# LIGHTING ACTIVITY WORKBOOK

# PREPARED FOR PACIFIC GAS & ELECTRIC, SOUTHERN CALIFORNIA EDISON, AND SAN DIEGO GAS & ELECTRIC

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# 1. Executive Summary

California has set an ambitious goal to reduce lighting energy use 60%-80% from the 2010 baseline year by 2020[1]. The California electric Investor Owned Utilities (IOUs) are key actors in the state's efforts to reach this goal because of their wide ranging work to advance efficient lighting solutions. The IOUs' Lighting Market Transformation program is focused on driving the market adoption of efficient lighting solutions through the wide range of activities supported by the IOUs: from emerging technology assessments and demonstrations to incentive and education programs to eventual inclusion of more efficient lighting technologies in state and federal codes and standards.

This report is a summary of an effort sponsored by the Lighting Market Transformation program to develop a Lighting Activity Workbook: a compendium of lighting activities completed during the 2010-2012 Program Cycle by the IOUs as well as information from eleven other efficiency organizations and standards bodies. The intent of the workbook is to facilitate greater coordination and collaboration among the IOUs and other energy efficiency organizations to accelerate efforts in bringing advanced lighting technologies to market.

Waypoint Building Group supported the IOUs in designing and developing the Lighting Activity Workbook. This report provides the background leading to the initiation of this project, the method used by Waypoint to gather and organize the workbook's information, and suggestions for building on this effort in the future. As next steps for the workbook, Waypoint recommends:

- Conducting a gap analysis to analyze the over or under representation of potential lighting solutions and to identify key initiatives by other leading efficiency organizations that can be leveraged by the IOUs to achieve their market transformation goals.
- Transitioning the Lighting Activity Workbook into a more user-friendly database.
- Enhancing the scope of the Lighting Activity Workbook to capture prospective future activities and additional technologies that could benefit from a similar effort.

[1] California Public Utilities Commission; Energy Efficiency Strategic Plan 2011 Update, Pages 95-112 http://www.cpuc.ca.gov/PUC/energy/Energy+Efficiency/eesp/

## 2. Background

The California electric investor owned utilities (IOUs) are among the largest energy efficiency organizations in the country, with combined 2010-2012 adopted budgets of over $3.15B.[2] With these funds, the IOUs advance numerous technologies that enable their customers to more effectively manage their energy use ranging from lighting to HVAC to consumer electronics, among others. Historically, lighting has been the primary driver of energy efficiency savings for the IOUs and that remains true this portfolio cycle. At the conclusion of Q3 2012, lighting technologies had delivered 50.5%, 54.7, and 69.3% of Pacific Gas and Electric, San Diego Gas and Electric, and Southern California Edison's non codes and standards portfolio performance, respectively.[3]

The significant percentage of performance attributed to lighting partially reflects that it is the largest source of electric energy consumption for residential (22%) and commercial (35%) customers in California and 25% of the state's total.[4] In addition to the quantity of energy consumed by California's lighting use, there are a number of lighting technologies that provide a wide range of customers the ability to cost-effectively reduce their energy use including compact fluorescent lamps (CFLs), light emitting diodes (LEDs) and lighting controls (controls).

Some lighting technologies, such as T8 linear fluorescent lamps and CFLs, will be deemphasized or eliminated in the 2013-2014 program cycle due to federal and state code changes. These technologies have formed a significant percentage of the IOUs' portfolios to date, but there is still significant energy efficiency potential to be tapped with the continuing adoption of advanced lighting technologies and practices in California. For example, the United States Department of Energy estimates that the over 8.2 billion lamps in the United States consume over 700 TWh of electricity.[5] Given that 62% of residential lamps in the United States are still lit through an incandescent source and the average residential lamp uses 46 watts of electricity, with 86% lacking a lighting control of any kind, there is still significant savings potential remaining.[6]

