EGS

Energy Efficiency and Sustainable Development in Schools

Guide for preparation of the Action Plan

ENERGY EDUCATION GOVERNANCE SCHOOLS

1. Introduction

This document is a guide for developing and implementing an action plan for energy efficiency in schools under the project **"EGS - Energy Efficiency and Sustainable Development in Schools**"The responsibility of **Center for Business Initiatives Aguieira Beira - IEBA.**

The Sustainable Development and, a fortiori, Energy Efficiency are "values" involving a constant work by the leaders of organizations (manufacturing companies, services, government agencies, schools, etc..) Since the requirements are always increasing as a function of framing environmental, technological and social, is not therefore compatible with stand alone.

With regard to energy efficiency is a consensus that depends both on technological and operational factors (organizational). In fact, it's not just a technology is more energy efficient that is guaranteed to improve facility performance. Actual conditions of operation and use of this technology are also determinants.

It is therefore essential to ensure that energy is used more efficiently, reducing energy losses and optimizing the conditions of acquisition and consumption. This requires a systematic approach. In this context, the implementation of a system power management is of great importance since it facilitates endogenization the concepts of sustainability and energy efficiency in the daily practices of an organization, as well as the need for its continued improvement.

An energy management system should consist of the following components:

- an energy policy drawn up by the top management of the organization;
- a strategic plan that includes an energy measurement system and documentation management;
- a multi-disciplinary team responsible for implementing the various actions led by a manager - the manager of energy - which will report directly to top management;
- a set of procedures and guidelines related to various aspects of energy, since its purchase and consumption;
- a manual power management, to ensure consistency in the various activities related to energy management and efficiency;
- indicators of "energy performance" to assess the evolution of the organization in the context of energy management and energy efficiency;
- rules for the dissemination of the results over time.

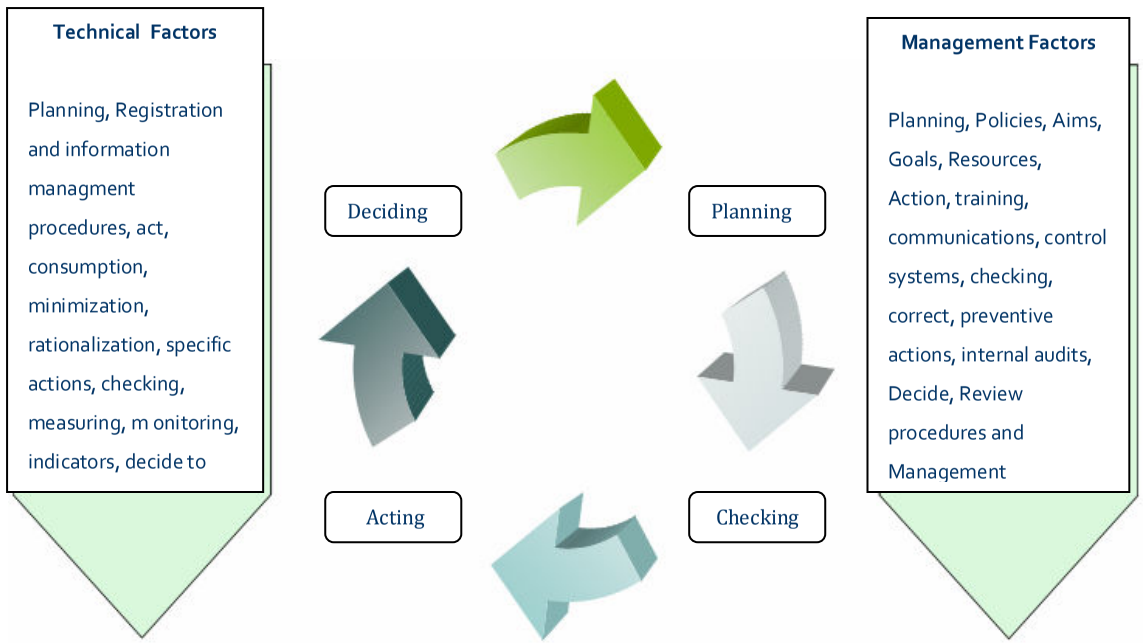

Figure 1 - Energy Management System. Factors in technical fields and management.

