



METROLIGHT
LIGHT FORWARD

Improving lighting energy efficiency with
advanced control and management

Metrolight

Presented by Ian Meikle, ENER-G

Taking HID Lighting into the 21st Century

Metrolight's Technology delivers:

- Tremendous energy savings
 - Up to 65% energy savings
 - Up to twice the lamp life of magnetic ballasts
- Spectacular light
- Dramatically reduced maintenance costs
- Unprecedented control
- Environmental conservation



Core Challenges with Magnetic Ballasts

Stressful Ignition Process

- Excessive amounts of energy and current are pushed during ignition process
 - Damages lamp electrodes
 - Creates arc chamber wall blackening
 - Causes lumen degradation
 - Dramatically reduces light output

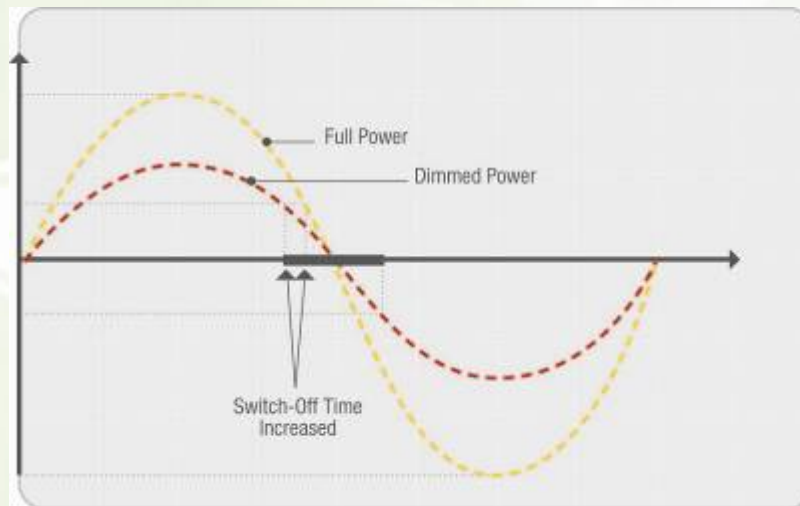
Low Frequency Operating Process

- HID lamp powered by low frequency sine wave that causes drastic electrode temperature changes
 - Further erodes electrodes
 - Shortens lamp life
 - Creates bulb wall blackening
 - Causes flickering

Core Challenges with Magnetic Ballasts

Dimming

- During dimming, amplitude of current and conduction period decrease causing off time to increase, further eroding electrodes



Dimming during Low Frequency Operation damages lamp and drastically reduces lamp life

