

Electrifying Heating in Commercial and Institutional Buildings



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Electrifying Heating in Commercial and Institutional Buildings

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About Electrifying Canada

Electrifying Canada is a business-led task force aiming to accelerate electrification across Canada to reach net-zero by 2050. As business leaders, we are eager to collaborate with government, Indigenous, and civil society leaders to translate electrification ambition into action. The Electrifying Canada task force is affiliated with the Energy Transitions Commission and funded by its founding members. Learn more at electrifyingcanada.ca.

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About the Research

Research for the Electrifying Canada task force is provided by Dunsky Energy + Climate Advisors. Dunsky's team of nearly 50 specialists across the buildings, transportation, industry, and energy supply sectors is proud to serve as the task force's research arm.

This report is a collective view of the Electrifying Canada task force and may not represent the individual viewpoints of members and/or their respective organizations.



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1. Turning Net-Zero Ambition Into Action on Building Heat Electrification

Reaching Canada’s target of net-zero emissions by 2050 requires major action. Pathways to achieving this target have been assessed by leading academics and institutions across the country, and while there is no silver bullet, these studies clearly identified clean electrification—substituting fossil fuels with clean, zero-carbon electricity—as the central pillar to achieving net-zero in Canada. The good news for businesses, for whom buildings can be a dominant source of corporate emissions, is that emissions related to heating can be reduced significantly by leveraging Canada’s clean electricity advantage.

The Electrifying Canada task force is targeting market segments where transformation is slower because the policy and technical direction is less clear and where businesses have significant greenhouse gas (GHG) emission-reduction opportunities. For the buildings sector, these criteria lead us to focus on commercial and institutional (C&I) buildings.

Heating buildings is currently a significant source of GHG emissions in Canada, and these emissions must be mitigated to meet our net-zero targets. Studies show that to reach economy-wide net-zero by 2050, about three quarters of C&I heating emissions must be eliminated by 2040 (Figure 1); since most heating equipment installed today is likely to still be running then, there is no time to waste.

1.1 State of Play

Canada is no stranger to heating with electricity. Today, around 15% of the C&I building heating load is provided by electricity. This increases to 30% in Quebec and 40% in Manitoba (Langlois-Bertrand et al., 2021), where electricity is relatively affordable and carbon free. However, apart from a few regions, the trend toward heating electrification has been mostly flat in recent years.

Today, electric heat pumps are becoming far more efficient than electric furnaces and baseboards and are growing in popularity and availability, including cold-climate versions of both ground-source and air-source heat pumps.

Electric heat pumps efficiently capture and concentrate the heat present in the outdoor air or in the ground or by recovering the heat buildings usually waste to the outdoors—a free source of energy. They can—and should—be paired with “smart” electrification approaches that further improve their business case by limiting their impact on our (currently or soon-to-be) winter-peaking grids. Smart electrification approaches include:

- Combining electrification with demand-reduction strategies (energy efficiency and peak demand management).