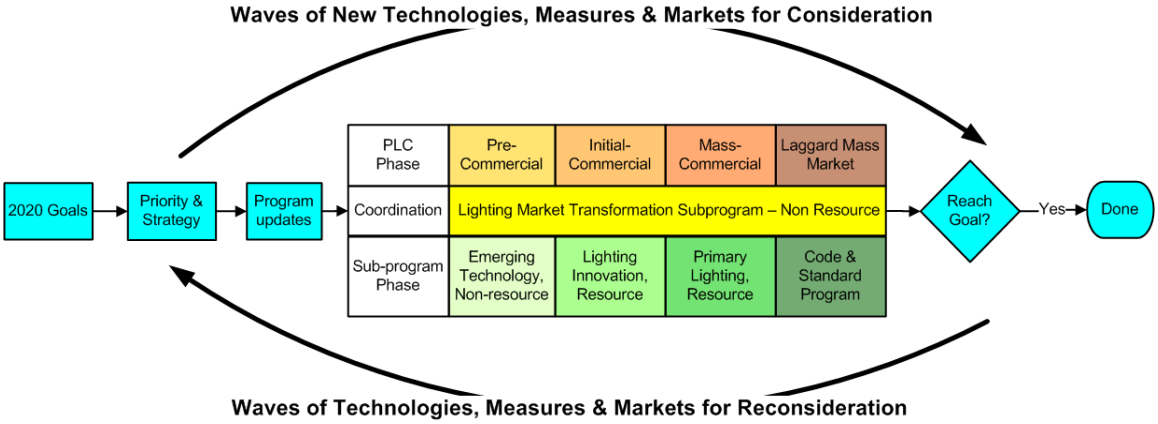
Given California's goal of reducing lighting energy use 60%-80% from the 2010 baseline year by 2020, the CPUC established a statewide Lighting Market Transformation program during the 2010-2012 portfolio cycle to develop and implement strategy for facilitating accelerated market adoption of more advanced lighting technologies and best practices. This program includes representatives from each of the Investor Owned Utilities that work with each IOU's cross-functional programs, the Energy Division and key industry stakeholders to advance efficient lighting technologies and best practices.

The process for achieving this goal has been to evaluate the full suite of lighting solutions, prioritize those that have the greatest energy efficiency potential, and then develop detailed plans for how the

[2] Energy Efficiency Groupware Application. Retrieved from: http://eega.cpuc.ca.gov/Documents.aspx
[3] Ibid.
[4] California Public Utilities Commission. Strategic Plan Lighting Chapter. Retrieved from: http://www.cpuc.ca.gov/NR/rdonlyres/BE058656-3913-4DDD-92D5-60E82DD6AF0C/0/Lightingchapter_CAEnergyEfficiencyStrategicPlan_Jan2011.pdf
[5] United States Department of Energy. 2010 Lighting Market Characterization. Retrieved from: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf
[6] Ibid.

IOUs will advance the prioritized technologies and market approaches. A diagram of this process can be found in Figure 1, 2013-2014 Lighting Market Transformation Process Flow.

Figure 1: 2013-2014 Lighting Market Transformation Process Flow




To develop lighting solution strategies, one of the program's first core activities was to develop the Lighting Solution Workbook[7] which provides a lighting market taxonomy based on California market data. This information was used to identify the market sectors and technologies with the greatest opportunity for significant energy reduction. In addition, the IOUs outline Pipeline Plans in their annual report each year. These Pipeline Plans detail how the IOUs are advancing the biggest opportunity solutions.

To complement the Lighting Solution Workbook, the program identified the need for a Lighting Activity Workbook: a compendium of the work the IOUs and key efficiency organizations are pursuing to advance efficient lighting solutions. The goal of the Lighting Activity Workbook is to provide the IOUs and its key partners with a full understanding of the work that each organization is doing to advance efficient lighting. The intended audience of this product was initially only the IOU program representatives. However, through its development, interest among many other efficiency organizations has influenced the project's approach and scope. The workbook is intended to maximize the synergies among the IOUs and its key partners to identify best practices. After this first iteration of the Lighting Activity Workbook, the program will collaborate with interested key partners and evaluate approaches for future versions of this workbook.

