

E-mobility in Quebec, case of battery recycling :

Towards Sustainable Electromobility in Quebec: What framework for End-of-Life Battery Management ?

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Lille, 12 oct. 2026

Outline of the presentation

1. Introduction : the project funding
2. Research questions and objectives of the project
3. Methodology of the policy landscape assessment
4. Early results from the policy assessment
5. Conclusion and future research directions

1. Introduction : the project funding

- A program for new academics
- 15 000\$/y for 3 years
- 70% for scholarships
- encouraging early-career professors to pursue innovative research avenues
- Started in sept. 2025

Soutien à la recherche pour la relève professorale (NP) 2025-2026

FONDS DE RECHERCHE DU QUÉBEC
SOCIÉTÉ ET CULTURE

Date limite (pré-demande) :
8 août 2024 à 16h00 (EST)

Date limite (demande) :
19 septembre 2024 à 16h00 (EST)

Annonce des résultats :
Fin avril 2025

Année de début d'octroi :
2025-2026

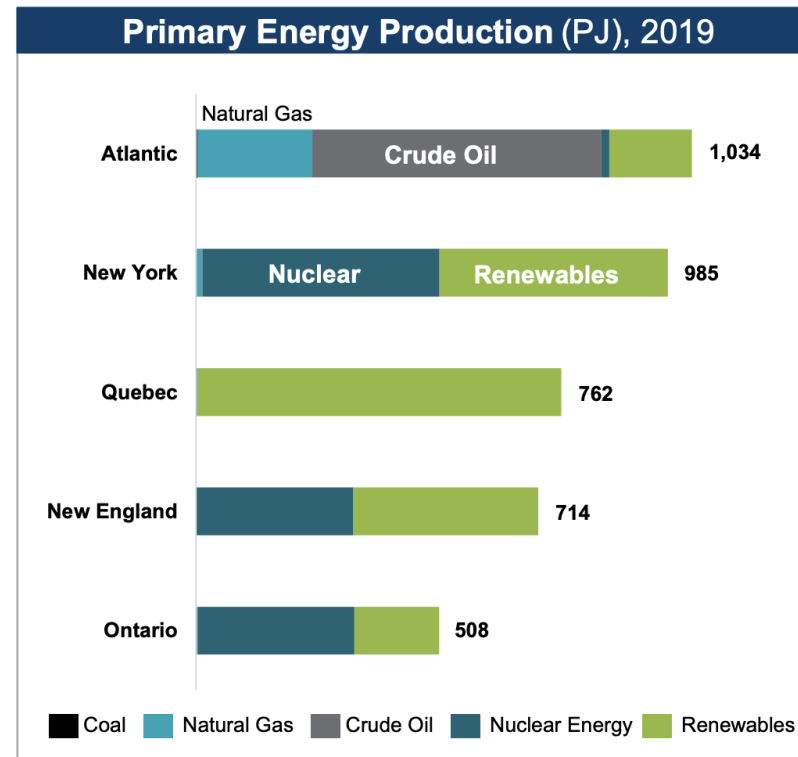
Montant :
15 000\$/ année (incluant l'équipement et excluant des FIR)

Durée du financement :
Maximum 3 ans (non renouvelable)

2. Research questions and objectives of the project

2. 1 Context : Reducing the transport sector GHG emissions

- A province where 93% of the energy production is generated from hydroelectric power (about 200 TWh/y)
- +15,050 MW of new generating capacity by 2030



Bouchet, C., Pineau, P.-O., 2022. *State of Energy in Northeastern North America*, Chair in Energy Sector Management, HEC Montréal.

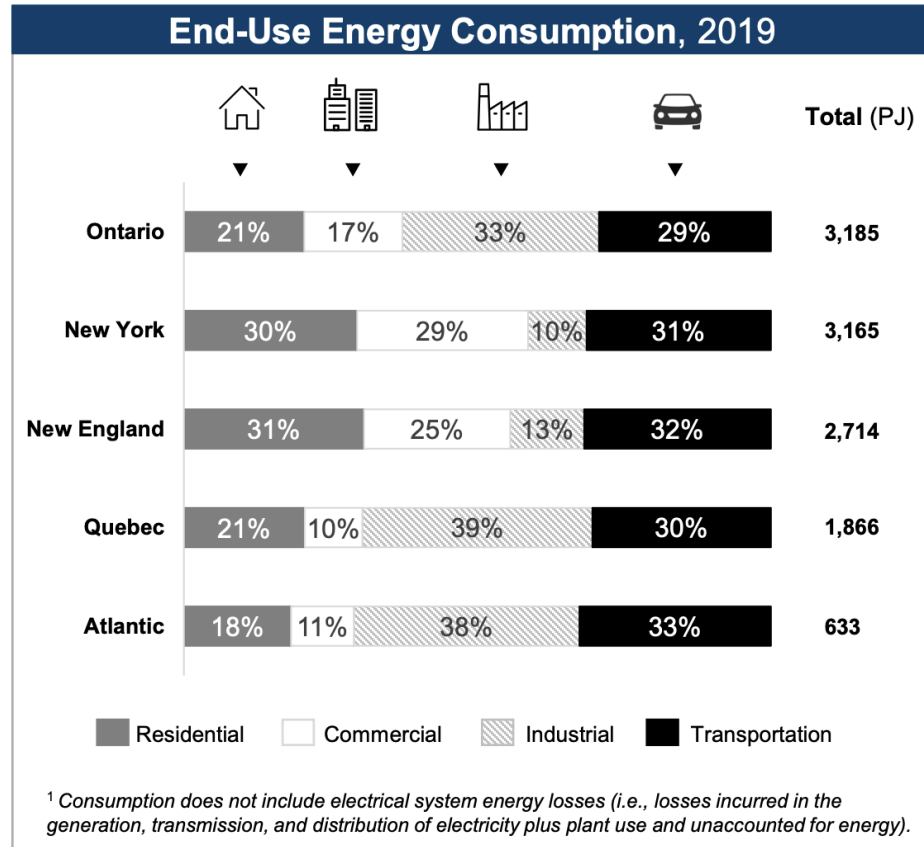


Source : Hydro-Québec, 2025.

