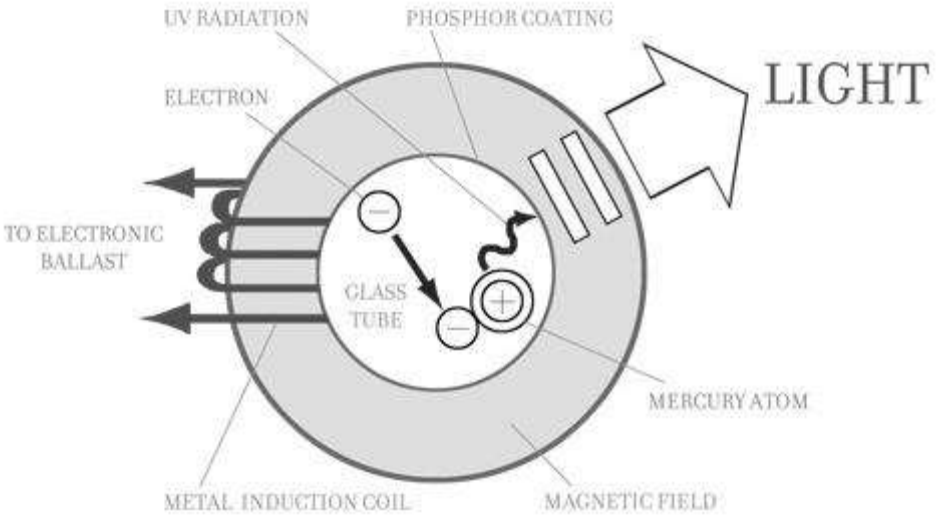
Retrofit Your City Street Lighting and Start Saving Thousands of Mega Watt's and CO2 Emissions

A) Working Theory of Induction Lamp

The basic technology for induction lamps is not particularly new. Essentially, an induction lamp is an electrode less fluorescent. Without electrodes, the lamp relies on the fundamental principles of electromagnetic induction and gas discharge to create light. The elimination of filaments and electrodes results in a lamp of unmatched life. Lasting 100,000 hours or 25 years, this system can outlast 100 incandescent, five HID, or five typical fluorescent lamp changes.



Based on these well-known principles, light can be generated via a gas discharge through simple magnetism. Electromagnetic transformers, which consist of rings with metal coils, create an electromagnetic field around a glass tube which contains the gas, using a high frequency that is generated by electronic ballast. The discharge path, induced by the coils, forms a closed loop causing acceleration of free electrons, which collide with mercury atoms and excite the electrons. As the excited electrons from these atoms fall back from this higher energy state to a lower stable level, they emit ultraviolet radiation. The UV radiation created is converted to visible light as it passes through a phosphor coating on the surface of the tube. The unusual shape of an induction lamp maximizes the efficiency of the fields that are generated.

Although it is not breakthrough science, until recently, it has not been so commercially viable. New developments have broken down the barriers of costs and technological setbacks, such as EMC interference, lumen depreciation, ability to dim and a useful range of available wattages. Today, its obvious benefits make it the clear-cut choice for many lighting applications over traditional light sources.

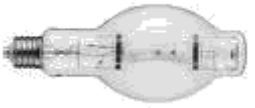
Features	Advantages	Benefits
• No electrodes, no filament to be damaged • Electrolytic capacitors used are high temperature (135 C) to insure 100000 hours service life under 60C working temperature • Mica-film capacitors, resistors and crystal diodes used are selected in terms of the highest quality standards.	• Long performance life up to 100,000 hours, lasting up to 100 times as long compared to incandescent lamps. • High luminous maintenance rate (at >95% after 2,000 hours and >85% after 60,000 hours) • High reliability factor	• Reduced re-lamping costs • Zero maintenance costs • Less problems caused by interruption of industrial production or traffic flow • Reduces recycling costs
• Power Factor>0.99 • IC controlled electronic ballast • Pupil Luminous Flux: Up to 150 Plm/W • High lumen efficiency • Superior energy saving	• Very high system efficiency (increase by 50% and 20% more than magnetic ballasts and conventional electronic ballasts respectively) • Better visibility • Lower energy bills	• Reduce electricity costs by up to 90%, 75% and 50% as compared to incandescent lamps, HID lamps, and fluorescent lamps respectively. • Reduced eye strain and stress • Increase bottom line profits
• Electromagnetic induction lighting	• Low heat output	• Reduced air-conditioning costs
• Wide voltage range • Instant start and instant re strike • Reliable ignition -20 - +50C	• Greater range of applications vs. HID and fluorescents	• Easy installation • Ease of use • Great for very low temperature regions and applications.

