

# Life cycle assessment (LCA) of reusable and single-use coffee cups



## CERAMIC MUG ? TRAVEL MUG ? PAPER CUP ? WHAT'S THE BEST CHOICE BASED ON THE SITUATION ?

### 1. Background of the study

With over 1.6 billion cups of coffee consumed a day worldwide,<sup>1</sup> the choice of coffee cups can have an impact on our planet!

Striving to cut the amount of resources wasted through reduction at the source and eco-responsible consumption, **RECYC-QUÉBEC** began examining reusable and disposable products to establish a solid foundation for possible initiatives to promote reduction at the source in this area.

### 2. What did we want to measure ?

The specific case of coffee **consumed** on site at Québec restaurants, by **comparing the use of disposable cups versus washable cups**.

Specifically, our goal was to :

- **Compare** the environmental profile;
- **Compare** the direct costs for the restaurant;
- **Analyze** the social acceptability issues at play for restaurants and consumers.

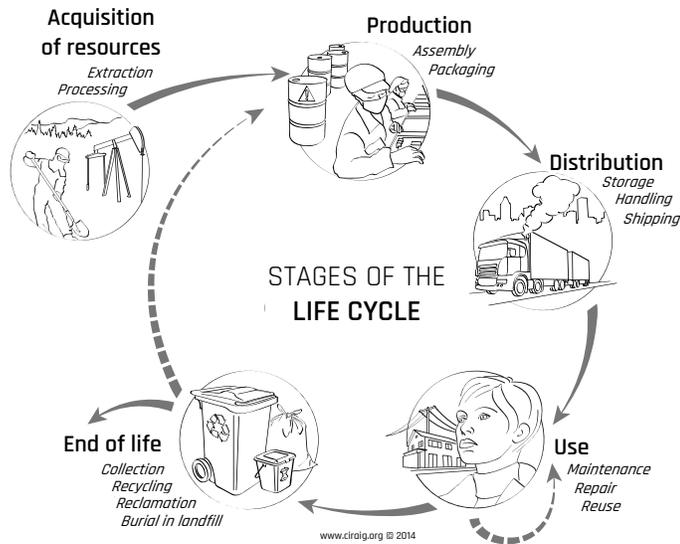
#### Functional unit :

One "medium" (i.e., 16 oz. or 475 ml) cup of coffee per day served for consumption on site at a Québec restaurant for one year (2013).

Containers	Features
 <p>Disposable cup made of paper lined with polyethylene (PE), and polystyrene (PS) lid</p>	<p>Sent to landfill</p>
 <p>Ceramic mug provided by the restaurant</p>	<p>Number of reuses variable based on breakage, loss, and theft</p> <p>Washed in commercial dishwasher after each use</p>
 <p>Travel mugs with polypropylene (PP) lid and handle</p> <ul style="list-style-type: none"> <li>▪ stainless steel</li> <li>▪ polypropylene</li> <li>▪ polycarbonate</li> </ul>	<p>Number of reuses variable based on breakage and loss</p> <p>Hand-washed after each use</p>

<sup>1</sup> International Coffee Organization

### 3. What is a life cycle analysis (LCA) according to ISO?



A comprehensive impact assessment of a product or service throughout its life cycle, from extraction of raw materials to end of life.

The International Reference Centre for the Life Cycle of Products, Processes, and Services (CIRAIG) was tasked with comparing the use of single-use and reusable containers from an environmental perspective and then determining the issues and economic and social levers that influence implementation of the best practices identified.

#### RESULTS SUMMARY FOR FIVE CATEGORIES OF ENVIRONMENTAL IMPACTS

	Human Health	Quality of Ecosystems	Climate Change	Resource Depletion	Water Consumption	
Ceramic mug	●	●	●	●	●	● Better
Travel mug	●	●	●	●	●	● Average
Paper cup (PE)	●	●	●	●	●	● Worse

\* Assuming 500 uses for ceramic mugs and travel mugs

### 4. Results

#### OBJECTIVES OF THE ENVIRONMENTAL COMPONENT

The following parameters influence the results :

- **Mass** of disposable cups ;
- **Quantities** of hot water and soap used to wash travel mugs ;
- **Energy context** (results apply to Québec only).