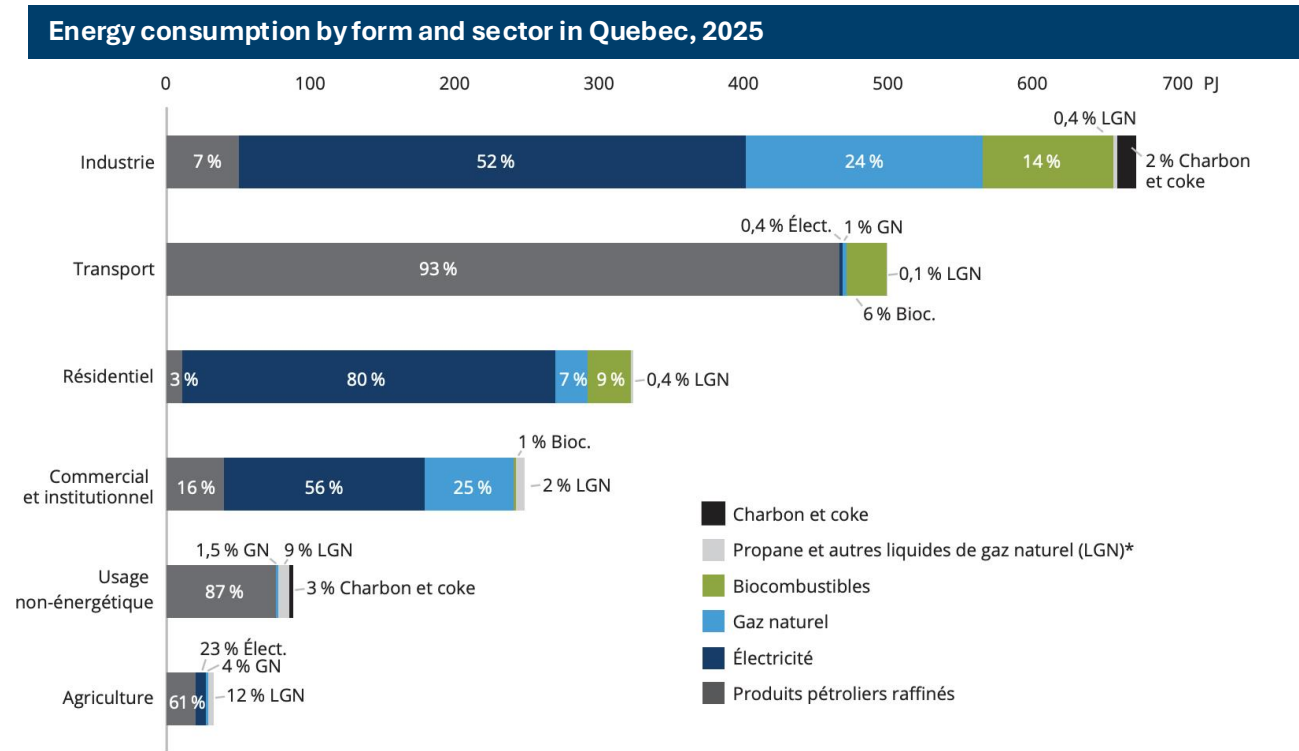
Note : Carte réalisée par Géomatique. Hydro-Québec Innovation. équipement et services partagés.

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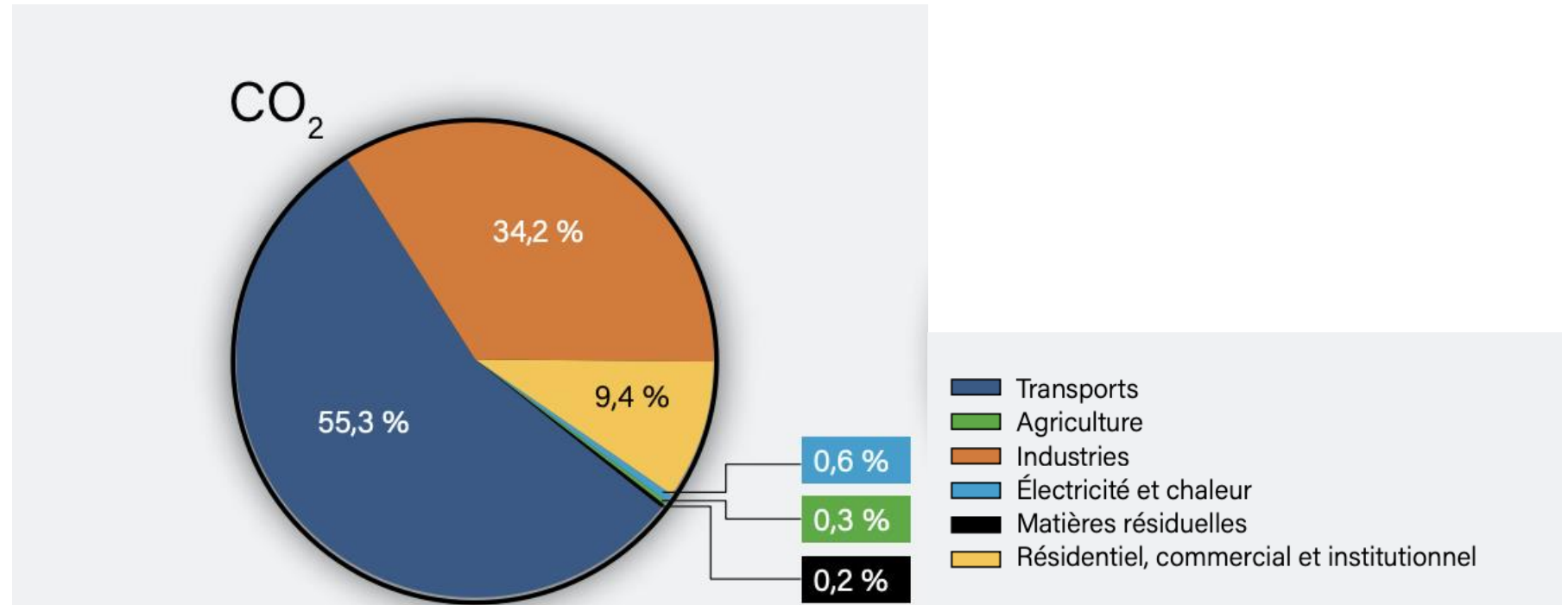