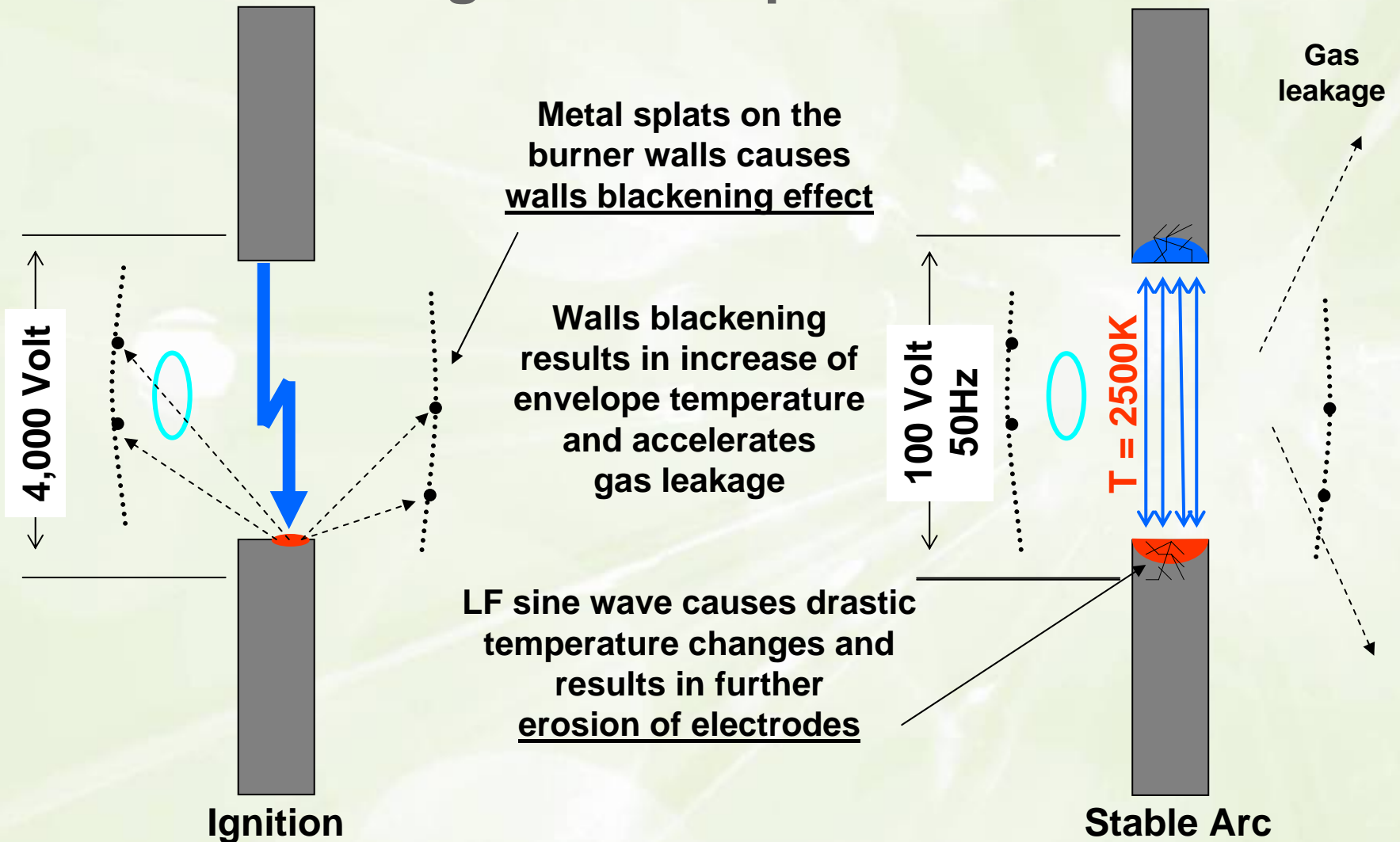
Controllability

- Limited control and communication with ballast

Low Efficiency

- Typical ballast efficiency of less than 15%.

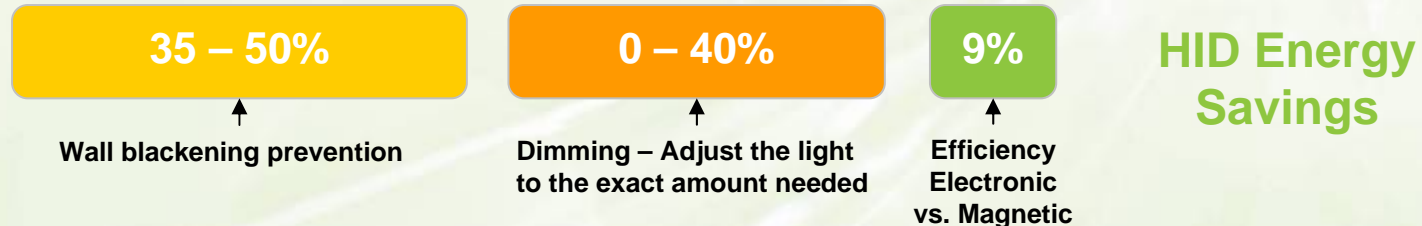
Conventional Ignition & Operation



The Solution

How to Save Money with HID Lighting Systems

- **Improve ballast efficiency** (Reduce ballast losses)
- **Reduce lumen degradation caused by wall blackening**
 - increase lamp life
 - Same Lumen with less power/less fixtures
- **Adapt light to exact requirements**



Metrolight addresses all the above issues utilizing sophisticated patented technology

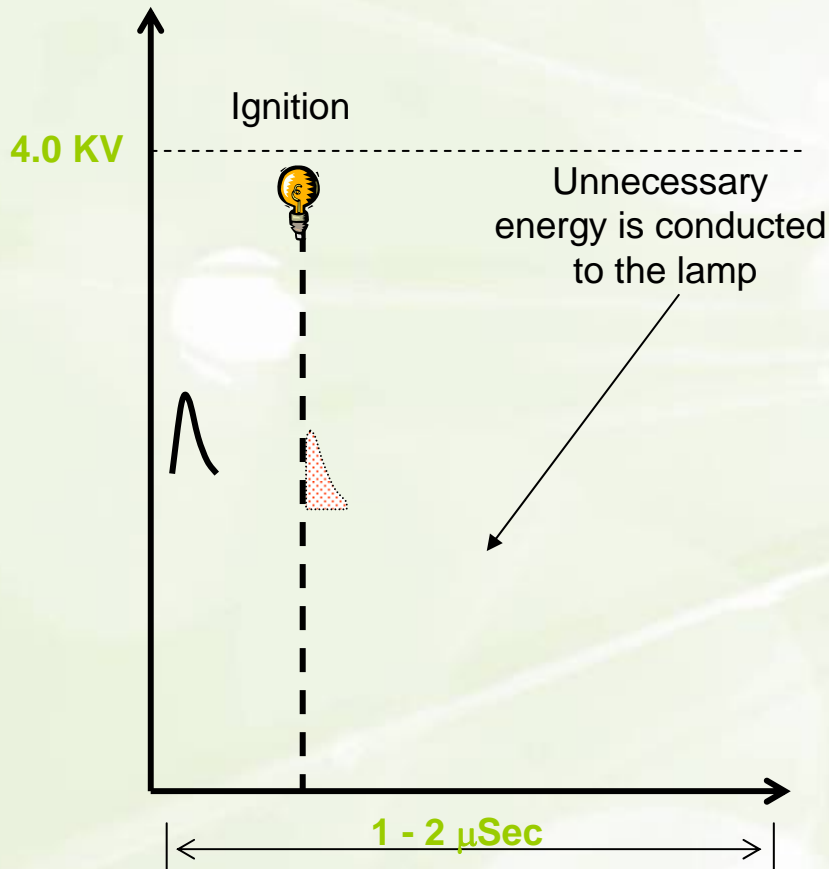
Superior Technology from Metrolight

- Metrolight's Smart Electronic Ballast for HID™ is an intelligent device built around a powerful microprocessor that enables:
 - Monitoring of all internal ballast parameters
 - Control of energy supply to lamp
 - Connectivity to control and monitoring systems
- 94% efficiency with Metrolight's Smart Electronic Ballast for HID™
- Micro-Start™ Ignition Process
- High Frequency Operation
- Dimming – Analog, Digital, Pre set

