



Sustainability Applied™

Driving Adoption of Innovative Solutions

A HOLISTIC, INTEGRATED APPROACH TO OPTIMIZE RESOURCE USE AT A GAY LEA FOODS FACILITY



Prepared for:
The City of Toronto

Prepared by:
The Bloom Centre for Sustainability

September 2013

Financial support of this project has been provided by the City of Toronto.



BLOOM would also like to acknowledge the support provided by Toronto Hydro and Enbridge Gas Distribution.

CONTACT INFORMATION

BLOOM
Kevin Jones
President and CEO
kjones@bloomcentre.com
www.bloomcentre.com

Gay Lea Foods Co-operative Limited
Zbigniew Ewertowski
Director of Corporate Engineering
zewertowski@gayleafoods.com
www.gaylea.com

Enviro-Stewards Inc.
Bruce Taylor
President and CEO
btaylor@enviro-stewards.com
www.enviro-stewards.com

The City of Toronto, Economic Development
and Culture Department
Michael Wolfson
Senior Advisor, Food & Beverage Sector
mwolfso@toronto.ca
www.toronto.ca

Enhancing Competitiveness

Improving the economic competitiveness and environmental sustainability performance of manufacturing sectors is a priority for communities across North America, but often policy and programs provided by different levels of governments do not deliver their full potential because they operate in isolation.

The City of Toronto's food and beverage manufacturing sector is one such example. It is a major contributor to employment and economic activity that is under constant pressure from narrow profit margins and increased competition. A number of business assistance programs to improve the resource efficiency of food processors are available, but these programs tend to operate separately and focus on a specific area such as electricity, natural gas or water.

BLOOM brought together key stakeholders to demonstrate the value of a collaborative approach that provides enhanced outcomes for the food and beverage sector, utilities and the City of Toronto.

Food Sector Overview

Food and beverage processing in the City of Toronto is a mainstay of Toronto's manufacturing sector. It is the second largest manufacturing industry in Toronto and a key contributor to economic prosperity. In the Toronto Census Metropolitan Area, there are nearly 1,000 food and beverage manufacturing establishments employing more than 60,000 people¹. Toronto's food and beverage cluster is the largest in Canada and second largest in North America, and in 2010 had annual sales of about \$17 billion².

Employment in this sector has increased at a rate of five per cent per year and is expected to double within the next 10 years.

Companies in Toronto's food sector range from large corporations, with significant available resources, to small operations with annual sales of less than \$5 Million. These small companies represent more than 80 percent of the food processors in Toronto.

Similar to Toronto, food and beverage processors in other Ontario municipalities are facing rising costs for energy, water and wastewater. This is putting increased pressure on already thin profit margins. New and innovative solutions to manage these risks are crucial to the future economic success of the food sector and its ability to compete in domestic and global markets.

¹ Canadian Business Patterns, December 2012 and Labour Force Survey, 2012.

² Ontario Ministry of Agriculture and Food, 2010.

TORONTO FOOD AND BEVERAGE SECTOR HIGHLIGHTS

- ▶ \$17 Billion in sales (2010)
- ▶ 60,000 employees
- ▶ Nearly 1,000 establishments

Business Assistance Programs

Food and beverage processors in Toronto have access to a wide range of business assistance programs. In recognition of the importance of the food and beverage sector to Toronto's economic prosperity, the City of Toronto Economic Development and Culture Department

has a dedicated senior advisor for the food and beverage sector to support food processors with operating and growing their businesses.

In terms of utilities, incentive programs are available through Toronto Hydro, Enbridge Gas Distribution and Toronto Water to support food processors with identifying and implementing efficiency improvements to reduce the consumption of electricity, natural gas and water in their facilities.

These programs can assist many food and beverage processors that lack the internal resources and expertise to identify, evaluate and implement projects to improve energy and water use.

Even large corporations with the internal capacity to undertake projects to improve energy and water efficiency can benefit from these assistance programs.

However, because these incentive programs operate independently from one another, food processors can become overwhelmed by the time required to investigate and prepare applications. In addition, since each of these programs have their own focus and eligibility criteria, multi-disciplinary opportunities that would be identified in a holistic approach can be missed.

Finally, many processors do not have the time to investigate and submit separate applications to each of these programs, while others may not understand how these programs provide business value.

CITY OF TORONTO STRATEGIC PLAN TO ACCELERATE ECONOMIC GROWTH AND JOB CREATION³

Core Strategies:

1. Make Toronto the most competitive big city in North America.
2. Ensure adequate supply of business input essentials.
3. Encourage business investment and formation.
4. Boost business growth.

Even large corporations with internal capacity can miss opportunities within their own operations.

³ Collaborating for Competitiveness. A Strategic Plan for Accelerating Economic Growth and Job Creation in Toronto, City of Toronto, January 2013.

