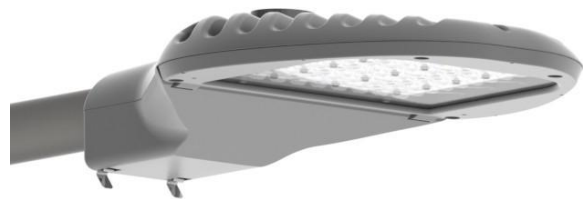


EHID & LED FOR EXTERIOR, HIBAYS, ETC.

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MAY 16, 2011



FOLLOW THE MONEY

Before I read an article or a white paper, I want to know who the writer is and who paid for it, because that helps understand the credibility and any slant of the document. I am an independent lighting consultant, who has written several white papers. I thank Philips for paying for most of my time on this one, so it can be offered for free, instead of me having to charge people for it. Please be aware, that my major message would be the same if I wrote this totally on my own time or if a different company sponsored it. I cannot risk credibility. Other manufacturers are also mentioned. (No matter how much money an induction company would pay me, I would not write a white paper trying to make induction look good for many applications)

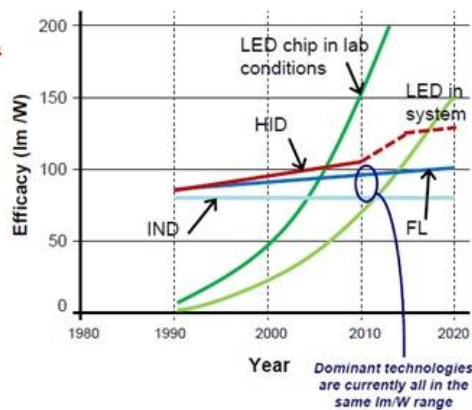
TERMS

CMH	Ceramic Metal Halide
CRI	Color Rendering Index
EHID	Electronically ballasted High Intensity Discharge (for this paper it refers just to CMH)
Fixture	Luminaire
Hibay	High bay
HPS	High Pressure Sodium
LED	Light Emitting Diode
LPS	Low Pressure Sodium
LPW	Lumens Per Watt
MH	Metal Halide
MV	Mercury Vapor
OEM	Original Equipment Manufacturer

PRE EXECUTIVE SUMMARY TABLE

Tech Timeline - System Lumen Efficacy

- HID
 - Current system efficacy 105 lm/W
 - Several companies have announced work on 140-150 lm/W lamps by ~2013)
- Linear Fluorescent
 - Slow but steady progress in efficacy and longer life
- Induction
 - Little or no progress in lumen output or life. Some catching up is in progress on lumen maintenance for low-cost products.
- LED
 - Fast improvements. Large differences between lab, source conditions and bulk of systems in the market. US DOE prognosis is 150 lm/W by 2020, 200 lm/W by 2030.



EXECUTIVE SUMMARY

EHID, which this document focuses on 45 – 320W 20,000 – 30,000 hour rated CMH lamps, and LED can often cost effectively replace or be used instead of:

- HPS
- Standard or probe start MH
- Pulse start quartz MH driven by magnetic ballast
- MV
- LPS
- Induction

Although most people are quite familiar with LEDs, EHID is often a secret. The above table shows that EHID and LED will probably both improve more rapidly than most other technologies.

EHID and LED can have about the same performance and use about the same wattage, but EHID often costs less, especially when existing fixtures can be retrofitted. Parts and labor to retrofit a well designed fixture that is still in good shape with EHID may cost one fourth compared to replacing that fixture with an LED one. Some fixture manufacturers have high performance reflector kits designed for specific CMH lamps for their fixtures that have been in use.

Two 315 – 320W CMH lamps with two electronic ballasts is often more cost effective than LED to replace 1000W HPS or MH, because so many LEDs would be required, which increases cost.

There are some EHID fixtures and kits with two lamps and one 1-lamp electronic ballast with only one lamp on at a time, so some kits and fixtures will not have to be relamped for up to 60,000 hours, which is about the same life as LED fixtures.

EHID and LED can eliminate the yellow light and low color rendering of HPS and LPS.

Some CMH lamps are warm color tone 2800 – 3000K, which may be preferred to 6000K or even 4000K LEDs.

Some electronic ballasts for EHID are dimmable, so controls can be used. Some CMH lamps are being developed to have very short dimming time down to 50% and back up to maximum light output, allowing them to be used with high/low occupancy sensors.

