



# Regional Streetlight Procurement Program

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12/07/17*

# Delaware Valley Regional Planning Commission (DVRPC)

An aerial photograph of Philadelphia, Pennsylvania, showing the city skyline with numerous skyscrapers, the Schuylkill River, and surrounding urban and suburban areas. The sky is clear and blue.

Metropolitan Planning Organization  
for Greater Philadelphia Region

Bi-state, nine counties surrounding  
and including Philadelphia.

5.6 million residents

Planning areas

Transportation Planning, Air Quality,  
Smart Growth Planning, Environmental  
Planning, Housing and Economic  
Development, Population and  
Employment forecasts, Long Range  
Planning, *Energy Planning*

# Challenges for Municipal Energy Management

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238 small and medium sized municipalities  
in SE Pennsylvania

- average population of 10,220

Where do I start?  
Who do I trust?  
What solutions are right for me?  
How do I pay for it?  
How do I convince my elected officials this is a good idea?  
How do I track the progress?

# Barriers specific to street lighting

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- 20 year project – this is a big decision.
- Will technology improve?
- Design considerations
  - Controls ready
  - Color temperature
  - Illumination levels
- Operations and Maintenance

# The Perfect Storm for a Retrofit

## Technological

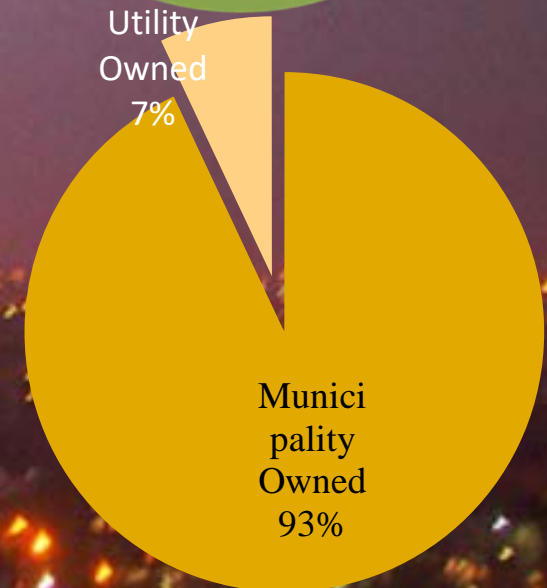
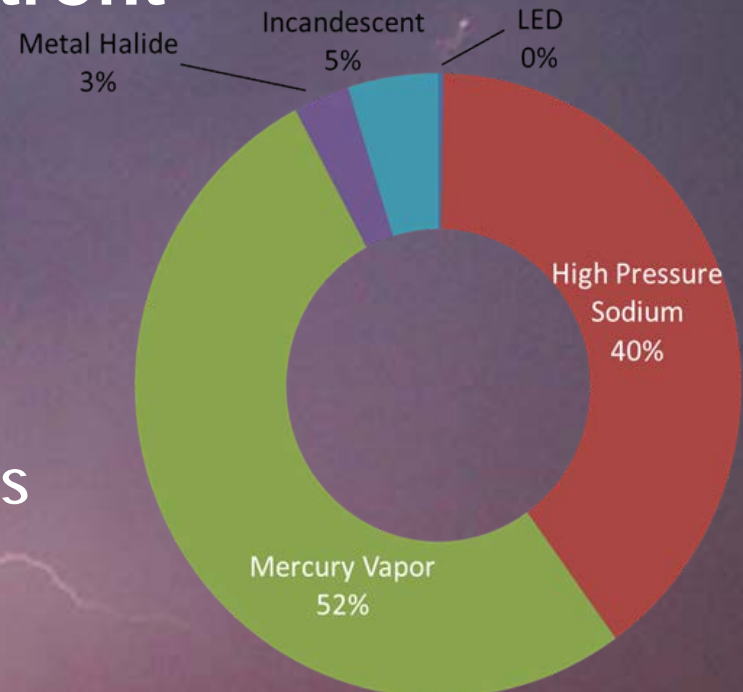
LED performance improvements  
Successful pilots in the region

## Regulatory

Municipal ownership of streetlights  
Utility recognition of LEDs

## Financial

LED costs dropping  
Pennsylvania Sustainable Energy  
Finance (PennSEF) Program



# Regional Streetlight Procurement Program

35 municipalities in southeastern PA pooled their decision making and purchasing power to access energy performance contracting, finance, and technical assistance to convert their entire street lighting systems to LED.



>26,000 streetlights, etc, converted to LED



\$16 million net savings over 20 years



10.6 million kWh saved annually



5,500 metric tons of CO2e reduced annually



Improved lighting quality improves



# Program Partners

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## DVRPC

- Program manager and lead

## Keystone Lighting Solutions (KLS)

- Program “unbiased” technical partner, assisted with RFP, design and procurement oversight, and overall program design.
- Owners agent for 16/35 municipalities

## Pennsylvania Sustainable Energy Finance Program (PennSEF)

- Provided standardized program documentation (RFP, Guaranteed Savings Agreements), and legal and technical guidance on the energy performance contracting process in PA.
- Arranged a pool of financing

## Municipal Steering Committee

ESO – Johnson Controls Inc.

PECO – Investor Owned Utility



# Municipal Participants

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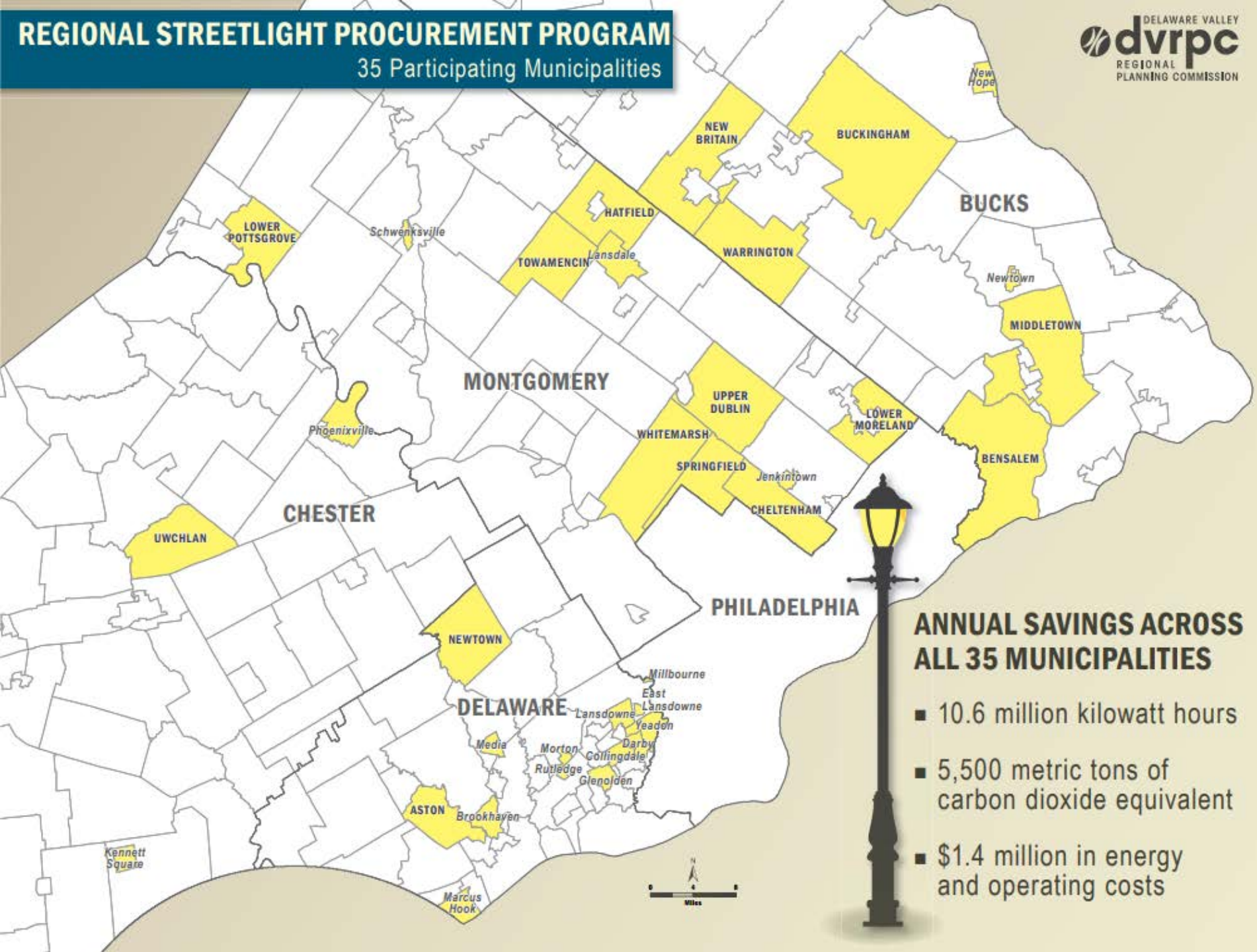
## 35 municipalities

