Best Practice Energy Efficient Lighting and Lighting Control Projects
Green Technology Overview

- **Growth Through Regulation**
  - Proposition 39 Planning
  - Title 24 – Energy Efficiency Part Six
  - Utility Rebate Program Utilization

- **Energy Efficiency Lighting and Lighting Control**
  - Technologies
  - Understanding the Options
  - Benefits and of Controls

- **Osram Sylvania Product Solutions**
  - Applications
  - Cost Saving Techniques

- **Case Studies**
  - Sharing all the benefits

- **“Bringing it all Together”**
  - Savings to Investment Ratio
  - Example- Fluorescent to LED interior lighting
REXEL Banners

Rexel Holdings USA

Rexel USA/
PROP 39

growth through REGULATION

01 What is Prop 39?
California initiative, Prop 39, grants $550 million annually for eligible projects to improve energy efficiency and expand clean energy generation in schools.

02 Who qualifies for these funds?
Eligible local educational agencies (LEAs) including county offices of education, school districts, charter schools and state special schools — can request funding by submitting an energy expenditure plan application to the CEC.

03 What opportunities does this create for contractors?
Contractors partnered with Rexel can gain a competitive advantage in this fast emerging market.

04 How can a partnership with Rexel help?
- Energy Surveys
- Development and submittal of energy project expenditure plans to CEC
- Project Management
- Manufacture agnostic product solutions
Proposition 39 – CA Clean Energy Job Act

The California Clean Energy Jobs Act (Prop. 39) changed the corporate income tax code and allocates projected revenue to California's General Fund and the Clean Energy Job Creation Fund for five fiscal years, beginning with fiscal year 2013-14.

Under the initiative, roughly up to $550 million annually is available for appropriation by the Legislature for eligible projects to improve energy efficiency and expand clean energy generation in schools.

Eligible local educational agencies (LEAs) — including county offices of education, school districts, charter schools and state special schools— can request funding by submitting an energy expenditure plan application to the California Energy Commission.

http://www.energy.ca.gov/efficiency/proposition39/
Proposition 39 Planning -

- Benchmarking
- Energy Surveys
- Data analytics
- Project cost effectiveness calculations
- Development and submittal of energy project expenditure plans to CEC
- Supporting CEC review of energy project expenditure
- Performing energy project tracking and reporting
- Providing final project reporting
- For their energy equipment/products and installation (to be determined through the planning process listed above; Provide quality high technology product choices at competitive price (lighting, controls, HVAC, PV, etc)
- Assist with or support installation and commissioning
- Provide installation M&V support
Complete Solutions

**Logistics**
- Trained expertise
- Local or national ... Customer first solutions
- Transferrable service

**On Site**
- Audits and Assessment
- Controls expertise
- Energy solutions and recommendations
- Complete Turnkey Solutions

**Board Room**
- Good, better, best solutions
- Project management
- ROI calculations
- TCO recommendations

**Financing**
- Rebates ... Calculation and submission management
- Financing recommendations
- Tax deduction consulting
Rexel Lighting Layouts and 3D Rendering

Energy Proposal Centers can now create in-house Lighting Layouts!

Benefits:
- ANY manufacturers layout, multiple manufacturers combined
- Customized with your name and Rexel logos
- No more waiting for the manufacturer or rep
  - Proposal Center lead time guarantee of 3 business days after receiving all necessary information

Requirements:
- Complete and submit your lighting layout request form to your Proposal Center
  - ESPCWest@Rexelusa.com OR ESPCEast@Rexelusa.com
  - Request forms can be found on Rexel Insight on the Energy Solutions page

Energy Proposal Center staff are trained to use Visual 2012 software
- Meet FC levels per requirements
- Increase safety of facility
- Compare different luminaires to get the best solution

Statistics

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01 What is Title 24 2013?
Title 24 2013 are the most recent updates to California's energy efficient building codes. Beginning July 1st, 2014 all commercial spaces will be required to follow the guidelines listed therein.

