

## Potential Carbon Emission and Electricity Cost Reduction from Replacing Fluorescent Lamps with Light Emitting Diode (LED) Lamps Universitas Gadjah Mada Academic Hospital, Indonesia

### GGHH Agenda Goals

- Energy

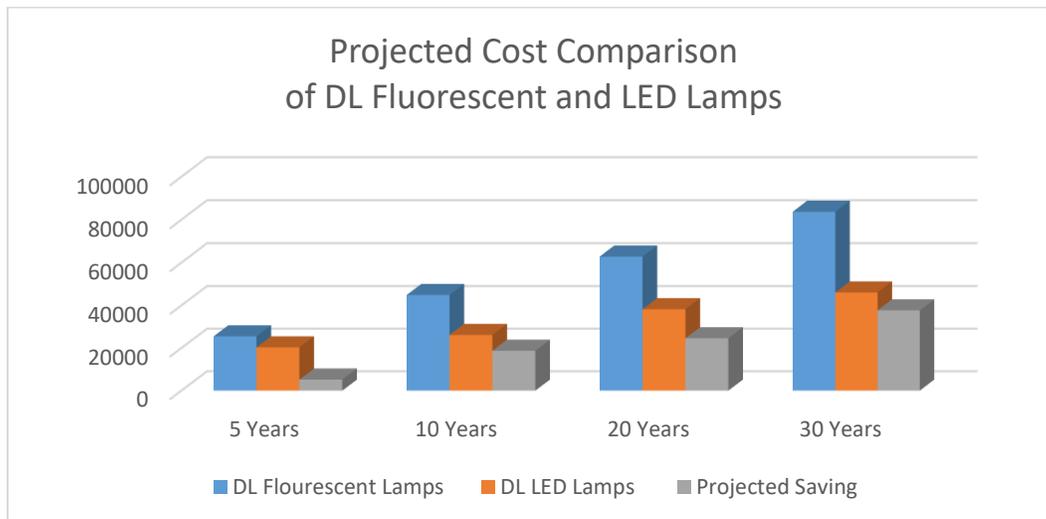
### Hospital Goal

- Reduction of electricity cost by lowering electricity consumption through replacing downlight (DL) fluorescent lamps with DL light emitting diodes (LED) lamps
- Decrease the generated volume of carbon emission by lessening consumed electricity

### Progress Achieved

#### Financial Benefits

- Universitas Gadjah Mada Academic Hospital of conducted time-based projections for five-, ten-, twenty- and, thirty- year periods, to measure the cost effectiveness of replacing all DL fluorescent light with DL LED lights. The study has shown at least a 20% cost savings in all the simulated projections. The chart below presents these projections



**Figure 1** Projected Cost Comparison of DL Fluorescent and LED Lamps

- Life Cycle Calculation Analysis has also shown the factors affecting the cost difference between fluorescent lamp and LED lamp installation. The distribution of costs are seen in the chart below. Among the identified costs, electricity consumption generates the highest cost and greatest economic savings should the LED lamps replacement take place

