



# Creating an Industrial Symbiosis



Centre de transfert technologique  
en écologie industrielle

# Information

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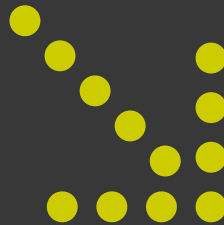
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# Foreword

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This guide is the product of reflections had by le Centre de transfert technologique en écologie industrielle during the Bécancour Industrial Park and Port (Parc industriel et portuaire de Bécancour) symbiosis project in the Centre-du-Québec region of Quebec. Undertaken with the support of le ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie (MESRST), la Société du parc industriel et portuaire de Bécancour and le Comité des organismes et entreprises du parc, this first pilot project involved over 10 businesses and environmental service providers in the Centre-du-Québec.

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Since 2008, the CTTÉI has led and collaborated on a half dozen industrial symbiosis projects in Quebec and Ontario with the help of industrial ecology and sustainability advisors.

## Find Out More

Visit the web pages and blogs of each of the CTTÉI's industrial symbiosis projects on the Synergie Québec website ([synergiequebec.ca](http://synergiequebec.ca)).

SYNERGIE  
Québec



The creation of this guide was made possible due to the financial support of le Ministère de l'Enseignement supérieur, de la Recherche, de la Science et de la Technologie (MESRST) within the context of the Programme de soutien à la valorisation et au transfert (development and support program).

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# Introduction

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The urgent nature of cost efficiency, environmental protection, resource management, greenhouse gas emissions reduction and social considerations are imposing increasing pressure on the industrial sector. In order to reconcile the spheres of sustainable development, industrial ecology has developed concepts and innovative “cradle-to-cradle” industrial practices. Given the current industrial context, industrial ecology must exist beyond a conceptual theory as a practical application.

Modelling itself after natural ecosystems, industrial ecology establishes tools to optimise resource use and reduce the quantity of generated waste in a “closed loop” approach. The industrial symbiosis is without doubt the most concrete example of the concept of industrial ecology. The challenge lies in circulating one’s residual materials and energy to substitute the inputs of another. The objective is thus to prolong the life cycle of resources by substituting and mutualising material flows! This circular movement also applies to human resources by through expertise and services exchanges, equipment sharing, etc.

This guide puts forth a simple method for creating an industrial symbiosis project. The methodology developed by le Centre de transfert technologique en écologie industrielle (CTTÉI) is based on the concepts of industrial ecology, principles of the Quebec Sustainable Development Act, but mainly from feedback from the industrial symbiosis projects that have been developed since 2008.

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# 1. Purpose of the guide

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The purpose of this guide is to provide methodological and operational tools needed to undertake an industrial symbiosis project. However, it is impossible to do this alone! The success and continuity of a symbiosis fundamentally rely on the participation of different actors and efficient planning and coordination.

## 1.1 Who is the Guide for?

This guide is intended primarily for economic development agencies and other public or private decision-makers looking to establish an industrial symbiosis project within local sustainable development agendas. Other stakeholders will find relevant information about the considerations of such a project and about the very active role they will be required to play.

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## Annexed

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The guide provides references related to industrial ecology and tools to support project initiators during the various steps of creating an industrial symbiosis.

## Share your experience!

Have you launched an industrial symbiosis initiative? Do not hesitate to include us in your process, your comments and your suggestions. Help us improve the guide!



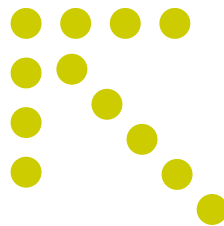


## 1.2 How should the Guide be used?

The methodology and tools included in the guide are presented as suggestions. The guide is not exhaustive: each project and each site is unique. Symbiosis initiators must adapt the procedures to their industrial, economic, environmental and social contexts. The content and structure of the guide will evolve over time. It will be updated periodically based on the feedback received from the different industrial symbiosis projects.

## 1.3 Structure of the Guide

The guide is structured into five sections. The first section gives an overview of waste management in Quebec. The second provides information about industrial ecology, its concepts and its tools. The third presents the major symbiosis implementation steps developed by le Centre de transfert technologique en écologie industrielle (CTTÉI). The last two sections suggest methods for assessing the symbiosis process to ensure continuous improvement and longevity.



# 2. Waste Management in Quebec

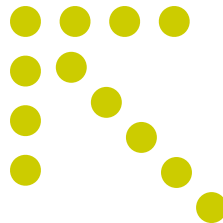
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Consumer society exerts great pressure on resources, renewable or not. It leads inevitably to their depletion and also to the questioning of the traditional industrial development model. Paper, cardboard, plastics, glass, metals, organic matter, petroleum products, wood, concrete, and many other resources are extracted, transformed, transported, used, discarded, or, at best, recovered. The increase in waste follows that of consumption. To deal with this problem, industrial ecology proposes a systemic approach to optimise material and energy flows in an endless circuit, continually drawing value from residual materials.

## 2.1 Legislative Context

Whether considered an asset or a hindrance, legislation is an obligation businesses must face. No fewer than thirty Canadian and Quebecois regulations pertain to the impact of industrial activities on the environment, including Environment Quality Act, Transportation of Dangerous Substances Regulation, Regulation Respecting the Recovery and Reclamation of Products by Enterprises, etc.

As in all industrial activity, certain regulatory aspects will eventually have to be considered in industrial symbiosis or product optimisation projects (obtaining permits or authorization certificates, emission standards, etc.). It is therefore very important for participating businesses to have a full understanding of their implications.



# Final Waste Product

The material resulting from the sorting, packaging and recovery of waste once valuable components can no longer be extracted or polluting or dangerous elements cannot be removed, given the available technical and economic conditions.

*Quebec Residual Materials Management Policy 2011-2015 Action Plan*

[www.mddefp.gouv.qc.ca/matieres/pgmr/plan-action\\_en.pdf](http://www.mddefp.gouv.qc.ca/matieres/pgmr/plan-action_en.pdf) (English overview)  
[www.mddep.gouv.qc.ca/matieres/pgmr/presentation.pdf](http://www.mddep.gouv.qc.ca/matieres/pgmr/presentation.pdf) (complete French document)



## 2.1.1. Quebec Policy on Residual Materials

Diverting all materials capable of being recovered, i.e. everything other than the final waste product, from disposal is the main objective of the Quebec Residual Materials Management Policy 2011-2015 Action Plan, QRMMP (Plan d'action 2011-2015 Politique québécoise de gestion des matière résiduelles, PQGMR). The policy invokes the principles of the 3RV-e (table 1) and proposes strategies such as putting an end to the waste of natural resources by increasing recovery rates and making all those concerned with waste management aware of their responsibilities.

To discourage and control disposal, the QRMMP aims at making waste recovery activities competitive by increasing disposal fees to \$9.50/year for the period between October 1st, 2010 and September 30th, 2015. As of January 1st, 2013, fees totalled \$20.91/metric tonne. This amount is charged to users of disposal services. If they do not modify their practices, certain large users could be significantly affected.

## The 3RV-e Principle

In waste management, unless a lifecycle analysis of a good or service can justify otherwise, reduction at the source, reuse, recycling (including biological treatment or land spreading), other forms of value extraction, energy recovery and disposal must given priority to in this order.