The IOUs commissioned Waypoint Building Group to design and develop the Lighting Activity Workbook. This report summarizes the methodology and result of this effort. It should be noted that both workbooks are not intended to flow linearly, but rather to mutually reinforce one another. The Lighting Solution Workbook provides insight into which technologies should be the greatest focus for the IOUs and it also informs their Pipeline Plans. The Lighting Activity Workbook helps to track and coordinate IOU efforts to advance technologies and drive greater market penetration of leading lighting solutions. These efforts will result in transformed markets which will alter where the biggest opportunities are for

[7] The Lighting Solution Workbook report can be found here: http://www.calmac.org/publications/LMT_Workbook_Final_Report_2-24-12.pdf

IOUs. These opportunities will, in turn, be reflected in the Lighting Solution Workbook which will then impact the Pipeline Plans and efforts chosen by the IOUs.

The remainder of this report summarizes the information collected in the Lighting Activity Workbook, the process for obtaining it and recommendations for how the report can further enable the IOUs efforts in the future.

## 3. Methodology

To assist with the workbook's development the Waypoint team first conducted a literature review of pertinent documents identified by the Lighting Market Transformation program, namely the Lighting Solutions Workbook and LMT Annual Reports. This background information led to the development of the Lighting Activity Workbook's categories. These categories will be outlined in more depth in the Report Structure section of this report, but are as follows:

- Activity Category
- Activity Name
- Sector
- Sub-Sector
- Application
- New Product / Service
- Legacy Product / Service
- Program / Study / Campaign Launch
- Program / Study Expected Completion Date
- Funding
- Brief Description / Purpose
- Lead Organization
- Partners
- Website

Once the workbook categories were determined by the project sponsors, the next task was to determine from which individuals within their organizations and outside of their organizations they wanted to gather input. The partners determined that the project's scope would include the following eleven external organizations with a range of lighting expertise including standards bodies, regional efficiency organizations and leading energy efficiency organizations:

- Bonneville Power Administration
- British Columbia Hydro
- California Lighting Technology Center
- Efficiency Vermont
- New York State Research and Development Authority
- Northeast Energy Efficiency Partnership

- Northwest Energy Efficiency Alliance
- Pacific Northwest National Laboratory
- Puget Sound Energy
- Sacramento Municipal Utility District
- United States Environmental Protection Agency

After the partners selected organizations, Waypoint developed an interview guide in close consultation with the project sponsors to capture information on the categories for the Lighting Activity Workbook as well as other topics of interest. The questions asked during the interviews can be found in Appendix A: Lighting Activity Workbook Interview Guide.

Throughout the project, the team conducted weekly check-in meetings to update the sponsors on progress connecting with their internal contacts as well as the selected external organizations and to review the updated versions of the Lighting Activity Workbook.

# 4. Workbook Structure

The Lighting Activity Workbook is intended to be used in conjunction with the Lighting Solutions Workbook and to inform Pipeline Plans as well as future Annual Reports. As a result, the project sponsors clearly indicated that, to the extent possible, the Workbook's structure should closely mirror that of the Lighting Solution Workbook to enable future integration. This section defines the fourteen categories for the Lighting Activity Workbook in detail.

### Activity Category

This category captures the key element of the IOUs work that the activity corresponds to, including:

- Emerging Technologies – Demonstrating innovative lighting technology that promise significant savings potential
- Innovative Pilot – Testing innovative market deployment approaches
- Education and Training – Information developed to inform consumers about a technology or trainings offered to help residential/commercial customers and trade professionals understand and implement technologies or best operational practices
- Marketing – Approaches to influencing customers' purchasing behavior and driving customer's awareness of efficient lighting solutions
- Evaluation, Measurement and Verification – Work to assess a program's impact
- Workpaper Development – Business cases developed by the IOUs to justify energy savings claims for deemed (set dollar amount) incentives
- Codes and Standards – Work completed to influence local, state or federal standards to raise the baseline energy performance of a technology or building type
- Market Transformation – Activities driving the market toward sustainable adoption of energy efficient lighting solutions whereby program interventions, such as incentives, are no longer necessary

### Activity Name

This column captures a short description of the work pursued by the IOUs or external organizations.