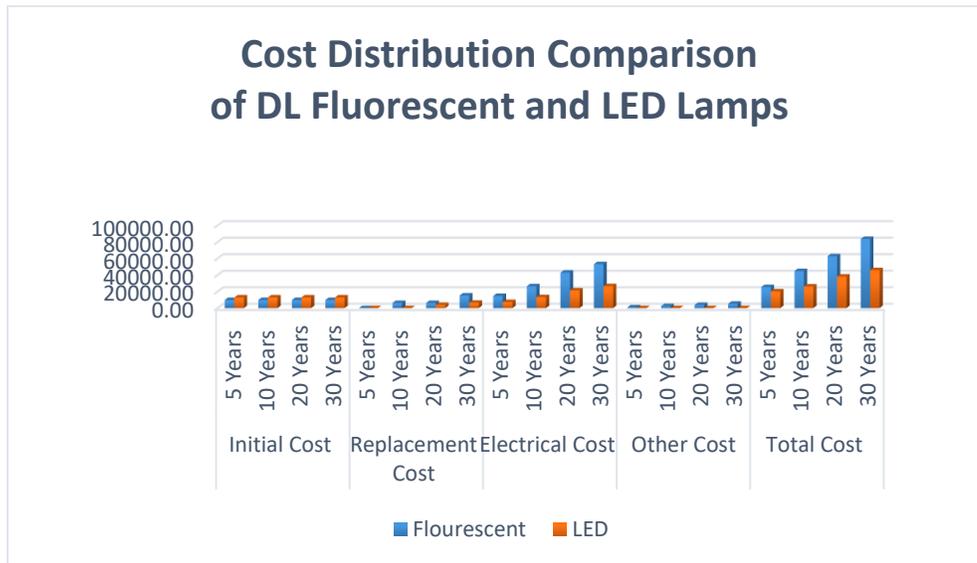
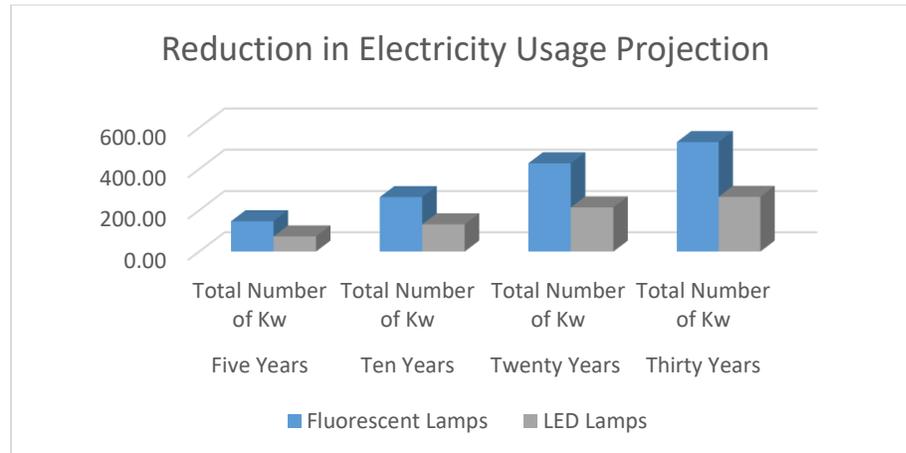


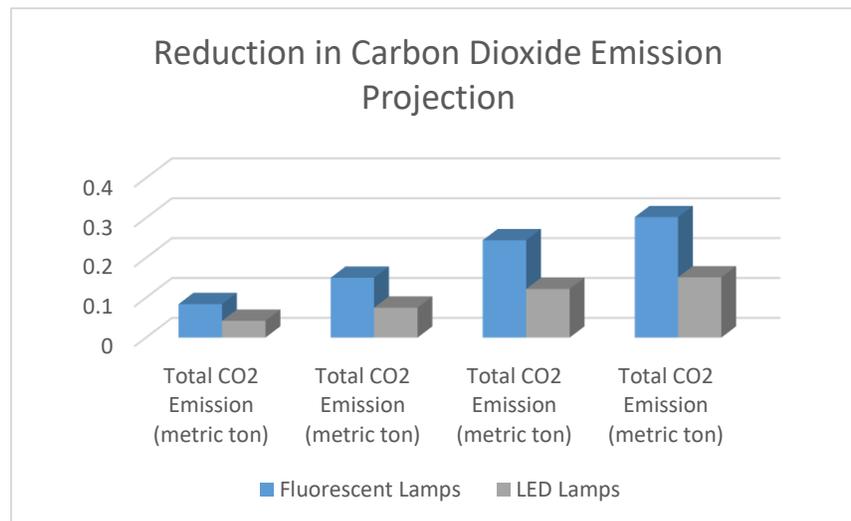
Figure 2 Cost Comparison of DL Fluorescent and LED Lamps

### Environmental Benefits

- Decrease in number of mercury containing lamps installed and managed within the hospital vicinity
- A total of 2949 fluorescent DL lamps were changed with LED DL lamps. Usage of LED lamps allowed acquisition of lower wattage lamps for same quality of light. As a result, less emissions are generated from the lower wattage of the electricity used



**Figure 3 Reduction in Electricity Usage Projection**



**Figure 4 Reduction in Carbon Dioxide Emission Projection**

- Lessened risk of exposure to mercury due to breakage of mercury containing DL fluorescent lamps

#### **The Issue**

The Hospital is a health service institution which provides complete individual health services, i.e. inpatient, outpatient, and emergency services. The hospital tries their best to prioritize patient safety in all the services provided. This results to high dependency on energy sources to perform daily operation. With the increase in energy costs and implementation of National Health Insurance (JKN) program since 1<sup>st</sup> January 2014, the hospital management must take actions to heighten their efficiency to allow hospital

growth and survival. In this case study, energy conservation was focused on efficiency level of lamps by calculating energy used for lighting the hospital.

