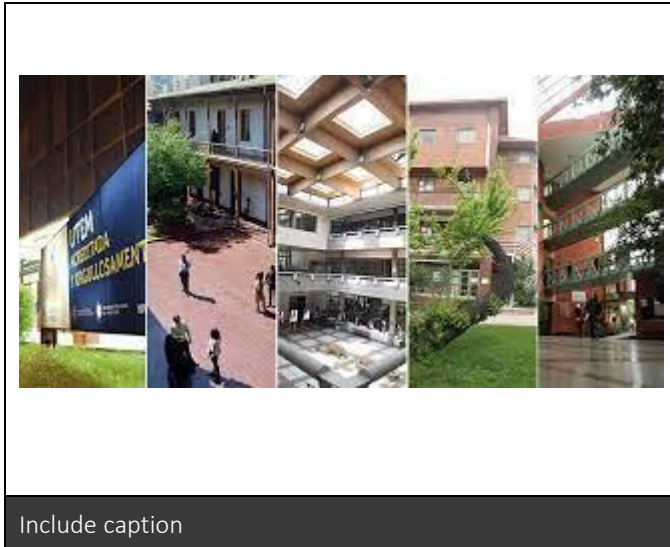


# ISO 50001 Energy Management System Case Study

2021

Chile

## Metropolitan Technological University



## Organization Profile & Business Case

The Metropolitan Technological University was born in response to the need of the State and of society to have a higher education institution that contributes to the development of the various fields of sustainability and technology. This intention is faithfully expressed in the founding Mission of our house of studies, establishing as a guideline the training of professionals who contribute to the sustainable development of society.

This mandate urges us to train ethical, committed and innovative citizens, who in their professional practice incorporate the principles of sustainability to build a sustainable society. Reaching this ideal requires a commitment from the University to promote actions in three major areas: institutional commitment, comprehensive education in sustainability, and sustainable campus management. In this last area, indicators have been raised and systems implemented that allow a sustainable educational process to be carried out.

In this context during 2019, the Metropolitan Technological University implemented an Energy Management System (EnMS) based on ISO 50.001:2011, which was certified at the end of the same year. The scope is defined for the energy consumption of electricity of the University, considering the limits of the facilities of Central Campus, Providencia Campus and Macul Campus.

Electricity consumption represents on average 21% of the total organizational carbon footprint, therefore, implementing a system and setting reduction goals is a relevant matter, and to be considered, within the responsibilities of the university, due to the impact generated by the educational and administrative process in terms of GHG.

The program that encouraged our energy management actions was the Energy Management Systems Promotion Program carried out by the Energy Sustainability Agency of Chile. This line of support includes co-financing for the development of implementations and certifications of Energy Management Systems based on the ISO 50001 standard that help beneficiary companies to develop and establish the necessary processes to improve their energy performance, including energy efficiency, use and energy consumption. Add text here in Calibri Font Size 11. Do not exceed 6 pages.

***“Turn off the light and turn on the savings,  
the UTEM is at stake for energy efficiency”***

—Cristopher Toledo Puga, Coordinator Sustainability Program

**Business Benefits**

At the end of 2018, the Metropolitan Technological University began the implementation of an Energy Management System (EnMS) at the Institutional level under the ISO 50.001 standard. During the initial implementation and certification of the system, the UTEM was advised by an external company, who worked together with the UTEM Sustainability Program and the most relevant areas in terms of significant energy use in the implementation of the system.

After carrying out an analysis of the electricity consumption of the different years and the energy diagnosis that the university had, it was concluded that the year 2017 was the most appropriate to be considered as a base year, since it was a normal year in operational terms.

The implementation of the EnMS began in 2019, for this year it was possible to establish an improvement in electricity consumption at the institutional level of 9%, which is equivalent to a saving of 713 total GJ, 17.495 USD (considering that less than 25% of the total cost was due to operational savings) and 80 tons of CO<sub>2</sub>e. Among the projects that contributed the most to these reductions are the technological replacement of LED lighting (previously fluorescent lighting) in the following facilities: gymnasium and electronics laboratory, both on the Macul Campus, and the remodeling of the bathrooms on the Providencia Campus.

