The importance of energy efficiency in buildings

Reducing energy demand at source is not only more sustainable in the long term but in many instances may also incur very little cost

Introduction

Rapidly increasing energy prices, concerns about resource depletion and climate change, and calls for national energy self-sufficiency have concentrated people's mind s on the role energy plays in our lives. Much of the effort is focused on securing sufficient supplies of oil, gas, etc, at affordable prices, but reducing energy demand at source can be better alternative. There are a number of ways of reducing energy demand in the two main building types in urban locations, housing and commercial buildings such as offices and hotels, at zero or relatively low cost

While an individual household may not appear to use much energy, one only has to multiply that by the population figure to appreciate the scale of domestic energy consumption. In India, the domestic sector is responsible for 45 percent primary fuel use, and domestic use of all fuels is increasing; 23.8 percent of annum for electricity, 35 percent for LPG, and 3.7 percent for firewood. Rural India is more dependent on traditional biofuels; on average 55 percent of households in India have access to electricity, this figure falling to 43.5 percent for rural areas.

The construction industry is booming, and is one of the largest energy consuming sectors in India. Even a 10 percent reduction in energy use in building would have a significant impact on national energy requirements, and this could be achieved with little or no investment, simply by being more diligent in our use of energy in homes and offices. There are, however, a number of issues relating to building design that should be considered when building a new house, office or hotel, and which will affect the energy consumption.

India has a great potential for the use of renewable energy technologies, but before considering how the energy is supplied, the first step should be to reduce the loads in the building. The use of an energy audit, described in the next section, will identify where and by how much loads can be reduced.

Energy Use in Existing Buildings

Since we replace old buildings with new ones only at a very slow rate, it is important to consider how we use energy in the buildings already there.

The first step in an energy efficiency approach is to find out where in the building most energy is used. An energy audit will pinpoint those areas and enables the most effective measures for cutting the energy costs to be identified.

It is estimated that buildings could save 10-15 percent on their energy bills by implementing energy efficiency improvements, which not only make the environment more comfortable but can also yield long-term financial rewards. The proposed solutions for saving energy may apply throughout the buildings from the roof, walls, and insulation that enclose it to the appliances and lights inside.

One of the prices we pay for increased affluence is that people become careless with energy use, and also people like to demonstrate their wealth, for example by purchasing air-conditioning systems. An air-conditioner will not have to work as hard if the condenser is in a relatively cool place. Therefore, the air-conditioner should be placed in a shady location such as the north side of the building, away from the sun. A unit operating in the shade uses as much as 10 percent less electricity than the same one operating in the sun.

Purchasing a large room air conditioning unit will not necessarily make people feel more comfortable. In fact, a room air conditioner that is too large for the area it is intended to cool, will perform less efficiently and less effectively than a smaller, properly sized unit. This is because room units work better if they run for relatively long periods of time than if they are continually switching off and on. Longer run-times allow air-conditioners to maintain a more constant room temperature and remove excess humidity. Domestic air-conditioning units, in particular, often only have on/off switches or rudimentary temperature control.

The thermostat should not be set at a colder setting than normal when the air-conditioner is switched on. It will not cool the home any faster and could result in excessive cooling and, therefore, unnecessary expense. The smaller the difference between the indoor and outdoor temperatures, the lower the overall cooling bill. By allowing the temperature to drift upward slightly by a degree or so, a substantial amount of energy can be saved.

Also, windows and openings should be closed when using air-conditioning as there is little point in using energy to cool the air, then allowing a large amount of warm air into the building. The location of a temperature sensor should be such that it senses the temperature experienced by the occupants and \can therefore control the environment to the desired level.

In the existing buildings, control of electric equipment is generally poor and, therefore, any gadget not in use should be switched off immediately. Most appliances such as computers, televisions and DVD players continue to use small amounts of electricity n their clocks and remote controls. Such appliances often have standby modes, which may consume as much as 50 percent of normal load; they should be switched off immediately. Most appliances such as computers, televisions and DVD players continue to use small amounts of electricity in their clocks and remote controls. Such appliances often have standby modes, which may consume as much as 50 percent of normal load; they should be switched off completely when not in use. In hot weather, an idling computer adds heat to a room, forcing air conditioning to run longer and use even more electricity to lower the temperature.

