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INDUSTRIAL ECOLOGY IN QUEBEC A KEY TRIGGER IN THE CIRCULAR ECONOMY

Over 1.3 million tons of avoided greenhouse gas and \$ 313 million in savings for businesses and regions engaging in industrial ecology projects over the next decade

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Executive summary

Context



The global industrial sector is a major economic driver in Quebec that concentrates more than **30% of greenhouse gas (GHG) emission** and produces approximately **5 million tons of waste per year**. As a key strategy of the circular economy, **industrial ecology therefore represents a significant lever for reducing this footprint** by sharing goods and services (sharing synergies) and reusing recoverable waste as resources (substitution synergies). The development of these practices contributes to the achievement of the objectives of **GHG reduction, while securing the resilience and dynamism of the economic models of manufacturers and regions**.

The regulatory framework has been consolidated over the past ten years. The action plans of the **Quebec Residual Materials Management Policy** and the **Extended Producer Responsibility** are the first regulations to encourage companies to recover waste. Environmental protection is also addressed through the entry into force of the **cap-and-trade system for greenhouse gas emission allowances** (C&T system) and the **Environment Quality Act**. These main measures are paving the way for a **37.5% reduction in GHGs by 2030**, a target announced in the 2030 Energy Policy.

Legislative



Momentum



Through the launch in 2016 of the request for proposals for the transition to the circular economy (**RECYC-QUEBEC - APTEC**), about **500 synergies**, still currently active, were set up by the experts and facilitators of the Centre de transfert technologique en écologie industrielle (**CTTÉI**) and of **Synergie Québec**. These synergies are grouped together in several business networks at a local scale, called **industrial symbioses**. Today, they cover most of southern Quebec, from the Outaouais to the Gaspésie, and the North Shore. Over the past five years, they have notably made it possible to avoid around **9,200 tons of CO₂** and save around **\$ 4.3 million** for participating companies.

Many barriers remain to be broken down in order to industrialize the process across Quebec. The **regulatory framework, both at the provincial and federal level, must in particular be consolidated** to generate more public and private investments and **put Quebec technological innovation clusters at the service of industrial ecology**. However, the success of new initiatives can already be seen through the technical and economic pre-evaluation of synergies, the selection of a territory already covered by expert bodies and the **collection of quality data and information** which will facilitate the harmonization of future projects.

Potential



Prospects for the deployment of industrial ecology in Quebec

Industrial ecology, a major lever for ecological transition

\$ 313 million in savings for companies engaging in industrial ecology projects over the next 10 years.

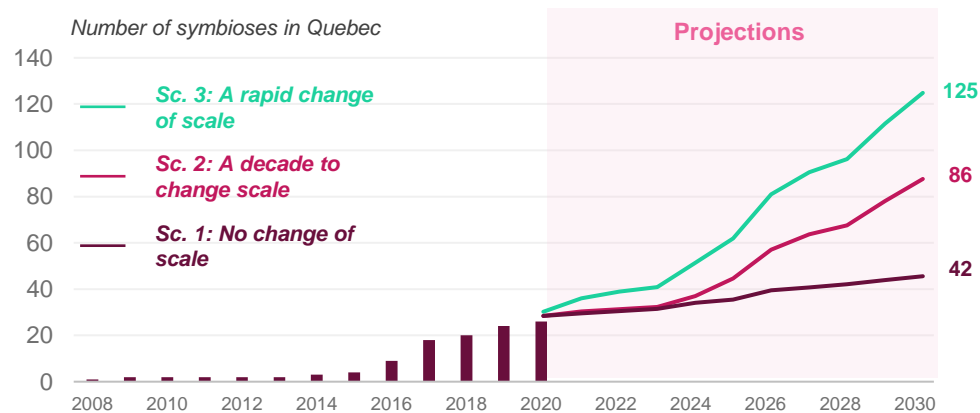
The acceleration of the dynamic could make it possible to convert more than half of Quebec industrial parks and avoid more than 1.3 million tons of greenhouse gas over the next decade.

Change of scale :

Ecological transition requires moving from **a linear economy towards a circular economy**. Thus, industrial ecology is intended to intensify to involve the industrial sector in a global effort. In order to accelerate the deployment of practices and to sustainably structure the sector, we believe that **a 75% increase in public funding from 2024** would make it possible to acquire experience at the provincial level giving access to economies of scale while significantly reducing the environmental impact of economic players. It would also encourage the **rise of private financings**.

Projections for 2030 :

Based on public lessons learned from the CTTÉI and the Quebec ecosystem, Sia Partners analyzed various scenarios for the deployment of industrial ecology across Quebec, and foresaw a gradual acceleration in the launch of new projects that would lead to **125 industrial symbioses** by 2030.



Focus: A rapid change of scale (Sc. 3)



A valorization of **665,000 tons of waste in 2030** and nearly **3,35 million** over the decade



A decrease of **267,000 tons of greenhouse gas emissions in 2030** and nearly **1.35 Mt.CO₂e of GHG** avoided over the decade



Benefits of \$ 313 million for industries and territories

Summary

Introduction of the study

1. Principles and challenges of industrial ecology
2. The dynamics of industrial ecology in Quebec
3. Scenarios for a change of scale

Conclusions and convictions brought by Sia Partners

Principles and challenges of industrial ecology



Principles and challenges of industrial ecology

Industrial ecology is a circular economy strategy addressing all economic players

Circular economy is an organizational model which aims to limit the consumption of primary resources by moving from a linear model (that involves extracting, manufacturing, consuming and discarding) to a circular organization of activities. This organization promotes responsible production and consumption as well as the reuse of materials

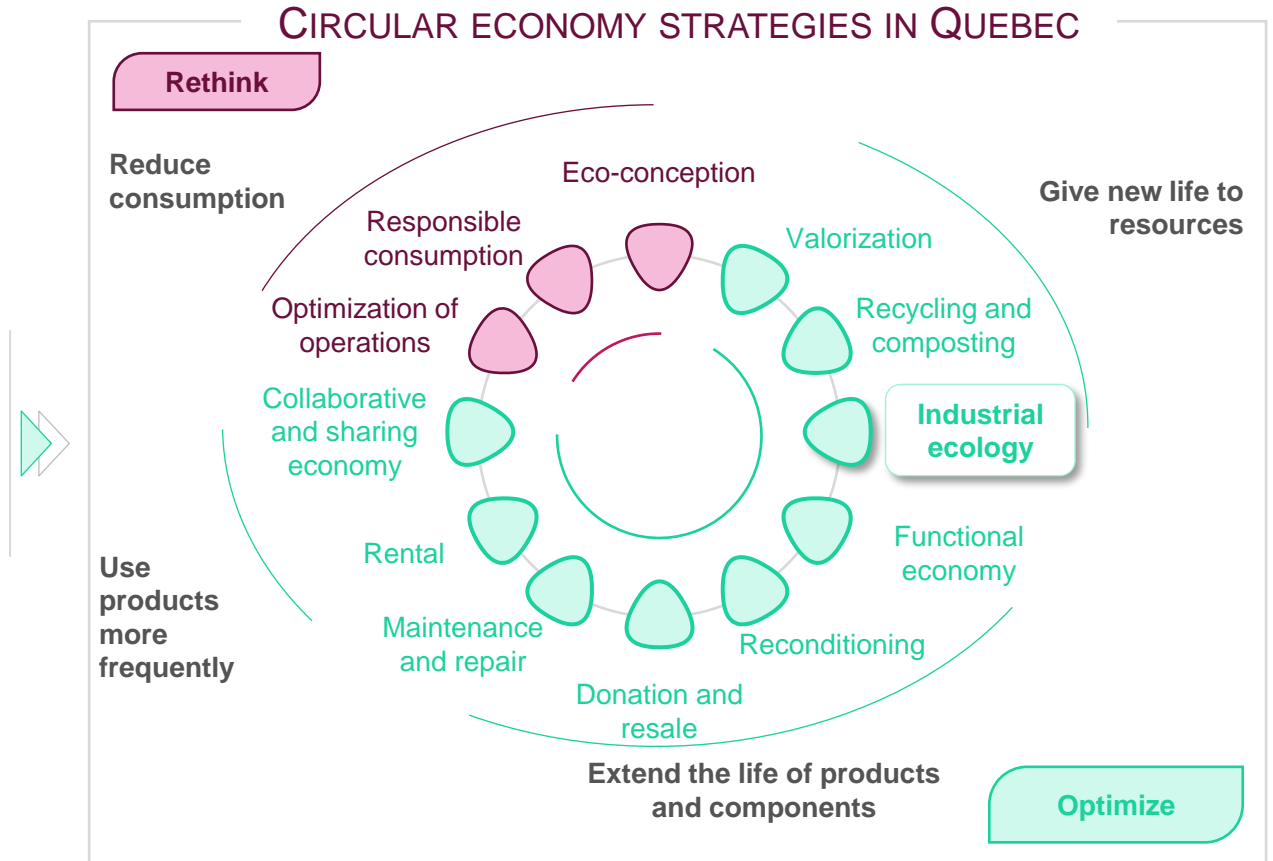
In Quebec, the transition to a circular economy is based on strategies and tools defined by the Institut de l'environnement, du développement durable et de l'économie circulaire (EDDEC Institute), including **industrial ecology (IE)**.

