Save Energy Going Up or Down

Advances in Vertical Transportation Efficiency

Introduction

Elevators in modern buildings are faster and more comfortable than their counterparts decades ago. But even when you are standing inside an innovative looking elevator cab, it is hard to identify the green features in the elevator and recognize their energy savings. Elevators are estimated to use about 5% of the energy in a standard office building. Although the energy use is relatively small, elevators and other vertical transportation systems are presently an unregulated energy use, not covered by energy codes. Consequently, the systems can often be made far more efficient.

This issue of e-News details major sustainable features in elevators and escalators and some design considerations.

Types of Elevators and How They Work

Hydraulic elevators dominate the market. They are used in buildings of not more than six or seven stories. The simplest hydraulic elevator consists of an elevator cab, a single-stage hydraulic cylinder and a hydraulic pump. The pump forces fluid into the low end of the cylinder and pushes the piston upwards. On the simple systems a bore hole (continued on page 2)
housing the hydraulic cylinder must go as deep as the total elevator lift height. Telescoping hydraulics can be used to reduce the depth of the bore hole, or the hydraulic mechanism can be located within the elevator shaft.

When building height increases, traction elevators are preferable. In this case, the cab is suspended from wire ropes wrapped around a sheave. The sheave is driven by a motor, with the mechanism located in the machine room atop the hoistway. A counterweight is also connected to the cab by a pulley to reduce the maximum weight that needs to be lifted.

ENERGY SAVING OPPORTUNITIES

Machine Room-Less Elevators

Machine Room-Less Elevators (MRL) were introduced to the United States less than a decade ago. The need for a machine room is eliminated since all mechanical equipment for an MRL fits in the elevator hoistway. MRL installations have risen from 5% five years ago to approximately 15% to 20% today.

MRL is suitable for low-rise buildings and provides a number of sustainable benefits over a hydraulic elevator. In addition to the benefit of space saving, MRL uses a smaller motor, generates much less heat, and does not necessarily need to be served by a cooling system.

Regeneration

Potential energy stored in an elevator can be recovered as electricity with the use of a regenerative motor. Note that this usually happens with the elevator moving up since an elevator is counterbalanced as if partially full. The energy of an elevator in “freefall” or “freerise” (depending on load) is traditionally dissipated as heat. A regenerative drive, on the other hand, transfers unused energy back into a building’s electrical system for use by other electrical loads. By converting the recovered energy into electricity rather than heat, the cooling loads created by the elevator equipment are also reduced.

Dispatch Control

Advanced elevator systems can also save energy by using destination control software to optimize the pattern of passenger pick-ups and drop-offs. The software seeks to minimize both the distance travelled and the number of stops to minimize energy use and improve service. More advanced systems can direct passengers headed to the same floor to enter the same elevator. The software can increase system capacity by 15-30%. In the lobby of a building, dispatch decisions are made after riders enter the floor they wish to visit on a touchpad. Some software can even learn from the daily traffic flow in an elevator to better tailor future dispatching to match the expected flow.

Standby Energy

As with almost all equipment, elevators have significant standby loads. Total energy consumption for an elevator while standing still is often equal to the energy consumption during transport, although the ratio

Elevators Contribution to LEED Certification

Although the LEED rating system does not directly award points to energy efficient elevators and escalators, elevators and escalators can assist in obtaining LEED points in various categories. Some examples are:

- **EA Credit 5**: Remote monitoring systems and software track energy consumption over time.
- **MR Credit 2.1 and 2.2**: With proper management of construction waste, only a small portion of the waste generated by elevator installation will end up in a landfill.
- **MR Credit 7**: Substitute wood products used in the elevator cabs or platforms with Forest Stewardship Council (FSC)-certified products.
- **EQ Credit 4.2 or 4.4**: Insure that any paint or solvent used on-site when installing an elevator and/or escalator meets LEED requirements.

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depends on the rate of elevator usage. Standby loads can be reduced by replacing incandescent lights with fluorescent or LED lighting. Fans and signal lighting can also be reduced when elevators are not in use.

Shared Hoistway Elevator
Elevator systems can now be installed that have two cabs sharing the same hoistway. Passenger capacity is almost doubled while reducing space requirements and energy consumption.

OTHER DESIGN CONSIDERATIONS

Chemical management
Because MRL elevators are gearless, they do not have the same need for lubricants as traditional elevators. The absence of a lubricated gearcase reduces the potential for chemical leaks, exposure, and contamination.

Hydraulic elevators require oil to maintain smooth operation. If this oil permeates water sources, it can become an environmental hazard. By replacing standard hydraulic elevator oil with vegetable-based or biodegradable lubricants, the potential environmental impact is drastically diminished.

Tenant relations
Advanced dispatching systems not only save energy but also tenant time by moving occupants to their destinations faster. Combined with the green attributes and possible contributions to a LEED rating, a high efficiency elevator system can improve the marketability of a property.

Most of the elevator manufacturers can offer these energy efficiency features as a part of full replacement solutions often retaining the existing elevator truss. This significantly reduces the capital costs and minimizes the disruption of services caused by an elevator upgrade. For instance, One Wachovia Center in Charlotte, North Carolina recently installed destination control software, saving energy and increasing the passenger transportation efficiency by 30%.

Options for Energy Efficient Escalators
Escalators generally operate at a constant speed under constantly varying loads. Traditionally, enough power was supplied to the motor at all times to move a full capacity load. Escalators can now be equipped with a power saving device that leaves the speed of the escalator unchanged but reduces the power consumed by the escalator when fewer people are on it. The device incorporates a solid-state soft starter with patented

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Training Highlights

California utilities offer outstanding educational opportunities that focus on the design, construction and operation of energy-efficient buildings. Here are a few of the many upcoming classes and events; for complete schedules, visit each utility’s website.

Identifying Energy Efficient Upgrades and Incentives - An Online Course
This course will explore the most time-efficient and cost-effective approaches to identifying energy-saving measures for your building; how the utilities’ incentive offerings can reduce first cost and improve financial returns; and how proper evaluation of the costs and benefits of proposed upgrades can help get these projects approved.

November 19 (Friday, 9:00 am to 12:00 pm) Internet http://www.pge.com/mybusiness/edusafety/training/pec/classes/index.jsp?reqType=detail&ID=4487&db=PEC4487.csv&pageTitle=Class Details and Registration&postback=yes

Adjustable Speed Drives
Technicians, operators, and maintenance professionals will learn about adjustable and variable frequency drives and application issues. All techniques discussed will be practical and proven approaches. Attendees will explore how adjustable speed drives can provide benefits such as reducing energy and maintenance costs in commercial, industrial, and residential applications.

October 29 (Thursday, 8:30 am to 12:30 pm) SCE Wildomar Service Center https://www.sce.com/ECR/EnergyCenterClassSchedule.aspx?ORG=CTAC,OTHER

Building Information Modeling
This workshop will demonstrate how to utilize Building Information Modeling (BIM) tools to achieve higher performance buildings. Attendees will learn BIM applications that demonstrate the energy impact of their buildings earlier in the design process.

November 4 (Thursday, 9:00 am to 11:00 am) San Diego Energy Resource Center https://seminars.sdge.com/iebms/coe/coe_p1_all.aspx?cc=COE&oc=05

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