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Continuous search for new ways to reduce operational cost.

The First International Seminar on Road Tunnel Operations Management & Safety
18-20 October 2006 - Chongqing China
Sponsored Organizations: Hosted By:

Facts – Energy consumption in Norwegian tunnels

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption</th>
<th>Equipment</th>
<th>New Tunnels</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>93 GWh</td>
<td>Light, Ventilation, Pumping of water</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>More than 100 GWh</td>
<td>More equipment</td>
<td>20-30 km new tunnels every year</td>
</tr>
</tbody>
</table>

Energy prices may increase by 100 - 200% in the next few years

Content

A project to save energy in Norway
On roads and tunnels

Estimated el-consumption

The goal

Energy consumption in tunnel operation in Norway

Energy consumption (in kWh)

- Region south
- Region nord
- Region east
- Region west
- Lanes/traffic

Total
Use of vegetation to reduce the adaptation problem

Dark background and shielding from the sky and direct sun may reduce the need for light in the entrance zone.

It also reduces the distraction for the drivers.

Pilot: Light on the walls

In-directly lighting of the road surface

Some lamps are directing their light on the walls.

Change to new fans reduces the energy consumption

Bigger FANS – reduced friction
Better efficiency and less noise

Pilot: Traffic steering of tunnel light

- No traffic – only every 4th lamp is on
- Sensors outside and inside the tunnel turns light on when traffic arrives - reacts also on humans
- Needs use of lamps that lights up quickly (LEDs and QL lamps etc)
- Photo cells replaced by new and cheap luminance meters?
- Useful in tunnels with low traffic or where traffic comes in waves with intervals
Pilot 3: Intelligent road and tunnel light

Results before and after rehabilitation

Thank You for your attention