02 Why are these codes important?
Energy efficiency standards make buildings more comfortable, lower energy costs, and reduce greenhouse gas emissions.

03 Will this impact building costs?
On average, there is a 30-40% total cost increase from existing standards 2008-present. However, dramatic energy savings from Daylight Harvesting, Vacancy Control, and Automatic Demand Response will easily recover the initial cost.

04 How much energy will these new standards save?
New standards will use 25% less energy for lighting, heating, and cooling than the 2008 standards. (Reduce greenhouse gas emissions by 170,500 tons per year)
Title 24 2013- Part Six – Energy Efficiency

Changes are coming…Prepare for the impact

- Affects permitted projects (new construction and retrofits) beginning Jan. 1, 2014 (postponed July, 1, 2014)
- Heavy emphasis on use of controls (multi level dimming, partial on-off, redundancy of systems, etc)
- Security and egress lighting affected for switching
- Demand Response capability required, although D/R participation not required…yet
- Outdoor lighting has enhanced control requirements
- Daylighting formulas required for: skylit, primary sidelit and secondary sidelit areas
- Commissioning to be included in the design and construction to verify system requirements
Change: Section 130.1(b) & Section 130.1(a) 2C
Nonresidential indoor lighting, advanced multi-level lighting controls (controllable ballasts) increased in granularity (in addition to ON/OFF, increasing from one intermediate level to three intermediate levels for or continuous dimming), favoring dimmable ballasts for linear fluorescent lighting systems. These controls will allow precise and non-interruptive adjustment of lighting to match the available day lighting, and provide dimming and demand response function throughout the building.

Solution: LED Dimming drivers with fixtures/ Fluorescent Dimming Ballast with XPXL reduced wattage 28W Lamps tying into Lighting Control System to allow fixtures to react to daylighting and demand response. Depending on the application, MFG solutions will vary.
Change: Section 130.1(d) & Section 140.6(d)
Enhancing, modifying, and daylighting controls mandatory requirements (removed off ramps); daylighting language significantly simplified. (Section 130.1(d) Inserted prescriptive daylighting control requirements for secondary daylit zones.

Solution: Daylighting Harvesting control allowing prescriptive control for first and secondary zones. May require multiple units to meet daylight zoning requirements.
**CA Title 24 – 2013 Standards Summary of Changes**

**Lighting**

**Change: Section 130.1(d)3 & Section 130.2(c)3B**

Increased requirements for multi-level lighting controls for nonresidential outdoor lighting. Existing outdoor lighting cutoff (shielding) requirements, changed to the new IES standard: Backlight, Uplight, Glare (BUG) requirements.

**Solution:** Exterior LED fixtures with dimming drivers offering 0-10V dimming or wireless dimming/multi-level dimming. Integrated occupancy sensors mounting on fixture or pole. BUG requirements.

![LED fixtures with dimming drivers](image)

- LED – 120W
  - 100% output
- LED – 120W
  - 40% output
Title 24 now requires that a commissioning report be completed and provided to each building owner. This includes reports on all functional performance tests completed as part of the acceptance test process. Projects issued a building permit on or after July 1, 2014 must undergo acceptance testing for:

- Automatic daylighting controls
- Automatic time switch controls
- Occupancy sensors
- Outdoor lighting shut-off controls
- Outdoor motion sensors
- Demand response (DR) controls

As soon as July 1, 2014, lighting controls acceptance test technicians will have to be certified through an approved training program, such as the California Advanced Lighting Controls Training Program (CALCTP), and registered with the State of California. Technicians’ employers will also have to be certified. Technician training and certification requirements are addressed in Section 13.11 (page 1049) of the Non-Residential Compliance Manual.
Utility Program Utilization

The Department of Energy (DOE) and individual statewide utilities (i.e. CA IOU’s) have created utility rebate/incentive programs to incentivize utility customers to implement energy efficiency solutions.

