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Proposal for analysis and improvement of the quality of electrical energy used at the Universidad Tecnologica del Sureste de Veracruz (UTSV), analysis period 2014-2015

Electrodomésticos de CA en una nanored doméstica de CD

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Abstract

Today it is becoming more widespread use of electrical equipment and sensitive electronic and continually electricity demands increase so it is essential that the facilities are conducted with adherence to current regulations and have obtained adequate protection equipment equally reduce disturbances in the national grid and installation depending on the application, for which it is important to establish coordination between the utility, manufacturers of electrical and electronic equipment and the users themselves because in this case We are dealing with the educational sector, directly talking about a Universidad Tecnológica del Sureste de Veracruz (UTSV).

Energy, Quality, Economy, Methods, Consumption

Resumen

En la actualidad cada vez es más extendido el uso de equipo eléctrico y electrónico sensible y continuamente las demandas de energía eléctrica se incrementan por lo que es indispensable que las instalaciones se realicen con apego a la normatividad vigente y se cuente con equipos de protección adecuados de igual forma se reduzcan los disturbios en la red eléctrica nacional y de una instalación en función de su demanda, para lo cual es importante establecer una coordinación entre la compañía suministradora, los fabricantes de equipos eléctricos y electrónicos y su vez los usuarios mismos ya que en este caso tratamos con el sector educativo directamente hablando de la Universidad Tecnológica del Sureste de Veracruz (UTSV).

Energía, Calidad, Economía, Métodos, Consumo

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Introduction

The purpose of this article is to provide information on transients and voltage disturbances that sometimes occur in power and low voltage circuits of this, the Universidad Tecnológica del Sureste de Veracruz (UTSV) while implementing actions that are committed to energy saving.

The transients and disturbances considered in the scope are limited to disturbances whose duration is less than half a cycle of the waveform as well as power interruptions that occur at undetermined times and that in turn hinder the continuity of teaching and administrative tasks. while the equipment inside the (UTSV) is not working.

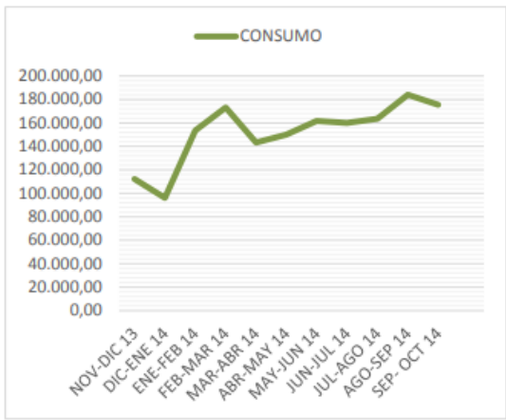
It is difficult to assign limit values to some of the characteristics of the transients because their effect and therefore their impact depends on the nature of the equipment subjected to these disturbances, since it can damage some, others it can temporarily modify its performance, or it does not cause any problems.

Based on the ―IEEE STD 1159-1995‖ ―Recommended Practices on Voltage Transients in Low-Voltage Alternating Current Power Circuits.

It is not sought to establish the performance parameters of protective equipment, but to present the guidelines on the application parameters of the same, as well as the corresponding actions to be implemented by the maintenance, administrative and teaching staff, as well as the awareness of energy saving in the Universidad Tecnológica del Sureste de Veracruz (UTSV).

Antecedent

Due to the rate structure of the sector, the medium voltage rate *(HM), which is the rate that is currently supplied by the (UTSV) and is the third most expensive in the country, not without first mentioning that due to deficiencies in electrical installations with Low quality presents a high consumption of energy causing a direct economic impact (graphic 1) for the educational institution in this case the Universidad Tecnológica del Sureste de Veracruz (UTSV) which has sophisticated equipment of laboratories and computer equipment itself that they need to operate in ideal conditions speaking in parameters of energy quality and for this purpose joint actions are being implemented between students, teaching staff and administrative staff of the institution to reduce the consumption of electrical energy, not without first mentioning that there are still harmful variables in each institution is the turn of the same that contribute to a poor quality of energy consumed.



Graphic 1 Approximate billing amount in the period 2013-2014 in the UTSV

We can define the quality of energy as the amount of energy that can be supplied to the equipment in an electrical installation with the appropriate characteristics in terms of defined variables such as (voltage, intensity, frequency, power, etc.).

These are necessary to maintain maximum efficiency in the equipment interconnected to the main supply network.

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Therefore, variables and terms like:

- Transients.
- Flickers.
- Wave amplitude.
- Low voltage.
- Sudden over-voltage.
- Frequency.
- Harmonics.
- Power factor.

They are common to carry out a qualitative analysis of the conditions in which the institution operates, in this way the power factor is addressed first hand, which is a very strong conditioning factor that impacts the economic part of the institution, as shown in (graphic 2) in the lower part the (f.p) has remained stable at an average of 95.47% during the period from 2014 to the date analysed February 2015.

Noting thus and considering that currently the company C.F.E "FEDERAL ELECTRICITY COMMISSION". Considers optimum a power factor greater than 90%, it is concluded that this condition is satisfied in the institution.