Collaborating for Competitiveness Pilot Project

In order to demonstrate the value of a more coordinated business assistance program, BLOOM brought together the key stakeholders to collaborate on a Pilot Project with one Toronto food and beverage processor.

The objective was to determine the benefits of an integrated approach to identify opportunities around energy, water and resources that could improve the bottom-line and overall sustainability performance of a food processor.

The Pilot Project involved a third party assessment of a Gay Lea Foods processing facility in Toronto by a qualified engineering consulting firm, Enviro-Stewards Inc. The scope of work included a detailed baseline assessment and the identification of opportunities to reduce energy, water and resource consumption.

Financial incentives and technical support offered by Toronto Hydro, Enbridge Gas Distribution and the City of Toronto were levered to support an integrated assessment.

The experience and lessons learned from the Pilot can serve as a template for a “collaborative model” that would better support the needs of the food and beverage sector in the City of Toronto.

PROJECT LEADERSHIP GROUP

- ▶ City of Toronto Economic Development, Water and Energy Efficiency Departments
- ▶ Toronto Hydro
- ▶ Enbridge Gas Distribution
- ▶ BLOOM

“ Taking an integrated opportunity approach captures the inter-connections between energy, water and resource usage and results in greater efficiencies and bottom-line impacts.”

Kevin Jones, President and CEO, BLOOM

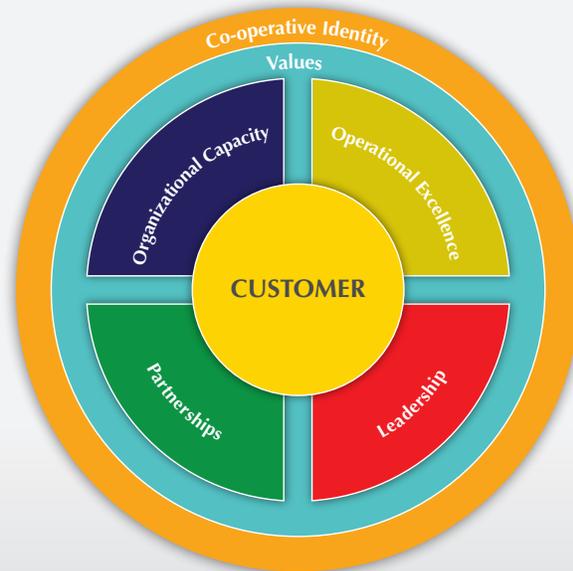
ABOUT GAY LEA FOODS

Founded in 1958, Gay Lea Foods is Ontario's largest dairy co-operative owned and operated by milk producers in Ontario. About half of the co-operative's 3,790 members are involved in milk production representing 25 percent of all Ontario dairy farms. Today, Gay Lea processes approximately 15 percent of Ontario's milk production.

The company's head office is located in Mississauga, Ontario and there are currently six production facilities located in Toronto, Guelph, Madoc and Teeswater.

Gay Lea manufactures a range of wholesome dairy products including milk, cream, cheese, dips, butter, sour cream, whipped cream, and cottage cheese.

In 2008, Gay Lea prepared its first sustainability report, which introduced its environmental goals and achievements, which are integrated and aligned with its "four quadrants" and core values (right).



“ We are always re-thinking our business processes to ensure that everything we do adds value and earns a return. We have a continuous focus on improved efficiencies and process excellence.”

Andrew MacGillivray, President and CEO, Gay Lea Foods Co-operative Ltd.

Gay Lea Foods Pilot Project

The Pilot Project was carried out at Gay Lea Foods Longlife facility in the City of Toronto, which employs 150 permanent staff and operates on a 24/7 schedule.

The manufacturing process at the Longlife facility is shown in Figure 1 and can be summarized as follows:

- ▶ The type of processing is extended shelf life (ESL) and aseptic.
- ▶ Milk and cream of varying levels of butterfat are received in bulk tankers and unloaded to silos in the receiving bay.
- ▶ Milk and cream are blended at various ratios to achieve a blend with the desired final butterfat percentage.
- ▶ The blend is sterilized using ultra-high temperature technology (UHT).
 - ▶ The blend is cooled after sterilization.
 - ▶ The blend is transferred to a homogenizer where the pistons of the machine breakdown the fat particles to reduce their size and allow them to evenly disperse throughout the blend to prevent separation of the fat from the water phase.
 - ▶ The blend is packaged and the packaged products are held in a cooler storage area from where it is loaded on to trucks for shipment.