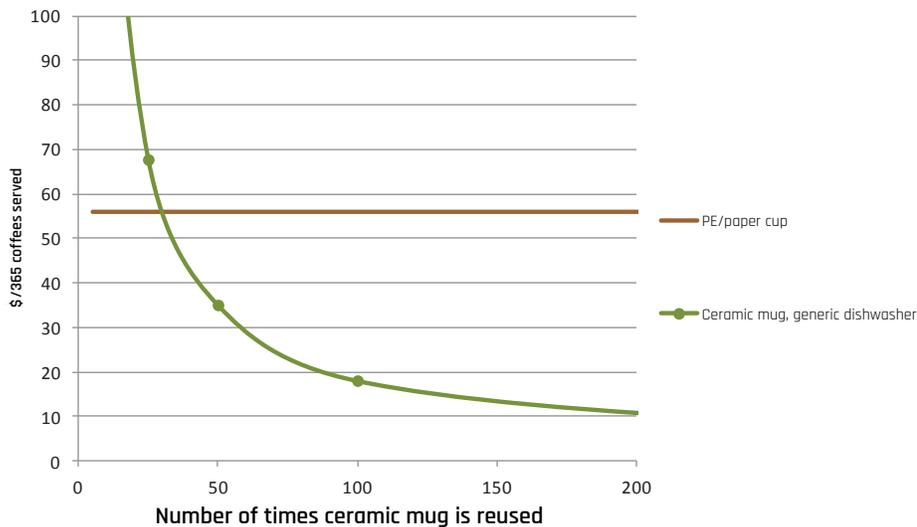


- Overall, ceramic mugs have fewer environmental impacts than travel mugs or paper cups ;
- Ceramic mugs have a smaller potential environmental impact than paper cups with lids when used at least 200 to 300 times ;
- Travel mugs generally become preferable to paper cups after a reasonable number of uses, except for the Water Consumption and Quality of Ecosystems categories (for which we cannot identify a winner) ;
- Most of the potential impacts attributable to travel mugs stem from the fact that they must be hand-washed. A quick rinse in cold water (without soap) would bring travel mugs almost on par with ceramic mugs in terms of their impacts ;
- Among travel mugs, stainless steel models with polypropylene (PP) lid and handle perform better from an environmental perspective than travel mugs made of polypropylene or polycarbonate ;
- Serving coffee in two stacked paper cups (to protect hands from heat) has slightly more potential impacts than using a double-walled cup ;
- The use of cardboard sleeves to insulate single-wall paper cups only slightly increases the potential impacts and is preferable to using double-walled cups.

## OBJECTIVES OF THE ECONOMIC COMPONENT

- **Identify** the direct and indirect costs associated with the various coffee consumption systems;
- **Assess** the costs incurred by restaurants based on the options chosen;
- **Recommend** practices for sourcing and using coffee containers to ensure the economic profitability of the changes for restaurants.

The numbers 100 (worst case) and 500 (best case) were kept as extreme scenarios in order to better assess the robustness of the results.



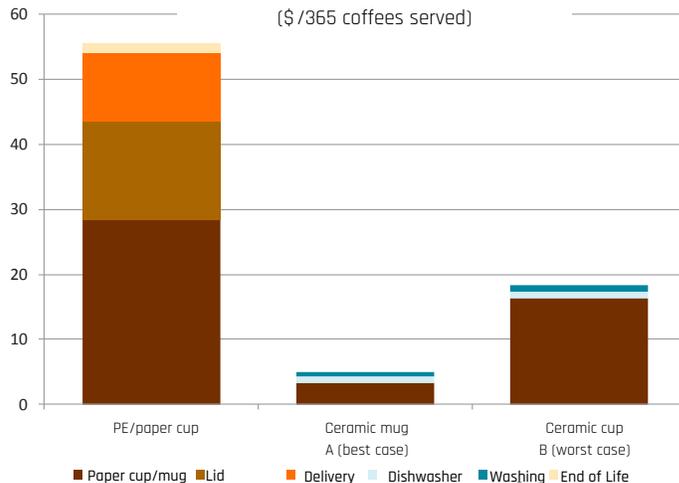
**Ceramic mugs are less expensive than single-use paper cups for restaurants once they are reused 45 times (regardless of dishwasher type, based on a purchase price of \$ 4.50 per mug).**

Recommendations on how to minimize the cost of using ceramic mugs :

- **Purchase** mugs in large quantities to reduce the unit cost;
- **Reuse** the mugs as many times as possible before replacing them.

Lastly, although dishwasher efficiency does not have a major influence on the cost of serving coffee in mugs, we nevertheless **recommend** that restaurants opt for high-efficiency models in order to reduce their overall energy consumption.

**Direct costs for the restaurant**  
(\$ / 365 coffees served)



**OPTION A :** Mugs reused 500 times in a high-efficiency dishwasher  
**OPTION B :** Mugs reused 100 times in a generic dishwasher

## OBJECTIVES OF THE SOCIAL COMPONENT

- **Identify** the obstacles and levers for reducing use of single-use paper cups in order to develop strategies facilitating this transition, notably by raising awareness of merchants and consumers;
- **Analyze** the issues associated with the social acceptability of a transition from single-use paper cups to wider spread use of reusable cups.

### Obstacles and levers for using reusable containers for coffee consumed on site

Stakeholders concerned	Obstacles	Levers
Consumers	<p>Lack of information on the availability of reusable containers (when they are used at a restaurant);</p> <p>Consumer mobility and desire to keep coffee hot for a long time;</p> <p>Hygienic concerns regarding reusable containers (aversion or fear of risks of infection)</p>	<p>Reassure consumers regarding hygienic issues of reusable mugs;</p> <p>Raise consumers' awareness of the environmental impacts of disposable containers;</p> <p>Leverage consumers' positive values (campaign promoting the benefits of reusable mugs);</p> <p>Hold consumers accountable by making them responsible for the cost or benefits associated with their choice</p>
Restaurants	<p>Material constraints : need for space and initial investment in washing and rinsing equipment (desire to limit costs of purchasing dishes and labor for washing them);</p> <p>Constraints regarding the restaurant's image and credibility due to consumers' hygienic concerns about reusable mugs;</p> <p>Opportunity to use disposable containers for advertising;</p> <p>Misunderstanding of the costs and environmental benefits associated with using disposable and reusable containers.</p>	<p>Reward and promote best practices;</p> <p>Help restaurants choose best practices;</p> <p>Encourage restaurants to make reusable mugs available to customers.</p>
Suppliers		Promote travel mugs that are designed to meet consumer needs.

## 5. General conclusions

- Ceramic mugs should be the first choice for those who drink their coffee in a restaurant;
- It becomes more advantageous for restaurants to serve coffee in ceramic mugs once the mugs are reused more than 45 times (assuming a base unit price of \$ 4.50);
- As for travel mugs, the models to favor should be lightweight, durable, comfortable, well insulated, and easy to wash;
- For both ceramic mugs and travel mugs, the transition should go hand in hand with efforts to inform consumers and merchants about the environmental impacts associated with coffee drinking habits;
- Consumers and restaurants need to be informed of the environmental impacts of non-reusable containers and encouraged to adopt better practices;
- It is important to reduce hot water and soap consumption when washing mugs.