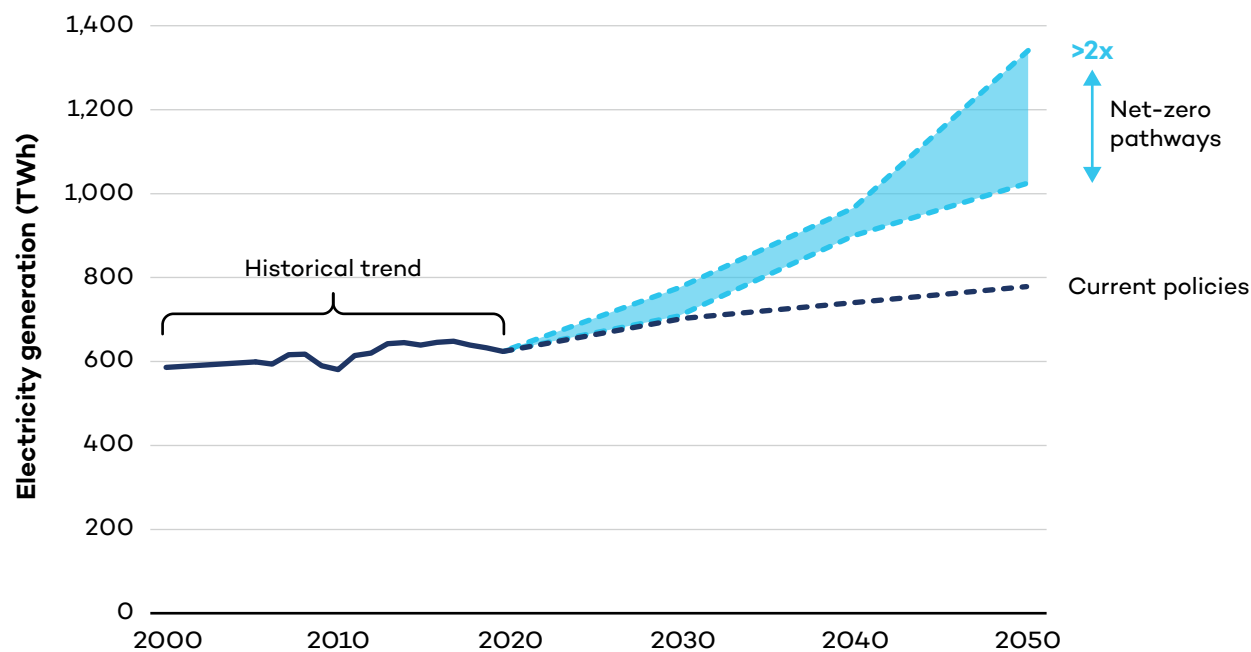


- Selecting heat pumps that are efficient at peak (ground source instead of air-source).
- Opting for hybrid heating systems (temporarily keeping a portion of existing gas consumption as a supplemental source of heat, if required).

Despite the potential and benefits of heat pumps, smart heating electrification is not yet happening at the pace and scale required in Canada. Concerns about heating electrification differ across the country, depending on the gap between gas and electricity rates (which can challenge the business case for electrification) and the season in which electricity use peaks (if currently winter peaking, greater electrification requires new generation capacity, which can lead to significant costs to the utility and ratepayers).

Our meta-analysis of pathways to net-zero highlights the dramatic shift required in the next 30 years to reach economy-wide net-zero: by 2050, we need to massively electrify C&I building heating, as shown in Figure 1. The remaining non-electric heating load would be provided by low-carbon gases.

Figure 1. Reaching net-zero requires a significant increase in electricity’s share of C&I buildings’ heating energy demand, rising from less than 15% to at least 75% by 2050.



Source: Produced by Dunsky Energy + Climate Advisors for Electrifying Canada, 2022.

Data source for historical trend: Natural Resources Canada, 2022.

Data sources for net-zero pathways: Electric Power Research Institute, 2021; Langlois-Bertrand et al., 2021; Larson et al., 2021.

Across Canada, many provincial and municipal climate change action plans have identified heating decarbonization as a short-term priority. This has led to some early policy leadership, like



the City of Vancouver's greenhouse gas intensity requirement (ZEBx, 2021) for new construction or fuel-oil bans in Quebec's existing buildings (Gouvernement du Québec, 2022), which tilt the scales toward clean electricity as the heating source of choice. Similarly, private sector portfolio managers across the country have benefited from existing efficiency and carbon reduction programs to improve their energy productivity, including deep energy retrofits leveraging electric heat pumps to displace natural gas in cost-effective efficiency packages. As more and more businesses are adopting GHG reduction targets for their operations, the C&I market is at the early stages of its huge electrification opportunity.

Concerns about heating electrification differ across the country, depending on the gap between gas and electricity rates (which can challenge the business case for electrification) and the season in which electricity use peaks (if currently winter peaking, greater electrification requires new generation capacity, which can lead to significant costs to the utility and ratepayers).

Three big wins for corporate Canada

We see three big wins from smart heating electrification in C&I buildings:

1. Significant GHG emission reductions

Space and water heating represent major sources of corporate emissions for many businesses. Businesses are not likely to reach their climate targets without decarbonizing heating, and smart electrification represents an accessible, near-term opportunity.

2. Future-proofing building operations

Transitioning C&I buildings from fossil fuel-fired to primarily electricity-driven heating can prepare buildings for operating in a world trending toward net-zero. The decarbonization of heating will happen one way or another, and businesses can ease the transition of their operations by starting early. As the cost of carbon pollution increases and as occupants and tenants increasingly demand low-carbon operations, planned decarbonization through an efficient, peak-managed approach can help ensure a cost-effective transition while also hedging against volatile natural gas prices.