- Each had their own contract “Guaranteed Savings Agreement”, but benefitted from pooling power
- 35 proceeded with contract out of 45
- 32 owned lights, 3 purchased from the utility
- Cobrahead, decorative, exterior, traffic signals converted. One implemented wireless network controls
- Range of project sizes:
  - Outdoor Lighting Systems ranged in size from 60 fixtures - 3500 fixtures, average 765.
  - Project cost ranged from \$24K - \$2.2M
  - 24 municipalities utilized financing, 11 paid using internal funds
- Payback ranged from 3-20 years, 10.4 average.
  - 3 municipalities purchased their lights from the utility. (average payback 6.3 years)



# REGIONAL STREETLIGHT PROCUREMENT PROGRAM

35 Participating Municipalities



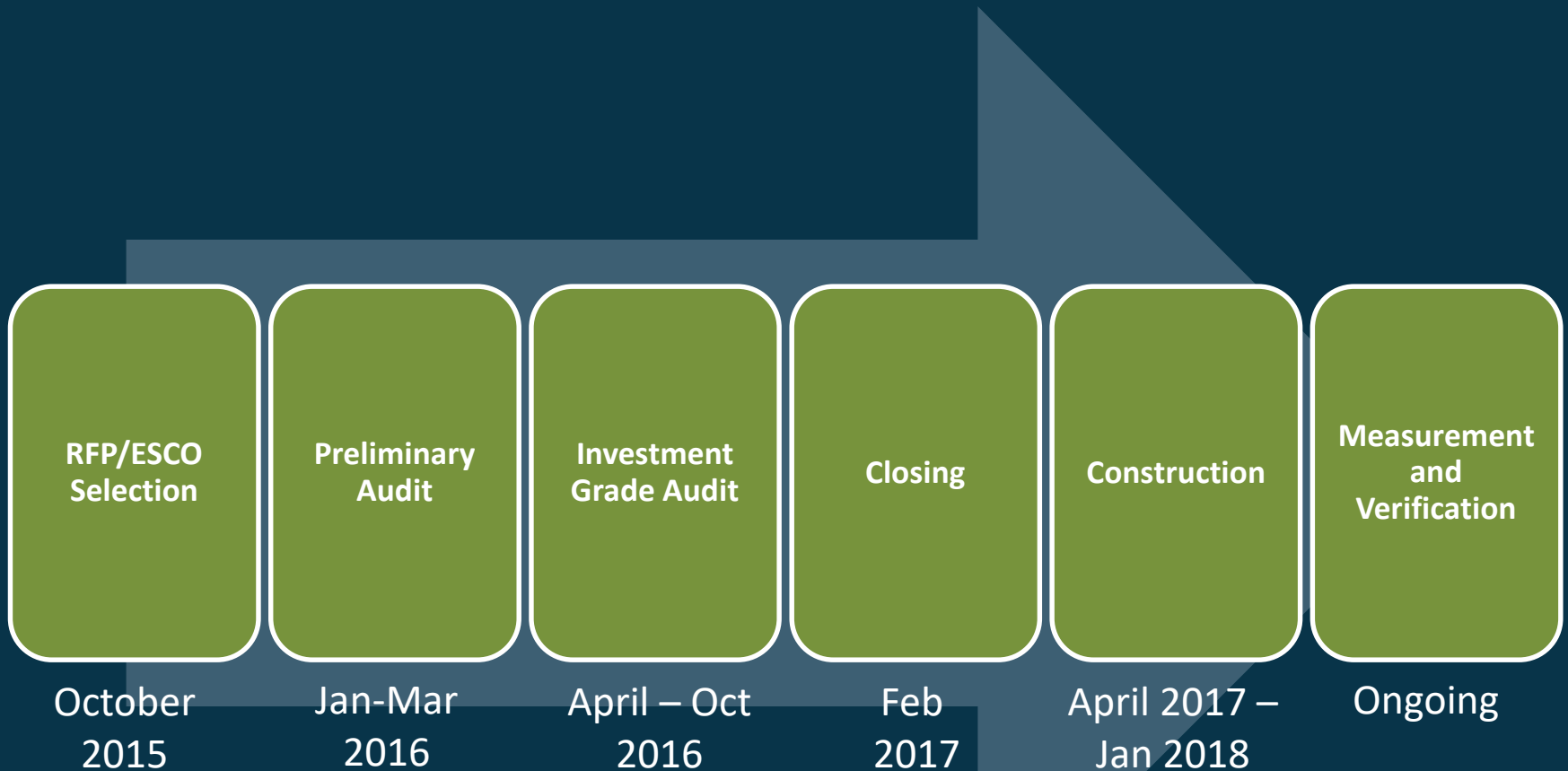
## ANNUAL SAVINGS ACROSS ALL 35 MUNICIPALITIES

- 10.6 million kilowatt hours
- 5,500 metric tons of carbon dioxide equivalent
- \$1.4 million in energy and operating costs



# Common Program Timeline

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# Common Program Timeline

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- RFP is one of the most important steps to the process
- Issued by DVRPC on behalf of 45 Municipalities
- Developed by DVRPC, KLS, Municipal Steering Committee, and PennSEF.
- Technical specification and Design and Pricing Plan
- A steering committee of municipalities, with guidance, selected a single ESCO for the program

# RFP: Key Considerations

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- **RFP is a significant tool to guide design and lock in pricing**
- **RSLPP LED Streetlight Specification**
  - Started w/DOE MSSLC “System Specification”, Modified by KLS RSLPP needs
  - Color temperature, controls ready, illumination
- **Streetlight Design and Pricing Plan**
  - Evaluate Respondents on the quality of LED street lighting design
  - Allows for apples to apples comparison
  - **Serve as the baseline fixture and labor prices**

