🍋 Project Overview

Project Type: Lemonade Production Facility – Batch-based, Craft Operation
Location: Asheville, North Carolina
Production Capacity: 500 bottles/day (12 oz each)
Operating Days: 6 days/week
Target Shelf Life: 7 days (requires cold chain)
Product Type: Small-batch, preservative-free specialty lemonade (e.g., basil-lime, ginger-mint, lavender-honey)
Packaging: Recyclable glass bottles

🏭 Site Conditions

Climate: Humid Subtropical
Water Source: Municipal – filtered
Electrical Access: 240V single-phase and 3-phase available
Zoning: Light industrial, food manufacturing approved
Flooring: Reinforced concrete (suitable for wet processing areas)
Drainage: Sloped with trench drains

⚙️ Equipment Details

Equipment	Description	Capacity/Specs	Unit Cost
Fruit Washer	Automated rotating drum washer	250 lbs/hr	$6,000
Cold Press Juicer	Hydraulic press for raw juice	30 gallons/hr	$18,000
Mixing Tank (Stainless)	For blending juice with flavors/syrups	100 gallons, jacketed	$12,000
Bottle Rinser & Filler	4-nozzle filler, semi-automatic	400 bottles/hr	$9,000
Bottle Capper	Pneumatic capper	500 bottles/hr	$4,000
Label Applicator	Manual-assisted, roll-feed	600 bottles/hr	$2,500

Cold Storage	Walk-in cooler, 6’×8’	1,200 bottles	$10,000
Cleaning-in-Place (CIP) Kit	Circulation pump, sanitizing reservoir	20 gallons/min	$2,000

Total Equipment Cost: **$63,500**

🔁 Process Flow

1. **Raw Material Intake** – Lemons, herbs, sugar/syrups delivered fresh daily
2. **Washing & Sorting** – Clean produce using drum washer
3. **Juicing** – Cold-press to preserve nutrients
4. **Flavor Infusion** – Herbs or spices added to mixing tank
5. **Bottling** – Glass bottles rinsed, filled, and capped
6. **Labeling & Batch Coding** – Brand + date labels applied
7. **Cold Storage** – Inventory stored for distribution within 48 hours
8. **Sanitization** – CIP used at day-end to clean all food-contact surfaces

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💰 Cost Rules & Assumptions

Explicit Rules:

- Equipment operating cost ≈ 10% of its purchase value annually
- Bottling line (filler + capper + labeler) capacity limited to **400 bottles/hr**, which is the system bottleneck
- Cold press must run at least **2 hours/day** to meet production targets

- Walk-in cooler must maintain **<40°F** for safety
- Utilities (electricity + water) assumed at $0.07/bottle

Implicit Rules:

- If scaling to 1000 bottles/day, must double bottling line OR add shift
- Maximum practical juicing time/day = 6 hours due to operator fatigue
- Weekly downtime = 1 day for deep cleaning and maintenance
- 15% overhead added to base cost to account for unlisted minor items (hoses, clamps, racks, safety gear)

🧾 Utility & Install Cost Estimates

Item	Description	Estimated Cost
Plumbing & Drainage	Food-grade piping, floor drains	$5,000
Electrical Panel Upgrade	For juicer, cooler, and motor loads	$7,000
HVAC & Cold Chain Infrastructure	Ventilation, cooler installation	$8,500
Equipment Rigging & Placement	Delivery, setup, anchoring	$3,500
Workstations & Wash Basins	Stainless prep tables, hand-wash stations	$2,000
Inspection & Certification	Health dept. approval, food safety certs	$1,500

Utilities & Install Subtotal: **$27,500**

🧱 Building Fit-Out (Optional Improvements)

- Paint, signage, lighting: **$4,000**
- Light renovations (partition walls): **$6,000**
- Contingency (10% of TIC): **$9,100**

📊 Total Installed Cost (TIC) Summary

Category	Cost
Equipment	$63,500
Utilities & Install	$27,500
Building Fit-Out	$10,000
Contingency (10%)	$9,100

✅ **Total Installed Cost (TIC)**: **$110,100**

⚠️ Risks & Optionality Levers

Key Sensitivities:

- 🍋 Citrus pricing fluctuations may affect raw material availability
- 📦 Glass bottle supply chain needs backup vendor (import delays possible)
- ⚡ Utility rates may rise, pushing per-bottle cost above $0.10
- 🧼 Sanitation violations could halt operations temporarily
- ❄️ Cold storage reliability is critical — consider backup generator

Optionality Levers for Cost/Capacity:

- Use plastic bottles to reduce per-unit cost by $0.08

- Upgrade to automatic labeler to save 1 labor hour/day (~$3,500)
- Move to 2 shifts for higher throughput without full re-capitalization
- Partner with a nearby cold-storage provider instead of owning cooler
- Increase product shelf-life (e.g., flash pasteurization) to expand delivery radius

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✅ Recommendations

- Proceed with baseline design as outlined for 500 bottles/day
- Use modular equipment (press, filler) to ease future upgrades
- Begin small, focus on quality and compliance
- Consider batch tracking software if scaling to regional distribution
- Reassess cold chain needs quarterly