3. Developing an electrification services industry

Smart electrification requires planning to optimize the transition, reorienting the typical replacement cycles of equipment and building components, and taking a whole-building approach rather than going with the conventional like-for-like replacement. To be deployed at the pace and scale required, this conventional approach will not be enough, and new business models will have to be adopted. In particular, turnkey delivery services and performance contracts coupled with innovative financing approaches will be required.



1.2 Key Barriers to Heating Electrification

Our research and interviews with Canadian and Indigenous corporate leaders identified three main barriers to C&I heating electrification that will need to be overcome to reach net-zero.

1. **Cheap natural gas challenges the business case for electrification:** Low-cost natural gas skews the business case toward higher-emissions heating. Buildings interested in electrifying heat risk facing higher energy bills, even with the high efficiency of heat pumps. Further, commercial electricity rate structures typically include peak demand charges, which can add significant costs to the building operator, particularly in electrical systems that are winter peaking. The rising price of carbon pollution will help reduce this fossil fuel gas advantage over clean electricity but not fast enough to drive significant action in the near term. Given the longevity of capital investments in heating systems, this advantage risks locking in polluting heating for decades.
2. **Knowledge gaps and a business-as-usual bias:** Most equipment replacements happen upon failure or at end-of-life, and like-for-like replacement is typical. However, to be practical and economical, smart electrification benefits from optimized long-term planning that incorporates it in a whole-building approach to heat management. Unfortunately, most building owners do not yet have the internal capacity to tackle this challenge. This planning process is further challenged by an external workforce that is conservative by nature: many (though not all) technical experts (engineering firms; heating, ventilation and air conditioning [HVAC] distributors; or installers) lean on the equipment and systems they are most familiar with.
3. **Financing constraints:** Electrification and deep retrofits in C&I buildings will lead to significant capital expenditures. In certain cases—even when there is a strong business case and planning support for electrification—building owners face challenges financing the retrofit required to electrify their heating. Some organizations, such as public institutions, cannot raise additional debt, while others are already too heavily leveraged to make the investment in heating electrification.

Despite these barriers, innovative solutions are being tested and implemented across the country to electrify heating.



2. Seizing the Opportunity: Five catalysts to accelerate electrifying heating in C & I buildings

Canada has a transformational opportunity to meet our net-zero target by leveraging the competitive advantage offered by our clean electricity. However, our research finds that while Canada has huge opportunities and significant advantages, we also face a significant risk: complacency.

Without clear direction, proactive planning, and bold decisions, we won't be successful in overcoming the barriers to electrification identified above.

Failure to do so means losing out on our competitive advantage, vastly increasing transition costs and risks, and foregoing significant opportunities.

Figure 2. Five catalysts to accelerate electrification





But it is clear that whether we succeed or fail is up to us. **Achieving electrification at the pace and scale needed requires the *proactive* and collaborative efforts of all stakeholders**—electricity producers, end users, regulators, and policy-makers—across the electricity value chain. Meeting Canada’s net-zero target is a significant challenge, and clean electrification is the single most valuable tool to reduce emissions. That is why we, as leaders from the nation’s private sector, have identified **five evidence-based catalysts to initiate and enable electrification** (Figure 2). This brief translates the catalysts and their implications for the electrification of heating for C&I buildings.

2.1 Act to Electrify Heating in C&I Buildings via Near-Term Plans and Projects



Take action to support the early deployment of electrified heating systems, learning by doing, and translating climate action targets into electrification plans and pilots that prove out technologies and approaches to support scaled up investment.

Why?

Many corporations have climate action targets, but action-oriented near-term plans to electrify heating are missing. Smart electrification requires planning and a systems mindset. Building electrification requires a thoughtful long-term vision supported by near-term implementation.

Call to Action: Businesses must develop near-term business plans and projects to electrify heating in C&I buildings.

Building owners, operators, and developers, ourselves included, must translate long-term corporate climate targets into action through near-term plans and pilots for heating electrification.

Thoughtful near- and long-term planning is required to optimize the path to decarbonizing heating. Planning for fossil fuel-based equipment replacement and accompanying efficiency and peak demand management measures are key components of gradual and smart electrification.

Heating systems are important features of building operations but are typically a low priority, dealt with through piecemeal changes. Smart electrification requires a change in mindset to a whole-building and systems approach, which requires a transformation in the way buildings are operated and serviced. Internal capacity building is critical and can be supported by the emerging building electrification service industry, whose experts in equipment, commissioning, operation, financing, and other technical features can help reduce barriers to implementation.