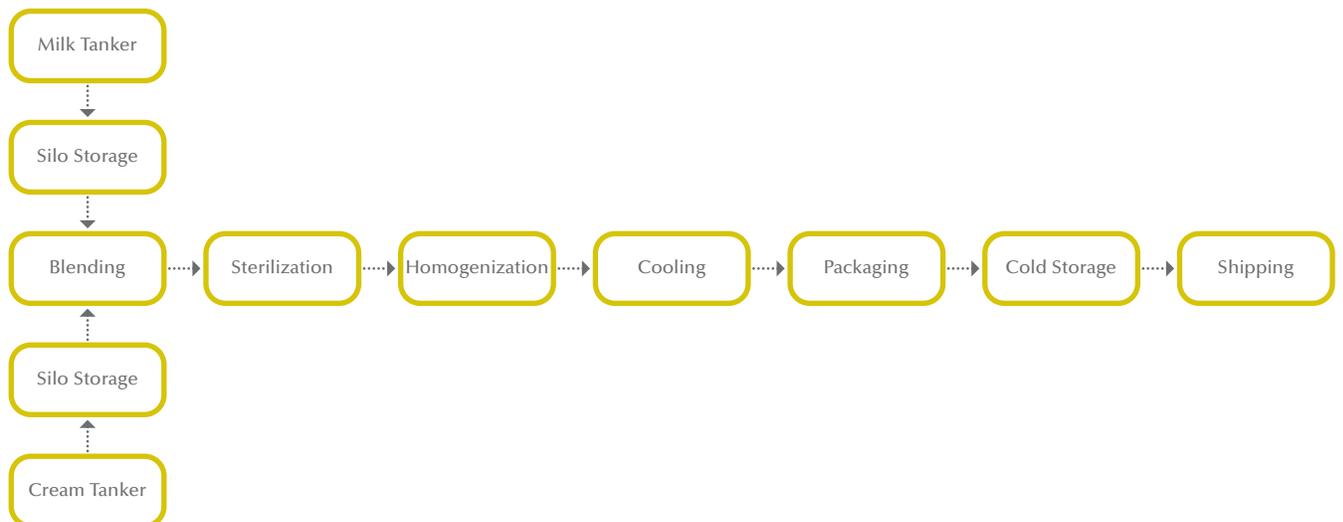


Figure 1: Process Flow at Gay Lea Longlife Facility

Drivers for Change

Like other food and beverage processors, Gay Lea Foods operates in a challenging business environment. Each day they face fierce competition, intense price pressures, complex regulatory concerns and evolving consumer tastes for their products.

Utility costs for energy, water and wastewater management are rising significantly and there is a need to be more efficient in these areas to drive out costs, improve the bottom-line and comply with sewer use by-laws. The Toronto facility is also significantly land constrained, making it difficult to expand operations. For instance, there is no space for a separate on-site wastewater treatment system and innovative opportunities are needed within the operations to reduce the volume and strength of wastewater loadings.

“ The multi-stakeholder collaborative nature of this Pilot Project was very attractive to us. The ability to take an integrated and comprehensive approach to have a 3rd party assessment of all aspects of our process operation - energy, water, wastewater, ingredients - made it an easy decision to participate.”

Zbigniew Ewertowski, Director of Corporate Engineering, Gay Lea Foods

APPROACH AND OBJECTIVES

The approach developed by Enviro-Stewards to carry out the integrated assessment of the Longlife manufacturing process was based on asking the questions Who, What, Why, Where and When.

Who – Engage the Champions

- ▶ To **gain buy-in and facilitate change**, representatives from Gay Lea Foods corporate engineering group, and staff from the Longlife facility including plant management, engineering, maintenance and quality control participated in a kick-off meeting to discuss the project scope and objectives. This team reconvened during the progress meeting to review the findings and alternatives under consideration prior to establishment of a shortlist of opportunities for economic feasibility analysis.

What – Collect Reliable Data

- ▶ To **establish baseline conditions**, a detailed and systematic assessment of energy and water consumption was carried out using data loggers, flow meters, amp meters and visual observations.

Why – Identify Underlying Causes

- ▶ To address contributors to energy, water and resource use, **root cause analysis** was conducted to identify underlying problems and potential solutions.

Where – Create Energy and Water Balances

- ▶ To determine **where to focus change initiatives**, an analysis was conducted using material and energy balances and Pareto charts to prioritize areas of opportunity that would potentially maximize return on investment.

What and When – Identify and Implement Opportunities

- ▶ Based on the integrated assessment, opportunities were identified and their **feasibility and business case justification** were determined.
- ▶ Gay Lea prioritized what opportunities to implement and investigated additional financial and technical support from utility programs.

“ We find that this streamlined approach leads to high implementation rates and compelling business cases with a high Return on Investment.”

*Bruce Taylor, President & CEO,
Enviro-Stewards Ltd.*

Key Findings and Opportunities

Measuring and Establishing Baselines

A key objective of the assessment was to establish baseline conditions and collect reliable data to determine where electricity, natural gas and water were being used in the manufacturing process. This is a crucial and fundamental first step to facilitate change and to identify potential performance improvements. **Without this baseline, a company cannot set targets, establish key performance indicators and continuously improve.**

Detailed measurement also provides the data needed to identify the unit processes and equipment that are the top utility consumers, based on the “Pareto Principle”. This principle, also known as the “80/20 rule”, states that 20 percent of operational activity is responsible for 80 percent of the results. This should be used as a daily reminder for food and beverage processors to focus their time and energy on work that represents the greatest opportunity and benefit. With this approach, companies, like Gay Lea Foods, can focus their efforts on operations that consume the most resources in order to maximize return on investment.