As a member of the Global Green and Healthy Hospitals Program (GGHH), the hospital aims to reduce its carbon emission in various methods. One of them is through reduction of electricity consumption and one of them is through decreasing wattage of lamps.

### **Sustainability Strategy Implemented**

In order to fully implement energy efficiency and reduce electricity consumption, implementation of a LED lighting upgrade was done as pilot program. This will lead the way to a full implementation in the whole facility.

This pilot was done on the 1) toilets in laboratory rooms, 2) nurses' station, 3) corridors, 4) inpatient units and, 5) offices' rooms. These are spaces where lights are continuously turned on most of the time. Selecting pilot areas will makes it easier to measure outcomes and address gaps in time for furthering the project's implementation.

### **Implementation Process**

The Academic Hospital Universitas Gadjah Mada has created a team that first surveyed the hospital for the quantity and quality of lamps they need.

After the types of lamps needed were surveyed, areas where the transition will have the most significant impact were identified. The areas identified were the 1) toilets in laboratory rooms, 2) nurses' station, 3) corridors, 4) inpatient units and 5) offices' rooms. These are spaces where lights are continuously turned on most of the time. When these areas were known, suitable alternatives were also identified. DL LED lamps alternatives should provide the same quality of brightness against its counterpart, DL fluorescent lamps. This process facilitated conducting a Life Cycle Calculation Analysis which made the transition viable and implementable. Through this analysis the hospital management was convinced that the action will benefit the hospital.

On 2016 the activities for replacing the DL fluorescent lights was started. All DL fluorescent lamps were all replaced with DL LED lamps by June, 2017.



Figure 5 Fluorescent Lamp



Figure 6 Installed Fluorescent Lamp



Figure 7 LED Lamps



Figure 8 Installed LED Lamp

### Tracking Progress

The Academic Hospital Universitas Gadjah Mada will continue to monitor the installed DL LED lamps based on the indicators used for the Life Cycle Calculation Analysis. These are the cost on replacing LED lamps, electricity consumption and electricity costs.

The hospital will also monitor the completion of changing the TL fluorescent lamps with TL LED lamps until the target year (2019).

Being a member of GGHH offered an opportunity to utilize a free online platform. In this platform the hospital can record, monitor and evaluate the progress of the program implemented.

### Challenges and Lessons Learned

Initial capital expense is significantly higher. Replacing the DL fluorescent lamps with DL LED lamps cost approximately 23.78% greater. However, the life cycle analysis carried out show that the savings from electricity consumption may cover this cost.

The cost difference for installing 2949 DL LED lamps in comparison to utilizing DL fluorescent lamps is USD 3071. On the other hand, at least for the first five years the saving from electricity consumption when lights are replaced is USD7375. Easily, this figure shows that expense levels off within 2.5 years.

Also, the hospital has learned through this process that alternatives with lower wattages are readily available in the market and give out same quality of light (in terms of brightness). The hospital may not only save on electricity cost but also from disposal of these lamps and from the emission they generate.

### **Next Steps**

The Academic Hospital Universitas Gadjah Mada has a total of 4771 lamps (downlight (DL) and tube luminescent (TL) lamps) in the hospital. Currently, the hospital has replaced all the 2949 DL fluorescent lamps with DL LED lamps.

The hospital is planning to replace the remaining 1822 TL lamps (lamps that are more difficult to replace) by 2019.

### **Demographic Information**

Universitas Gadjah Mada Academic Hospital is established as one of State University Hospitals in Indonesia that has been in operation since March 2, 2012. UGM Academic Hospital is a state B class teaching hospital, with 122 beds and more than 650 employees. The hospital is located on 44.637 m<sup>2</sup> of land. The usable floor area of the buildings is 9.282,5 m<sup>2</sup>.

As an education hospital, UGM Academic Hospital is designed with its basic concept that is integrated healthcare service in clusters with multi professionals working team/inter professional collaboration practice (IPCP). UGM Academic Hospital also provides education and training service for students of healthcare sectors as well as other related programs.

### **Links**

<http://rsa.ugm.ac.id/>

### **Quotes:**

Please share a few key quotes from stakeholders involved in this process.

Please, list all contacts named in this case study.

Friendly and caring hospital

**Keywords / Topics:**

Energy, electricity consumption

**Submission date:**

January 2018