



**Report of the Auditor General
of the Ville de Montréal**
to the City Council and to the
Urban Agglomeration Council

For the Year Ended December 31, 2015

4.6

**Energy
Management**



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List of Acronyms

DÉEU	Direction de l'épuration des eaux usées	m ²	square metre
DEP	Direction de l'eau potable	m ³	cubic metre
GHG	greenhouse gas	SIGI	Système intégré de gestion des immeubles
kW	kilowatt	SGPI	Service de la gestion et de la planification immobilière
kWh	kilowatt-hour		

4.6. Energy Management

1. Background

Improving the energy efficiency of municipal buildings, as well as wastewater treatment and drinking water production processes, is among the objectives set forth in the City's *Plan corporatif de Montréal en développement durable 2010-2015*.¹ This municipal plan is namely aimed at achieving a 30% reduction in greenhouse gas (GHG) emissions by 2020.

In addition to reducing GHG emissions, improving the energy efficiency of buildings and other facilities is also intended to reduce energy costs (e.g., electricity, natural gas).

In 2010, the inventory of the City's GHG emissions—carried out by the Direction de l'environnement of the Service des infrastructures, du transport et de l'environnement²—revealed that the energy consumption of buildings and wastewater treatment processes was among the activities with the highest levels of GHG emissions at 21% and 34% respectively.

Indeed, the City owns an important building inventory comprised of a little more than 1,300³ buildings that cover a total surface area of approximately 1.6 million square metres (m²). The City operates the third largest wastewater treatment plant in the world as well as six drinking water production plants⁴, including the two largest in Canada (Charles-J. Des Bailleurs and Atwater).

For 2015, the energy expenditures initially budgeted by the City totalled some \$87.3 million⁵ (\$81.2 million in 2014). This budget mainly covers electricity costs, but also includes natural gas and, to a lesser extent, fuel oil.

The environmental and budgetary repercussions are undeniable. That is why the City needs to implement measures to improve the energy efficiency of its buildings and other equipment and facilities. Reducing energy consumption will lead de facto to a reduction in GHG emissions⁶.

¹ This plan is inspired by and complementary to the *Plan de développement durable de la collectivité montréalaise 2010-2015*.

² These activities are now the responsibility of the Service de l'environnement reporting to the Direction générale adjointe au développement.

³ Source: Service de la gestion et de la planification immobilière (2015).

⁴ The six plants are: Atwater, Charles-J. Des Bailleurs, Dorval, Lachine, Pierrefonds and Pointe-Claire.

⁵ Excluding paramunicipal corporations.

⁶ Source: *Plan d'économie d'énergie 2013-2015*, Service de la concertation des arrondissements et des ressources matérielles (September 2012).

2. Purpose and Scope of the Audit

The purpose of this audit was to determine the goals set by the City in terms of reducing the energy consumption of municipal buildings as well as wastewater treatment and drinking water production facilities; to determine the actions taken to achieve these objectives; and to measure and report the results.

The bulk of our audit concerned 2014 and 2015; however, for certain aspects, data dating back to before these years were also taken into consideration.

The work involved the following business units:

- The Service de la gestion et de la planification immobilière (SGPI) – Division de la stratégie et du développement – Section énergie et environnement;
- The Service de l'eau – Direction de l'épuration des eaux usées (DÉEU) and Direction de l'eau potable (DEP);
- The following boroughs of former suburban municipalities⁷:
 - Anjou borough;
 - Lachine borough;
 - LaSalle borough;
 - Montréal-Nord borough;
 - Outremont borough;
 - Pierrefonds-Roxboro borough;
 - Saint-Laurent borough;
 - Saint-Léonard borough;
 - Verdun borough.

Our work consisted of conducting interviews with managers and employees, reviewing various documents and conducting surveys that we deemed appropriate to gather meaningful information.

3. Main Findings

Our audit revealed sectors where improvements should be made, namely:

- A formal and ongoing accountability process enabling the SGPI to periodically assess the degree of achievement of the targets set in terms of reducing the energy consumption of municipal buildings under its responsibility has yet to be implemented;

⁷ The L'Île-Bizard–Sainte-Geneviève borough was excluded from the scope of the audit as it was undergoing a major reorganization at the time our work began.

- Measurable objectives, action plans and accountability mechanisms with respect to the optimization of energy costs have not been set for the buildings and facilities of either the Service de l'eau or the boroughs of former suburban municipalities;
- No process has yet been developed to verify energy bills associated with, among other things, wastewater treatment or drinking water production facilities. In some cases, energy bills are neither critically reviewed nor monitored;
- Most (7 out of 9) of the audited boroughs of former suburban municipalities do not conduct critical reviews and do not monitor the energy bills associated with the municipal buildings for which they are responsible.

4. Audit Results

From the outset, we must point out that the City's energy monitoring responsibilities are divided between the municipal departments and the boroughs.

Indeed, the Section énergie et environnement, which reports to the Service de la gestion et de la planification immobilière (SGPI), manages energy bills (e.g., electricity, natural gas, fuel oil) associated with the buildings of the Service de Police de la Ville de Montréal, the Service de sécurité incendie de Montréal, most of⁸ the other central departments and nine boroughs of former⁹ Ville de Montréal. Moreover, although this activity is not covered by this audit, it should be noted that the boroughs remain responsible for managing traffic light and public lighting energy bills.

According to the information obtained from the representatives we interviewed, out of the total of 1,300 or so buildings that make up the City's building inventory, this management activity of the SGPI covers a little more than 750 buildings spanning a total surface area of close to 900,000 m². The total energy budget works out to \$22 million per year. This property inventory is comprised mainly of sports complexes, arenas, pools, municipal workshops, fire stations, neighbourhood police stations, libraries, administrative buildings and park lodges.