In the scheme of Figure 1 shows the division between technical fields and management (organizational), the various aspects of the system power management.

The implementation of a system power management is a process whose complexity depends on the nature of the facility and organizational entity itself. The following figure shows the various steps that can be the implementation, divided into four phases:

- the first phase of planning, which aims at preparing the various aspects of system implementation;
- the second, which corresponds to the operational implementation of the procedures previously established and designated to be dai action stage;
- the third, which corresponds to the work of verifying the results and, finally;
- the fourth and final phase of the correction of discrepancies and adoption of corrective measures.

	Planning	Action	Checking	Correcting
	Energy Survey ⇩ management commitment ⇩ appointment of energy managers ⇩ policy definition of power ⇩ responsibilities define ⇩ elaborate action program ⇩ set goals and objectives Define action plan.	Plan information awareness ⇩ evaluating resources ⇩ implement projects ⇩ monitor progress ⇩ set new goals ⇩ communicate results ⇩ celebrate good results	Analyse results ⇩ Check effectiveness ⇩ Examine conditions for improvement ⇩ Correcting	Correct deficiencies ⇩ Reviewing policies ⇩ Reviewing objectives and targets ⇩ Action plans to update Restart

Figure 2 - Steps in implementing an energy management system.

2. Action Plan. Assumptions

The action plan recommended for this project was developed based on the fundamentals of energy management systems, presented briefly in the previous chapter. The specifics of the educational and organizational structure, beyond the information gathered in visits.

The dynamics that implementing any system for energy efficiency requires justifies the involvement of top management of the school as well as a proper policy of publicizing the plan and its work.

However, it is noted that due to the dynamics of such organizations, those responsible for plan on energy efficiency should take a more pro-active in raising awareness both of her own top management wants from the other elements that belong to the organization.

The proposed plan consists of five phases, presented in the following figure, and the main results.