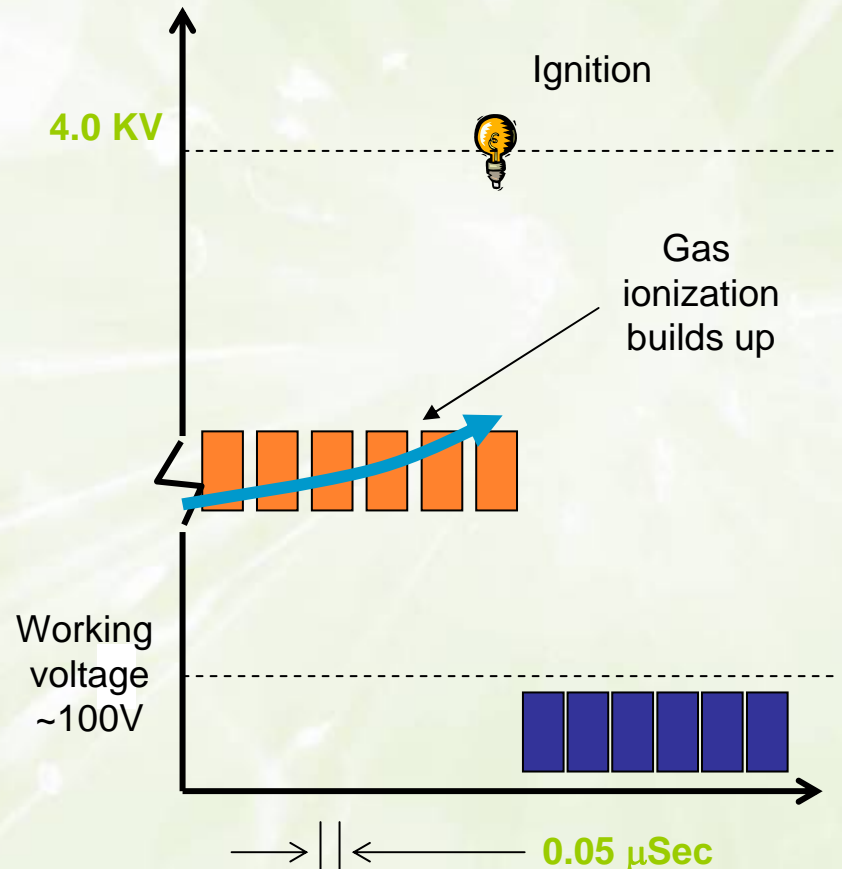


MicroStart™ Ignition Overview

Electro-Magnetic Ballast



Metrolight Electronic Ballast



MicroStart™ Ignition

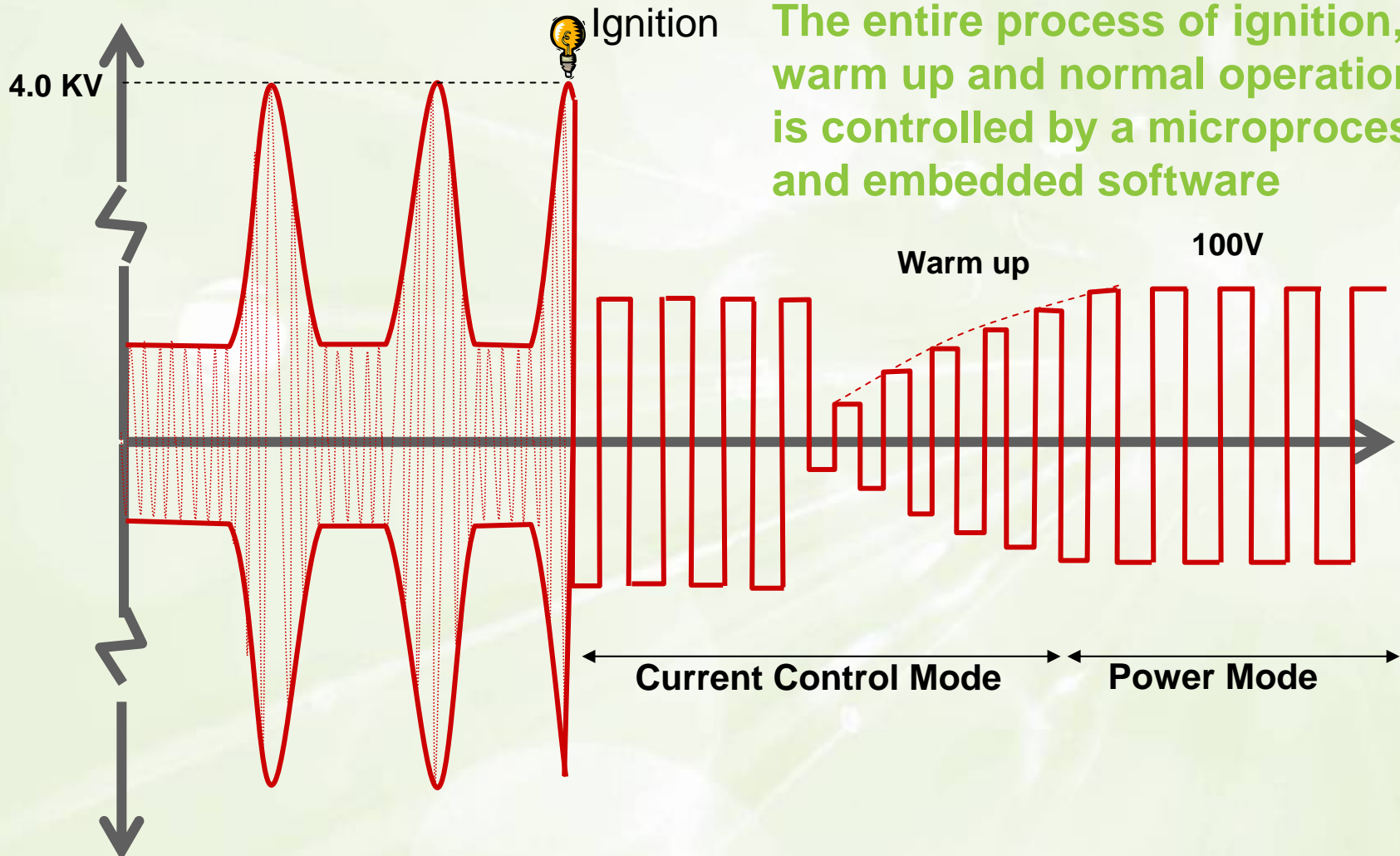
Patented technology – computer controlled digital ignition