*Quebec Residual Materials Management Policy 2011-2015 Action Plan*

[www.mddefp.gouv.qc.ca/matieres/pgmr/plan-action\\_en.pdf](http://www.mddefp.gouv.qc.ca/matieres/pgmr/plan-action_en.pdf) (English overview)

[www.mddep.gouv.qc.ca/matieres/pgmr/presentation.pdf](http://www.mddep.gouv.qc.ca/matieres/pgmr/presentation.pdf) (entire French document)



**Table 1:** 3 RV-e Hierarchy

3RV-e	Definition	Examples
Reduction at the source	Reduction in the quantity of materials used to produce, distribute and use a product or service.	<ul style="list-style-type: none"> <li>• Reducing the weight of the material needed to produce a hammer handle.</li> <li>• Reducing the amount of packaging needed for the sale of a toaster.</li> </ul>
Reuse	Repeated use of a product or packaging without modifying its appearance or properties.	<ul style="list-style-type: none"> <li>• Reusing a bottle to store tap water in the fridge.</li> <li>• Returning a beer bottle so that it can be washed and re-filled (deposit programme).</li> </ul>
Recycling	Mechanical crushing of a material that is subsequently used as a secondary material by replacing a virgin material of the same type.	<ul style="list-style-type: none"> <li>• Grinding a glass bottle into powder to make batt insulation used in construction.</li> <li>• Pulverising perishables for composting or biomethanation, followed by land spreading.</li> </ul>
Value Extraction	All other value extraction processes that irreversibly transform a material so that it may be used as a substitute for a primary material.	<ul style="list-style-type: none"> <li>• Depolymerising recovered plastics to synthesize new materials.</li> <li>• Fragmenting cellulose wood debris to make ethanol for automotive fuel.</li> </ul>
Energy Recovery	Recovery of the energy contained in chemical bonds by irreversibly transforming residual materials.	<ul style="list-style-type: none"> <li>• Using wood debris in an industrial burner.</li> <li>• Heating a greenhouse with recovered oil.</li> </ul>
Disposal	Operation to store or remove residual materials as a means of elimination without any recovery.	<ul style="list-style-type: none"> <li>• Dumping in a landfill.</li> <li>• Storing without any type of value extraction.</li> <li>• Incineration.</li> </ul>

# Bans

The QRMMP identifies three categories of materials to be banned from disposal by 2020: paper and cardboard in 2013, wood in 2014, organic matter by 2020 (interim recycling objective of 60% for 2015). How will this affect waste management for organisations, especially businesses and industries? Limited storage capacity, industrial parks underserved by collection services, distant recovery facilities and exorbitant service costs are some examples. Through collaboration, industrial ecology stands to optimise the range of products and services offered within a region, such as having nearby recycling facilities, mutualised waste collection, group pricing, etc.



## 2.2 Materials and Activity Sectors

The origin and distribution of residual materials determines their classification into the following 3 sectors: the Municipal sector, the Industrial, Commercial and Institutional (ICI) sector and the Construction, Renovation and Demolition (CRD) sector.

### **Municipal Sector**

Each municipality (or municipal amalgamation) is responsible for creating and implementing a waste plan that complies with the Environmental Quality Act and the QRMMP. Perishable organic matter, paper and cardboard and municipal sludge make up the bulk of municipal waste. Improved facilities and behaviour modification are gradually leading to the decrease of the amount of waste being eliminated. According to RECYC-QUÉBEC's 2010-2011 Waste Assessment (Bilan 2010-2011 de la gestion des matières résiduelles au Québec) the recovery rate of materials from residences by selective collection is 59%, representing an increase of 13% in two years.

### **Industrial, Commercial and Institutional (ICI) Sector**

ICI establishments are responsible for the residual materials they generate. This type of management is often negotiated individually by private contracts with rental companies and container removal companies. Metals and perishable organic matter make up the majority of ICI waste. In certain municipalities, ICIs who generate small quantities of material can use municipal recycling and waste collection services without any additional costs.

### **Construction, Renovation and Demolition (CRD) Sector**

The CRD sector is comprised of businesses whose work regularly takes place at different locations. The main waste streams come from road and public infrastructure, and buildings (concrete, brick, asphalt, rubble, metals, wood, etc.)

## 2.3 Collection Services and Disposal Sites

Two decades of waste management policies have resulted in disconnected programmes and facilities. The current challenge is to integrate them so that they work together. For example, the municipal sector offers selective collection of recyclables across almost 98% of the built regions of Quebec, however neglects to include waste recovery in high-density buildings (multiple accommodations) and small and medium sized enterprises (SMEs).

Materials classified under **selective collection** are paper and cardboard fibres, plastic containers and packaging, glass and metal. In order to collect and sort them into homogenous waste streams, Quebec has waste concentrating and sorting facilities. Their numbers are decreasing in favour of more efficient sorting centers that can respond to the increase in recovery rates and the quality of material streams sought (large acceptance and treatment capacity, mechanized and automated sorting equipment, etc.) The entire waste recovery and recycling sector still shows signs of economic crisis (2008-2009 market disruptions) in the global demand of sorted materials and also in investments required to modernise sorting lines.

**Third-stream collection** deals with perishable organic matter. It is being phased in gradually, as these materials will be banned from elimination in 2020. Many municipalities have already enacted door-to-door “brown bin” collection or they recycle the sludge from their sewage plants or wastewater treatment facilities. Recovered material can be processed biologically through composting or biomethanation with the resulting compost or digestate being used in land spreading. Municipal and agricultural sludge account for a significant amount of the supply expected from developing infrastructure networks.

**Complementary programmes** intended for and paid for by ICIs recover and recycle specific material, such as those of public and private deposit programmes for beer and pop bottles. The Extended Producer Responsibility (EPR) now applies to electronics, batteries and fluorescents, as well as used oil and paint. Another existing network effectively recovers used tires, a service paid for by consumers.





**Municipal Ecocentres** are voluntary drop-off points for the collection of materials that cannot be disposed of in regular recycling bins such as metal, wood, yard waste, hazardous household waste (HHW), reusable objects, etc. Ecocentres are found across most major cities and are sometimes similar to recycling centres. These facilities are intended for use primarily by citizens and small contractors (a commercial rate is set according to the quantity and nature of the material). Generally, users sort material themselves. The recovered materials are then directed to avenues of value extraction. Social economy businesses also operate recovery networks dedicated to specific materials such as textiles, bulky items and computers.

**Sorting centres for construction, renovation and demolition** (CRD) material allow for bulk material sorting from contractors within this sector. Almost ten of these centres are currently active however their numbers are increasing rapidly and they are setting up close to active urban municipalities. The Quebec Construction and Demolition Materials Recoverers and Recyclers Group (Regroupement des récupérateurs et des recycleurs de matériaux de construction et de démolition du Québec, 3R MCDQ) is also a very active in this area ([www.3rmcdq.qc.ca](http://www.3rmcdq.qc.ca)). Nine construction and demolition debris landfills (lieux d'enfouissement de débris de construction et de démolition, LEDCD) still exist. Once they are filled, no further facilities of this type will be authorised by the Ministry of Sustainable Development, Environment, Wildlife and Parks (Ministère du Développement durable, Environnement, Faune et Parcs). Therefore, these types of materials must be sent to CRD material sorting centres to be disposed of in engineered landfills (lieux d'enfouissement technique, LET), which is costly.

A **private automobile parts and metal recovery network** effectively recovers used vehicles and industrial metal residual material. Shredded when necessary, this waste is sent to electric arc furnaces. A significant amount of metal is recycled by this network. The market for used parts is also an important reuse channel.

**Disposal** in Quebec is centred around landfill operations in approximately thirty engineered landfills (lieux d'enfouissement technique, LET) developed and operated in compliance with Regulation Respecting the Landfilling and Incineration of Residual Materials (Règlement sur l'enfouissement et l'incinération de matières résiduelles) that covers waterproofing, leachate and water collection and treatment, biogas capture and removal, etc.) Bans enacted by the QRMMP (PQGMR) will help to significantly reduce these nuisances. Only one large incinerator is still active in the Quebec City for garbage disposal and the incineration of sludge from wastewater treatment plants.

## Ecocentres

Ecocentres provide citizens, certain contractors and small and medium enterprises (SMEs) with facilities for the reuse and recovery of residual materials, space for bulk deposits and sorting, covered buildings for the drop-off of reusable materials, containers for the recovery of specific materials, best practice awareness, etc.

The LaSalle (Montreal) Ecocentre for example, accepts residential-related materials from SMEs according to a commercial rate. The number of visits is not restricted; however hazardous materials and industrial materials from ICIs are not accepted.

Services offered vary from one Ecocentre to the next. It is recommended that interested ICIs contact the Ecocentre of their region to find out about the terms of use prior to arrival.



# 3. ABCs of Industrial Ecology

Ecology and industry? The two terms seem to conflict. However, like ecosystems in nature, industrial systems can aspire to work symbiotically and cyclically whereby material, energy and resource flows circulate in a loop from one organism to another and from one organisation to another.

## 3.1 Industrial Ecology

As Lavoisier said, “Nothing is lost, nothing is created, everything is transformed.” In its quest towards a zero waste system of production, industrial ecology developed “life cycle” thinking, which includes interdisciplinary strategies and tools such as eco-design, clean technology and production, industrial symbioses and life cycle analysis (LCA).

In practice, industries do not evolve in isolation; they are part of the community and interact with increasingly influential and demanding stakeholders. The site-specific approach of industrial ecology emphasizes the importance of working in collaboration with all these actors in new forms of governance in order to optimise resource use within a site.

