Municipal Solid-State STREET LIGHTING CONSORTIUM

U.S. Department of Energy

# Technology and Market Assessment of Networked Outdoor Lighting Controls


**Mark Rehley**

Operations Manager, Emerging Technologies
Northwest Energy Efficiency Alliance (NEEA)
421 SW Sixth Ave, Suite 600 Portland, OR 97204
503.688.5499 mrehley@neea.org

**Jordan Shackelford**

Project Manager
Energy Solutions
1610 Harrison Street Oakland, CA 94612
(510) 482-4420 x 213
jshackelford@energy-solution.com

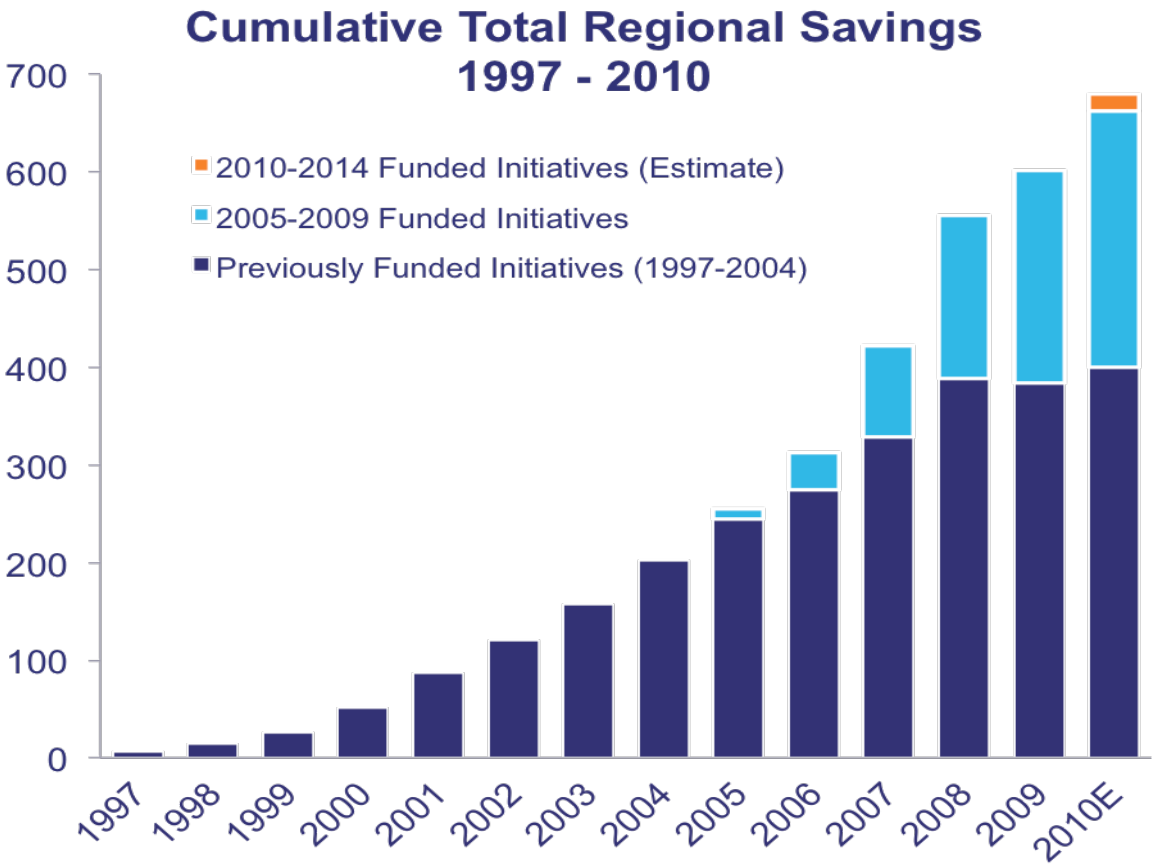
# About NEEA

## Our Purpose

To maximize energy efficiency

## Our Mission

Mobilize the Northwest to become increasingly energy-efficient for a sustainable future