High frequency bursts

- Ignites lamp almost immediately
- Does not require high repetition rate of pulses
- Very little energy discharged (1% - 2% energy compared to magnetic)
- Immediately stops energy flow when ignition is detected by microprocessor
- Reverts to current-mode control ensuring lamp power-handling capability not exceeded

MicroStart™ Resonant Ignition Technique

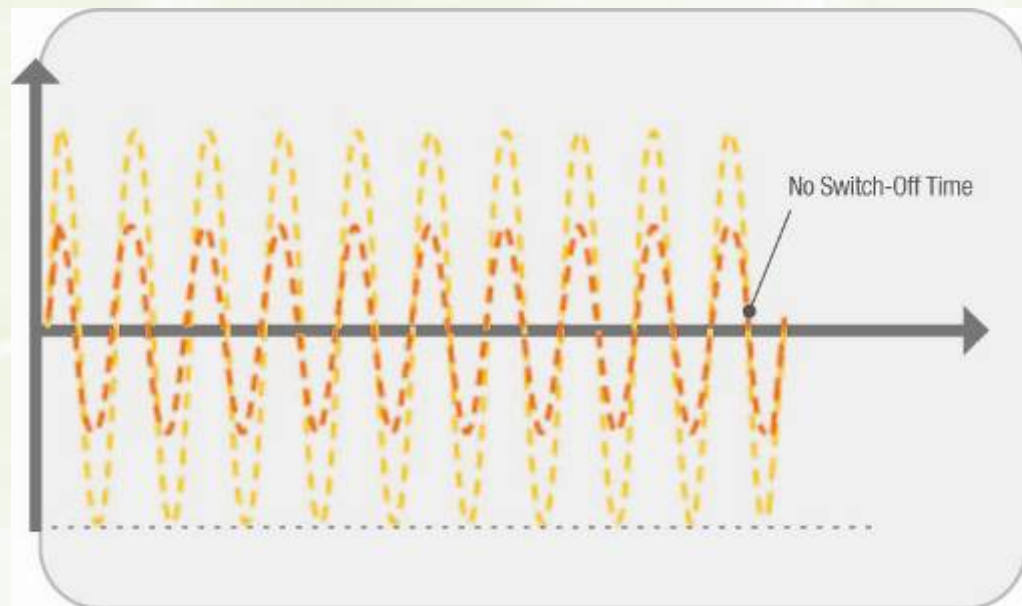
The entire process of ignition, warm up and normal operation is controlled by a microprocessor and embedded software



High Frequency Operation

- Preserves lamp electrodes from erosion
- Increases efficacy of HID lamps
- Improves performance
- Extends lamp life

High Frequency
Operation



Results - Extending Lamp Life

400W Metal-Halide Lamp after 8,000 Operating Hours



Tungsten electrodes - Side view

**Metrolight Smart Electronic
Ballast for HID™ with High
Frequency MicroStart™
Ignition**

**Conventional magnetic or
electronic ballast**



Results - Extending Lamp Life

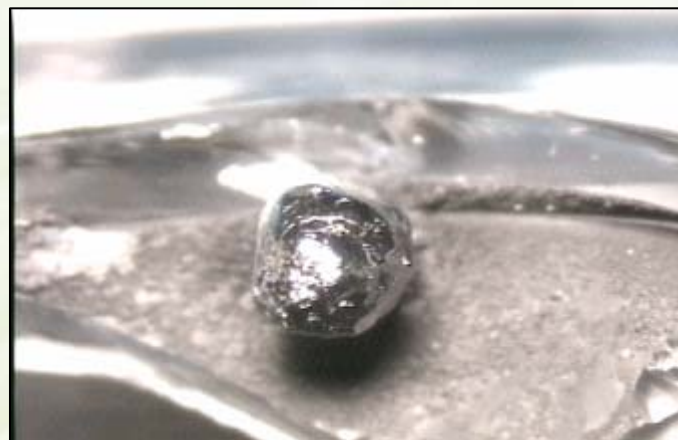
400W Metal-Halide Lamp after 8,000 Operating Hours