With respect to the wastewater treatment plant and the six drinking water production facilities, all aspects of the energy management of these buildings is the responsibility of the Service de l'eau rather than the SGPI. The annual energy budget¹⁰ hovers around \$14.4 million for

⁸ For example, the energy bills of the buildings occupied by the Service des grands parcs, du verdissement et du Mont-Royal are not managed by the SGPI but rather by the department itself.

⁹ These boroughs are: Ahuntsic-Cartierville, Côte-des-neiges–Our-Dame-de-Grâce, Plateau-Mont-Royal, Mercier–Hochelaga-Maisonneuve, Rosemont–La Petite-Patrie, Rivière-des-Prairies–Pointe-aux-Trembles, Sud-Ouest, Ville-Marie, and Villeray–Saint-Michel–Parc-Extension.

¹⁰ According to the original 2015 budget.

the wastewater treatment plant and \$16.9 million in the case of the drinking water production facilities.

The same applies to the boroughs of former suburban municipalities, which independently manage the energy bills of the buildings for which they are responsible, without any input from the SGPI. In the past years, the energy budget for the nine boroughs of former suburban municipalities covered by this audit totalled a little more than \$14.1 million.¹¹

This having been said, our audit first focussed on the search for objectives and performance indicators established by the different business units audited to promote energy cost reductions, thereby contributing to the City's greenhouse gas (GHG) emissions reductions target.

Secondly, although energy performance improvements depend on the integration of various activities such as the preventive maintenance of various building and facility components as well as the implementation of energy-saving projects, our audit focussed more specifically on a fundamental energy management activity, i.e., the implementation of mechanisms to verify and monitor the energy costs billed by energy providers.

4.1. Establishment of Energy Cost Reduction Objectives, Evaluation of Results and Accountability

4.1.1. Service de la gestion et de la planification immobilière

4.1.1.A. Background and Findings

In the wake of the adoption in April 2005¹² of its first *Plan stratégique de développement durable de la collectivité montréalaise (2005-2009)*, the City's executive committee approved the *Politique de développement durable pour les édifices de la Ville de Montréal* in June 2009.¹³

The policy establishes various objectives that are to be met, including in the areas of municipal building design, construction, renovation and operations. The policy sets the reduction target at 15% (with respect to a baseline year of 2007) for municipal buildings'

¹¹ Including traffic light and public lighting energy consumption, not included in the scope of this audit.

¹² Resolution CE05 0712.

¹³ Resolution CE09 1027.

energy consumption by 2012 to contribute to achieving the City's environmental targets for GHG emissions reductions.

At the same time as the policy was approved, a first three-year sustainable development action plan was developed¹⁴ for municipal buildings spanning the years 2009 to 2011. With respect to energy management, the action plan includes the reduction target of 15% for buildings' energy consumption, calls for the implementation of an energy savings plan from 2009 to 2013 and establishes the extent of long-term energy savings achieved at the end of the period as the applicable performance indicator.

At the conclusion of this plan, in 2011, we traced the existence of a summary of the results achieved at the end of each of the plan's three years. According to the information obtained from the persons interviewed, this summary was presented to the director of the Direction des stratégies et des transactions immobilières at the time, but it was never presented to the department's management team. Moreover, we noted that interim summaries were not produced annually to report on progress made with respect to the actions set forth in the plan. The summaries produced at the end of the three years of the plan reveal that the 15% reduction target set for buildings' energy consumption was only achieved by 50%.

For 2012, the people we interviewed pointed out that the actions set forth in the 2009–2011 action plan were pursued and rolled over into the 2013–2015 action plan. Indeed, in October 2012, the City's executive committee adopted the *Plan d'économie d'énergie 2013-2015*,¹⁵ which is consistent with the limits set forth in the second action plan, i.e., the *Plan d'action en développement durable pour les édifices de la Ville 2013-2014-2015*. The building energy consumption reduction target was then raised from 15% to 20%. The energy savings plan in question concerns only the buildings under the responsibility of the SGPI. It calls for actions articulated around four main activities that impact energy costs, namely:

- Energy management, including verifying and paying bills, monitoring and analyzing buildings' energy consumption, negotiating supply contracts and optimizing rates;
- Property management in terms of needs such as the type and number of buildings required and the evaluation of required facilities and spaces;
- The efficient operation of equipment with respect to conducting preventive maintenance programs, climatic standards or the upgrading of certain equipment;
- The energy efficiency of construction, renovation or expansion projects (e.g., LEED Gold and LEED Silver certifications) or equipment replacement.

¹⁴ Title: *Plan d'action en développement durable pour les édifices de la Ville de Montréal (2009-2010-2011)*.

¹⁵ Resolution CE12 1677.

At the time the energy savings plan was approved in October 2012, the forecasted objective at the end of the three-year plan (2013–2015) in terms of estimated energy savings was set at \$4.68 million per year, with buildings' GHG emissions reductions set at close to 5,000 tons of CO₂ per year.

At the time we finalized our audit in January 2016, summaries of the *Plan d'action en développement durable pour les édifices de la Ville 2013-2015* and the *Plan d'économie d'énergie 2013-2015* were not available. This situation is understandable since 2015 had just ended. However, we noted once again that there was no documented monitoring of the progress of planned actions at the end of each year of these plans, nor was there any formal accountability process at a predetermined frequency to inform the SGPI of the progress achieved with respect to the established targets.

According to the information obtained from the department manager responsible for implementing the *Plan d'économie d'énergie 2013-2015*, the only accountability exercised periodically concerns its annual performance evaluation, whereas a performance contract objective is associated with the implementation of the energy savings plan.

Moreover, although the *Plan d'économie d'énergie 2013-2015* called for accountability measures using dashboards to monitor the implementation of actions and savings, we noted, in light of the information obtained, that a single dashboard was produced in April 2015 at the request of the manager appointed at the head of the SGPI in December 2014. This dashboard mainly sets out energy savings forecasts per activity for 2013–2015 and as of December 31, 2016. It provides no indication of the extent of savings realized to date.

