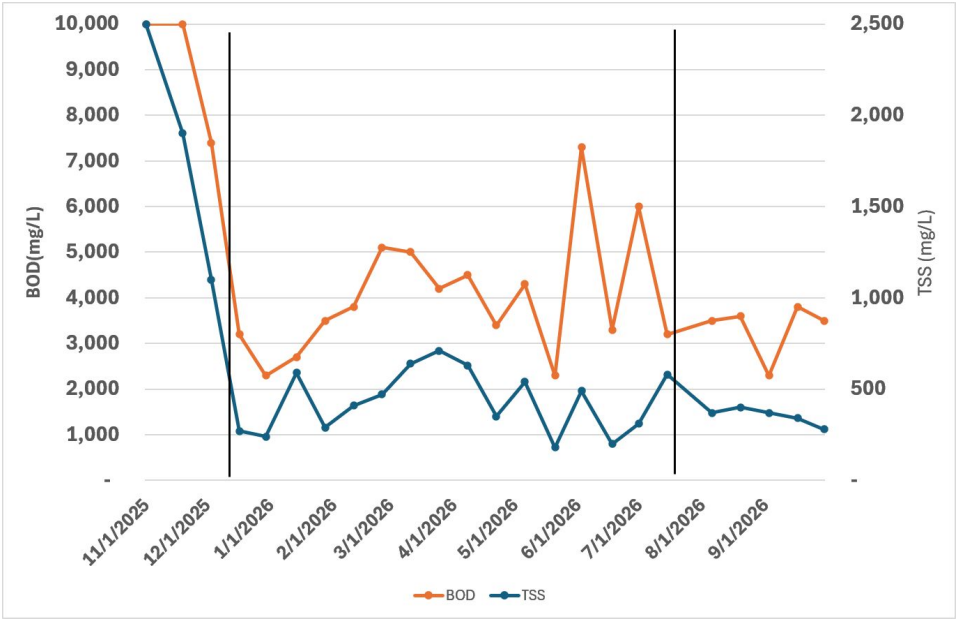
- Brewing byproducts are not wastewater.  They are a resource
- Sidestreaming/reusing byproducts saves water, energy, and waste
  - This includes spoiled/waste beer
- A lot of brewery wastewater compliance energy may be focused in the wrong areas
  - Is it possible to shift the burden through incentives vs surcharges?



# Inside the Brewery

**Batch processing rarely provides a constant flow of effluent, and the slugs are never neutral**

**500 gallons of high strength effluent being generated within a 20 minute window is not only common, it's built-in**



# Inside the Brewery

**Point Source ID: Hot Trub**
**Effluent Profile: Grain solids, hop particles, coagulated proteins, wort**
**Flow: 2,500 gallons per week**



# Inside the Brewery

**Point Source ID: Cold Trub**
**Effluent Profile: Yeast, hop particles, coagulated proteins, beer**
**Flow: 3,200 gallons per week**