### Legend

1. Surface water
2. Gas
3. Organic matter (biomass)
4. Fly ash
5. Heat
6. Steam
7. Potable water
8. Sulphur
9. Gypsum
10. Gypsum waste
11. Process water

## Find Out More

### *L'écologie industrielle en 42 mots (French only)*

Nicolas Vendette and Valérie Côté

Centre de transfert technologique en écologie industrielle (2008)

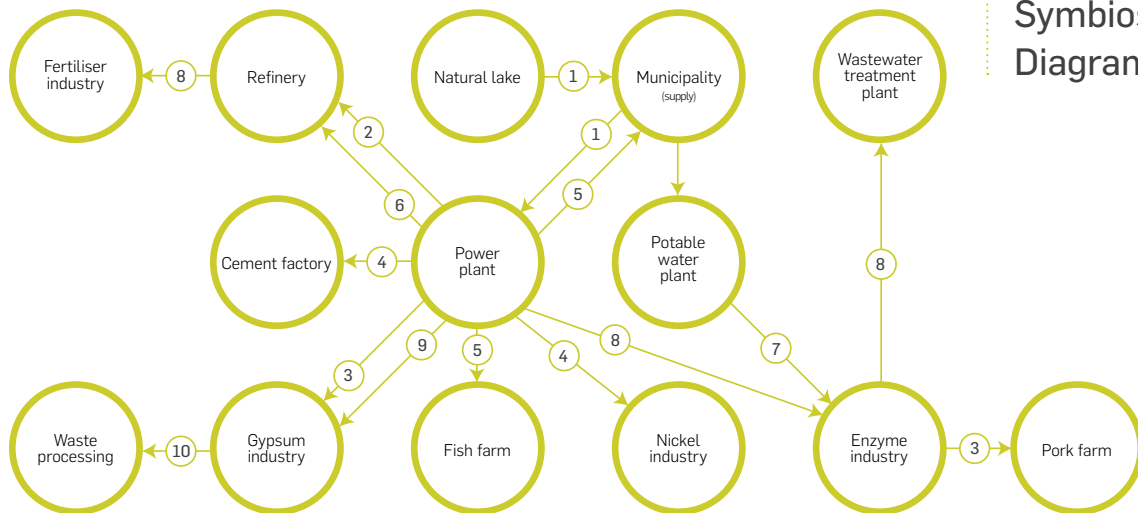
[www.CTTÉI.qc.ca/documents/Elen42mots.pdf](http://www.CTTÉI.qc.ca/documents/Elen42mots.pdf)

**L'ÉCOLOGIE  
INDUSTRIELLE  
EN 42 MOTS**





## Industrial Symbiosis Diagram



### 3.2 Industrial Symbioses

An industrial symbiosis is a network of organisations (businesses, municipalities, social economy organisations, etc.) linked together via exchanges of material, water, energy or human resources (figure 1). These exchanges are referred to as “synergies.” They reflect the collaborative application of the 3-RVE principle (Reduction at the source, Reuse, Recycling, Value extraction and Elimination). The objective is to increase organisations’ economic efficiency, reduce their environmental impact and to increase their social responsibility. Additionally, geographic proximity plays a large part in the logistics of establishing synergies and possibly their economic viability.

The impact of synergies does not only translate into benefits for organisations but also for the entire region where the synergy is located (local appeal and development, new business creation from available resource flows, skill enhancement, etc.).

## Find Out More

Since its spontaneous initiatives in the 1980s, the industrial symbiosis in Kalundborg, Denmark has evolved. Currently, the main partners are the Dong Energy Asnæs coal power plant, the Statoil refinery, the construction material and plasterboard manufacturer, Gyproc, the cement industry, the biotech company Novozymes/Novo Nordisk and the city of Kalundborg itself. Over thirty water, energy, waste and resource exchanges are currently taking place (2013).



### 3.3 Synergies

The unique characteristics of each site give rise to the creation of different types of synergies. Generally, they are either substitution synergies or mutualisation synergies (figure 2).

#### 3.3.1 Substitution Synergies

In this type of synergy, a residual material acts as a substitute, in whole or in part, for a primary or virgin material input (figure 3). The residual material, now called a “secondary material,” extends the use and life cycle of materials from one participating organisation to the next. The finalising of this type of exchange may require sorting, processing (pelletisation, granulation, bagging, etc.), decontamination of the material prior to use, or even carrying out applied research projects to develop a new product.



#### Harsco Minerals: a synergy as the basis of a business model

The metallurgical industry generates numerous by-products that can be used in various civil engineering applications. Harsco Minerals (Harsco Minéraux), located in Sorel-Tracy, recovers more than one million tonnes of material from the activities of Rio Tinto Iron & Titanium, Arcelor Mittal and Sorel Forge, all of which are nearby businesses.

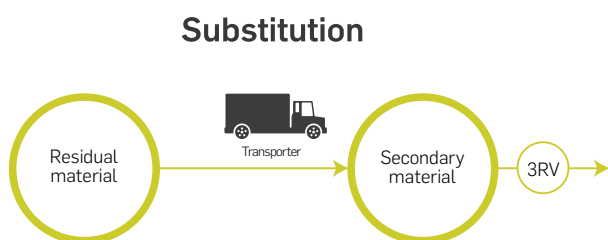
Very active in applied research, Harsco Minerals has notably developed specialised products for pool filtration and sandblasting. This has resulted in disposal cost savings for some businesses, and new product markets and job creation for others. Overall, every business involved in this synergy benefits!

Exchanges designed to extract value from resources apply to a various types of resources:

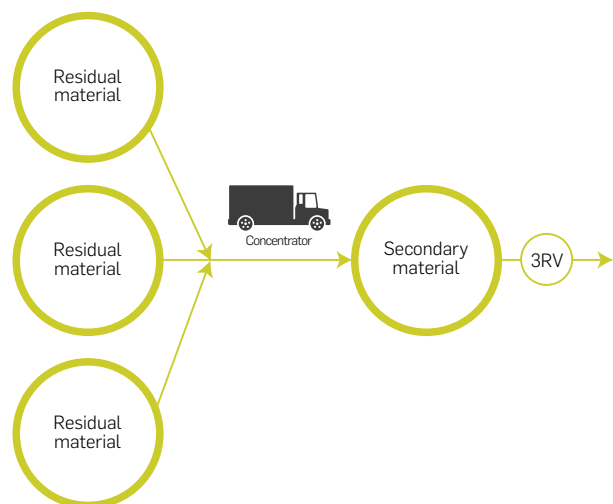
- **Intangible resources:**  
Services, procedures, training, information, etc.
- **Industrial waste and consumables:**  
Water, energy, residual materials, etc.
- **Physical resources and equipment:**  
Machines, buildings, storage, etc.
- **Human resources:**  
Personnel, experts, technicians, instructors, etc.

Figure 2

#### Types of Synergies



#### Mutualisation



# Green materials and eco-products

Materials and products that are less damaging to the environment over the course of their life cycle compared to other similar materials and products on the market that deliver the same service or level of performance.

## Examples of mutualisation

- Grouping of employee services (catering, childcare, etc.).
- Janitorial services.
- Organising public transit for employees.
- Pooled purchasing of goods and services (equipment for personal or communal protection, pallets, paper shredding, cardboard collection, uniform cleaning, landscaping, de-icing, snow removal, etc.).
- Shared storage space.
- Communal management of certain residual materials may lead to the development of new services or industries nearby (methanation, composting, decontamination, grinding, etc.).
- Etc.

## Challenges of mutualisation

Establishing mutualisation networks can be hindered by logistic and operational challenges. The concerted effort of interested parties is certainly the best way to overcome these challenges, however it is not always easy to unite these parties and to establish a plan wherein the interests of all are preserved. At this point, the assistance of a third impartial party may help establish successful mutualisations.