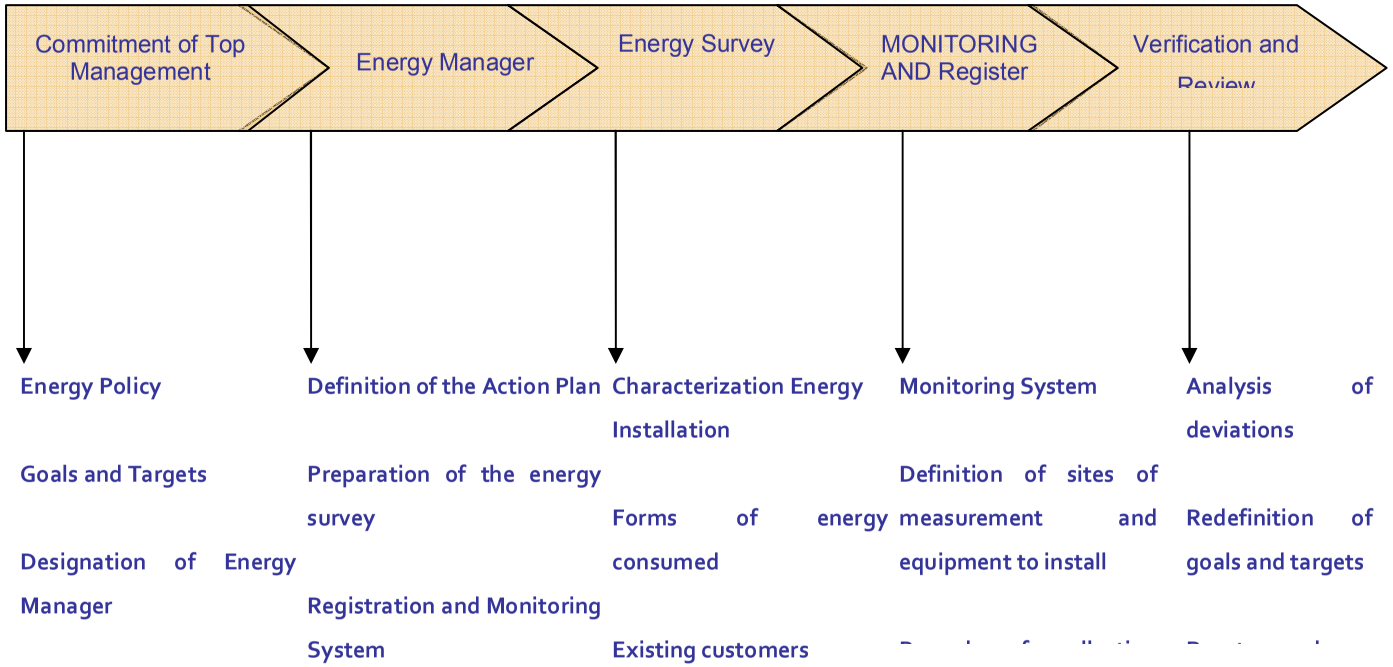

Figure 3 - Phases of the rationalization plan.

3. Action Plan

3.1 Commitment of Top Management

As for the management of various resources, material and financial resources available in an organization and establishing it is important that top management take and disclose its objectives regarding the use and consumption.

Should adopt an energy policy that reflects your vision, the medium and long term, the energy performance of the organization, establish goals and objectives, specific and measurable, in relation to how energy should be used. Initially it is permissible to be drafted a "declaration of intent" to allow a endogeneisation the various aspects and factors related to energy use and its management in the organization.

The way the top management announces energy policy or intention is important to ensure a significant impact across the organization's structure, since it is essential to mobilize all employees. Thus, this disclosure must be clear and accessible to all.

Another important factor for evidence of involvement of top management is the designation of an official to ensure compliance with what is advocated in energy policy or statement of intent - the energy manager. In addition to his responsibilities should be well known and their consistency in hierarchical organization. In many cases, the energy manager can create a team, which will also see their skills publicized.

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In the case of schools the declaration of an energy policy may not be feasible at first.
One should therefore adopt a "Declaration of Intent

The top management should be involved directly in the time of evaluation results at the end of a period of work, contributing to the analysis of possible gaps and establish new goals and objectives, if necessary.

3.2 The Energy Manager

The energy manager has the task to develop an action plan to ensure compliance with energy policy. Should be someone with expertise in the area and with easy access to management in order to more easily be able to present and justify investments and other actions needed.

The energy manager has a key role in the organization's efforts with regard to the rationalization of consumption and energy efficiency management. You should have a daily concern with energy costs and how energy is consumed in the company in order to more easily find solutions that lead to improved energy performance.

It is the responsibility of the power manager to know with accuracy the reasons of energy consumption in the company, and how it is consumed and costs. It is also your responsibility to draw up an annual plan of power should be defined the objectives and targets and means.

The functions of the energy manager will be more easier it is facilitated when their access to top-level decision, thus allowing it to influence directly.

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We recommend the creation of a working team, whose primary concern is the performance of the lift system and energy monitoring and recording.

3.3 Energy Survey

The completion of an energy audit or survey of a facility, should match the first step of implementing a plan for energy efficiency. In the first case, it is an instrument of an operational nature that provides information on the installation, including:

- quantify the overall energy consumption of an organization, department or section;
- identify forms of energy consumed in the organization, department or section in question;
- existing consumers and their characteristics in the context of energy);
- flows and energy transformations that occur at the facility;
- relate the power consumption with the activity of the organization;
- evaluate the effect of energy use have been implemented.

With the completion of the survey will be possible to know the energy flow "energy" of the organization, department or section, which is essential for a proper energy management.

In situations where the energy survey is conducted for the first time, its sensitizing potential is high, since it can lead to awareness on the part of the senior, the energy situation of the organization. This awareness is essential to ensure the implementation of the plan for energy efficiency.

