Intelligent lighting control and monitoring system for Singapore Public Housing Estate
The Presentation Content

- Background
- Objectives
- What is DALI
- Delmatic DELi – Controller
- System Installation & Architecture
- Testing Process and Results
- Summary and Demonstration
## Background

Present Public housings situation:

1. Excessive lighting level in low usage area
2. Require lighting checkers to check lamps regularly during daytime which are time consuming & labour intensive
3. Wastage of electricity during the inspection period
4. No efficient way to monitor burning hours of lamp for pro-active maintenance
The aims are to -

• provide latest energy saving T5 lamps & Dali high frequency Intelligent dual-wattage (eg:14w/24w) ballasts
• improve service to residents through faster response and reduced downtime.
• enable flexible timing commands to turn lights on/off/dim
• allow remote monitoring and control
• provide fault reporting and pin-point location
• provide management report on downtime and running hours of lamps for better control of resources
• enhance labour productivity & reduce manpower requirements
What is Dali?

Dali stands for Digital Addressable Lighting Interface.

Dali is a digital dimming protocol developed initially by the major European ballast manufacturers and subsequently adopted worldwide.

Dali is an international non-proprietary protocol set out in annexe E4 of ECG technical standard IEC929 for luminaire ballasts.
Dali enables ballasts from any manufacturer to respond to standard, published commands.

Dali provides accurate digital dimming between 100% and 1%.

Dali provides lamp failure feedback in real time.

Dali enables ballasts to be individually addressed, switched, dimmed and monitored along a single buswire.

Dali guarantees interchangeability of ballasts.

Dali is vendor independent, so clients are not lock-in to a single supplier.
a Dali network comprises up to 64 ballasts (or devices)

but 64 ballasts/luminaires represents only a part of a building so Dali subsystems need to be linked together using another technology

the technology used on this project is Echelon LonWorks network

Delmatic’s DELi module connects Dali through LonWorks
DELi module merges Lon and Dali and combines the installation & addressable benefits of Dali with the building-wide benefits of a Lon system.
The Simple Process

The system is incorporated into the existing installations without any changes to the mains wiring.

The standard magnetic ballasts of the existing luminaire are replaced by the Dali intelligent high frequency electronic ballasts. A single two-core control cable runs between the ballasts and the DELi Control Modules.

The DELi Modules are connected to the building controller by a twisted pair cable.
Singapore Public Housing

Luminaire with Osram DALI multi-watt Electronic Control Gear and T5 Lamp

Located at switch room

Connected via Surbana's IEMS network to Town Council Office

Delmatic Control System
Dali installation – totally flexible

Flexibility is independent of the mains wiring.

Luminaires can be addressed along the buswire and can be configured into controlled groups and may be dimmed at programmed times of day.

PC located at the town council office
Testing Process

- **Pre-Measurement**: taking watt reading of existing lighting based on magnetic ballasts

- **Post Measurement**: taking watt reading of new DALI high frequency ballasts based on the following steps:
  1. New lighting system using switch-board timer control. Lighting at 100% brightness at 7pm.
  2. Switch-over to software system, 24/7 control: Software sends timing command at 7pm at 100% & midnight at 100%.
  3. Software sends dimming command at 7pm at 100% & 70% dimming level at midnight.
  4. Software sends dimming command at 7pm to 80% & midnight to 65% dimming level.

- **Final Test**: Put Blk 117 only night time software control (12/7) and Blk 113 still under software control (24/7) – to see any different in performance like lamp-life, energy consumption and any other observations to take note.
Result of Findings

- Show the impact of oil prices over electrical tariff
- Show reduction of lighting consumption over one year test period
- Show actual reduction of energy bills incurred by Town council
- Show new lighting energy bill as proportion of total bill
- Other Observations
HDB INTELLIGENT LIGHTING CONTROL
Energy Monitoring Chart

- Low Loss Magnetic Ballast: 77 kWh per block per night
- HF DALI with switchboard timer: 59.6 kWh per block per night
- System 24/7 with timing via software: 56 kWh per block per night
- 7pm 100% & 70% Dimming@midnite: 34 kWh per block per night
- 7pm dim 80% & 65% Dimming@midnite: 23.6 kWh per block per night
- 7pm dim 80% & 65% Dimming@midnite but Blk 117 NO DAY control: 22.52 kWh per block per night