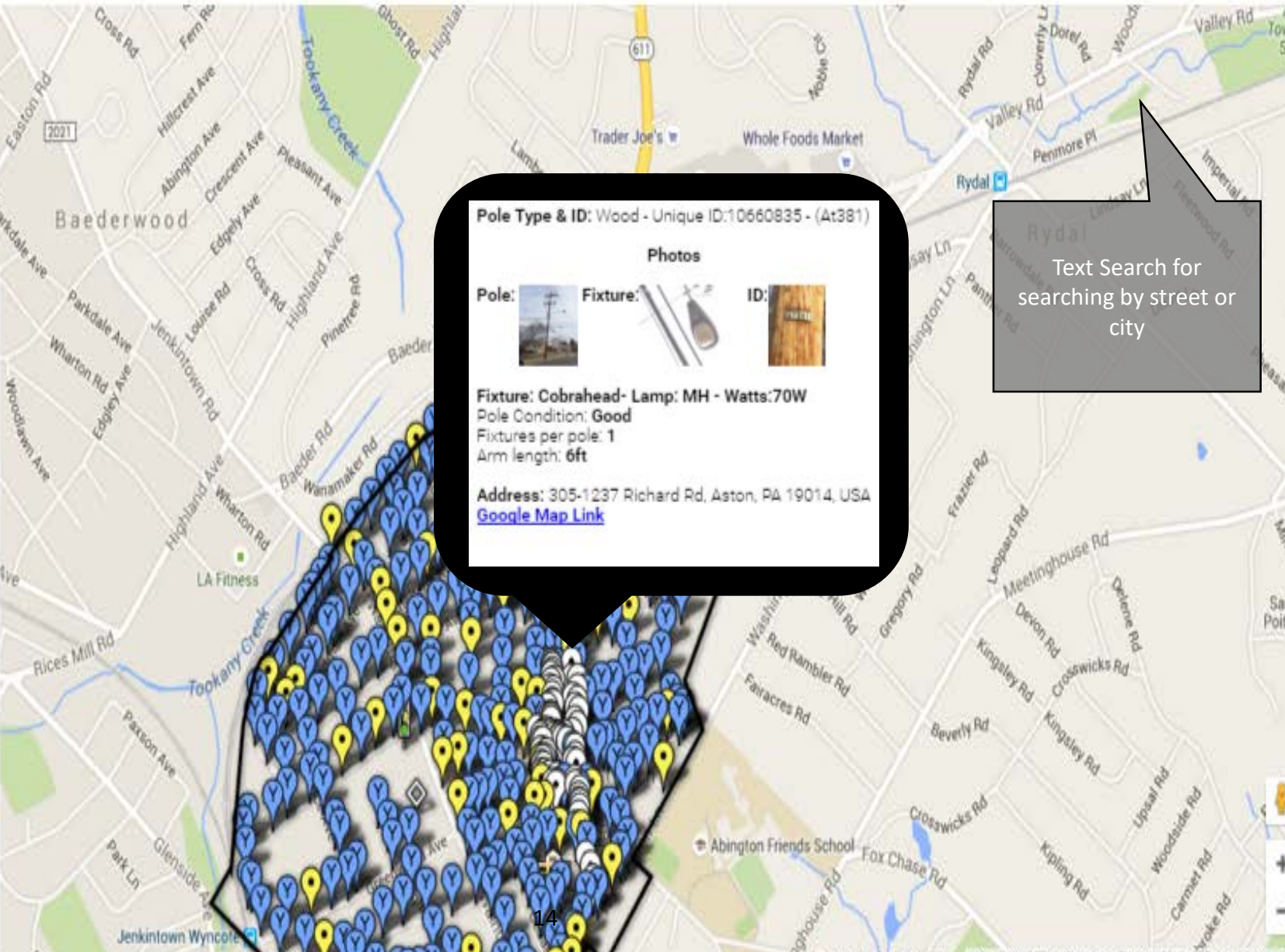
# Supplemental Efforts

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- Program management of ESCO
- On-call to municipalities
- Workshops and Webinars:
  - Program steps and process expectations
  - Networked controls
  - AMA Blue Light Response
  - Tracking Operations and Maintenance Savings
- Trial installations
- Utility Engagement

- Satellite
- Map Status
- Unverified Cobrahead
- Unverified Cobrahead
- Unverified 4 side Colonial
- Unverified 4 side Colonial
- Unverified Acorn
- Unverified Acorn
- Unverified Gen Decoratives
- Unverified Gen Decoratives
- Cobrahead not on PECO
- Decorative not on PECO
- Ball Field
- Traffic Light
- Buildings



**Pole Type & ID:** Wood - Unique ID:10660835 - (At381)

**Photos**

**Pole:**  **Fixture:**  **ID:** 

**Fixture:** Cobrahead- Lamp: MH - Watts:70W  
**Pole Condition:** Good  
**Fixtures per pole:** 1  
**Arm length:** 6ft

**Address:** 305-1237 Richard Rd, Aston, PA 19014, USA  
[Google Map Link](#)

Text Search for searching by street or city



*Loving Life Productions*





# Key RSLPP Program Elements

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## Energy Performance Contracting

Allows public entities to execute projects with no upfront cost.

Savings guarantee boosts confidence in Decision Making Process

Turnkey....



## Pooled Procurement and Financing

Pooling allowed municipalities, regardless of size, to access EPCs and Financing

Price of labor and equipment below market value



## Third party Product and Design Vetting

Program included a common specification (MSSLC based) for all equipment and reviewed design solutions throughout project.

# Key RSLPP Program Elements

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## Transparency & Standardization

Transparency was sought on everything - from ESCO service costs to all products and pricing.

Standard documents facilitated decision making.



## Data

As a result of M&V, the program will have significant data on O&M savings, as well as metered energy savings.



## Utility Engagement

Municipalities can engage the utility as a coalition.

# What We Achieved

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- Development of process for thoughtful and holistic conversion of municipal streetlighting systems
- Building confidence in Energy Performance Contracting, accessing finance
- Partnership building – and regional cooperation
- Creating a replicable program concept for other types of municipal and public facilities



## For More Information

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# Program Technical Details

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- Specification and Solution Development Process
- Creating Accountability from RFP to Construction

# Program Technical Details

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- **Specification and Solution Development Process**
- Creating Accountability from RFP to Construction

# Specification & Solution Development Process

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*Assessment of  
Design Capability  
and Basis for  
Comparison*

*Municipality  
Needs Based  
Custom Project  
Design*

- Base RFP Specification
- ESCO RFP Proposed Solution
- ESCO Preliminary Design
- Program & Municipality Trial Installations
- Joint Review of Key Design Considerations
- ESCO Final Design
- Construction Adjustments

# Base RFP Specification

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- Used MSSLC Model Specification as Starting Point
  - Application and performance based
  - Summary Utility Inventory Data indicated the need for five standard applications
    - Local > 70W, 100W & 150W HPS
    - Collector > 250W HPS
    - Arterial > 400W HPS
- Identified Pole Spacing and Fixture Mounting Criteria to Meet IES RP-8 Standards
- Defined LED Luminaire Specifications
  - Max Allowed Wattage, Min Rated Life, Required Warranty, etc.
- Complimentary product specifications
  - Luminaire & Drivers
  - Photocontrols and Networked Controls