In short, we noted that the SGPI has set objectives, performance indicators and action plans with respect to the sustainable development and energy efficiency of the buildings for which it is responsible. However, in the absence of formally established periodic progress reports and accountability mechanisms, it is difficult to assess the extent to which established targets have been achieved and act when necessary if corrective measures are required to pursue planned activities. Furthermore, considering that the *Politique de développement durable pour les édifices de la Ville de Montréal* followed by the *Plan d'économie d'énergie 2013-2015* were both approved by the City's executive committee, it is reasonable to believe that formal accountability measures are periodically required.

4.1.1.B. Recommendation

We recommend that the Service de la gestion et de la planification immobilière implement a formal and ongoing accountability requiring the periodic production of progress reports, enabling it to assess the extent to which the established objectives have been achieved and orient the decision-making process accordingly.

Business unit's response:

[TRANSLATION] Update the chart showing annual cumulative energy savings monitoring every year (vs 2011). Also the consumption performance indicator in gigajoules per m².

Submit these results every year to the department manager, who in turn will submit them to the assistant City manager. (Planned completion: June 2016)

Update the project progress chart three times a year. This chart will be submitted to the SGPI management. (Planned completion: December 2016)

4.1.2. Service de l'eau

4.1.2.A. Background and Findings

In accordance with the *Plan corporatif de Montréal en développement durable 2010-2015* adopted by the urban agglomeration council¹⁶ in November 2010, all of the City's business units were individually responsible for taking steps to contribute to achieving the 30% GHG emissions reduction target by 2020. Achieving this target depends in part on monitoring and analyzing the energy consumption inherent in the units' activities.

The energy budget required to treat wastewater and drinking water is significant (a little more than \$31 million in 2015). For both the Direction de l'épuration des eaux usées (DÉEU) and the Direction de l'eau potable (DEP), wastewater treatment and drinking water production processes account for most of the energy expenditure.

During the interviews that were conducted, issues concerning energy consumption were elicited, as were various past ad hoc measures taken to optimize equipment operations and thus promote a reduction of energy costs. Among other things, beyond the fact that almost all buildings and underground tunnels located on the site of the wastewater treatment plant are heated and cooled using the heat recuperated from the sludge incineration process, other actions were also mentioned to this end (e.g., the replacement of fixed-speed pump motors

¹⁶ Resolution CG10 0413.

with variable-speed motors, the repair of backflow valves in the system, the disclosure of instructions regarding pump start-up procedures to prevent an overly high power demand).¹⁷

We also familiarized ourselves with the performance indicators established and used by the two departments listed below.

Direction de l'épuration des eaux usées

A table titled *Tableau de suivi des cibles* is filled out periodically to assess the plant manager's performance. This table is used to measure various aspects of plant operations. Namely, one of its targets concerns the average cost of wastewater treatment, using the energy cost added to the cost of chemicals per cubic metre (m³) of treated water as an indicator of success. The resulting ratio is compared to a scale of success with a gradation of target performance thresholds ("minimal," "satisfactory" and "excellent") which appear to have been established based on the plant's historical data.

Moreover, although the plant's energy costs are compiled and monitored on a historical basis, we observed that neither specific objectives to reduce these costs or optimize energy consumption nor any action plan were formally established to this end for department management accountability purposes.

Direction de l'eau potable

In addition to a monthly report per plant providing a host of operational data, a management dashboard is produced to provide a variety of information on the six plants' operations. With respect to energy consumption, we noted the existence of a performance indicator that measures the number of kilowatt-hours (kWh) per m³ of drinking water produced. The ratio obtained for each plant is assessed according to a target indicator with minimum and maximum thresholds. According to the information obtained from the head of plant operations, the data required to develop the dashboard started being compiled approximately two years ago. With respect to the target performance indicators, it appears they were established on the basis of historical data from the Atwater plant, considered as a relevant reference in terms of performance. However, as with the Direction des eaux usées, we were unable to retrace any energy cost reduction or optimization objective and no action plan has been developed to this end.

¹⁷ Amount of electricity required by the electrical installations and devices connected to Hydro-Québec's network.

A reality concerning these plants (wastewater and drinking water) cannot be ignored: they must operate 24 hours a day to protect public safety as well as the environment. Furthermore, although the underlying energy expenditure may initially seem impossible to compress any further, it is nevertheless important to analyze it and examine the operations inherent to the treatment processes to ultimately allow measures to be determined to reduce costs or optimize the energy required to operate the plants.

That being said, we are aware of the existence within the Service de l'eau of broad orientations and actions undertaken, as part of the *Stratégie montréalaise de l'eau 2011-2020*. Among other things, we noted the implementation of a major project to detect and repair water leaks in the system. This will certainly contribute to reducing the energy costs of both wastewater treatment and drinking water production facilities. Indeed, limiting the quantity of water lost by the system has a direct impact on the number of cubic meters of wastewater or drinking water that the various plants are required to process as well as on the fluctuation of the variable costs involved.

We were also informed that, given the (wastewater and drinking water) plant upgrading project aimed at ensuring certain plants' compliance with new government standards, electricity costs are expected to increase. Indeed, it appears that the addition of certain processes at the treatment facility will require more electricity.

Ultimately, in the interest of improving performance and contributing to the achievement of the City's GHG emissions reduction target, we believe that the Service de l'eau should implement an energy cost optimization process calling for the establishment of measurable objectives, the development of action plans and periodic accountability mechanisms.

4.1.2.B. Recommendation

We recommend that the Service de l'eau establish the measurable objectives, action plans and accountability mechanisms it deems appropriate to optimize the energy costs inherent to its activities and thus contribute to the achievement of the City's greenhouse gas emissions reduction target.