### Sector

The workbook highlights three sectors: residential, nonresidential interior, and nonresidential exterior. This is the same structure used by the Lighting Solutions Workbook as well as BC Hydro's lighting roadmap. In addition, the California Commercial End Use Survey[8] divides the commercial lighting market into interior and exterior applications.

### Sub-Sector and Application

There is tremendous variability in the technologies used and operating practices within residential, nonresidential interior, and nonresidential exterior sectors. As a result, subsectors were provided for each sector to provide additional data granularity. The Lighting Solutions Workbook explored in depth the correct method for designing subsectors including:

Residential – The only residential sector is "All Residential". This sector is divided into two additional sub-sectors: interior and exterior applications.

Nonresidential Interior – The sub-sector and applications were divided based on commercial activities including:

- Common to all sub-sectors
  - General Lighting
  - Exit Signs
  - General Lighting for Lobbies and Corridors
- Small Commercial (Office, Retail, Clinics, Minimart)
  - General Lighting
- Large/Medium Offices
  - General Lighting
- Large/Medium Nonfood Retail, Warehouses, Manufacturing
  - Low/Medium Bay Lighting
  - High Bay Lighting
- Agricultural
  - General Lighting
- Large/Medium Grocery Store
  - Low/Medium Bay Lighting
  - Case/Display Lighting
- Hotel/Motel, Multifamily, Dorms, Assisted Living
  - Portable Fixtures in Rooms
  - Recessed/Common Area Lighting
- Hospitals
  - General Lighting

[8] Itron. California Commercial End-Use Survey. 2006.

- Restaurants
    - Dining Room Lighting
    - Menu Board Lighting
    - Kitchen Lighting
- University/College
    - Medium Bay for Classroom/Office Lighting
    - High Bay Lighting
- K-12
    - Classroom Lighting
    - Gymnasium/Cafeteria Lighting
- Other
    - General Lighting

Nonresidential Exterior – This sector was divided into the following two sub-sectors and corresponding applications:

- Roadway Lighting
    - Street Lights
    - Traffic Signals
    - Signs and Billboards
- Area Lighting
    - Outdoor Parking (Pole-Mounted)
    - Covered Parking (Ceiling Mounted)
    - Perimeter (Wallpacks)
    - Public Area (Pathway and Landscape)

### New Product/Service

This category was slightly modified from the Lighting Solution Workbook's "Replacement Lighting Practice" category based on feedback from the project's sponsors. The Lighting Activity Workbook encompasses both efforts to evaluate and incentivize technology as well as efforts to promote and educate customers on technology. As such, the category needed to be broader than it was for the Solutions Workbook, which is focused solely on providing an accurate taxonomy for the lighting market.

### Legacy Product/Service

The existing lighting practice that the new product or service is meant to replace.

### Program/Study Launch

The quarter the effort was initiated.

### Program/Study Completion

The quarter the effort was completed.

### Funding

The amount of funding directed at the effort (where available).

### Brief Description
This field is a synopsis of the activity that highlights key findings where available.

### Lead Organization
The organization leading the effort, frequently this responsibility was shared across the IOUs.

### Partners
This category lists all collaborators on a given activity. For instance, for emerging technologies partners this would include the vendors whose technology is evaluated as well as the organizations agreeing to participate in the study. For an innovative pilot, partners could include participating technology vendors and retailers.

### Website
This field provides the URL where additional information about the activity can be found. Examples include the emerging technology report or a link to a completed evaluation study.

## 5. Conclusions and Future Opportunities
The Lighting Activity Workbook project has revealed a tremendous amount of work underway across the IOUs and leading efficiency organizations to advance high performance lighting. Although the workbook now contains hundreds of rows of information, it is clear that the document is a first step in a longer process of information gathering to enable collaboration among the IOUs, standards bodies and other efficiency organizations. There was a great deal of enthusiasm among the other efficiency organizations to formalize the document into a format that can be maintained and updated over time.

Through the workbook project, a number of additional opportunities were identified by the Waypoint Team to improve upon the initial workbook iteration as well as to enhance collaboration between the IOUs and other leading efficiency organizations. The most significant of these opportunities are outlined below.

