**Emerging Technologies: Recent Results and Issues for Outdoor Lighting**

Mary Matteson Bryan, P.E.

Anchorage, AK
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CUSTOMER ENERGY EFFICIENCY EMERGING TECHNOLOGIES

PG&E

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## Presentation Overview

- Recent Results
  - Oakland Phase III
- Issues
  - Maintenance, design practices, incentives, rate schedules



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## Presentation Overview

- **Recent Results**
  - Oakland Phase III
- Issues



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## Emerging Technologies

- New Sources
  - LED Lighting
  - Induction Lighting

Beta LED


Induction Lighting

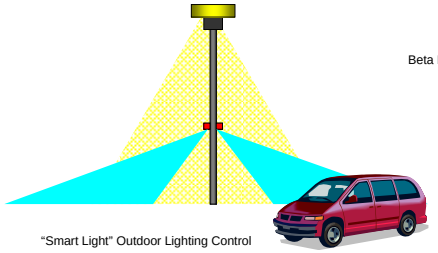
Others?

Induction Parking Garage

Source: California Lighting Technologies Center

## Emerging Technologies

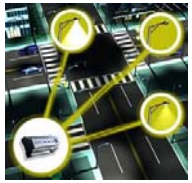
- Controls



"Smart Light" Outdoor Lighting Control

Source: California Lighting Technologies Center

Beta LED w Occupancy Control



Echelon Network Streetlight Control





## Recent Results: LED Street Light Assessment - Oakland, CA

- Emerging Technologies Field Assessment
  - Collaboration with PG&E, DOE (PNNL), City of Oakland, Beta LED
  - Basecase: 100 W HPS
  - Phase II
    - November 2007
    - 3-bar Beta LED Edge
  - Phase III
    - July 2008
    - Beta LEDWay

www.etcc-ca.com or www.netl.doe.gov/ssl





## LED Street Light Assessment - Oakland, CA

- **Measured Power Consumption**

| Fixture | HPS | Phase 2 LED | Phase 3 LED |
|---|---|---|---|
| Power (W) | 121 | 78 | 58 |
| Savings | | 43 | 63 |
| Percent Reduction | | **36%** | **52%** |

Source: PG&E Emerging Technologies Assessment





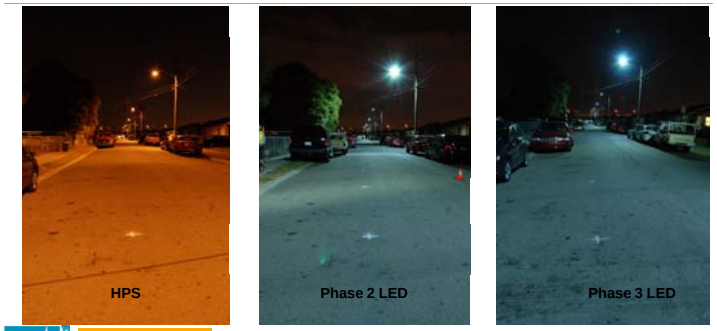
## LED Street Light Assessment - Oakland, CA

- **Lighting Performance**

| Fixture | Avg Illum (fc) | Max Illum (fc) | Min Illum (fc) | Max to Min |
|---|---|---|---|---|
| HPS | 1.00 | 3.53 | 0.19 | 19.0:1 |
| Phase 2 LED | 0.58 | 1.21 | 0.19 | 6.5:1 |
| Phase 3 LED | 0.50 | 1.21 | 0.19 | 6.5:1 |

Source: PG&E Emerging Technologies Assessment

## LED Street Light Assessment - Oakland, CA








## LED Street Light Assessment - Oakland, CA

- Customer Acceptance
  - 60 households contacted
  - 20 noticed the new lights
  - 70% preferred LED lights
  - Perceived improved visibility, overall appearance and nighttime safety