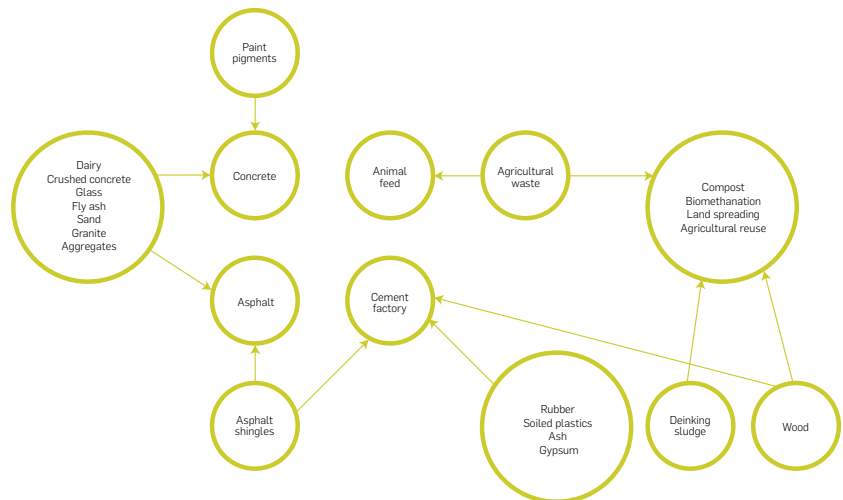
- Traceability
- Responsibility
- Quality assurance and quality control
- Supply contamination
- Payment and cancellation dates of existing policies and contracts
- Collective schedule/calendar
- Internal resources (lack thereof)

## 3.3.2 Mutualisation Synergies

In a mutualisation, participants share most of their resources by coordinating how they are managed and what their specific needs are. This involves the sharing of services, equipment, space, etc. Having the strength of a group enables economies of scale when purchasing goods or services and optimises site logistics. Having well managed transportation (procurement, disposal, waste collection, etc.) improves the group's carbon footprint. Mutualised resources can be handled by a third-party or a participating member. A participating member can also be the user of these resources.

Figure 3

## Examples of Substitution Synergies



# 4. Creating an industrial symbiosis

The creation of an industrial symbiosis cannot be improvised. The Centre de transfert technologique en écologie industrielle (CTTÉI) has developed a simple, versatile methodology based on experience from the different projects it has overseen.

## 4.1 Stakeholders

Considering stakeholders' needs (figure 4) is crucial when creating a symbiosis project. These actors represent all groups, organisations or individuals who could have an affect, or be affected by the project. Their interests differ, can at times be opposing, and also evolve and change over time (table 2). For the project initiator, it is important to fully understand these issues in order to establish strategic priorities. They will also serve as indicators for measuring the progress or success of a project.

### 4.1.1 Project Initiator

The project initiator is the one who first sets the industrial symbiosis process in motion. Often a local development actor, this individual has a positive influence on the different solicited groups. His or her main role is to facilitate communication between the project management team, participating organisations and others involved in the symbiosis. He or she is responsible for securing financing, goal setting, and accountability. The entire process must be transparent.

## Examples of Symbiosis Project Initiators

- **Economic Development Agencies:** local development centres (CLD), community support organisations (SADC), chambers of commerce, etc.
- **Business Representatives and Groups:** activity zones, industrial parks, sector-specific groups, non-profit organisations, employers' councils, etc.
- **Political Representatives:** regional administration, regional county municipalities (RCM), municipal elected officials, mayors, councillors, etc.
- **Environmental and Social Organisations:** regional environmental councils, social economy organisations, inter-municipal waste management organisations, etc.



**Table 2:** Stakeholder Concerns, Expectations and Considerations

Stakeholders	Concerns, Expectations and Considerations		
	Economic	Environmental	Social
Project Initiator Partners	Local development. Local appeal. Hub of skills and competitiveness. Business longevity. Job preservation and creation.	Environmental impact reduction. Innovation. Regional influence. Meeting of national waste management objectives. Improved environmental quality.	Social responsibility. Local sustainable development. Transparency. Communication. Jobs. Influence. Reduced nuisances.
Project Management Team/Industrial Ecology Advisor	New business opportunities. Skilled workforce training. Innovation. Identification of complementary businesses. Identification of R&D needs.	Optimised resource and waste management. Calculation of benefits.	Opportunity management. Networking. Ethics. Confidentiality. Communication between stakeholders. Information. Formation of a skilled workforce.
Participating Organisations	Cost reduction (procurement, equipment, disposal, etc.). Creation of value. Cost efficiency.	Regulatory compliance. Management cost reduction. Increased recyclability of products. Eco-design.	Retention or creation of commercial relationships. Creation of local partnerships. Social responsibility. Corporate image. Positive neighbour relationships.
Service Providers	Improved service offerings. New clients. Market sharing and differentiation of products and services. Cost efficiency.	Supply chain optimisation. Formalised technical specification.	Retention or creation of commercial relationship. Creation of local partnerships. Social responsibility. Fair competition.
Technical Experts	Skills and competitiveness hub. Creation of substitution and mutualisation opportunities.	R&D. Optimised resource and material management. Innovation. Eco-design.	Recognition of industrial ecology. Ethics. Confidentiality. Understanding the mechanisms of how synergies are carried.
Community	Local benefits. Attracting of complementary businesses to those on site. Regional planning.	Regulatory compliance. Respect for the environment. Ecosystem conservation. Reduced nuisances.	Retention or creation of local jobs. Social acceptability. Social responsibility. Health and safety. Quality of Life. Hazard control. Conservation (heritage, landscape, usage, etc.).

# Lanaudière: A Unifying Regional Project

Initiated by the L'Assomption Local Development Centre (Centre local de développement de L'Assomption) in 2009, the regional industrial symbiosis project was designed to offer businesses of the region of Lanaudière an innovative way to improve their productivity and environmental performance. The first project of its kind in Quebec, the initiatives undertaken within the 158 participating businesses led to the identification of almost 300 synergies, representing more than 130 000 tonnes of industrial waste. Now led by Lanaudière Économique, a non-profit organisation for economic development actors of Lanaudière, the project has been elevated by having a sustainable development advisor who offers tailored training and support to businesses.



## 4.1.2 Project Management Team

The project management team reports directly to the project initiator. He or she is responsible for establishing strategic directions, administering an action plan, monitoring progress and respecting deadlines. Some organisations may create an internal committee, or a committee made up of both internal and external members, depending on the involvement of participants. Others may prefer to delegate the entire project management to a third independent party specialised in these types of projects, such as the CTTÉI.

## 4.1.3 Industrial Ecology Advisor

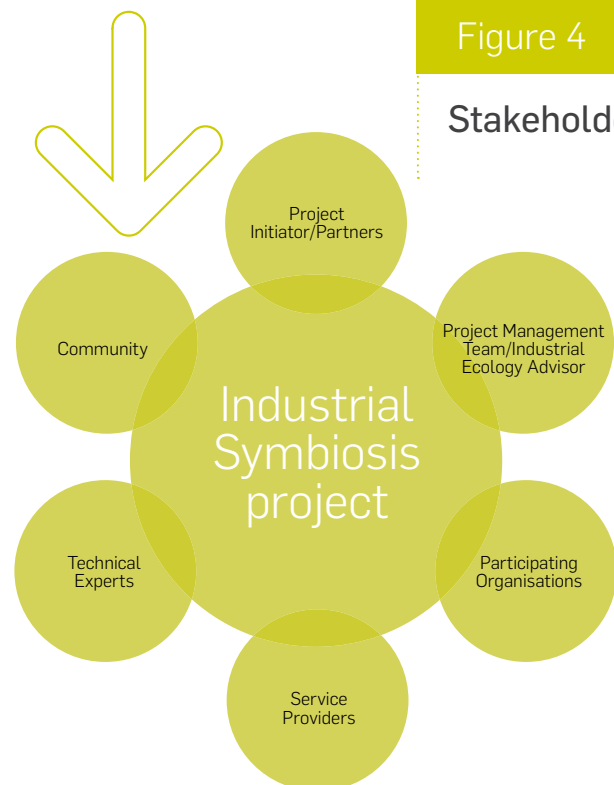
As a member of the project management team, the industrial ecology advisor is the point of contact between symbiosis participants. In addition to his or her technical expertise in waste management and industrial processes, he or she must possess strong knowledge of the site, its businesses, and stakeholders. His or her role is primarily to collect information on stakeholder needs and corresponding available resources, to propose synergies, to validate the technical and economic feasibility of potential exchanges and to evaluate economic, environmental and social benefits. The industrial ecology advisor could also carry out or commission technical feasibility tests either on-site or in laboratory. Often, he or she is required to assist in the technical design of solutions and must work out logistics. The support provided is especially useful in facilitating communication between actors and setting terms of exchange. Where needed, he or she can act as an intermediary in contract negotiations and during the implementation of the synergy itself.