- How does a product (LED fixture, LED lamp, controls, etc.) qualify?
- Title 24 Impact? – Controls aren’t a bad thing!
Energy Efficiency Lighting Technologies

Reduced wattage fluorescent lamps

- Extended Life, extended warranty XLL lamps

**Advantages**
- Reduced wattage than traditional T8 fluorescent lamps (28W & 25W)
- Extended Life and Extended warranty – 84,000 operating hours and Quick 60 Program
- Maintenance cost reduction
- Price competitive
- Ideal for retrofitting

**Disadvantages**
- Lack of utility rebates
- Limited applications
- Safety hazards – increased phosphor levels
- Minimal energy savings
Energy Efficiency Lighting Technologies

Induction Fixtures and retrofit kits

- **Advantages**
  - 50-60% Energy Savings to traditional technologies (HID, halogen)
  - Extended life 100,000 operating hours
  - Utility Rebates available
  - Price competitive vs. traditional technologies
  - Good solution for exterior applications, warehouse, and canopies
  - Low temp starting (-13F for 40/70W; -40 for 100-200W)
  - Maintenance Cost Reductions

- **Disadvantages**
  - Older technology
  - Limited wattage options
  - Light pollution and lack of distribution
  - Limited control (Bi-level)
  - Minimal applications
  - Lack of safety – failure issues
Energy Efficiency Lighting Technologies

LED (Light Emitting Diodes) or SSL (Solid State Lighting)

Building the future of the lighting industry

Advantages

- Up to 80% energy savings over traditional technology
- Maintenance cost reductions – 100,000 operating hours (Ls70)
- Safety- superior light with minimal failures
- Easily controlled - bi-level and dimming
- Instant On – No time delays for warm up
- Crisp, clear color temperatures for security and advertising property
- Ideal for any application
- Reliable and design flexible – outstanding optics and distribution
- Increased utility rebates
- Excels in cold environments

Disadvantages – Deciphering and understanding what to choose and why
Applications
LED is proven for interior applications

- Interior Office Space

- Hallways and Stairwells

- Warehouse and Mixed Use

- Screw in Lamps/LED tubes

- Replacing Compact fluorescent

- Parking Garages
Applications

LED is proven for exterior applications

Wall packs

Parking and Area Lighting

Tunnels and Roadway

Landscaping
Additional Controls and Benefits

Interior controls allow for daylight harvesting and vacancy control.
- Lights are not needed at 100% output when daylighting is in space
- Automatic response with manual override
- Installing occupancy/vacancy sensors offer energy reduction
  - (i.e. Stairwells – up to 80% savings)
Additional Controls and Benefits

Incorporating controls into LED interior/exterior applications offer additional benefits…

- Light Levels can be dimmed when space is unoccupied
- Ability to offer additional energy savings beyond Fixture for fixture change out
- Additional utility incentives when incorporating Controls
- Wireless controls reduce cost significantly for Install/upgrades
- Reduction in maintenance cost – longevity
- User interface allows fixtures to be controlled From anywhere – view status of fixtures
- Easily upgradable
Understanding – Who is Who?

- Quality/Performance?
  - Retrofit vs. New
- Warranty?
- Lumens/watt?
- DLC Listed?
- Temperature Ratings?
- Country of origin?
- Years in Business?
- Price competitive?
Products Overview
ESCO Version
Bruce Ryman
The largest, pure play global lighting company - FY13

Our 4 Segments

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<th>Segment</th>
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<td>Specialty Lighting (SP)</td>
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<td>Lamps &amp; Components (LC)</td>
<td>46%</td>
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<td>Luminaires &amp; Solutions (LS)</td>
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Our Brand Portfolio

New OSRAM Headquarters, Munich

- €5.3bn sales
- ~35k employees
- 29% SSL share
- ~80% professional customers
- ~20% retail customers

1) Based on sum of segments’ revenue, without considering corporate items and consolidation
2) FTEs as of 30.09.2013
3) As % of sales / Source: OSRAM data
OSRAM SYLVANIA
Leadership and Commitment to Solid State Lighting

