Approach of energy indicator by end use to improve energy performance at the National University of Colombia - Bogotá, under the parameters of the ISO 50001 standard

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I. Introduction

Energy Management systems

The SGEs are born by the need of the entities to contemplate the use of energy from a complete perspective and that shows leadership with the interaction between all the levels of a certain organization, as well as support techniques to achieve continuous improvement of energy performance.
I. Introduction

ISO 50001 standard

In the regulatory aspect, the main reference is the ISO 50001 standard, which proposes parameters to establish an Energy Management System (EnMS) in an organization.
II. Energy Consumption in the University

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy [GWh]</td>
<td>727.19</td>
<td>864.12</td>
<td>895.77</td>
<td>881.4</td>
<td>972.78</td>
<td>289.53</td>
<td>917.29</td>
<td>929.02</td>
<td>968.24</td>
<td>861.13</td>
<td>740.9</td>
<td></td>
</tr>
</tbody>
</table>

Energy consumption in the National University of Colombia Bogotá (Year 2019)
II. Energy Consumption in the University

Energy consumption in building Uriel Gutierrez
II. Energy Consumption in the University

Energy consumption in building Uriel Gutierrez

Uriel Gutierrez’s energy consumption for the year 2021

<table>
<thead>
<tr>
<th>Months</th>
<th>Energy consumed in [kWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/11/2020</td>
<td>61.37</td>
</tr>
<tr>
<td>1/12/2020</td>
<td>56.85</td>
</tr>
<tr>
<td>1/01/2021</td>
<td>61.07</td>
</tr>
</tbody>
</table>

Pareto diagram for energy end uses

- Communication networks
- Illumination
- Heat production
- Refrigeration
- HVAC (Heat ventilation Air)
- Others
- Multimedia display
- Food warming
- Sound
II. Energy Consumption in the University

Energy consumption for Roberto Franco Station
II. Energy Consumption in the University

Energy consumption for Roberto Franco Station

Station’s energy consumption for the year 2021

<table>
<thead>
<tr>
<th>Months</th>
<th>Energy Consumed [kWh]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/11/2020</td>
<td>1897</td>
</tr>
<tr>
<td>1/12/2020</td>
<td>1900</td>
</tr>
<tr>
<td>1/01/2021</td>
<td>1720</td>
</tr>
</tbody>
</table>

Pareto’s diagram for final uses of energy in Roberto Franco Station

- Energy [kWh]
- Accumulated percentage %

Consumo Energetico [kWh]

- Food Refrigeration: 836,289 kWh, 66%
- Toilets: 294,248 kWh, 25%
- Computers: 74,24 kWh, 91%
- Refrigeration: 64,132 kWh, 96%
- Illumination: 30,682 kWh
- Food preparation: 12,33 kWh
- Video playback: 6,428 kWh
- Peripherals: 4,467 kWh

Total: 100%
IV. Defining the evaluation indicator by type of building

\[
\text{Total energy period} = \sum_{i=1}^{n} (d_i \times E_{\text{daily}_i})
\]

Where:
- \(d_i\): Number of days’ type \(i\) in the period
- \(E_{\text{daily}_i}\): Daily energy consumed on day type \(i\)

Energy performance improvement measurement using energy baselines and energy performance indicators (adapted from GTC ISO 50006)

\[
\text{IDE (E use)} = \frac{\text{Energy}_{\text{final use}} \ [\text{kWh}]}{\text{Energy}_{\text{total}}}
\]
IV. Results

IDE for Building Uriel Gutierrez and Roberto Franco Station

![Graph showing IDE final use in Uriel Gutierrez Building]

![Graph showing IDE energy consumption areas in Roberto Franco Station]
V. Conclusions

In order for the university campus to have an energy management system implemented and in operation in the future, an intelligent energy measurement system is required that feeds the energy performance indicators, in the same way, to be able to implement the IDE by uses it is necessary that a load survey of each building is carried out at the university and the typology of each building, must be known. The per-use IDE should not change if the end-use percentages do not change over time References.
VI. Questions