# RFP Performance Specification Example

SITE PARAMETERS <i>(See drawings in Appendix A)</i>		
ROADWAY DATA	Median width (including curbs, gutters, and shoulders)	0 ft
	Number of vehicular lanes (total on both sides of median)	2
	Width of one vehicular lane	12 ft
	Shoulder width (including gutter and curb)	0 ft
	IES pavement class.	<input type="checkbox"/> R1 <input type="checkbox"/> R2 <input checked="" type="checkbox"/> R3 <input type="checkbox"/> R4
SIDEWALK DATA	Berm width (from curb to sidewalk)	2 ft
	Sidewalk width	4 ft
	Sidewalk on	<input checked="" type="checkbox"/> Both sides of street <input type="checkbox"/> Pole side <input type="checkbox"/> Other side
LIGHT POLE DATA	Luminaire mounting height	27 ft
	Arm length (horizontal)	3 ft
	Luminaires per pole	1
	Pole set-back from curb	1 ft
	Pole spacing (one pole cycle, parallel to path of travel)	100 ft
	Pole layout	<input checked="" type="checkbox"/> One side <input type="checkbox"/> Opposite <input type="checkbox"/> Staggered <input type="checkbox"/> Median

# RFP Performance Specification Example

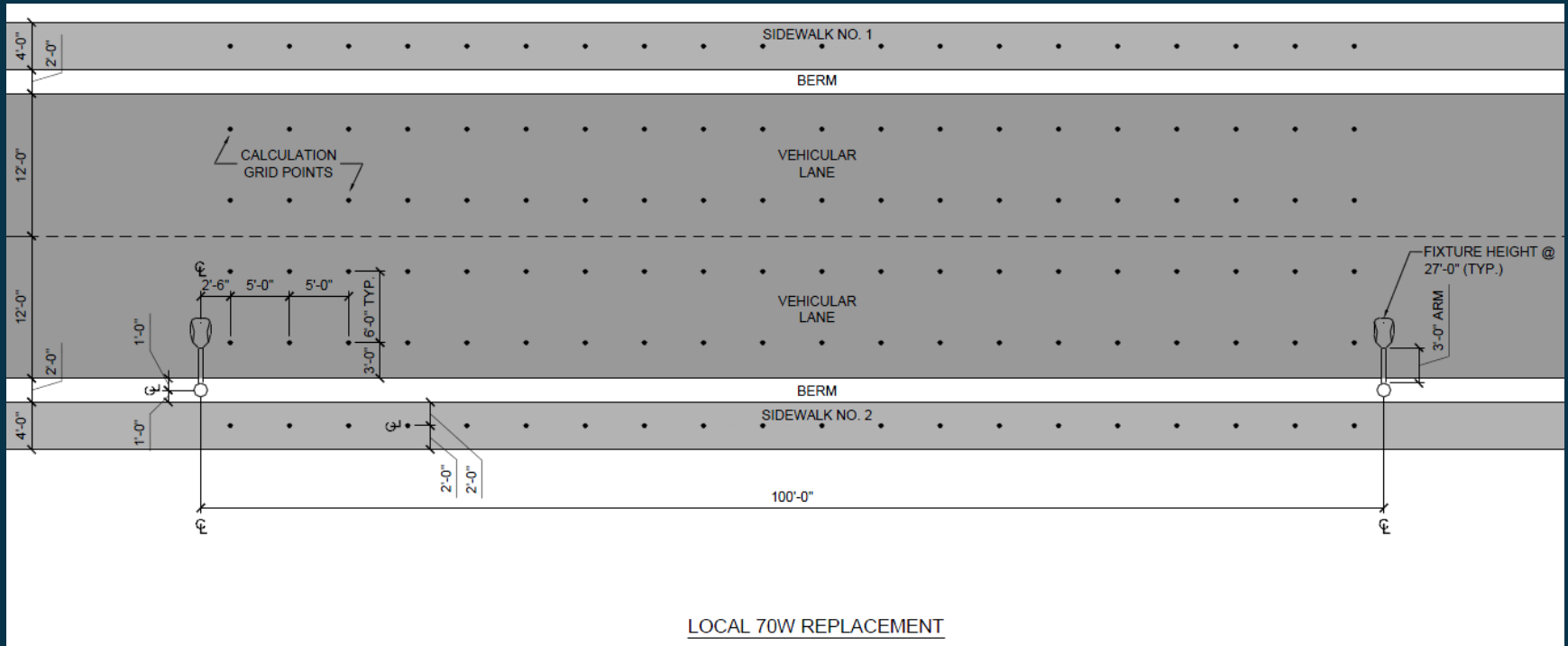
PERFORMANCE CRITERIA			
MAINTAINED ROADWAY ILLUMINATION			
PHOTOPIC ILLUMINANCE	Average horizontal illuminance at pavement		4.0 lux (0.4 fc)
	Avg:min uniformity ratio		6.0
	Max:min uniformity ratio		n/a
DISABILITY GLARE	Max. veiling luminance ratio		0.4
MAINTAINED SIDEWALK ILLUMINATION			
PHOTOPIC ILLUMINANCE	Average horizontal at pavement		3.0 lux (0.3 fc)
	Avg:min uniformity ratio (horizontal)		6.0
	Min. vertical illum. at 4.9 ft, in directions of travel		0.8 lux (0.08 fc)
LED LUMINAIRE			
INPUT POWER	Max. nominal luminaire input power		40W
VOLTAGE	Nominal luminaire input voltage range		120-277 V
LUMEN MAINT.	Min. % of initial output at 36,000 hours operation		90%
WARRANTY	Min. luminaire warranty		10 years
NOMINAL CCT	Rated correlated color temperature		4000 ± 200 K
BUG RATINGS	Preferred backlight-uplight-glare ratings		B1-U0-G1
FINISH	Luminaire housing finish color		Gray
WEIGHT	Luminaire weight		20-30 lb
EPA	Max. effective projected area		0.7 ft <sup>2</sup>
MOUNTING	Method	<input type="checkbox"/> Post-top <input checked="" type="checkbox"/> Side-arm <input type="checkbox"/> Trun./yoke <input type="checkbox"/> Swivel-tenon	
	Tenon nominal pipe size (NPS)		1 5/8" – 2"
VIBRATION	ANSI C136.31	<input checked="" type="checkbox"/> Level 1 (normal) <input type="checkbox"/> Level 2 (bridge/overpass)	
THERMAL ENVIRONMENT	Typical min. ambient temperature during operation		-20 °C
	Typical max. ambient temperature during operation		40 °C
CONTROL INTERFACE	<input type="checkbox"/> None	<input type="checkbox"/> ANSI C136.10 (3-pin)	<input checked="" type="checkbox"/> ANSI C136.41, 5-pin
LED DRIVER	<input type="checkbox"/> Not dimmable		<input checked="" type="checkbox"/> Dimmable, DALI (IEC 62386)
	<input checked="" type="checkbox"/> Dimmable, 0-10V (IEC 60929)		<input checked="" type="checkbox"/> Dimmable, DALI (IEC 62386)