**Metrolight Smart Electronic
Ballast for HID™ with High
Frequency MicroStart™
Ignition**

Tungsten electrodes - Top view

**Conventional magnetic or
electronic ballast**



Results – Preventing Wall Blackening

400W Metal-Halide Lamp after 8,000 Operating Hours



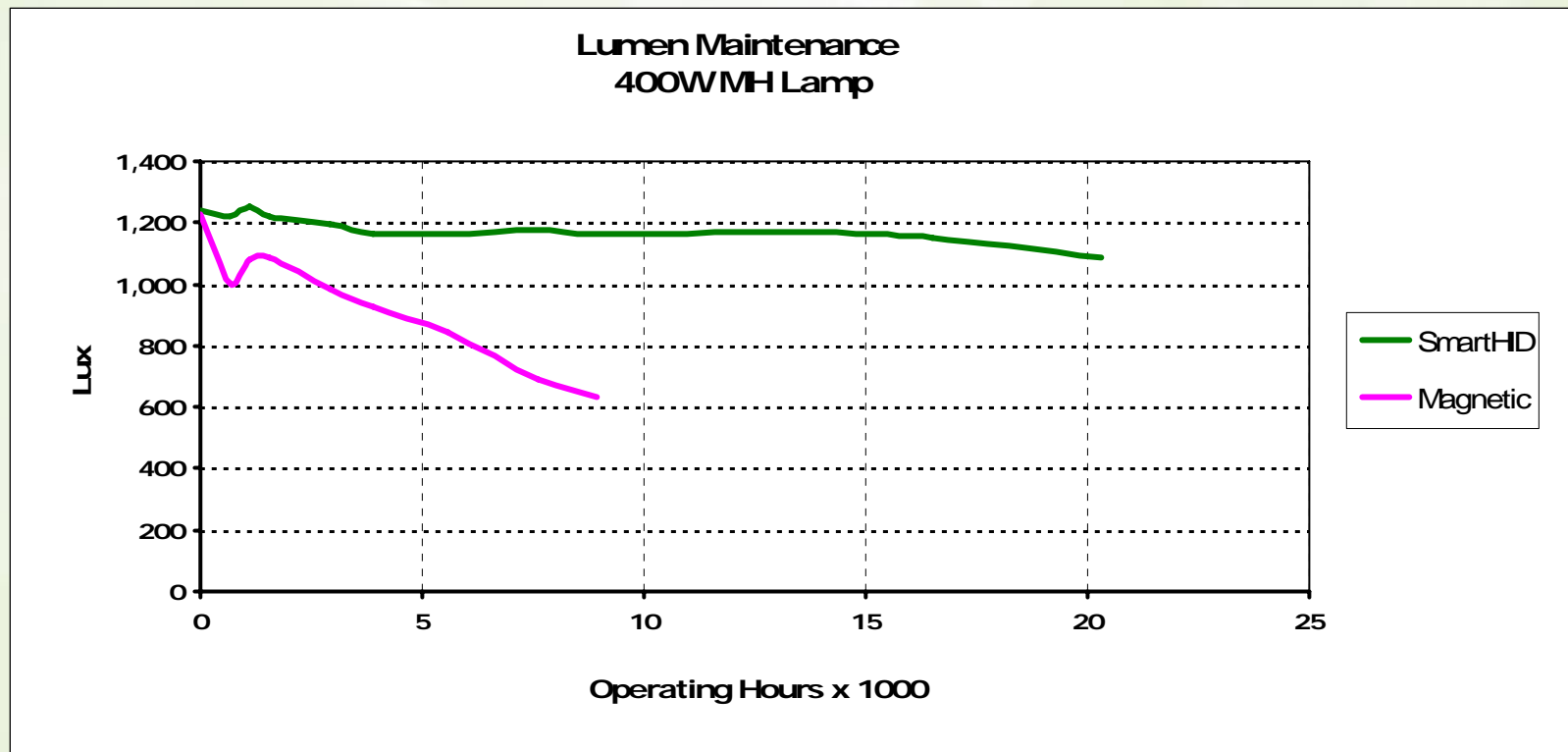
**Magnetic
Ballast**



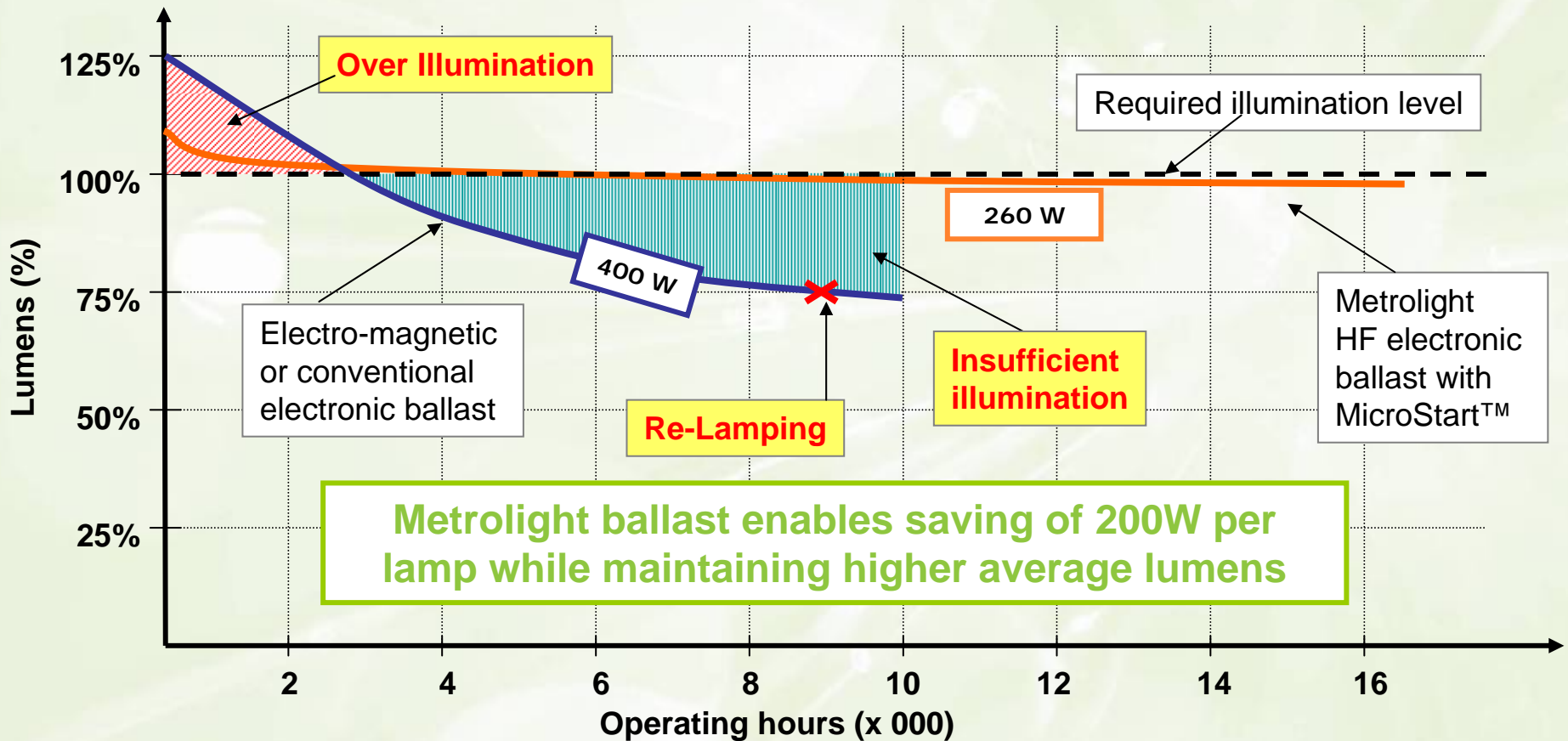
**Metrolight
Smart
Electronic
Ballast for
HID™**