In general, we should focus on footcandles per watt or dollars per footcandles where the light is needed instead of LPW. Both well designed EHID and LED fixtures can be cost effective with regards to footcandles per watt and dollars per footcandles.

Some lighting professionals feel more comfortable with time proven technologies, including EHID, compared to LED

Several applications will be discussed. Long term benefit, which is a type of cost of ownership, is included, because that is much more important than payback.

It will be an LED or another type of solid state lighting world, but right now, don't automatically go with LED without comparing it with EHID.

Induction is not that good compared to latest generation EHID and LED. EHID and LED will continue to rapidly improve, while mature technology induction will lag further behind EHID and LED down the road. No matter what induction people state, don't buy it for most applications.

DISCUSSION

LIGHTING TECHNOLOGIES

EHID

Even if Philips did not help pay for this white paper, I would still focus on two Philips systems, CosmoPolis (Cosmo) and Elite, both of which have been around in Europe for years and have been more recently introduced in North America. I am not aware of any other manufacturer that can match the number of customers and installations, warranties, product lines, lumen maintenance curves, fast response from 50% to 100% light levels, long lamp lives and small lamp sizes, which can allow for high fixture efficiency, good optical control and multiple lamps in a fixture.

Since there have been and will be so many upgrades with Cosmo and Elite lamps and ballasts, I will not focus on details of existing offerings and specifications. You can check out the most current information on Philips' website and/or communicate with your Philips' rep. Any document that is dated earlier than a year ago has a very good probability of being out of date.

Both of these lamps are smaller than most other HID lamps, which can allow for high performance reflectors and very good optical control in new fixtures and in kits.

Both of these lamps also require dedicated small lamp holders. Guth and others offer retrofit screw-in medium and mogul base adapter lamp holders, which can center the lamp arc tube in the fixture. For some retrofit applications additional screw-in medium to medium or mogul to mogul base extenders may be helpful.

Some of the Philips' owned fixture manufacturers, such as Gardco, provide reflector retrofit kits with lamp holders, so Cosmo or Elite systems can easily be installed in existing fixtures that are still in good shape in the field. Various reflector manufacturers across the country can also make reflector kits with lamp holders for Cosmo and Elite for a wide range of fixture types.

Lamp life can be up to 30,000 hours, and there is work to improve that to up to 40,000 hours.

To get maintenance times about the same as LED and induction, fixtures and kits can have two lamps and one 1-lamp electronic ballast, which only drives one lamp at a time. This can double 30,000 hour lamp life to 60,000 hours. But since lamp life is when 50% of the lamps are burned out, group relampings could be scheduled at 45,000 – 50,000 hours.

Philips offers fixed output and dimming electronic ballasts. With dimming ballasts controls can be used. The Philips' Dynadimmer controller, which may cost about \$30 from a distributor, can be programmed to reduce light output and wattage during the night where there is less traffic, which is when light is necessary.

You can also check out GE's and Sylvania's EHID systems and Metrolight's and others' electronic ballasts. Metrolight's EcoBOX can prevent lamp heat from reaching the ballast, which can extend ballast life in some applications.

Please be aware that CMH lamps do not work very well with some electronic ballasts, because of lamp resonance issues at high frequency. Check if the lamp manufacturer will warranty its CMH lamps with specific electronic ballasts.

COSMO

45, 60, 90, and 140 watt lamps are available. These can usually replace 70 – 250W HPS and standard MH lamps, one for one.

Bare 140W lamps have initial 118 LPW, but more important, the lamp and ballast system has initial 107 LPW. Lower wattage versions have slightly lower LPWs.

Mean lumen maintenance is about 85%, and end of life lumen maintenance is also very good.

2800K is the workhorse version with the longest life, which is 30,000 hours in horizontal position and shorter life in vertical position. Cosmo is different from most other MH lamps, which have longer life in vertical position.

Although most CMH lamps have 85 – 95 CRI, Cosmo lamps only have about 70 CRI, which is about the same as quartz MH and exterior LED. For many interior applications, the CRI needs to be at least 80. So Cosmo should mainly be considered for exterior applications.

Since it takes only 90 seconds to dim from 100% to 50% and 5 seconds to go from 50% to 100%, these lamps can be used with bi-level occupancy and motion sensors.

So what do these lamps and ballasts cost? Of course, quantity and other factors make a big difference, but the following ballpark pricing from distribution may be helpful.