### Conduct a Gap Analysis
The Lighting Solution Workbook provides a taxonomy for the California lighting market with corresponding estimates of energy efficiency potential. The Lighting Activity Workbook highlights efforts underway to advance key lighting technologies. The IOUs can now conduct a gap analysis to determine which high potential technologies are over and under-represented by their efforts as well as to identify key initiatives by other efficiency organizations that can be leveraged by the IOUs to achieve their market transformation goals.

### Transition the Workbook into a User-Friendly Database
The IOUs sought to complete the first phase of the Lighting Activity Workbook during the 2010-2012 portfolio cycle with an understanding that it is a first iteration in a long process of effectively communicating information within and between the IOUs as well as with other efficiency organizations. The initial iteration has a great deal of information, but as an Excel file it will be challenging to maintain in its current form because of concerns about document control and accessibility. The project sponsors have reiterated throughout the process that in order to evolve, additional technology solutions for

maintaining and updating the data need to be explored. Waypoint has identified two decision points to move forward in this product's evolution:

***File Sharing and Access –***Throughout the workbook project a Microsoft SharePoint site has been used to share information among the project sponsors and with the Waypoint team. The site will remain active after the conclusion of the project for the project sponsors. If the future plan of the Activity Workbook is to share this information between a core group of select program managers, SharePoint (or a similar document-sharing platform) is recommended.

The downsides to SharePoint are that 1) the site requires an administrator and 2) documents stored on this platform often suffer from "out of sight, out of mind" and therefore are not always well maintained. Depending on the future audience of the Lighting Activity Workbook, the IOU's may want to evaluate a public website for displaying the information. The transparency of a public website promotes maintenance. Another limit to the current format is the limited ability to search and filter a spreadsheet. A more advanced database approach can be centrally stored in a SharePoint site or public website.

Other potential participating organizations that the IOUs could target to enhance the Lighting Activity Workbook include:

- BC Hydro
- Bonneville Power Administration
- California Public Utilities Commission
- California Lighting Technology Center
- ComEd
- Commercial Buildings Consortium
- Consortium for Energy Efficiency
- Efficiency Vermont
- Green Parking Council
- National Grid
- New York Energy Research and Development Authority
- Northeast Energy Efficiency Partnership
- Northwest Energy Efficiency Alliance
- NSTAR
- Sacramento Municipal Utilities District
- U.S. Department of Energy and National Labs
- U.S. Environmental Protection Agency

***Data Input and Updates –***There are three primary options for a process to update the information in the workbook over time.

First, an option that will require the least up-front investment is to require users to manually update the information in the spreadsheet when there is a change in program information or a new activity. This

process is simple, but it will be difficult to ensure that the information will be kept updated and consistent over time.

Second, an interviewee proposed using XML tags to allow a database to be automatically populated with relevant information. Tags allow a web program to scan organization web pages and insert updated information into the database automatically as it is revised. The downside to this approach is that it will require adopting this tagging practice within several areas of each efficiency organization (e.g. emerging technologies, marketing teams, EM&V).

A third, hybrid approach, is to develop a standard form that is imbedded with XML tags to be completed by users. Users will still be required to conduct limited data entry, but this process can be standardized and more user friendly in a form than by entering data into a spreadsheet. The workbook can be configured to automatically populate with updated data since the form is coded with the XML tags.

### Prospective View

The first stage of the project was to document efforts underway. During conversations with the project sponsors it was acknowledged that additional work is needed to capture the prospective work planned by the IOUs and leading efficiency organizations within a reasonable time horizon (two years was recommended). Conversations with external parties revealed similar interest in documenting planned work to allow for greater collaboration.

### Include Other Technologies

Multiple external organizations lamented that this effort was isolated to lighting technologies. If the LMT members find the database to be a useful communication and planning tool such an effort should be considered for other high priority technology categories such as HVAC and plug loads.