Results – Lumen Maintenance

Metrolight Smart Electronic Ballast for HID™ vs. Magnetic Ballast



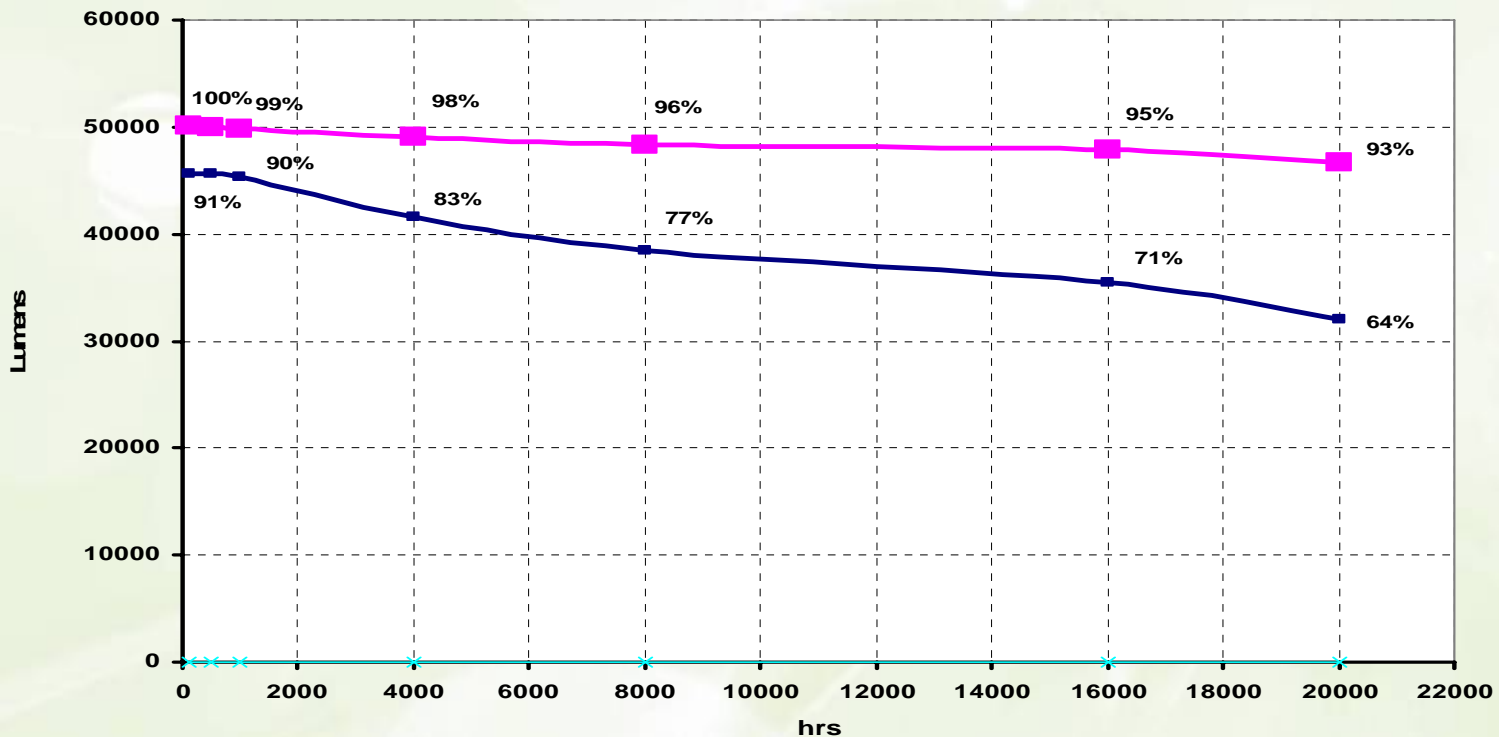
\$ Bottom line effect on Metrolight's customer energy bill



Results – Lumen Maintenance

Metrolight Smart Electronic Ballast for HID™ vs. Magnetic Ballast on HPS lamps

Philips Son-T HPS 400W with EM vs ML electronic
Lumens vs time



Superior Dimming Control

Analog Dimming

- Connects to analog dimmers or controllers, light sensors, ambient sensors, timers, etc. for simple and automatic lighting control
- Based on adaptive control of output current of individual ballast providing continuous, flicker-free dimming at the required light output level

Digital Dimming

- Digitally controlled via Metrolight Control™ software
- Enables defining schedules for dimming per individual ballast or group of ballasts

