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Quebec’s renewable electricity: wealth creation through eco-responsible leveraging

Short Report

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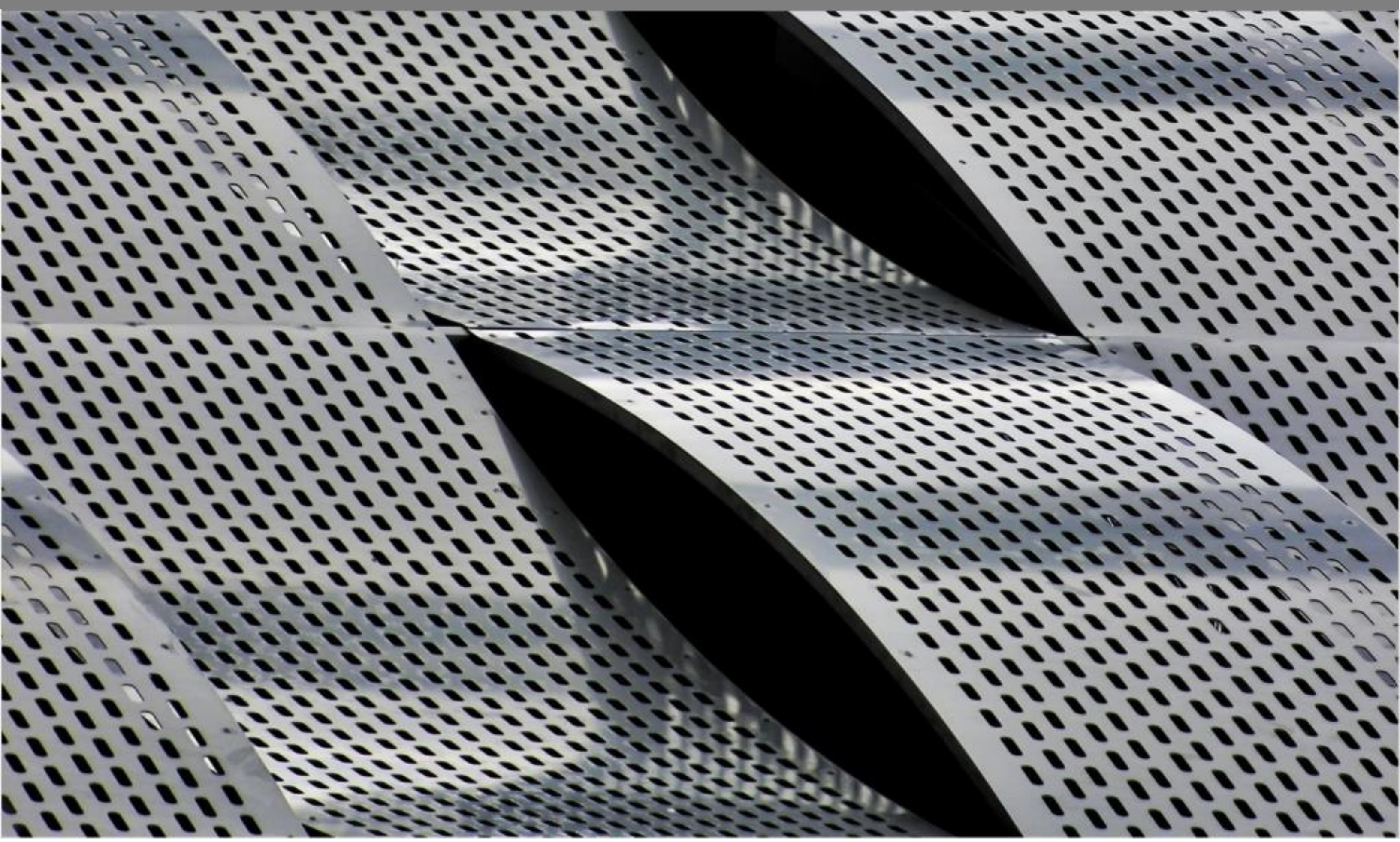

With the financial support from Aluminium Association of Canada

Carried out by Institut du Québec

About

Aluminium Association of Canada

The Aluminium Association of Canada (AAC) is a non-profit organization whose mission is to represent the Canadian primary aluminium industry to the public, users, public authorities, as well as with key economic and environmental stakeholders. The AAC brings together the three Canadian primary aluminium producers: Alcoa, Aluminerie Alouette and Rio Tinto Aluminium.