Sources : Voir graphique 2; Statistique Canada, 2025 (tableau 25-10-0029-01); Navius, 2025; MELCCFP, 2025 (communication personnelle).
Note : La catégorie « liquide de gaz naturel » inclut le propane et le butane.

Whitmore, J., Pineau, P.-O., 2026. *État de l'énergie au Québec 2026*, Chair in Energy Sector Management, HEC Montréal, prepared for the provincial government of Quebec

2. Research questions and objectives of the project

2. 1 Context : Reducing the transport sector GHG emissions

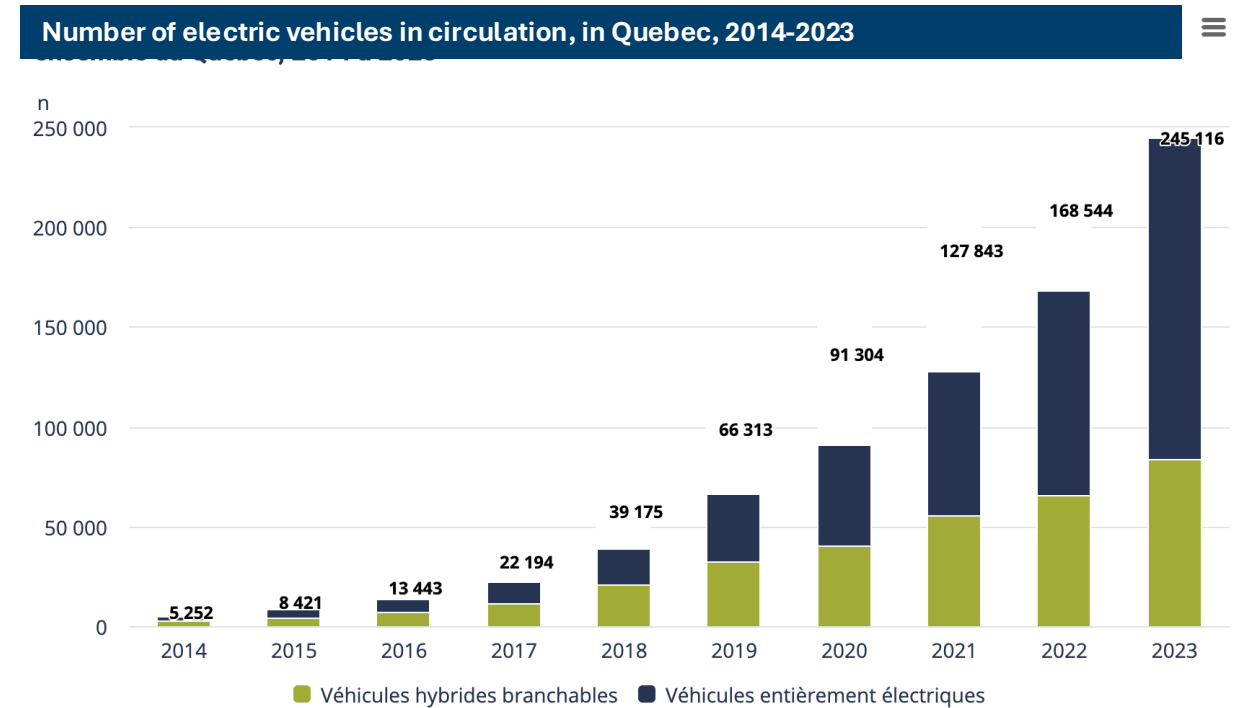


National GHG emissions inventory (Quebec) 1990-2023

2. Research questions and objectives of the project

2. 1 Context : Reducing the transport sector GHG emissions

- The first **2011–2020 Electric Vehicle Action Plan**
- In 2015, the **2015–2020 Transportation Electrification Action Plan**
- By 2018, the **2030 Sustainable Mobility Policy** aimed to have 1 million electric vehicles on Quebec's roads by 2030;
- 42% of the Canadian electric vehicle fleet, representing 454 922,000 vehicles
- 19,7% of market share in Quebec / 6% of the total fleet of cars in Quebec
- **1 million electric vehicles in Canada in April 2026**



Note

Données au 31 décembre.

Source

Société de l'assurance automobile du Québec (SAAQ).