About 30% and about 40% reductions in energy consumption.
### Proportion of Bills between Re-wired Lighting and Others

Total Saving of electricity bills of $1,300 (between 2004 and 2005)

<table>
<thead>
<tr>
<th>Period (per month)</th>
<th>Consumption in Kwhr</th>
<th>Tariff (cents)</th>
<th>Only Blk Lighting Cost</th>
<th>TC total bills</th>
<th>Proportion under blk lighting</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-04</td>
<td>2317.9</td>
<td>15.44</td>
<td>$357.88</td>
<td>$1,095.94</td>
<td>32.66%</td>
<td>Before rewiring; magnetic ballast</td>
</tr>
<tr>
<td>Jan-05</td>
<td>1548.71</td>
<td>16.73</td>
<td>$259.10</td>
<td>$1,000.72</td>
<td>25.89%</td>
<td>With HF ballast; no dim control</td>
</tr>
<tr>
<td>Apr-05</td>
<td>977.8</td>
<td>16.06</td>
<td>$157.03</td>
<td>$964.00</td>
<td>16.29%</td>
<td>With 70% dim at midnight</td>
</tr>
<tr>
<td>Jun-05</td>
<td>683</td>
<td>16.06</td>
<td>$109.69</td>
<td>$901.13</td>
<td>12.17%</td>
<td>With 80% dim 7 pm; 65% midnight</td>
</tr>
</tbody>
</table>

#### Proportion of Bill Over Different Test Stages

- **Re-wired Lighting Load**
- **Other Elect Load**
### Other Observations

1. **Lamp Failures**: 3 nos reported for Block 113 and 9 nos at Block 117 (4 nos due to damage caused by vandalism). This numbers appears normal.

2. **Response Time**: The response time to replace faulty lamp has improved because town council able to log-in anytime to check lamp status compared with twice weekly check by contractor. Response time to replace faulty lamp is faster.

3. **Manpower Saving**: Unable to translate this into monetary figures because Town Council still need to maintain the manpower to check other blocks not under lighting control but checkers no need to check the current blocks under this pilot project.

4. **Complaints**: Throughout the test period, no complaints regarding lighting has been reported to Town Council.

5. **24 hours monitoring**: There is 0.5% to 1% more energy expended to enable 24 hours monitoring. This is translated to about $7 per month. With automatic report, we can put on 12/7 and save Town council manpower to log-in to check status, further saving on administrative manpower.
(PAYBACK TIME FOR THE LIGHTING MANAGEMENT SYSTEM)
Using the tender rate for Blocks 101 to 115 Gangsa Road for Pilot Trial at Blk 117 Clementi Street 13

1. Cost difference between lowest tender for Option 1 (high frequency lighting w/o lighting control system) and Option 2 (with lighting control) and standard hf ballast cost:

   $28,126 per block

2. Net cost saving using lighting management system (based on energy saving at 71%, $0.21 cents tariff, labour saving, maintenance cost):

   $304 per block per month

3. Payback using lighting management system (item 1/item 2):

   92.45 months or 7.7 years
To improve the system efficiency, we can integrate the present Lighting Management System to the current Integrated Estate Management System (IEMS). This way we have seamless integration from the various sites direct to the operator and maintenance crew.
Using the Delmatic’s Intelligent Lighting Control and Monitoring system with Osram QTi dali high frequency multi-watt ballast with high efficacy T5 fluorescent lamp offer the following benefits -

• **saving of more than 70% of electrical energy**
• **Labour saving and minimising downtime of lamps**
• **Individual addressing, switching and dimming of individual luminaire**
• **monitoring of lamp failures**
• **reporting status of lamp’s operation**
• **flexible to use different lamp wattage without changing ballast**
• **further energy saving through by using motion detector and photocell**
• **scalabilities of the system: more blks can be added to the present system**
Intelligent lighting control and monitoring system for Singapore Public Housing Estate

THANK YOU
Next . . . .
System Demonstration