Business unit's response:

[TRANSLATION] Submit annual reports on implementation of the DÉEU's action plan to the DÉEU manager and the Service de l'eau manager. (Planned completion: annual)

Submit annual reports on implementation of the DEP's action plan to the DEP manager and the Service de l'eau manager. (Planned completion: annual)

4.1.3. Boroughs of former suburban municipalities

4.1.3.A. Background and Findings

As previously mentioned, the boroughs of former suburban municipalities manage their building inventory's energy consumption independently, without input from the SGPI. For 2015, the energy budget of the nine audited boroughs of former suburban municipalities totalled \$14.1 million, divided as follows: electricity – 80%, natural gas – 19%, and fuel oil – 1%.

Building conditions vary greatly from one borough to the next, and various factors influence their energy consumption including the age of buildings and their components (e.g., heating, ventilation and air conditioning systems), use and occupancy rate as well as preventive maintenance or renovations carried out over the years.

Upon completion of our visit of the boroughs and in light of the information gathered from the personnel we interviewed, we concluded that actions were sporadically undertaken in the past to optimize buildings' energy consumption (e.g., installing automatic systems to control lighting, heating and ventilation during unoccupied periods; gradually eliminating the use of fuel oil; installing energy-efficient lighting (LEDs); and replacing thermostats). In the case of most of the boroughs visited, however, it was pointed out that these actions had been taken on an as-needs basis in response to immediate priorities and according to available budgets or as part of major renovation work. Several of the people we interviewed mentioned that their borough's buildings were in a state of major disrepair, a situation that inevitably had an impact on energy costs.

Furthermore, although energy consumption is a preoccupation, we noted in the case of the nine boroughs that were audited that no measurable objectives have been formally established to reduce buildings' energy costs (e.g., achieve an X% reduction over a period of Y) and that no action plan exists to this end.

In fact, the only actions or major orientations that we identified are those associated with the City's *Plan corporatif de Montréal en développement durable 2010-2015*. This plan was adopted by the urban agglomeration council in November 2010 and is aimed, among other things, at achieving a 30% reduction in GHG emissions by 2020. Consequently, to achieve this target, each borough was to develop a local sustainable development plan, which was done. Furthermore, within the limits of the development of the City's *Plan de réduction des*

émissions de gaz à effet de serre corporatives 2013-2020,¹⁸ each borough was invited to take stock of its GHG emissions and commit to implementing certain GHG emissions reduction measures, including for buildings, by 2020. With respect to buildings' energy consumption, the following commitments, for example, were identified:

- Assign a manager the responsibility of keeping track of buildings' energy consumption;
- Implement a policy for the efficient management of buildings' energy consumption;
- Improve the air-tightness and insulation of building envelopes.

Consequently, we feel that the audited boroughs would also benefit from establishing objectives and action plans to promote both a reduction of the energy costs associated with their buildings and the achievement of the City's GHG emissions reduction target.

4.1.3.B. Recommendation

We recommend that the nine audited boroughs of former suburban municipalities take the necessary measures to establish the measurable objectives, action plans and accountability mechanisms they deem appropriate in order to optimize the energy costs of the buildings for which they are responsible, thereby contributing to the achievement of the City's greenhouse gas emissions reduction target.

Business units' responses:

ANJOU BOROUGH

[TRANSLATION] Install a computerized system to control the heating, ventilation and air conditioning.

Install energy efficient lighting.

Replace thermostats.

Maintain electromechanical equipment geared towards saving energy.

Optimal adjustment of combustion equipment.

Instrumentation and control (adjustment of systems during unoccupied periods).

Improve air-tightness and insulation in building envelopes.

Annual report and communication of results. (Planned completion: December 2016)

¹⁸ This plan stems from the Direction de l'environnement of the Service des infrastructures, du transport et de l'environnement that existed at the time.

LACHINE BOROUGH

[TRANSLATION] Assign responsibility for monitoring building energy consumption to the Direction des travaux publics. (Planned completion: April 2016)

Compile energy expenditures for buildings (electricity, fuel oil, natural gas and others) over the past three years to identify the largest sources of energy consumption. (Planned completion: September 2016)

Based on the results of the compilation, create a profile of the state of buildings, taking into account the extent of their energy consumption, with the objective of covering 10% of buildings per year. (Planned completion: September 2016)

Conduct an energy audit of five buildings identified as having a strong annual energy savings potential. (Planned completion: June 2017)

Carry out the most cost-efficient work based on availability of funds.

Report annually to the borough council on progress made.

LASALLE BOROUGH

[TRANSLATION] Complete the update of data on energy bills for buildings in the HELIOS software. (Planned completion: June 2016)

Evaluate potential energy savings scenarios based on past actions, projects in progress and budgets using simulations performed with the HELIOS software. (Planned completion: October 2016)

Produce an action plan with measurable objectives based on orientations approved by the borough's decision-making authorities. (Planned completion: November 2016)

Monitor energy consumption and produce an annual report. (Planned completion: December 2016)

MONTREAL-NORD BOROUGH

[TRANSLATION] Determine the energy consumption of all buildings in the borough. (Planned completion: July 2016)

Compare the energy consumption of these buildings with that of similar buildings on the City's territory. (Planned completion: August 2016)

Identify buildings with abnormally high energy consumption. (Planned completion: August 2016)

Propose corrective measures to improve the energy performance of the targeted buildings (insulation, air-tightness, replacing heating unit). (Planned completion: September 2016)

Adopt a budget for completing the work required. **(Planned completion: September 2016)**

Execute an initial phase of the required work in the buildings identified. **(Planned completion: October 2016)**

OUTREMONT BOROUGH

[TRANSLATION] Continue to bring equipment up to standards when it is replaced by the building maintenance team.

Take steps to update the 2012 study conducted by the Service des technologies de l'information on the lack of investment in buildings in the borough, paying particular attention to the condition of heating equipment.

Based on their current state and condition, identify buildings for which priority investments are likely to be justified, in view of the expected reduction of GHG emissions.