Integrated into the **2018-2023 energy transition, innovation and efficiency master plan**, these ambitions should enable Quebec to achieve targets set by the 2030 energy policy, including:

- 37.5%	+ 15%	+ 50%
of GHG emissions	energy efficiency	of bioenergy

The Electrification and Climate Change Plan, expected to be disclosed in fall 2020, should specifically reveal Quebec's targets both in terms of measurement and optimization to monitor and support the dynamics.

* GHG = Greenhouse Gas



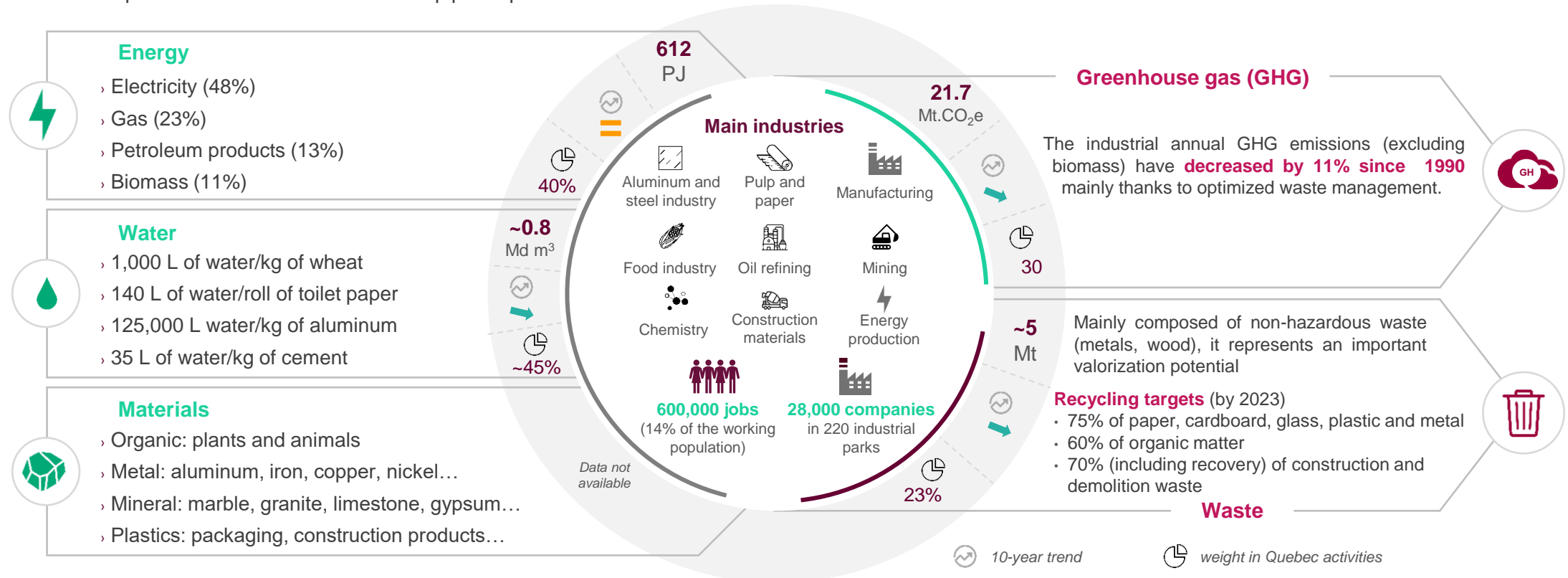
As a pillar of the circular economy, industrial ecology is an approach that aims, for the economic players in a geographical sector, to promote the sharing, reuse and recycling of industrial resources in order to optimize their use and reduce the environmental footprint.

Source: EDDEC Institute, Ministry of Energy and Natural Resources

Principles and challenges of industrial ecology

Industrial ecology is a response from the industry sector to reduce its carbon and material footprint

The Quebec economic fabric has become widely service-based over the past twenty years, but the linear industrial economy still represents a major part in the consumption of resources and the production of recoverable end-of-pipe outputs.



Industrial ecology is a lever for economic players to contribute to ecological transition and to provincial objectives, by reducing carbon and material footprints.

These changes in industrial production and consumption patterns are helping to strengthen the circular model throughout the whole economy.

Sources: Chair in Energy Sector Management, Statistics Canada, RECYC-QUÉBEC, Institut de la statistique du Québec, Sia Partners 2015-2020 aggregated data

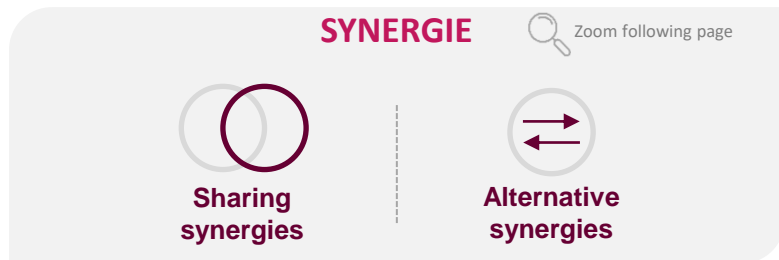
Principles and challenges of industrial ecology

Industrial ecology or the introduction of virtuous circles for the economic actors of a territory

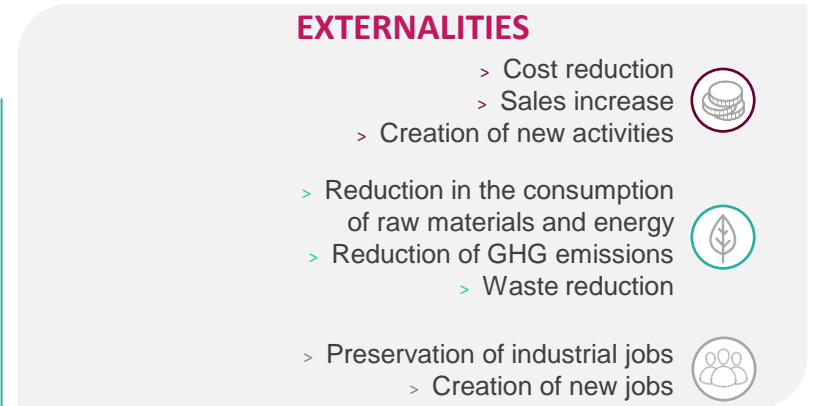
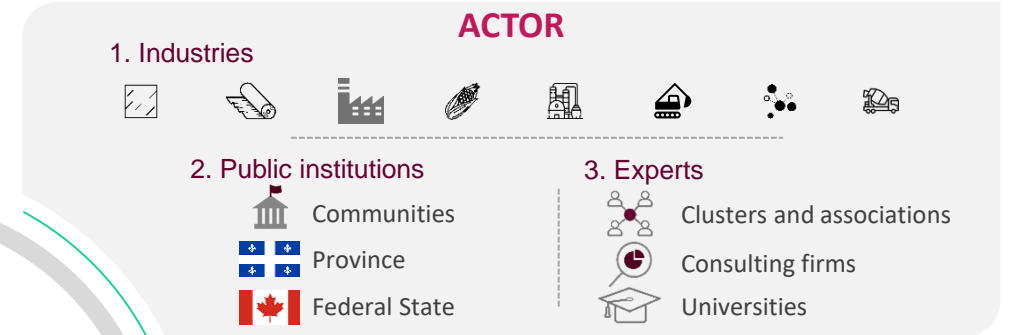
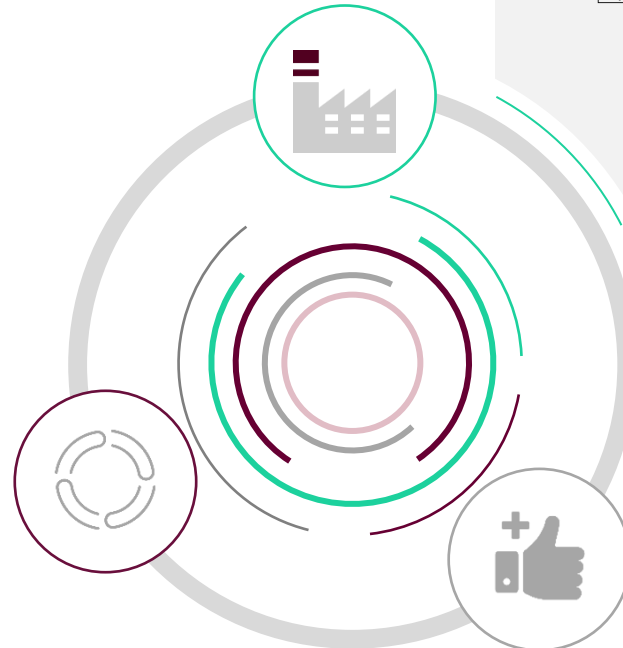
Industrial ecology is based on the collective management of flows feeding industrial activity and generated by it. Its implementation enables **synergies** between a set of actors from the same territory which constitutes an **industrial symbiosis**.