The Canadian aluminium industry is the fifth largest in the world with an annual production of more than 3 million tons of primary aluminium. Quebec facilities support more than 7,500 of the best-paying jobs in the manufacturing industry. Around this industry gravitate more than 2,500 suppliers of goods and services and 1,400 processors who in turn contribute to the economic dynamism of Canada and its regions. The aluminium industry alone represents approximately 10% of Quebec manufacturing exports.

L'Institut du Québec

L'Institut du Québec is a non-profit organization that focuses its research and studies on the socioeconomic issues facing Quebec. It aims to provide public authorities and the private sector with the necessary tools to make informed decisions, and thus contribute to building a more dynamic, competitive and prosperous society.

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Report background

The world energy context will change markedly in the years to come, both because of the structural transformations of economies, reinforced by the COVID-19 pandemic, and because of the greenhouse gas reduction targets to which most countries committed in their efforts to counter global warming.

Quebec is no exception to these major trends. Its electricity sector will be faced with significant challenges in particular because this source of energy is at the crossroads of its two major collective priorities: the fight against climate change and wealth creation.

These major trends mean that Hydro-Québec, in its forecasts, now estimates that current resources will not be sufficient to meet needs, that the additional capacity needed to meet this demand will impart higher costs and that, in this context, it warns companies wishing to have access to large blocks of energy that it will not necessarily meet their needs and thus will develop guidelines to prioritize the most promising projects. In this vein, Hydro-Québec has launched a call for dialogue, emphasizing that the issue of the use of electricity goes beyond the State corporation and requires a broad debate.

By inserting itself into this call for discussion, the Institut du Québec (IDQ) does not seek to privilege options over others, aware of the fact that the optimal use of this precious resource must be based on diversity and balance. On the other hand, **we aim at providing a framework and tools to ensure that choices that will be made are based on fundamentals promoting Quebec's economic wealth and the decarbonization of its environment**.

Against this background, the IDQ worked at crafting a framework defining the objectives sought in optimizing energy resources, while proposing guidelines and a set of tools for decision making in allocating large blocks of electricity. Five principles should guide and frame the decision-making process surrounding these allocations:

1. Ensure genuine public debate,
2. Maximize the benefits for Quebec as a whole,
3. Reconcile economy and environment,
4. Seek balance through a portfolio approach,
5. Evidence based decision-making.

The Aluminium Association of Canada (AAC) approached the IDQ to produce such an analysis and financially supported a large part of the process. The IDQ, an independent research centre, accepted this support by offering to analyze energy issues in a global way and above all, to approach them from a public policy perspective. It is important that the choices that are or will be made by Quebec regarding the use of its electricity are based on a matrix reconciling the objectives of economic development and the fight against climate change.

The analysis[1] presented in this document is based on various sources of public information as well as the reports of three studies commissioned by the AAC[2],: **Pascal Cormier**, Economist in energy (PCEE), *Analysis report on the post-2021 energy context in Quebec*; **Energyzt**, *Hydro-Quebec's*

[1] All sources and references are available in the long version of the report on the website of the Institut du Québec and the Aluminium Association of Canada.
[2] These studies are public and are available and available on the Association's website

Projected Demand and Supply; **Aviseo**, *Comparative analysis of the economic impact of Quebec aluminium smelters*.

The nature and scope of the energy issue in Quebec

First, this report seeks to paint a portrait of the evolution of the electricity market, in the medium term, on the 2030 horizon, and in the long term, on the 2045 horizon. This effort is aimed at better understanding the nature and scope of the issue associated with the future use of electricity in Quebec. In short, it aims to measure the expected degree of pressure on resources and to assess whether Quebec risks finding itself in a situation of electricity shortage, tightening between supply and demand, or whether, on the contrary, electricity resources can easily meet demand.

Hydro-Québec Distribution (HQD) establishes its electricity supply strategies on the basis of a ten-year plan published every three years and filed with the Régie de l'énergie. This plan is subject to annual monitoring. The government corporation's latest demand projections come from its 2020-2029 Supply Plan, published in 2019, and the last revision dates from 2021. These demand forecasts relate to domestic consumption. Exports and trading with neighbouring networks are the responsibility of Hydro-Québec Production (HQP), and must be added to the demand in Quebec to establish the total electricity needs.

In its last revision of 2021, HQD predicts greater demand growth in the next decade than in the last. In addition, we note that for a forecast growth in demand of 20 TWh over the period 2020-2029, only 6.9 TWh is attributable to baseload growth, and that consequently 13.1 TWh, almost two-thirds, are based on less established or less known sectors, whose evolution is more difficult to predict (such as the progress of greenhouse cultivation, the attractiveness of Quebec for data centres, the potential of the hydrogen market, or even on the success of achieving various policy objectives, such as the conversion to dual energy or the rate of adoption of electric vehicles).