For the year 2020, the EnMS continued in operation, however, the health crisis forced all officials and students to change the operation of the university, going from a face-to-face modality to a virtual one. Although, this modality brought with it an improvement in electricity consumption at the institutional level which reached 42%, equivalent to 2.595 GJ, \$USD 62.925 (considering that between 50-75% of the total cost was due to operational savings) and 289 tons of CO<sub>2</sub>e, this is mainly due to the fact that the facilities were not operational. During this year, we continued to monitor energy consumption and carry out training and

Case Study Snapshot	
<b>Industry</b>	Education
<b>Product/Service</b>	Service
<b>Location</b>	Santiago, Chile
<b>Energy management system</b>	ISO 50001
<b>Energy performance improvement period, in years</b>	2
<b>Energy Performance Improvement (%) over improvement period</b>	9% (2019) 42% (2020)
<b>Total energy cost savings over improvement period</b>	\$USD 80.420
<b>Cost to implement EnMS</b>	\$USD 16.914
<b>Total Energy Savings over improvement period</b>	3.279 (GJ)
<b>Total CO<sub>2</sub>-e emission reduction over improvement period</b>	369 tons

awareness activities for the community associated with the SGE.

Regarding the implementation costs of the EnMS, we estimate that these amount to approximately \$USD 16.914, which is broken down into internal staff time (leader of the EnMS), to develop and implement the EnMS, equivalent to an annual half-working day, which equates to approximately \$USD 7.752. Internal staff time to prepare for the external audit, equivalent to 1.292 USD. Costs associated with hiring an external audit for \$USD 2.333 and external technical advice for \$USD 5.537.

**Plan**

The UTEM (by its acronym in Spanish) maintains a permanent commitment to sustainability, establishing the objective through the Sustainability Program to

generate the UTEM Sustainability Development Plan in matters of Campus operation. Based on this commitment, the UTEM Sustainability Program takes the initiative to implement an EnMS at the institutional level, in order to improve its energy performance. This initiative was presented to the Rectoría, who promised to support the implementation of this system and assigned the responsibilities to those who would later make up the management team of the EnMS.

Prior to the implementation of the EnMS, the UTEM developed an energy diagnosis through a title work, this work, among other things, allowed to establish the significant uses of energy at the institutional level and thus establish that electricity consumption would be on which I would focus the SGE later.

At the time of establishing the objectives of the EnMS, an analysis was carried out of the projects that were already being executed in the institution and which of these contributed to the objectives established for the EnMS. The foregoing, in order to focus efforts and resources on the actions that were already being implemented, this strategy allowed adding activities to the EnMS plan on issues of technological spare parts, training and awareness.

The energy review is in charge of the EnMS Leader, who is in charge of carrying out the energy review at the institutional level, this review includes updating the significant uses and the record of electricity consumption at the institutional level, with this information it is monitored and established actions that improve energy performance.

The EnMS is implemented for the 3 main campuses that the university has. To carry out the actions that need to be implemented, the management team incorporates the supervisors of each of these campuses, who are in charge of supporting the implementation of the activities in their operations. In addition, the team is made up of cross-campus areas, these are: Directorate of Administration, Department of Works and General Services, Training Unit and Procurement Unit.

The Senior Management of the EnMS was assigned to the Directorate of Administration by the Rectoría. This direction was chosen because the largest number of activities related to university campus operations are concentrated here. Likewise, the financial resources for the implementation and maintenance of the EnMS are concentrated in the budget of the Sustainability Program.

***“The EnMS allowed us to identify the potential that the university had in energy efficiency and to reinforce our commitment to sustainability”***

— Christopher Toledo Puga, Coordinator Sustainability Program

### Do, Check, Act

The implementation process was led by the UTEM Sustainability Program, who were technically advised by an external company that supported throughout this period until obtaining the EnMS certification. With the initial support of the Rectoría, the units and departments that would make up the energy management team were identified and established, considering those areas that are transversal to all the campuses and the representatives of each one of them. For this team, specific training was applied on the procedures and operational controls that would begin to be applied in the institution. During this training period, feedback was also generated on the implementation of the EnMS and the action plan.

The senior management of the EnMS is also the head of all the units that make up the management team, therefore, they provided all the facilities and resources to incorporate the new responsibilities in the personnel that make up the management team.

The activities implemented in the action plan are broken down into three main areas: a) training and awareness, where training was focused on cleaning,

porter and maintenance personnel of the university. Likewise, awareness campaigns were carried out focused on the entire university community, these are: students, officials and academics; b) application and dissemination of operational controls, these were disseminated through mass emails to the entire community and then their effectiveness was verified through a visit to the facilities, performing a sampling of the operational controls applied, where it was determined that these are being applied; c) technological replacement of fluorescent lighting by LED lighting, in different campus facilities.

To determine if the energy performance had improved, the most relevant indicators were analyzed for the delivery of the educational process, for this the variables used for the development of the Baseline are used as the first reference approximation, such as the occupancy rate or variables environmental, which can be used to update and / or add energy performance indicators when said variables have a relationship with energy consumption.