These initiatives are perpetuated and steered by a **coordinator of symbiosis** which acts as an intermediary between the various industrial stakeholders. On top of facilitating contacts, he ensures compliance and technical, economic, social and regulatory validation of projects.

2. **[How]** Create the **synergies** that valorize the flows



1. **[Who]** Impulse collaboration in a panel of **industrial various actors**

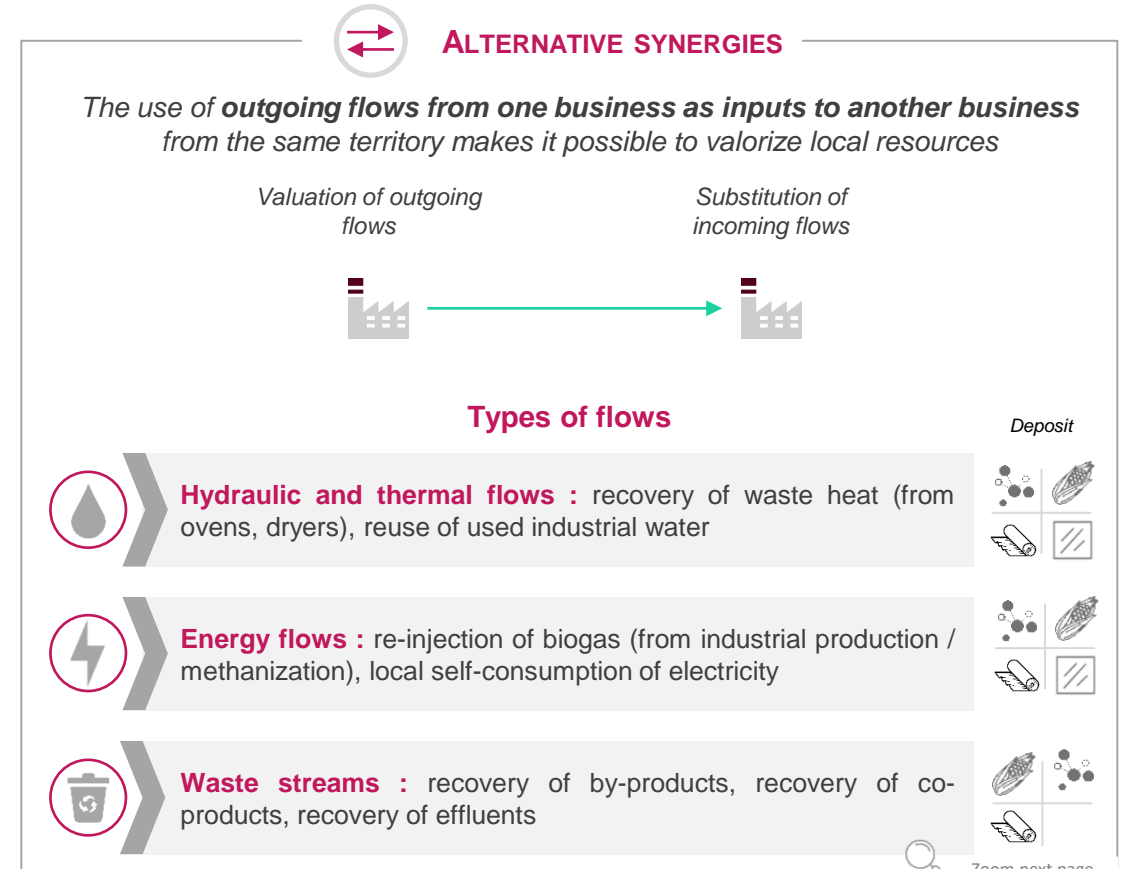
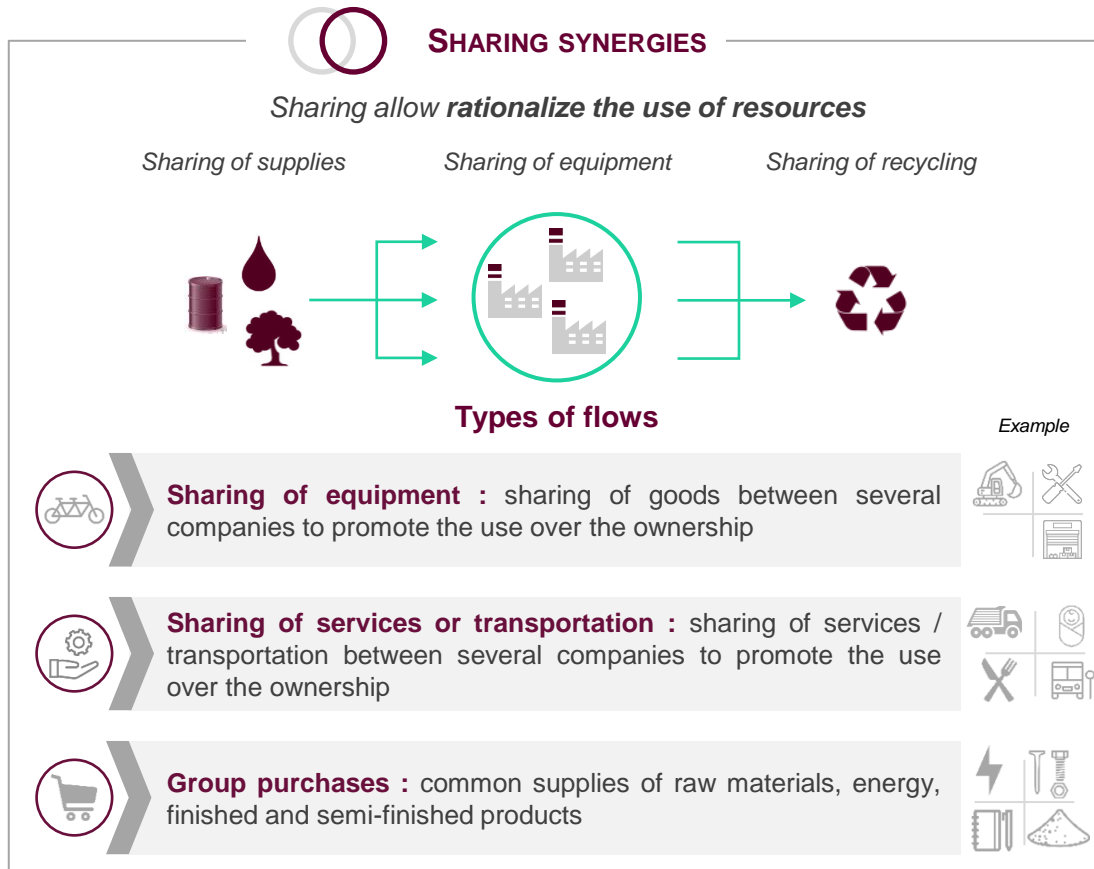


3. **[Why]** Reduce the **environmental footprint** of activities while generating **economical and social benefits**

Industrial ecology concerns all types of industrial activities and requires the collaboration of private and public actors to establish effective synergies. Without major environmental and social incentives from the government, the economic opportunities are the main motivation for companies to get involved in a project.

Principles and challenges of industrial ecology

The mechanisms: create synergies to complete the flows of energy, materials, people