The forecasts for the 2020-29 horizon are therefore subject to great uncertainty, probably greater than in the past, due to the scenarios that are envisaged in terms of the energy transition. For example, the firm specializing in energy PCEE considers that some of the elements of HQD's 2020-2029 forecasts are questionable and thus proposes a more moderate growth in demand. On the other hand, Hydro-Québec is seeting an exceptional enthusiasm for clean energy in Quebec and points out that it has received an astonishing number of requests for connection to the network relating to large-scale industrial facilities. This potential demand does not currently appear in the 2020-2029 demand forecasts. Decarbonization is a fundamental trend and will fuel the demand for electricity in Quebec, as well as industrial projects consuming electricity from Quebec. But the number of projects that will eventually be realized and the speed at which decarbonization will occur remain big unknowns.

Added to this uncertainty is a rupture caused by Hydro-Québec itself, namely the strategy of replacing Quebec electricity exports on short-term markets by negotiating firm long-term contracts with the State of Massachusetts and New York City. These major contracts, which represent a commitment of nearly 30 TWh per year (taking into account the obligation to maintain certain previous sales volumes in the case of the contract with Massachusetts) and which will begin in

2024 and 2025, will have a major impact on the allocation of electricity resources for the next few years.

HQD's latest forecasts, the tabling of Hydro-Québec's (HQ) latest strategic plan and the new electricity export strategy have simultaneously switched HQ's public positioning, the most notable elements of which are the following: the costs for the supply of additional electricity will be high, i.e. 11 cents/kWh, the presence of a gap between the price charged to users and the cost of production of this electricity, the significant gap between the revenues obtained by sales to businesses and export revenues, the rapid arrival of the time when energy resources will not be sufficient to meet needs, i.e. from 2027, and the possibility that Hydro-Québec will not be able to meet all requests for large electricity blocks, i.e. those of 50 MW or more. However, this document brings nuances to some of these assertions. Hydro-Québec always plans a certain level of surplus to respond to exceptional situations. It should be noted, however, that it is the scale of the latter that is important.

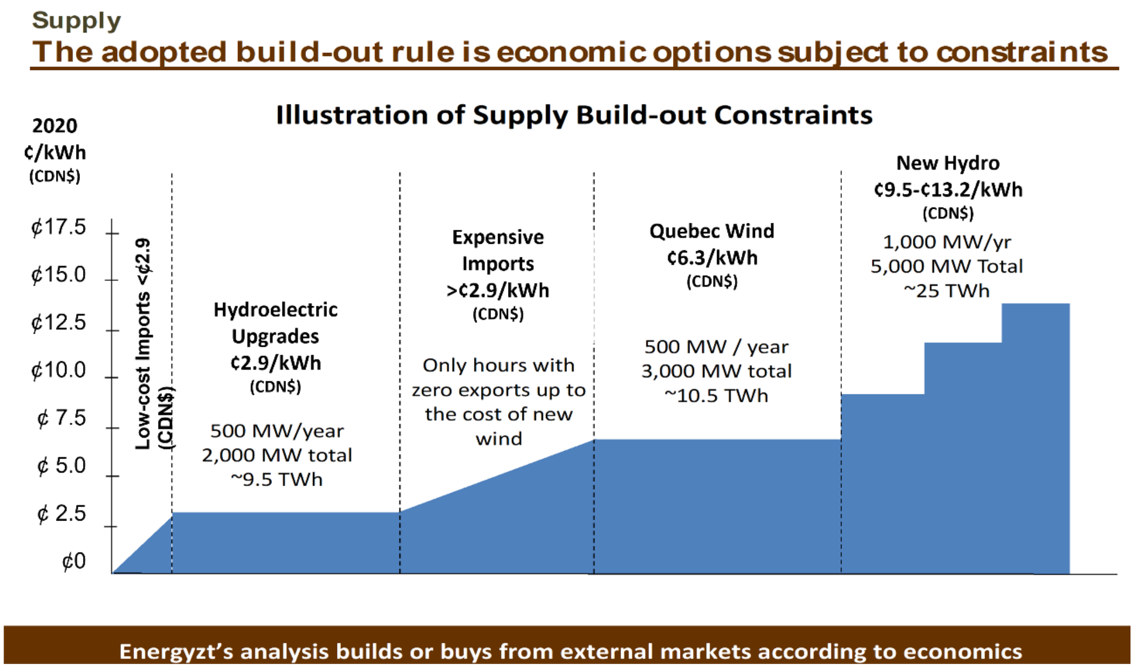
Moreover, it is essential, in a framework of optimal resource planning, to be able to count on projections that go beyond a medium-term horizon, in this case, 2020-2029, because the implementation of resources to meet future needs requires long lead times, especially if the pressure is such that new hydroelectric plants must be used. This is also the case for the strategic planning of many industries, especially those that require significant capitalization – such as aluminium, steel or hydrogen – or even for decarbonization policies that will be spread over a long period, in particular Quebec's objective of carbon neutrality in 2050. Decisions made in the years to come must be able to take into account the implications and consequences on a more distant horizon.

