Electrical Energy Management in the Hospital Environment

a report by

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Introduction

A shortage of funds, combined with the continuous growth in the consumption of electrical energy, is leading the Brazilian energy market towards facing serious problems, with a recent crisis of electrical energy supply and a risk of programmed blackouts to avoid the system's collapse. That crisis reinforced awareness of the need for energy conservation and its financial benefits. Healthcare units, mainly hospitals, are institutions that depend essentially on electric energy and must continue operating on low revenues in a market that is becoming more competitive each day.

More than being just a local problem, energy shortage is an increasing predisposition worldwide. This problem is even worse for the healthcare sector of the low-industrialised Latin American countries, where the hospitals are identified as great energy consumers.

An energy management programme could range from simple actions, such as awareness campaigns, to complex solutions engaging more investments and long-term revenues, such as co-generation plants. Nevertheless, the commitment of all hospital communities is extremely important, especially that of higher administration, for the implementation of a successful programme.

The in-house technology and facilities management groups, facilitated by their knowledge of the institution's systems and operating technologies, may perform a valuable role by proposing, setting up or supervising such programmes.

Electrical Energy Management Programme

An energy management programme is applicable not only to electrical plants, even though in Brazil electrical energy is certainly the most used method of energy transmission inside the hospital; therefore the greatest opportunities of saving costs should be based on electrical energy management.

An energy management programme should include a characterisation of the energy type and its applications, characterisation of typical consumption, evaluation of facilities and systems, evaluation of supply contract and other possibilities of acquiring energy, identification and evaluation of energy-saving opportunities and, finally, development of an action plan to implement and review the programme. This process should be continuous, being constantly revised in an effort to discover new opportunities.

Electricity can be described as an intermediate form of energy between its source and final application. There are few processes that use electricity to directly produce a result, but it is often transformed via other energy types (such as heat) that will produce a desired result. Therefore, it is important to pay close attention on energy losses by transformation within systems at the hospital.

Characterisation of typical consumption should be performed by collecting and analysing the electricity billing of two (or more) past years. Billing can inform of consumption data and its cost components, which can be plotted in graphs that will allow identifying the typical consumption pattern and its abnormalities. Those graphics can be used to project the future energy consumption and as a useful evaluation tool of the programme.

The evaluation range of the hospital facilities and systems will depend on the programme's scope. Nevertheless, it is an opportunity to know better the hospital operation and its patterns. Therefore, information about the units' operation periods should be collected, a list of equipment and systems that are great energy consumers should be made within its operational patterns, as that data would support the identification and evaluation of energy conservation opportunities. The electricity billing contract should be re-evaluated using that previous information. New conditions on the electricity billing structure and alternative energy sources should also be considered.

During the data acquisition process, preliminary identification of energy conservation and cost-reduction opportunities should be undertaken. Those opportunities will be assessed in terms of their

costs, benefits and technical feasibility. Through analysis of all collected data, new opportunities may also be identified.

Finally, an action plan is elaborated containing the elected energy conservation opportunities, goals and means of re-evaluation the plan. During this process, new opportunities may be found. This plan should consider an implementation sequence that one action may generate resources, through savings, for the next activity.

Opportunities of Energy Conservation

Some common electric energy conservation opportunities found in hospitals are presented here. It is important to note that those opportunities may vary from one institution to another because they are directly related to the unit's characteristics.

Electrical Fittings

Hospital electrical cabling may be responsible for energy losses. Fittings that have been under-specified and without charge balance may produce energy losses due to heating of the wiring, in addition to the risk of short-circuit, fire and other problems. Therefore, a good design and proper maintenance of electrical fittings, more than just a matter of safety, is also important for energy conservation.

Another point to be considered is the excess of reactive power. In Brazil, electrical fittings with a power factor lower than 0.92 are subject to expensive charges for excess of reactive power. If detected, this problem can be solved easily with a capacitor bank.

Lighting Systems

The lighting system is responsible for a considerable amount of energy consumption. Therefore, energy conservation opportunities in this system may save a great deal. Among other opportunities, by adjusting the lighting levels for each environment, the use of higher efficiency lamps and light fixtures, the use of presence sensors (a less expensive technology nowadays) and a comprehensive programme of maintenance and cleaning, considerable electrical energy savings can be achieved.

Air-conditioning Systems

In Brazil, most air-conditioning systems are used for environment cooling. Choosing the most suitable equipment with the highest possible efficiency is the first step towards energy conservation on this system. Proper periodic maintenance of parts and equipment associated with the air-conditioning systems, including cleaning of heat exchangers, cleaning air outlets, repair of ducts, periodic substitution of filters and proper heat isolation of conditioned sites are some of the many functions that could improve efficiency and reduce consumption.

Campaigns focusing on proper use by hospital personnel and automation of the system, by applying sensors and better controls, are actions that reduce the workload of the system and consequently its energy consumption.

Demand Management

As well as reducing electricity acquisition cost, it is also possible to save by controlling load demand at times that the cost is greater or when there is the risk of breaching contracted values. This could be accomplished by means of altering the work routines of some units, avoiding the use of non-emergency equipment in those periods and employing emergency generators to supply a part of the hospital's demand. This may be feasible as breaching penalties are often more expensive than other types of fuel such as diesel.

Alternative Energy Sources and Co-generation

The implementation of solar water heaters and co-generation plants may provide great opportunities for energy conservation in large hospitals. As well as these options, there are gas water heaters and variety of steam boilers that work using less expensive energy sources then electricity.

A fact to consider is that, for the Brazilian economy, long-term investments such as implementation of co-generation plants may be difficult. However, with the alternative of natural gas use (a less expensive fuel) increasing in some cities, this kind of investment may become safer and more affordable.

Conclusion

An electrical energy management programme, even one that simply involves the application of basic low-cost solutions, may result in great energy savings, especially in hospitals where no energy conservation efforts have so far been undertaken. Another important fact is that energy management is an activity that could be performed, or at least initiated, by in-house technology and facilities management groups, adding value to their work.

It is important to seek out information about how electrical energy is acquired and used in hospitals to support an evaluation of facilities and systems in the scope of such a programme. ■