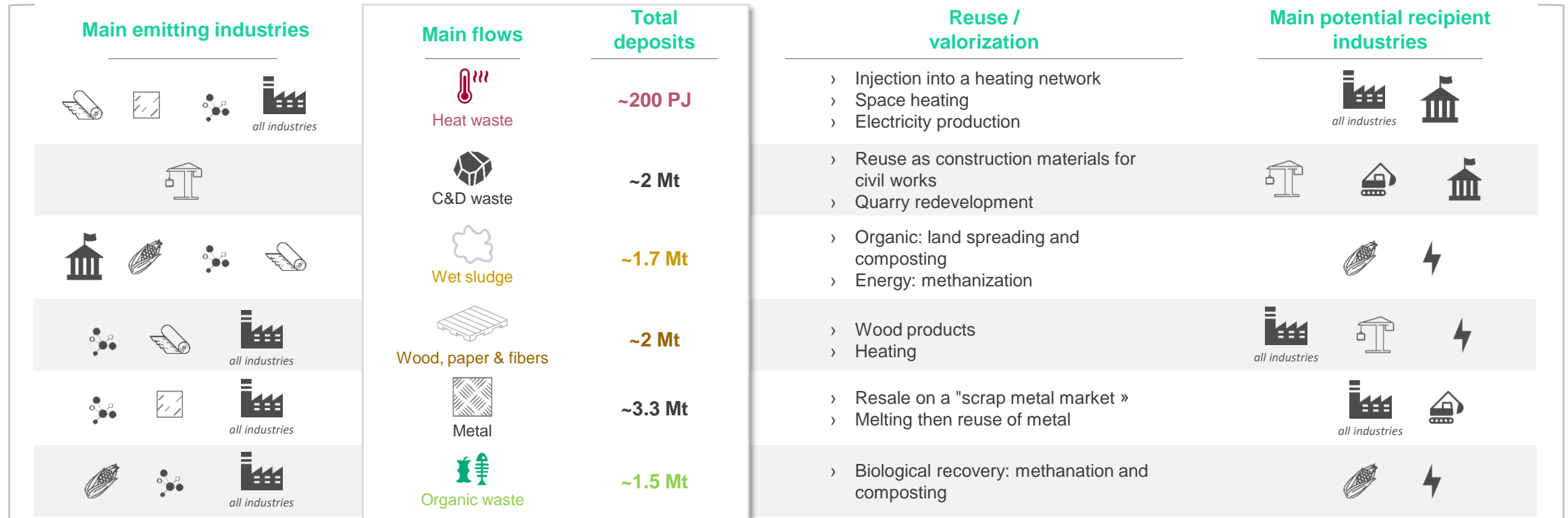
Thanks to the development of synergies between companies in a geographical sector, industrial ecology makes it possible to rationalize the use of resources and to recover waste.

This optimization of flow exchanges generates economic gains for companies and increases territorial attractiveness.

Principles and challenges of industrial ecology

High potential flow sources to create substitute synergies and boost Quebec industrial territories

The pulp and paper, agri-food, steel and chemical sectors have the largest deposits of resources which can be reused by other companies. Wood residues and organic waste in particular represent an interesting energy recovery potential.

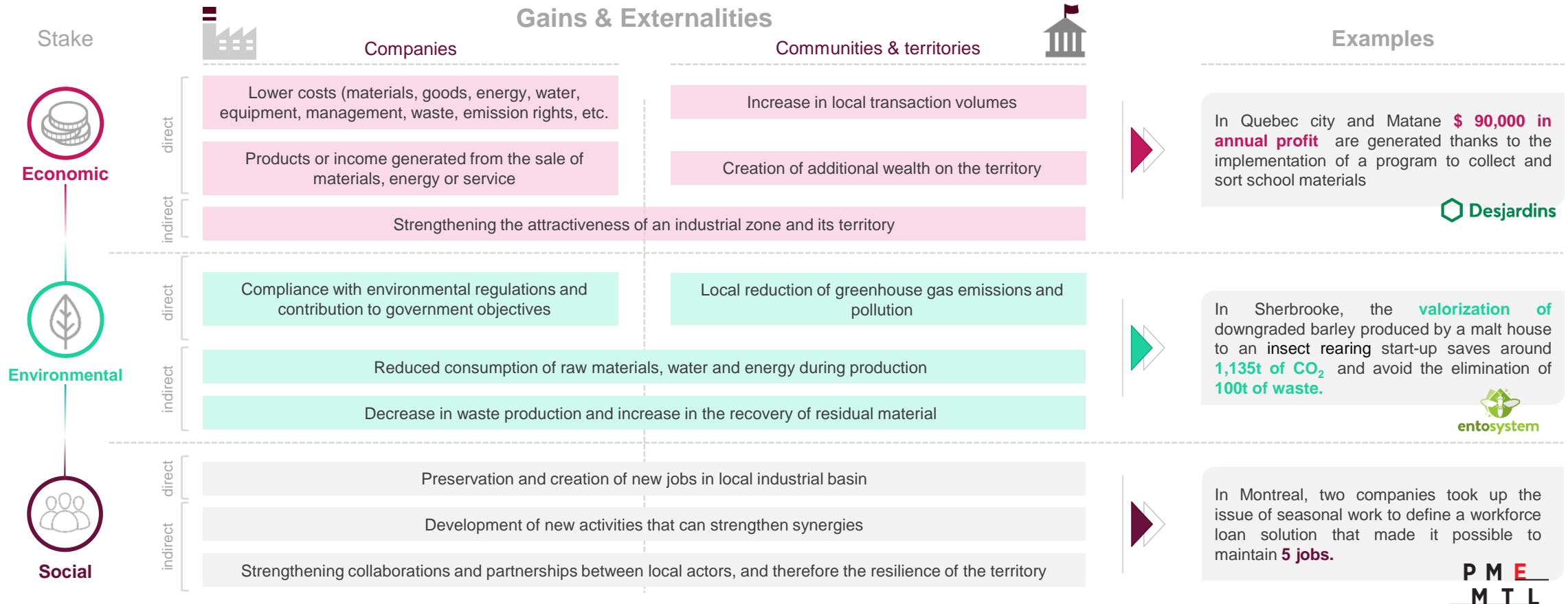


The deposits of materials and/or heat sources that could lead to synergies are more or less significant and exploitable depending on the territories and the economic actors in place. However, any company can intervene in the establishment of a synergy as a supplier or receiver of a flow.

Sources: Commission on Quebec Energy Issues, RECYC-QUÉBEC, MELCC

Principles and challenges of industrial ecology

The gains and externalities of industrial ecology are part of a sustainable and inclusive growth approach



Because the main players of industrial ecology are private companies, the economic lever is predominant in initiating and developing synergies. The environmental efficiency resulting from this commitment must be sustainable to create a real competitive advantage for the territory, a source of attractiveness and development of the employment pool.

Sources: Center for technology transfer in industrial ecology

The dynamics of industrial ecology in Quebec



The dynamics of industrial ecology in Quebec

A regulatory framework in Canada leaving a great deal of autonomy to the province



A regulatory framework that varies in each province

Many texts regulate the impact of industrial activities on the environment (Environment Quality Act, Regulation on the transportation of hazardous materials, etc.), but the programs in application have not yet been harmonized at the federal level.

There are over 120 EPR programs (extended producer responsibility) across the various provinces. Each of these programs establishes regulations for producers around a type of product (e.g.: paint, tires, etc.).



Public and private initiatives at local levels

Several companies or municipalities initiate their own waste reduction program and set up circular loops to facilitate the recycling or reuse of their products or resources.

Among the various examples, we could mention the **NISP Canada program** (National Industrial Symbiosis Program). This industrial symbiosis program has identified synergies in the geographic regions of Greater Vancouver and Greater Edmonton. This pilot project has shown an economic return of \$ 7 for every dollar invested.



More advanced provinces: Ontario, the first province to define a regulatory framework to reduce its waste

Ontario has set two ambitious goals: to achieve zero waste in the province and to achieve zero greenhouse gas emissions from the waste sector.

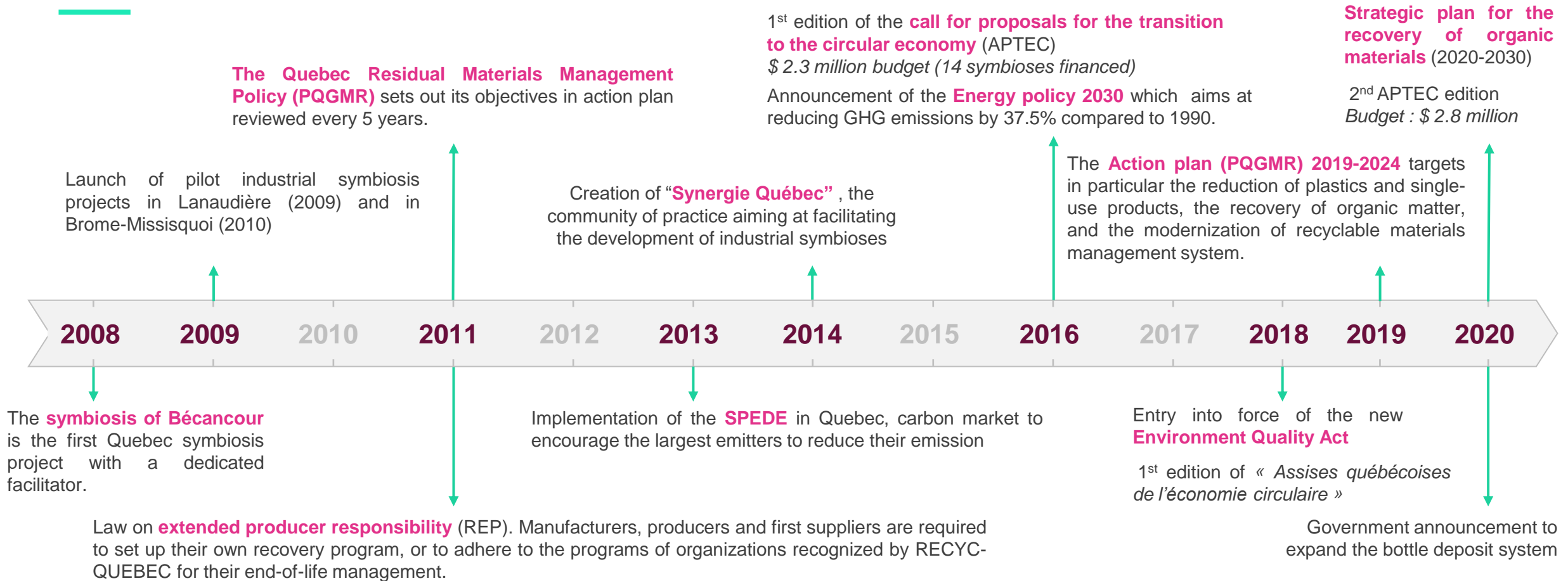
The 2016 Law on Resource Recovery and the Circular Economy intends to:

- minimize the use of raw material
- maximize the useful life of materials and other resources through resource recovery
- minimize the waste produced at the end of the useful life of products and packaging

Local initiatives have been put in place within certain organizations, cities or provinces, but today there is no regulatory framework at the federal level regarding the use of resources and the reduction of waste.