\$ 55 lamp

\$ 90 fixed output ballast

\$110 dimming ballast

\$ 10 screw-in medium or mogul base adapter lamp holder socket

Pricing to OEMs is less. And pricing in general may be getting less.

Retrofitting fixtures that have horizontal mounted HID lamps with Cosmo can usually cost a lot less than purchasing and installing new LED fixtures.

ELITE

210 and 315W lamps are available, which can replace 250 – 400W HPS and standard MH lamps one for one. Two 315W lamps with two electronic ballasts can replace one 1000W HPS and standard MH lamp.

Bare lamps have up to initial 120 LPW, but more important, the lamp and ballast system can have up to initial 111 LPW.

Lumen maintenance is 80% at 20,000 hours, which is excellent.

3000 and 4200K are available at 90+ CRI, which these combinations can be great for car sales parking lot pole fixtures, big box retail store hibays, etc.

Philips designed all of the lamps for 30,000 hours. The first lamp types that have been in the field long enough have that rating. Newer lamp types are currently rated for either 20,000 or 24,000 hours, but after there is sufficient field history, they should all get the 30,000 hour rating.

All Philips ballasts for these lamps are dimmable.

Although it currently takes 2.5 minutes to dim from full light output to 50% and the same time from 50% to full light output, bi-level motion and occupancy sensors cannot be used. But there is work to get the dimming down time to 30 seconds and return to full light output to 3 seconds later this year.

So what do these lamps and ballasts cost? Of course, quantity and other factors make a big difference, but the following ballpark pricing from distribution may be helpful.

\$ 65 lamp

\$125 dimming ballast

\$ 10 screw-in medium or mogul base adapter lamp holder socket

Pricing to OEMs is less. And pricing in general may be getting less.

Yes, LEDs can be used to replace 1000W HPS and standard MH, but so many LEDs are required, that the price is very high. Two 315W Elite lamps, two Elite ballasts and a retrofit reflector kit or in a new fixture cost a lot less than an equivalent LED fixture.

LED

Since most people involved with lighting are aware of LEDs, discussion of them is very brief.

Some of the new LED chips have 140 – 160 LPW without including thermal, driver or fixture efficiency losses.

Although some LED fixtures provide initial 100+ LPW including thermal, driver and fixture efficient losses, most of the exterior ones provide about 70.

But even at initial 70 LPW out of the fixture, LED can be very good, because well designed LED fixtures can direct the light where it needs to go, including between fixtures and to designated perimeters without the wasteful blob of excessive light underneath most other types of fixtures.

Although 6000K LEDs have the highest LPW, several chip manufacturers offer exterior grade 4000K LEDs that are almost as efficacious, but with a lower CRI. 65 – 70 CRI is usually okay for exterior and hibay applications.

Some people even consider 4000K LEDs too blue or white for some exterior and hibay applications. Now 3000 and 3500K LEDs are not really cost effective for most exterior and hibay applications. For these applications 2800 - 3500K CMH lamps may be best. (Down the road warm color tone LEDs should be cost effective for exterior applications)

In general, the Kelvin of LEDs does not match the Kelvin of other light sources. For example, most 3500K LEDs look more like a 4100K or even a 5000K fluorescent than a 3500K fluorescent. Another example is that most 2700K LED PAR38s do not match 2700K halogen PAR38s. Hopefully something will be done in the future to help people color match LEDs and other technologies.

If you are not already aware, LM80 addresses just how long the LEDs should last, not how long the driver, electrical connections, seals or other components of the LED fixture will last. So even if the LM80 is 150,000 hours, the fixture may not last longer than 75,000 or even 50,000 hours. At 11 – 12 hours per day, 50,000 hours will be over 10 years. Many things can go wrong in 10 years. Plus by then, LEDs and/or some other lighting technology will probably be so much better and less expensive, that it should be cost effective to replace current generation LED fixtures. It may even be cost effective to retrofit some LED fixtures in 5 years.

EHID & LED

The table below shows that both EHID and LED can often reduce wattage by about 50% when replacing magnetically ballasted HPS and probe start or standard MH. Sometimes savings will be more or less depending if existing is over or under lit, existing fixtures have good or bad fixture efficiency and optical control, fixture spacing, etc. With EHID, sometimes a reflector will be required and other times not.

HID lamps, including CMH ones, have higher LPW as wattage increases. But higher wattage and higher lumen LED fixtures just have more LEDs with the same LPW. That is why the percent of energy savings is lower with LEDs, when replacing 400 and 1000W HPS and MH.