Source: PG&E Emerging Technologies Assessment





## LED Street Light Assessment - Oakland, CA

- **Economic Performance**

| Retrofit Scenario | Installed Cost ($) | Total Annual Savings ($/yr) | Estimated Payback (yr) |
|---|---|---|---|
| HPS | $0 | $0 | NA |
| Phase 2 LED | $833 | $42 | ~20 |
| Phase 3 LED | $605 | $52 | ~12 |

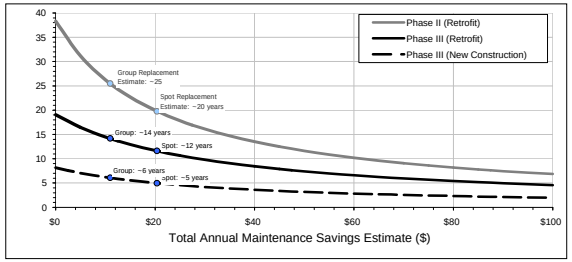
Source: PG&E Emerging Technologies Assessment





## LED Street Light Assessment - Oakland, CA

- **Maintenance Cost Impact on Economic Performance**




Source: PG&E Emerging Technologies Assessment

## LED Street Light Assessment - Oakland, CA

- **Progress in 12 Months**
  - Cost reduced 34% (from $610 to $400 luminaire cost)
  - Energy consumption reduced by 25% (from 78W to 58W)
  - Lighting performance maintained
    - Same LEDs, better engineering





## Presentation Overview

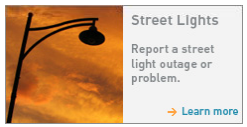
- Opportunities
- Issues
  - Maintenance, design practices, incentives, rate schedules





## Maintenance and Operation Cost Savings

- Longer life
  - Reduced replacement part cost
  - Reduced field labor
  - Reduced hazardous waste disposal cost
  - Reduced administration cost
- Difficult to quantify
  - Range from $12/year/fixture - over $100/year/fixture








## Outdoor Lighting Practices

- Current practices do not fully address the different attributes of various lighting sources
- Outdoor Lighting Symposium - September 2008
  - Areas identified for research and development
    - Lumen effectiveness multipliers
    - Best practices
    - Adaptive standards
    - Development of visibility metrics
    - Additional demonstrations

## Incentive Program Development Challenges

- Variable Product Quality
- High Cost - Marginal Total Resource Cost (TRC)
- Setting Incentive Levels
- Rapid Technology Advancements
- Customer Education






## Standards Based Incentive Approach

- Benefits
  - Maintain high quality
  - Support DOE Energy Star and industry-standard test methods
  - Send signal to the market that quality matters
- Results
  - Higher customer satisfaction
  - Persistent, reliable energy savings





## Proposed DOE Energy Star Category A Criteria

- Street and Area Lighting
  - Minimum Light Output: 2,300 lumens (initial)
  - Zonal Lumen Density Requirement: 100% below 90º, Dark Sky compliant
  - Beam Uniformity: Varies by luminaire classification type
  - Minimum Luminaire Efficacy: 50 lumens/watt

http://www.drintl.com/temp/ENERGY_STAR_Cat_A_Additions_final.pdf





## Street Light Rate Schedules

- Issues
  - Street Lights are typically unmetered
  - Rate based on type of lamp, calculated energy use
  - No “standard” products
  - Lengthy regulatory process
  - What about controlled streetlights?

## Street Light Rate Schedules

- Proposed Solutions
  - Develop “wattage categories”

| LED Luminaire Wattage | Rate $/Luminaire/mo |
|---|---|
| 50.0 - 54.9 | $???? |
| 55.0 - 59.9 | $???? |
| 60.0 - 64.9 | $???? |

  - Validate energy consumption based on IESNA LM-79 test
  - Adjust controlled streetlights based on confirmed operating schedule





## Thank You!

Mary Matteson Bryan, P.E.
- Tel: 415 305 5445
- marymattesonbryan@pacbell.net