“ We develop KPIs for what we can control at the plant operations level. Key metrics include reducing kWh of electricity, m³ of natural gas and water, and kg of BOD concentrations.”

Zbigniew Ewertowski, Director of Corporate Engineering, Gay Lea Foods

Utility data records, amp meters, ultrasonic flow meters, and manual bucket and stopwatch measurements were used by Enviro-Stewards, to develop a utility use breakdown by major processes and pieces of equipment at the Longlife facility. Pareto charts for each of these are shown in Figures 2, 3 and 4 respectively.

- ▶ In terms of electricity, one-third is consumed for the facility's cooling load from the ammonia compressors and seasonal factors. Another third results from the operation of five pieces of equipment (three homogenizers and two air compressors). Various pumps to transfer raw materials, product, chilled water and evaporation water account for most of the remaining consumption.

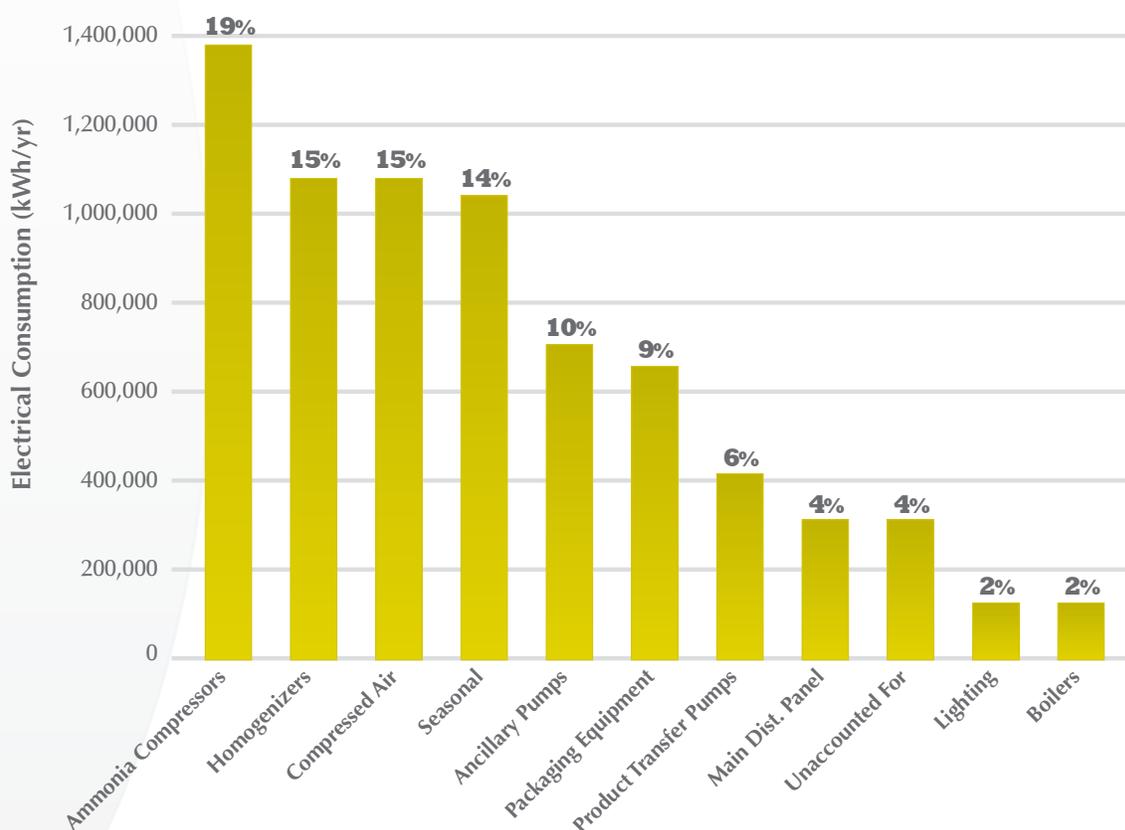


Figure 2: Pareto Chart of Top Electrical Consumers

- ▶ It is interesting to note that lighting (which is typically a focus of many utility incentive programs) accounts for only two percent of total electricity consumption at the Longlife facility.