Feedback from experience shows that beyond technical, economic and environmental issues, the social element plays a central role in developing industrial symbioses as it strengthens the engagement of stakeholders required for the longevity of the projects

Figure 4

Stakeholders



# Bécancour Industrial Park and Port Symbiosis

The industrial symbiosis of the Bécancour Industrial Park and Port (Parc industriel et portuaire de Bécancour) was the first of the CTTÉI's symbiosis projects. As of 2008, 12 businesses accepted to share information about their activities, their needs, and materials, water and energy they wanted to exchange within the park. From the 102 offers and 32 requests for materials during the first round of the project, 40 synergies were identified, with a total value in resources of 1.6 million dollars!

Since then, an industrial ecology advisor dedicated exclusively to the symbiosis project has been brought on board. The advisor has already identified 70 new potential synergies and businesses have confirmed the technical and economic feasibility of many of them. The implementation of synergies continues!

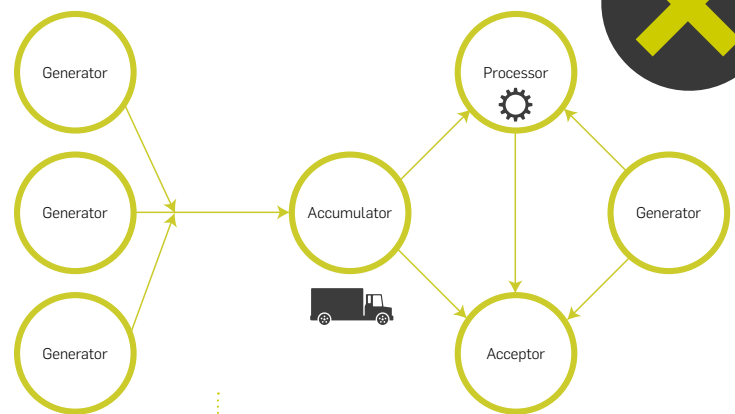


Figure 5

## Participants Roles in a Symbiosis

1. **Generator:** Someone with a material to dispose of (offering an input).
2. **Concentrator:** Someone who mutualises resources. This step is sometimes necessary in order to have flows that are significant enough to be viably treated or recycled.
3. **Processor:** Someone who processes resources needed in order for them to meet the technical specifications of the acceptor.
4. **Acceptor:** Someone who makes use of the secondary material (requesting an input).

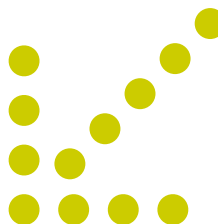
Work together!

Each site is usually served by environmental service providers. Their participation in the creation of the symbiosis is of particular importance. By working directly with the established network of service providers, the project management team and the industrial ecology advisor seek to optimise the mutualisation and circulation of flows in order to increase the efficiency of the group and to reduce the quantity of discarded resources.

### 4.1.4 Participating Organisations

Participating organisations are all entities participating in a symbiosis, whether in the synergy group itself or externally (table 3). This includes not only businesses, but also municipalities and environmental service providers (waste haulers, packagers, recyclers, etc.). In order to simplify their identification, participants can be classified into 4 groups (figure 5).

# Training and Recovery Centres (CFER)



The mission of Training and Recovery Centres (Centres de formation en entreprise et récupération, CFER) is to support youth with learning difficulties and to provide them with workforce preparation training. Closely linked to sustainable development, the network has allowed for the creation of various technical services related to waste disassembly and treatment necessary for their re-entry into the market. For example, the CFER Normand-Maurice in Victoriaville dismantles Hydro Quebec's line hardware, sorts that of Bell Canada and disassembles obsolete electronics dropped off at Bureau en Gros. It was the first establishment of this kind in Quebec.

**Quebec CFER Network**  
[www.reseaucfer.ca](http://www.reseaucfer.ca)



**Table 3:** Examples of Participants and Their Role in a Symbiosis

Participants	Type of Actor	Role in the Symbiosis
Municipality	Concentrator/Processor	Wastewater collection and treatment.
Waste Management Contractor	Concentrator/Processor	Private waste collection and treatment. Disposal in engineering landfills.
Transfer Centre	Concentrator/Processor	Hazardous material recovery and sorting.
Joint Enterprise	Concentrator	Recyclable material recovery and sorting.
Kitchen Cabinet Manufacturer	Generator	Wood scrap generation.
Paper and Cardboard Packaging Manufacturer	Concentrator/Processor/Acceptor/Generator	Paper and cardboard collection. Treatment of collected materials. Manufacturing of products from recycled fibres. Products from crusher by-products.
Ecocentre	Concentrator	Recovery site (fee for use) for businesses (construction, renovation and demolition waste, tires, etc.).
Social Economy Businesses	Concentrator/Processor	Electronics sorting and disassembly.
Training and Recovery Centre (CFER)	Concentrator/Processor	Wooden pallet recycling.
Recovery Centre	Concentrator	Used goods store (reuse). Deposit for Extended producer responsibility (EPR).



## Annex 1

### List of Industrial Ecology Experts

## Need a Boost?

Creating an industrial symbiosis relies on the intervention of many actors, often with divergent interests. In order to assist them, the project initiator may delegate project management to an independent third party specialised in these types of processes. The CTTÉI has led and collaborated on many symbiosis projects in Quebec and Ontario since 2008.

Contact us to find out more about our industrial ecology support services!



#### 4.1.5 Technical Expertise

Creating synergies can at times present significant technical and logistic challenges. Different actors, such as Quebec's College Centres for Technology Transfer (Centres collégiaux de transfert technologique), university or national research centres, waste management consultants, engineering firms, clean technology producers, private analysis laboratories etc., can all help the project management team and the industrial ecology advisor overcome difficulties, while some experts can even be integrated into the team.

#### 4.2 Implementation Steps

There are five major steps in creating an industrial symbiosis: project planning, site assessment, participant recruitment and data collection, potential synergy identification and implementation and monitoring (table 4). Each step involves a series of actions to be taken in the cycle of continuous improvement.

## Why Contact an Expert?

- Inventory needs and available resources of the site.
- Analyse the site's industrial make-up and material flows.
- Visit and audit participating organisations
- Determine physicochemical properties of materials.
- Identify and analyse potential synergies.
- Analyse the technical and economic feasibility of synergies.
- Conduct applied research projects (new markets, technical validation, etc.).
- Carry out applied research projects to develop treatment and decontamination solutions.
- Develop prototypes or eco-products.
- Identify industrial equipment in order to adapt or scale processes.
- Calculate potential economic and environmental benefits
- Inventory greenhouse gas emissions.
- Provide guidance in accreditation or certification processes.
- Etc.



**Table 4:** Steps in Creating an Industrial Symbiosis

<p><b>1. Project Planning</b></p>	<ul style="list-style-type: none"> <li>• Define the project site.</li> <li>• Identify, contact and engage partners.</li> <li>• Secure financing for the project.</li> <li>• Launch and promote the project.</li> </ul>
<p><b>2. Site Assessment</b></p>	<ul style="list-style-type: none"> <li>• Identify stakeholders and analyse local context.</li> <li>• Understand the industrial characteristics of the location and identify existing channels for waste recovery and value extraction.</li> <li>• Select businesses to solicit.</li> </ul>
<p><b>3. Participant Recruitment and Data Collection</b></p>	<ul style="list-style-type: none"> <li>• Contact selected businesses.</li> <li>• Collect data on material and energy flows consumed and generated by participating organisations in order to create a flow map.</li> <li>• Compile collected information.</li> </ul>
<p><b>4. Potential Synergy Identification</b></p>	<ul style="list-style-type: none"> <li>• Analyse opportunities for synergies based on offers and requests from businesses established in step 3.</li> <li>• Evaluate and prioritise the most promising synergies based on criteria established by participating organisations, technical feasibility of synergies and benefits they could provide.</li> </ul>
<p><b>5. Implementation and Monitoring</b></p>	<ul style="list-style-type: none"> <li>• Notify participants of potential synergies.</li> <li>• Assist participants in decision-making and the implementation of recommendations.</li> <li>• Test and evaluate feasibility (economic, technical, logistic, etc.) as needed via preliminary testing in laboratory, industry, on-site or by expert consultation.</li> <li>• Set terms of exchange. Serve as an impartial intermediary as needed in negotiations or discussions between those involved in the synergy.</li> <li>• Monitor progress of exchanges, collect feedback and share results.</li> </ul>

### 4.2.1 Step 1: Project Planning

First, the project initiator must assemble partners and define the site of the synergy group, i.e. the perimeter in which the synergy will be created. It can be an industrial park, a city, a regional county municipality (RCM) or any other zone of activity. The initiator is responsible for engaging stakeholders and resources necessary for the project. At this point, the project goals are determined and the project initiator has a team made up of at least one project manager and one industrial ecology advisor (project management team). In order to ensure a positive response by the community, there must be an official project launch and publicity of the project details. Such communication strategies also have the advantage of giving visibility, permission and credibility to the project. They should also stimulate the interest of the public and the curiosity of affected stakeholders.