WATTAGE SAVINGS TABLE										
EXISTING			ENERGY EFFICIENT OPTIONS							
			EHID					LED		
lamp type	lamp watts	appr. system watts	lamp type	lamp watts	appr. system watts (some dimmed)	appr. watt savings	watt reduction %	appr. system watts	appr. watt savings	watt reduction %
HPS or MH	70	95	Cosmo	45	51	44	46%	38 - 57	38 - 57	40 - 60%
HPS or MH	100	133		60	68	65	49%	53 - 80	53 - 80	40 - 60%
HPS	150	188		90	99	101	54%	80 - 120	80 - 120	40 - 60%
MH	175	215		140	154	141	48%	118 - 177	118 - 177	40 - 60%
HPS or MH	250	295	215	170	125	42%				
HPS or MH	400	460	Elite	215	227	233	51%	230 - 322	138 - 230	30 - 50%
HPS or MH	310	280		310	180	180	39%			
HPS or MH	1000	1090		310 x 2	682	408	408	37%	654 - 872	218 - 436
Notes										
Existing MH lamps are considered to standard or probe start.										
Existing HID has magnetic ballasting. Cosmo and Elite lamps have electronic ballasting.										
170 system watts for 215W Elite lamp is with dimming when that may provide sufficient light. Max system watts is 227.										
215W Elite lamp may only be able to replace 400W MH or HPS if existing fixture has low fixture efficiency or bad optical control and Elite lamp has high performance fixture or reflector kit.										
280 system watts for 310W Elite lamp is with dimming when that may provide sufficient light. Max system watts is 341.										
Approximate LED system wattage is based on saving 40 - 60% of existing for up to 250W existing HID, 30 - 50% savings on 400W existing HID & 20 - 40% savings on 1000W existing HID.										
Prepared by Stan Walerczyk of Lighting Wizards. 5/16/11 version										

The above LED numbers are not with the new higher LPW Cree XPG or Lumiled Rebel LEDs.

Since LEDs lose 30% of initial lumens at end of rated life and Cosmo and Elite lose less than that, LED fixtures may have to provide more initial lumens in order to provide sufficient light at end of rated life.

As LEDs dim, they can get more efficient. On the other hand, as electronically ballasted CMH lamps dim, those systems become less efficient. But dimming electronic CMH systems are more efficient than dimming electronic fluorescent systems, because the CMH systems do not require lamp cathode heating.

Although EHID fixtures and reflector kits can have very good optical control, it is usually not as good as well designed LED fixtures.

Although EHID's LPW are improving, it is not as fast as LED's LPW. So even if EHID is more cost effective today, that may not be the case after the Cree XPG.

INDUCTION

Although Induction could sometimes compare fairly well with LED and EHID before fall of 2009, now induction is no where close to the performance of well designed LED and EHID systems. And since induction is a mature technology, it will get further behind as time goes on.

Here is a brief general run down on Induction.

- Initial bare lamp lumens per watt including generator is usually 70 - 80.
- Lamps are so large, that fixture efficiency is usually quite low and fixtures would have to be the size of a hefty kitchen sink, to have decent optical control.
- Lumen maintenance is about 70 – 75% at 60,000 hours, so need to be overlit initially.
- Although the lamps are rated for 100,000 hours, 60,000 – 70,000 hours is the realistic useable system life.

It is amazing how many manufacturers and sales people are knocking on doors trying to sell induction.

It is surprising that there are still rebates or incentives for induction, since bare lamp lumens per watt is so low, fixture efficiency is usually so low and optical control is virtually non-existent.

Many induction lamp and generator manufacturers and sales companies may go out of business or stop including induction, so end-customers may not be able to get warranty support or replacement parts.

Philips is selling its QL induction line and will focus on LED, EHID and other high performance lighting technologies. Philips will still carry it and take care of warranties and replacement parts.

If somebody really wants to go with induction, Sylvania is the only other recommended manufacturer that it is a good bet to take care of warranties and replacement parts down the road.

Antioch, CA is an example of a city that replaced HPS with induction streetlights, and residents have complained about too little light between fixtures.

www.mercurynews.com/breaking-news/ci_17417236?nclick_check=1

Across the country when you fly, you can sometimes see cities that have induction streetlights, because the darkness between fixtures.

