BOTTLED VS. TAP WATER: IMPACT ASSESSMENT

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OVERVIEW

1. Drink Local: Accomplishments to date
2. Environmental Impact
3. Health: Concerns and Regulations
4. Water Testing: Tastes and Preferences
5. Summary and Recommendation
ACCOMPLISHMENTS

• 190+ filtered bottle filling stations on campus:
  o Residential college dorms
  o Athletic buildings
  o Academic & administrative buildings

• All freshmen receive reusable water bottles at Move-In.
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ENVIRONMENTAL IMPACT

PRODUCTION

- It takes about \( 2,000 \times \) more energy to produce bottled water than tap. (Gleick 2009)

- In the United States about \( 50 \) billion \textit{water bottles} are used annually. This requires:
  - 15–30 million \textit{barrels of oil}, which is equivalent to fueling 100,000 – 2 million cars for 1 year.
  - 100–150 billion \textit{L of water}.
  - 12 billion \textit{lbs. of CO}_2 emitted.
**Table 5.** Total energy requirements for producing bottled water. (Note: we assume here an average ratio of three kWh (thermal) per kWh (electrical) and 3.6 MJ kWh$^{-1}$.)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Energy intensity (MJ$_{th}$ l$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture plastic bottle</td>
<td>4.0</td>
</tr>
<tr>
<td>Treatment at bottling plant</td>
<td>0.0001–0.02</td>
</tr>
<tr>
<td>Fill, label, and seal bottle</td>
<td>0.01</td>
</tr>
<tr>
<td>Transportation: range from three scenarios</td>
<td>1.4–5.8</td>
</tr>
<tr>
<td>Cooling</td>
<td>0.2–0.4</td>
</tr>
<tr>
<td>Total</td>
<td>5.6–10.2</td>
</tr>
</tbody>
</table>
ENVIROMENTAL IMPACT

WASTE

- Only **23%** of disposable water bottles recycled.
- It takes **~700 years** for PET bottles to decompose.
- **At Princeton:**
  - Princeton brand water bottles are made with ENSO biodegradable plastic.
  - PET bottles are used in the Ustore, Frist Campus Center, and several other campus venues.
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### HEALTH CONCERNS

**Regulatory bodies:**

- Bottled water – Food and Drug Administration (FDA)
- Tap water – Environmental Protection Agency (EPA)

<table>
<thead>
<tr>
<th>Name of Substance</th>
<th>Raritan Water System (2013) (Princeton tap water)</th>
<th>FDA Standards for Bottled Water Quality: Allowable Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>Not Detected</td>
<td>0.3 mg/L</td>
</tr>
<tr>
<td>Manganese</td>
<td>Not Detected</td>
<td>0.05 mg/L</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.0 to 0.002 mg/L</td>
<td>0.010 mg/L</td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.6 - 1.0 mg/L</td>
<td>1.4 - 2.4 mg/L (temp. dependent)</td>
</tr>
<tr>
<td>Chloramine</td>
<td>0.8 mg/L</td>
<td>4.0 mg/L</td>
</tr>
<tr>
<td>Lead</td>
<td>0.005mg/L</td>
<td>0.005 mg/L</td>
</tr>
<tr>
<td>Copper</td>
<td>0.5 mg/L</td>
<td>1.0 mg/L</td>
</tr>
<tr>
<td>Nitrate</td>
<td>0.4-2.4 mg/L</td>
<td>10 mg/L</td>
</tr>
</tbody>
</table>
HEALTH CONCERNS

- Tap water quality at Princeton rivals that of FDA-certified bottled water.

- Princeton has 190+ filtered water stations that provide better water quality than tap water:
  - The filter removes chlorine taste and odor, dirt and rust.
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WATER TASTE STUDY

- October 29th, 2014

- We tested 104 students to evaluate whether they:
  - Could taste the difference between filtered tap water and bottled water (Princeton brand)?
  - Had a preference for either taste?

![Diagram showing results of the taste study.]

- Identification:
  - Could not identify: 12
  - Successfully identified:
    - Tap water: 24
    - Bottled water: 11

- Preference:
  - Indifferent: 24

- Total:
  - 104 students tested
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## SUMMARY

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<thead>
<tr>
<th>BOTTLED WATER</th>
<th>TAP WATER</th>
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</thead>
<tbody>
<tr>
<td><strong>Energy:</strong></td>
<td></td>
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<tr>
<td>- 2,000x more energy intensive.</td>
<td></td>
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<tr>
<td>- Consider water use, oil use, and carbon emissions.</td>
<td></td>
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<tr>
<td><strong>Waste:</strong></td>
<td></td>
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<tr>
<td>- Single-Use</td>
<td></td>
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<tr>
<td>- In 2013, the recycling rate for bottled water was <strong>23%</strong>.</td>
<td></td>
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<tr>
<td><strong>Health:</strong></td>
<td></td>
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<tr>
<td>- Princeton tap water quality rivals that of bottled water.</td>
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<tr>
<td><strong>Cost:</strong></td>
<td></td>
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<tr>
<td>- $1.22 - $7.50 per gallon</td>
<td>$0.0004 per gallon</td>
</tr>
<tr>
<td><strong>Taste:</strong></td>
<td></td>
</tr>
<tr>
<td>- NO discernable taste difference</td>
<td></td>
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</tbody>
</table>
RECOMMENDATION

1. Discontinue the sale of bottled water in Frist cafeteria and C-store and replace with reusable “Drink Local” water bottles.

2. Discontinue the sale of bottled water in campus vending machines and the U. Store.

3. Increase the number and accessibility of bottle filling stations.

4. Replace bottled water at campus events with 5 gallon water jugs and reusable cups.


