Green Technologies in Elevator & Escalator Design

November 1, 2012
Hydraulic elevators

**Holed Hydraulic**
- Used in lower-rise 2 and 3 story buildings
- More energy used than other elevator systems
- Oil in tank; piston pushes elevator
- Greener option: holeless hydraulic with no drilling in ground
- Now available in a self-contained MRL option

**Holeless Hydraulic**

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Controller/Fluid tank

In-Ground Cylinder

NO In-Ground Cylinder
Machine-roomless traction elevators

- Commonly used in 4-story and above applications
- No machine or control space required: everything self-contained in the hoistway
- Less energy than conventional traction: environmentally friendly
- Improved ride comfort
Escalators

- Required everywhere where a constant and efficient traffic flow is required
- Less lubrication required
- LED Lighting improves energy efficiency
- Standby/Sleep Mode options to reduce energy consumption
Features of “Green” Elevators

- LED lighting with auto-shutoff
- Regenerative drive
- Coated-steel belts
- Compact gearless machine
- Electrical components standby/sleep mode
Compact and efficient

AC gearless machine tucks away at the top of the hoistway – 70% smaller

Compact synchronous permanent-magnet motor

50% more efficient than conventional geared machines

Lubrication free
  Sealed bearings
  Coated steel belts
Coated Steel Belts

Innovative, durable

Zinc-plated steel wires minimize corrosion

Tough polyurethane coating avoids metal-to-metal contact – reduces noise and vibration

Belt comprises high-tensile strength steel wires

No lubrication required - green

12 smaller cords and flat arrangement provide better flexibility than conventional ropes.
Green, Compact Controllers

Regenerative Drive technology

Achieve up to **75% more energy savings** over conventional geared and hydraulic elevators.

- Converts normally wasted energy into electricity and feeds it back to the building grid to power other systems
- The smaller controller uses up to 50% less space than the traditional traction controller
- The controller unit is quieter and produces less heat than the traditional traction controller
- The controller can be located in the hoistway
What Is Regenerative?

Energy Efficiency

- Power delivered to a drive during a run with a fully loaded car in the up direction
- Power returned to a utility during a run in the down direction

For a non-regenerative drive the green power is lost, whereas the regenerative drive returns this power to the building or utility.

- The new controller not only uses less energy while lifting loads
- It gives energy back into the building power grid while on descent instead of releasing or burning off as heat (DBRs)
- Power is regenerated when:
  1. Travel of lightly loaded car up
  2. Travel of heavily loaded car down
  3. During deceleration
LED Lighting

New LED illumination reduces energy consumption

Highly efficient: Lasts up to 10 times longer than conventional fluorescent lamps

MORE energy savings and LESS downtime
Sleep Mode

When there’s no passenger demand for the elevator, advanced, automatic switch-off mode “puts elevator to sleep”

Makes LED lighting up to 80 percent more efficient than conventional lighting options

Saving Energy

Ready to Operate
Efficient Overall Performance

An energy-efficient system with a regenerative drive, LED lighting, and automatic switch-off maximizes performance efficiency.

Bar chart showing energy consumption for different systems (Hydraulic, Geared, Gearless) and their components (Car lighting, Controls, Propulsion). Based on 1000 kg at 1 m/s, 8 stops, and 200,000 starts per year.
## Machine Room-less vs. Hydraulic: Comparison

### Energy Savings

<table>
<thead>
<tr>
<th></th>
<th>Machine Room Less</th>
<th>Hydro-Holed</th>
<th>Hydro-Holeless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Technology</td>
<td>Standard</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Motor HP</td>
<td>11 HP</td>
<td>50 HP</td>
<td>25 HP</td>
</tr>
<tr>
<td>Peak Power Demand</td>
<td>8 kVA</td>
<td>18 kVA</td>
<td>15 kVA</td>
</tr>
<tr>
<td>Acceleration/Starting Current</td>
<td>19 A</td>
<td>150 A</td>
<td>83 A</td>
</tr>
<tr>
<td>Normal Running Current</td>
<td>13 A</td>
<td>65 A</td>
<td>36 A</td>
</tr>
<tr>
<td>Annual Energy Consumption</td>
<td>621 kW-hr</td>
<td>2513 kW-hr</td>
<td>2450 kW-hr</td>
</tr>
<tr>
<td>Heat Release</td>
<td>5195 BTU/hr</td>
<td>15270 BTU/hr</td>
<td>9545 BTU/hr</td>
</tr>
<tr>
<td>Fixed Cost per Year</td>
<td>$120</td>
<td>$277</td>
<td>$225</td>
</tr>
<tr>
<td>Variable Cost per Year</td>
<td>$67</td>
<td>$270</td>
<td>$264</td>
</tr>
<tr>
<td>Lifecycle Cost for 20 Years</td>
<td>$3,740</td>
<td>$10,940</td>
<td>$9,780</td>
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</tbody>
</table>

Up to $7,200 in savings
Escalators and moving walkways

Pioneering technology, moving passengers forward

- Highly efficient lubrication system
- LED lighting
- Smarter operations: Regenerative drives & power monitoring
New, modern high-efficiency lubrication systems reduce the oil consumption per year from 10 gallons to ¼ gallon and at the same time increase the lifetime of the step chain.
LED Lighting Options

- **LED Skirt Panel Lighting**
  - white
  - colored

- **LED Balustrade Illumination**

- **LED Bottom Plate Lighting**

- **LED Comb Lighting**

- **LED Truss Lighting**
Different amounts of savings can be realized, depending on the type of drive used.

