ECONOMIC ANALYSIS OF DATA CENTERS

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Direction Développement des affaires – Québec
Hydro-Québec

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1.1 Overview

Hydro-Québec has identified the development of the data center sector as an avenue of growth that will contribute to meeting one of the main objectives of its Strategic Plan 2016–2020, which is to double its revenues within 15 years. The opportunities for growth within this sector, along with the assets that make Québec a natural candidate for hosting such centers, are among the reasons behind this decision.

According to JLL Data Center Outlook 2016, worldwide data traffic is expected to increa tenfold in the next five years and the data center industry is expected to double in si This impressive growth is due to several trends, including the adoption of cloud computi and consumers' ever-increasing thirst for digital technology (i.e., online shoppi streaming, social media, the sharing economy, etc.).

Growth is particularly strong within the "colocation" data center sector, which is growing 10% to 15% every year. Privately owned, corporate data centers (which constitute a mo mature market), seem to be experiencing a decrease in growth, although more and mo companies are offering this type of service. However, companies in the data-intens market continue to increase the number and size of their data storage facilities.

Though the data center market is still fragmented, new key players, including Equinix a Digital Realty, are beginning to establish a presence and build larger centers in ma regions. In parallel, there is increasing competition between jurisdictions to attract the new "mega centers." For example (in the U.S. alone), over half of the 50 U.S. states ha introduced tax incentives to attract data centers.

In addition to financial incentives, some regions, including Québec, benefit from ma comparative advantages that enable them to attract this type of business. Québe "natural" assets include the following:

- **Source of low-cost electricity**: a very important aspect, given the high ener costs associated with operating a data center (on average, these energy costs c represent more than 20% of the center's operating costs, since electricity required to run computer systems and cool equipment.

- **Energy supply with low GHG emissions**: an increasingly significant siti criterion, given the social pressure exerted on data entre operators and customer

- **Cold climate**: a factor that contributes to lowering electricity bills and thus, reduces overall operating costs.

- **Stricter data confidentiality laws in Canada**: particularly in comparison to current legislation in the U.S. (namely, the USA PATRIOT Act, which allows American authorities to access data stored on U.S. soil—a provision which does not exist in Canada's *Privacy Act*).

- **Proximity to the U.S. market** a factor that enables companies operating data centers in Québec to efficiently service U.S. clients through faster, more efficient communication and data access.

Another of these "natural" advantages is the territory's depth in terms of information technology (IT) skills. Québec boasts a large pool of IT specialists, as well as a wide network of support facilities specializing in the field of information technology (i.e., higher education institutions, research institutes, cooperative organizations, etc.).

According to a Cushman and Wakefield analysis, Canada is considered the 6th best data center location in the world, outranking the United States by four positions. This is mainly due to the criteria that apply to the energy resource. Canada also has a denser concentration of data centers per capita than the U.S.

Québec's data centers are concentrated around the cities of Montréal and Québec. Although installed capacity in the Greater Montréal area is still relatively small in comparison to other North American markets, Montréal stands out for its planned capacity additions. According to industry experts, the drivers for this anticipated growth will likely be new legislation governing data sovereignty and low costs associated with a renewable energy source.

To capitalize on these trends, the Québec government, economic development bodies and Hydro-Québec have increased their efforts to promote and attract investment from the data center sector. More specifically, over the past few years, Hydro-Québec has also developed a specific offer for these investors, which includes:

- Highly competitive rates such as the Economic Development Rate (EDR) and Demand Response (DR) Program

- A portfolio of prequalified sites, representing more than 25 million square feet at strategic locations

- Support to get projects up and running quickly

- Expertise in energy efficiency to reduce energy consumption

Moreover, the sector-related benefits and economic spinoffs for Québec can vary from one type of data center to another, as evidenced by the economic analysis conducted in 2010. The purpose of that analysis was to address the following questions: Is it relevant to attract data centers to Québec? If so, what types of data center? With what kind of activity profile? Under what conditions? The objective was to conduct a rigorous, neutral evaluation of the economic value generated by the different data center models. The evaluation also helped guide the targeting and screening process for financially supported project cases.