Automatic Pre-Set Dimming

- Define dimming regime using internal ballast clock

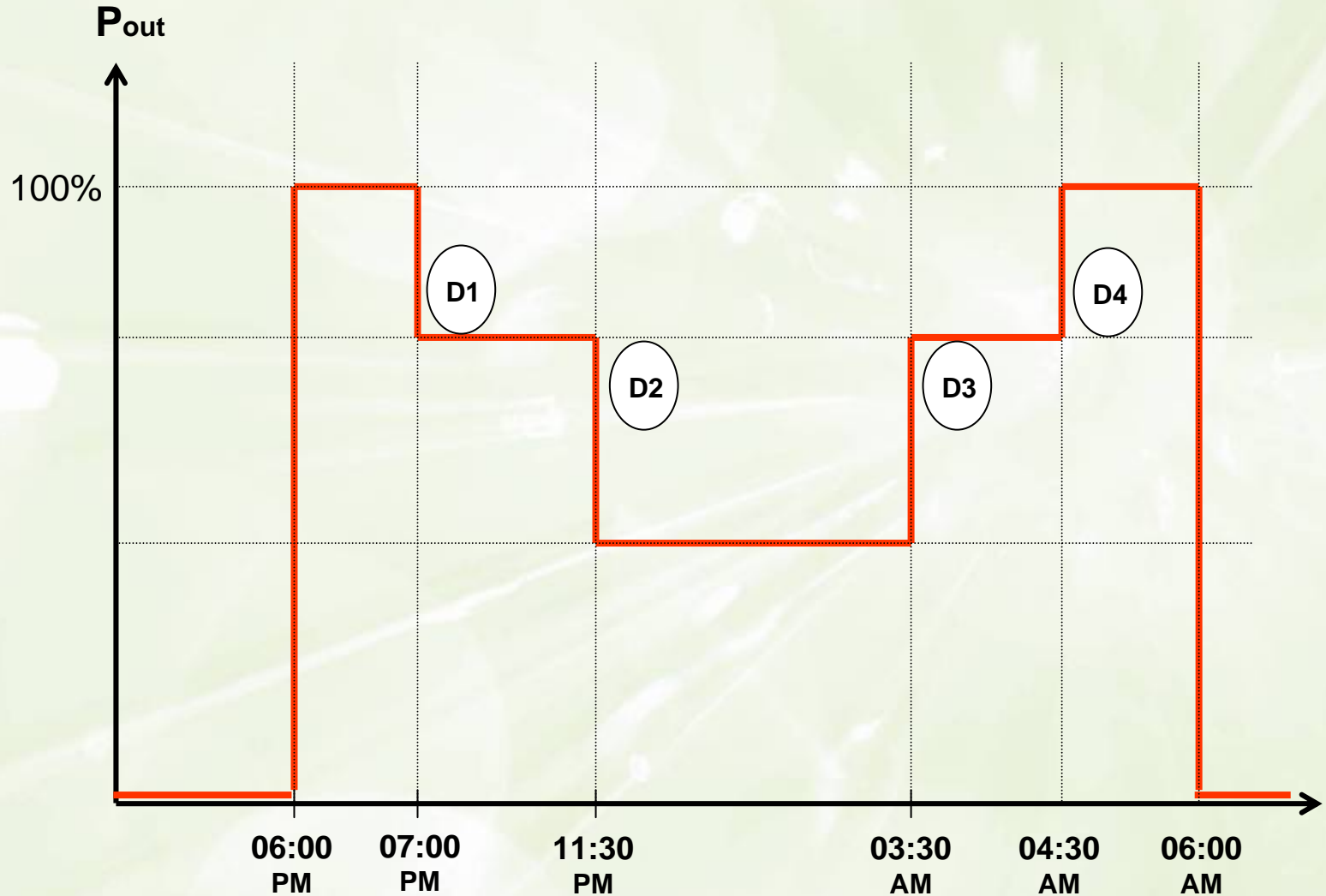
Control and Monitoring – Metrolight Control™

- Revolutionary concept that elevates controllability of lighting systems to a whole new level
- Sophisticated, yet easy-to-use control software
- Advanced technology enables exacting control to increase savings, improve performance and extend lamp life