Lighting can use a surprising amount of energy, particularly if blinds are drawn to reduce solar access. Lighting needs and use patterns need to be studied, paying special attention to high-use areas such as the living room, kitchen, and outside lighting in a house. Therefore, replacing standard light bulbs and fixtures with compact fluorescent lamps (CFLs) and using lighting controls such as occupancy sensors, dimmers, or timers will help to reduce lighting energy use. Exterior lighting is one of the best places to use CFLs because of their long life. Low energy fluorescent bulbs use one-fifth the energy of conventional tungsten bulbs while giving the same light output, reducing CO_2 emissions, and lasting 9,000 + hours longer than incandescent bulbs. In addition to the reduced consumption, they also emit only one-fifth of the heat into the room, thereby reducing cooling requirements.
In many households, heating of water is still carried out using gas or a geyser (electrical water heater). Solar radiation is abundant in India and should be utilized wherever possible for water heating. The technology is well established, the plant relatively cheap, and it can easily be fitted to existing and new buildings. Adding a solar collector and a large storage tank (to handle cloudy days) can reduce electricity consumption for water heating (by 40 to 90) and make economic sense. Solar are environmentally friendly and can avoid the harmful greenhouse gas emissions associated with electricity production.

In rural areas cooking and some heating is still carried out using firewood and other solid fuels such as firewood and other solid fuels such as cattle dung. While these represent effective use of a renewable resource, they also emit fumes into the building that are responsible for a substantial number of respiratory problems, which are particularly prevalent among the poor. Effective ventilation should be used whenever such fuels are utilized, which in smaller houses with limited resources may be difficult. Also, more effective stoves can be used even with these traditional fuels, to reduce emissions and consumption.

Building Design and Plant for New Buildings

An energy-efficient system for commercial buildings such as offices and hotels is one that meets the primary needs and provides the necessary indoor thermal climate and air quality while consuming the least amount of energy. In terms of indoor thermal environment, the main problem in buildings in India is to keep them cool, not warm.

The basic construction, location and orientation of the building will have a significant impact on its energy consumption. The trend toward lightweight construction with hollow concrete or terracotta blocks is not a good construction method in hot climates. Solid blocks have a high thermal mass and absorb some of the solar heat, delaying transmission of heat through the building for several hours. Filling hollow blocks with soil will have the same result.

A basic principle should be to keep heat out of the building in the first place, by restricting the ingress of solar radiation. This can be achieved by appropriate orientation and design of the main windows and by the use of blinds and other shading devices. External blinds are preferred to internal ones since they keep more of the solar radiation out of the building, but they also have to be more durable. Second, solar radiation hitting the outer walls of the building will transmit through the structure into the building, and can be reduced considerably by the use of thermal insulation.

It is particularly cost-effective on roofs as at latitudes closer to the equator most of the solar radiation entering the building comes from the roof.

The purpose of these measures is to reduce or eliminate our reliance on mechanical air conditioning, which is to reduce or eliminate our reliance on mechanical air-conditioning, which is a significant user of electricity. Not only does this result in high CO_2 emissions but also places and additional strain on the electricity generation and supply infrastructure.

Sizing is equally important for central air-conditioning systems. For a central system, the fan must be set to shut off at the same time as the cooling unit as the cooling unit (compressor). Using circulating fans in individual rooms is far better and more efficient than using the system's central fan to provide circulation. Proper integration of daylight in building with electric light should be considered to ensure that energy is efficiently used and glare is controlled. This integration can only be achieved through a carefully coordinated design of the day lighting and electric lighting systems.

Finally, as with all energy-efficient design strategies, there are some costs associated with the use of controls that have to be in proper functioning order. Poor installation, commissioning, or operations and maintenance practices can lead to sub-optimum performance.

In commercial buildings, monitoring energy use is important to keep control of energy consumption and costs, observe trends and identify opportunities for improvement. Either an electronic building management systems (BMS), or fairly low-cost will help keep track of consumption.

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Reference Book:

The Bulletin on Energy Efficiency
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