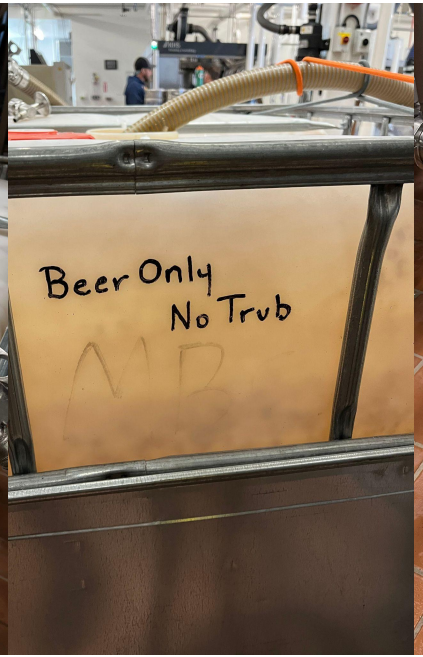

# Inside the Brewery

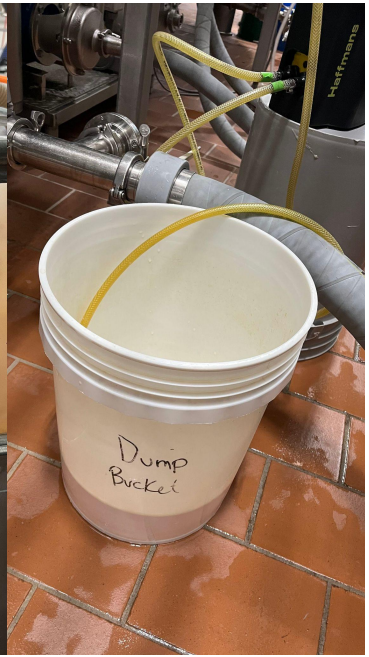
**Finished Product**

**5%-7% ABV**

**Flow: ~180 GPD**





# Brewery Byproducts

| | BOD* | TSS* | DO | GPD |
|---|---|---|---|---|
| Cold Trub | 199,000 | 35,000 | <50 ppb | 650 |
| Hot Trub | 85,000 | 8,500 | 5 ppm | 500 |
| Finished Product | 220,000 | 41 | <50 ppb | 180 |
| Wort | 151,000 | 1,510 | 10 ppm | 250 |
| Yeast | 220,000 | 41 | <50 ppb | 159 |

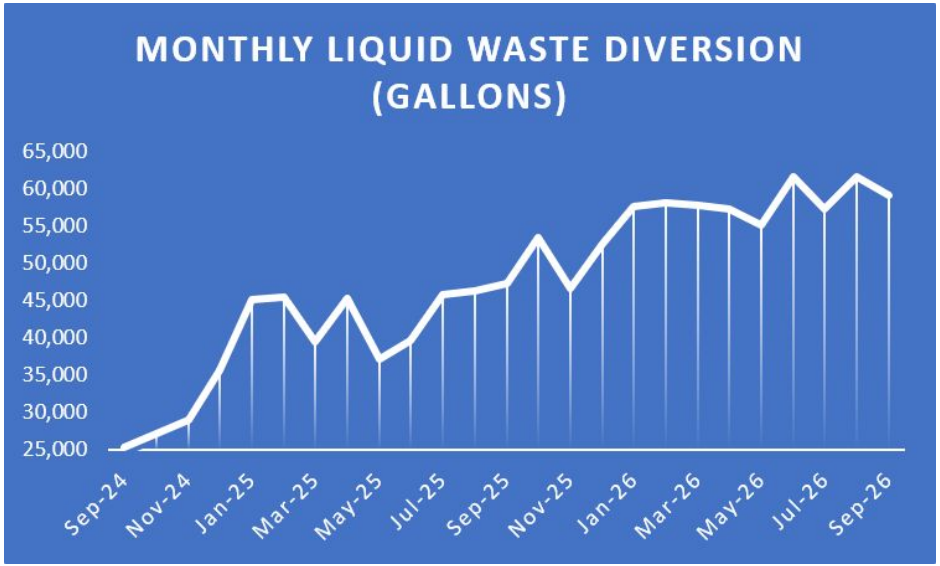
*mg/L



# Partnerships

Sample Name:Maine Beer Co Trub

| Parameter | Wet weight basis (As Received) | Lbs/1000 gallons (Liquid) |
|---|---|---|
| Moisture (%) | 95.1 | |
| Total Nitrogen (%) | 0.22 | 18.3 |
| NH4-N (%) | < 0.01 | < 0.1 |
| Organic-N (%) | 0.22 | 18.3 |
| Phosphorus (%) | 0.03 (x 2.29 = 0.07 % $P_2O_5$) | $P_2O_5$ = 5.8 |
| Potassium (%) | 0.04 (x 1.21 = 0.05 % $K_2O$) | $K_2O$ = 4.2 |
| Calcium (%) | 0.03 | 2.5 |
| Magnesium (%) | 0.01 | 0.8 |
| Boron (ppm) | 1.0 | 0.01 |
| Copper (ppm) | 0.0 | < 0.01 |
| Iron (ppm) | 13 | 0.11 |
| Manganese (ppm) | 2 | 0.02 |
| Sodium (ppm) | 24 | 0.2 |
| Zinc (ppm) | 2 | 0.02 |



