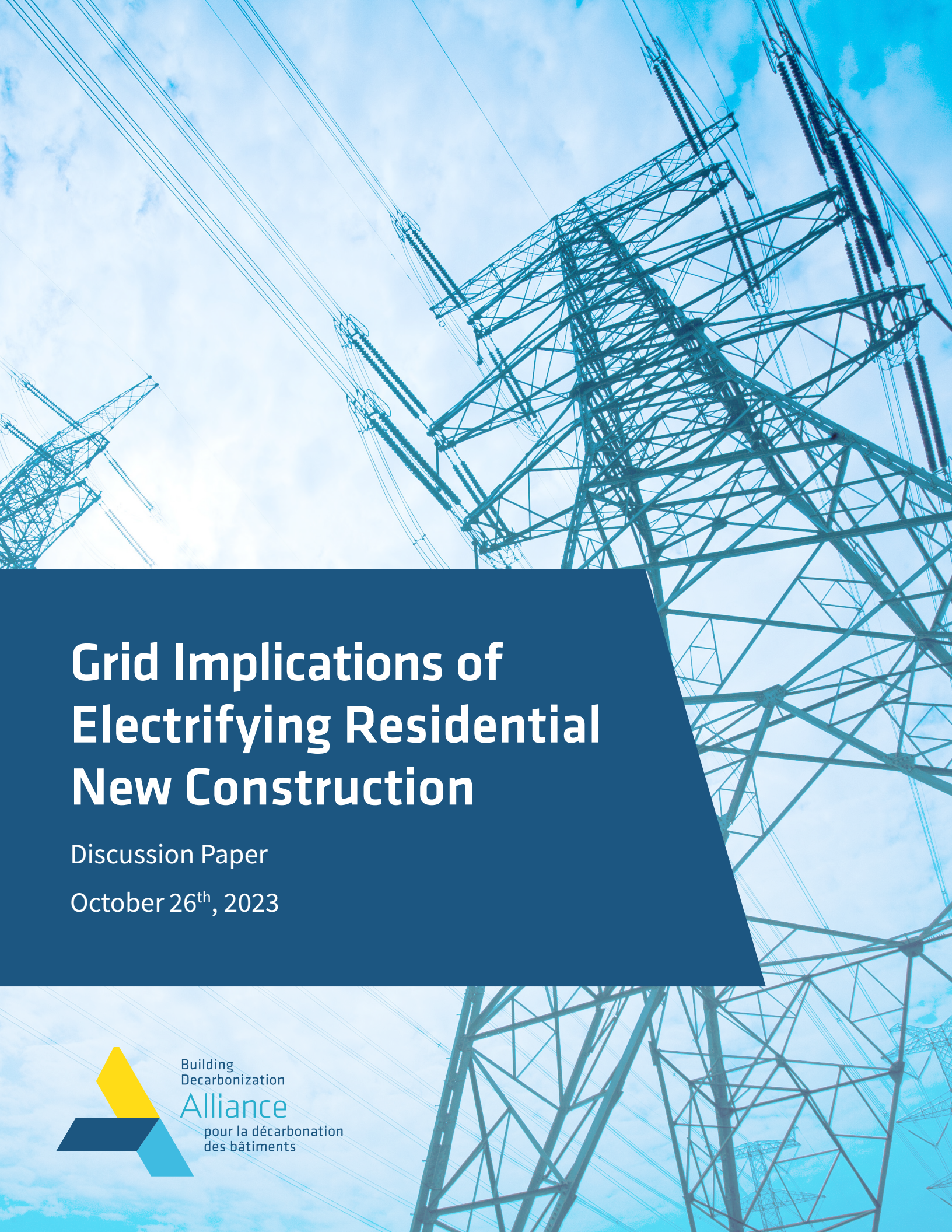

Grid Implications of Electrifying Residential New Construction

Discussion Paper

October 26th, 2023

Building Decarbonization Alliance
pour la décarbonation des bâtiments

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We're Calling for Your Feedback on this Issue!

This discussion paper is intended to present what we know so far about this complex issue based on limited engagement. We are therefore calling on stakeholders in this space to bring forward additional insights, observations, or data to further support or challenge our understanding of this complex issue. Although all are welcome to comment, we would specifically like to hear from:

- Transmission and distribution system planners at Canadian electric utilities
- Regulators and intervenors to regulatory processes
- Government policy makers from all orders
- Residential developers and builders
- Consultants and advisors having worked on this issue.