‘LED vs. INDUCTION Full-Cut Streetlights, Etc.’, which I wrote in 2010 and is available on my website, has isolux diagrams of HPS, induction and LED cobraheads, which shows that the induction is the worst providing light between fixtures, which is the most important.

www.lightingwizards.com

HPS, even with magnetic ballasting, can even provide higher end of rated life LWP out of fixtures than induction.

Maybe the only decent application for induction is acorn or globe fixtures on top of poles, because optical control is not that important, but even for these fixtures, EHID or LED are probably better.

It may even be cost effective to retrofit or replace existing induction fixtures with EHID or LED.

GETTING RID OF LOW CRI YELLOW LIGHT

Both EHID and LED provide a relatively high CRI white light. You probably have seen numerous before photos with HPS and/or LPS and after photos with 4000 – 6000K LED and 4000K MH.

The top and before photo is with 20 CRI HPS, and the below and after photo 2800K 70 CRI Cosmo CMH.

The higher CRI white light is much better in a number of ways, including for security. For example, colors of a vandal's shirt or hit and run car can be much better seen with white light than with the yellow light.



APPLICATIONS

Most of these applications are based on projects that I have been involved with.

SHOEBOX & CAKEBOX POLE FIXTURES WITH HORIZONTAL 150W HPS



For fixtures that are in good shape with good reflectors and optical control, the main choice is to retrofit with EHID or replace with new LED fixtures.

60W Cosmo and 70W LED options are listed, because there are some areas that can be considered to be overlit.

Although neither of two clients wanted to reduce light levels in the middle of the night when there is less pedestrian or vehicle traffic, dimming could be easily done with both EHID and LED.

SHOEBOX & CAKEBOX POLE LIGHT FEASIBILITY STUDY																			
\$0.115		blended KWH rate		\$0.05												15		long term benefit years	
existing				proposed															
fixture type	rated lamp life at 10 hour cycles	watts	annual hours	technology	option	retrofit or replacement fixture option description (poles, arms, etc. not included)	rated life	watts	watts reduction	% watts reduction	annual electrical savings	appr. installed cost	rebate	long term benefit just electricity	per year maintenance savings, improved lighting quality, etc. benefit for comprehensive long term benefit and payback	long term benefit comprehensive	payback in years just electricity	payback in years comprehensive	
exterior cake box pole fixture with 150W HPS lamp & magnetic ballast	24,000	188	4200	EHID	A	1 Philips 60W Cosmo lamp, mogul to mogul base lamp holder, screw-in lamp holder & Philips Cosmo electronic ballast	30,000	68	120	64%	\$57.96	\$250	\$25.20	\$619	\$15	\$870	3.9	3.1	
					B	1 Philips 90W Cosmo lamp, mogul to mogul base lamp holder, screw-in lamp holder & Philips Cosmo electronic ballast	30,000	99	89	47%	\$42.99	\$250	\$18.69	\$395	\$15	\$638	5.4	4.0	
					C	2 Philips 60W Cosmo lamp, custom lamp holder ki & Philips Cosmo 1 1-lamp electronic ballast (only lamp on a time)	60,000	68	120	64%	\$57.96	\$350	\$25.20	\$519	\$30	\$995	5.6	3.7	
					D	2 Philips 90W Cosmo lamps, custom lamp holder ki & Philips Cosmo 1 1-lamp electronic ballast (only lamp on a time)	60,000	99	89	47%	\$42.99	\$350	\$18.69	\$295	\$30	\$763	7.7	4.5	
				LED	E	new round post top LED fixture matching existing green paint	75,000	70	118	63%	\$56.99	\$1,000	\$24.78	-\$145	\$35	\$405	17.1	10.6	
					F	new round post top LED fixture matching existing green paint	75,000	90	98	52%	\$47.33	\$1,200	\$20.58	-\$490	\$35	\$56	24.9	14.3	

prepared by Stan Walercyk of Lighting Wizards 5/11/11

Gardco has a case study at Texas A&M University that evaluated both EHID and LED and decided on EHID. www.sitelighting.com/Literature/CaseStudy_TAMU.pdf

If new fixtures are needed, then it can be more of a toss up between EHID and LED, often with LED winning.

PENDANT OR TEAR DROP FIXTURES WITH 70W VERTICAL HPS



This is for a small city's historic residential district. Some key people like the existing yellow light, and other key people do not.