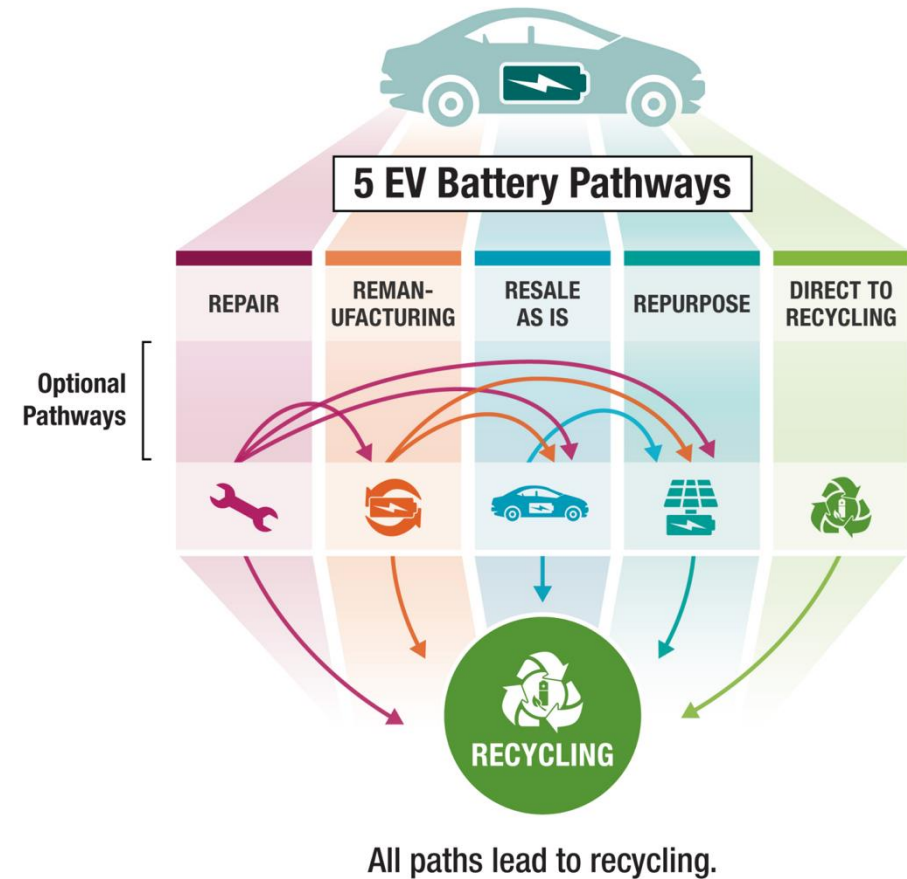
Compilation

Ministère des Transports et de la Mobilité durable et Institut de la statistique du Québec.

2. Research questions and objectives of the project

2. 1 Context : the challenge of End-of-Life of (future) batteries

- Quebec's EV success story now brings a waste challenge
- In Quebec, projections based on new electric vehicle registrations since 2011, estimate that at least **93,000 batteries will be ready for recycling by 2040 (40,000 tonnes)**
- with an + 500,000 batteries added between 2040 and 2045 (Lizotte, 2025)
- Based on : an **eight-year or 160,000-kilometer** high-voltage battery warranty, and about **70 percent of the original capacity (if no damage or defect)**
- Waste, particularly the waste of the ecological transition such as electric car batteries, is **a future collective problem** requiring public action (Garcier et al., 2017).



Source: Call2Recycle®

2. Research questions and objectives of the project

2. 1 Context : the challenge of recycling End-of-Life of (future) batteries

Benefits

- Fewer than 5% of Li-ion batteries are recycled worldwide
- Demand by 2050: lithium ×17 tp 21, cobalt ×7 to 17, nickel ×11 to 28
- China makes over 85% of batteries and components
- Production needs 3× the raw material and 9× the energy of recycling

Challenges

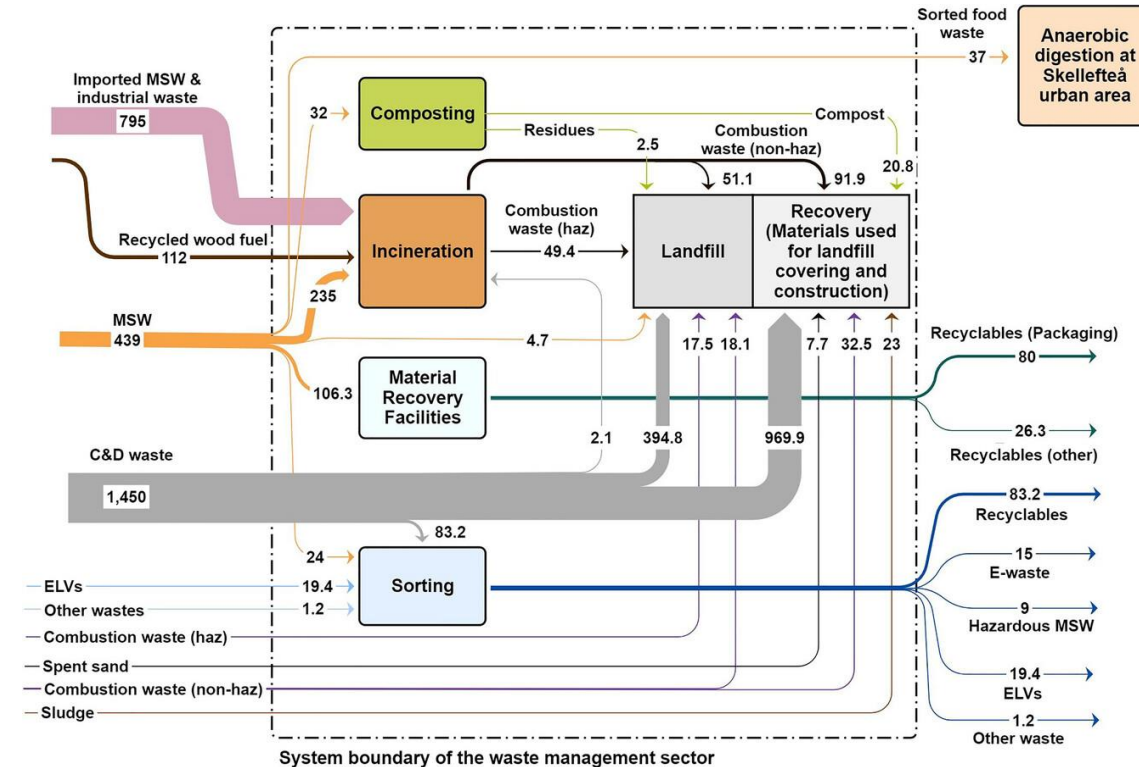
- No standard chemistries or dismantling methods
- Safer packs are required,
- Shorter routes
- More automated dismantling
- Capital-intensive, volatile prices, immature volumes
- Who organizes, structures and funds a durable chain?