Considerations

It is worth mentioning that the company C.F.E manages standards in the sense of penalties and bonuses, benefiting the institution in the last months of monitoring.

And like any project, you need to know what the benefit of power factor correction is. And indeed, it is:

- Reduction of electrical losses in the conductors.
- Reduction of voltage drop losses.
- Increased availability of transformers and distribution equipment commonly called “reliability”.
- Increase in the useful life of the installation.
- Reduction of the cost of service in the billing period.

According to C.F.E the behavior of the power factor, a penalty will be applied when the P.F. <90% and a bonus when the P.F. >90% using the following equations where:

$$B=\frac{1}{4}\left[1-\left(\frac{90}{F.P}\right)\right]*100$$

$$P=\frac{3}{5}\left[\left(\frac{90}{F.P}\right)-1\right]*100$$

B: bonus (-%)

P: Penalty (+%)

P.F.: power factor (%)

Condición de facturación.	% máximo aplicable.
BONIFICACION.	2.5
PENALIACION	120

Table 1

In such a way that in the UTSV it was possible to exceed the nominal value established by C.F.E as optimal, having an f.p = 95.47% average during the entire billing period from February 2014 to January 2015.

Result 1

Said benefit was obtained by the replacement of more efficient transformation equipment and load distribution in the distribution equipment internal to the institution, since initially there were voltage fluctuations and hot spots originated in the areas of poor conduction.

Figure 1 CT'S current transformers with weakened conductor and in poor conditions.

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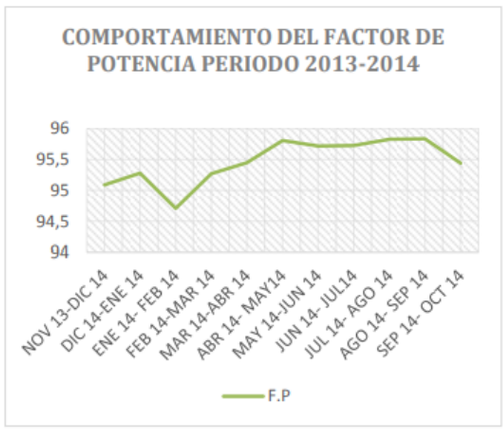
Not so, it is considered that due to the main business of the educational institution, a slightly irrational use of electrical energy is detected, which seeks to implement actions with the students, teachers and administrative staff that reduce the time of use of the lights, equipment inviting to reduce the period of suspension of computer equipment until reaching the possibility of implementing proximity sensor equipment so that they act when students and staff are not in the classroom or cubicles.



Graphic 2 Power factor UTSV billing period 2013-2014

Conditions of the current electrical installations in the (UTSV)

Currently the facilities of the (UTSV) are in a general maintenance phase since the expansion of the infrastructure requires more load consumption, for this reason it is important to detect failures in time and determine the fluctuation rates of the load in order to ensure energy quality within the institution. (fig. 2).

Figure 2 Switching station of the (UTSV) with hardware recently replaced and under maintenance.

Figure 3 Set of switching substation and current transformers TC'S

Analysis of electrical infrastructure in the (UTSV)

The Technological University of the Southeast of Veracruz (UTSV) currently has equipment of different utility, especially in workshops, due to this situation (table 1) mentions the number of them, giving an estimate of the load installed in the institution based on the following: perform the following analysis:

EDIFICIOS	POTENCIA MAXIMA CONSIMIDA*
EDIFICIO DE DOCENCIA "A"	15.023KWH
EDIFICIO DE DOCENCIA "B"	13.00 KWH
BIBLIOTECA	4.2 KWH
TALLER DE METROLOGIA	1.5KWH
TALLER DE ELECTRICIDAD Y MECATRONICA	2.5 KWH
TALLERES DE INFORMATICA	3.5KWH
TOTAL (KWH)	39.723

Table 2 Average consumption of the institution by areas of greatest impact

Developing methodology

The parameters that make up the power quality are commonly governed by the relevant regulations for this case, the "IEEE STD 1100-1999", in such a way that the power quality analyzer will be used for the analysis of its operating conditions. mca: hioki 3197.

Which has the characteristic of performing the on-site analysis of the energy quality conditions, taking into account the current regulations and the possible basic conditions of operation in the installation through the entity that monitors the energy sector in this case C.F.E.

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Figure 4 Hioki 3197 power quality analyzer.

Mainly what is sought in the diagnostic analysis with the hioki 3197 equipment. It is:

- Qualitatively determine the installation of the main supply equipment and its grounding.
- Power quality upon arrival of the delivery team to assigned areas.
- Detection of current leaks and/or hot spots by means of thermography.