Position of Strength

• 25% of Total Sales Globally
• OSRAM Opto one of the largest global producer of LED chips
• 10 Billion LEDs manufactured annually
• Over 6,000 Patents
• Supplying customers globally for over 30 years

Research:

• 6.3% of sales
• Germany (Augsburg, Regensburg)
• USA (Beverly, Danvers)
ULTRA LED Lamps & Downlight Retrofits
UTRA RT6HO & RT8 LED Downlight Kits
ULTRA RT6 HO
LED Downlight Retrofit Kits

High efficiency, high lumen output

Energy saving, high lumen, universal input voltage (120-277V) retrofit for 6-inch downlights with compact fluorescent 2X26W double tube or 1X26/1X32W triple tube pin-based lamps providing energy savings up to 60% and long 50,000 hours rated life ($L_{70}$).

- 1500 lumens - 21W (71 LPW)
- Up to 4x life of compact fluorescent
- Instant on, full brightness
- Dry, damp and wet rated, non-Dimmable
- 82 CRI - 3000K, 3500K and 4000K CCT

Applications
- Downlight retrofit for compact fluorescent or halogen fixtures

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<td>72495 - LED/RT6/1500/HO/840</td>
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ULTRA RT8
LED Downlight Retrofit Kit

High efficiency, highest lumen output

Energy saving, high lumen, universal input voltage (120-277V) retrofit for 8-inch downlights with compact fluorescent 26/32/42W double tube or triple tube pin-based lamps providing energy savings up to 50% and long 50,000 hours rated life (L70).

• 2000 lumens - 27W (74 LPW)
• Up to 4x life of compact fluorescent
• Instant on, full brightness
• Dry, damp and wet rated, non-Dimmable
• 82 CRI - 3000K, 3500K and 4000K CCT

Applications
• Downlight retrofit for compact fluorescent, halogen or metal halide fixtures

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<td>72509 - LED/RT8/2000/840</td>
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LED T8 Options in the North American Market

Internal driver
LED T8 Lamps

External driver
LED T8 Lamps

Fluorescent Ballast
Compatible LED T8 Lamps
ULTRA HE T8 LED Retrofit Kits
(External Driver)

SubstiTUBE™ IS T8 LED Lamp
Compatible T8 LED lamp for use with Instant Start Electronic T8 Ballasts
ULTRA HE LED T8 Retrofit Kits (External Driver)

Overview

- **Light output:**
  - 2ft - Up to 1150 lumens @ 10W
    - available in 1, 2, & 3 lamp configurations
  - 4ft - Up to 2450 lumens @ 19W
    - available in 1, 2, 3 & 4 lamp configurations
  - 4ft Dimmable - Up to 2450 lumens @ 22W

- **Efficacy:** Up to 129 LPW
- **Long life:** 60,000 hours (L70)
- **CCT:** 3000K, 3500K, 4100K, 5000K
- **CRI:** >80
- **Beam angle:** 150°
- **Input voltage:** Universal 120-277V & 347V (dedicated external driver)
- **Driver:** External, non-isolated

- **Warranty:**
  - 5-year system warranty (24/7 operation)
  - 7-year system warranty (16/7 operation)
  - 8-year system warranty (12/7 operation)
- **Made in South Korea:** a favored trading partner
# SubstiTUBE™ IS T8 LED (Compatible)

## Overview

SubstiTUBE™ IS T8 LED

Compatible T8 LED for use with instant start electronic T8 ballasts

### Key Features & Benefits

- **Light output:**
  - 4ft: ~2000 lumens on ISN ballast

- **Efficacy:** ~105 LPW

- **Long life:** 50,000 hours (L70)

- **Input voltage:** Universal 120-277V & 347V

- **CCT:** 3000K, 3500K, 4100K, 5000K

- **Beam angle:** 150°

- **Compatible with instant start electronic T8 ballasts with input voltage of 120-277V and 347V**