Since forecast deviations are already significant in this area over cycles of four or five years, it will be understood that the degree of uncertainty in long-term forecasts will therefore be even greater. Especially since to the classic unknowns – such as the evolution of the economy, changes in behaviour, and technological progress – are added the possibility of a more radical rupture brought about by decarbonization and the efforts to achieve the carbon neutrality targets and objectives to which the governments of Canada and Quebec have committed.

Several demand growth scenarios over the period 2022-2050 are presented in this report, ranging from an increase in electricity needs over this period of 25 TWh to 125 TWh. What will be the actual growth over this period? We have no answers to this question, but this report is based on the assumption that the energy transition will be strong, that societies like those in Canada or Quebec will have to step up the pace, in particular due to a global context in full transformation. It is impossible to know if Quebec will succeed in achieving carbon neutrality or if it will succeed in achieving it when expected, i.e. in 2050. However, the scenario assuming that Quebec will multiply the interventions to move towards this objective, without being a certainty, is possible and plausible, and therefore, as a precautionary principle, must be taken into account. Due to climate issues, we believe that there will therefore be a break caused by an acceleration of the decarbonization process, the consequences of which will be marked on the demand for electricity.

Electricity supply forecasts are easier to make. The mechanics of supply consist in providing for the gradual addition of resources, either through investments in production or through purchases, to meet additional needs. This is a process where investment plans are regularly readjusted based on the reassessment of demand. Several additional sources of supply are already identified and known in Quebec and the winning strategy will be to put them into service when they are needed, and to schedule them according to their costs, their technical characteristics or the time between design and commissioning.

The work of the firm Energyzt consulted for this report cites the following sources, in order, to meet the additional demand: low-cost imports (less than 2.6¢/kWh), refitting of power plants (nearly 2.6¢/kWh), less expensive imports than wind power (between 2.6¢ and 6.5¢/kWh), the increase in the wind farm (6.5¢/kWh) and finally, new hydroelectric plants (9.5¢/kWh to 13.5¢/kWh). The current potential for additional supply, excluding energy efficiency measures and before having to build new hydroelectric works, would vary between 25 and 30 TWh.



With regard to the nature and scope of Quebec's energy issue, the following observations can be made:

- **Quebec will not be faced with electricity shortages, but that a tighter balance will be observed over the 2026-2027 horizon**, should the entry into force of firm electricity export contracts to Massachusetts and New York City.

- **Over a longer horizon, starting in 2035, decarbonization efforts will put significant pressure on electricity demand**. If the pace and speed of this evolution remain a great unknown, **this underlying trend calls for preparation and planning of the various potential options for additional sources of electricity supply**.

- **Quebec will not be faced with an explosion in the price of its electricity, but upward pressure will be observed, particularly as of the 2030-35 horizon**. New, more expensive electricity supplies will remain at the margins for the next few years. **In addition, Quebec can count on several new sources of supply at 6.5¢/kWh or less. Future years' add-on prices will not be 11¢/kWh**. This price describes the cost paid for post-legacy projects, especially wind and small power projects, under contracts signed since the turn of the century when market conditions were not the same, and often for expensive projects, because they were supported by the government to promote regional development. However, in the longer term, once the decarbonization process is well underway, more expensive supplies may be required.

- **The new firm export agreements reduce the amount of energy that can be considered surplus from about 40 TWh to about 10 TWh**. This decline in available surpluses significantly reduces Hydro-Québec’s agility and flexibility to adjust to demand and meet domestic needs. **This new form of use of surpluses is the main factor explaining the shortage of resources in 2027**. Quebec does not lack electricity, but a large part of this electricity has been allocated elsewhere.

- **Quebec will nevertheless be faced with a tight enough situation to justify prudence and discernment in the allocation of electricity blocks**. The attractiveness of Quebec’s green energy and the fundamental trend towards decarbonization require us to make the most of our available resources by prioritizing the allocations that generate the most benefits in terms of wealth creation in Quebec and in terms of the reduction of greenhouse gases.