# ESCO RFP Proposed Solution

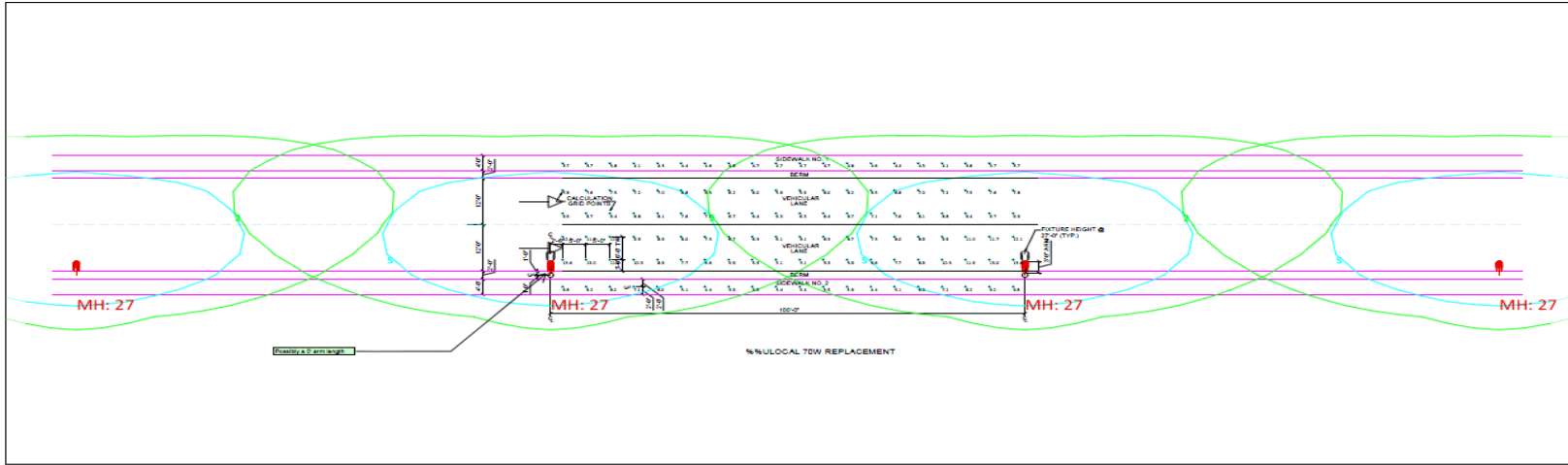
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- RFP Submittal Requirements
  - Photometric analysis submittals
    - Program developed and provided...
      - Standard CAD-based template
      - Photometric submittal instructions & assumptions
    - Product specification sheets
- ESCO RFP solutions used for...
  - Assessment of design capability
  - Basis for comparison for proposed product solution

# Program Photometric Submittal Template



# ESCO Photometric Submittal Example



Scale: 1 inch= 10 Ft.

Symbol	Qty	Label	Arrangement	Lumens	Lum. Watts	LLD	LDD	LATF	LLF	BUG Rating
-C19	9	RFS-35W16LED4K-T-R2M-3	SINGLE	3955	38	0.999	0.999	0.999	0.999	91-110-021

Light Loss Factor:  
 LLD 0.9 (or lower)  
 LDD 0.9 (or lower)  
 LATF 0.99 (or lower)  
 Total LLF  
 0.78 (or lower)

Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min	LVRatio	Description
RoadOpt_1_Illum	Illuminance	Lux	0.10	13.6	5.1	0.02	2.67	N.A.	Spaced as shown
RoadOpt_1_Veil Lum	Veiling Luminance	Cd/Sq.m	0.08	0.15	0.02	4.00	7.50	0.33	Spaced as shown
Sidewalk - Far - H	Illuminance	Lux	0.29	4.8	3.7	0.13	1.30	N.A.	Horizontal
Sidewalk - Far - V	Illuminance	Lux	3.21	4.2	0.00	1.27	2.24	N.A.	Vertical, 4.9ft Elevation
Sidewalk - Near - H	Illuminance	Lux	0.00	9.8	3.4	0.29	2.88	N.A.	Horizontal
Sidewalk - Near - V	Illuminance	Lux	3.12	5.8	0.00	7.80	14.50	N.A.	Vertical, 4.9ft Elevation

\*The 35W fixture meets the light level requirements, however, more field evaluation may be necessary.

Will reduce with corrected LLF

Manufacturer's Claim:  
 Footcandle  
 Avg Illum @ 1m  
 Avg Min ratio 5  
 Max Ver ratio 0.4  
 Sidewalk  
 Avg Illum 3 lux  
 Avg Min ratio 5  
 Min Ver Ratio 0.8

Rev	Date	Description
01	11/11/2015	Initial
02	11/11/2015	Revised
03		
04		
05		

Project: Denver Valley Regional RFP  
 Designer: [Name]  
 Checker: [Name]  
 Date: [Date]  
 Scale: [Scale]  
 Sheet: [Number] of [Total]

**PHILIPS**  
 Lighting Solutions

# ESCO Preliminary Design

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- Data Driven Exercise
  - Pre-Audit using Utility Inventory Data
- Upgrade solutions based on existing fixture specifications (i.e. location, lamp technology, wattage) and some initial attempts to standardize based on application type (i.e. local roadway)
  - Primarily a 1-for-1 replacement design strategy
- ESCO Delivered a Preliminary Audit Proposal with Scope of Work and Cash Flow Analysis
  - 90% Savings Commitment

# Program & Municipality Trial Installations

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- Four County-Based Cobrahead Trial Installations
  - Standard applications > Local, Collector & Arterial all at 4000K CCT for illuminance & other performance evaluations – three fixtures each
  - Three additional 3000K fixtures next to three 4000K fixtures for Local to evaluate CCT differences
- Municipality Specific Trial Installations
  - Up to 3 additional fixtures
  - Typically to evaluate decorative solutions
  - Often compared lumen packages and CCT side-by-side



# Joint Review of Key Design Considerations

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- Color Temperature
  - Review of AMA concerns, industry responses and relevant facts to consider
- Distribution Type
  - Initial ESCO approach to standardize on Type II for roadways and Type III for intersections
  - Program identified applications where Type V should be considered
- Lighting Controls
  - Education on options