The dynamics of industrial ecology in Quebec

A recent phenomenon in Quebec



New regulations, funding programs and the establishment of Synergie Québec in 2014 have made it possible to structure industrial ecology initiatives and accelerate their development in Quebec. The government's ambition to be a leader in that dynamics is notably shown in the 2019-2024 residual materials management action plan.

The dynamics of industrial ecology in Quebec

Funding organizations and programs, to accelerate the implementation of the IE, coupled with tax incentives

Several organizations and funding programs to boost industrial ecology initiatives and support regulations



RECYC-QUEBEC is the reference for everything related to the responsible management of residual materials in Quebec. The organization runs more than 20 programs to support waste reduction initiatives. A request for projects (**APTEC**), is underway to support the establishment of industrial symbioses in Quebec. **The budget for this program is \$ 2.8 million (2020).**



Éco Entreprises Québec is a non-profit private organization that allows 3,400 companies and organizations subject to the Environment Quality Act to fulfill their legal obligations regarding the recycling of their containers, packaging and printed materials.



The mission of the **Centre de transfert technologique en écologie industrielle** is to increase the performance of businesses and communities through research and development of innovative approaches and technologies in industrial ecology. The project "**Synergie Québec**" supports the establishment of symbioses in Quebec.



Taxes

Various tax measures are in place in Quebec to promote industrial ecology, notably:

- Extended producer responsibility
- Extended consumer responsibility
- The **carbon market (SPEDE)** targets companies emitting more than 25,000 tons of CO₂ equivalent annually
- Landfill taxes
- Fees for the elimination of residual material



Local initiatives

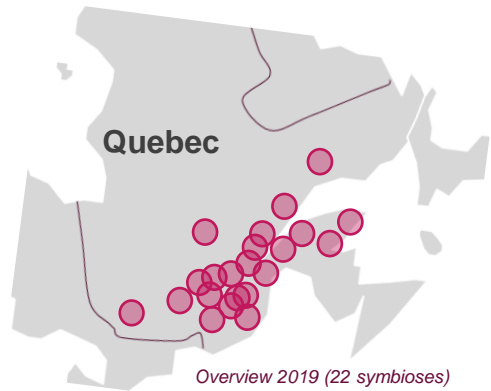
In addition to the systems in place, **initiatives are launched independently** through private funding.

Information relating to these projects are not always easily retrievable. However, these projects also contribute to the achievement of the government's environmental objectives.

Public organizations are essential players in the search for viable technical solutions and in the launch of industrial ecology initiatives. They financially support the development of the sector to reduce the material and carbon footprint of the industrial sector.

The dynamics of industrial ecology in Quebec

Promising first results, witnessing a new momentum for Quebec



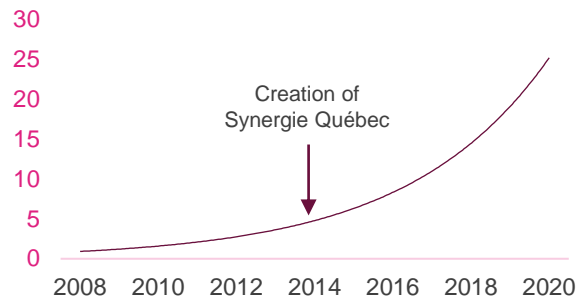
25 symbioses (2020) listed by “Synergie Québec”

SYNERGIE Québec

Synergie Québec is a community of practice dedicated to industrial symbioses and circular economy projects led by the CTTÉI. Created in 2014, it now brings together more than **60 facilitators** and around **2,200 companies** united by the desire to make financial gains and contribute to local growth while promoting sustainable development. This network has **documented nearly 5,800 documentations** and provides applied research services, facilitation services, tools, methodologies and visibility to all those involved in the transition to the circular economy.

Each symbiosis brings together a set of companies which set up synergies locally that will last for several years. Every year, on average **10 new synergies emerged in each symbiosis in Quebec.**

Evolution of the number of active symbioses in Quebec (2008-2019)



The benefits of Synergie Québec for the 2015-2019 period (CTTÉI data)



2,200 companies involved
42 synergies achieved



17,800 tons of material
diverted from disposal



9,200 tons
of avoided CO₂



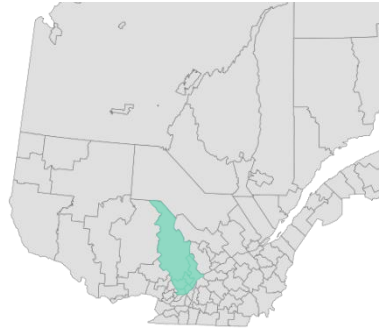
\$ 4.3 million savings for
involved partners

In Quebec, synergies are materializing and the first tangible results are already showing the economic, environmental and social potential of these symbioses. Catalyzed by Synergie Québec, these symbioses have multiplied since 2014 and cover more and more territories.

The dynamics of industrial ecology in Quebec

Zoom: “Synergie Lanaudière”, a Quebec pioneer in territorial industrial symbioses

Project history



Lanaudière is the second region of Quebec to have implemented an industrial symbiosis in 2009. Promoting the recycling of residual materials in 4 industrial parks, the initiative mobilized in 2018, **34 organizations** and enabled the realization of **45 synergies**.

Following the completion of a study of potential deposits and a territorial diagnosis, **Synergie Lanaudière received \$180,000 from RECYC-QUÉBEC** in 2017 to continue to play the role of intermediary between local economic players in order to design a local network and promote the sustainability of synergies.

Main synergies implemented



- Mutualization of **recovery process** of post-industrial waste
- Mutualization of **biomethanization unit** for the production of biogas



- **200,000** asphalt shingles and **200,000** other residual materials (tires, textiles, non-recyclable plastics, etc.) diverted from landfill and upgraded to alternative fuels since 2006 (synergies put in place before the launch of the symbiosis)
- Manufacture of industrial pipes from recovered and conditioned plastic residues
- Manufacture of cosmetic products from wine and grape residues

Established industries



Key factors of success

- > Proximity with local actors
- > The complementarity of financial support for the animation and management of the project

Gains (2018)

- + \$ 20,000 saving
- \$ 52,000 inter-organization exchanges
- **392,000 tons** of available materials
- **554 tons** of exchanged materials
- **380 tons** of avoided CO₂
- 1,190 listed offers/resources

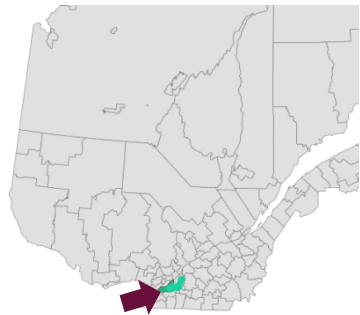


By being one of the first to receive public funding, the symbiosis of Lanaudière has played a pioneering role over the past ten years by providing feedbacks to the new symbiosis projects. Gathering more than 350 organizations, it is still one of the symbiosis in Quebec that generates the highest number of synergies each year.

The dynamics of industrial ecology in Quebec

Zoom: “Synergie Montreal”, a lever to revive the sector's industrial economy

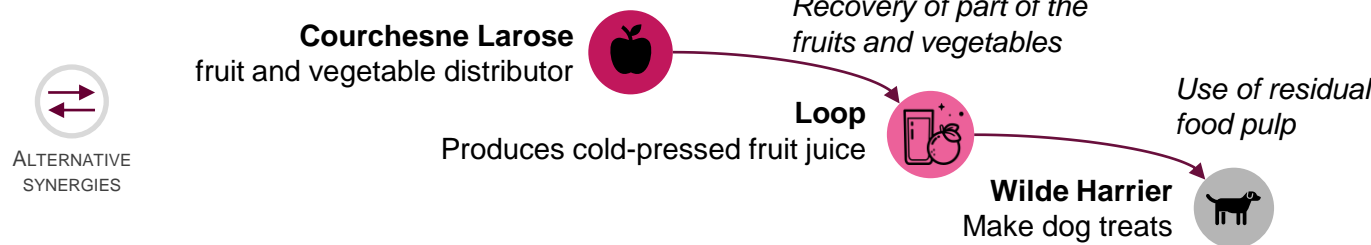
Project history



Launched in 2016 by PME MTL Est-de-l'Île and in partnership with the CTTÉI, **Synergie Montreal** has for strategy to revive the economy of the territory.