Results

**Up to 40% additional energy savings
with Metrolight Smart Electronic Ballast for HID™ dimming and
controls features**

Autonomous Dimming Scheme



Street Light Project

Reduced initial power – 80% of nominal power

- 250W HPS operated at 200Watt
- 400W HPS operated at 320Watt

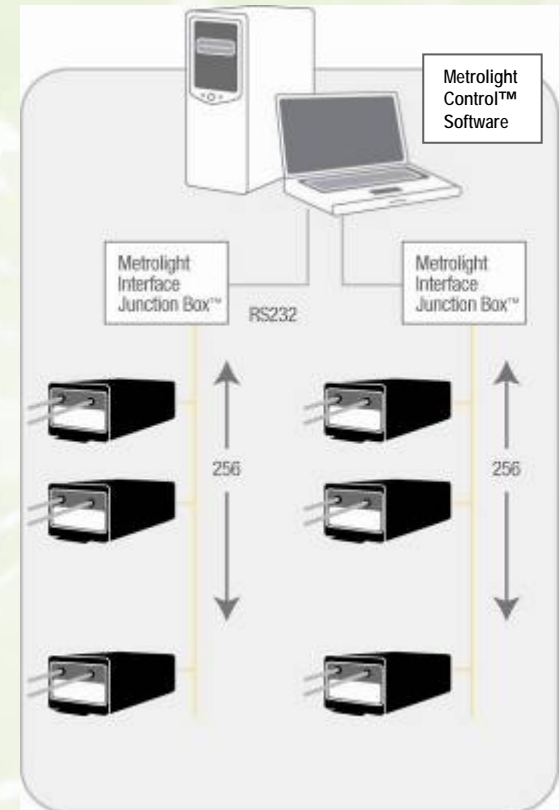
Dimming at “dead” hours ~ 35%

Estimated energy saving: 35% – 45%



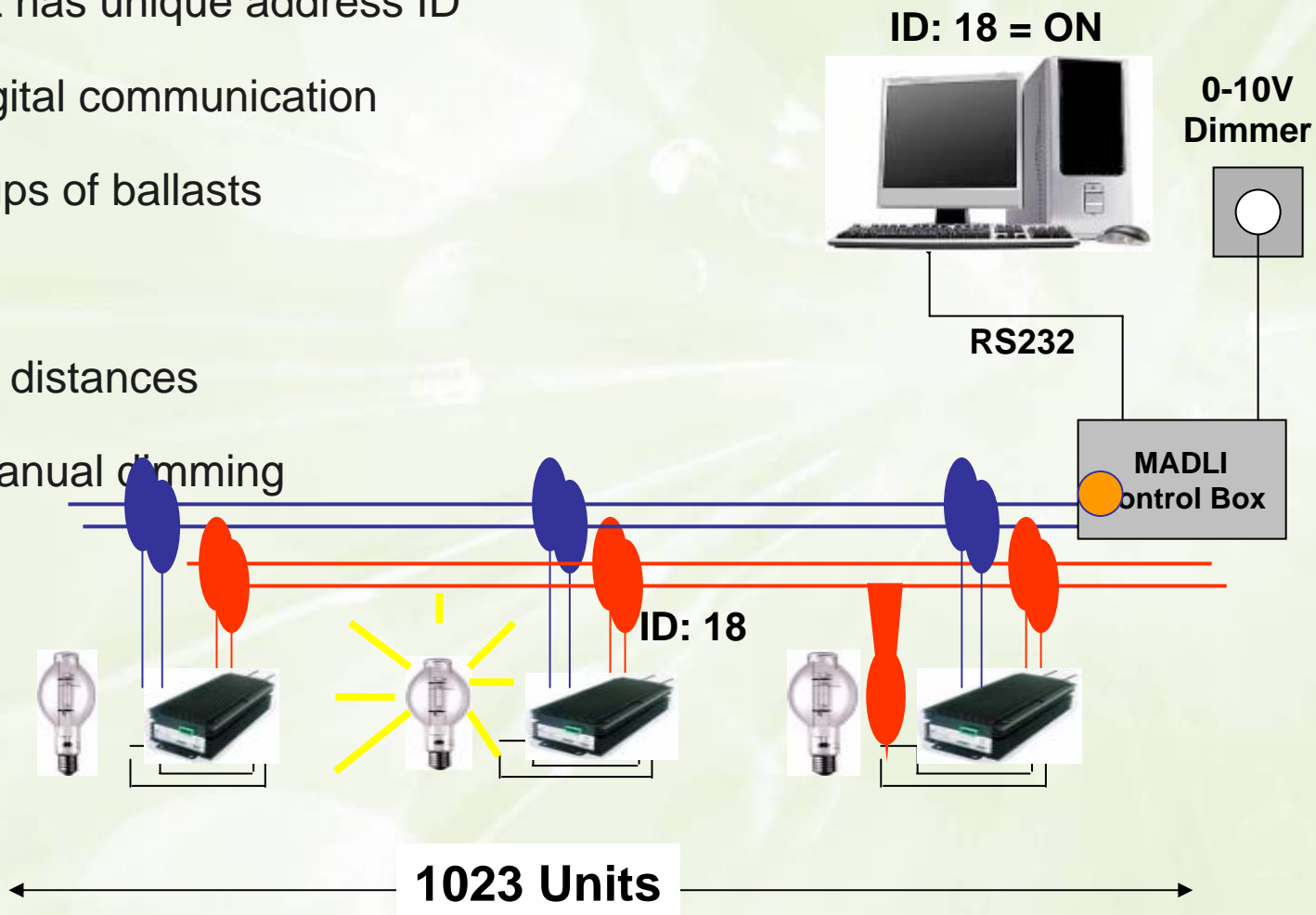
Metrolight Control™ Features

- Online two-way communication
- Set lighting protocols in advance
- Advanced notification of lamp end-of-life for preventative maintenance planning
- Receive status indicators and activity data on every lamp remotely
- Program and upgrade all ballasts with one command from afar
- Load-shed energy in every location at the same time



MADLI™ Communication

- Each ballast has unique address ID
- Two-way digital communication
- Logical groups of ballasts
- 4800 bps
- Covers long distances
- Central & manual dimming



Better Electrical Protection

Metrolight ballasts provide a variety of electrical protection mechanisms

- Short output protection circuit (Between lamp terminals and to Ground)
- Open output protection circuit
- Over-temperature protection
- Over-input-voltage protection (IEEE C62.41 up to 10KV)
- Under-input-voltage protection
- Lamp end-of-life (EOL) protection

Mechanisms are software controlled

- Enables precise monitoring
- Enables accurately presetting new values for different types of applications or lamps

Comparative Analysis

Metrolight Smart Electronic Ballast for HID™ vs. Fluorescent

	ML Electronic	Fluorescent
Number of Lamps	1	5 or 6
Number of Sockets	1	12
Number of Ballasts	1	2 or 3
Maintenance	Very Low	High
Lumen vs. ambient temperature	No dependence	Highly dependent
Lumen output over time	Consistently high	Reduced(1)
Ambient temp. without lumens depreciation	-30C to 65C	15C to 30C
Total system reliability	Very High	Low
Installation cost	Low	High

(1) Due to dust/dirt depreciation

**With greater energy savings,
longer lamp life
and spectacular light
the future of lighting is here –
today!**