## Success Factors

- Create local momentum for promoting industrial ecology. Demonstrate interest.
- Encourage engagement and participation of local leaders.
- Set governance rules between partners and the project management team.
- Launch and promote the project (press release, media coverage, web site, etc.).



## 4.2.2 Step 2: Site Assessment

The assessment allows for a better understanding of the characteristics of the site and the needs of organisations. It is an essential step in orienting the symbiosis towards synergies most likely to have a significant impact on economic, environmental and social benefits. Certain information is essential in creating a symbiosis (table 5).

**Table 5:** Site Assessment

Information To Collect	Why Is It Important?
Types and number of businesses or other organisations involved (activity sector, number of employees, industrial parks, etc.).	To evaluate the dynamic of the site in terms of planning and economic development.
Industrial metabolism of the site. Flow map (mainly of incoming and outgoing material and energy).	To identify problematic flows (waste of resources, materials sent to landfill, lack of recovery options, high treatment costs, etc.) and to quantify the potential supply available.
Existing infrastructure and waste-related services (haulers, sorting centres, Ecocentres, construction and demolition debris landfills, engineered landfills, recyclers, etc.).	To identify local or external resources and actors active on the site who could be recruited during the project. To identify sectors and services that are missing or to be improved.
Synergies already in place (types of exchanges, initiators, partners, impacts, feedback, etc.).	To demonstrate the technical and economic feasibility of synergies, identify organisations proactive in industrial ecology. Optimise synergies already in place.
Network of industrial ecology and related experts.	To identify local and external resources available to assist the project initiator in the different steps in creating a symbiosis (training, data collection, laboratory tests, etc.).



## 4.2.3 Step 3: Participant Recruitment and Data Collection

The selection of participating organisations is critical during the first wave of the project. At this stage in the project, organisations with a strong synergistic potential (i.e. the ability to form synergies between one another) should be selected in order to create momentum and to take advantage of the benefits of the synergies as quickly as possible. The project initiator, partners, project manager and industrial ecology advisor should choose organisations based on the site assessment and the project directions. The number of organisations to select depends on the objectives of the project and the financial, human and material resources available. If organisations are selected wisely, mainly in terms of how well they complement each other, a group of a dozen participants is sufficient to begin a project.

# Guidelines for Selecting Participants

**Based on different industrial symbiosis experience, the CTTÉI has developed guidelines for selecting participating organisations that will help drive the creation of synergies. The participation of these organisations is often a key success factor in symbiosis projects. The following types of organisations should be given priority:**

1. Proactive organisations/leaders in economic and sustainable development.
2. Environmental service providers.
3. Organisations from within the most active sector.
4. Organisations operating within a wide range of activity sectors.
5. Creator or many jobs (size of organisations).
6. Organisations with a supply shortage or difficulty disposing of materials and energy.



Once selected, organisations must accept to participate in the project. Different recruitment mechanisms can be used (information meeting, letter, email, phone call, etc.) but in all cases it is essential to promote the project and to specify the expected level of participation (timeline, human resources required, information to provide, confidentiality agreement, etc.). The communication tools developed for the project should be quite simple, clear and coherent. This first contact with organisations is also an excellent way for the project initiator to introduce the project management team and the industrial ecology advisor.



## Synergie Québec: To spread the word and create synergies!

Once a project includes 15 participating organisations, managing information quickly becomes difficult. Synergie Québec ([synergiequebec.ca](http://synergiequebec.ca)) is a web platform developed by the CTTÉI that showcases the industrial symbiosis project community. As a paid member, each project can display its partners and activities through the use of a personal blog. Synergie Québec also houses a web tool for the identification of potential synergies from member organisations' offers and requests.





## Annex 2

### Sample data collection questionnaire

#### 4.2.4 Step 4: Potential Synergy Identification

In order to identify potential synergies, the industrial ecology advisor generally follows a four-step process:

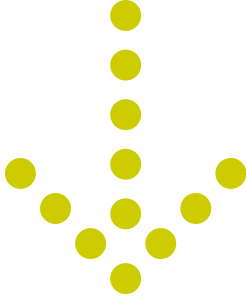
- 1. Data collection. Obtain quantitative and qualitative information about organisations' inputs and outputs (requests and offers for material, energy and services).**
- 2. Analyse site offers and requests. The industrial ecology advisor confidentially analyses all information without divulging it to the rest of the synergy group.**
- 3. Identify potential synergies by comparing offers with requests. This step can be done manually or with the help of the web tool developed by the CTTÉI that identifies matches semi-automatically.**
- 4. Evaluate technical, economic and logistic pre-feasibility of potential synergies to prioritise them before presenting them to participants.**

Some exchanges are straightforward. For example, an offer of wood can easily be matched with a request for the same product. However, experience shows there can be more complex matches, such as the addition of residual glass in concrete manufacturing to create a new product, the use of food rinse water in animal feed production, the recycling of residual phosphoric acid in fertiliser, etc. These non-traditional exchanges multiply the number of possible synergies. This type of expertise builds over time or through collaborations with consultants or specialists with more technical knowledge or industry experience.

## Success Factors

- Organisation prioritisation. Select proactive organisations looking to invest in and contribute to the project, and to implement proposed solutions, first.
- Relationships. Establish trust between participating organisations, project management team and industrial ecology advisor.
- Thorough data collection. Information can be collected by various means (sending a questionnaire, phone interview, etc.), but the industrial visit is without doubt the most effective. The industrial ecology advisor should be trained to audit waste management systems and industrial processes in order to quickly assess materials of interest and essential information to be collected.
- Data quality. Collect high-quality information (relevant, valid, complete, precise and current).
- Data manipulation. Compile information into a database or a synergy creation tool such as Synergie Québec.
- Synergy sorting. Put aside synergies with a low potential for success due to technical, economic, legal, or logistical, etc. reasons.





#### 4.2.5 Step 5: Implementation and Monitoring

It is not enough to simply identify synergies theoretically for them to magically put themselves into place between two organisations. Throughout the process, the role of the industrial ecology advisor is to create favourable conditions that will lead to their implementation. During this step, feedback from participating businesses is essential since the decision to go ahead with an exchange resides with them. To maintain their interest, a group dynamic must be fostered and participants' sense of belonging to the project must be strengthened. Various means can be used to achieve this, such as luncheons, trainings or conferences on topics relevant to multiple businesses, industrial visits, electronic newsletters, etc. The important thing is to communicate often and to build on the domino effect of successful cases.



#### Implementation and Monitoring Process

1. **Give participating organisations the list of potential synergies relevant to them.**
2. **Validate the feasibility of synergies with organisations based on their acceptability criteria. Identify obstacles to the implementation of the synergies and ways to overcome them, where necessary.**
3. **Provide technical support to organisations during their preliminary tests (material characterisation, waste processor and hauler search, environmental assessments, etc.).**
4. **Expand the search perimeter to find opportunities for “orphan” offers and requests i.e. those without an acceptor from within the group members. Other organisations, even those located off-site, could join the symbiosis to meet specific needs.**
5. **Identify business opportunities (incorporation of businesses whose offers or requests would complement those already present, development of new processes, improved site appeal, addition of start-ups to complete existing service offerings, etc.).**
6. **Diffuse project results to stakeholders and the community (while respecting confidentiality agreements).**
7. **Gather comments from stakeholders about their satisfaction levels, how well the service meets their needs and the impacts of the project.**
8. **Solicit new organisations and continually repeat the process to ensure the longevity of the project.**

**Table 6:** Overview of CTTÉI Symbiosis Projects

<b>Symbiosis Project</b>	<b>Bécancour</b>	<b>Lanaudière</b>	<b>Shawinigan</b>	<b>Rivière-du-Loup</b>	<b>Toronto</b>
<b>Type of Site</b>	Industrial park	Administrative region	Industrial parks	City	Eco-business zone
<b>Number of Participating Businesses</b>	12	158	31	18	76
<b>Type of Project Initiator</b>	Park management company	Economic development organisations	Economic development organisations	City	Public-private partnership
<b>Number of Identified Synergies</b>	109	285	72	101	49



## Success Factors

- Professional conduct (respect of confidentiality, no conflicts of interest in the proposal of potential synergies, transparency for partners, etc.).
- Good relationships with the network of environmental service providers.
- Priority focus given to synergies showing strong potential.
- Dissemination of feedback from organisations that have implemented synergies to inform the public about their experience and the benefits of their project.
- Timeline. Diligently follow-up with participating organisations.
- Launch of a second wave of organisation selection and solicitation



# 5. Evaluation

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Monitoring the evolution of an industrial symbiosis is essential in order to improve its performance on a given site. It is in project initiators' best interest to calculate benefits and share their experiences in order to increase the prevalence of symbiosis projects and to improve symbiosis development plans.