The baseline is a quantitative reference that provides the basis for comparison of energy performance, which is determined for the year 2017, which is considered as a dependent variable. With the baseline, results of the declared energy objectives can be seen, as well as the results of dissemination campaigns or training.

For the construction of the electrical baseline, the statistical tools of Excel will be used to find correlations and, if they exist, obtain a regression with a mathematical model. In the absence of a representative model, the actual information from the previous period of electricity billing will be used as a baseline.

The independent variables used for the preparation of the Baseline Lines are detailed as follows:

- Average ambient air temperature
- Heating and cooling degree days (HDD and CDD)
- Occupancy rate: The occupancy rate will be calculated as the weighted occupation of students and

officials with academics (people), based on the number of days that each group performs activities.

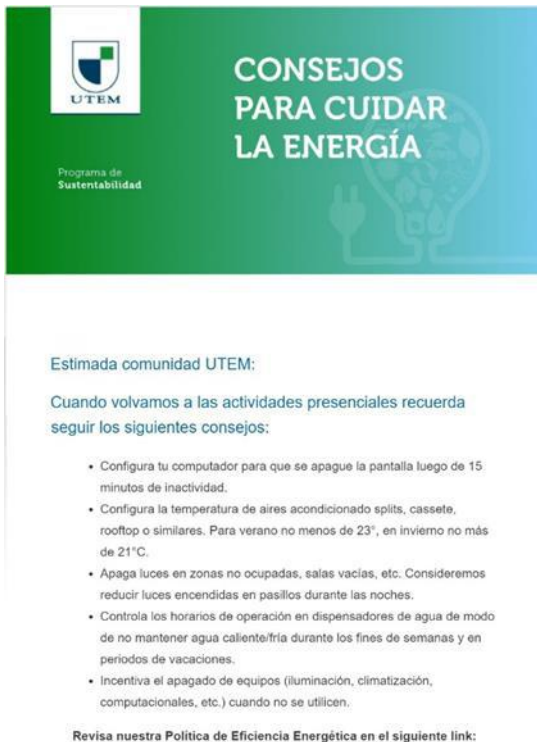
With the regression obtained from the dependent variable (2017 baseline consumption) and the independent variables (mean temperature, mean ambient air temperature, HDD, CDD and occupancy), a consumption is estimated for the current period which is compared with the real consumption for the same period.

The results obtained by campus for the years 2019 and 2020 are shown below.

Campus	Estimated Consumption 2019 (baseline 2017) (GJ)	Consumption in 2019 (GJ)	Estimated Consumption 2020 (baseline 2017) (GJ)	Consumption in 2020 (GJ)
Central	3.471	3.259	3.002	1.418
Providencia	789	756	495	306
Macul	2.968	2.500	2.186	1.394

Campus	Energy Performance Improvement in 2019 (%)	Energy Performance Improvement in 2020 (%)
Central	6	53
Providencia	4	38
Macul	16	36
Average Energy Performance Improvement (%)	9	42

The operational controls have been disseminated through informative emails to the entire university community, an example is shown below:



## Transparency

The UTEM informed the entire community about the ISO 500 organizational certification, through different digital media: Facebook, Instagram and internal press releases, see <https://noticias.utem.cl/2020/04/28/utem-certifies-iso-50001-energy-management-system/>

These controls are constantly reinforced through digital means and are also included in all the trainings that are developed associated with the EnMS.

Regarding the procurement processes, new criteria were included in the purchases of items that had significant energy use, for example, in the case of air conditioning equipment, it was established as a requirement that these be ecological, of this How the university ensures that it will meet energy efficiency criteria. In the case of the purchase of computers, it was established as a criterion that they had the energy efficiency label "Energy Star".

## What We Would Have Done Differently

- One of the improvements we have made after implementing and certifying the EnMS has been to adjust the procurement procedures and new projects, since there were some points that were not being fulfilled, since part of the staff did not have time to assume new responsibilities. Therefore, I believe that one of the improvements that I would implement would be to better study how to adjust the new procedures to the operation of the university, trying to minimize new tasks that the personnel that are part of the management team will have to assume.

The Energy Management Leadership Awards is an international competition that recognizes leading organizations for sharing high-quality, replicable descriptions of their ISO 50001 implementation and certification experiences. The Clean Energy Ministerial (CEM) began offering these Awards in 2016. For more information, please visit [www.cleanenergyministerial.org/EMAwards](http://www.cleanenergyministerial.org/EMAwards).