On the condition that funds are available in the three-year capital expenditures program, prioritize responses needed to improve the energy balance. **(Planned completion: December 2016)**

PIERREFONDS-ROXBORO BOROUGH

[TRANSLATION] Before we are in a position to set measurable objectives, we need to identify all our energy sources and determine the building components associated with each of these sources.

To do this, it will be necessary to establish a Building Master Plan identifying all components of all buildings in the borough. **(Planned completion: April 2017)**

Determine the potential energy savings for each building and for each component of these buildings. **(Planned completion: June 2017)**

As a follow-up to the previous point, set measurable objectives and prioritize them on the basis of their energy savings potential. **(Planned completion: June 2017)**

Establish a five-year capital expenditures program to upgrade certain components of our buildings in order to achieve the objectives set. **(Planned completion: 2017 to 2021)**

SAINT-LAURENT BOROUGH

[TRANSLATION] Together with its partners, the borough will implement a procedure for setting measurable objectives, action plans and accountability mechanisms based on its available resources in order to optimize energy costs associated with buildings under its responsibility and thereby help achieve the corporate GHG emissions reduction target. **(Planned completion: December 2016)**

The borough will pursue its efforts to achieve the 30% GHG emissions reduction target by 2020 relative to 2002 levels. **(Planned completion: in progress)**

SAINT-LÉONARD BOROUGH

[TRANSLATION] An action plan for 2016–2018 has been submitted to borough management. The target is the same as for the City: to reduce electricity and natural gas consumption by 5%. At the start of every financial year, as soon as energy consumption results are known, an update of this plan will be submitted to the borough director. **(Planned completion: immediate)**

VERDUN BOROUGH

[TRANSLATION] Continue developing our Building Master Plan. **(Planned completion: November 2017)**

Following the production of the Building Master Plan, produce investment scenarios prioritizing energy savings based on the data compiled. **(Planned completion: March 2018)**

Present the investments required to the borough's elected officials to determining the approach and the decision. **(Planned completion: April 2018)**

Achieve a 20% reduction over three years in energy consumption of buildings in which energy consumption investments were made. (Proposed reference year: 2017, following the implementation of HELIOS). **(Planned completion: 2019 and thereafter)**

Develop a formal, ongoing accountability process in order to regularly evaluate the extent to which the objectives set have been achieved. **(Planned completion: June 2018)**

4.2. Monitoring and Analyzing Energy Bills

Systematically verifying the costs billed by suppliers and monitoring the evolution of energy consumption over time constitute the managerial basis of improving the energy efficiency of buildings and facilities. Indeed, it is not possible to make informed decisions regarding the actions that need to be taken on a priority basis to reduce energy consumption without knowledge of these buildings' and facilities' situation with regard to energy. Monitoring energy consumption is one of the means that can be taken to develop this knowledge.

In order to be able to efficiently reduce energy costs, it is a priority to:

- Know the inventory of buildings and other facilities (e.g., the plant, the pump station, the reservoirs) as well as the energy sources they use. Specifically concerning electricity and

natural gas, it is important to have taken the inventory of existing meters and reconciled the data collected with the information provided on suppliers' invoices in order to validate that only the City's energy costs are being paid;

- Verify all invoices;
- Compile invoices by type of energy used to obtain the actual energy consumption portrait per building or facility and to be able to compare the evolution of costs over time (e.g., detection of overconsumption).

Verifying billed costs and monitoring energy consumption make it possible to:

- Detect suppliers' billing errors;
- Detect cases of overconsumption, identify causes and react promptly to implement the necessary corrective measures (e.g., malfunction of equipment);
- Validate the results of actions taken to reduce energy bills (e.g., a condenser bank installed, the heating system replaced, general lighting modernized);
- Obtain a source of relevant information to orient necessary corrective measures or priority renovation projects;
- Justify the required investments and account for them.

Thus, several billing aspects need to be examined, even more specifically with respect to Hydro-Québec bills, for which the monthly amount payable is calculated based on a number of parameters (e.g., applicable rate, contract power,¹⁹ actual power demand). Upon receipt of the energy bills, it is therefore important to verify the following information, among other things:

- The rates billed by suppliers to ensure that the correct rates are billed and that they are best adapted to present and future conditions (rates vary according to consumption levels);
- The billing period in days;
- The specific parameters used to calculate the amount payable, namely with respect to electricity.

In the case of the wastewater treatment plant and drinking water production facilities, it is that much more important to verify the energy bills given the specific features of the large-power rates (5,000 kilowatts [kW] or more) that apply to some of them, the large quantities of energy consumed and the resulting costs.

The following sections of this report therefore successively present our observations regarding how energy bills are analyzed and monitored by the SGPI, the Service de l'eau

¹⁹ Minimal power that is set forth by tariff regulation or contract and that the client is required to pay, whether said power is consumed or not.

and the boroughs of former suburban municipalities for the buildings and facilities for which they are responsible.

4.2.1. Service de la gestion et de la planification immobilière

4.2.1.A. Background and Findings

As previously mentioned, the Section énergie et environnement reporting to the Division de la stratégie et du développement of the SGPI is the administrative unit responsible for managing the energy consumption of the buildings of most central departments as well as the nine boroughs of the former Ville de Montréal. This accounts for a little more than 50%²⁰ of the City's building inventory.

The SGPI's energy management includes receiving, verifying and paying bills,²¹ analyzing applicable rates; monitoring and analyzing buildings' energy consumption (e.g., electricity, natural gas, fuel oil); negotiating energy supply contracts (e.g., natural gas); and managing financial assistance requests for new construction, expansion or major renovation projects.

These activities make it possible namely to:

- Generate ongoing savings for the City;
- Identify high energy consuming buildings;
- Establish targets and priorities for action.

As property manager, the SGPI has the inventory and characteristics (e.g., surface area, year of construction, sources of energy used) of the buildings making up the building inventory for which it is responsible as well as various computerized tools that it uses for energy management purposes.