Interested stakeholders from these organizations can provide thoughts and insights by following this link to an online form that will capture your thoughts in a structured way. We thank you in advance for your participation!

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Executive Summary

The impetus for this short discussion paper was a recent Le Droit article which implied that even today, grid constraints can limit or delay new residential projects (in this specific case, in Gatineau, Quebec).[1] This article raised concerns in the energy information space and among policy makers about the viability of all-electric residential new construction in the near term.

The Building Decarbonization Alliance sought to better understand the issue and undertook a series of interviews with utilities and one of their trade associations. Based on these discussions, we understand that **widespread concerns are not warranted.** Indeed, we have found that:

- Generally, current substation, feeder, and transformer capacity will not limit electrified new construction in the near term.
- There do exist highly localized grid constraints in the transmission and distribution system that could impact new construction planned in these specific locations in the near-term.
- In such areas where grid constraints exist, developers and local government's ability to provide utilities with sufficient lead time will often allow the grid to be ready for the new developments.
- Lead time requirements vary based on the nature of the planning and coordination relationships between stakeholders which facilitates advance notice, the processes for service extensions at the utility, and the nature of the particular grid constraints.
- Generally, the larger the new load, the more lead time is required because such developments push further up the distribution and transmission systems.
- To allow utilities to support broad-scale electrification over the longer term, changes to regulatory rules and approaches to enable the proactive build-out of the grid and modify the existing "beneficiary pays" approach are needed.
- Clear government policies defining outcomes and actions will enable utilities to plan and build with greater certainty.

As a result of these findings, we are of the view that:

1. **We should not delay the pursuit of broadly electrifying new construction simply because doing so will be more challenging in a few areas than in most others.** Electrification is possible and happening today, and we can manage the fact that it is not a homogenous process across Canada.
2. **Governments can enable utilities** and their regulators to better plan and build capacity by enacting policies promoting electrification of new construction (e.g., building codes, building or equipment standards, incentives).

We make a range of observations and recommendations to support this view in the balance of this discussion paper. **We are calling on stakeholders in this space to bring forward additional insights, observations, or data to further support or challenge our understanding of this complex issue.**

[1] Mathieu Bélanger (September 26, 2023). Hydro-Québec pourrait retarder des projets résidentiels à Gatineau en raison d'un manque d'électricité. Accessed here.

Purpose

As noted in our **Case for Building Electrification in Canada** report, building electrification is the most promising way to reduce emissions, accepting that we will need to mitigate potential grid impacts as the grid expands and modernizes to meet the expected increases in electrical demand. This is a complex issue driven by localized conditions which we aim to better understand over the medium- and long-term (5 years and beyond) at the provincial and national scale using our open-source building decarbonization model results in early 2024. In the interim, we continue to explore various aspects of grid impacts of building electrification. This discussion paper summarizes and advances our understanding of grid constraints for near-term (the next 5 years) new construction projects based on qualitative primary research in the form of interviews.

The impetus for this discussion paper was a recent Le Droit article which implied that even today, grid constraints can limit or delay new residential projects (in this specific case, in Gatineau, QC).[2] During the city meeting, Hydro Quebec noted that they have sufficient capacity to provide electricity for all, but that it is important to plan for expansion needs due to ongoing development.[3] When discussing new residential construction, Hydro Quebec noted additional production will be required to accommodate an increase in demand, and that planning for this increase in demand is of critical importance to ensure sufficient capacity.[4] This article raised concerns in the energy information space and among policy makers about the viability of all-electric residential new construction in the near term.

To better understand the likely impacts of near-term limitations, we activated the Building Decarbonization Alliance's Partner network and reached out to electric utilities across the country to gather their feedback on the impact of electrifying new residential construction. We asked about:

- The types of grid limitations which can impact electrifying new construction space and water heating for residential and multi-unit residential buildings (MURBs).
- To what extent these limitations are based on capacity (generation) and/ or supply (transmission and distribution) constraints.
- How widespread such limitations are for the utilities (e.g., grid wide, a few substations, some transformers).
- The approaches currently being pursued to mitigate any such grid limitations.