A framework for assessing the most promising uses for economic development

In a context of tightening between supply and demand for clean energy and electrical power, which forces choices to be made when deciding on the allocation of large blocks of electricity, one of the important criteria for determining the optimal allocation of available resources must be their economic impact. The situation requires more clarity in the decision-making process and more rigour, and transparency, in particular to compare the different uses and determine the ones that will have the greatest impact, to ensure that the development potential of the electrical resource is maximized.

The economic impact can be measured in various ways. Traditionally, in Quebec, job creation has been the main objective of development policies. This criterion, which was explained by the need to reduce high unemployment rates, has however lost its relevance in a period characterized by full employment, labor shortages and the acceleration of the digital shift (automation, robotization, artificial intelligence). In this report, we instead propose two approaches based on criteria that are more appropriate to changes in the economic context.e for evaluating the most promising uses for economic development.

The first approach focuses on what is usually described as economic benefits, or wealth creation. This measure can be expressed in terms of added value generated in Quebec per kilowatthour of electricity allocated to various industries or activities. To do this, we can use a dynamic model of the Quebec economy or a static model. In order to illustrate how such an approach makes it possible to compare the impact of various uses of electricity, the results of a recent report by the firm Aviseo are presented. A dynamic model of the Quebec economy was used in this case.

The second approach broadens the concept of wealth creation and attempts to assess how the development of various electricity-using sectors can help strengthen the Quebec economy and improve its growth potential in the future. This approach focuses on the various factors that make it possible to support a gradual increase in the standard of living of Quebec citizens while contributing to a reduction of the gaps with other jurisdictions, such as Ontario. This multi-criteria approach seeks to integrate the structuring effects of resource allocations and calls on broader and sometimes more intangible considerations, in particular the strategic nature of certain industries.

The analysis focuses on five specific business areas: aluminium production, greenhouse production, data centres, green hydrogen production and electricity exports. The choice of these areas of activity is based on two considerations. First, these are sectors that consume a lot of electricity, each of which can have significant repercussions on the supply-demand balance for electrical energy in Quebec. Next, these areas of activity have all been the subject of specific orientations from the Quebec government, which has identified them as growth vectors and has dedicated plans or strategies to them and which they thus constitute, for Hydro-Québec , expanding sectors. All of these areas of activity include or may include projects of more than 50 MW that require specific decisions from government authorities and/or Hydro-Québec

However, because electricity rates and distribution costs vary from one sector to another, the various uses of electricity will have different impacts on Hydro-Québec's financial results, and ultimately on dividends paid to its sole shareholder, the Quebec government. These impacts must also be taken into account in the decision-making process.

The results of the first approach, excluding the impact of electricity production, are presented in the following table. This comparison only covers activities/projects that require large blocks of energy (more than 50 MW). Levels and scheduling may differ for smaller, less energy-intensive projects.

Table 1

Impact on Quebec's GDP of the same electricity allocation to various consumption sectors

Added value in ¢ per kWh for only large blocks of electrical energy

	Impact sur le PIB du Québec (excluant la production d'électricité) 2019
Aluminerie	8,96 ¢/kWh
Serres	5,50 à 6,50 ¢/kWh
Centres de données	3,88 à 5,00 ¢/kWh
Hydrogène vert	5,38 ¢/kWh
Exportations	0,34 ¢/kWh

Source : Étude Aviseo à partir d'un modèle d'équilibre général. À noter que les impacts sur le PIB pour les gros projets de serres ou de centres de données, qui exigent/exigeraient des niveaux importants de MW, se situent dans le bas de la fourchette présentée dans l'étude.

It is important to mention that these results are based on the information available and should be considered indicative and subject to improvement. The modelling of certain sectors requires making a greater number of assumptions and involves more uncertainties. This is the case for hydrogen in particular, an emerging sector where technologies and cost structures will continue to evolve. The impact could be higher or lower depending on the characteristics of the projects envisaged and the ability to develop a chain of Quebec suppliers of goods and equipment.

The impacts presented previously excluded the net revenues from the sale of electricity to the various uses considered. However, selling prices and ultimately the profitability of these sales may vary from one sector to another, and in some cases even from one year to another. The following table presents the 2021 tariffs/prices concerned for the areas analyzed and for the allocation of large blocks of electrical energy.