Energy Savings Options:
- Continuous Operation
- Power Management device
- Stand-By with full load VF drive
- Stand-By with stand-by VF drive
- Stand-By with regenerative VF drive

0% - 70% savings range.
# Energy Saving Options

<table>
<thead>
<tr>
<th>[kWh]²</th>
<th>Continuous Operation</th>
<th>Power Management device</th>
<th>Stand-By with full load VF drive ³</th>
<th>Stand-By with stand-by VF drive ³</th>
<th>Stand-By with regenerative VF drive ³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up direction</td>
<td>26.42</td>
<td>25.26</td>
<td>18.70</td>
<td>22.82</td>
<td>18.70</td>
</tr>
<tr>
<td>Down direction</td>
<td>- 2.15 ¹</td>
<td>- 2.87 ¹</td>
<td>0.71</td>
<td>- 5.69 ¹</td>
<td>- 8.77 ¹</td>
</tr>
<tr>
<td>Combined</td>
<td>24.27</td>
<td>22.39</td>
<td>19.41</td>
<td>17.13</td>
<td>9.93</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>0 %</td>
<td>8 %</td>
<td>20%</td>
<td>30%</td>
<td>60%</td>
</tr>
</tbody>
</table>

**Notes:**
1) generated energy
2) Load pattern
   - 12 h operation, 3.5h 0% load, 3.75h 25% load, 4.5h 50% load, 0.75h 100% load
3) Stand-By speed operation (aka sleep mode) is included in the ANSI A17.1 – 2010 code
A Green Escalator

High-Efficiency Lubrication System

Regenerative VF Drives

LED Lighting
There are opportunities to be environmentally friendly throughout the entire life cycle.
Incorporating the latest energy-saving technologies, such as regenerative drives and LED lighting options,

Better design = less energy minimizes the carbon footprint and is up to 75 percent more energy efficient than conventional systems with non-regenerative drives.
More recycling, less waste

- Recycles about 97% of industrial waste
- Dramatically reduces non-recyclable waste and keeps costs down

### Industrial Process Waste Non-Recycled (Millions lbs)

<table>
<thead>
<tr>
<th>Year</th>
<th>Waste (Millions lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1.74</td>
</tr>
<tr>
<td>2007</td>
<td>1.55</td>
</tr>
<tr>
<td>2008</td>
<td>1.24</td>
</tr>
<tr>
<td>2009</td>
<td>0.89</td>
</tr>
<tr>
<td>2010</td>
<td>0.43</td>
</tr>
</tbody>
</table>
Installation

Quick and efficient

Reduce installation material requirements and excess scrap materials

Less packaging = less waste
Most of an elevator’s environmental impact stem from daily operations, which can be reduced through green features.
Quick and efficient repairs in the greenest way possible

- Environmentally friendly cleaners
- Safe waste removal
- Recycling
Modernization

Customized solutions, exceptional results

Annual energy consumption (kWh)*

Before

After mod. and regenerative drive

12,845
3,261

1275kg @ 1.6m/s

16,137
4,086

1600kg @ 1.6m/s

*Based on 20-floor building with a 60-meter rise and 300,000 trips per year (propulsion system only)
Modernization
Modernization – Gen2
End-of-life Recycling

More than 95 percent of the materials used can be recyclable.

Including the coated-steel flat belts that allow for such environmentally friendly performance.
LEED Credits

LEED is a rating system that certifies how “green” a project is, not the individual products.

- Products **cannot** be LEED certified.
- Manufacturers **cannot** be LEED certified.
- LEED credits fall into two main category types:
  
  **Contribution:** Material/Product selection can contribute toward a project obtaining points.
  
  **Compliance:** Violating a compliance credit may cause the project to lose points.

Applicable credits vary on a per project basis.
I heard that elevators are not applicable to LEED, is this true?

No, while elevators are excluded from a few LEED credit areas, they must still comply with other areas and can also contribute in to credits such as Energy and Innovation in Design.

Can a project earn points for more than one credit?

No. “Double dipping” is not allowed – That is, the project cannot earn points under EA Credit 1 for saving energy and use the same savings to support an ID credit.

What are the cost benefits of using LEED?

LEED certified buildings can cut operating costs by 13.6% in new construction buildings and can increase asset value. You can also qualify for tax rebates, zoning allowances and other incentives in hundreds of cities.

Is there a website where I can find more information?

http://www.usgbc.org/LEED
Questions ?
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