These initial findings were compiled based on responses from four utilities (collectively delivering electricity to nearly 7 million customers). We also consulted Electricity Canada. Electricity Canada represents the energy companies that generate, transmit, and distribute electrical energy across Canada and we note that this report does not represent an endorsement on their behalf. We will continue to explore these limitations and the accompanying solutions to enable broad scale

[2] Ibid

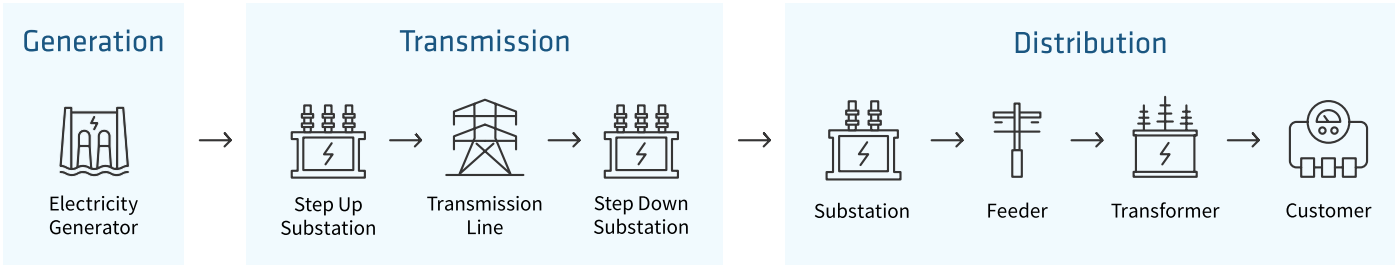
[3] Quant à la capacité, monsieur Bernier mentionne que HQ est actuellement capable de fournir l'électricité à tous, mais qu'il est important de bien planifier les besoins et le développement en fonction de la croissance." Accessed here.

4 "Elle (Madame la conseillère Anik Des Marais) mentionne également discuter régulièrement avec différents promoteurs en ce a trait à l'électrification, se disant surprise de l'incapacité de HQ de fournir en électricité les nouvelles constructions résidentielles. Monsieur Bernier mentionne qu'une production supplémentaire serait requise pour répondre à l'ensemble des demandes et ajoute l'importance de bien planifier les développements afin d'assurer la capacité." Accessed here.

building decarbonization via the Building Decarbonization Alliance's 2024 Grid Impact initiative and ongoing stakeholder engagement activities.

Electricity Delivery 101

There are several steps required to go from generating electricity (e.g., at a power plant) to using the electricity in a customers' home or building. To ensure clarity and understanding among readers of this discussion paper, the steps are summarized in sequence below using the industry-specific terminology. It is important to note that our discussion paper focuses on the distribution network.



Findings

As a result of our findings, we are of the view that promoting the electrification of new construction today can and should be pursued, and that broad and generalized grid constraint concerns for these activities are unfounded based on our research to date. Proceeding with electrified new construction is necessary today to avoid requiring future retrofits to meet zero emissions, to move an important part of the market towards building decarbonization, and to have utilities, regulators, and the development community work through the challenges associated with electrification (i.e., improve planning and visibility, enforce relationships).

Localized grid constraints currently exist, but are the exception and not the rule

Utilities noted that near-term electrification policies will, in limited cases, be difficult to implement due to grid constraints that are very system / area specific (i.e., along the transmission and distribution networks). However, no utility indicated that current generation capacity was a limiting factor. For construction of larger new residential blocks or MURBs, limitations are most likely at the distribution substation and feeder levels, whereas individual homes could be constrained at the transformer level. The degree of constraint faced by individual utilities varied:

- One utility noted many of their feeders are only at 50-60% capacity, which means adding electrified buildings in these areas is not an issue.
- Another noted that only a few feeders and a substation could delay some new construction from electrifying (< 1% of such systems), though they are actively working to increase capacity in these areas facing constraint. As such, over the next 2-3 years, some developments may need to be constructed without fully electrifying.
- And a third noted minimal near-term constraints on their entire distribution network (for a region with historically slower uptake of heat pumps and electric vehicles).

While most utilities noted substation, feeder, and transformers as the limiting factors for electrification, one did note that accumulating sufficient generation in the medium- to long-term would be difficult to meet both increased electrification and the Clean Energy Regulations mandate of a clean grid by 2035. Another interviewee noted that longer-term, generation will become an ever more prevalent limitation unless new generation can be permitted quickly. The Building Decarbonization Alliance acknowledges these challenges but believes that they can be overcome in the longer term with proper planning oversight and regulatory reforms.

Nevertheless, all utilities interviewed are either planning and/or delivering electricity to new electrified residential buildings and communities today, or, are at a minimum, piloting such communities to familiarize themselves with their needs.

To overcome the issue of localized grid constraints, one utility noted that all electric new construction can be achieved without grid expansion by:

1. Having utilities work with developers to site developments in areas where excess capacity exists.
2. Ensuring new buildings are energy efficient, thus lowering electricity demand requirements.