Perceived success depends largely on the priorities of the participants. It is therefore very important to determine the needs and expectations of different stakeholders at the beginning of the project and throughout its duration. A symbiosis is not a static object; it does not have an official end. Evaluation and monitoring must be done regularly to ensure that the symbiosis plan is updated and that the project is continued.e.

To support project initiators in evaluating and monitoring their projects, the Centre de transfert technologique en écologie industrielle (CTTÉI) has developed economic, environmental, technical/logistic and human indicators to help stakeholders better identify the impacts of their symbiosis project and options for continued improvement (table 7). Indicators selected will depend on desired outcomes of the project and can be monitored based on quantifiable objectives established in advance.

The information required for reporting can be gathered by each one of the participating organisations (surveying, feedback monitoring, annual meeting, etc.) It is preferable to have participants document their observations and necessary adjustments made throughout the project. This information can then be compiled and analysed by the industrial ecology advisor.

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**Table 7: Industrial Symbiosis Project Monitoring Indicators**

Economic Indicators
Primary material cost savings
Primary material cost savings
Water cost savings
Equipment and infrastructure cost savings
Operational and managerial cost savings
Waste treatment cost savings
Waste disposal cost savings
Savings from the avoided purchase of greenhouse gas allocations according to the Quebec Cap and Trade System for Greenhouse Gas Emissions Allowances (Système de plafonnement et d'échange de droits d'émission de gaz à effet de serre du Québec, SPEDE)
Savings from avoided regulatory fines (risk reduction)
Revenue from the sale of secondary materials
Revenue from the creation of new products or services
Revenue from the sale of greenhouse gas emissions allocations according to the Quebec Cap and Trade System for Greenhouse Gas Emissions Allowances (Système de plafonnement et d'échange de droits d'émission de gaz à effet de serre du Québec, SPEDE)
Existing client retention (improved reputation and increased competitiveness)
Number of new clients (improved reputation and increased competitiveness)
Return on investment (ROI)
Environmental Indicators
Quantity of waste generated (including hazardous waste)
Quantity of primary materials saved
Quantity of energy saved
Quantity of water saved
Quantity of greenhouse gases emitted
Number of environmental certificates obtained
Number of regulatory fines incurred
Number of eco-design products

The monitoring of indicators must be adapted and improved upon throughout the project. Above all, initiatives and their results must be documented. The sharing of experiences is a key factor in improving the success rate of an industrial symbiosis. Results can be shared via conferences, presentations, trainings, publications, web platforms like Synergie Québec, etc. There is no shortage of ways to showcase a project. Publicity must be accounted for in the project planning.

**Table 7:** Industrial Symbiosis Project Monitoring Indicators(suite)

<b>Technical/Logistic Indicators</b>
Number of processes optimised
Level of process optimisation achieved
Amount of time saved
Number of shared facilities or equipment
Number of new technologies developed
Number of technologies transferred
<b>Social Indicators</b>
Number of jobs created
Number of services shared
Number of spaces and facilities shared
Number of corporate social responsibility (CSR) certifications obtained
Number of new actors/stakeholders
Number of trainings offered (skill development)
Rate of health and safety incidents
Rate of business cooperation
Rate of community participation
Rate of organisation and community awareness
Level of social acceptance

### Annexes 3 and 4

Waste management support programmes:

- **RECYC-QUÉBEC financial assistance programmes**

Waste management and sustainable development certifications:

- **Certification programmes**



# 6. Industrial Symbiosis: Long-term Outlook

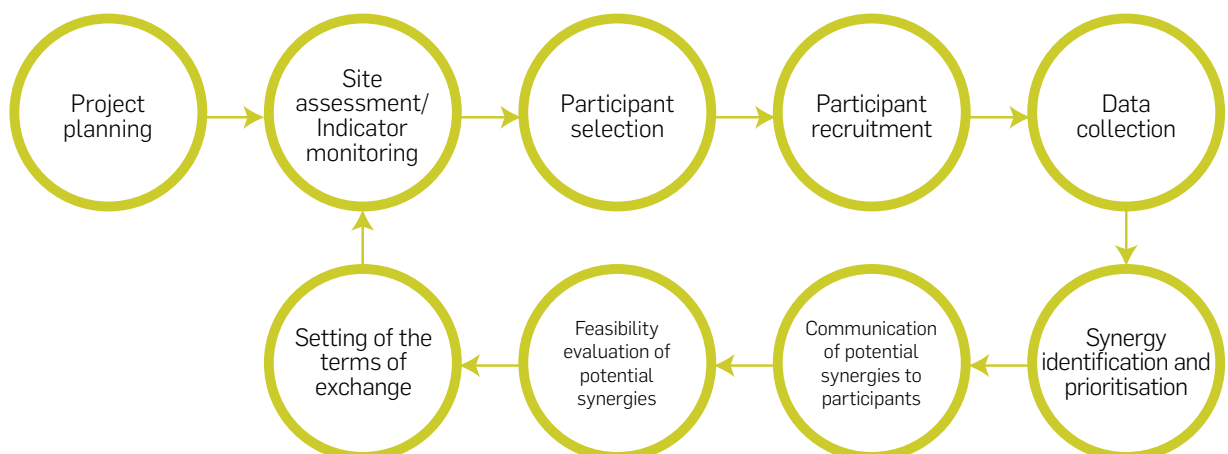
How can you ensure the success of an industrial symbiosis over the long term? Experience with these kinds of projects is relatively recent and few answers exist about the factors that influence their longevity. Despite this, some elements are already proving to have a positive effect on the creation of industrial symbiosis projects, such as:

- **Continuous solicitation of new organisations to join the synergy group.**
- **Periodic updates of material and energy flow data.**
- **Maintenance of the dynamic created between participants by staying in tune with their needs and by proposing activities or services that are in line with their priorities.**
- **Sharing and promoting best practices between different synergy groups.**
- **Requesting external expertise to implement complicated synergies.**
- **Support from new partners (institutional, political or other) to adopt the industrial symbiosis approach into more global sustainable development strategies.**

An industrial symbiosis is not a static object. To ensure its longevity, a model of continuous improvement should be followed the implementation steps should be re-visited so that goals can be revised and the symbiosis can be strengthened (figure 6).

Figure 6

## Implementation Steps and Continuous Improvement



# Conclusion

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It is clear that today's businesses and organisations are interested in optimising how they manage their production flows by looking for solutions primarily in their immediate economic environment. For public actors, a key idea to move towards local solutions by seeking to close material and energy loops at a given scale (site, region, sector, urban zone, activity zone, etc.).

Technological advancement and competing pressures are having a great impact on the industrial sector. These constant changes bring about rapid modifications to modes of production, procurement and disposal of objects at the end of their life. The speeds at which these disruptions occur far exceed the capacity of companies to manage their resources intelligently within the context of sustainable development. Industrial ecology positions itself as an effective sustainable development strategy, where the goal is to minimise environmental impacts of the production system as a whole.



## Your Turn!

The purpose of this guide was to familiarise you with the process of implementing an industrial symbiosis by allowing you to learn from the experiences of the CTTÉI. By now, you would have understood that each project is unique and that the results are directly correlated to the amount of work put into it. The many recommendations and resources proposed should help you optimise your efforts and avoid missteps. Therefore, do not hesitate to make use of them and to keep us updated on your project.