Goal:

This catalyst aims to:

- Accelerate the pace of C&I building retrofits through planning, pilots, and projects.
- Support measurable near-term progress toward long-term corporate climate targets.
- Build internal and sectoral capacity through project learning and knowledge sharing.
- Develop the emerging Canadian building electrification services sector to support scaled-up efforts.

Spotlight: Turning net-zero DREAMs into reality

DREAM, an Ontario-based real estate investment trust managing CAD 13 billion in assets around the country, announced in 2021 that it is committing to reaching net-zero in its operational and some development emissions by 2035—that is 15 years ahead of most countries' and companies' net-zero targets. The company is currently developing its net-zero strategy with science-based interim targets, to be released in 2022, and will disclose all building energy data by 2025 (Dream Group of Companies, 2021).

These commitments have spurred DREAM to act on electrification, with clarity that decarbonization pathways will primarily rely upon electrification. The company has received financing from the Canada Infrastructure Bank for deep decarbonization retrofits in 19 buildings in its Ontario and Saskatchewan portfolios. The agreement, worth CAD 137 million, will create an estimated 1,500 jobs. The developer has also brought a large zero-carbon district heating system online for a large new net-zero community under development in Ottawa and Gatineau (Canada Infrastructure Bank, 2021).

2.2 Empower Proactive Utility Leadership Through Climate Mandates and the Integration of Electricity and Natural Gas Regulation



Fully embracing the potential to electrify heating will require modernizing the mandates of regulators, system planners, system operators, and local and provincial utilities—including electric and gas—to reflect the key role they will play in achieving net-zero and to ensure utility plans and regulatory decisions are consistent with pathways to net-zero.

Why?

Electricity and natural gas are tightly regulated markets in Canada, ensuring protection and access to all citizens. With a mandated focus on affordability and reliability, traditional utility regulation may consider—but is not bound by—climate targets in the decision-making process.



The constraints of a relatively conservative, risk-averse regulated system limit the authority of utilities to proactively meet the needs of a rapidly decarbonizing economy while simultaneously prohibiting other actors from providing solutions where the utility may not be able to meet low-carbon energy demand. Further, electricity and natural gas are commonly siloed in regulations, which limits the potential to optimize economy-wide decarbonization across both the electricity and gas systems.

Moreover, traditional utility regulation is not bound by climate targets in decision making, which is especially limiting for gas utilities. Natural gas utilities continue to expand their market, even in the face of the need to decarbonize buildings. This expansion risks locking in emissions or stranding assets and slows efforts to electrify. However, natural gas resource plans are typically considered in isolation from electricity resource plans, foregoing the opportunity to optimize both electricity and gas systems for cost-effective decarbonization. By integrating the regulation and planning of the two markets, natural gas utilities could be effectively leveraged to accelerate partial electrification through hybrid heating approaches where this could achieve system-wide cost savings by reducing peak electricity demand impacts.

Call to Action: Provincial governments must embed net-zero objectives into the mandates of utility regulators and utilities and require the development of integrated gas and electricity plans.

Provincial governments must modernize utility regulators and, where applicable, utility, system planner, and system operator mandates to integrate electricity and natural gas markets with economy-wide net-zero targets. This mandate should require that energy supplies, combined with demand management, are sufficient to support the complete decarbonization of end uses, including C&I heating, at the lowest cost.

Goal:

This catalyst aims to:

- Ensure regulators and utilities realize the decarbonization potential of electrification.
- Empower electric utilities to plan for and proactively ensure building net-zero efforts while maximizing the benefits from demand-side management programs.
- Integrate electricity and natural gas planning to optimize heating electrification.



Spotlight: Integrating electricity and natural gas planning in Quebec

The integration of electricity and natural gas utilities for emission reductions in the building sector is being explored in Quebec. A joint regulatory application by the electric (Hydro-Québec) and natural gas (Énergir) utilities, currently under review, is proposing a dual-fuel building decarbonization strategy (Hydro-Québec & Énergir, 2022). The first phase would be focused on residential customers, with the C&I sector following in the short term.

Natural gas-heated buildings would get electrified through hybrid systems, eliminating about three quarters of gas consumption without impacting Hydro-Québec's winter peak. The approach is based on three main elements:

- Leveraging existing **incentives** for heat pumps.
- Using the residential **dual-fuel rate** and creating one for businesses.
- **Cross-subsidizing to share the costs and benefits**, with Hydro-Québec using a relatively small portion of its peak demand savings to compensate Énergir for its peak services.