As you can see, this type of cast metal fixture is quite expensive. If most of the existing fixtures were in good shape, it would probably be better to retrofit them. But many are not in good shape, and most lenses need to be replaced.

Labor cost is not included, because how labor will be done is a big 'if'.

Options with 2 Cosmo lamps are not included, because 2 lamps in these fixtures would reduce fixture efficiency and proper distribution with only 1 lamp on a time. The City may decide to include some type of controls.

HISTORIC STREETLIGHT FEASIBILITY STUDY																			
\$0.14		blended KWH rate		\$0.10		/KWH saved over first year incentive										15		long term benefit years	
existing				proposed															
fixture type	rated lamp life at 10 hour cycles	watts	annual hours	retrofit or new	technology	option	retrofit or replacement fixture option description (poles, arms, etc. not included)	rated life	watts	watts reduction	% watts reduction	annual electrical savings	appr. parts cost without tax or freight	rebate	long term benefit just electricity	per year maintenance savings, improved lighting quality, etc. benefit for comprehensive long term benefit and payback	long term benefit comprehensive	payback in years just electricity	payback in years comprehensive
historical style pendant fixture with vertical 70W standard HPS lamp & magnetic ballast	24,000	95	4200	retrofit	HPS	A	extended life non-cycling or dual arc tube 70W HPS lamp	40,000	95	0	0%	\$0.00	\$15	\$0.00	-\$15	\$5	\$60	#DIV/0!	3.0
						B	extended life non-cycling or dual arc tube 70W HPS lamp & electronic ballast	40,000+	79	16	17%	\$9.41	\$100	\$6.72	\$41	\$10	\$198	9.9	4.8
					CMH	C	Philips 45W Cosmopolis CMH lamp, horizontal lamp holder kit & electronic ballast	30,000	51	44	46%	\$25.87	\$150	\$18.48	\$238	\$20	\$557	5.1	2.9
						D	Philips 60W Cosmopolis CMH lamp, horizontal lamp holder kit & electronic ballast	30,000	68	27	28%	\$15.88	\$150	\$11.34	\$88	\$20	\$399	8.7	3.9
					induction	E	Philips 85W 3000K QL induction lamp, generator & kit (only reason listed is because City already is using in acorn fixtures)	60,000 - 70,000	85	10	11%	\$5.88	\$250	\$4.20	-\$162	\$25	\$217	41.8	8.0
					LED	F	Philips Lumex LifeLED, Philips Guth XTR LED or equivalent 4000 - 5000K LED screw-in with remote driver or hardware kit	50,000 - 70,000	50	45	47%	\$26.46	\$450	\$18.90	-\$53	\$25	\$341	16.3	8.4
				new	HPS	G	new pendant fixture with extend life non-cycling or dual arc tube 70W HPS lamp & magnetic ballast	40,000	95	0	0%	\$0.00	\$900	\$0.00	-\$900	\$5	-\$825	#DIV/0!	180.0
						H	new pendant fixture with extended life non-cycling or dual arc tube 70W HPS lamp & electronic ballast	40,000+	79	16	17%	\$9.41	\$925	\$6.72	-\$784	\$10	-\$627	97.6	47.3
					CMH	I	new pendant fixture with Philips 45W Cosmopolis CMH lamp & electronic ballast	30,000	51	44	46%	\$25.87	\$950	\$18.48	-\$562	\$20	-\$243	36.0	20.3
						J	new pendant fixture with Philips 60W Cosmopolis CMH lamp & electronic ballast	30,000	68	27	28%	\$15.88	\$950	\$11.34	-\$712	\$20	-\$401	59.1	26.2
					induction	K	new pendant fixture with Philips 85W 3000K QL induction lamp & generator (only reason listed is because City already is using in acorn fixtures)	60,000 - 70,000	85	10	11%	\$5.88	\$1,000	\$4.20	-\$912	\$25	-\$533	169.4	32.2
					LED	L	new pendant fixture with 4000 or 3500K LEDs	75,000	50	45	47%	\$26.46	\$1,090	\$18.90	-\$693	\$30	-\$224	40.5	19.0
						M	new pendant fixture with 4000K LEDs (to allow for max energy savings, maybe not to have a bottom plastic or glass lens)	75,000	45	50	53%	\$29.40	\$900	\$21.00	-\$459	\$30	\$12	29.9	14.8
						N	new Leotek Green Cobra, Beta LEDway, Philips Roadway or equivalent cobra head with 4000K LEDs (This would require a different arm on the pole)	75,000	40	55	58%	\$32.34	\$300	\$23.10	\$185	\$30	\$658	8.6	4.4

prepared by Stan Walercyk of Lighting Wizards 5/11/11

COBRAHEAD STREETLIGHTS WITH 70-250W HORIZONTAL HPS



First of all, sag lenses, like the one shown in the above photo, should not be used, because they allow up light, which is not dark sky friendly.