In other cases where the distribution grid is constrained, utilities, builders, and regulators can undertake spatially specific community energy planning to examine community and grid design parameters to assess changes that would enable electrified communities (e.g., grid expansion, micro generation, community geo-thermal).

Time is the main limiting factor to ensuring an adequate grid connection

In cases where a development would like to proceed in a grid constrained area, one utility succinctly stated that:

> *"Electrifying new construction is not a question of physical impossibility, it's a question of time."*

Utilities are constantly upgrading and modernizing their grids but need sufficient lead time to adequately plan for new connections. There is a need to align human capital, materials, and financing to make the required grid updates. The amount of time largely depends on the project's location:

- If there is already sufficient capacity, minimal time is needed, and existing processes are sufficient.
- If a new feeder is required, 2-3 years of lead time should suffice, which is not outside of the regular planning timetables for new developments.
- If there's a new commercial subdivision being created in a major city center, it may require 10 years. However, major developments in these areas are generally known, planned, and zoned well in advance, highlighting the important role of close collaboration between municipalities and the local utility.

To place this into context, one utility noted completing 27,000 connection requests per year, with most not needing much design work and therefore being approved in a week. For the larger, more complex connections, of which there were nearly 5,000 per year, there have been longer wait times, in part due to staffing challenges. The utility has been hiring more designers and creating efficiencies, to help get ahead of these types of requests (especially in high growth areas).

Coordination is key. Some utilities have fostered relationships with the local developer community and/or local governments to have a better understanding of upcoming projects. While this approach was more heavily pronounced with local utilities (as opposed to provincial ones covering a large geographic area), the general view is that coordination activities will continue to increase to better understand local grid requirements. There are also opportunities for utilities to solicit connection information earlier in the development process, as it is not uncommon for utilities to be alerted late in the design process. Better dialogue between builders and developers and the utility, along with education about the utilities' grid extension timelines and processes could go a long way toward fostering better planning and making the extension process more efficient.

One utility noted a benefit to working directly with larger projects' electrical consulting engineer(s). Today, engineers typically assume which feeders have sufficient capacity and where the best service entrance would be (i.e., assuming which feeder will be used). Once the utility is engaged further in the process, they may note that this assumption was wrong, which leads to needing to change the design and build, which introduces delays. Instead, the utility can provide the appropriate feeder location and capacity information earlier in the design process. Depending on the project size, this can be done years before construction.

The existing regulatory construct limits utilities' ability to plan ahead

Regulators, whose mandate is to encourage affordable energy prices, generally aim to restrict anticipatory expansion of the distribution system. As such, utilities are limited in terms of the types and timing of investments that can be made. While there is a general misconception that grid capacity is built prior to demand existing, regulators more broadly aim to have grids function with as little spare capacity downstream at the feeder level as is reasonably prudent from a reliability perspective to avoid carrying unnecessary costs and their associated rate implications. In this context, understanding when and where new demand will be located is ever more pressing (e.g., which substations, feeders, and transformers will need additional capacity) to allow for these new requirements to form part of forward planning estimates and budget implications in their regulatory submissions.

Nevertheless, utilities are working within existing regulatory constructs to actively plan for and build new infrastructure (e.g., one utility noted building 35 additional feeders in the past five years). The current focus is on grid hot spots, which could either be considered communities that are already grid constrained but where a lot of future growth is unlikely (i.e., focus on demand-side energy efficiency), or communities that are grid constrained and that expect future growth (i.e., focus on supply-side grid expansion). One utility noted having eight or nine such communities and constrained substations. Utilities are mapping out longer-term forecasts for spatially specific demand, but these approaches remain at the early stage of development and deployment.

Government policies at municipal, provincial, and federal levels that drive electrification would benefit distribution utilities by increasing certainty on the anticipated demand growth from electrification. Once policies are in place, utilities can employ them in their regulatory submissions as evidence for the need to build up the electricity system to meet higher demand. Without such policies, a utility noted a belief that their requests for additional capacity would be rejected by the regulator. For widespread electrification, sufficient time will be needed between the policy's enactment and its implementation to allow for utilities and regulators to modify their operations to accommodate increased demand. This dynamic is already in evidence: policies like BC's Zero Carbon Step Code, where 13 local governments have already adopted the top two steps disallowing fossil fuels for primary heating, have raised the level of discussion between utilities, local governments, and leading developers to improve the utilities readiness for new construction.