2.3 Align Utility Planning With Net-Zero Pathways to Proactively Ensure Ample Clean Power Supply for Heating Electrification



Align and optimize utility planning with net-zero pathways to ensure all customers have enough clean power where and when they need it, enabling them to electrify heating for C&I buildings.

Why?

Proactive planning and outreach by utilities, system planners, and system operators to building owners, operators, and developers will be necessary to understand capacity and demand needs. Net-zero planning requires proactive outreach to building owners and operators, not only to understand the scale and pace of electric heating demand coming from C&I buildings but also to encourage and “sell” electrification.

In addition, many utilities in Canada are winter peaking, and those that are not today are likely to develop a winter peak in the near future as more heating systems electrify. It could be challenging to meet the additional load from C&I electric heating. Consequently, effective and proactive action should encourage (and co-invest) in peak demand mitigation measures, such as building-scale storage and demand response measures, to help reduce system costs.



Call to Action: Governing bodies of utilities and planning authorities must proactively align plans and investments with achieving net-zero emissions in C&I buildings.

The governing bodies of utilities and planning authorities must focus planning and action on scenarios aligned with Canada's climate commitments. This shift will allow utilities to expand their focus to include decarbonizing economy-wide energy use, including electrification of heating in C&I buildings.

Utility resource planning should expand beyond traditional capacity planning to proactively assess and plan for the electricity supply needed to electrify 75%–90% of the C&I heating load by 2050 (Figure 1) while reaping the benefits of efficiency improvements, demand management, and hybrid heating approaches.

Goal:

This catalyst aims to:

- Ensure Canadian businesses have enough clean power to electrify their buildings.
- Encourage utilities to become proactive champions of electrification and to bridge the gap between business electrification needs and utility planning.
- Improve awareness of utilities regarding their central role in accelerating heating electrification to reach economy-wide net-zero targets.

Spotlight: Mitigating commercial electrification peak demand

Commercial heating electrification programs and initiatives have been developed and improved in a few regions across Canada. For example, “efficient” heating electrification measures are now eligible in Hydro-Québec's C&I incentive programs. Even though the electric utility cannot claim fossil fuel savings or GHG emission savings under the provincial energy regulation framework, it can incentivize clients to select higher-efficiency electric heat pumps when they decide to electrify (Hydro-Québec, 2022).

Moreover, Hydro-Québec recently launched Hilo, a subsidiary that will serve as a testing ground for innovative energy services. Hilo is expanding into commercial building energy management through a partnership that will offer commercial customers automated power demand management services, which will reward customers who proactively participate in peak-period management efforts (Hydro-Québec, 2021). By mitigating peak demand costs at the building level, commercial customers can reduce electricity costs while mitigating the peak demand impact of electric heating at the grid level.



2.4 Tilt the Playing Field Toward Decarbonization by Setting Building Performance Standards



Facilitate greater investment certainty by regulating with clear performance standards to drive down buildings emissions over time using clear and corresponding timelines for scaling up clean electricity. Performance-based standards can foster private sector innovation by defining the target, not prescribing the path, for net-zero performance

Why?

The current business case for electrification is challenging because natural gas is relatively cheap. Setting GHG emissions-based performance requirements does not prescribe a “winner”—a specific energy source or technology—but it allows building owners and developers to choose the best way to meet the requirement. However, we anticipate that given electrification’s improving cost-effectiveness and a rising price on the carbon pollution from natural gas, these standards will predominantly be met through smart electrification, complemented as needed by renewable gases.

Currently, utilities are hesitant to plan and build for broad-scale heating electrification as it is not yet seen as a foregone conclusion, which is a reasonable perspective. This reinforces the need for governments to use regulations to drive building decarbonization, providing greater certainty to inform utility planning and investment.

Call to Action: Provincial and municipal governments must set performance standards for C&I buildings.

Building performance standards for existing buildings would set a limit on the GHG intensity of a building (tonnes emitted by floor area), which would decline over time. Mandatory building GHG performance rating and disclosure programs would be an important complementary measure that can inform prospective buyers or tenants of the GHG performance of buildings.

For new construction, these standards should be incorporated into building codes, but newly constructed buildings would have to meet the declining emission intensities a few years after completion.

