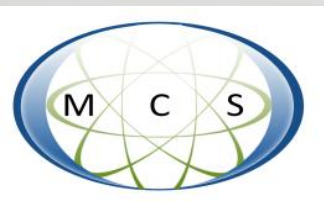


EMANZ Lighting Expo

Lighting Renewals

- Capturing the Energy Saving Opportunities -



Mason Consulting & Services Ltd – Energy Management Association of NZ



Introduction

- Technologies currently in use and their performance
- Standards
- Opportunity indicators
- Energy conservation measures and their implementation
- Measurement and verification
- Resources

Brief History



From this

- Minimal output and no control



to this








- Low output and some control



to this in 150 years

- High output and full control

Typical Technologies Currently in Use

-  Linear fluorescent
-  Compact fluorescent
-  Metal halide
-  Low voltage tungsten halogen
-  LED
-  Magnetic & electronic control gear
-  Stand alone occupancy sensors

Performance Metrics

- **Power density** - lighting power density is stated in Watts/m² and recommendations are made in NZS4243 – currently 12W/m² for commercial offices
- **Green house gas emissions** - kg CO₂e/kWh
- **Efficacy (lamps)** - lumens/watt i.e. the amount of light produced for the amount of power used
- **Efficiency (luminaires)** – total light output ratio (TLOR), the ratio of the light produced by the luminaire divided by the light produced by its lamps.
 - e.g. old technology recessed fluorescent 65% TLOR
 - e.g. new technology recessed fluorescent 90% TLOR
- **Illumination level** – lux (lumens/m²)

Lamp Efficacies and Life

Indicative lamp efficacies and lives:

- Incandescent = 10 lumens/Watt & 1,000 hours
- Tungsten halogen = 20 lm/W & 2,000 hrs
- Compact metal halide = 80 lm/W & 15,000 hrs
- Compact fluorescent = 80 lm/W & 10,000 hrs
- Induction = 80 lm/W & 80,000 hrs
- LED = 50 to 100 lm/W & 25 to 50,000 hrs
- Linear fluorescent = 80 to 100 lm/W & 10 to 25,000 hrs

Relevant Standards

- [AS/NZS 1680](#) (various parts) – Interior lighting
- [NZS 4243.2](#) – Energy efficiency, large buildings. Should this be [BS/EN 15193](#) as this gives a [Lighting Energy Numeric Indicator \(LENI\)](#) in kWh/m²/year
- [AS/NZS 3598](#) – Energy audits
- [ISO 50001](#) – Energy management
- [ANSI/ASHRAE/IES 90.1](#) – Energy standards for buildings
- [IESNA LM-79-2008](#) - Approved method for the electrical and photometric testing of solid-state lighting devices
- [IESNA LM-80-2008](#) – Approved method of testing lumen maintenance for solid-state lighting devices
- [IESNA TM-21](#) - specifies how to extrapolate the LM80 lumen maintenance data to times beyond the LM-80 test time

Opportunity Indicators

- Excessive illumination levels – 600 lux common in office areas, AS/NZS 1680 suggests 320 lux
- High power density – 20 to 30 W/m² common
- Old luminaires and technology – 3x36W recessed fluorescent luminaires with standard loss magnetic ballasts still widely in use
- Poor control (switching) – the master switch at the door!!
- Variable occupancy – work spaces can be unoccupied 50% of the time
- Good daylight
- High maintenance costs – luminaires at the end of their life

Common Energy Conservation Measures (ECMs)

- Staff awareness and motivation programs
- Delamping – many spaces are over-lit
- Retrofits – existing luminaires modified to utilise new technologies
- Re-design and new luminaires – provides maximised savings
- Enhanced controls

ECMs - Staff Awareness and Motivation

- Staff can be unaware of the benefits and savings associated with energy efficiency
- Staff usually have a very good understanding of plant and equipment and have good ideas for 'doing it better'
- If staff see that energy efficiency is important to management then it can empower them to pursue it as well

ECMs - Delamping

- De-lamping is a simple process that can provide a cost effective compliant solution
- It will not address the issues associated with equipment at end of life
- It will not achieve the 50%+ savings that are often available in lighting systems.

ECMs – Retrofits 1

Existing:



3x36W T8 fluorescent:

- Energy cost = \$60/yr.