Changes to permitting and updates to regulatory guidance are needed now; otherwise targets as far as 2035 may be out of reach.[5] For example, utilities require that developers pay a fee to cover the cost of a new connection to the grid for new construction, but these fees are typically unpredictable to the developer, as they are project- specific based on the local grid characteristics. In some cases, the fees can be quite high, hampering development. The key factors in determining the scale of cost are the grid upgrade required and the utility's regulatorily approved methodology to split costs between the utility and the customer. To provide greater predictability on these costs, multiple utilities are exploring updates to their customer connection policies to improve the fairness of distributing the costs of connection amongst new customers.

Electrification policies accelerate decarbonization, but implementation requires nuance

While previous sections focused on summarizing feedback received from utilities, this section presents our recommendations.

There are several factors driving an increase in grid capacity needs: new construction, densification, and electrification (of buildings, industry, and vehicles), among others, all add to the needs, while energy efficiency and demand-side management initiatives (e.g., load shifting, peak shaving) lower them. Each of these factors can vary at the regional, provincial, municipal, and even transformer levels. In fact, not all building electrification will result in greater load—modern design of an all-electric building will reduce the load relative to electric resistance heating wherever it is prevalent.

The most cost-effective way to have a decarbonized building stock by 2050 is to ensure that new buildings are built to zero-emissions standards today (i.e., an energy efficient building relying on clean energy for heating). Additional **policies and programs supporting the electrification of new construction are needed** to avoid future retrofits to meet decarbonization goals and to limit the future cost of stranded assets in the form of natural gas networks expansions that should have been avoided in the first instance. As we heard from the utilities in this discussion paper, most areas across the country can move ahead with fully electrified buildings in new construction today. However, as the Canadian landscape is diverse, any such **initiatives should be designed to address**

[5] While not the primary focus of this memo, additional information on regulatory reform opportunities can be found in Electricity Canada's recent publications:
- Back to Bonbright: Economic Regulation Fundamentals Can Enable Net Zero. Accessed **here**.
- Build Things Faster, 2023. Accessed **here**.

localized constraints by removing barriers and streamlining or accelerating processes.

Regardless of government mandates and policies, utilities should continue being proactive in expanding and modernizing their grids, for example by:

- Proactively seeking information from municipalities, large building owners, and developers about their sustainability plans for the next decade,
- Modeling at a granular level the impacts of various electrification scenarios and developing corresponding risk management and mitigation plans,
- Understanding and reflecting local municipal government decarbonization policies and plans in scenario modeling and rate case submission, as these considerations can impact regulator decision-making.[6]
- Undertaking analysis to understand the grid impact of building electrification and exploring options for managing peak, and
- Being proactive in their rate case submissions to their regulator by putting together a compelling case that seeks rates that allow them to expand and modernize the grid.

Ensuring that new construction is electrified today represents a tremendous opportunity to further develop the market at a pace and scale that is manageable, and in greenfield conditions that allow for the latest design and construction practices to demonstrate the benefits of zero-emitting homes. Encouraging low-emitting new construction today will pave the way for the sector tackle the more daunting challenge of decarbonizing existing buildings tomorrow. Ultimately, continuing to delay the decarbonization of new construction will set the building sector behind its decarbonization targets, making 2050 targets harder and more expensive to achieve. The prospect of some limited and localized grid challenges should not deter action in the near term. Moving ahead with the objective of electrifying all new buildings, recognizing that a few may encounter obstacles, will benefit the environment. Finding practical coordination solutions and considering regulatory updates to overcome issues where they are encountered should be viewed as an opportunity to pave the way for further electrification activities.

[6] Canadian Climate Institute (2023). St. Laurent North denied. Accessed **here**.

Join Us!

The Building Decarbonization Alliance, is a non-partisan and cross-sector coalition working to change the narrative on building heat, inspire and inform industry and government leadership, and accelerate market transformation. We reach beyond rhetoric to engage with evidence and science, helping put in place the conditions for effective policy, change the narrative, and increase awareness of the benefits of decarbonized all-electric buildings.

In this, our inaugural year, we've already convened over 145 Partner organizations. And we're just getting started - as we move into 2024, we're working hard to expand the reach of our Alliance and proposing an exciting slate of research and initiatives to advance our mission and vision.

If you are interested in supporting our work, visit **www.buildingdecarbonization.ca** or reach out to us at **info@buildingdecarbonization.ca** to find out how you can help accelerate building electrification.