Cities, counties, states and countries can easily replace these with LED cobraheads, saving 40 – 60% of the wattage, reducing maintenance costs and improving lighting quality. For quantities of at least 1000, the unit price can be \$250 - \$300, which is a lot less than what it was a few years ago.

As many people know, Los Angeles is replacing 140,000 of its HPS cobraheads with LED.

Recently, at least one city went out to bid and good LED cobraheads cost less than induction cobraheads.

But EHID can be a good option.

Chicago has recently purchased and installed tens of thousands of new cobraheads with Cosmo lamps and ballasts. It is understood that the City will continue, as long as expectations are met.

Below is a sample product that Philips Mexico is developing. It has 2 Cosmo lamps in separate reflector chambers and 1 1-lamp ballast, which will only drive 1 lamp at a time, to reduce maintenance costs.



Philips Roadway is developing a similar cobrahead, called the Helios EON. It will be shown at this year's Lightfair.

FLOODS & WALLPACKS WITH 400W STANDARD MH



Although these fixtures can be replaced with LED fixtures, so many LEDs are required, that they are quite expensive.

Fixtures can be retrofitted or replaced with 1 Philips 315W Elite CMH lamp and electronic ballast.

If existing fixtures are not very efficient and do not have good optical control, they could be retrofitted or replaced with 1 Philips 210W Elite CMH lamp, electronic ballast and good reflector design.

HIBAYS WITH 1000W STANDARD MH



This is not one of my current projects, but one large convention center recently went out to bid to replace its 1000W standard MH hibays with new hibays, each with 2 Philips 315W Elite lamps and 2 electronic ballasts.

This will reduce wattage from about 1080 to 680, improve CRI, and improve lamp life.

(Hint: you may be able to see the new lights at 2012 Lightfair)

LED hibays that can replace 1000W standard MH may cost \$2000.

If size and appearance are not issues, hibays with 12 - 16 T8s or 8 – 12 T5HOs could be used. I have frequently replaced with 1000W standard MH hibays with 2 x 8 hibays that have 12 high lumen 5000K 32W F32T8s and 1.15 BF high performance ballasts.

THAT'S ALL FOLKS

Listed are just a few applications, fixture types and lamp types and wattages. For example, there are shoebox fixtures with 1000W HPS or standard MH and low bays with 250W standard MH.

In the bigger picture, you can evaluate the pros and cons of EHID and LED retrofits, replacements and fixtures for new construction.

Again, on the EHID side, please also consider GE, Sylvania, Metrolight and others.

As many of you already know, with any type of kit, UL approval is important.

Please let me know what you come up with on various projects. My email address is stan@lightingwizards.com.

ABOUT THE AUTHOR

Stan Walerczyk is principal of Lighting Wizards, an independent energy efficiency consulting firm. His 22 years lighting experience includes distribution, maintenance, retrofit contracting, 3rd party review, consulting, design and research. He has been assisting on DOE research on spectrally/scotopically enhanced lighting. He is a DOE CALiPER Guidance Committee member on LED products. He has written over 30 published papers and presented over 600 seminars, including speaking twice at the 2011 Lightfair. **His hibay, interior lighting and exterior lighting seminars further discuss how EHID compares with LED and how they compare with other technologies.** He is a Certified Lighting Energy Professional by the Association of Energy Engineers and is Lighting Certified by the National Council on Qualifications for the Lighting Professions. He was a member of the Illuminating Engineering Society from 1995 to 2008 and is currently on its Visual Effects of Lamp Spectral Distribution and Energy Management Committees. Complete bio, seminar schedule, testimonials and other information are available at www.lightingwizards.com.

These are all of his free white papers, which are downloadable:

- EHID & LED For Exterior, Hibays, Etc.
- High Bay Occupancy Sensors: A Comparison
- How to Retrofit Parabolic Troffers
- LED vs. Induction – Full Cut-Off Streetlights, Etc.

White paper that costs \$50:

- Best Practice Report