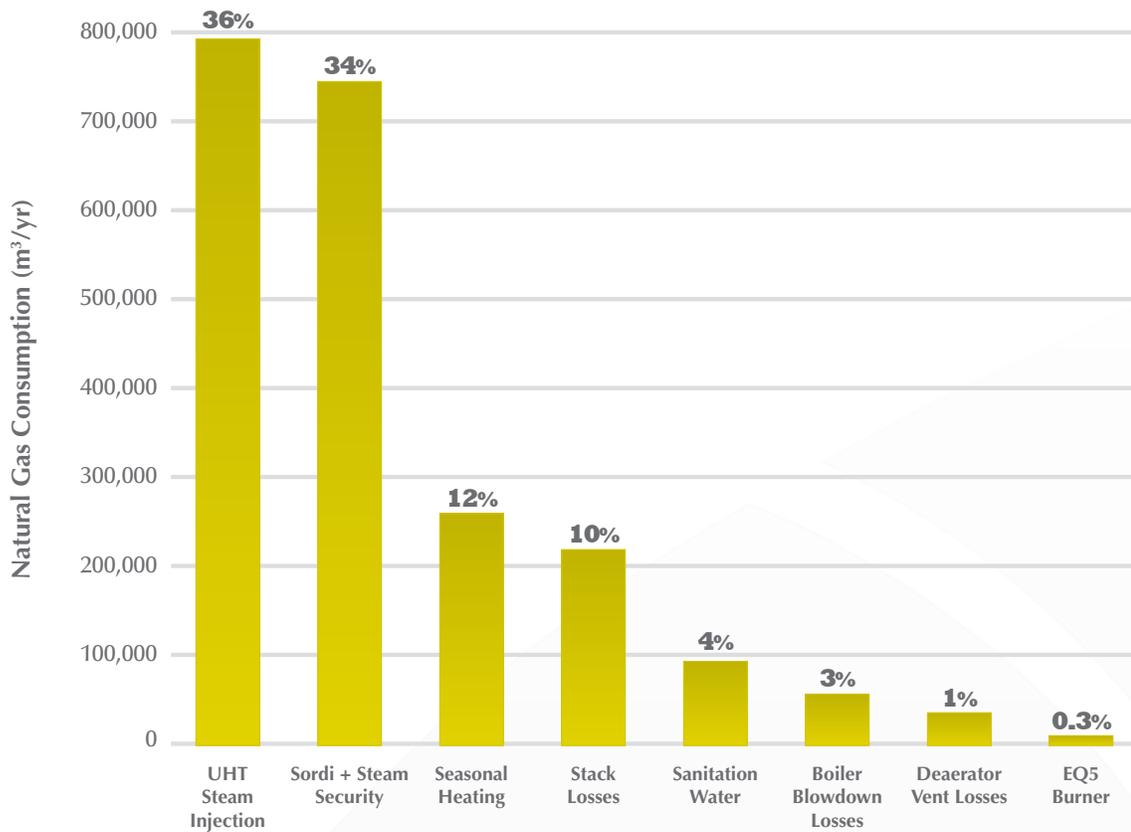


Figure 3: Pareto Chart of Top Natural Gas Consumers

- ▶ In terms of natural gas, thermal energy to sterilize milk and cream, and to maintain that sterility in the manufacturing process accounts for 70 percent of the facility's natural gas consumption. Approximately half of the remaining 30 percent is lost at the boilers through the stacks, deaerator vent and blow down.



- ▶ In terms of water, cleaning and sanitation practices, manual and automated Clean-In-Place (CIP) systems, account for about one-third of the total consumption. About a fifth of the water is used by the sterilizers that require water to push product to the filling equipment at the end of the batch as well as to rinse the lines. Another fifth is used to generate soft water to feed the boilers and to provide cooling to the homogenizers.