# AMA Blue Light Concerns



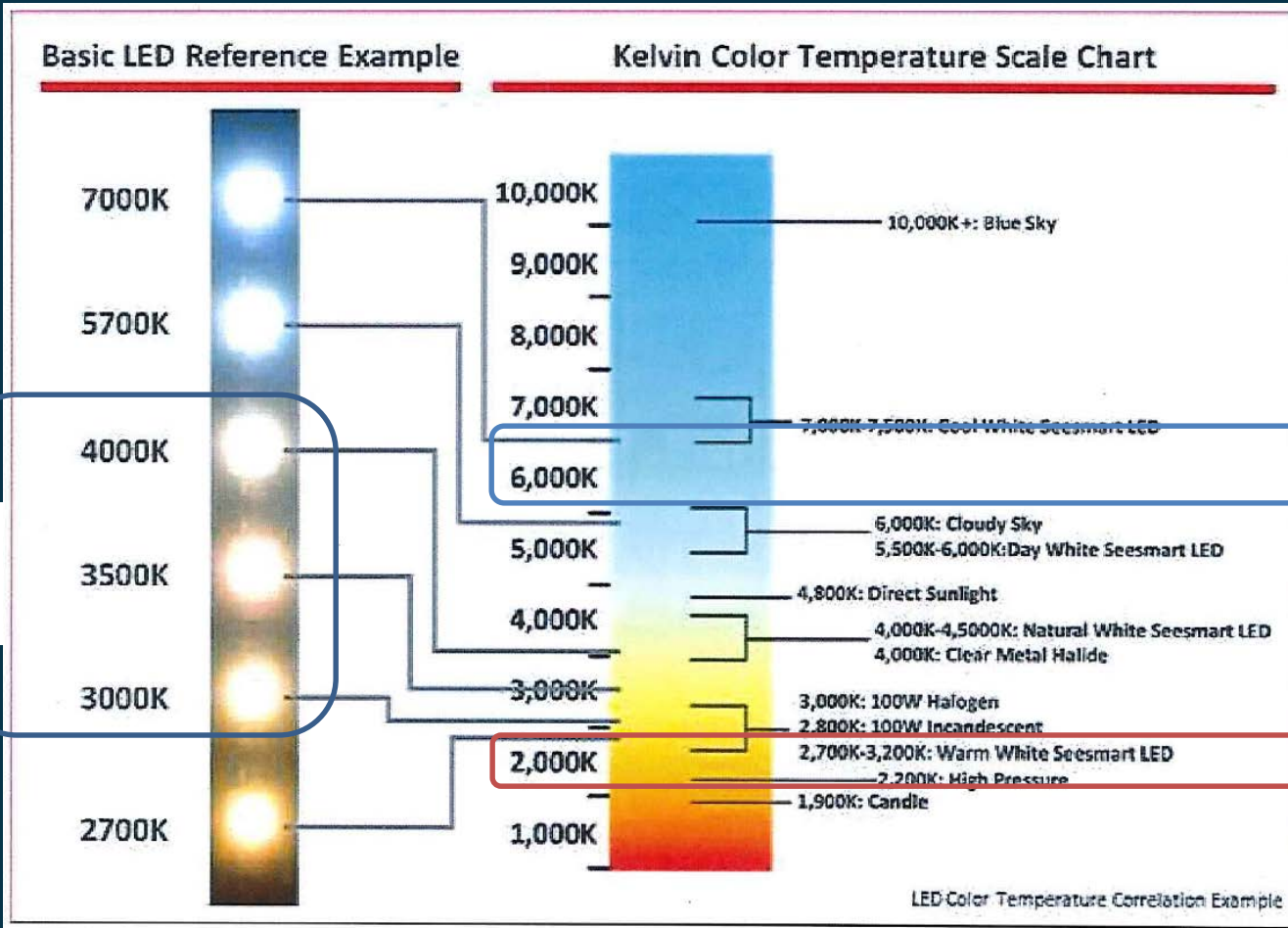
LA BUREAU OF STREET LIGHTING

# AMA “Blue Light” Concerns

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- AMA Comments
  - [AMA] recommends to “minimize detrimental health and environmental effects...blue-rich...streetlights operate at a wavelength that most adversely suppresses melatonin during night...impact on circadian sleep rhythms”
- Industry Expert Feedback (DOE MSSLC)
  - “...there’s **nothing inherently different about the blue light emitted by LEDs**; that is, at the same power and wavelength, electromagnetic energy is the same, **regardless of source type.**”
  - “...undesirable effects from exposure to light at night emerges from evolving research, the implications **apply to all light sources — including, but by no means limited to, LEDs.** Further, these research results are often also relevant to light we receive from televisions, phones, computer displays, and other such devices.”
  - The “blue” spectrum of visible light actually covers a range of wavelengths, from blue-violet to blue-green, although there's no specific definition of “blue light.” **Correlated color temperature (CCT) is a rough measure** of the balance of energy in a spectrum, with lower values indicating relatively less blue content. While CCT doesn’t explicitly characterize the potential for nonvisual effects, it’s generally able to indicate the spectrum-specific potential for these effects, which also critically depend on **quantity and duration of exposure.** In point of fact, if one compares the blue content of an LED source with that of any other source, with both sources at the same CCT, the LED source emits about the same amount of blue. This applies to halogen, fluorescent, high-pressure sodium, metal halide, induction, and other source types.

# Color Spectrum of Light



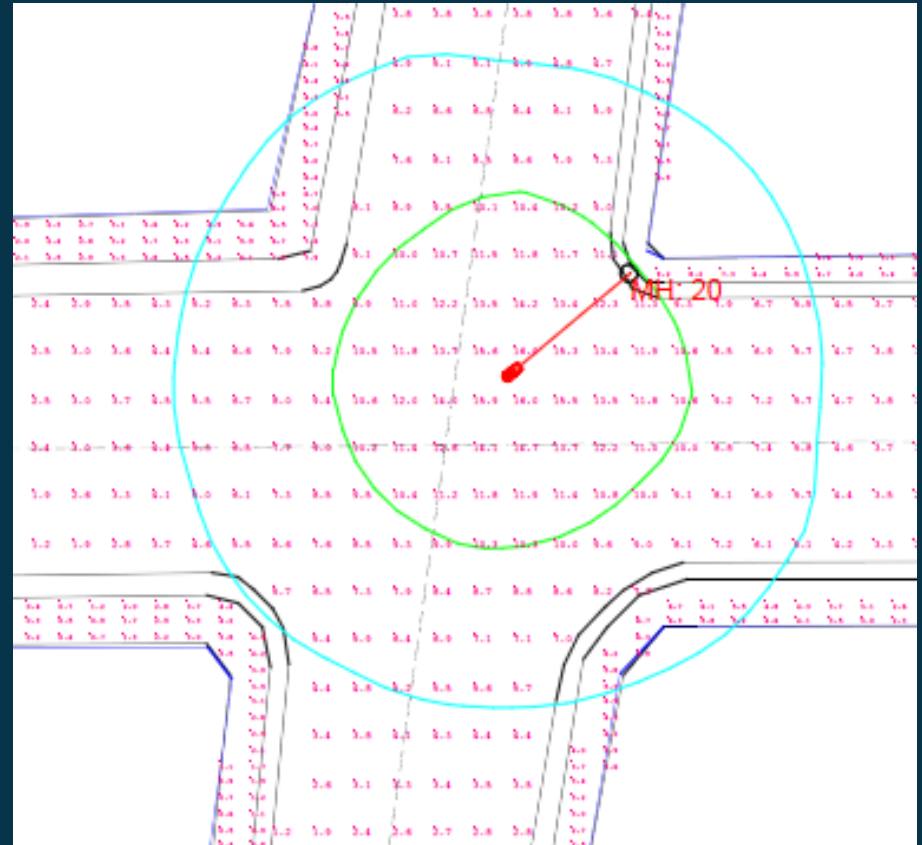
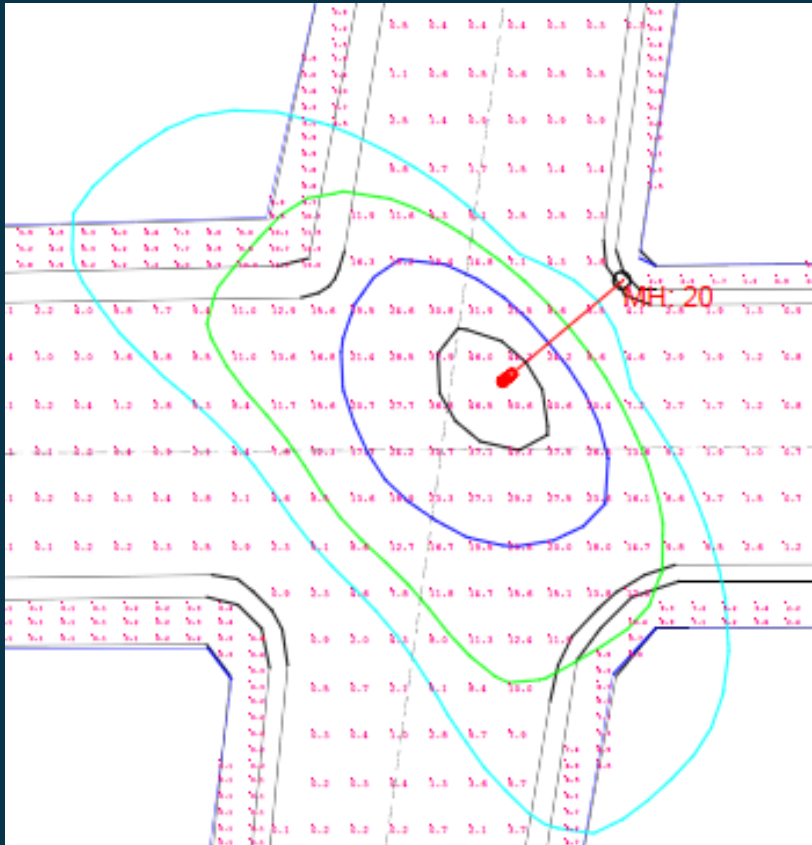
Mercury Vapor