Table 2

Price or class of prices for electricity sold to various consumer sectors

In ¢ per kWh for only large blocks of electrical energy

	Prix ou classe de tarif de l'électricité vendu 2021
Aluminerie *(~25,0 TWh)*	5,3 ¢/kWh (varie selon les années[1])
Serres *(~2,0 TWh)*	~ 3,3 à 5,6 ¢/kWh (varie selon les projets et rabais[2])
Centres de données *(~4,0 TWh)*	~4,0 à 5,6 ¢/kWh (varie selon les projets et rabais[3])
Hydrogène vert *(inconnu)*	~3,3 à 5,6 ¢/kWh (varie selon les projets et rabais[4])
Exportations *(~35,0 TWh)*	4,1 ¢/kWh (varie selon les années et les contrat fermes affichent des prix plus élevés[5])

1. *AAC : Le prix moyen payé par l'ensemble des alumineries en 2021. Le prix fluctue selon les alumineries et en fonction du prix de l'aluminium*
2. *Le prix varie selon la grille de tarif applicable au projet et des tarifs spéciaux sont également disponibles. Selon des annonces récentes, les projets les plus importants auraient par exemple accès à un prix de 5,59 ₵/kWh duquel serait soustrait un rabais pour une période de temps de 40 % sur la facture d'électricité consenti par le gouvernement du Québec*
3. *Le prix varie selon la grille de tarif applicable au projet et des tarifs spéciaux sont également disponibles. Le tarif spécial de développement économique est régulièrement avancé pour les plus gros projets (~4,04 ₵/ kWh) par des organismes comme Montréal International pour attirer des centres de données dans « Le Grand Montréal »*
4. *On peut anticiper que le prix pour ce type de projet variera aussi selon la grille de tarif applicable (essentiellement le tarif L étant donné les niveaux de puissance nécessaires) et que des tarifs spéciaux pourraient être envisagés. Selon certaines annonces, un tarif spécial a par exemple été accordé récemment pour le projet de production d'hydrogène vert d'Air Liquide à 3,28 ₵/kWh.*
5. *HQ : prix des exportations nettes. Il s'agit principalement de vente sur le marché Spot puisque les grands contrats fermes avec le Massachussetts ou la ville de New York sont à venir. Le prix payé pour la première année en $ 2021 pour le contrat du Massachussetts s'établit à près de 8,5 ¢/kWh. Pour le contrat de New York, la portion versée hors transport n'est pas connue.*

It should be noted that the price received for electricity exported in 2021 reflects the state of the short-term market. Firm sales contracts will generate higher prices. While the information for the contract to New York City is not known, the contract to Massachusetts indicates a price of around 8.5 cents per kWh, which is double the price of net exports in 2021. Analysis should be based on the net revenues generated at Hydro-Québec for each of these uses (selling price minus transmission, distribution and other costs specific to each of these uses). As this information is not publicly available, the table should be considered illustrative of the portion related to the impacts of electricity generation. Here too, it would be possible to ensure that the relevant key data is available and taken into consideration by public decision makers in their analysis of the economic impact of an allocation of a specific large block of energy.

The second approach proposed, that of multi-criteria analysis, is based on an analysis grid focused on the wealth creation and the raising of the standard of living. This approach proposed by the IDQ introduces an additional dynamic element seeking to identify the positive elements that will strengthen the growth potential in the future. Thirteen criteria were selected to assess the structuring effect of a sector on the Quebec economy. Most are linked, directly or indirectly, to the determinants of productivity and wealth creation.

The following table schematically presents the application of this grid to the four industrial sectors analyzed.

Table 3

Multi-criteria analysis of different sectors analyzed

	Alumineries	Centres de données	Hydrogène	Serriculture
Critères génériques				
Poids économique	●	◔	n.a.	◔
Développement et croissance	◕	◕	◕ ?	◑
Résilience et capacité compétitive	◕	◑	◑ ?	◑
Critères liés au niveau de vie				
Contribution aux exportations	●	◔	◔	◔
Potentiel d'innovation	◑	◔	◕	◔
Potentiel d'investissement	◕	◑	◕ ?	◑
Composition de la main d'œuvre	◕	◑	◑	◔
Niveau d'éducation	◑	◑	◑	◔
Effets structurants	◕	◔	◑ ?	◑
Critères contextuels				
Politiques d'aide de l'État	◕	◑	◕	◕
Inclusion	◕	◔	◑	◑
Durabilité	◕	◑	◕	◑

With regard to the evaluation of the most promising uses for economic development, the following conclusions can be drawn:

- **When electricity is used to support economic activities in Quebec, the economic benefits are significantly greater.** In a process of identifying the most promising uses of the blocks of electricity available to support economic development, Quebec must therefore favour the sectors that use this energy on Quebec territory and that generate added value in Quebec itself. **However, the contribution can vary significantly from one sector to another and from one project to another. The nature of the activities carried out in Quebec and the sector's contribution to a dynamic economic ecosystem explain these differences.** For a rigorous evaluation, it is therefore important to obtain from applicants for large blocks of electricity all the information necessary for informed decision-making and to take into account the elements that bring added value in the evaluation of promising projects for the allocation of large blocks of electricity.