On the one hand, the information obtained reveals that buildings' electrical or natural gas meters have historically been inventoried to mark their location, determine with accuracy what they power and corroborate the information provided on suppliers' bills. Since then, this has been done as new meters have been installed. Indeed, the people we interviewed within the SGPI mentioned that a same electrical meter can sometimes power more than one building. All of this information concerning each building is kept in a database within the *Système intégré de gestion des immeubles* (SIGI).

²⁰ A little more than 750 of the 1,300 buildings making up the City's building inventory.

²¹ According to the information obtained, electricity and natural gas bills represent 95% of the bills processed by the SGPI. The remaining 5% include fuel oil, propane gas, steam and others.

On the other hand, the HELIOS energy management software is used to verify the energy bills issued to the SGPI. Indeed, all energy bills are entered in the software beforehand. The HELIOS software is used first and foremost to reduce the energy costs of the buildings or processes under study. According to the information obtained, this software offers several functionalities. It is used namely to:

- Automate the verification of the various invoice parameters and alert the user when discrepancies are observed (e.g., an error concerning the rate or billing period, a low power factor²² leading to additional costs in the form of penalties charged by Hydro-Québec);
- Compile energy bill data and compare the historical evolution of costs;
- Conduct the most appropriate rate analysis based on consumption;
- Generate consumption reports and statistics;
- Conduct simulations (e.g., to assess the financial impact of a variation in rates).

Two office clerks are responsible for entering the bills into HELIOS, and a SGPI planning advisor reviews the results of the analyses carried out by HELIOS and attempts to determine the causes of any discrepancy observed. Once verified, the bills entered into HELIOS are forwarded to the SIGI for the purpose of populating the database of information used to monitor each building's energy consumption (e.g., the energy cost per square metre [m²]), to generate budgetary developments and to complete the underlying process to pay the bills.

Finally, we observed that the analysis of buildings' energy consumption was also monitored using computerized tools designed by the SGPI to gather information from the SIGI's database. A dashboard is used for each building to historically monitor actual consumption and compare it with forecasted consumption to detect potential cases of overconsumption based on preprogrammed parameters (e.g., a variation of more than 20%). Cases that are considered suspicious (e.g., an increased consumption of gas, increased kW) and need to be investigated to determine the cause and correct the problem are entered by the planning advisor in a file titled *Anomalies de surenergy consumption*. If applicable, these detected discrepancies are forwarded to the SGPI's technical team in charge of building maintenance. We reviewed the file used to monitor cases of overconsumption and found that it contains various pieces of information, including the identification of the building at cause, the nature and duration of the discrepancy observed, a historical monitoring record and—ultimately—the nature of corrective measures taken.

In short, in light of our audit, the energy monitoring work carried out by the SGPI appears adequate to us. Consequently, we have no specific recommendation to make in this regard.

²² Hydro-Québec's electrical service conditions call for a power factor of 90% (small- and medium-power customers) or 95% (large-power customers) which must be maintained to avoid billing surcharges.

4.2.2. Service de l'eau

4.2.2.A. Background and Findings

Direction de l'épuration des eaux usées

As previously stated, the energy budget required for wastewater treatment operations runs around \$14.4 million²³ per year. This budget is comprised mainly of electrical (79%) and natural gas (19%) purchases. The remaining energy expenditures (2%) are engaged to purchase fuel oil (used when Gaz Métropolitain cuts the supply of natural gas) and diesel fuel (used to power generators).

According to the information obtained from the people we interviewed, in addition to the treatment plant, the DÉEU is also responsible for managing the energy consumption of various other facilities that make up the wastewater collection network, including 90 pump stations and 35 edicules.²⁴ Nevertheless, the processes used to pump and treat the water that is directed to the plant account for the highest proportion of energy expenditures. These processes alone cost a little more than \$10 million in electricity per year.

With respect to the verification and monitoring of energy bills, the information obtained reveals the following facts:

- The HELIOS software is not used to verify and monitor the evolution of energy costs;
- As we shall see below, considering the energy monitoring carried out with respect to the treatment plant's electricity and natural gas bills, we noted that the meters at issue were inventoried and reconciled with those appearing on suppliers' bills. However, we were not able to obtain evidence that such a process had been carried out for various other facilities (e.g., pump stations and edicules) throughout the wastewater collection network;
- With respect to the treatment plant's electricity and natural gas bills, we observed that they are analyzed and closely monitored. The engineers we interviewed pointed out that the plant has its own energy meters (electricity and gas). This enables the plant to corroborate the volumes billed in kilowatt-hours or m³ on a monthly basis. A review of the cost monitoring carried out monthly using Excel spreadsheets designed by the process engineer in charge enabled us to note the existence of the following reconciliations for electricity and natural gas:
 - Monthly estimation of the foreseeable budget costs based on a model designed in accordance with an estimate of the volumes of water historically treated by the plant;

²³ Original 2015 budget.

²⁴ These are small service buildings that are part of the wastewater collection network and house electromechanical and other equipment (e.g., generators, lift gates).

- Monthly calculation of the foreseeable cost of the bill in accordance with the plant meter readings;
- Monthly comparison of the budgeted cost, the foreseeable cost based on the meters and the actual cost billed by the suppliers concerned;
- As far as the electricity bills for various other facilities (e.g., pump stations and edicules) making up the wastewater collection network are concerned, although the amount is not as high (approximately \$700,000 per year), it nevertheless appears that they are not subject to verification apart from a summary visual review nor compiled other than by the finance department for the purpose of paying all bills.

Direction de l'eau potable

The DEP is responsible for managing the energy bills of the six drinking water production plants as well as the 14 water reservoirs and other smaller buildings used to house distribution network equipment (e.g., pump stations, water intakes). Annually, the energy budget associated with drinking water production runs around \$16.9 million. Electricity accounts for the bulk of energy expenditures.