Where management practices are already made endogenous energy in the organization, raising energy is assumed as an operational tool of great value, since it allows, expeditiously, to assess the energy performance of the organization, department or section and to evaluate the effect of any corrective actions or, finally, highlight the need for adoption of such measures.

It is considered of interest to note that the energy survey is a different instrument from an energy audit. The energy audit is designed to perform a detailed examination of the conditions of energy use in the organization, department or section in order to be able to develop their energy and mass balances.

Thus, besides the identification of forms of energy consumed is necessary to identify and characterize the processes of energy transformation. Thus we can quantify the energy losses and to define the minimization and energy recovery. It is, therefore, a task more demanding of information needed, often only possible with the measurements of the field, and more expensive.

However, to ensure an adequate power to carry out energy audits is essential, although it can be done at a lower frequency than in the case of the lifting power. Performing the energy audit should result in a rationalization plan and its implementation program.

In the legal domain, the companies considered energy-intensive, are required to perform an energy audit every five years[1]. The technicians responsible for conducting audits must be accredited by the Directorate General of Geology and Energy, according to the company's economic activity.

Step 1 - Identification and quantification of energy consumption

In this step should be identified as forms of energy consumed, for example, electric power, natural gas, propane, diesel, etc.., And quantified their consumption. In the case of supplies on which there are different types / levels of supply (in case of electricity and gas) consumption should be recorded for different periods or steps.

In some cases there may be partial energy meters, ie by department, section, or consumer. This information is valuable since it allows for more detail on the characterization of energy consumption and the (s) consumer (s) member (s). The information should be systematized, for example, through a table.

The determination of consumption must be made for the same period of time and energy for the same unit, thus allowing comparison between the various forms of energy consumed. With these data it is also possible to prepare *consumption structure* installation, ie, the determination, in percentage terms, the consumption of various energy sources used.

[1] Decree-Law No. 52/82 of February 26 and Ordinance No. 359/82 of 7 April

The energy unit most often used to express the consumption of various forms of energy is **Tonne of oil equivalent - toe.**

The toe is a unit of energy defined as the amount of heat released by burning one ton of crude oil, whose composition results from the mixture of crude oils with different origins. On average a toe corresponds to 42 billion joules or 42×106 J.

Since the composition of crude oil considered for the establishment of the toe can vary the offsets for other forms of energy may also vary. The following table shows the inputs used for the conversion in the case of the most common units in accordance with Order No. 17313/2008 of June 26. (For more information http://www.adene.pt).

The table below provides an example for the recording of information in this step.

Table 1 - Table type for recording the quantities of energy consumed in a facility

Name of entity	Global Energy Consumption			
	Year		Period	
	Local			
F. Energy	Value	Value (toe)	% Of total	Resp.
Global observations				
Reviewed by		Date		

Step 2 - Identification of Customers

At this stage must be identified several existing customers on the premises, their characteristics in terms of energy, operating system and operating conditions, namely that the variable that induces the energy they consume. These factors should be listed and linked to the activity of the organization.

The registration of consumers can be made based on its type, its place of consumption, or even by the factors outlined above. Neither form of registration exclusive. In fact, the creation of a registration system that allows consumers to index as a function of several variables is important to further facilitate the understanding of energy flows in existing facilities.

The written record of the operation of a type of consumer or consumers and their impact on energy consumption is important for assessing the adequacy of pricing options. Moreover, his analysis will identify measures leading to diversion, reducing or minimizing consumption.

The systematization of the information obtained in this part of the survey depends on whether the energy level of detail of data obtained either from the "group" of consumers who may have made. In many situations it is common to systematize the information pertaining to consumers, according to the area or department of the company, as shown in the figure.

At this stage of the lifting power is also important to characterize the organization of production, that is, why is power consumption. If in the case of secondary sector entities to characterize the production is something common in the case of the tertiary sector this may not occur.