How do things stand in 2017? This is a very good question, since economic spinoffs can vary over time. In fact, data center operating technology and practices are continually evolving, and the resulting changes can have repercussions on the economic impacts of the centers' activities.

1.2 Analysis objectives

This analysis thus falls within the overall context described above. Hydro-Québec's Direction Développement des affaires – Québec wished to update a portion of the 2010 analysis, since the update results would make it possible to determine whether the current targeting and screening process should be used as is, or whether it should be adjusted.

More specifically, the analysis focused on evaluating the gross economic value generated by the different data center models.[1] This made it possible to not only establish which types of data center generate sufficient value to justify supplying them with electricity, but also to identify some of the characteristics that contribute to increasing the economic value of such an investment. This made it possible to measure the direct and indirect impacts and potential ripple effect of data centers in Québec.

The following section (Section 2) describes the economic spinoffs from activities that overlap with data center management and storage operations. Section 3 addresses the effects of other types of activities that do the same. These activities may relate to products and services from specialized suppliers, or to other peripheral services. The conclusion of this report summarizes all major observations stemming from the economic analysis.

[1] This involved updating portions of chapters 2 and 3 of the 2010 study

1.3 Procedure followed

At the time of the 2010 analysis, there were few active data centers in Québec. Analysis results were based on information from centers outside Québec (i.e., in the United States, British Columbia and Ontario), and on cost models.[2] This changed significantly in 2017.

There are currently some 20 companies conducting data processing and hosting activities within buildings categorized as data centers.[3] The number of facilities operated by these businesses has increased steadily over the last five years to currently reach about 40. This does not include projects that had been approved but were not yet active when the analysis was conducted (i.e., projects that were in the planning stage and/or under construction at the beginning of 2017). More importantly, most of the active centers had not yet reached full deployment. Although operational data centers represented a power demand of approximately 40 MW at the end of 2016, their long-term needs were estimated at about 350 MW.

The 2017 analysis was based on the profile of activities and expenses of data centers operating in Québec. This was accomplished by conducting a survey of active data centers in the territory. The results presented in the following section identify three types of data center, which are described later in the document and respectively correspond to the following:

- Pure or dedicated “proprietary” centers
- Pure “colocation” centers
- “Extended-service” centers

The results provided here correspond to the models for each type of center and are not based on information specific to any one data center now operating in Québec. These results reflect centers currently operating in Québec.

[2] Namely, the cost model developed by the Uptime Institute.

[3] The number of companies occupying white spaces within larger data centers is obviously much higher. In fact, almost all companies now have internal equipment that stores certain types of data. However, due to their size and function, the organizations which monitor these facilities do not categorize them as data centers.

2 ECONOMIC VALUE OF DATA HOSTING ACTIVITIES

2.1 Basic parameters

The economic value analysis corresponds to the creation of wealth in the territory. The net creation of wealth can be evaluated by measuring the added value generated in Québec by a specific project on one hand, and by subtracting the rate shock resulting from the difference between the marginal cost of electricity and the awarded rate on the other. This document focuses on the gross creation of wealth and does not take energy supply costs into account, due to the current and anticipated electricity surplus. However, Hydro-Québec authorities can assess net economic value by applying the appropriate opportunity cost of electricity.

Added value constitutes the total remuneration paid to all Québec economic agents, i.e., all salaries and guarantees (before taxes), net company revenues and other gross revenues before taxes. Measuring the creation of economic value factors takes into consideration the direct effects of the expenses incurred, as well as the indirect effects (i.e., the impact on suppliers). The analysis must also factor in operating and investment expenses. Operating expenses can be described as total annual expenses, taking the depreciation of annual capital assets into account.