• CRI > 80 (Ra) • Wide colour temperature range • Full spectrum available • Precise wavelengths • Working frequency: 210KHz	• Allows colours to be perceived correctly • Like natural sunlight • Range of colour temperatures and wavelengths • Excellent lighting quality with no flicker	• Ideal for indoor retail, museums, shopping malls and more. • Increase safety and security • Increase worker productivity • U.V. Applications @ 253.7Nm
• Amalgam Content < 0.25mg	• No liquid mercury to harm human beings or the environment	• Health & safety • Environmental Protection
• Low Harmonic distortion- International "L" class standard.	• Less harm to electric safety	• Electric grid security
• Electromagnetic Compatibility (EMC) meets all international standards including FCC	• No electronic interference or potential radiation damage.	• Safe for use near other electronic devices
• Listed and certified by CE, FCC, UL, CCC, ISO and other standards.	• No more restrictions for applications in the United States and around the world	• Ease of use as retrofit or in new construction applications

B) Performance Comparison

FUTEK ® Induction Lamps vs. H.I.D. Lamps

Comparison	Futek ® Induction	Metal Halide	High Pressure Sodium
Warrantee	5 years	None	None
Life Hours	100,000	6,000~20,000	18000- 32000
Energy Saving Efficiency	Excellent	Lower	Lower
Lumen Efficacy	Photopic Efficacy: **150 Plm/W**	Photopic Efficacy: **110 Plm/W**	Photopic Efficacy: **90 Plm/W**

	(Plm: Pupil Lumen) Traditional Efficacy: 80 Lm/W	(Plm: Pupil Lumen) Traditional Efficacy: 75 Lm/W	(Plm: Pupil Lumen) Traditional Efficacy: 120 Lm/W
Lumen Depreciation Rate %	5% @ 2,000 Hours	30% @ 2,000 Hours	20% @ 2,000 Hours
Lamp Operating Temperature	Lower, <80°F Reduces A/C cost	Higher, >300° F Increased A/C cost	Higher, >350° F Increased A/C cost
CRI	>80 (Ra)	65~80 (Ra)	<39 (Ra)
Re-strike	Instant	Needs up to 10~15 minutes	Needs up to 10~15 minutes
Flicker	None	Much	Much
Glare	None	Much	Much
Environmental Safety	No Mercury No lamp waste in 10 years	Contains mercury Concern with much lamp waste over 10 years	Contains mercury Concern with much lamp waste over 10 years
Images			

Futek® Induction Lamps vs. Fluorescent Lamps

Comparison	Futek® Induction	Compact Fluorescent	Fluorescent Tubes
Warrantee	5 years	1 year	None
Life Hours	100,000	6,000~15,000	8,000~36,000
Energy Saving Efficiency	Excellent	Good	Excellent
Lumen Efficacy	Photopic Efficacy: 150 Plm/W (Plm: Pupil Lumen)	Photopic Efficacy: 85 Plm/W (Plm: Pupil Lumen)	Photopic Efficacy: 69 Plm/W(Plm: Pupil Lumen)

	Traditional Efficacy: 80 Lm/W	Traditional Efficacy: 50 Lm/W	Traditional Efficacy: 70 Lm/W
Lumen Depreciation Rate %	5% @ 2,000 Hours	30% @ 2,000 Hours	25% @ 2,000 Hours
Lamp Operating Temperature	Lower, <80°F Reduces A/C cost	Higher, >100° F Increased A/C cost	Higher, >150° F Increased A/C cost
CRI	>80 (Ra)	65~80 (Ra)	60 (Ra)
Re-strike	Instant	Instant, with initial 3 minute warm up time.	Instant, with initial 3 minute warm up time.
Flicker	None	Much	Much
Glare	None	Much	Much
Environmental Safety	No Mercury No lamp waste in 10 years	Contains mercury Concern with much lamp waste over 10 years	Contains mercury Concern with much lamp waste over 10 years
Images			

C) Measuring Lumens—What Are "Pupil Lumens"?

How people see and are psychologically impacted by lighting has been a subject of much study and discussion for years. Describing light as "lumen output" and measuring it as "foot candles" on a work plane have been the traditional ways of describing and defining how much light is required to perform a variety of tasks.

However, that is being re-examined based on results of studies on visual performance and the psychological impacts of lighting. Additionally, the "colour rendering index" (CRI) and correlated colour temperature (CCT) describe the quality of the light (relating to how true colours appear compared to under a noon north sky on a clear day).