In this sector organizations and within an energy audit or survey the number of service hours, the m2 or m3 occupied or even number of services are ways of accounting for production.

Similarly to the characterization of energy consumption information relating to consumers and the production of the organization should be systematized on suitable media. The following tables represent two examples of how to do this systematically.

Table 2 - Table type for the registration of consumers, their characteristics and areas of influence

Name of entity			Energy Management System Identification and characterization of consumers						
Designation	No.	Function	Catchment area	Pot. (KW)	No. of hours	Total hours	Cons. Expected (kWh)	Cons. real (kWh)	Sis. Med
Global observations									
Reviewed by			Date						

Table 3 - Table type for the registration of consumers by area or sector.

Name of entity		Energy Management System Characterization of Consumption by area	
Area	Function	Consumer	Power Consumption
Global observations			
Reviewed by		Date	

Step 3 - Energy Accounting. Results Analysis

Within an energy lifting the designation "*energy accounting* " refers to the processing of data obtained in earlier phases in view of calculating and determining a set of variables and energy indicators.

So, after collecting information on energy consumption and consumers can analyze data in order to characterize the current situation of the facility and *establish the baseline* from which to set objectives and targets for specific projects.

If you have already been carried out a survey at a time before energy, information analysis will determine the differences between the two moments and analyze and understand more generally the result of measures have been adopted.

In general, the energy accounting should be performed to determine:

- Global consumption in tonnes of oil equivalent (toe), organization, department or section, depending on the period considered and production;

- consumption structure, ie the percentage of various forms of energy consumed relative to global consumption - consumption structure;

- the distribution of energy consumption over the billing periods or steps - load diagrams;

- the relationship between forms of energy consumed and production values;
- the relationship between global energy consumption and production by linear adjustment methodology or CUSUM;
- energy flows in the installation and amounts of energy involved;
- the definition of a control chart and its values.

With regard to the most widely used energy indicators, for legal reasons, is the specific consumption. This indicator expresses the amount of energy consumed in toe's, per unit produced. The comparison with the value defined legally as a function of economic activity code, called the specific consumption pattern, compares the situation allows the organization to analyze and calculate the quantities required to reduce consumption over five years if the value is not legal fulfilled.

However, other indicators may be defined for those responsible to consider the interest in energy management. This definition could be based on:

- sectoral energy studies;
- studies of specific technologies;
- objectives of the organization itself.

3.4 The System Monitoring and registration.

With the completion of lifting energy is the energy manager and his team have a "*photographic image* " the installation, which can identify the correct points less in energy management. Thus, in a context of sustainability, it is important to ensure a continuous and systematic monitoring of energy consumption, consumers (equipment) and their use schemes.