Existing luminaire fitted with high efficiency module:



2x24W T5 fluorescent:

- Energy cost = \$25/yr.
- Saving = \$35/yr.
- **58% energy cost reduction**

ECMs – Retrofits 2

Existing:



50W low voltage halogen:

- Energy cost = \$22.50/yr.

Existing luminaire fitted with LED lamp:



10W LED:

- Energy cost = \$4.50/yr.
- Saving = \$18/yr.
- **80% energy cost reduction**

ECMs - Redesign & New Luminaires 1

Existing:



2x58W T8 fluorescent
batten:

➤ Energy cost = \$63/yr.

Replaced by:



1x80W high efficiency T5
fluorescent:

➤ Energy cost = \$38/yr.

➤ Saving = \$25/yr.

➤ **40% energy cost reduction**

ECMs - Redesign & New Luminaires 2

Existing:



3x36W T8 recessed
fluorescent :

- Energy cost = \$60/yr.

Replaced by:



2x28W high efficiency T5
fluorescent:

- Energy cost = \$29/yr.
- Saving = \$31/yr.
- **52% energy cost reduction**

ECMs - Redesign & New Luminaires 3

Existing:



1x400W metal halide hi-bay:

➤ Energy cost = \$265/yr.

Replaced by:



4x54W high efficiency T5 fluorescent hi-bay:

➤ Energy cost = \$135/yr.

➤ Saving = \$130/yr.

➤ **49% energy cost reduction**

ECMs - Controls

- Good manual switching has to be local to and have relevance for the users, otherwise lighting just gets left on!
- Controls are experiencing rapid growth due to enhanced functionality and cost effectiveness
- 'Smarts' being integrated into sensors and luminaires, providing 'plug & play' solutions
- Wireless controls available and becoming more cost effective
- Digital lighting control systems, such as DALI, offer the benefits of individual addressing, plus performance and maintenance reporting
- Automation systems available that sit over lighting, security, and BMS systems can report energy usage and trending.
- Reasonable to assume that controls could provide an additional 30% savings over what luminaires can provide

Measurement and Verification

- M&V is increasingly being implemented in upgrade projects, inline with the Efficiency Valuation Organisation (EVO) International Performance Measurement and Verification Protocol (IPMVP), ref to <http://www.evo-world.org/>
- A wide range of cost effective logging and monitoring technologies now available, ranging from:
 - Self-powering stand-alone mini-loggers recording simple parameters such as amps and illumination levels
 - To powered stand-alone loggers recording various parameters such as power, power factor, and harmonics
 - To internet based 'real-time' systems that provide load profiles, usage data, PC 'information dashboard', and before/after comparisons

Identification of Energy Conservation

Measures

- **Scope the potential** by reviewing the performance metrics or by doing a walk-through audit
- **Carry out an in-depth audit** using an auditor experienced in energy efficient lighting. It is important the audit:
 - Identifies the client's requirements, operational conditions, and energy costs
 - Highlights any current compliance issues
 - Identifies the actual maintenance costs and procedures
 - Optimises the potential savings and, if need be, by re-design space by space
 - Builds a sound savings and investment case

Implementation of ECMs

- Barriers to implementation:
 - Landlord – Property Manager – Tennant relationship
 - Knowledge gap
 - Staff busy doing core business
 - Financial pressure to invest in ‘production’
- Involve all stake holders
- Obtain funding
- Establish baseline energy usage
- Detail and tender the project requirements
- Manage the project installation
- Verify the savings
- Report and promote project savings and benefits

Resources

- The Energy Efficiency and Conservation Authority (EECA) has a wide range of funding programs and case studies - www.eecabusiness.govt.nz
- RightLight - www.rightlight.govt.nz
- The Energy Management Association of NZ (EMANZ) provides:
 - Energy Specialists and Facilities Managers training
 - Energy Auditor accreditation
 - Energy auditing manual
 - www.emanz.org.nz

Conclusions

- Often existing lighting systems do not offer optimum efficiency as over-lighting is common and the use of outdated technologies is widespread
- There are a wide range of luminaire and control technologies available for energy saving upgrades
- There can be up to 80% savings potential, best identified by carrying out an in-depth audit
- Audits should look at all aspects of the lighting system
- Staff involvement and motivation is important for the success of energy efficiency initiatives
- Developing luminaire and control technologies will further enhance the potential savings



**Thank you for the opportunity to
speak today!!**

Your questions are welcome