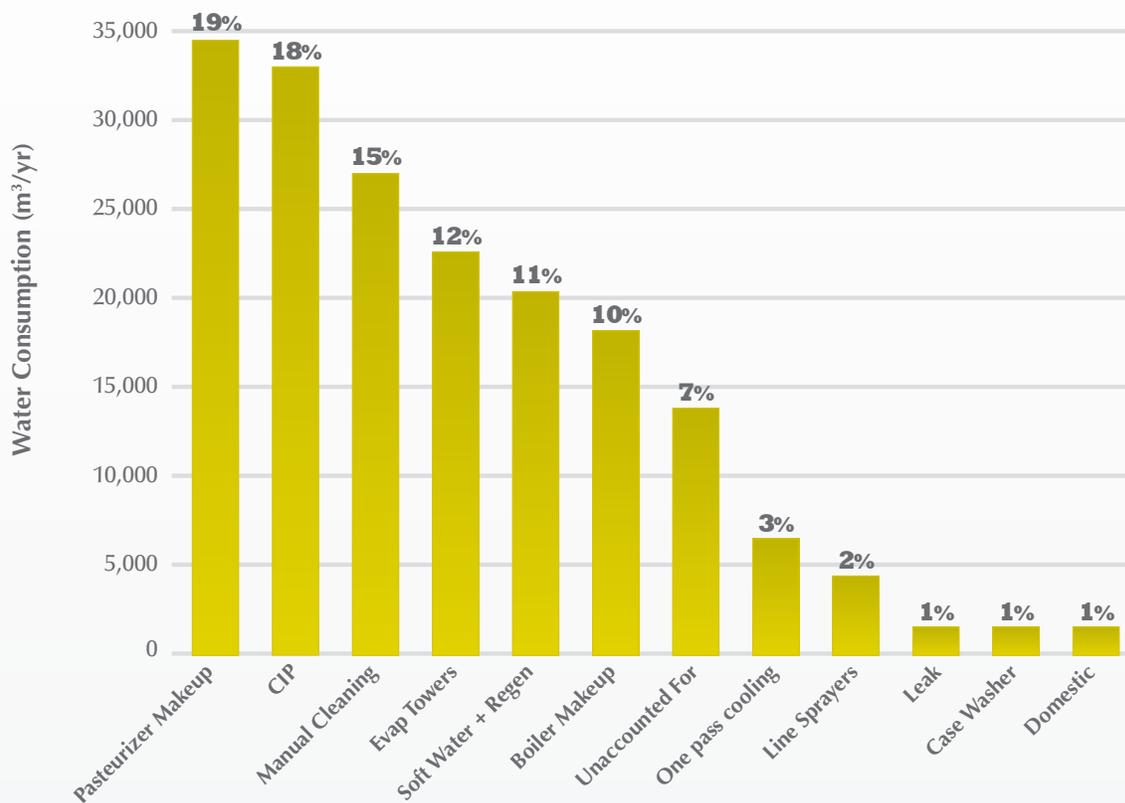


Figure 4: Pareto Chart of Top Water Consumers

Enviro-Stewards also conducted an analysis to characterize wastewater. It was found that the main source of BOD is from the sterilizers and product conveyance piping. Gay Lea Foods is currently paying a high annual surcharge of about \$170,000 to the City of Toronto due to BOD concentrations that exceed the sewer use by-law.

Opportunities Identified

The integrated assessment conducted by Enviro-Stewards identified 11 separate opportunities to reduce energy and water consumption and recover lost product. **The opportunities represent more than \$230,000 in annual savings with an aggregate simple payback of eight months.** A summary of the identified opportunities is shown in Figure 5.

Gay Lea Foods has already implemented or plans to implement many of these opportunities. On the natural gas side, there are four separate opportunities that can be implemented in an integrated fashion. These are being further investigated by Gay Lea in collaboration with Enviro-Stewards and Enbridge Gas Distribution. They include: installation of a condensing stack economizer on the boiler; pre-heating boiler makeup with water used to condense condensate from the homogenizers; using homogenizer water in the cooling tower; and reusing waste heat from the condensing economizer in the receiving bay.

ESTIMATED ANNUAL REDUCTIONS

| | |
|-----------------|------------------------|
| Electricity | 158,000 kWh |
| Natural Gas | 276,000 m ³ |
| Water | 14,000 m ³ |
| BOD | 150,000 kg |
| Recovered Cream | 37,000 L |

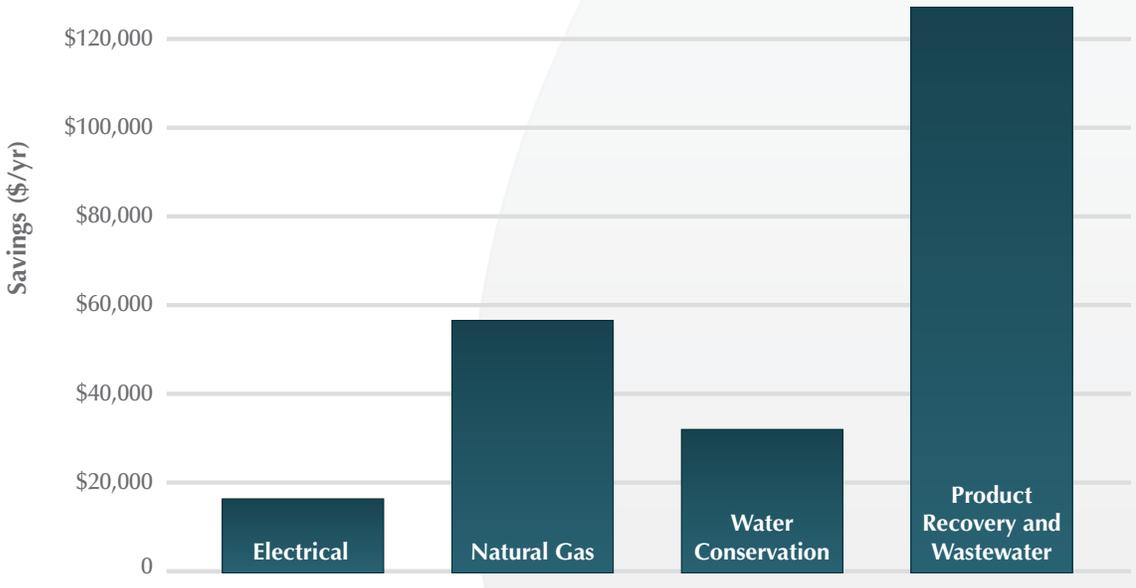


Figure 5: Identified Opportunities

One interesting “innovation opportunity” identified was to recover lost product during the unloading of bulk cream trucks in the receiving area of the Longlife facility. It was discovered that approximately 50 litres of cream remains in the tanker truck as lost product. If this product could be recovered, the annual savings in purchased cream costs is estimated at about \$120,000.