- Recycling EV batteries is strategic, but hard to organise

2. Research questions and objectives of the project

2.1 Main research questions and theoretical framework grounded in territorial ecology

- Urban studies define the infrastructures for recycling as **sociotechnical systems**
- They are linked to their physical, natural, political and cultural "context "
- An analysis of the **political and social determinants** of how the industry operates
- The strategies of local actors in capturing resources and in controlling and structuring flows
- Flows are transformed, and can be transformed, by potential **conflicts or trade-offs between actors**
- The main challenge is not only technical : it is institutional with locks-in and power dynamics



Papageorgiou, A., Björklund, A., & Sinha, R. (2024). Applying material and energy flow analysis to assess urban metabolism in the context of the circular economy. *Journal of Industrial Ecology*, 28, 885–900. <https://doi.org/10.1111/jiec.13504>

2. Research questions and objectives of the project

2.1 Main research questions and theoretical framework grounded in territorial ecology

1

What, then, are the political, social and territorial **barriers** to the operation of a mass battery recycling sector in Quebec?

2

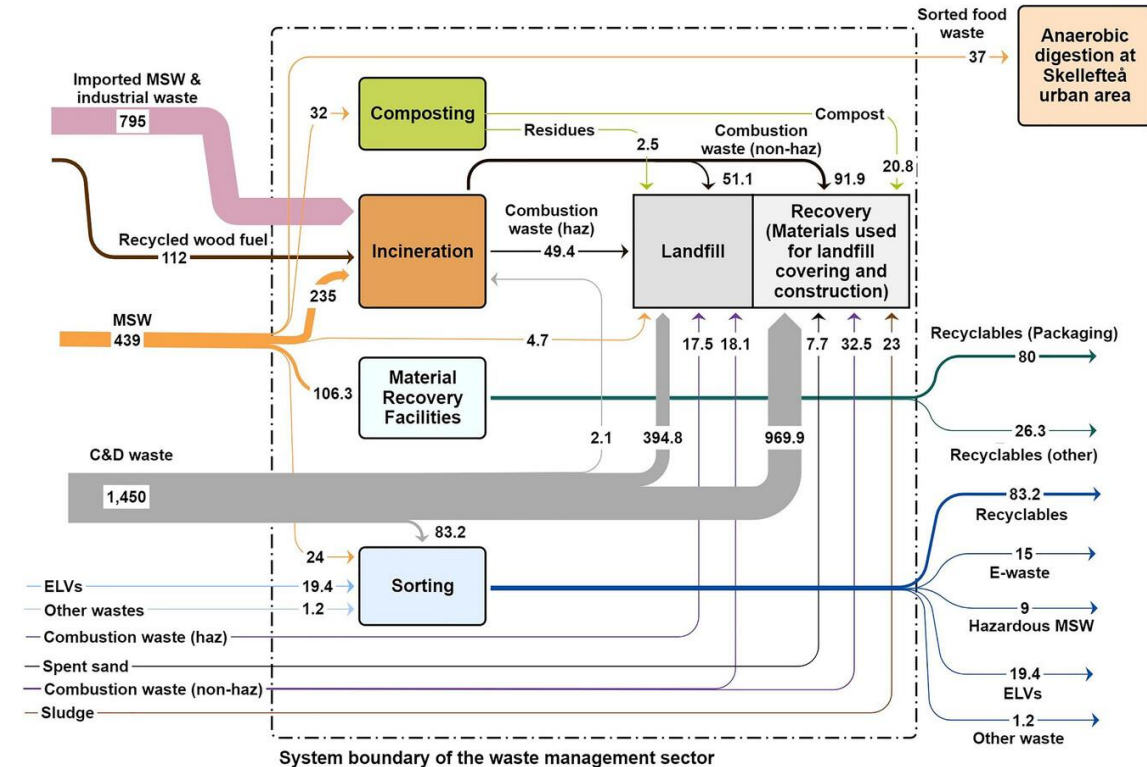
What **levers** does the province also have to sustain a still-emerging sector over the long term?

3

To what extent does the mass electrification of road transport change **the territorial metabolism** of Quebec's regions and the balance of their material flows?