As previously noted, the Charles-J. Des Bailleurs and Atwater plants are the two largest drinking water production plants. Indeed, according to the information obtained, these two plants combined provide 88% of the City's total plant production capacity. Consequently, operating these plants generates considerable electricity costs, all the more so since Hydro-Québec bills a large-power customer rate (LG rate). For example, for 2015, the data collected reveals that the Charles-J. Des Bailleurs and Atwater plants paid electricity bills totalling \$6.8 million and \$3.7 million respectively (before taxes).

With respect to the verification and monitoring of energy bills, the information obtained reveals the following facts:

- The HELIOS software is not used to verify or monitor the evolution of energy costs;
- A process aimed at reconciling the inventory of meters taken on site with those billed by Hydro-Québec should be implemented;
- Apart from the McTavish reservoir, we could find no evidence that the electricity bills (approximately \$2 million) attributable to the other water reservoirs and other smaller facilities housing the various equipment that make up the distribution network are specifically verified, nor that their energy consumption is monitored over time. Indeed, the only compilation found is the one made by the finance department for the purpose of paying all bills issued to the DEP;
- With respect to the electricity bills of the six drinking water production plants, the information obtained reveals that they are subject to a visual review for the purpose of

verifying certain parameters (e.g., rate, billing period, power factors). More specifically, we observed that the electricity bills of the Charles-J. Des Bailleurs and Atwater plants as well as the McTavish reservoir are monitored and compiled separately by an engineer. Indeed, several data provided on these bills as well as various other information concerning plant operations are compiled in an Excel spreadsheet (e.g., electricity costs, power factor, power demand, billed power, volume of water distributed in m³, kWh consumption, unit kWh/m³ consumption of distributed water);

- As previously mentioned (section 4.1.2.), a monthly report is generated for each plant to provide various operational data. One of this report's sections deals with the plant's electrical consumption parameters (e.g., billed cost, kWh consumption, real power in kW). Furthermore, a management dashboard is generated, within which the evolution of the plant's energy consumption per m³ of drinking water is monitored;
- However, at the time of our audit, we did not observe that any counter-verification of the maximum real power demand (in kW) and the monthly consumption (in kWh) used by Hydro-Québec to bill the plants was systematically conducted. Indeed, it would appear that four of the six plants (Atwater, Dorval, Pierrefonds-Roxboro and Lachine) as well as the McTavish reservoir are not equipped with their own electrical meters. This makes it impossible to compare actual consumption with the data generated by Hydro-Québec's meters. Furthermore, although one of the engineers we interviewed contends that internal plant controls could have included periodic readings of Hydro-Québec meters for the purpose of later comparing these readings to the bills, nothing of the sort was done. Two of the plants are equipped with their own meters (Des Bailleurs and Pointe-Claire). However, the engineers responsible for these plants point out that the reliability²⁵ of these meters is questionable given the discrepancies observed between the readings taken on site and the readings billed by Hydro-Québec;
- Finally, although the bills covering the other sources of energy consumed by the plants (e.g., natural gas) are not significant, they are not subject to any specific verification.

4.2.2.B. Recommendation

We recommend that the Service de l'eau take the necessary measures to corroborate on site the existence of each energy meter billed by suppliers and implement mechanisms to verify all energy bills, with the goal of ensuring effective and cost-efficient management of the energy consumption of the facilities for which it is responsible.

²⁵ One of the engineers we contacted also mentioned that the electrical meters may need to be calibrated.

Business unit's response:

[TRANSLATION] Organize a meeting with the SGPI in order to become familiar with the HELIOS software. (Planned completion: June 2016)

Determine whether the HELIOS software is compatible with our operations. If so, purchase it. (Planned completion: December 2016)

If the HELIOS software is purchased, we will analyze the results to determine whether there was possible overbilling for public lavatories and pump stations present on the DÉEU network and DEP plants and reservoirs. (Planned completion: March 2017)

4.2.3. Boroughs of Former Suburban Municipalities

4.2.3.A. Background and Findings

As was previously mentioned in this report, the boroughs of former suburban municipalities are responsible for managing the energy bills of the municipal buildings on their territory.

With respect to the nine boroughs covered by our audit, we observed the following facts:

- The audited boroughs are aware of their building inventories and the energy sources used. However, very few of them confirm having validated all of the existing meters (Hydro-Québec or Gaz Métro) in the field or having reconciled them with the information provided on the bills they pay. Indeed, in light of the information obtained from the people we interviewed, we noted that Saint-Laurent is the only borough that was able to demonstrate that it had completed this exercise;
- Only two boroughs, Saint-Laurent and Saint-Léonard, use the HELIOS software to compile, verify and analyze the evolution of their energy bills;
- The seven²⁶ other boroughs visited do not use HELIOS, and the people we interviewed admitted that the bills are not systematically verified. Indeed, the bills are received and compiled mainly for payment and budget monitoring purposes. Most of the people we interviewed admitted that they do not dispose of the necessary tools to perform this task, whereas others mention that they do not possess the necessary technical knowledge, given the different parameters used to calculate energy bills. Indeed, within these boroughs, bills are received and processed by the financial and material resources departments, whereas the public works department is responsible for their buildings. In most cases, public works officials state that they are not provided with the bills. When they are, the bills are generally not subject to a critical review (e.g., appropriateness of

²⁶ This observation concerns the following boroughs: Anjou, Lachine, LaSalle, Montréal-Nord, Outremont, Pierrefonds-Roxboro and Verdun.

rates, billing period, power factor). It was, however, pointed out that, in cases of doubt, the persons in charge of making sure that the bills are paid will question the public works officials. In conclusion, we noted that these boroughs do not systematically analyze the various billing parameters or the evolution of buildings' energy consumption figures in an attempt to detect discrepancies.

