Lunch Packaging at NU

MSE 395: MATERIALS FOR ENERGY-EFFICIENT TECHNOLOGY

SPRING 2009
Eating lunch involves packaging

- There are several options available for lunch at NU.
- Eating lunch will inevitably involve some kind of packaging or tableware.
- Each of these has its own associated costs of production, manufacturing, use, and disposal.

- What is the environmental cost of the packaging for Northwestern lunch options?
Options and issues we explored

- We looked at
  - Norris Stir Fry
  - Rollin’ to Go
  - Chinese Lunch
  - Noyes Street Café
  - Leftovers
- Cost for one use
- Breaking even points due to reuse
- Effects of refuse burning
Assumptions

- CES is all knowing
  - Embedded energy values
  - Manufacturing energy values
  - Recycling rates and energy values

- Disposal patterns
  - Picked up by garbage trucks in Evanston
  - Freight train to landfill in Michigan

- Burning of refuse happens near landfill
  - 5.11 kWh per kg refuse
Norris Stir Fry

- Disposable PS container
- Disposable wooden chopsticks
- Total
  - Energy: 3.080 MJ
  - CO₂: 0.1138 kg

![Energy Costs (MJ)](chart.png)
Norris Stir Fry

- Disposable PS container
- Disposable wooden chopsticks
- Total
  - Energy: 3.080 MJ
  - CO₂: 0.1138 kg

![CO₂ Output Graph]
Rollin’ to Go

- Brown paper bag
- Paper sandwich wrapper lined with aluminum
- Total
  - Energy: 1.042 MJ
  - CO₂: 0.0522 kg

![Image of brown paper bags]

Energy Costs (MJ)

- Embedded
- Manufacturing
- Use
- Disposal
Rollin’ to Go

- Brown paper bag
- Paper sandwich wrapper lined with aluminum
- Total
  - Energy: 1.042 MJ
  - CO$_2$: 0.0522 kg
Chinese Lunch

- PS foam shell
- HDPE soup container
- Disposable fork
- Total
  - Energy: 4.210 MJ
  - CO₂: 0.13?? kg

![Energy Costs (MJ)](chart.png)
Chinese Lunch

- PS foam shell
- HDPE soup container
- Disposable fork
- Total
  - Energy: 4.210 MJ
  - CO₂: 0.13?? kg

![Chinese Lunch Image]

**CO₂ Output (kg)**

- Embedded
- Manufacturing
- Use
- Disposal

![CO₂ Output Graph]
Noyes Street Café

- Reusable ceramic plate
- Reusable stainless steel utensils
- Total
  - Energy: 44.72 MJ
  - CO$_2$: 0.2912 kg

![Image of ceramic plate and utensils]

![Energy Use (MJ) bar chart]

- Embedded
- Manufacturing
- Use
- Disposal
Noyes Street Café

- Reusable ceramic plate
- Reusable stainless steel utensils
- Total
  - Energy: 44.72 MJ
  - CO$_2$: 0.2912 kg
Leftovers

- Reusable Tupperware
- Reusable stainless steel fork
- Total
  - Energy: 3.551 MJ
  - CO₂: 0.1525 kg

![Energy Use (MJ) graph](chart.png)
Leftovers

- Reusable Tupperware
- Reusable stainless steel fork
- Total
  - Energy: 3.551 MJ
  - CO$_2$: 0.1525 kg

![Graph showing CO2 Output (kg)](chart.png)
Comparison for Single Use

Total Energy Use (MJ)

- Norris Stir Fry
- Rollin' to Go
- Chinese Lunch
- Noyes Street Café
- Left-Overs
Comparison for Single Use

Total CO\textsubscript{2} Output (kg)

<table>
<thead>
<tr>
<th>Restaurant</th>
<th>CO\textsubscript{2} Output (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norris Stir Fry</td>
<td>0.15</td>
</tr>
<tr>
<td>Rollin' to Go</td>
<td>0.05</td>
</tr>
<tr>
<td>Chinese Lunch</td>
<td>0.15</td>
</tr>
<tr>
<td>Noyes Street Café</td>
<td>0.35</td>
</tr>
<tr>
<td>Left-Overs</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Reusable Options

- Some of the previous options however are reusable.
- Values per meal change greatly under this consideration.

- If we wash dishes 7 days a week with a load of 25 sets we get an energy cost of about $0.3129 \text{ MJ per wash}$.

- We can calculate the number of times we would have to eat and wash our reusable options to break even in either energy use or CO$_2$ output.
Using Refuse as Biofuels

- Refuse has the potential to be burnt for energy instead of being land filled.

- We made the assumption that half the disposable materials are burned to produce electricity with 30% efficiency.

- We saw a general decrease in energy use values with an increase in CO$_2$ output.
Comparison for Use with Refuse Burning

Total Energy Use (MJ)

<table>
<thead>
<tr>
<th>Restaurant</th>
<th>Total Energy Use (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norris Stir Fry</td>
<td>New: 2, Old: 3</td>
</tr>
<tr>
<td>Rollin' to Go</td>
<td>New: 1, Old: 2</td>
</tr>
<tr>
<td>Chinese Lunch</td>
<td>New: 4, Old: 5</td>
</tr>
<tr>
<td>Noyes Street Café</td>
<td>New: 45, Old: 0</td>
</tr>
<tr>
<td>Left-Overs</td>
<td>New: 1, Old: 1</td>
</tr>
</tbody>
</table>
Comparison for Use with Refuse Burning

Total CO2 Output (kg)

Norris Stir Fry  Rollin' to Go  Chinese Lunch  Noyes Street Café  Left-Overs

- New
- Old
Break Even Uses for Refuse Burning

### Noyes Street Cafe

- **Norris Stir Fry**: 70 for Energy, 10 for CO2
- **Rollin' to Go**: 60 for Energy, 1 for CO2
- **Chinese Food**: 50 for Energy, 2 for CO2

### Leftovers

- **Norris Stir Fry**: 6 for Energy, 5 for CO2
- **Rollin' to Go**: 5 for Energy, 4 for CO2
- **Chinese Food**: 4 for Energy, 3 for CO2
In conclusion, we can see that:

- The best option for low energy use and low CO$_2$ output is **eating leftovers**.
- That reusable **plates and silverware** is also excellent but may have to be **used many times** to compete with the better disposable choices.
- Of the disposable choices, Rollin’ to Go is the best and the Chinese lunches are the worst in terms of energy and CO$_2$. 
Questions?
Team

- Piotr Blaszczak (Presenter)
- Matt Jones
- Kyle Osberg
- Brian Wasserman
Picture Sources

- In order of viewing
  - [http://weblogs.baltimoresun.com/entertainment/dining/reviews/blog/BambooChopsticks.jpg](http://weblogs.baltimoresun.com/entertainment/dining/reviews/blog/BambooChopsticks.jpg)
  - [http://www.tiresias.org/images/clasp_tupperware_1.jpg](http://www.tiresias.org/images/clasp_tupperware_1.jpg)