4

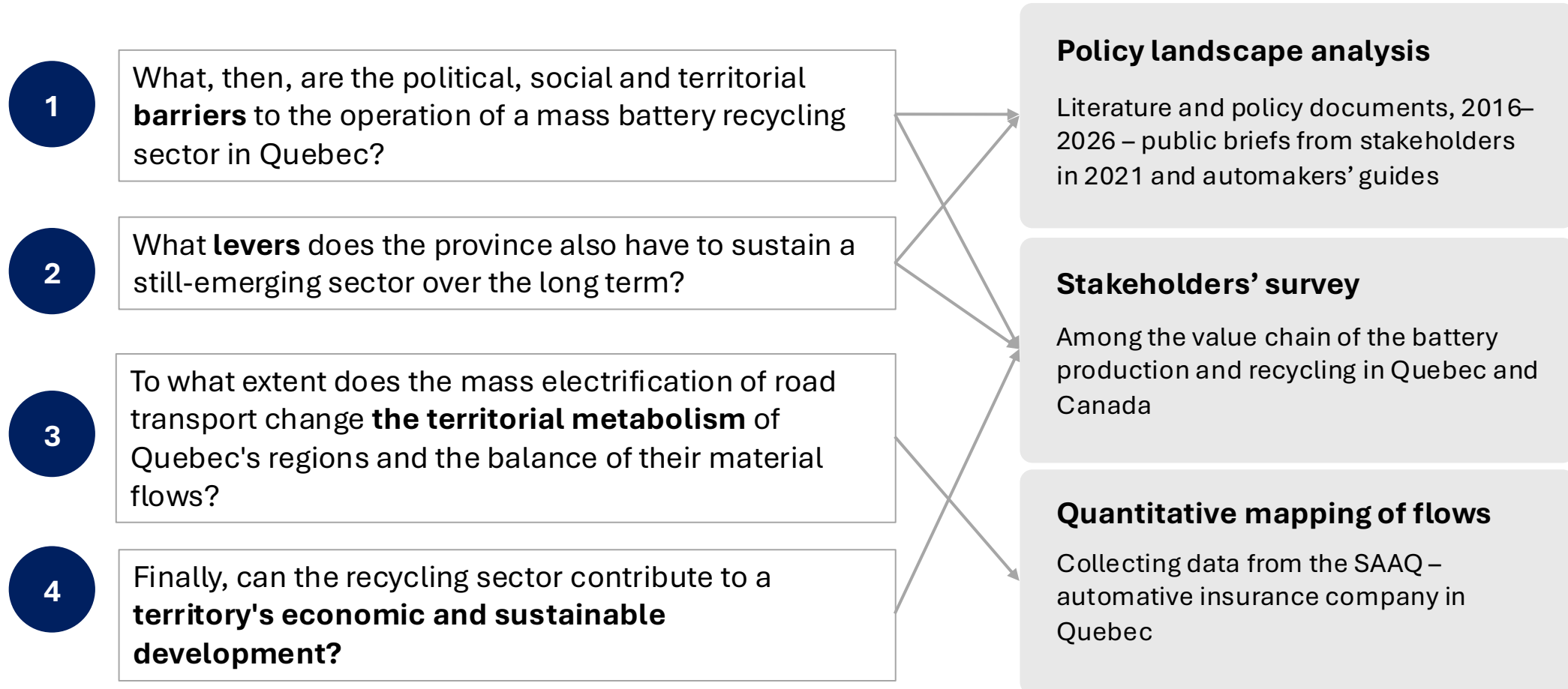
Finally, can the recycling sector contribute to a **territory's economic and sustainable development**?



Papageorgiou, A., Björklund, A., & Sinha, R. (2024). Applying material and energy flow analysis to assess urban metabolism in the context of the circular economy. *Journal of Industrial Ecology*, 28, 885–900. <https://doi.org/10.1111/jiec.13504>

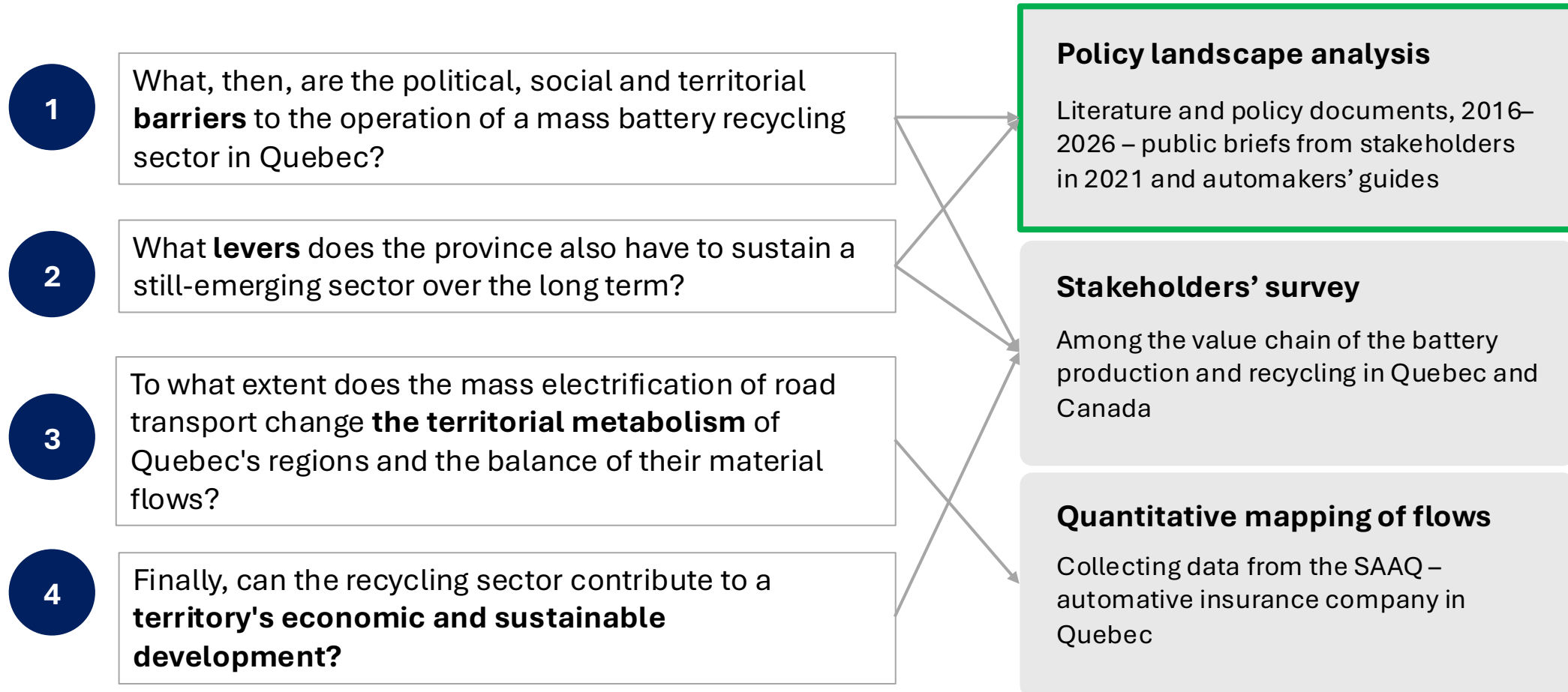
2. Research questions and objectives of the project