In addition to the added value corresponding to the creation of wealth, the economic impact can also be measured in terms of **supported employment**. The variables of level and quality of employment associated with an economic activity remain significant. In the context of this analysis, supported employment includes direct employment (i.e., employees paid by the data center) and total employment, which includes employment supported within the data center supplier chain. The employment level is measured in terms of full time jobs (part time jobs are evaluated on a full time basis).

Moreover, this analysis has identified **three types of active data centers** in Québec: pure or dedicated “proprietary” centers, pure “colocation” centers and “extended-service” centers.

- “Proprietary” centers correspond to the model where the facility is dedicated to the activities of a single enterprise. This is an in-house service with simplified, optimized activities.
- The role of center personnel is essentially to focus on keeping the facilities running smoothly. A number of companies in the data-intensive sector, such as financial institutions or telecommunications companies, operate this type of data center. Their internal requirements are often such that the need for efficiency leads them to set up large-scale facilities within a designated building

- As their name indicates, “colocation” centers correspond to the model where a specialized company rents data hosting services to external enterprises. In addition to the activities carried out to ensure that the data hosting facilities are functioning properly, these centers usually have market development and client management teams. They may have several small clients or only few large ones, or a combination of all types of clients. Some focus on more specialized areas or niche markets. This type of data center is experiencing significant growth, due to the development of cloud computing and the outsourcing of data storage operations. Since these facilities need to promote their services, most public data centers are of the “colocation” type (a few examples, among others in Québec, are COLO D, 4 Degrés colocation, Cologix and Root).
- Lastly, “extended-service” centers correspond to businesses operating in Québec that have added other peripheral activities to their specific data hosting operations. These include centers in Québec that provide services such as research, call centers and service centers. Such supplementary activities may be directly or indirectly related to the centers’ data hosting activities, but always require additional personnel. The facilities of companies such as OVH or Ericsson are this type of center.

Note that the purpose of the facilities and organizations is not fixed or static. Data centers can evolve from one type to another. In fact, a specific type of center can act as a stepping stone to the next. For example, certain telecommunications companies that originally developed facilities for their own in-house needs have begun to offer “colocation” services, and some pure “colocation” centers have begun adding services to their local offer, thereby becoming “extended-service” centers.

The economic impacts of all three types of data center were measured in proportion to their specific energy intensity, be it in MW or kWh.

2.2 Main results

Economic impacts by type of data center

We will first look at the results in relation to power demand. The table below shows the levels of direct and total employment per MW. Not surprisingly, there are significant differences between the three main types of data center analyzed, the ratio varying between onefold, twofold and fivefold. Note that there are also variances in the value added per MW, but these differences are smaller (one- to twofold). Lastly, the value added per supported job evolves in the opposite direction.

TABLEAU 1 – ECONOMIC IMPACT PER MW AND DATA CENTER TYPE

ECONOMIC IMPACT PER MW AND JOB	
Pure “proprietary” data centers	
Direct jobs/MW	5
Total jobs/MW	11,4
Total value added/MW	$1.5M
Total value added/Direct jobs	$298,706
Total value added/Total jobs	$131,021
Pure “colocation” data centers	
Direct jobs/MW	12
Total jobs/MW	19.7
Total value added /MW	$2.2M
Total value added/Direct jobs	$187,116
Total value added/Total jobs	$114.101
“Extended-service” data centers	
Direct jobs/MW	25
Total jobs/MW	33.0
Total value added/MW	$3.3M
Total value added/Direct jobs	$131,321
Total value added/Total jobs	$99,489

** Power demand*
Source: KPMG analysis

It should be noted that these variances were expected. Pure “proprietary” data centers employ fewer people for a facility of comparable size than the other two center types, since they do not have the marketing/client-management personnel that pure “colocation” centers have, nor do they have the employees associated with peripheral activities of “extended service” centers. Furthermore, although the employment lever is stronger in the latter two types of data center, the value added per supported job is higher in pure “proprietary” data centers. This is essentially due to the higher non-salary expenses per job in these data centers.