- **The same reasoning makes it possible to underline that exports, on the other hand, do not constitute a good lever for wealth creation**. They must, of course, have a place in a portfolio of uses of electricity because they make it possible to contribute to achieving other objectives, such as the management of surpluses, the decarbonization of the American Northeast, and the profitability of state company.

- **An application of a multi-criteria grid to the five high electricity user sectors highlights the fact that the most promising uses of electricity are those which have structuring effects going beyond strictly direct economic activity permitted by the use of this energy**. For example, the production of green hydrogen could support technology transfer and innovation, while, conversely, data centres seem to have little impact on the development of the ecosystem. information technologies. The greatest economic impacts will be obtained by choosing sectors that can have a leverage effect.

A framework for assessing the most promising uses for decarbonization

Renewable electricity will play a central role in the decarbonization of societies, in Quebec as elsewhere, because it is this form of energy which, in most situations, will be the most appropriate and the most economical to replace fossil fuels, greenhouse gas emitters. This is an important consideration that must be integrated into the analysis of the optimal allocation of large blocks of electricity in Quebec. The evaluation of the most promising uses for decarbonization, here or elsewhere, must be part of the decision criteria.

As electricity is at the heart of GHG reduction policies in Quebec, uses for economic development purposes will be in “competition” with fossil fuel substitution policies. For this reason, this report has added to the five high electricity-consuming economic sectors two areas that are not industries, but sectors of high demand. These are the electrification of transport and the conversion of building heating. Furthermore, it should also be noted that the two dimensions are not necessarily in opposition and that there are uses that are beneficial both economically and in terms of decarbonization.

This decarbonization impact can be measured in various ways. In this report, we propose two complementary approaches. The first approach consists of evaluating the reduction of GHGs per MWh. There are already reduction measures in % or in $/ton of reduction, but in this reflection we can focus on the reduction of GHGs according to the electricity consumed. This angle is more appropriate if one has to take into account the choices to be made in the allocation of electricity.

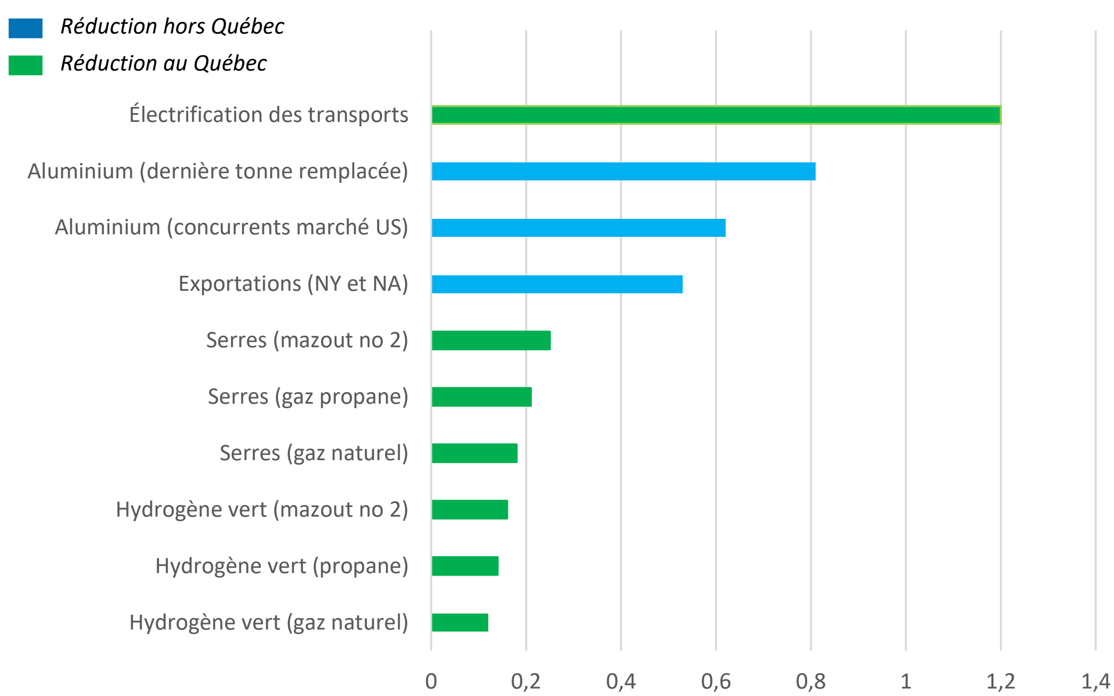
The second approach extends the concept of reduction per MWh to take into account the additional added value in terms of decarbonization impacts. It goes beyond the effect linked to the substitution of fossil energy for clean electrical energy, in order to take into account the additional impact of the user of electricity on the decarbonization plan.