The objective is to set up an industrial symbiosis in order to link companies together and ensure that **the outputs of some can become the inputs of others** so as bringing economic and environmental benefits from the reuse of waste into the production cycle. The density of the industrial park of the island made it possible to quickly obtain significant results with the realization of **55 synergies** involving **251 companies** in 2018.

Example of synergies implemented



Established industries



Key factors of success

- > The dynamism of a dense industrial zone
- > Tools and resources to understand accessible funding and administrative information

Gains (2018)

- + \$ 100,000 savings
- 1,023 tons of reused materials
- 1,540 tons of avoided CO₂
- 2 jobs created over 2016-2018

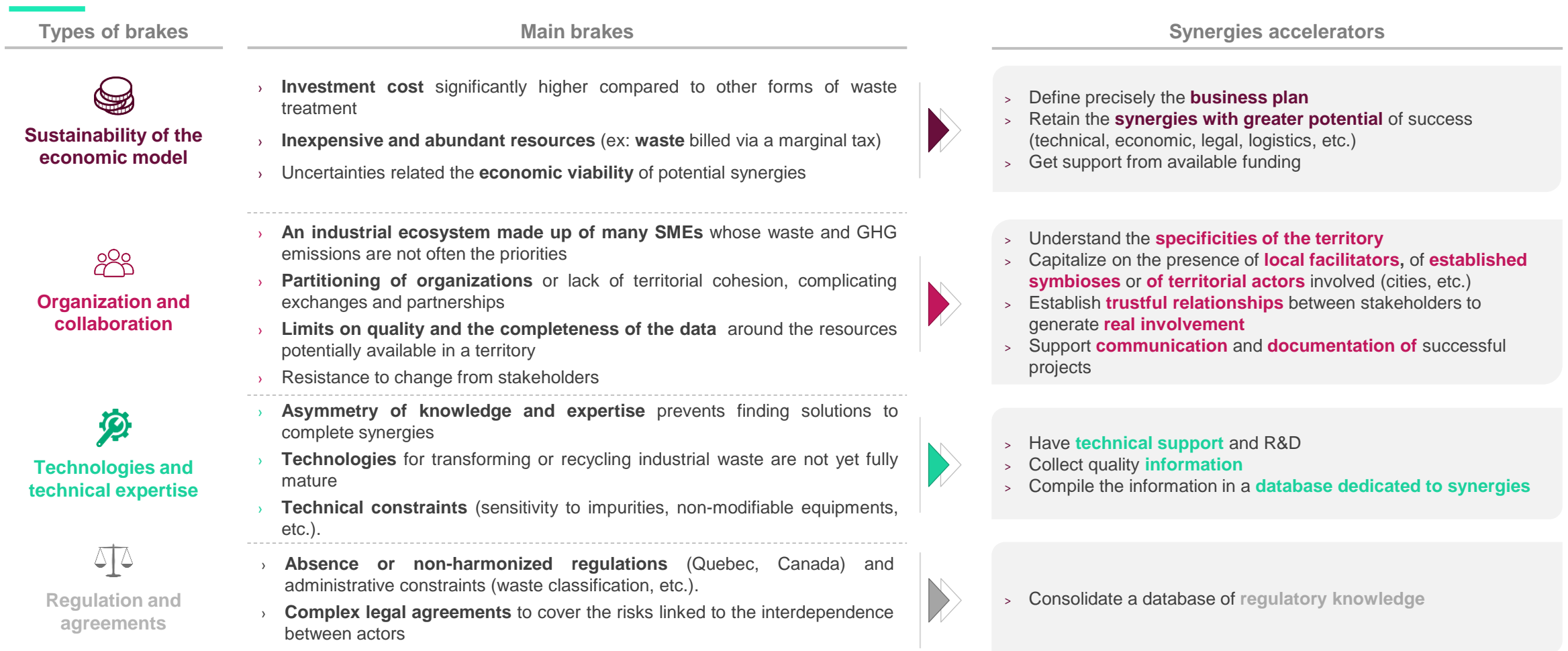
The project extended to the entire city of Montreal

In 2019, the project will be extended to whole Montreal and will benefit from **investment of \$ 450,000** of the City of Montreal to establish links between companies and create new synergies. This should make it possible to reduce the amount of waste since more than **929,000 tons** of residual materials were generated in 2018.

The implementation of new synergies in Montreal contributes to a reduction in the generated residual materials and is aligned with the waste reduction objectives of the City of Montreal. In the continuity of this initiative and others in progress, the City of Montreal adopted in August 2020 a master plan for the management of residual materials 2020-2025 aiming towards a zero waste city.

The dynamics of industrial ecology in Quebec

Challenges to be met in order to industrialize the process across Quebec



Led by the CTTÉI, the recent dynamics of Quebec industrial ecology is getting structured and must face many challenges. In order to sustain and accelerate its development, public and government support remains essential.

Scenarios for a change of scale



Scenarios for a change of scale

The industrialization of industrial ecology will require a change of scale in the number of new initiatives and in their scope

We are seeing a real increase in the number of industrial ecology initiatives in Quebec with **nearly 25 symbioses in 2020**. Thanks to the tools and methodologies developed, especially by Synergie Québec, the implementation of new symbioses should accelerate and they will be able to cover the territory on a finer mesh, meaning **at an industrial zone scale**.

According to various feedback, it is now possible **to switch to a more dynamic industrialization of the IE approach**, with a **change of scale** in the number of new synergies yearly launched.

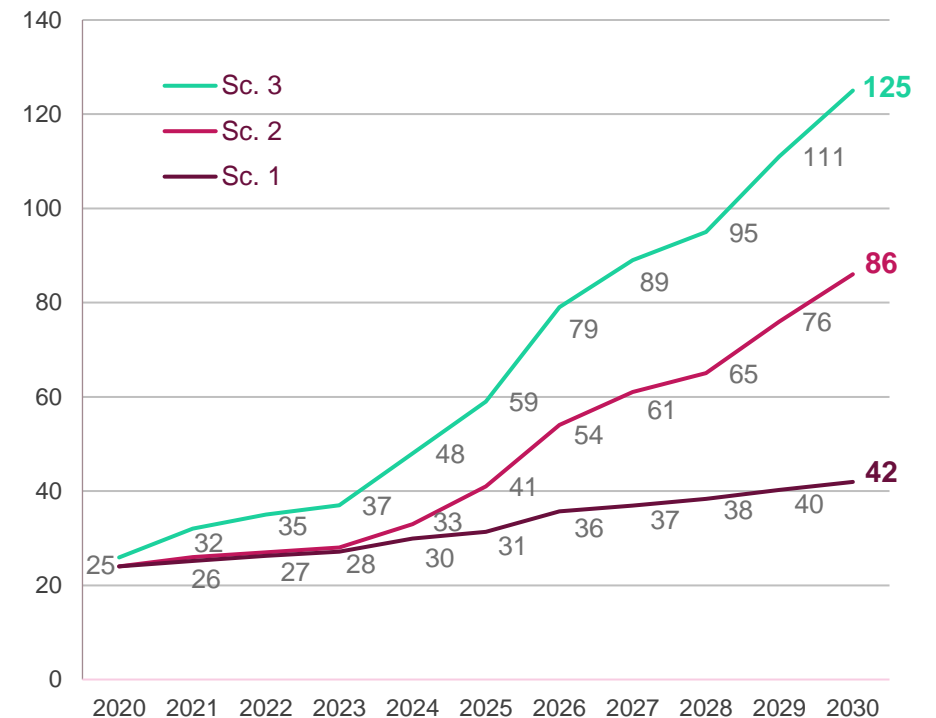


This analysis aims to estimate the **economic, social and environmental effect** that may result from a change of scale from industrial ecology specifically in Quebec

We have therefore defined 3 scenarios which model the speed with which the **change of scale could occur**:

- **No change of scale (Sc. 1)** : The pursuit of a growth which follows the dynamics observed currently, without change of scale, induces a number of new symbioses increasing linearly every year to reach **42 by the end of 2030**.
- **A decade to change scale (Sc. 2)** : Thanks to the intensification of public investment from 2024 and the implementation of stricter regulations and taxation in terms of waste and emissions, the creation of new symbioses should accelerate. We consider that continuous learning from 2020 until 2024 then makes it possible to double the performance of synergies in terms of economic and environmental externalities, as well as the avoided operating costs. We would then record **86 active symbioses in 2030**.
- **A rapid change of scale (Sc. 3)** : By using the assumptions of scenario 2 and with a greater financial contribution from the private sector, **industrial ecology could change scale**, to reach **125 active symbioses in 2030**. **More than one industrial park out of two in Quebec** would then have joined the dynamic which constitutes a realistic scenario.