The number of direct jobs per MW in “proprietary” data centers varied between 4 and 10, with an average concentration of approximately 5. The “colocation” center numbers varied between 10 and 20 per MW, with a concentration of approximately 12. The differences were greater in “extended-service” centers, since their situation more or less constitutes a case-by-case scenario. However, a higher concentration of approximately 20 to 30 direct jobs per MW was noted.

In addition to direct jobs, there are also indirect jobs within the main data center suppliers (i.e., suppliers of electricity, bandwidth, ventilation/air conditioning equipment services, etc.), as well as jobs related to building construction and maintenance. The job “multiplier” for suppliers is a function of the value of purchases per employee. As previously mentioned, “proprietary” data centers have higher non-salary expenses per direct job than the other two center types. Therefore, suppliers of this type of data center have the equivalent of 1.3 jobs for each of their direct jobs, versus 0.6 for “colocation” center suppliers and 0.3 for “extended-service” center suppliers. However, this leveraging effect is not sufficient to eliminate the advantage of the latter two in terms of total jobs per MW.

Total employment impacts of data centers in Québec

In addition to the economic impacts generated by each of the three types of data center, it may be relevant to discuss the overall contribution of these activities to Québec’s economy. Since several of the centers now operating in Québec were still under development last year, the total economic impact of the data centers was evaluated on three levels: i) impact of existing centers in 2016, ii) impact of existing centers in 2025 (i.e., at the time of their anticipated full deployment), and iii) the impact of existing and new data centers in 2025, assuming the sector’s 1,000-MW consumption scenario is reached.

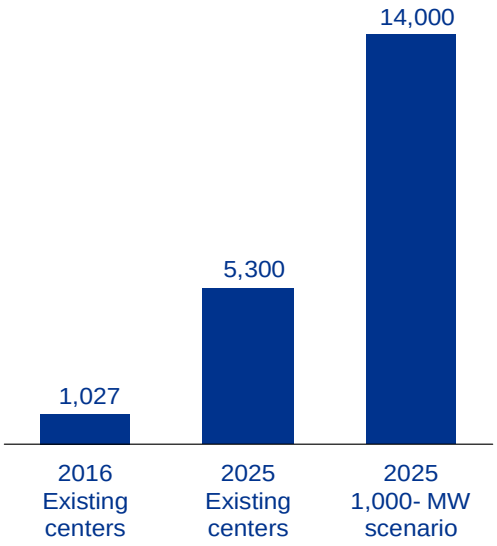
Looking at the economic spinoffs from 2016 (last complete year) from all data centers currently operating in Québec, the facilities are estimated to have supported 626 direct jobs. If we include indirect jobs within the supplier chain, the total number of supported jobs in the Québec economy reached around 1,027 that year.

Moreover, activity in the existing data centers in Québec in 2016 was well below the expected level at the time of their full deployment. For example, the centers’ electricity consumption in 2016 was only 25% of that anticipated in 2025. Once all current data centers and their anticipated activities are at full capacity (based on their forecast electricity consumption), total direct jobs in the existing data centers would represent close to 1,000 jobs by 2025. Prospective data centers here would be of varying sizes, with staff numbers ranging from under 5 to approximately 400 employees. If we include supported indirect employment within the supplier chain, the total number of jobs in the Québec economy would reach about 5,300 over the same time horizon.

This 2025 estimate concerns only existing data centers or those in development. Factoring in the new centers that will surely be added would result in an even higher number of supported jobs. Note that experts in the field believe that Québec is well positioned to benefit from the anticipated growth in this sector, especially since efforts are currently being made to promote, attract and develop this type of activity. Some scenarios predict that this sector could represent a power demand of about 1,000 MW by 2025–2030. Should this prove to be the case, the number of jobs supported by this sector in the Québec economy would reach nearly 14,000.