*Source: NEEA 2009 Annual Report*

# NEEA Funders





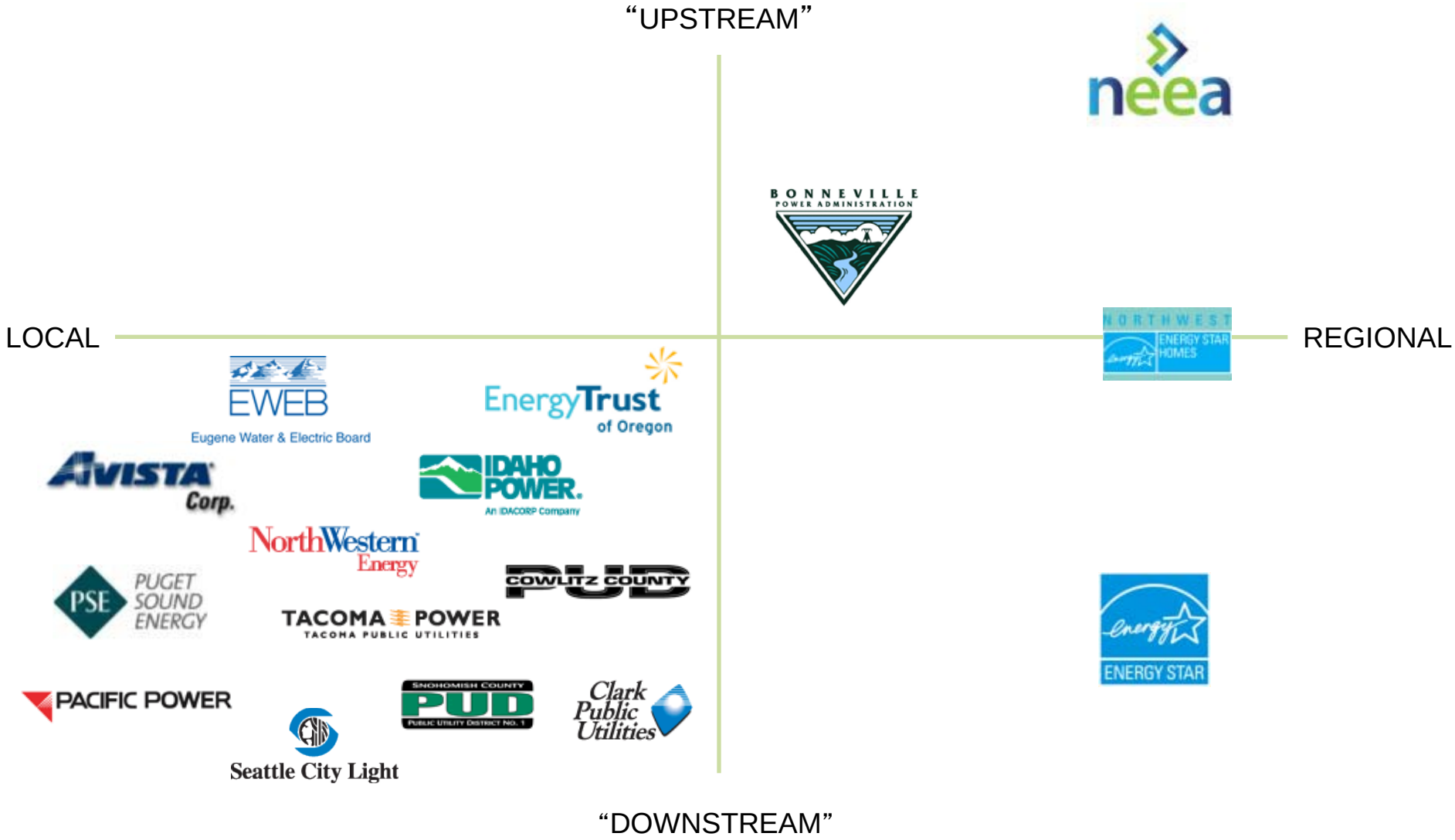








# NEEA's Role in Regional Partnership



# NEEA's History of Success

**Efficient Washers 50% Market Share**

1997

**1997** NEEA Launched

**1998** BacGen Reduces Wastewater Treatment Energy Use by 50%

**2000** VFD cold Storage Fans Reduce Energy Use by 61-86%

**2001** ENERGY STAR Windows Market Share Hits 75%

**2004** NEEA First National Partner for 80PLUS

**2004** Northwest ENERGY STAR New Homes Specifications

**2005** BetterBricks Healthcare Focus

**2007** CFL sales Top 18 Million

**2008** Northwest Food Processing Industry

**2009** Ductless Heat Pump Pilot Launched

**2010** Energy Forward Campaign

Municipal Solid-State STREET LIGHTING CONSORTIUM

U.S. Department of Energy

# Current Initiatives

## Residential

- Efficient Homes
- Televisions
- Desktop PCs
- Heat Pump Water Heaters
- Ductless Heat Pumps

## Commercial

- Commercial Lighting Solutions
- Existing Building Renewal
- Commercial Real Estate
- Healthcare
- Business IT

## Industrial

- Small/Medium Businesses
- Food Processors

## Agriculture

- Large Dairies
- Irrigation

## Codes & Standards

- Other Commercial Codes
- Other Commercial Standards
- Other Residential Standards
- Other Residential Codes

---

## Emerging Technology

- Heat Pump Water Heaters
- High Performance Windows
- Green Pumps
- Solid State Lighting

## Partner Services

- ConduitNW.org
- Efficiency Connections Northwest
- Other Regional Resources

Municipal Solid-State STREET LIGHTING CONSORTIUM

U.S. Department of Energy

# Technology and Market Assessment of Networked Outdoor Lighting Controls

# Outdoor Lighting: The Size of the Challenge

- U.S. roadway lighting
  - 52.8 TWh/year
- U.S. parking lot/garage lighting
  - 51.1 TWh/year
- Combined equivalent of:
  - 166.6 million barrels of oil
  - Over 71.6 million metric tons of $CO_2$-equivalent
  - Annual electricity use of almost 8.7 million homes