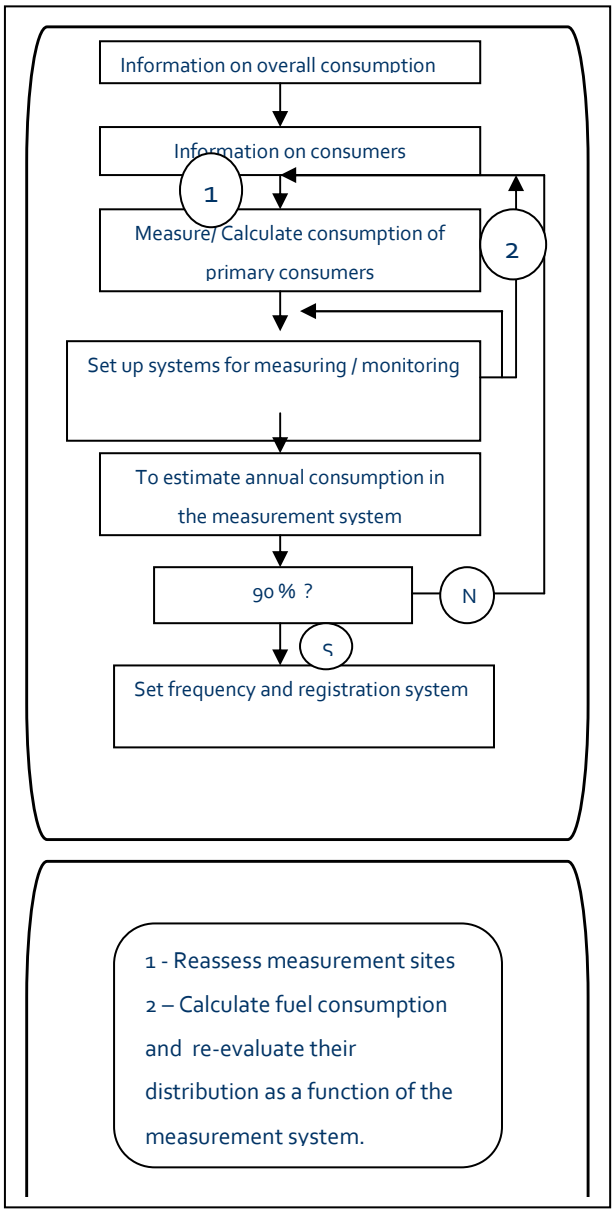
It is therefore important to implement a system for monitoring and recording of data deemed relevant to ensure *"Surveillance"* installation, check on the result of measures implemented to evaluate the performance of previously set objectives and targets and identify more quickly consumption deviations.

The implementation of monitoring implies that the variables are selected in advance to monitor and where they should be installed measuring equipment.

It is considered important to stress that monitor consumption beyond the information obtained by actual measurement of energy consumption (through the use of safety devices) may also be made through consumption calculated based on the readings, for example by the difference between readings. In this case it is referred to as indirect measurement.

It is considered good practice for energy management to ensure that at least some 80 to 90% of energy consumption is directly measured. In this context, the successive increase in consumption can be measured directly from a

Given the cost of measurement equipment that can represent the implementation of a monitoring system will involve the phased implementation of such equipment. In **figure** presents an algorithm that can be used to assess the need for implementation or not of a measurement equipment.



To ensure that collection of information regarding the actual consumption is due will define a process to ensure simple and automatic measurement, particularly with the use of equipment that allows for storage of data and send your remote (wireless, Internet, etc..).

Another important factor is to ensure adequate procedures for reading consumption and ensure adequate technical capacity in order to ensure that the primary consumers are being monitored. On the other hand it is also important to ensure that a consumer is properly assigned to a consumer.

Figure 4 - Algorithm for the monitoring system.

The measurement of consumption alone will not save energy but the actions / measures that result from them. On average, the savings due to implementation of an adequate monitoring system is being 5 to 10% of global consumption early.

Besides ensuring an adequate system for monitoring is also important to implement a registration system that allows, in addition to file the information collected, information processing, and also constitute a fundamental part of the supporting documentation of a management system energy.

The power manager to see an elaborate set of procedures to ensure the collection of information with the desired frequency and effectively, but also ensure their proper registration and processing of information. The documents, including tables that may have been used during the energy survey is a good starting point for monitoring and recording system, provided it is ensured the proper registration of the measuring frequency.

By way of example in the figures below are a few tables kind that could be used as a means of recording and processing of information.

Table 4 - Type table for registering the electricity consumption

Name of entity		Monitoring Consumption Electricity		
		Meter Reading		
		Freq. Reading		
Date	Reading	Difference	Remarks	Resp.
Global observations				
Reviewed by		Date		

Table 5 - Table type for the recording of gas consumption

Name of entity		Monitoring of Conjuice Gas		
		Meter Reading		
		Freq. Reading		
Date	Reading	Difference	Remarks	Resp.
Global observations				
Reviewed by		Date		

Table 6 - Type table for registering the consumption of a certain form of energy for the consumers

Name of entity			Energy Management System Aggregate Consumption		
Form of Energy	Cons. Total	Sis. Med	Consumer / Cons.	Description	Sis. Med
	Total				
Global observations					
Reviewed by			Date		