Most commonly used LED, Fluorescent & Metal Halide

High Pressure Sodium

RSLPP  
Options

# Type V Distribution Analysis



# Lighting Controls

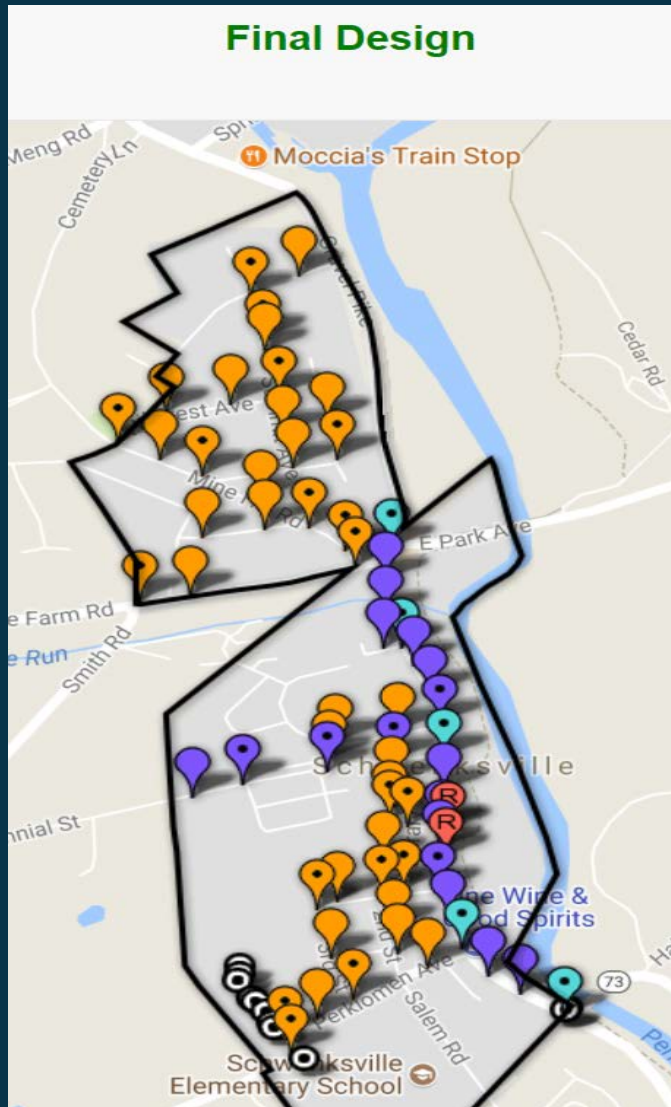


# ESCO Final Design

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- Municipality Review & Verification
- Review Border Road Fixtures
- Areas with Safety Concern
- ESCO Provided Final Investment Grade Audit Proposal for Municipality Approval
- Basis for Guaranteed Savings Agreement

# ESCO Final Design



**Pole Type & ID:** Wood - Unique ID:11660027 - (42196)

## Photos



**Fixture:** Cobrahead- Lamp: MH - Watts:100W

**Proposed:** 38W

**Fixture Code:**RFS-54W16LED3K-T-R3M-UNIV-DMG-FAWS-RCD-SP2-GY3

**Pole Condition:** Good

**Pole Location :** Intersection

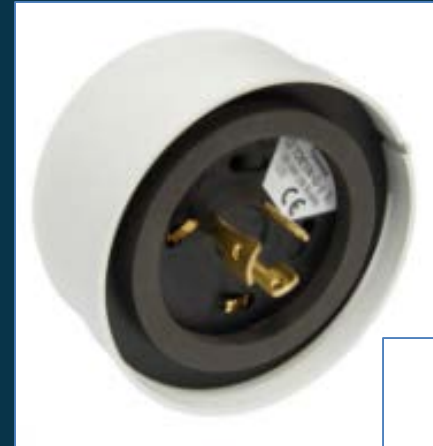
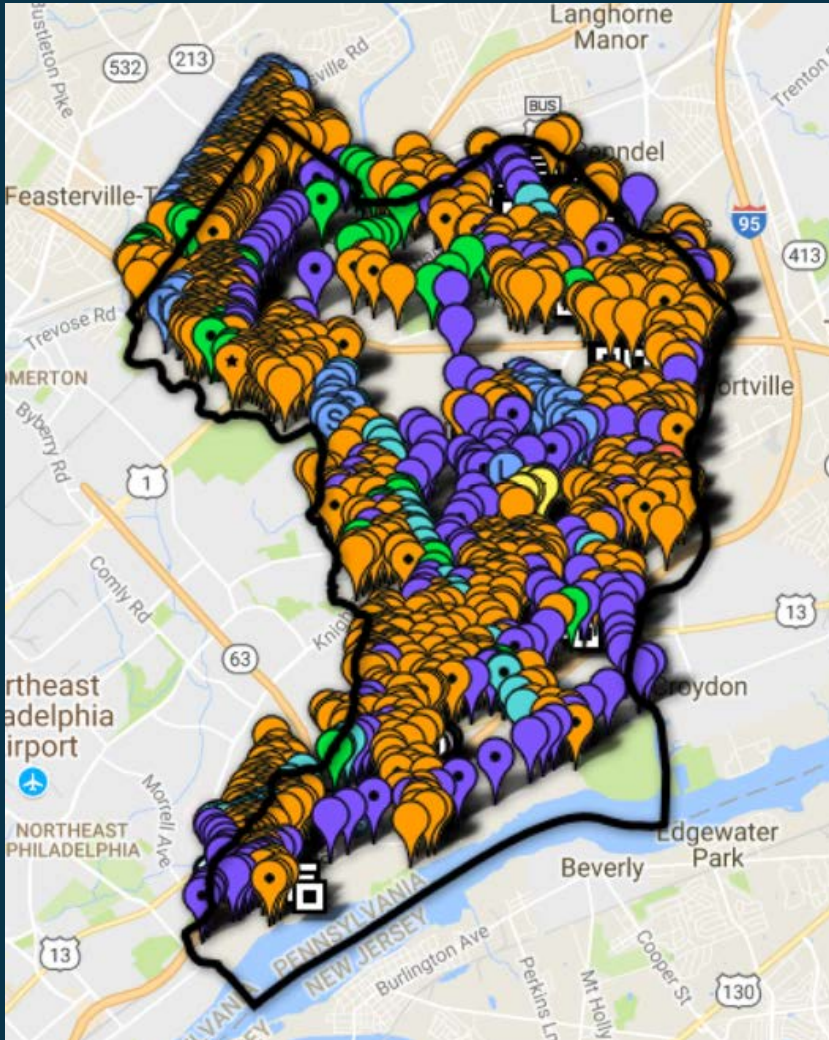
**Fixtures per pole:** 1