Result 2

Figure 5 Inspection and analysis of power quality - in situ with hikoi 3197 equipment

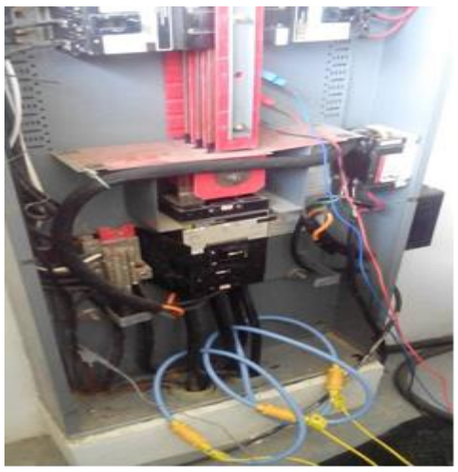

Figure 6 Current clam connections of the power quality analyser equipment

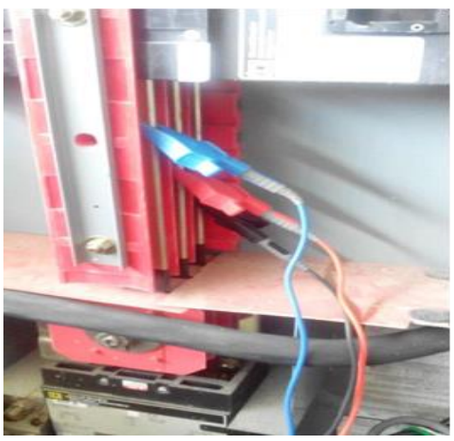

Figure 7 Connections for voltage detection of the power quality analyser equipment

The three points essentially mentioned above are considered to have a great impact on what is the utility of energy, functioning as main factors of large-scale and long-term electrical failures.

Therefore, it was detected that there is an overloaded power supply phase in the workshop area.

LINEA (V1)	VALOR VOLTAJE (VOLTS)	CORRIENTE (AMP)
V1	124.1	12.53

Table 3 Values obtained from the power quality analyser taken from the main distribution centre to laboratories.

As far as (figure 7) corresponds to the line The main distribution module which is illustrated in the figures shown above.

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Figure 8 Appreciable current unbalance in phase 2 (V2)

The procedure was to verify at that moment which was the largest load that was being consumed and in which workshop to detect the possible anomaly.

On the other hand, the participation of the university community, especially (teachers and administrative staff), is very important, since they are normally in continuous contact with teams that are employed on a day-to-day basis.

For this reason, there is a strong possibility of carrying out a preliminary investigation of the tests with the hioki 3197 analyser equipment. This calls for questions such as:

- Are there occasional flickers on the equipment?
- How and when does the problem occur?
- Many teams manifest the same problem?
- What time does the problem occur?
- Are there abnormal temperatures in the equipment?

For this purpose and in the same way, the topography of the electrical installation must be taken into account. Specifically to locate possible origins of the faults and also in which points the hioki 3197 power quality analyzer equipment has to be placed.

It is very important to take the parameters of the input energy from the supply company C.F.E, as well as the data plate of the arrival transformers from medium voltage to low voltage, types of connection to service, size of the conductors and date of the last electrical maintenance activities carried out on the equipment.

Acknowledgment

The present progress of research and improvement work is being carried out by the academic body in degree of "in consolidation" of the industrial area maintenance career of the Technological University of the Southeast of Veracruz (UTSV), which is in charge of Ing. Edgar Fidel Toledo Matus Rector of the maximum house of studies of the cd. From Nanchital de Lázaro Cárdeno, to whom we thank for their valuable and timely support for making this study possible, in addition to thanking the time and dedication of our fellow teachers and students who have participated in this improvement project.

Conclusions

The electrical equipment represents the main energy consumption in an electrical installation, regardless of the type of activity, for this reason it is of the utmost importance to minimize energy consumption or to use exactly each (kwh) in the task that is required.

What is planned to be done with this study is to create mainly a plan for saving energy and in the same way a new culture for saving it among the teaching staff, administrative staff and students in general.

From this, the reason for being able to reduce to the minimum the amount of energy that the university invoices month after month to the energy company becomes important, since this action indicates a not very encouraging situation, since the additional consumption not only generates more contamination, but also produces an excessive spending of money on concepts of billing and maintenance to the technological university of the southeast of Veracruz.

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All this reflects that a complete culmination has not yet been reached in terms of correcting and mitigating excessive energy consumption, however, the group in which we work to reduce this problem will continue to work on the occasion of continuous improvement for the electrical installation. university in general.

References

"Fideicomiso para el ahorro de energia electrica". (2007). Mexico, D.F., México.

Gobierno de la Républica. (2013). Reforma Energética Resumen Ejecutivo.

HARPER, E. (4TA EDICION). CURSO DE TRANSFORMADORES Y MOTORES DE INDUCCION. LIMUSA NORIEGA EDITORES.

Harper, H. (3era edicion). Curso de transformadores y motores de inducción. NORIEGA EDITORES.

RAS, 2.-E. (7MA EDICION). TRANSFORMADORES DE POTENCIA,DE MEDIDA Y DE PROTECCION. MEXICO: ALFA-OMEGA.

SENER. (2015). AHORRO DE ENERGIA. MEXICO, MEXICO, MEXICO.

TIPLER. (2003). Fisica para la ciencia y la tecnologia. Barcelona, España.

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