CHART 1 – ESTIMATE OF JOBS SUPPORTED BY DATA CENTERS

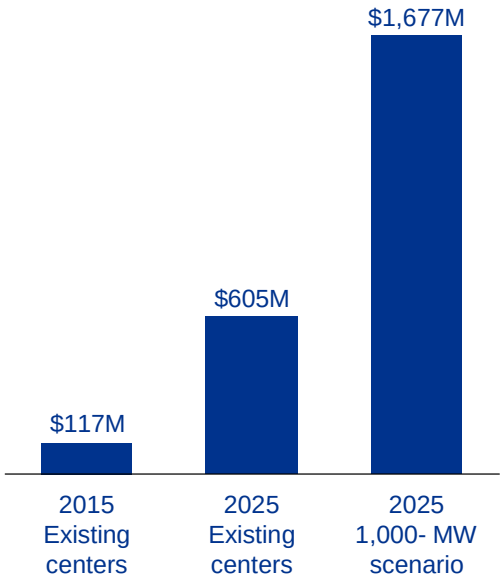
(Québec, Direct and Indirect Employment, 2016–2025)



Source: KPMG analysis

The economic impact of the existing and potential data centers can also be measured in monetary value. The figure below outlines the three preceding scenarios, but also shows the added value generated in Québec for each. Remember that the added value corresponds to the increase in revenue and thus, is an indicator of the creation of wealth in each economy. The progression is clearly similar to that associated with employment, depending on the scenarios considered.

FIGURE 2 – ESTIMATE OF ADDED VALUE GENERATED BY DATA CENTERS
(Québec, Direct and Indirect Value Added in Millions of 2016 Dollars, 2016–2025)

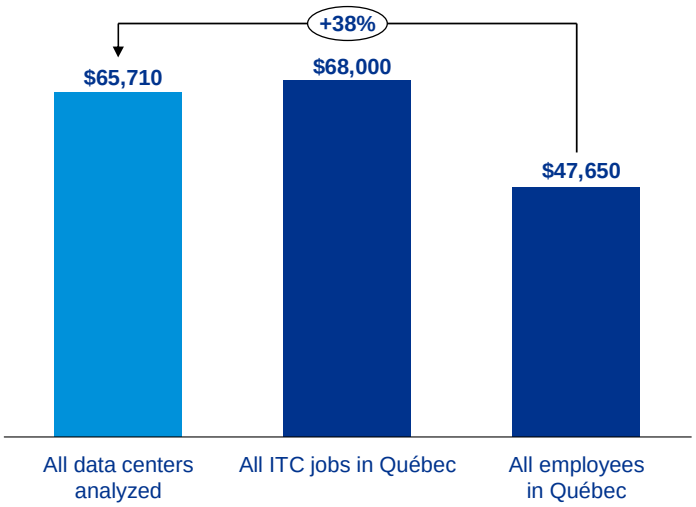


Source: KPMG Analysis

Remuneration level of jobs supported by data centers

The level of remuneration associated with direct jobs for data centers active in Québec is estimated at $65,710. This amount reflects the mix of jobs observed in the centers. This constitutes an average covering all types of positions and occupations. It therefore refers to high quality jobs that are more highly paid than the average job in Québec, but slightly lower paid than most ICT jobs in Québec).

FIGURE 3 – COMPARISON OF AVERAGE SALARIES IN 2016, IN $
(Results of the official survey and statistics)



Source: KPMG analysis

Economic impact per kWh and type of data center

The table below shows the gross economic value of all three data center models based on electricity consumption which, in turn, is based on the power demand and utilization factor inherent to this activity. Note that the creation of wealth varies between $0.18/kWh and $0.39/kWh, depending on the model selected, i.e., a one- to threefold ratio. These results are obviously explained by the ratio of jobs to MW, which varies considerably between the three types of data center. However, note that the variation in gross economic value is slightly lower than that observed in the jobs/MW ratio (threefold for gross economic value and nearly tenfold for the jobs/MW ratio).