“White Water” Project

Although not an outcome of the assessment that was carried out by Enviro-Stewards, Gay Lea is in the process of implementing an innovative “white water” project. White water is the milky water that results from regular water coming into contact with the dairy liquids (milk and cream) during the manufacturing process. As part of the cleaning cycle, water is used to push the dairy liquids out of different pieces of equipment such as heat exchangers, pipes, valves and pumps.

This white water contains organic ingredients such as proteins, milk fat and lactose (milk sugar) where a large portion is lost to the drain and becomes part of the wastewater effluent.

The white water project will essentially concentrate the diluted milk and cream solutions and allow the individual components (e.g., milk fat, proteins, lactose) to be reused as ingredients in other manufacturing processes.

BENEFITS OF THE WHITE WATER PROJECT

- ▶ Reduction in purchased water supply costs due to reuse of purified water from the white water process.
- ▶ Reduction of the organic matter content in the wastewater effluent and therefore reduction in wastewater surcharge payments.
- ▶ Sewer use by-law compliance with other parameters such as phosphorous, fats, oils and greases and TKN.

Lessons Learned

This Pilot Project has shown the benefits of a holistic approach and has provided valuable insight into how existing incentive and support programs can be coordinated to reduce barriers to uptake and provide superior outcomes for Toronto's food and beverage industry.

Getting the Facts

“ If we don't know our baseline and where we are with our energy and water usage, how can we measure and prove the actual savings when we make a change in the manufacturing process?”

Sanjay Tandan, Plant Manager, Gay Lea Foods, Longlife Facility

- ▶ It is crucial for food and beverage processors to establish baseline conditions to develop a good understanding of “what is going on in the facility” in terms of energy and water use, and to determine the “root causes” associated with lost energy, lost water, lost ingredients and lost product.

Taking an Integrated Approach

- ▶ By taking a holistic and integrated approach, Gay Lea recognized the inter-connections between energy, water and other resources. This approach can optimize solutions, result in a stronger business-case justification and identify innovation opportunities.
- ▶ As shown in Figure 6, Gay Lea Foods identified an additional \$100,000 in annual savings by taking an integrated approach.

Challenging the “Status Quo”

- ▶ By continually re-thinking business processes and challenging the status quo, Gay Lea Foods has been able to optimize their manufacturing processes and continually drive out inefficiencies and costs.

Gay Lea identified an additional \$100,000 in annual savings by taking an integrated approach.

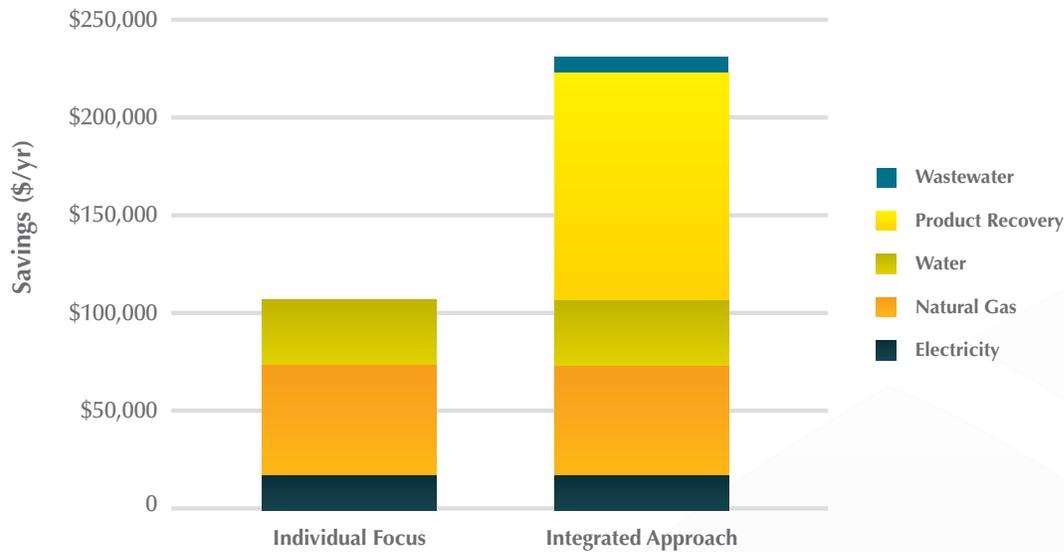


Figure 6: Benefits of an Integrated Approach

Collaborating with Multiple Stakeholders

- ▶ Food processors need to understand the value of both internal and external collaborations and partnerships that can be levered to identify opportunities for innovative solutions related to energy and water use, and resource management.
- ▶ As shown in Figure 7, Gay Lea Foods was able to lever financial incentives from the City of Toronto, Toronto Hydro and Enbridge to conduct an integrated assessment that not only reduced its risk and financial commitment, it resulted in identification of more opportunities.