As lighting technology evolves into various types and colours, simply measuring the lumens proves not to be fully adequate in predicting how well people can see. An excellent example is the low-sodium lamp which produces many lumens, but only two colours (yellow and grey); the ability to make out details—beyond shapes of objects—is lost under this light source. Different light sources produce light in different spectral ranges and there is a wide variety of spectral output available in fluorescent lamps.

Vision itself is affected by many factors, from light intensity, distribution, colour, and contrast, as well as reflections, glare, air quality, motion of subjects and viewers, and more. Our eyes use different parts to see in bright light and low light conditions. The eye contains cones and rods which were thought to work in opposite conditions. Cones provide colour vision and fine detail (photopic) in bright light and rods take over in dim light (scotopic). In bright light our pupils contract allowing more detail to be perceived, while depth of field and perceived brightness also increase. In low light our eyes dilate to allow more lights in.

Light meters and recommended light levels for tasks have traditionally been calibrated for daytime viewing, and general interior lighting, based on the photopic response. However, studies are indicating that the scotopic vision is more involved in interior lighting than thought, and affects pupil size. At recent conferences, some presenters encouraged designers to specify the photopic/scotopic (P/S) ratio of lamps when selecting them in order to get better design, efficiency, and better vision for occupants.

Sam Berman—formerly with the Lighting Systems Research Group at Lawrence Berkeley Laboratory and a major supporter of the importance of the P/S ratio in lighting selection—developed a conversion factor that applies the P/S ratio to lumen output of various light sources, and then expresses the effective lumens the eye will perceive for vision based on the size of the pupil and the effect on vision (see Table 1 below). Some lamps, like low-pressure sodium, lose most of their output using this method, while others like high-quality fluorescent lamps gain substantially.

Induction lamps are basically equivalent to high-quality fluorescent lamps with a CRI of 80 and a colour temperature of 4100K (T-8 in the table below). Berman’s table suggests that, while the T-8 4100 lamp has rated lumens of 90 per watt, the pupil (effective) lumens are actually 145 per watt. If contrast and distribution are controlled, this suggests that fewer watts are needed to provide good vision than rated lumen output would suggest, meaning energy savings will result.

Table 1. Conversion factors for lumens to Pupil Lumens

Correction factors applied to conventional values of lumens per watt yield a value for pupil lumens per watt, which is a measure of how effectively the eye sees the light that is emitted. The pupil is more receptive to light at the blue end of the spectrum.

Light source	Conventional lumens per watt	Correction factor (P/S ratio)	Pupil lumens per watt
Low-pressure sodium	165	0.38	63
5,000-K T5 fluorescent	104	1.83	190
4,100-K T8 fluorescent	90	1.62	145
Clear metal halide	85	1.49	126
2700-K Futek® Lamp	**80**	**1.62**	**129**
5,000-K pure triphosphor fluorescent	70	1.58	111
3,500-K triphosphor fluorescent	69	1.24	85
50-watt high-pressure sodium	65	0.76	49
2,900-K warm white fluorescent	65	0.98	64
Daylight fluorescent	55	1.72	95
35-watt high-pressure sodium	55	0.57	31
Standard incandescent	15	1.26	19
Tungsten halogen	22	1.32	29

Summary

Recent studies seem to favour white light (as from induction lamps) for viewing moving objects in low-light conditions, such as spotting a pedestrian, animal, or other moving object off to the side of the roadway at night. Some cities opt to use white light rather than the yellowish light of high-pressure sodium (even though the price is higher) in hopes of reducing accidents.

The improved colour rendering of white light in retail areas and places where people congregate after dark make it a popular choice for street lighting in downtown areas.

Induction lamps produce high quality white light. More lamps and fixtures are becoming available, but they do carry a premium price and still have limited applications. The long life of these lamps can substantially reduce maintenance costs due to re-lamping.

White light is proving to have advantages for visual performance. Current codes and standards are based on measurements that do not address the impact of pupil lumens, and pupil lumens can be quite different from traditionally measured lumen output of lamps. Studies on the relevance of light spectrum and the mechanics of vision are ongoing, and codes and standards may reflect that in the future.

Enquiry and Ordering of Product :
If you are interested to order the Futek® energy saving technology Series or like to find out more information, you may contact us www.futeklighting.com and we will assign an Energy Consultant to contact you shortly.

Commercial Project:
If you are interested to implement Energy Saving and Management project for your company, please contact us www.futeklighting.com

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We owned exclusive rights to a wide range of Energy Saving and Management products. If you are interested to be our licensed distributor or Sales Representative, please contact us.

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