TABLE 2 – ECONOMIC IMPACT PER KWH AND DATA CENTER TYPE ANALYZED

	TYPICAL DATA CENTER MODELS		
	Pure "proprietary" data centers	Pure "colocation" data centers	"Extended-service" data centers
Added value generated in Quebec	18.0¢/kWh	27.0¢/kWh	39.0¢/kWh

Source: KPMG analysis

It should be noted that these results cannot be compared to those from 2010 with complete accuracy, since the results of the earlier analysis were based on active centers outside Québec and the typology used at the time related solely to the size of the data center.[4] However, the "average center" in 2010 was similar to the "pure" data center in 2017

In 2010, the value added per kWh of the average Québec data center was estimated at 16.0¢ (the differences between "proprietary" and "colocation" centers had not yet been measured). In 2016 dollars, this would be equivalent to approximately 18.0¢/kWh. Thus, the impact per kWh appears to have increased over the last decade, since the current analysis represents a ratio of between 18.0¢ and 27.0¢ per kWh. This increase is not surprising, since several improvements have made it possible to increase the overall energy efficiency of the data centers over time. Moreover, it should be noted that many of the data centers analyzed are not yet fully deployed and optimized. This situation may have contributed to the slight increase in economic spinoffs from current data center activities.

All the data center models allow for an increase in economic value created, provided the data hosting function is paired with additional activities relating to applications development, information analysis or other types of services offered by the companies (i.e., research and development centers, service centers, call centers, etc.). Since these activities consume little electricity, their addition helps increase the economic impact per power demand MW or kWh consumed.

The 2010 analysis estimated the additional impacts resulting from these supplementary services based on the various levels of additional employment. Table 3 provides the results for a mega data center and shows that the additional value added was close to 10¢/kWh (2010 study). It is interesting to note that our "extended-service" centers add value of nearly 12¢/kWh when compared to pure "colocation" centers (2017 study). While these are not necessarily the same activities as those estimated in 2010, the tangible effect of grafting other functions onto data hosting services is clear.

[4] The models used at that time were: model "A," which corresponded to a small, relatively unoptimized center mainly servicing local or regional clients; model "B," which represented a typical data center capable of servicing regional, national, or external clients, and model "C,' which corresponded to a mega data center capable of servicing either a single enterprise or external clients.

TABLE 3 – ADDITIONAL ECONOMIC VALUE BASED ON VARIOUS LEVELS OF ADDITIONAL DATA PROCESSING OR APPLICATIONS DEVELOPMENT JOBS
(*Added value generated in Québec in ¢ per kWh)*

ADDITION OF DATA PROCESSING OR APPLICATIONS DEVELOPMENT ACTIVITIES	ESTIMATED ADDITIONAL GROSS ECONOMIC VALUE IN 2010
10 direct jobs linked to these activities	9.1¢/kWh
50 direct jobs linked to these activities	9.9¢/kWh
100 direct jobs linked to these activities	10.8¢/kWh

Source: KPMG Analysis

In 2010, it was estimated that a ratio of 3.5 direct jobs per MW or higher generated a net creation of economic value of more than 11¢/kWh in Québec. This appeared to be the minimum level required to cover the marginal costs of supplying electricity. It was also noted that, in the narrow sense, a number of the jobs associated with a data center (such as security and in-house facilities maintenance) could be awarded to external suppliers and that consequently, it was important to pay particular attention to jobs the promoter was or was not considering as part of its project.

The 2017 analysis indicates that a typical data center, even a “proprietary” one, meets the minimum target of 3.5 direct jobs per MW. Given the increased energy efficiency of data centers, even a level of 3.1 direct jobs per MW is sufficient to reach the 11¢/kWh threshold. Moreover, the aim is still to achieve higher levels to maximize the economic impact of data hosting activities. This objective is especially desirable, given that Québec currently offers several types of financial and non-financial support to data centers.