- **THD <20%, power factor >0.90**

- **013 medium bi-pin base**

- **Long life: 50,000 hour life (L70)**

- **5 year warranty (24 hour burn cycle)**

- **Reduces energy consumption up to 35%**

- **No warm-up time, instant-on with full light output and stable lamp to lamp color**

- **Glass free, vibration and impact resistant**

- **No UV emission**

- **Suitable for dry and damp locations (cannot come in direct contact with water)**

- **Made in South Korea: a favored trading partner**

## Specifications and Certifications

OSRAM SubstiTUBE IS T8 LED lamps are an energy saving alternative, designed to replace traditional fluorescent T12 or T8 lamps. These shatterproof T8 LED lamps contain no mercury, provide instant light and a uniform light distribution.

Engineered to operate on existing instant start electronic T8 ballasts, these lamps minimize labor and recycling costs.

- **UL Listed**
- **E327386**
- **E350359**
- **TUV**
- **RoHS**
- **DLC**

## Product Offering

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<th>Length</th>
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<tr>
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Traditional Lamps
OCTRON® 800XP® XL and XP XL SUPERSAVER®
ECOLOGIC®3 T8 Lamps

Longest life family in the Industry

Long life, energy saving T8 lamps with up to 84,000 hours average rated life at 12 hours/start on programmed start ballast and up to 75,000 hours average rated life at 12 hours/start on instant start ballast available in 4-ft and new 3-ft and 2-ft lamps.

- Consistent luminance within 4%
- 4ft - 25W SS (2400 lm), 28W SS (2600 lm) and 32W (2950 lm)
- 3ft - 21W SS (1850 lm)
- 2ft - 15W SS (1150 lm)
- 85 CRI - 3000K, 3500K, 4100K and 5000K
- Dimmable on approved ballasts

Covered by QUICK 7XL+™ System Warranty with QUICKTRONIC electronic PROStart®, DIM, or DALI ballasts covering ballasts for 7-years and full wattage lamps for 6-years and SUPERSAVER XL lamps for 7 years.

Full warranty coverage on short cycle down to 10-minutes/start and longer settings.
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Lumen Maintenance Comparison

Lumen Maintenance

% of Initial Luminous Flux vs. Life (hours)

- 700 Series
- XP & XP/SS
- XP/XL/SS
- XP/XL
- T8 LED

OSRAM SYLVANIA
ENCELIUM® Energy Management System
ZigBee Wireless Capabilities

*Bringing Encelium into new spaces*

- Cost effective solution to upgrade to Encelium
- Robust connectivity to hard-to-reach areas (ex. Parking garages)
- Sleek designs
- Simpler installation
Case Studies – Exterior LED Solutions

Uncovering all the Benefits
Case Study – CSUSM Post Top CFL to LED Upgrade
After energy efficient lighting upgrade

Case Study: Grossmont & Mira Costa College

Mira Costa Project
Rexel worked with Mira Costa College to assist in auditing the space and specifying the product solution best suited to the needs of the campus. The end result reduced annual energy consumption by 67% and created an attractive, safe environment for students and faculty.

Energy Savings

67%

Fixtures: ................... 333
Cost: .................... $245,000

Grossmont/Cuyamaca Project
In supporting the Grossmont College energy efficient projects, Rexel found the best product solution that matched the needs of the campus. Rexel was awarded the project with a key account utilizing CREE’s Edge Series products and Wattstopper Advanced Lighting Control Panels. The end result was a two-campus exterior lighting retrofit totaling 594 fixtures.

Energy Savings

64%

Fixtures: ................... 594
Cost: .................... $890,000
“Bringing it all Together”
Interior Linear Fluorescent Troffers -

Locations
- Facility Management
- Back of House
- Office space
- hallways

Reasons to upgrade
- Energy Savings
- Maintenance Cost Savings
- Increase in Productivity
- Safety
- Sustainability
- Saving Capital
- Generate Revenue
Why LED Tubes?