Projections of the number of symbioses in Quebec



Scenarios for a change of scale

Assumptions retained on the basis of projects carried out at the provincial level

In order to assess the means necessary to change scale, our model is based on **indicators linked to the financing of symbioses**. Within those, synergies appear between manufacturers and allow **economic gains as well as positive externalities in terms of GHG and recovered waste**.

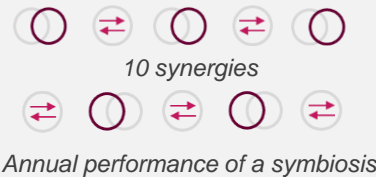
Development of symbioses

Th **public and private financial supports** allow to cover the development and activities of symbioses, especially the animation of workshops with the local industrial fabric.

We furthermore consider that **industrial symbioses will multiply over the next few years and cover smaller territories, at a scale of industrial zones**. Consequently, the number of animators (FTE) affected by symbiosis will be reduced from 1.4 today to 1 by symbiosis in 2030.

Establishment of synergies

We estimate that **10 new synergies will be realized per year through a symbiosis**.

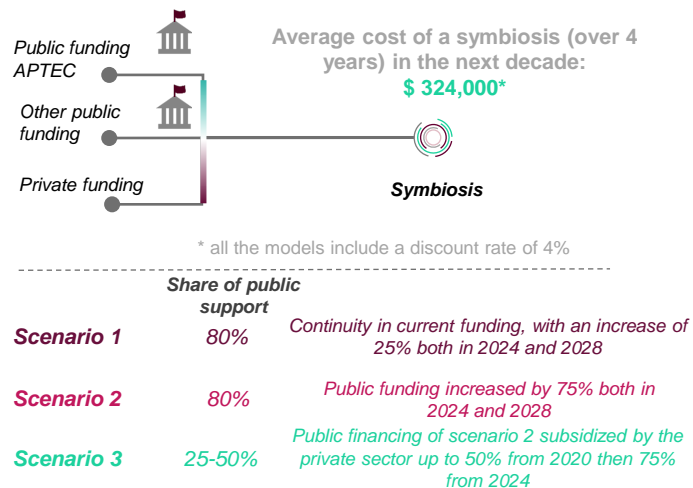


Measures of potential gains & externalities

The **economic benefits** as well as potential **environmental externalities** were evaluated according to the results of active symbioses in Quebec in the last 5 years.

Based on the momentum and feedback, **the synergies' gains should double from 2024 in scenarios 2 and 3**. Indeed, considering the expertise acquired by the facilitators and the green recovery policy, we hypothesize that the facilitators will focus on more promising initiatives in terms of spinoffs in the coming years.

Funding structure



Lifetime of synergies : Synergies have a maximum lifespan of 8 years.



NB: Today, some synergies are one-off and last only one year, while others aim at exchanging for several years. It is difficult to obtain consolidated data on the lifespan of these synergies because these initiatives are recent in Quebec.

Here are the annual gains by synergy (CTTÉI data):

- Avoided GHG: **25 tCO₂e / year**
- Avoided material flows: **61 tons of waste / year**
- Avoided operation costs: **\$ 5,700 / year** (including investments in the purchase of equipment, materials, etc.)

Specificities of scenario 3 Symbioses on a larger scale

In a context where the government would put in place more incentive regulations on the management of waste, resources and CO₂ emissions, we foresee a greater interest of large manufacturers in launching synergies.

Thus, 10 larger-scale symbioses will emerge from 2025.

Here are the gains for this type of symbiosis:

- Avoided GHG: **3,000 tCO₂e / year**
- Avoided material flows: **4,200 tons of waste / year**
- Avoided operation costs: **\$ 1,260,000 / year**

Scenarios for a change of scale

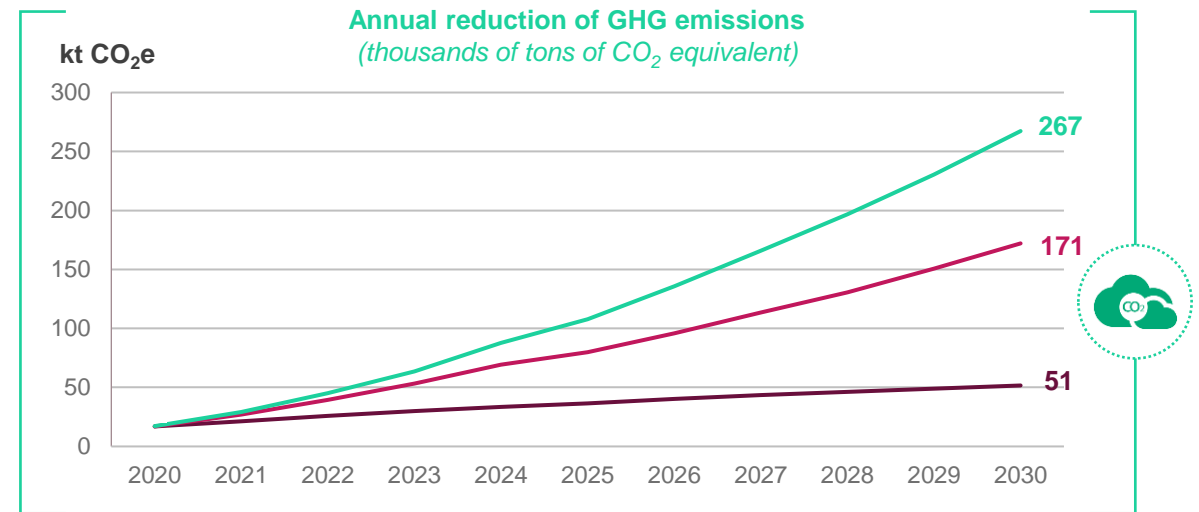
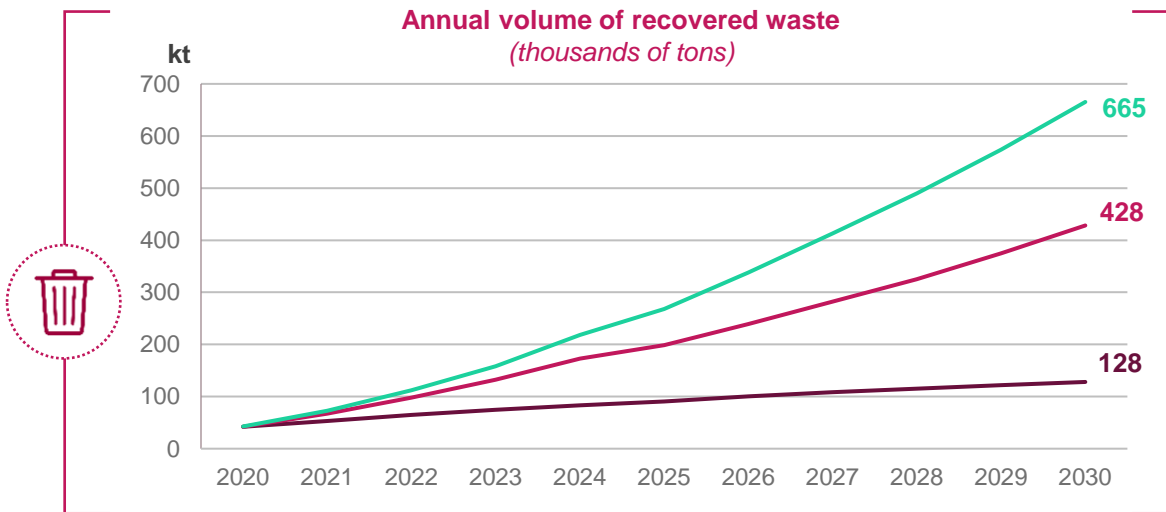
Three scenarios to place IE in Quebec industrial development and support the ecological transition

Environmental externalities

Scenario 1 : with a fairly linear growth in environmental indicators, this scenario allows **to recover 128,000 tons of waste and avoid 51,000 tons of GHG in 2030**. This is the equivalent of removing approximately 10,600 cars from Quebec roads.

Scenario 2 : with the continuous operational improvement of symbioses and the increase in public subsidies, this scenario allows **to recover 428,000 tons of waste and avoid 171,000 tons of GHG in 2030**. This represents the equivalent of removing approximately 35,500 cars from the roads of Quebec.

Scenario 3 : with the structuring support of private financing and large industrialists encouraged by a specific regulatory framework, this scenario allows **to recover 665,000 tons of waste and avoid 267,000 tons of GHG in 2030**. This represents the equivalent of removing approximately 55,500 cars from the roads of Quebec.