3 POTENTIAL CONTRIBUTION OF A GLOBAL VALUE CHAIN RELATED TO A DATA CENTER ECOSYSTEM

3.1 Downstream data center activities

Data hosting is not usually an end in itself. The exponential growth of the amount of data collected and the introduction of better, more performing technologies capable of analyzing it efficiently are opening the door to vast, multiple fields of application that relate to both the areas that have already existed for several years (such as the Internet, cloud computing, mobility, etc.) and emerging technological concepts such as Big Data, artificial intelligence and the Internet of Things (IoT).

As stated in the 2010 analysis, data processing, applications development and service center activities do not have to be physically located near data storage facilities. Each case is specifically related to the enterprise's historical or particular context. However, Québec stands out from many other regions that host data centers in that it has a vast and rich ICT ecosystem.

Québec has a critical mass of activities in several different fields and offers many advantages to companies who wish to base their IT activities in the province (e.g., a vast pool of skilled workers, research bodies, training organizations, industry stakeholder groups and networks, advantageous operating costs, government support, etc.). This is more than just "hype." Québec's ICT sector has experienced significant, sustained employment growth for quite some time (approximately 3.5% per year over the last decade) and year after year, has represented the largest portion of new, direct foreign investment in Greater Montréal.

The following table shows the economic value, in terms of added value, of three major types of activities downstream of the chain: centers offering computer services to their clients, development of data processing applications, and research and development centers. For purposes of clarity, they are expressed as segments of 10 jobs. There is some convergence in the impact of these major types of activities on the Québec economy. In brief, each segment of ten direct jobs contributes nearly $1.5 million dollars to the Québec economy (i.e., $150,000 per job).

TABLE 4 – ECONOMIC VALUE OF VARIOUS ACTIVITIES DOWNSTREAM OF THE DATA CENTER VALUE CHAIN

(*Value added in Québec by segment of ten direct jobs)*

EXAMPLES OF ACTIVITES DOWNSTREAM OF THE VALUE CHAIN	**VALUE ADDED IN QUÉBEC** *(IN $ PER SEGMENT OF 10 DIRECT JOBS)*
Center offering computer services to serviced clients *(e.g., cloud computing)*	$1,575,000
Data processing applications development	$1,475,000
Research and development center *(e.g., artificial intelligence)*	$1,425,000

Source: KPMG analysis

[redacted]

[redacted]

[5] Information from an article published in *La Presse* on April 28, 2017. More information is available here: http://affaires.lapresse.ca/economie/technologie/201704/28/01-5092727-centre-de-donnees-des-serveurs-dans-les-parcs-industriels-des-emplois-au-centre-ville.php.

3.2 Upstream data center activities

To function efficiently, data hosting activities rely on a series of service providers, equipment, components, products, etc., many of which are necessarily contracted or acquired locally. These services include electricity, site security and building maintenance. However, local suppliers may also be needed for specialized goods or services such as specific equipment, software, electronic components or other items. Performance, cost, reliability, compatibility and after-sales services are also key factors influencing the decision to acquire these specialized products.

The growing number and size of data centers have given rise to a major current and potential market for suppliers of these products. Their value for suppliers and for the economies in which these enterprises are located can be significant. This worldwide market can lead to innovative economic activities with a high export rate, and includes many well established international players (such as ABB, Cisco, Dell, Emerson, HP, IBM and Schneider Electric), as well as other, lesser-known but equally well-established companies (Asetek, Brocade, Cyber Power, Hitec, Para System, Stay Online, Stulz Air Technology Systems, etc.). Although the hardware market is often difficult to break into, new software solutions are making it possible to optimize data center performance and thus, contribute to weakening these barriers.