# Context for Updated Market Assessment

- PG&E study in 2009/2010:
  - Investigated 5 advanced controls products
  - Estimated energy savings of 29% from controls strategies
- Since PG&E study, the market has continued to rapidly evolve
  - Number of companies has increased dramatically
  - Types of controls products and features have changed

# Context for Updated Market Assessment

- NEEA sponsored new market assessment to update characterization of the rapidly changing market
  - Method:
    - Survey manufacturers and demonstration managers
    - Identify market changes and best product solutions based on features and in-field performance
    - Provide snapshot of current state of market
    - Provide guidance to potential consumers

# Outreach Efforts

**Surveyed Manufacturers**

- Acuity
- Strategic Telemetry
- Airinet
- Streetlight Intelligence
- CIMCON
- Venture
- Eagle WMAC
- Virticus
- Echelon
- Lumewave
- Owlet
- Ripley

**Surveyed Demonstrations**

- Glendale, Arizona
- Hamilton, Ontario
- Kansas City, Missouri
- Los Ángeles, California
- Portland, Oregon
- San Francisco, California
- San José, California
- U.S. Virgin Islands

# Available Controls: Then and Now

- Then: Simple photocells, and/or circuit based timers/schedules (parking lights)
- Now: Advanced networked systems (RF and/or PLC)
  - Sophisticated remote management/monitoring
    - Detect outages, issue maintenance alarms
    - Meter and log actual energy use
    - Dimming capability
    - Adaptive street lighting management, the practice of reducing lighting power and output as conditions change over time

# Advanced Controls Capabilities

- Standard features for controls products:
  - Basic on/off operation
  - Sunrise/sunset trimming
  - Failure detection and reporting
  - Luminaire grouping
  - Dimming and adaptive lighting capabilities
  - GPS-based mapping of managed fixtures
  - Power metering
  - Web-based monitoring and control
- Additional features popping up

# MSSLC Controls Task Force Survey

- Feb. 2011 Survey Results (64 cities and 33 utilities)
  - Maintenance benefits #1; also dimming, metering
  - Preference for self-hosting and managing network, data
  - Other features of interest:
    - GIS mapping, multiple security levels for access and operation
  - Favored RF over PLC based communications
  - Obstacles:
    - Cost
    - Lack of familiarity with or structure for managing streetlight controls systems
    - Lack of adaptive lighting guidance
    - Scalability concerns

# Controls Company Developments

- Many new entrants: both young and old!
- Exit of some larger brands
- Marketplace still maturing
- Of the 12 companies surveyed:
  - Acuity's ROAM leads in overall market penetration
  - 10: launched within the past 4 years
  - 6: launched within the past 2 years
  - ½: completed first 100+ fixture install in 2009 or later
  - 4: 10 or fewer employees
  - 2: haven't sold individual systems of over 100 units

# Real-world Installations

- Demonstrate technology to build confidence
- Installations mostly pilot scale
- But a few notable large installations are cropping up:
  - Los Angeles (underway), over 40,000 and counting: ROAM
  - Glendale, AZ; 19,500+: ROAM
  - US Virgin Islands; 16,000+ underway: CIMCON
  - Austin, TX installation of 70,000 planned: ROAM
  - San Francisco PUC installation of over 18,000 planned
  - San Jose installation of 62,000 planned

# Cost Challenges

- Up-front costs remain high
  - Estimated range of $100 to $250 per fixture
  - In many cases ongoing costs for network hosting and services
  - Compared to PG&E report of over a year ago, costs have remained stable even though more products are available
- Energy savings (reduced operating hours or lighting wattage) currently difficult to monetize

# Other Hurdles

- Non-metered (flat rate) streetlight energy tariffs
  - BUT "revenue grade" data could come from controls
    - Need: new tariffs that accept energy data from controls
    - Need: guidance on acceptable frequency, accuracy of measurements
- THEN adaptive lighting practices become attractive
  - BUT no IESNA guidance on use of RP-8-00 for adaptive lighting

| Road and Pedestrian Conflict Area | | Pavement Classification | | | Uniformity $E_{avg}/E_{min}$ |
|---|---|---|---|---|---|
| Road | Pedestrian Conflict Area | R1 fc | R2 & R3 fc | R4 fc | |
| Collector | High | 0.8 | 1.2 | 1.0 | 4.0 |
| | Medium | 0.6 | 0.9 | 0.8 | 4.0 |
| | Low | 0.4 | 0.6 | 0.5 | 4.0 |

  - CIE 115:2010 (Europe) does include adaptive lighting

# Trends and Developments

- City of San José's new Adaptive Street Lighting Design Guide
- BPA Adaptive Lighting Symposia in 2010 and 2011
- CLTC Guide for Implementing Adaptive, Energy-Efficient Exterior Lighting
- Push for "controls-ready" lighting products
- MSSLC Controls Task Force Draft Specification
- San José, Oakland, and CAL-SLA working for customer-owned, customer-metered tariff
  - Pilots underway

# Report Recommendations

- Continued information collection/sharing among public stakeholders
- Work toward metering structures that accept controls-based energy data
- Adaptive lighting guidance from IESNA and/or elsewhere critical
- Reduction in cost of advanced controls
- Controls-readiness in lighting investments