- Energy Savings – at least 30% from T8/T12
- Run off EXISTING ELECTRONIC BALLAST LAMP FOR LAMP CHANGE OUT
- Easy retrofit – uses existing tombstones
- Cost Effective
- Rebate Eligible (utility dependent)
- Safe
Interior Linear Fluorescent Troffers – Option # 2

LED Troffer Retrofit Kits

Why LED Kits?

- Energy Savings – at least 45%
- 50,000 Ls70 ratings
- Uses existing fixture and seismic bracing
- Adaptive control upgrade kits
- Cost Effective
- Rebate Eligible (utility dependent) DLC listed
- New lens look = aesthetically pleasing
Why New Fixture?

- Energy Savings – at least 45%
- 50,000 Ls70 ratings
- Replaces possible existing damaged fixtures
- Design effective
- Rebate Eligible (utility dependent) DLC listed
- New fixture look = aesthetically pleasing
- Extended warranty
- Multiple options – Variance in Cost
LED Fixtures with integrated controls

Out of the Box Controls Solution

Integrated Controls on new fixtures: “Out of the Box Solution.”

No control wires!

Programed control down to individual zones

Front end trimming

Occupancy and Day Lighting control – Increased Energy Savings

Smartcast Video
Savings to Investment Ratio - SIR

Step 1
Determine the total cost of the project. For example, if you want to replace 1,000 fluorescent T8 fixtures through a USD with energy-efficient LED lighting and energy-efficient fixtures cost $200 a piece, the total cost of the project would be (1,000 x $200) = $200,000.

Step 2
Determine the useful life of the asset. The useful life is the estimated period of time an asset will be useable and able to provide a service or produce revenue. Continuing with the same example, assume that the useful life of the energy-efficient LED fixtures is 20 years.

Step 3
Determine the annual increase (or decrease) in savings associated with the project. Continuing with the same example, assume that you would save $29,700 a year in energy costs by replacing 1,000 of your existing fluorescent fixtures with energy-efficient LED luminaires.

Step 4
Multiply the useful life of the product by the savings per year associated with the project. Then divide the result by the total cost of the project. Continuing with the same example: SEE NEXT SLIDE..
### XYZ USD Savings Calculator - Interior fluorescent to LED fixture with Lighting Control

**Streams of Cash Inflows and Outflows**

#### Analysis

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<tbody>
<tr>
<td><strong>CASH OUTFLOWS</strong>&lt;br&gt;Single investment</td>
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<td><strong>SUBTOTAL OUTFLOWS</strong></td>
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#### CASH INFLOWS

- **Rebate/incentive rec’d**<br>Energy savings | $ 100,000.00 <br>**Annual Cash Flow**<br>($100,000.00) | $29,700.00 | $30,591.00 | $31,508.73 | $32,453.99 | $33,427.61 | $34,430.44 | $35,463.36 | $36,527.25 | $37,623.07 | $38,752.00 | $38,752.00
- Maintenance Cost Savings | $ | $ | $ | $ | $ | $ | $ | $ | $ | $ | $ |
| **SUBTOTAL INFLOWS** | $ 100,000 | $29,700 | $30,591 | $31,508 | $32,454 | $33,428 | $34,430 | $35,463 | $36,527 | $37,623 | $38,752

| **Annual Present Value**<br>($100,000.00) | $27,000.00 | $25,281.82 | $23,672.98 | $22,166.51 | $20,755.92 | $19,435.09 | $18,198.31 | $17,040.23 | $15,955.85 | $14,940.48

#### 10-YEAR<br><br| Net Present Value | $ 104,447 | ($73,000.00) | ($47,716.18) | ($24,045.21) | ($1,878.69) | $18,877.22 | $38,312.31 | $56,810.62 | $73,580.85 | $89,506.71 | $104,447.19 |
| Simple Payback Period | 3.37 |
| Return on Investment | 29.7% |
| Initial Rate of Return | 29.7% |
| Modified Initial Rate of Return | 18.2% |
| Savings to Investment Ratio | 2.0 |

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**NOTE THAT CERTAIN RETURNS VARY DEPENDING ON THE LENGTH OF THE ANALYSIS TERM**
Thank you!