# Room for Improvement, Weak Wort



Reclaiming Weak Wort and Mash/Lauter Rinse Water

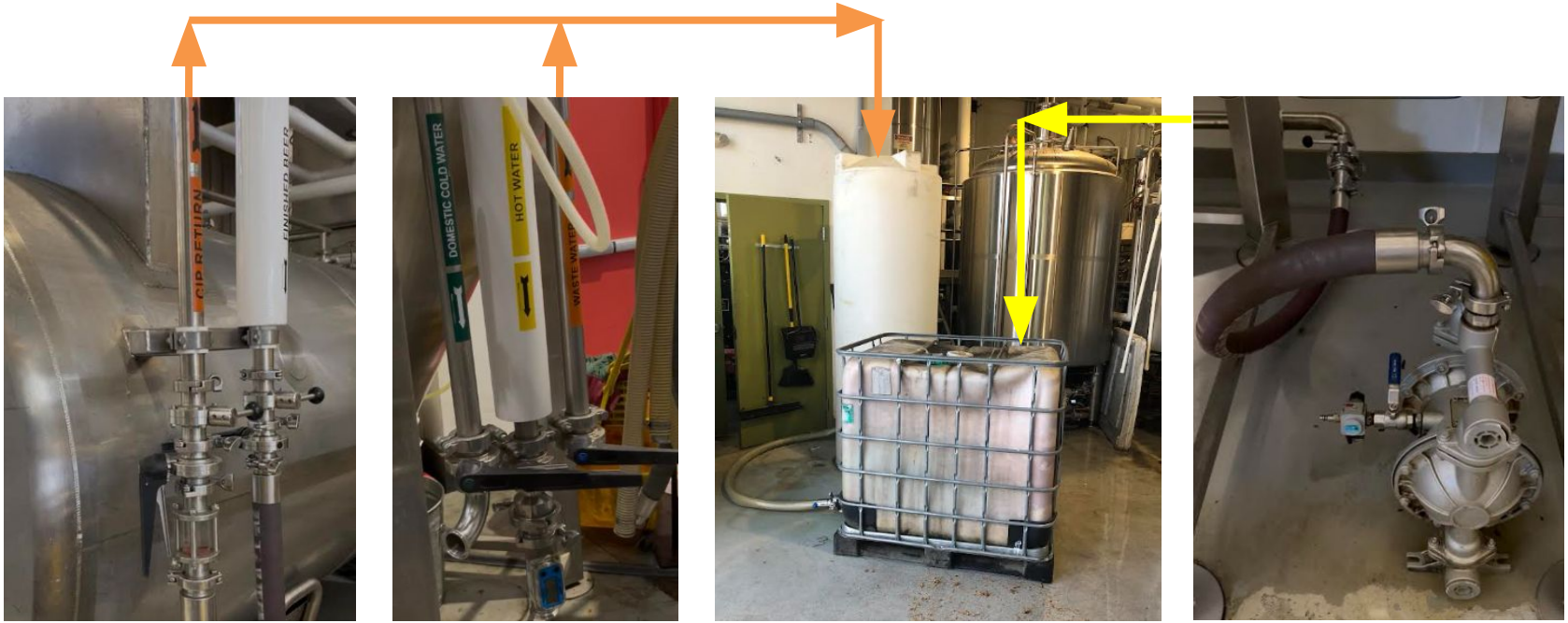
- Weak wort/Rinse water at Maine Beer Company comes in at >3° Plato, around 250 gallons in volume, 4x/day
- BOD = 25,000 mg/L, TSS= 8,700 mg/L
- Has value as sparge water given its dissolved sugars
- Weak wort recovery skid saves ~$115,000 annually in wastewater fine avoidance, sidestream cost avoidance, and grain and extract savings

# Room for Improvement, Cont'd

- Dewatering: Screw press/Decanter for liquid waste sidestream
  - Decrease volume of waste while increasing concentration of valuable byproduct

- Ethanol Recovery: Claiming moisture from trub and refining ethanol from removed liquid
  - Maximizing value of a waste stream to offset cost of pretreatment

# Collection at a Brewery




Bissell Brothers, Portland, ME. High/Low pH slugs from CIP (orange) and byproducts (yellow) captured. Byproducts pushed out using a diaphragm pump and pressure then vacced out and hauled to a digester. CIP slugs pushed using pump and neutralized prior to discharge.

# Outlets for Byproducts





Crystal Spring Farm, Brunswick, ME.  Spread on hayfields following a liquid manure model.

# Outlets for Byproducts



Whalers Brewing, South Kingstown, RI.
Self hauled to a commercial composter.



ReMix Organics, RI.  Collected in totes,
and hauled to an anaerobic digester.

# To Recap

- Breweries have a byproduct (trub) that is rich in organic material and dissolved sugars
- Sending slugs of trub or beer down the drain can disrupt municipal wastewater systems and cause financial stress for the brewery
- Diverting trub to streams that can extract further value from trub reduces breweries' costs, enriches soil, supplies raw materials to clean energy operations, and decreases the treatment and sludge burden on municipalities

# Questions?

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