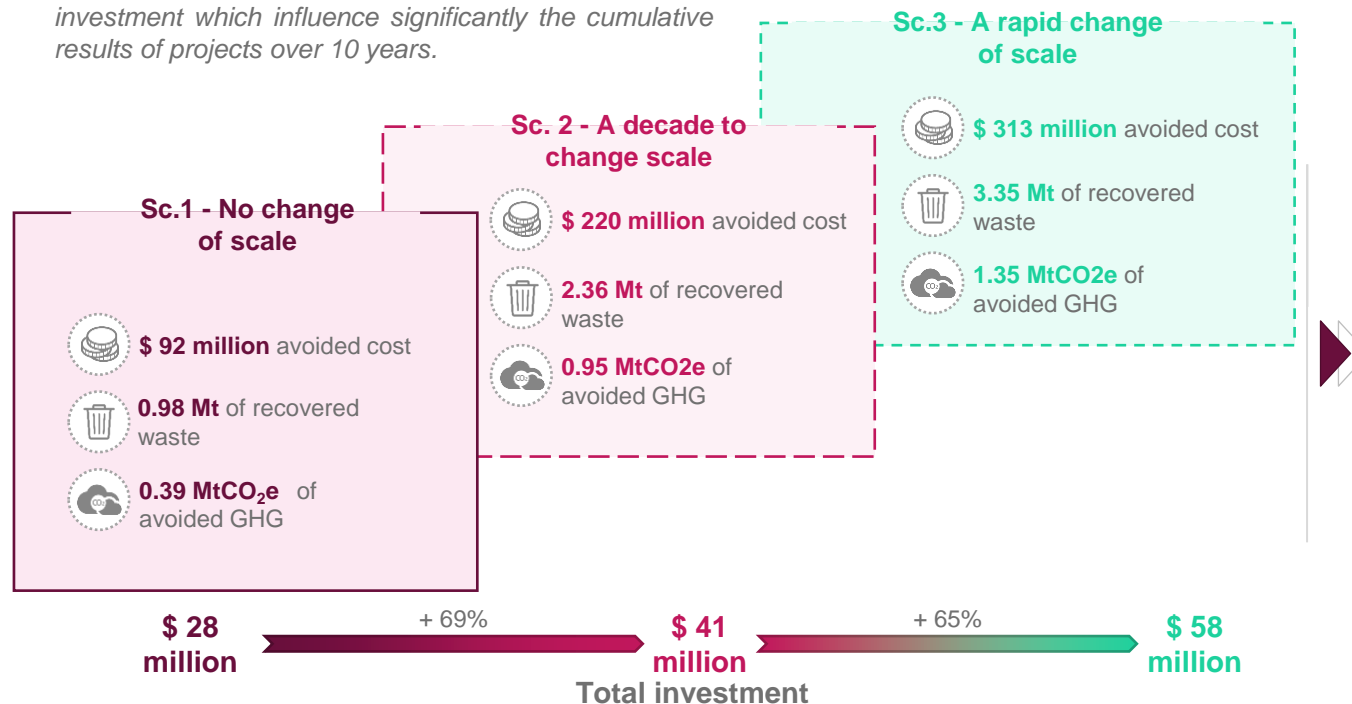


Scenarios for a change of scale

Scenarios for a high-impact change of scale that can be based on a context conducive to the circular economy

Whatever the trend that will be observed in the years to come, the steps related to industrial ecology could significantly **contribute to the renewal of the industrial sector**, both on socio-economical and environmental aspects. The projections demonstrate the value of supporting the most ambitious dynamics, and the most significant investments, by relying on structural trends that corroborate this sectoral transformation.

The three scenarios are distinguished by their level of investment which influence significantly the cumulative results of projects over 10 years.



Context favoring the most ambitious scenarios



Industrial ecology appears today as one of the solutions to be favored by industrial players to contribute to **material and carbon sobriety**



The 2020-2030 energy policy and the 2019-2024 residual materials management policy aims at an improvement by 15% of energy efficiency and a 40% reduction in petroleum products consumption in 2030, as well as increased recycling of most residual materials by 2023. These trajectories will then have to appeal in particular to the principles of the circular economy.



The **COVID-19 health crisis** underlines the fragility of globalized production chains. In response to the associated economic crisis, political support may translate into public aid for industrial relocation strategies and the implementation of measures aimed at improving the resilience of the industrial sector, such as the industrial ecology.

The necessary improvement in the resilience of our production systems makes it possible to consider a massification of approaches linked to the circular economy, and consequently to industrial ecology, in the years to come. The current context is therefore favorable to a deep evolution of our economic model which will not be possible without supporting the massive deployment of new dynamics.

Conclusions and convictions made by Sia Partners



Conclusions and convictions made by Sia Partners

Optimize regulatory environment to support the proliferation of new reflections around industrial ecology



Public support

Broaden the methods of financing industrial ecology projects in order to compensate for their lack of maturity, while exploiting their strong potential for positive socio-economical and environmental externalities

Findings & convictions

- › Quebec industrial ecology was truly born over the past 4 years following the **launch of APTEC and other public funding**.
- › Today, the number of symbioses and their scope remain too limited to become **a real tool for ecological transition** and **territorial relocation of industries**.
- › **Public financial support** of new IE projects must be strengthened to accelerate the change of scale while promoting private investment.

Recommendations

- › At the federal and provincial levels: **specifically allocate a budget** for R&D and investment in the industrial ecology sector
- › **Increase subsidies** for the development of new symbioses and for recycling activities
- › **Encourage private investment** to benefit from a leverage effect



Standards and regulations

Encourage project leaders to initiate the industrial ecology dynamics by relaxing the regulatory framework and defining the methods of carrying out projects

Findings & convictions

- › The standards and rules in force have not been subject to adjustments, however essential, to **remove the obstacles to the development of IE** and facilitate the establishment of new synergies.
- › The **incentive mechanism** are relevant tools for **guiding private actors towards the establishment of synergies** with significant environmental impact (waste, heat, CO₂ ...).
- › **The volume of residual material** and non-recovered waste remains **always consistent** and its eliminated proportion represents a dead loss for the Quebec economy.

Recommendations

- › Define a local harmonized materials repository for **facilitating the study of exchanges and project comparability**
- › **Build, consolidate and harmonize federal and provincial policies** that restrict negative externalities (carbon tax, water price, etc.)
- › Introduce incentives for **the use of secondary materials** and the establishment of synergies with strong gains

Conclusions and convictions made by Sia Partners

Engage each local initiative with a triple impact objective: economical, social and environmental



Leadership

Bring together the players in industrial ecology by encouraging reference entities to mobilize their expertise in carrying out projects of high economical, social and environmental value

Findings & convictions

- › **Several organization** (RECYC-QUÉBEC, ÉEQ, CTTEI, etc.) contribute to boost IE initiatives.
- › **Energy specialists and waste managers** are essential actors thanks to their **technical and economical expertise**, their **investment capacity** and **their logistics**.
- › Companies remain **under-informed about the possibilities of sharing and substitution**.

Recommendations

- › **Strengthen the position and responsibilities of the actors in place** by involving the communities, industrialists and consumers
- › **Communicate on the issues** around IE to federate and initiate behavior change



Role of coordinators

Strengthen the role of third-party actors to ensure dialogue between stakeholders and promote the creation of new synergies

Findings & convictions

- › Industrial ecology brings actors of very different natures to collaborate around projects that might be complex. It is therefore **necessary that an industrial expert coordinator**, ensures cross-functional management and monitoring of initiatives.
- › The **awareness campaign** in businesses are another lever for scaling up.

Recommendations

- › **Develop an open platform** for indicating needs and promoting policies
- › **Design and disseminate training programs**
- › Create a **unique repository of IE initiatives' supporting organizations**



Territorial innovation

Make industrial ecology a catalyst for innovative solutions that allow the industrial sector to continuously comfort its position as a driver of economical and technological transformations within a territory

Findings & convictions

- › The IE is innovative thanks to its **source of development** and **helps creating jobs**.
- › IE **uses technological innovation** to consolidate social and economical data. Currently, it is necessary to **improve the data quality** in order to consolidate the sector.
- › Beyond the synergies between industrialists, the IE must enhance its territorial anchoring by optimizing **its flows with non-industrial players** (public buildings, agricultural sector, tertiary sectors, etc.).
- › IE must rely **on existing local dynamics** for **building the resilience** of territories

Recommendations

- › **Give priority to quick-win synergies** to initiate local dynamics and commitment stakeholders while also testing synergies on a larger scale
- › **Rely on start-ups and digital tools** for assessing potential and measuring performance

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A black and white photograph showing a low-angle view of several tall skyscrapers reaching towards the sky. The perspective is from the ground looking up, creating a sense of height and scale. The sky is visible between the buildings, with some clouds.

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