

更換
高能源效益的
光管照明系統

Retrofit with
**Energy Efficient
Fluorescent Lighting System**

Purpose

This booklet aims to present different available technologies to convert conventional fluorescent lighting system into a more energy efficient lighting system and to provide some pragmatic approaches for lighting system improvements.

Simple, Easy and Cost Saving

In general, T5 electronic ballast (EB) fluorescent lighting system is about 30 to 40% more energy efficient than a conventional T8 electromagnetic ballast (EMB) system and is now commonly used in new installations. Users of old fluorescent lighting systems may retrofit their systems to T5 systems to enhance the energy efficiency and reduce the electricity expenditure. However, there may be operational constraints that prohibit the conversion work.

This booklet will introduce some simple options that make the lighting retrofitting work as simple as changing a light bulb. The energy savings and payback periods mentioned below are based on the retrofit of a T8 1200 mm EMB lighting system. If the retrofit work is applied to T12 EMB systems, higher energy savings and shorter payback periods could be achieved. To understand more about the T5 fluorescent lighting system, readers may visit the EMSD's website shown at the back page.

目的

本小冊子將會介紹多項技術，可將傳統光管照明系統變換成更具能源效益的系統，並同時提供一些實際可行的建議，供大家參考使用。

簡單、容易又節省

一般來說T5電子式鎮流器光管照明系統較傳統T8電磁式鎮流器照明系統省電百分之30至40。在新的照明系統中T5光管照明系統已被廣泛使用。雖然舊有的光管照明系統亦可進行改裝以減少耗電，但工序上的限制可能令改裝工作不能進行。

本小冊子簡介了一些簡單的方法令到改善照明系統就如更換燈泡那樣輕而易舉。內文所提及的節約能源百分比和成本回收期，乃假設將該項技術應用於1200 mm T8 電磁式鎮流器光管照明系統；如應用於現有T12系統時，便會有更高的能源節省和更短的回本期。如希望對T5光管照明系統的元件有進一步的認識，請閱覽背頁所登的機電工程署網站。

Upgrading Without Trouble

Pragmatic Approaches for Upgrading

The following **three technologies** provide users with simple and easy upgrading of the lighting systems.

1 Plug and Enhance (PnE)

PnE technology reduces energy consumption by using a quasi-electronic ballast (QEB) and tube replacement. QEB is an electronic device that works with the original EMB to light up the fluorescent tube. The overall efficiency is similar to an T5 EB lighting system.

升級無憂 工作優悠

實效辦法

以下**三種技術**，可以使用家簡單容易地提升系統效能。

1 「隨裝隨慳」

「隨裝隨慳」技術利用「仿電子鎮流器」和更換燈管，將照明系統的能耗減少。「仿電子鎮流器」是一種電子元件，透過與燈具中的電磁式鎮流器結合將燈管點亮。改裝後的整體能源效益表現，與一般的T5電子鎮流器照明系統相近。



Convert to T5 System

For upgrading to T5 system, a T8 tube can be replaced with a T5 tube together with a QEB attached as an end cap or inside a fitting. A short circuit component is required to replace the original starter for some systems.

變換成T5系統

要將舊系統變換成為T5照明系統，只須把T8燈管，換上配有「仿電子鎮流器」（可藏於尾蓋或另一燈具內）的T5燈管組合便可。部份裝置須將啟動器更換上一個短路器。

改裝前 Before Conversion



電磁式鎮流器T8燈具及T8燈管
T8 tube in an existing T8 EMB fitting

利用「隨裝隨慳」技術將燈具裝上T5燈管 PnE technology for upgrading to T5 system

例子一 Example 1



例子二 Example 2



The amount of energy saved in a real case of application and the estimated payback period are as follows:-

在實際應用以上改裝方法的個案中節省了的能耗百分比和估計回本期如下：

由 From	變為 To	節省能耗 Energy Savings (%)	成本回收期 Payback Period (年 Years)	光照度 Resulting Lighting Level (%)
1200 mm T8 電磁式 EMB	「隨裝隨慳」T5 PnE for T5	33	3.5	118

2 Light Level Abatement (LLA)

Over illumination is rather common, especially in small rooms. Light Level Abatement (LLA) technology can save energy for these installations. Dimming control is an effective LLA technology but it is not common for fluorescent lighting systems due to the cost reason. If properly selected, the following technique can reduce excessive lighting level and save energy.

2 「亮度調正」

過度照明是常見的現象，特別是在小面積的房間之內。「亮度調正」技術能為這些裝置省去不必要的能耗。利用光暗調控器去調節亮度是一項可行的方法，但由於費用較昂貴，並不普遍應用於光管照明系統。但若能正確挑選，以下的技術也可以解決過度照明的問題，以達致節約能源。

2.1 Use Shorter Tube

One of the LLA technologies is to replace the standard T8 tube in the existing luminaire with a shorter tube and a QEB extension adaptor. For example, the existing 1200 mm T8 tube can be replaced by a 900 mm T8 tube with a QEB extension adaptor or even by a 600 mm T8 tube for more energy saving.