2.1 Main research questions and theoretical framework grounded in territorial ecology



2. Research questions and objectives of the project

2.1 Main research questions and theoretical framework grounded in territorial ecology



3. Methodology of the policy landscape assessment

We queried several **official databases** including :

- *Quebec Politiques Orientations*;
- Canadian Policies and Directives;
- LégisQuebec;
- the Gazette du Québec.

Bilingual **keywords** for federal and provincial jurisdictions:

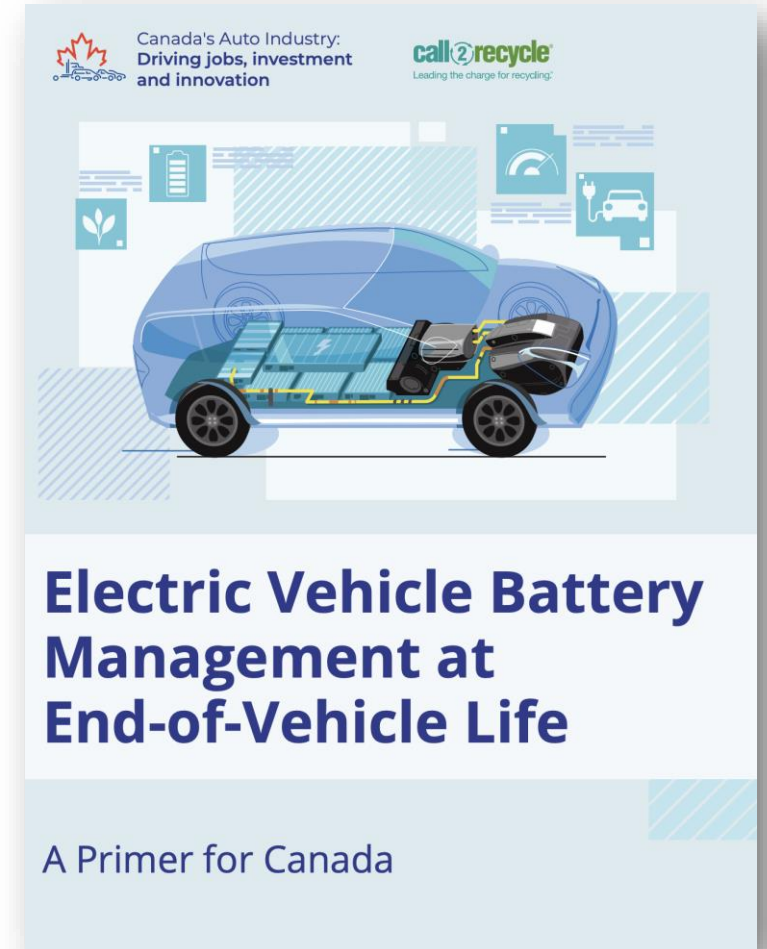
"Battery" AND "electric vehicles", AND "regulations", "recycling »...

The result is :

- **119 documents** including 6 policy briefs submitted during the 2021 public consultation

A **three-step process**:

- (1) classifying documents into three levels of relevance to prioritize reading;
- (2) drafting brief summaries while extracting key figures and highlights;
- (3) performing a deeper thematic analysis, on Nvivo, to map out: the stated objectives, policy instruments, incentives, key actors.



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4. Early results from the policy assessment

4.1 A radical shift in the provincial government's position

- In two years, a binding rule became a voluntary program

March 2020

Propulsion Québec study finds binding **Extended Producer Responsibility** the most robust option, as voluntary ambition is “often limited”

Oct 2021

Binding rule proposal by the government: recover at least 35% of batteries 10 years after sale, rising to 90%. 80 briefs of stakeholders received

Jun 2022

Regulation adopted, but EV batteries are excluded of binding ERP; a **voluntary programme is implemented** with 16 manufacturers engaged

4. Early results from the policy assessment

4.1 A radical shift in the provincial government's position

- Results of the 2021 public consultation :

Reuse, environmental NGOs and e-mobility stakeholders

- Favorable to EPR in principle including EV batteries
- Reject the 10-year trigger as arbitrary; fear planned obsolescence
- Ask for a 100% target and unconditional producer take-back
- Propose a battery passport for traceability

Automakers (ACCV, Appel à Recycler)

- EPR “probably does not fit” this unique product
- Avoid recovery rates and provincial-only rules
- Prefer a harmonised national policy and free North American flow of batteries
- Favour self-regulation and a voluntary regime