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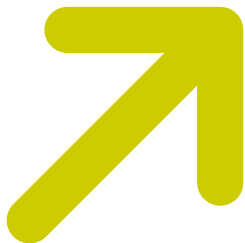
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# Annex 1

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## List of Industrial Ecology Experts

### List of Industrial Ecology Experts

**Interuniversity Research Centre for the Life Cycle of Products, Processes and Services (CIRAIG)**  
**Polytechnique Montréal**  
<http://www.ciraig.org/fr/acv.php>

**Quantis**  
<http://www.quantis-intl.com>

**Eco-design**  
**Institut de développement de produits (IDP)**  
<http://www.idp-ipd.com>

**Technical Assistance and R&D**  
**Centre de transfert technologique en écologie industrielle (CTTÉI)**  
<http://www.cttei.qc.ca>

**Trans-tech Network**  
**College Centres for Technology Transfer**  
<http://reseautranstech.qc.ca>

**Centre de recherche industrielle du Québec (CRIQ)**  
<http://www.criq.qc.ca>

**Symbioses and Exchange Programmes**  
**Synergie Québec**  
<http://synergiequebec.ca>

**Quebec Industrial Waste Exchange Program (BRIQ)**  
<http://www.briq.ca>



# Annex 2

## Sample Data Collection Questionnaire

### 1. Identification

- Name of the organisation (business, company, municipality, association, etc.)
- Date of the interview
- Name of the person filling out the questionnaire
- Information about the contact person at the organisation who provided the information to the interviewer: name, title, phone number
- Activity sector
- Description of the primary activities of the organisation
- Diagrams of a processes' main materials flows and equipment.



### 2. Inputs

**Specify the following information for each type of primary resource that could be replaced by a secondary material:**

- Material type and composition
- Current use
- Quantity consumed (mass, volume, etc.)
- Technical specifications expected
- Acceptable contamination rate
- Supply cost
- Possible interactions with the process
- Danger and health and safety

### 3. Outputs

**Specify the following information for each type of residual material that could be re-introduced into another industrial process:**

- Material type
- Available quantity (mass, volume, etc.)
- Source
- Characterisation
- Current disposal method (private collection, recycling, landfill, etc.)
- Treatment and disposal cost
- Storage capacity
- Danger and health and safety.

### 4. Equipment & Buildings

**Specify the equipment that could be shared and under which conditions (cardboard baler, wooden container, spectrometer, conference room, etc.).**

### 5. Special Requirements

**Specify if the organisation has any particular requirements (training, health and safety, process water etc.).**

# Annex 3

## RECYC-QUÉBEC Financial Assistance Programmes

The QRMMP 2011-2015 Action Plan offers many financial assistance programmes (table 8) to support waste management activities of different clients:

- **ICI Waste Management Performance.**
- **Technology and Process Implementation and Market Development.**
- **Social Economy and Community Engagement.**
- **Recyclables Sorting Centres Performance.**
- **Graduate Studies Scholarship Programmes.**

Additionally, the directions of RECYC-QUÉBEC's 2012-2017 Strategic Plan specifically target Industries, Commerce and Institutions (ICI) and the Construction, Renovation and Demolition (CRD) sector. RECYC-QUÉBEC will help industrial parks and commercial centres put adequate waste recovery systems in place. Other programmes offered by different ministries may also help organisations establish their projects within sustainable development contexts.



## Find Out More

### RECYC-QUÉBEC Financial Assistance and Related Programmes

<http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/programmes.asp>  
(French)







**Table 8: RECYC-QUÉBEC Programmes**

Programmes	Admissible Projects	Admissible Clients
<p><b>ICI Waste Management Performance</b>  <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/performance.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/performance.asp</a> (French)</p>	<p>Review, assessment, training and management plan.            Equipment acquisition.</p>	<p>Industrial, commercial or institutional establishments.            Consultants or waste haulers (as an intermediary).</p>
<p><b>Technology and Process Implementation and Market Development</b>  <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/technologies.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/technologies.asp</a> (French)</p>	<p>Review and assessment.            Operations and facilities development.</p>	<p>Waste treatment facilities.            Businesses working with product end-of-life.            Research centres.            Teaching institutions.            Association.            Consultant.</p>
<p><b>Social Economy and Community Engagement</b>  <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-eco-soc.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-eco-soc.asp</a> (French)</p>	<p>Business plan, market study, assessment and training.            Operations and facilities start-up and development.            Information campaign, publicity and education.</p>	<p>Social economy organisations.            Social integration organisations.            Community action groups.</p>
<p><b>Recyclables Sorting Centres Performance</b>  <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-centres-tri.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-centres-tri.asp</a> (French)</p>	<p>Status report and performance analysis.            Investment in improvement, implementation, consolidation or processing.</p>	<p>Recyclables sorting centres.</p>
<p><b>Graduate Studies Scholarships</b>  <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/Bourses.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/Bourses.asp</a> (French)</p>	<p>Waste management knowledge development.</p>	<p>Master and doctorate students.</p>

# Annex 4



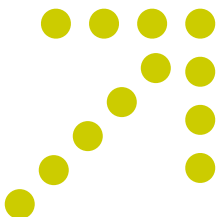
## Certification Programmes

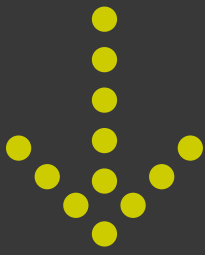
There are a wide variety of waste management and sustainable development certifications available (table 9). For organisations participating in an industrial symbiosis project, the certification process can be the opportunity to validate the compliance of their practices and to have their resource and by-product management efforts publicly recognised. By affirming their leadership, they also attest to the engagement and involvement of their employees.



**Table 9:** Certification Programmes

Programmes	Organisations	Targeted Activities
<b>ICI ON RECYCLE!</b> <a href="http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-reconnaissance/ici.asp">http://www.recyc-quebec.gouv.qc.ca/client/fr/programmes-services/prog-reconnaissance/ici.asp</a> (French)	RECYC-QUÉBEC	Recognition of ICIs who reach the programme's waste recovery goals.
<b>RECYC ECO Recycled-Content Products: BNQ 8952-911</b> <a href="http://www-es.criq.qc.ca/pls/owa_es/bnqw_norme.detail_norme?p_lang=fr&amp;p_id_norm=12692&amp;p_code_menu=NORME">http://www-es.criq.qc.ca/pls/owa_es/bnqw_norme.detail_norme?p_lang=fr&amp;p_id_norm=12692&amp;p_code_menu=NORME</a> (French)	Bureau de normalisation du Québec (BNQ) RECYC-QUÉBEC	Quantity of recycled materials in products and labelling of this product to facilitate identification.
<b>EcoLogo</b> <a href="http://www.ecologo.org">http://www.ecologo.org</a>	UL Environment (previously TerraChoice)	Third-party verified eco-label (compared to other products/services in the same category).
<b>BOMA BEST</b> (Building Environmental Standards) <a href="http://www.bomabest.com">http://www.bomabest.com</a>	Building Owners and Managers Association (BOMA) of Canada	Building energy and environmental performance (offices, commercial centres, outdoor retailers, light industrial buildings and residences).
<b>BNQ 2100 (9700-021): Sustainable Development - Guide for Applying Principles to the Management of Businesses and Other Organisations</b> <a href="http://www.bnq21000.qc.ca">http://www.bnq21000.qc.ca</a> (French)	Bureau de normalisation du Québec (BNQ)	Application of the principles of the Sustainable Development Act in all type of organisations, mainly those in Quebec.
<b>ISO 14000 – Environmental Management</b> <a href="http://www.iso.org/iso/home/standards/management-standards/iso14000.htm">http://www.iso.org/iso/home/standards/management-standards/iso14000.htm</a>	International Organization for Standardization (ISO)	Criteria for an environmental management system in the pursuit of continuous improvement.
<b>ISO 26000:2010 Guidance on Social Responsibility</b> <a href="http://www.iso.org/iso/catalogue_detail?csnumber=42546">http://www.iso.org/iso/catalogue_detail?csnumber=42546</a>	International Organization for Standardization (ISO)	Guidelines on social responsibility.
<b>Leadership in Energy and Environmental Design (LEED)</b> <a href="http://www.cagbc.org/Content/NavigationMenu/Programs/LEED/default.htm">http://www.cagbc.org/Content/NavigationMenu/Programs/LEED/default.htm</a>	Canada Green Building Council	Internationally accepted comparison standards for the design, construction and use of high efficiency buildings.





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