For both approaches, this report partially illustrates how these frameworks and tools could be used. Unlike the economic component, this type of evaluation is more difficult to perform and the measurement tools need to be refined. For example, how do you compare reduced GHGs here or in the US without a recognized accounting method? In the case of aluminium, which country to compare to: look at the last ton moved, the mix of competitors in the US market? In the case of hydrogen, compare only the carbon of electricity or also the carbon emitted by the processes? In the case of exports to the US, look at the average carbon content of the generation fleet, or only the more intense sources of supply that will be moved first? The available statistics should therefore be interpreted with caution.

The following diagram presents the first approach, which relates solely to the carbon substitution of the electricity used. For example, in the case of hydrogen, this diagram does not measure the potential reduction of carbon emitted by the processes. On the other hand, it makes it possible to distinguish between the reductions in Quebec and those which will be outside Quebec.

Chart 2

Ton of CO_2 displaced per MWh used



This first approach is already indicative, but it remains incomplete insofar as it does not represent the overall decarbonization effect. Since Quebec electricity is zero carbon, most foreign investments in Quebec can therefore show a reduction in GHGs compared to their country of origin. Similarly, most Quebec exports also displace products with higher carbon content. The scope may vary depending on the carbon intensity of the territory where the competitors are located. To differentiate these generic contributions, it may be desirable to take into account the additional added value in terms of decarbonization.

This report has not been able to focus on this additional dimension. On the other hand, it will clearly differ from one sector to another and some areas will have more substantial effects than others. The following table provides examples to consider for the five major sectors analyzed.

Table 4

Domaine d'activité	Exemples de valeur ajoutée additionnelle en matière de décarbonation
Alumineries	Effet de la légèreté et de la recyclabilité de l'aluminium
Serriculture	Diminution du transport des produits importés
Centres de données	Diminution de l'énergie nécessaire au refroidissement des équipements
Hydrogène	Contribution essentielle là où l'électrification est impossible
Exportations d'électricité	Fonction de réservoir et stabilité d'intégration d'énergies renouvelables intermittentes

With regard to the evaluation of the most promising uses for decarbonization, the following observations can be made:

- **Quebec must pay particular attention to the measures of its decarbonization efforts, particularly with regard to the use of electricity, to distinguish the two forms of impact: the reduction of GHGs outside Quebec's borders**, as is the case for electricity or aluminium exports**, and the reduction of the GHG inventory in Quebec itself**, as for the electrification of transportation, the production of green hydrogen or the increased use of dual energy.

- **In most of the sectors analysed, there is a convergence between the imperatives of decarbonization and the objectives of wealth creation:** a competitive advantage for green aluminium, as well as the development of a sector with green hydrogen and the increased food self-sufficiency thanks to greenhouses.

- **It is desirable to favour uses which, in addition to the gain provided by its carbon sobriety, can have a leverage effect bringing an additional impact to the decarbonization process**. This is the case of the contribution of electricity exports to the creation of a network with the American Northeast, or of aluminium because of the role of the metal in decarbonization, of green hydrogen which will support the industrial conversion, transportation electrification that generates an ecosystem of innovation that will amplify the progress of decarbonization. In the case of aluminium, the introduction of disruptive technologies such as ELYSIS™ can also add benefits to the local reduction of GHG emissions.

Ensuring the transparency of the debate

The issues relating to the role of electricity in the decades to come go beyond Hydro-Québec itself, as the Crown corporation has recognized, and concern Quebec society as a whole. This vast debate affects many aspects of our collective life, economic development, climate change, way of life, political choices. For it to be successful, it must be based on well-established facts and it must also be that stakeholders agree on the parameters on which this broad conversation should focus, in particular on the costs of electricity sources, the costs of production and distribution and the profitability of the various uses and the criteria for allocating blocks of energy.