Goal:

This catalyst aims to:

- Tilt the playing field by requiring, not simply encouraging, building decarbonization, so that early movers are not disadvantaged in the transition.
- Provide building owners, operators, and developers with long-term vision and certainty on the scale of decarbonization and the associated timeline.
- Improve certainty for utilities, which can then plan for meeting near-term, large-scale electricity demand to electrify heating.



Spotlight: Building performance standards in Canada's three largest cities

Montreal, Toronto, and Vancouver are committing to reducing building emissions by setting performance standards or retrofit codes. Reaching these standards does not necessarily require electrification, as the low-carbon solution is at the discretion of the builder. However, electric heating systems, whether fully electric or hybrid, will typically be the most cost-effective option for meeting these standards.

The City of Montreal requires annual energy disclosure for all existing large commercial, institutional, and multi-residential buildings (City of Montreal, 2022a). The disclosure will be used to provide a GHG emission rating and is planned to evolve to incorporate performance standards, targeting zero emissions for all buildings by 2040 (City of Montreal, 2022b). The cities of Toronto and Vancouver have performance requirements for all new building construction, establishing a baseline for low-carbon performance that increases in stringency over time (City of Toronto, 2022; City of Vancouver, 2022; ZEBx, 2021).

Implementing building standards is part of a broader trend across the continent. In January 2022, President Biden announced the National Building Performance Standards Coalition, a group of state and local governments committing to implementing building performance policies (The White House, 2022). Major cities have made this commitment to establish or maintain long-term energy and/or climate standards with interim targets that ratchet up over time, including New York City, Chicago, Boston, Los Angeles, Portland, and Seattle (National Building Performance Standards Coalition, 2022).

2.5 Finance Electrification Projects by Crowding in Private Investment



Channel interest in private investment through innovative public-private approaches to financing C&I retrofits.

Why?

Compared to the traditional approach of maintaining heating equipment and building components, deep retrofits focused on electrification require additional capital and a long-term perspective on return on investment. While there is a role for public incentives, “patient” private capital will be key in scaling the electrification of building heating as required in net-zero pathways.

Moreover, some organizations, such as public institutions, cannot raise additional debt, while others are already too heavily leveraged to invest in electrification. Innovative approaches can help tackle these barriers.



Call to Action: Develop innovative public–private financing products for smart electrification of C&I buildings.

Electrification and deep retrofits in C&I buildings will require significant investments. Public and private financial institutions must collaborate to develop financing approaches to electrify heating. Some C&I building retrofits can be optimized by using performance-based turnkey delivery services, but this solution must be scaled to match net-zero requirements. Project aggregation should be used to lower the overall financial risk, and public financing (Canada Infrastructure Bank and others) can be used to further mitigate financial risk (guarantees, first loss, etc.) and leverage private capital.

Goal:

This catalyst aims to:

- Address upfront capital needs and improve opportunities for available private capital.
- Replace widespread public incentives with targeted incentives for the most challenging business cases.
- Enable deeper retrofits through the use of performance-based turnkey approaches that reduce the risk for the private capital.

Spotlight: Leveraging public and private funds to de-risk deep decarbonization

SOFIAC, a Quebec-based energy service company, offers turnkey retrofit financing and implementation for commercial buildings. SOFIAC offers building owners financing to cover all project costs in a performance-based retrofit package designed to achieve positive cash flows for the client. To leverage private capital, SOFIAC further reduces risk at the portfolio level by aggregating building retrofit projects and uses both public financing and public incentives as additional levers (SOFIAC, 2021b).

In 2021, SOFIAC received a CAD 200 million in investment from the Canada Infrastructure Bank (CIB) and Fiera Private Debt to complete retrofits in commercial, industrial, and multi-residential buildings in Quebec. This package encompasses CAD 100 million in CIB loans and CAD 60 million in Fiera loans, with SOFIAC as a founding partner investing CAD 30 million in share capital, along with provincial subsidies of CAD 5.5 million. Retrofits will take place in buildings where the annual energy expenditure is over CAD 1 million, enabling major cost and emissions reductions through efficiency, heat recovery, electrification, and demand management measures, among others (SOFIAC, 2021a).



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Annex 1. Electrifying Canada

Members

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- Mathieu Lévesque – Research Coordinator
- Richard Bridle – Research Support
- Vanessa Farquharson – Communications
- Bill Hamlin – Stakeholder relations

Advisors to the Electrifying Canada task force

- Ita Kettleborough, Energy Transitions Commission
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