The following table shows the economic value in Québec, in terms of added value, of the two major types of activities upstream of the chain, i.e., electronic equipment and software solutions. Note that there can be major differences in the nature and scope of the products from specialized suppliers. The data shown corresponds to typical equipment- and software-related activities. Although the impact may increase or decrease depending on the specific product offered, the data allows for a reasonable estimate. For purposes of clarity, the impacts are also expressed as segments of 10 jobs. Again, there is some convergence in the impact of these two major types of activities on the Québec economy. In brief, each segment of 10 direct jobs contributes close to $1.45 million to the Québec economy (i.e., $145,000 per job).

TABLE 5 – ECONOMIC VALUE OF VARIOUS ACTIVITIES UPSTREAM OF THE DATA CENTER VALUE CHAIN

(*Value added in Québec by segment of 10 direct jobs)*

EXAMPLES OF ACTIVITIES UPSTREAM OF THE VALUE CHAIN	VALUE ADDED IN QUÉBEC *(IN $ PER SEGMENT OF 10 DIRECT JOBS)*
Manufacture of a piece of equipment or electronic component	$1,425,000
Development and sale of a software solution *(e.g., latency reduction)*	$1,475,000

Source: KPMG analysis

[redacted]

Although there are many other Québec enterprises whose target markets include data centers,[8] the three examples cited above clearly illustrate the potential arising from the development of upstream activities. Even though all three are only just beginning to break into the data center market, their activities represent additional economic value for Québec of close to $10 million dollars per year.

[6] "14 millions pour une start-up montréalaise," La Presse, March 25, 2017.

[7] http://affaires.lapresse.ca/economie/technologie/201509/08/01-4898490-9-millions-pour-une-entreprise- qui-reinvente-les-reseaux.php.

[8] For example, Hypertec's Ciara division, Maya, etc.

4 CONCLUSION

The purpose of this study was to update the analysis of the economic value of data centers for Québec. Contrary to the 2010 analysis, which was essentially based on facilities outside the territory, this analysis is based solely on data hosting centers operating in Québec.

The analysis identifies three major types of data center: “proprietary,” “colocation” and “extended-service.” The creation of wealth by these three types of centers varies on a ratio of one- to twofold for an equal energy consumption and one- to fivefold in terms of jobs. Although the 2010 and 2017 results could not be compared with complete accuracy, the ratio of economic impacts per MW power demand appears to have increased over the last few years.

The 2017 analysis indicates that a typical data center, even a “proprietary” one, meets the minimum target of 3.5 direct jobs per MW, which Hydro-Québec authorities use as a guideline. Given the increased energy efficiency of data centers, as few as 3.1 direct jobs per MW now make it possible to reach the 11¢/kWh threshold required to create wealth. Moreover, the aim is still to achieve higher levels to maximize the economic impact of data hosting activities. This objective is especially desirable, given that Québec currently offers several types of financial and non-financial support to data centers.

This analysis also aimed to measure the economic benefits associated with an increase in upstream and downstream data center activities. It may be relevant to develop a more global and integrated value chain, since this would help increase the economic impact stemming specifically from data hosting. Upstream spheres of activity may include electronic equipment/components, or software solutions designed for data centers. Downstream activities may include computer services offered to data center clients, the development of data processing applications, or research and development activities.

Regardless of whether it pertains to up- or downstream data center activities, each segment of 10 additional jobs contributes to supporting quality employment and generates approximately $1.5 million to the Québec economy. “Extended-service” data centers demonstrate this impact, since they create additional wealth of 12¢ per kWh when compared to pure “colocation” centers. This is where the tangible effect of grafting additional functions onto data hosting services becomes apparent.

Lastly, all data centers currently operating in Québec are beginning to exert a significant impact on the economy and their contribution will continue to grow in the coming years. The existing data centers supported 1,027 jobs in Québec in 2016 and once fully deployed, will support around 5,300 jobs in the Québec economy. Note that this estimate only concerns data centers already in operation or under development. According to some scenarios, this sector could have an overall power demand of approximately 1,000 MW by

2025–2030. If this proves to be the case, sector-supported employment in the Québec economy could represent close to 14,000 jobs.