**Arm length:** 12ft

**Address:** 919-999 Summit Ave, Schwenksville, PA 19473, USA

**Google Map Link Road Category:** 2

# ESCO Final Design





# Construction Adjustments

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- BOM Review
  - Quality control
  - Attic Stock
  - Final Adjustments
- Change Orders
  - Fixtures missed during audit
  - Municipality requested adds

# Program Technical Details

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- Specification and Solution Development Process
- **Creating Accountability from RFP to Construction**

# Creating Accountability from RFP to Construction

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- RFP Product & Pricing Matrix
- Procurement Oversight
- Owner's Agent

# RFP Product & Pricing Matrix

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- 5 Standardized Applications & Solutions
  - ESCO Product Submittals with Key Technical Data
  - **Unit Fixture Pricing**
    - Transparent ESCO Cost
    - Base Pricing and Common Fixture and Control Adders
      - 0-10V Drivers & 5-Pin NEMA Receptacles Base Specifications
    - Transparent Material Handling Markup
  - **ESCO Installation Unit Costs**
    - Assumed Prevailing Wage Rates
  - **ESCO Service Costs (% of Hard Costs)**
    - Audit, Analysis, Design & Procurement
    - Project Management, Commissioning, M&V
    - Overhead and Profit

# RFP Product & Pricing Matrix

RSLPP Product & Pricing Matrix	Baseline Solutions					
	Cobrahead Fixture Style					Total
	70W HPS	100W HPS	150W HPS	250W HPS	400W HPS	
<b>ESCO Information</b>						
ESCO Name						
<b>LED Replacement Fixture Product Submittals</b>						
<b>General Information</b>						
Manufacturer						
Model #						
IES File (hyperlink to source)						
Housing Finish Color						
Termin Nominal Pipe Size						
Nominal Luminaire Weight						
Nominal Luminaire EPA						
DLC Listed (Y/N)						
Make/model of LED light source(s)						
<b>Electrical Specifications</b>						
System Volts						
Nominal Luminaire Input Voltage						
System Drive Current (mA)						
Driver Type						
Driver Life (90% survival)						
<b>Photometric Performance</b>						
Initial Delivered Lumens						
IES Distribution Type						
BUG Rating - B (backlight)						
BUG Rating - U (uplight)						
BUG Rating - G (glare)						
CRI						
eLCI						
<b>Depreciation and Life Ratings</b>						
IES L70-70 Test Duration (Hours)						
Depreciation % @ 30,000 Hours						
L90 Rated Life (calculated)						
L80 Rated Life (calculated)						
L70 Rated Life (calculated)						
Warranty (years)						
<b>Efficiency Calculations</b>						
Lumens/Watt (Initial)						
Lumens/Watt (L90)						
Lumens/Watt (L80)						
Lumens/Watt (L70)						
<b>Control Specifications</b>						
ANSI Receptacle Pin Configuration						
<b>Fixture Unit Pricing</b>						
<b>Distributor Fixture Unit Cost (assumes prevailing wage cost with no markups)</b>						
Quantity <100						
Quantity 100-500						
Quantity 500-1000						
Quantity 1000+ *						
Price Effective Period (days)						
<b>Fixture Unit Cost ADDERS (enter N/A if not available or enter 0 if included in base spec fixture price)</b>						
Miscellaneous materials/parts required for mounting*						
0-10V Driver (Base Specification)						
DALI Driver						
5-Pin ANSI (Default)						
5-Pin ANSI (Base Specification)						
Photoresist*						
Shorting cap						

House Side Shield						
Field Adjustable Light Level Options (N/A = Not Available)						
ANSI C136-31 vibration level 2 (N/A = Not Available)						
<b>Control System Unit Cost Adders</b>						
Control Manufacturer						
Control System Family Name						
Fixture Control Node						
Control Gateway (if required)						
Control Server (if required)						
Control Software (if required)						
Software Term Length (Years)						
Hardware (i.e. Node) Expected Life (Years)						
<b>ESCO Material Markups</b>						
ESCO Material Handling % *						
<b>Installation Labor Unit Prices/Fixture (prevailing wage labor cost with no markups)</b>						
Fixture Replacement* (assume reuse of existing arm and power connection)						
Fixture Removal Only						
Fixture Add Only						
Arm Removal Only						
Arm Add Only						
Overhead Power Connection						
Underground Power Connection						
Overhead Power Disconnect/Removal						
Underground Power Disconnect/Removal						
Tree Branch Trimming						
<b>Total Hard Costs</b>						
Fixture Type Quantity *	7,247	18,596	1,709	2,823	1,974	32,349
Total Material Price	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total Installation Price	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Total Hard Costs	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>ESCO Service Costs (as % of Total Hard Costs)</b>						
Field Audit**						
Design and Analysis Services (includes trial installations) **						
Procurement Services**						
Project Management						
Commissioning						
M&V						
Overhead						
Profit						
Total ESCO Services %	0%	0%	0%	0%	0%	
Total ESCO Services \$	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ESCO Total Program Costs	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>Fields Requiring ESCO Input</b>						
* Fields used in total material price calculation						
** This amount will be used as max IGA Breakage Fee						
<b>Prevailing Wage Rate Assumptions</b>						
<b>Rate Classification</b>	Effective Date	Hourly Rate	Fringe Benefits	Total		
				\$0.00		
				\$0.00		
				\$0.00		
				\$0.00		
				\$0.00		
				\$0.00		
				\$0.00		
				\$0.00		

# Procurement

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- RFP
  - Defined transparent cost structure for five standardized cobrahead solutions
- Investment Grade Audit
  - As part of the final design process, ESCO proposed additional required fixtures and installation costs
    - Fixtures > Decorative/Ornamental (new fixtures & kits), Area Lighting, etc.
    - Controls > Customized Network Control Proposals
    - Installation > Retrofit Kits, Area Lighting
  - Program general technical review of solutions and defined additional required specifications (i.e. cut-off area lighting)
  - Program review of ESCO proposed alternate solutions (i.e. photocontrols)
- Aggregate Bill of Material
  - Program review of correct product solutions ordering nomenclature

# Valuable Oversight



# Owners Agent

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- Additional level of owner advocacy
- Municipality project level review of all ESCO deliverables
  - Preliminary Audit Proposal
  - BOM Review
  - Final IGA Proposal
  - Attendance at all meetings and participation with all meetings and correspondence
- Construction management support
- KLS unique in-depth understanding of ESCO program-level commitments and accountability



A photograph of a bridge at sunset. The sky is filled with orange and yellow clouds. In the foreground, a street lamp is lit up. The bridge has a railing and a walkway. In the background, a city skyline is visible against the sunset.

## For More Information

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