4. Early results from the policy assessment

4.1 The voluntary program: EVBatteryRecovery.ca, an industry-lead solution

- **16 manufacturers volunteers**
- Batteries must meet **5 criteria to be eligible**:
 1. Came from a hybrid, plug-in, electric or fuel-cell vehicle
 2. From a participating manufacturer
 3. Removed from the vehicle by qualified professionals
 4. Owned by the applicant, with no insurance claim pending
 5. Not modified, refurbished or reused by anyone (only authorized agents)
- If a battery fails one criteria it may become an “orphan” (high risk)
- **49,000 Chinese-made EV** a year allowed since January 2026 (rising to 70,000 by 2030)

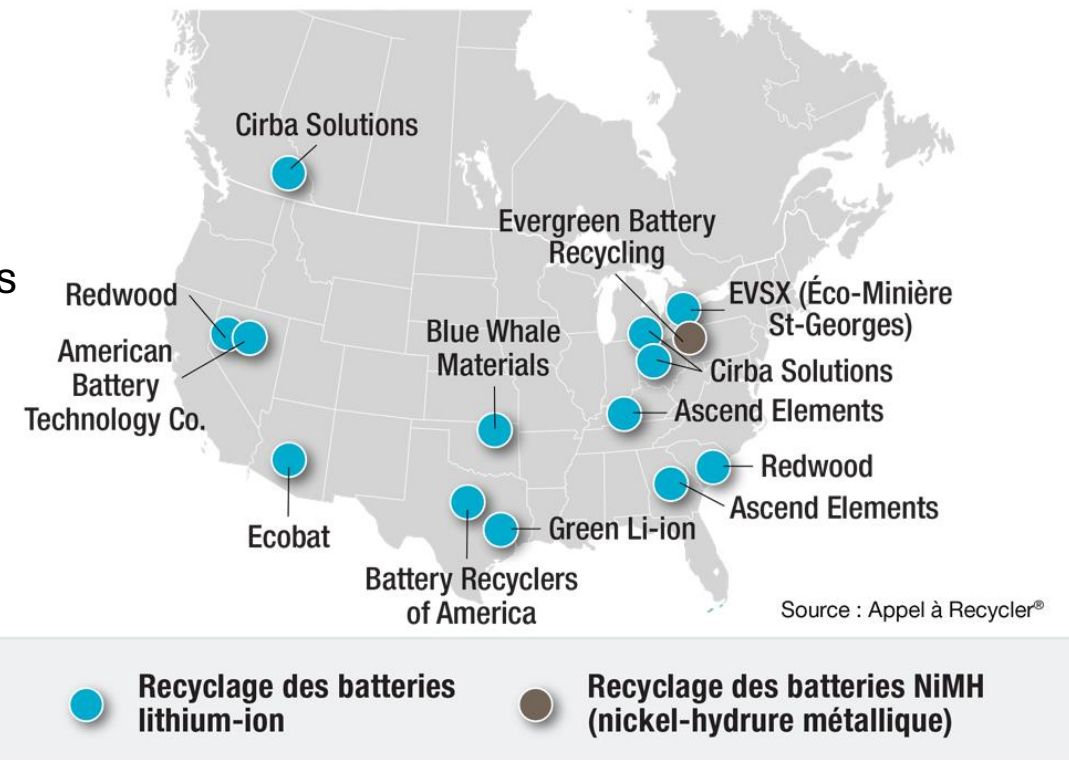


4. Early results from the policy assessment

4.1 The voluntary program: EVBatteryRecovery.ca, an industry-lead solution

- Zero Lithium-ion recycling plant in Quebec left (since Lithion's bankruptcy)
- Lithion had received 15 millions dollars of public aids
- To transport the batteries to a limited number of facilities will become a **logistical challenge**
- The orphan batteries are thus absorbed by :
 1. Municipalities (cover the cost of inelligible batteries)
 2. Dismantlers (not part of the program's design)
 3. Independent repairers

Recycling infrastructures in North America



4. Early results from the policy assessment

4.1 Other jurisdictions with binding targets

- **Norway** : has a binding EPR : it requires manufacturers and every importers of EV to join an organization approved by the government and to be held accountable through reporting (Autoretur Battery Recycling)
- **The EU** imposes a binding EPR, minimum material recovery targets and minimum recycled content thresholds (not a minimal number of battery collection or recycling)

Key EU milestones for EV battery recycling

Under the EU Batteries Regulation:

18 Aug 2025

Old directive replaced

Producers now pay for collecting and recycling waste batteries.

18 Feb 2027

Battery passport

Every new EV battery gets a digital record of its health, durability and repair data.

End of 2027

Material recovery: 90% / 50%

90% of cobalt, copper, nickel and lead, and 50% of lithium.

End of 2030

Recycling efficiency: 70%

For lithium-based batteries, up from 65%.

2031

Recovery: 95% / 80%

Plus recycled content in new EV batteries: 16% cobalt, 6% lithium, 6% nickel.

2036

Recycled content rises

26% cobalt, 12% lithium, 15% nickel.

Source: European Commission, EU Batteries Regulation and recycling efficiency calculation rules (July 2025).

5. Conclusion and future research directions

- Significant volumes of batteries to come
- The shift to a voluntary model reflects an industry-friendly balance not a technical choice, in Quebec
- High risk of ineligibility through the program and the gaps fall to municipalities and dismantlers
- A firmer framework is needed:
 1. Public reporting on batteries collected, refused and processed
 2. Clarify municipal role and funding; include dismantlers and repairers
 3. Binding EPR for every manufacturer selling and importing in Quebec, with reporting
 4. Public funds should support longer-term development, through access to patient capital (long horizon investments with deferred returns)

Next steps

- Interviews with municipalities, dismantlers, repairers, non-participating manufacturers, Appel à Recycler, MELCCFP and RECYC-QUÉBEC

Thank you for your attention !

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