2.1 使用較短燈管

其中一項「亮度調正」的方法是將較短的燈管安裝於現有的電磁式燈具中應用，祇要加上一個QEB式的延伸配合器。舉例，一套1200 mm T8電磁式鎮流器燈具，只要配上QEB式的延伸配合器便可改用900 mm燈管，甚至進一步改用600 mm燈管，以達到更節約的目標。

改裝前 Before Conversion



電磁式鎮流器T8燈具及T8燈管
1200 mm T8 tube in 1200 mm EMB fitting

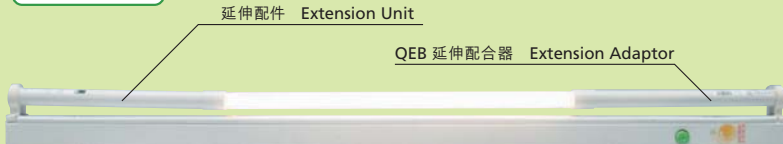
改裝後 After Conversion

例子一 Example 1



利用「亮度調正」技術裝上900 mm T8燈管
900 mm T8 tube in 1200 mm EMB fitting using LLA technology

例子二 Example 2



利用「亮度調正」技術裝上600 mm T8燈管
600 mm T8 tube in 1200 mm EMB fitting using LLA Technology

The estimated amount of energy that can be saved from the above conversions and the estimated payback periods are as follows:-

以上改裝，估計節省的能耗百分比和回本期如下：

由 From	變為 To	節省能耗 Energy Savings (%)	成本回收期 Payback Period (年 Years)	光照度 Resulting Lighting Level (%)
1200 mm T8 電磁式 EMB	900 mm T8 電子式 EB	29	3.5	75
	600 mm T8 電子式 EB	60	1.7	45

2.2 De-lamping

Energy can be saved directly by taking down tubes from lighting fittings. In general, the lighting level will be reduced by the same proportion (Note: some EB driven luminaires do not allow de-lamping). Should the lighting level be over reduced by de-lamping, you may consider to replace the standard tubes with tri-phosphors tubes (18% more light as described on Page 7) or add reflectors (25 to 35% increase in lighting level at the working plane) as described on Page 8, to bring the lighting level back to the desired level.

2.2 拆減燈管數量

從燈具中拆除部分燈管，可以直接節省能源。一般來說，光照度亦會按比例而降低（請注意：部份電子鎮流器燈具並不容許拆除燈管的變動。）但如果因拆除燈管，導致出現照明不足的情況，大家可以使用三基色燈管來代替標準燈管（這樣便可如第7頁所述獲得額外18%的光量），或如第8頁中所提及的加裝光反射器，以獲得額外25%-35%的光照度提升，使回復理想水平。



The amount of energy saved in two real cases of applications and the estimated payback periods are as follows:-

在實際應用以上改裝方法的個案中節省了的能耗百分比和估計成本回收期如下：

由 From	變為 To	節省能耗 Energy Savings (%)	成本回收期 Payback Period (年 Years)	光照度 Resulting Lighting Level (%)
3 x 1200 mm T8電子式 EB	2 x 1200 mm 三基色T8燈管 並採用光反射器 2 x 1200 mm tri-phosphors T8 with Redirection	33	1.5	109
3 x 1200 mm T8電磁式 EMB	使用2支「隨裝隨慳」T5燈管並採用光反射器 2 x PnE for T5 with Redirection	56	1.8	89

TRI-PHOSPHORS TUBE

There are 2 common types of fluorescent coatings namely standard halo-phosphate and tri-phosphors coating. The light output of a T8 1200 mm tri-phosphors tube is around 18% more than that of a standard halo-phosphate tube with the same power consumption.

三基色燈管

光管塗層也直接影響光管的能源效益；現行最普遍應用的光管塗層有標準式鹵粉塗層和三基色塗層，以一支1200 mm燈管為例，三基色塗層所產生的光量比標準式鹵粉塗層高出約18%。



3 Redirection (RD)

The light rays are emitted uniformly in all directions from a fluorescent tube. It is the design of a luminaire that makes use of reflections to direct the light rays towards the planes requiring illumination. Luminaires with pre-painting treated coating as reflecting surface would have opportunity to increase the light output by adopting the reflectors. RD technology makes use of reflector can direct most of the light emitted from the tube towards the area to be illuminated. The effect of high quality reflectors is obvious especially in small rooms and an increase of 25% to 35% of illumination at the working plane can be achieved.

3 「光源導向」

由於燈管的光線向四面散發，若要光線的分佈切合需要，我們須利用適當設計的燈具，藉反射將光線導向。內部焗漆的燈具反射率一般偏低，故可透過加裝光反射器，以增加光照度。「光源導向」技術利用光反射器，能將大部份從燈管釋出的光線，反射到需要照明的地方。特別在細小的房間內，高素質的光反射器的效果尤為明顯，可使工作面增加25%-35%的光照度。

3.1 Mirror Reflector

Mirror reflectors coated with silver/aluminium alloy or anodized aluminium are effective reflectors and when properly designed with dimension and curvature, can increase the illumination level by 35%.

3.2 Nano-technology Reflector

There is also a type of reflector coated with nano-technology material that can increase the illumination level by 25% with a more uniform distribution of light than the mirror reflector.



納米技術光反射器
Nano-technology Reflector

3.1 鏡面光反射器

經過陽極氧化鋁或鋁銀合金處理的鏡面光反射器，只要具有適當弧度和大小，便可以有效地增加35%的光照度。

3.2 納米技術光反射器

另一類的光反射器的表面，是經過納米技術物料處理過，使用後可增加光照度約25%，照射效果較為均勻。



鏡面光反射器
Mirror Reflector

To Make a Smart Choice

The above information and application examples are only some of the available technologies for retrofit and improvement of the energy efficiency of fluorescent lighting system. For further information or enquiry, please contact EMSD or visit our website.

「智」「惜」選擇

以上資料及例子，只是部份更換照明系統及改善能源效益的技術，市民如須進一步資料或查詢，請聯絡機電工程署或瀏覽本署網站。