## 6. Appendix A: Interview Guide

# LIGHTING ACTIVITY WORKBOOK INTERVIEW GUIDE


**Administered by Waypoint Building Group**

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**October/November 2012**

This questionnaire is part of a study conducted by Waypoint Building Group on behalf of Pacific Gas and Electric, San Diego Gas and Electric, and Southern California Edison. The intent is to capture lighting activities underway at your organization. Your participation is greatly appreciated. Thank you.

## Background

1. Name Click here to enter text.
2. Role Click here to enter text.
3. Size of efficiency budget Click here to enter text.
4. Size of lighting budget Click here to enter text.

## Efficiency Organizations

1. What emerging technology projects have been completed, are underway, or are planned for the 2010-2012 time period? Click here to enter text.
2. What education and training efforts does your organization provide? For instance, do you have training centers, online tools, or other efforts to educate your customers on efficient lighting technologies and techniques? Click here to enter text.
3. What significant marketing efforts have been completed, are underway, or are planned for the 2010-2012 time period? Click here to enter text.
4. What incentive programs are available through your organization to advance lighting energy efficiency? Click here to enter text.
5. Have any new approaches to advancing lighting efficiency been piloted since 2010? Are any new pilots underway or planned? Click here to enter text.
6. Are any EM&V activities underway? Specifically, are there any studies underway that would inform program models, technical potentials, market potentials, etc? Click here to enter text.
7. What efforts has your organization undertaken to advance lighting codes and standards since 2010?
8. Are there any other activities underway to advance efficient lighting that you would like to discuss? Click here to enter text.
9. Are there other categories of information that should be considered for future workbook updates? Click here to enter text.

## CLTC

1. Can you confirm that emerging technology projects are accurately captured for the 2010-2012 period? Click here to enter text.
2. What emerging technology work do you currently have underway? Click here to enter text.
3. What lighting codes and standards work have you been involved in? Click here to enter text.
4. What other innovative pilots/programs (outside of ET) are you currently working on? Click here to enter text.
5. Is there anything missing from our analysis that you would like to see added in future updates? Click here to enter text.

## ENERGY STAR

1. Can you confirm that the lighting standards that we have captured are accurate for the 2010-2012 time period? Click here to enter text.

2. What new lighting standards are expected over the next two years? Click here to enter text.
3. What have been the most significant marketing efforts since 2010? Click here to enter text.
4. What marketing efforts do you have planned over the next two years? Click here to enter text.
5. What education efforts are you involved with? Click here to enter text.
6. Any innovative pilots? Click here to enter text.
7. What is your involvement with Community Based Social Marketing? Click here to enter text.
8. Are you involved in any studies (this will augment the EM&V section)? Click here to enter text.

## NEEP

1. Can you confirm that we've captured the lighting standard additions and revisions since 2010? Click here to enter text.
2. What new lighting standards are anticipated over the next two years? Click here to enter text.
3. What education efforts should be captured in this document? Click here to enter text.
4. What marketing efforts do you have underway to promote efficient lighting? Click here to enter text.
5. Are there any other studies that the project team should be aware of? Click here to enter text.
6. Does NEEP have any tracking tool that it uses to monitor work underway across its member efficiency organizations?

## NEEA

1. What emerging technology projects have been completed, are underway, or are planned for the 2010-2012 time period? Click here to enter text.
2. What education and training efforts does your organization provide? For instance, do you have training centers, online tools, or other efforts to educate your customers on efficient lighting technologies and techniques? Click here to enter text.
3. What significant marketing efforts have been completed, are underway, or are planned for the 2010-2012 time period? Click here to enter text.
4. What incentive programs are available through your organization to advance lighting energy efficiency? Click here to enter text.
5. Have any new approaches to advancing lighting efficiency been piloted since 2010? Are any new pilots underway or planned? Click here to enter text.
6. Are any EM&V activities underway? Specifically, are there any studies underway that would inform program models, technical potentials, market potentials, etc? Click here to enter text.
7. What efforts has your organization undertaken to advance lighting codes and standards since 2010?
8. Are there any other activities underway to advance efficient lighting that you would like to discuss? Click here to enter text.
9. Are there other categories of information that should be considered for future workbook updates? Click here to enter text.
10. Does NEEA have a tracking tool that it uses to monitor work underway across its member organizations?