That being said, it must be pointed out for information purposes that we were provided with the *Plan d'harmonisation en gestion de l'énergie* developed by representatives of the Section énergie et environnement of the SGPI. This plan proposes to extend the SGPI's bill management services to other business units for which the SGPI is not currently responsible in order to promote consistency in the management and payment of energy bills and to reduce energy and administrative costs. According to the information obtained, although this harmonization plan was not officially approved by City officials, it did obtain the approval of the City's general manager during a presentation. At the time of our audit, steps leading to the integration of the Verdun borough had been initiated as part of a pilot project.

4.2.3.B. Recommendation

We recommend that the Anjou, Lachine, LaSalle, Montréal-Nord, Outremont, Pierrefonds-Roxboro and Verdun boroughs take the necessary measures to have their energy bills verified and their energy consumption monitored in order to be able to detect any discrepancies and promptly implement the necessary corrective measures.

Business units' responses:

ANJOU BOROUGH

[TRANSLATION] Install the energy management software HELIOS.

Compile data from the billing archives of previous years (electricity, gaz métró, fuel oil).

Monitor building energy consumption in order to have information on rate assessments, unit costs and costs per building.

Analyze energy consumption irregularities (overconsumption) to determine the causes and solve the problem. (Planned completion: December 2016)

LACHINE BOROUGH

[TRANSLATION] Document the energy sources used in each building.

Make an inventory of existing meters (Hydro-Québec and Gaz Métró).

Determine the data that need to be cross-checked using meter readings and bills, such as meter identification, appropriateness of rates and the period covered, then train staff accordingly.

Provide for a procedure to be followed in the event of irregularities. **(Planned completion: September 2016)**

LASALLE BOROUGH

[TRANSLATION] Monitor and analyze energy costs. Following training on the HELIOS software for energy billing, we need to finish entering data on buildings in the borough and keep energy billing data up to date for electricity and natural gas. **(Planned completion: June 2016)**

MONTREAL-NORD BOROUGH

[TRANSLATION] Obtain the HELIOS software licence. **(Planned completion: June 2016)**

Conduct an exhaustive audit of energy bills in the borough. **(Planned completion: July 2016)**

Analyze the results of the audit. **(Planned completion: August 2016)**

Implement the recommendations made as a result of the data analysis and provide for a shift in rates, elimination of certain energy sources and replacement of equipment with a poor energy performance. **(Planned completion: September 2016)**

OUTREMONT BOROUGH

[TRANSLATION] Validate the energy bills of the past year in order to determine how the energy expenditure is distributed in each building, thereby obtaining a profile of the actual situation while at the same time describing how it has changed over the years. The bills will be checked every month by the Division des Opérations manager to validate consumption and billing. **(Planned completion: June 2016)**

Implement HELIOS software to manage energy expenditure billing for buildings. **(Planned completion: December 2016)**

PIERREFONDS-ROXBORO BOROUGH

[TRANSLATION] Establish a procedure for monitoring energy costs (bills) for the various buildings or structures in the borough (signatory in charge of the file). **(Planned completion: June 2016)**

Identify and establish all energy networks based on the electrical panels associated with each billing. **(Planned completion: August 2016)**

Validate the billing method (actual, estimated) used by various sources and optimize the billing method with suppliers. (Planned completion: September 2016)

Purchase, install and train users on a computerized system (HELIOS) used to monitor billing of our energy sources. (Planned completion: September 2016)

Next to the process, put down on paper the responsibilities and deliverables of the people involved in the process. (Planned completion: September 2016)

Draft a report and meet with the borough's finance department in order to validate budget requirements and/or adjustments that need to be made for subsequent years. (Planned completion: November 2016)

VERDUN BOROUGH

[TRANSLATION] Appoint the division head in charge of buildings and rolling stock as the person responsible for monitoring building energy consumption. (Planned completion: March 2016)

Continue integrating the borough's data in the HELIOS software. The integration is supposed to be completed for the early summer of 2016. The reports generated will enable us to identify irregularities in consumption more systematically. (Planned completion: June 2016)

Compile information retroactively (2015 to the present) to compare it with 2016 data and future data. (Planned completion: May 2016)

5. Conclusion

Given the strategic orientation adopted by City officials with respect to sustainable development, the City's business units must contribute to achieving the City's target of reducing greenhouse gas (GHG) emissions by 30% by 2020 while striving to reduce their energy consumption. Under the circumstances, the City's business units must assess, based on their respective realities, the extent to which they are able to contribute to achieving this dual target and then set measurable objectives, use action plans to foresee the measures that need to be implemented and finally report on the results obtained on a periodic basis.

In this regard, our audit shed light on the fact that, in accordance with the *Plan d'économie d'énergie 2013-2015* adopted by the City's executive committee, the Service de la gestion et de la planification immobilière (SGPI) manages the energy consumption of the buildings for which it is responsible in the optic of achieving the 20% target set for reducing energy consumption. We feel that this is a sound management practice, which should be completed by the implementation of a formal and ongoing accountability mechanism to measure the level of achievement. This is currently not the case.

We also observed that both the Service de l'eau and the boroughs of former suburban municipalities that were audited had not set measurable objectives aimed at reducing the energy consumption of the facilities and buildings for which they are responsible.

Also, our audit led us to observe that, apart from the SGPI, most of the business units audited²⁷ have still not implemented sufficient monitoring measures to enable the periodic verification of the energy bills associated with the buildings and other facilities under their responsibility and monitor them over time. For the sake of effective and cost-efficient energy management, we believe that such measures are indispensable to be able to detect discrepancies and promptly take corrective measures to eliminate these discrepancies as quickly as possible. At the same time, considered as the basis of any energy management plan, the implementation of energy consumption verification and monitoring mechanisms will promote the achievement of the City's GHG emissions reduction target.

That being said, should the results obtained at the end of the pilot project carried out by the SGPI with the Verdun borough prove conclusive, we feel that one of the solutions that should be considered is to extend the SGPI's energy bill management services to the City's other business units that currently perform these tasks independently.

²⁷ The Service de l'eau and seven of the nine boroughs of former suburban municipalities that were audited.