“ What we continually stress to food and beverage processors is the importance of collaborating and working closely with our Department, and the Utilities to take full advantage of the programs they offer.”

Michael Wolfson, Senior Advisor, City of Toronto, Economic Development and Culture Department

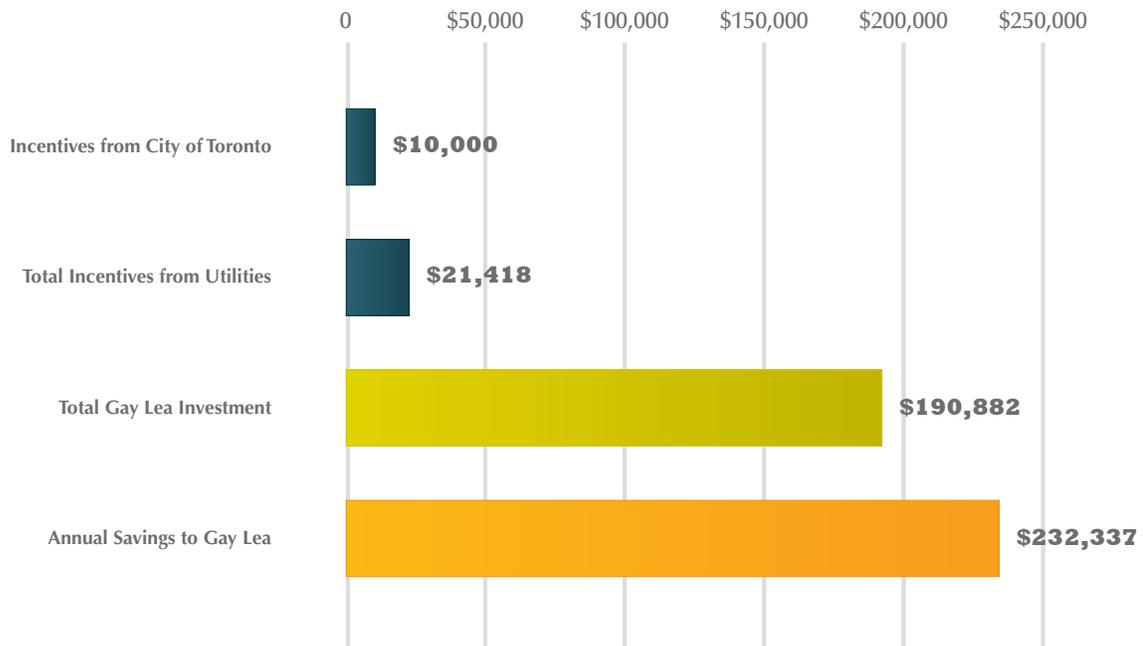


Figure 7: Leverage of City and Utility Incentives

Delivering a “One Window” Program

- ▶ There are many utility and municipal programs available to support Toronto’s food and beverage sector with implementing energy, water and resource efficiency and conservation practices.

Despite good intentions, these programs are usually delivered in a discrete and uncoordinated manner that result in limited uptake and less than optimal use of resources and investment.

In addition, many food and beverage companies are overwhelmed by the wide range of programs available. They are frustrated by the time needed to navigate and submit applications to each program and they do not see how they are connected nor how they can provide business benefit.

- ▶ This Pilot Project demonstrated the value of an aligned and collaborative approach where objectives of different stakeholders converged into shared goals, resulting in benefits not only for Gay Lea Foods, but also for the City of Toronto and the electrical, natural gas and water utilities.

- ▶ The City of Toronto and other municipalities in Ontario where there are food and beverage sector clusters can adopt a similar one-window or one-stop program approach. These programs should be:
 - ▶ Easy to deliver with low administrative and transaction costs.
 - ▶ Simple for food and beverage processors and sector stakeholders to navigate and access.
 - ▶ Performance or entitlement based to reward positive behaviour change and to provide incentives to food and beverage processors to implement on-site initiatives to improve their energy, water and resource usage.
 - ▶ Delivered at the speed of business.

Food processors often do not have the time and resources to submit applications and prepare reports for every utility incentive program; having a “one window” approach can simplify the process and improve program uptake.



Sustainability Applied™

**The Bloom Centre for
Sustainability**

101A – 2070 Hadwen Road
Mississauga, ON Canada L5K 2C9

t: 905.822.4133

info@bloomcentre.com
www.bloomcentre.com