



# EMERGING ENERGY TECHNOLOGIES FOR SUSTAINABLE BUILDINGS IN MALAYSIA



# **DISTRICT COOLING SYSTEM (DCS)**



# District Cooling System (DCS)

- Economical means of providing Chilled-Water (for air-conditioning purposes) through a central plant serving multiple buildings or a huge development.



# Objectives of DCS

- To centralize production of Chilled Water by using District Cooling System (DCS) Plant. The generated Chilled Water will then be channeled to various building blocks thru pre-insulated seamless underground pipes.



# Key Benefits of DCS

- Smaller total plant capacity
- Improved plant control & monitoring (centralized plant)
- Improved plant maintenance (less number of (bigger) chillers)
- Fixed maintenance cost
- Improved IRR and expected 5-7 years return

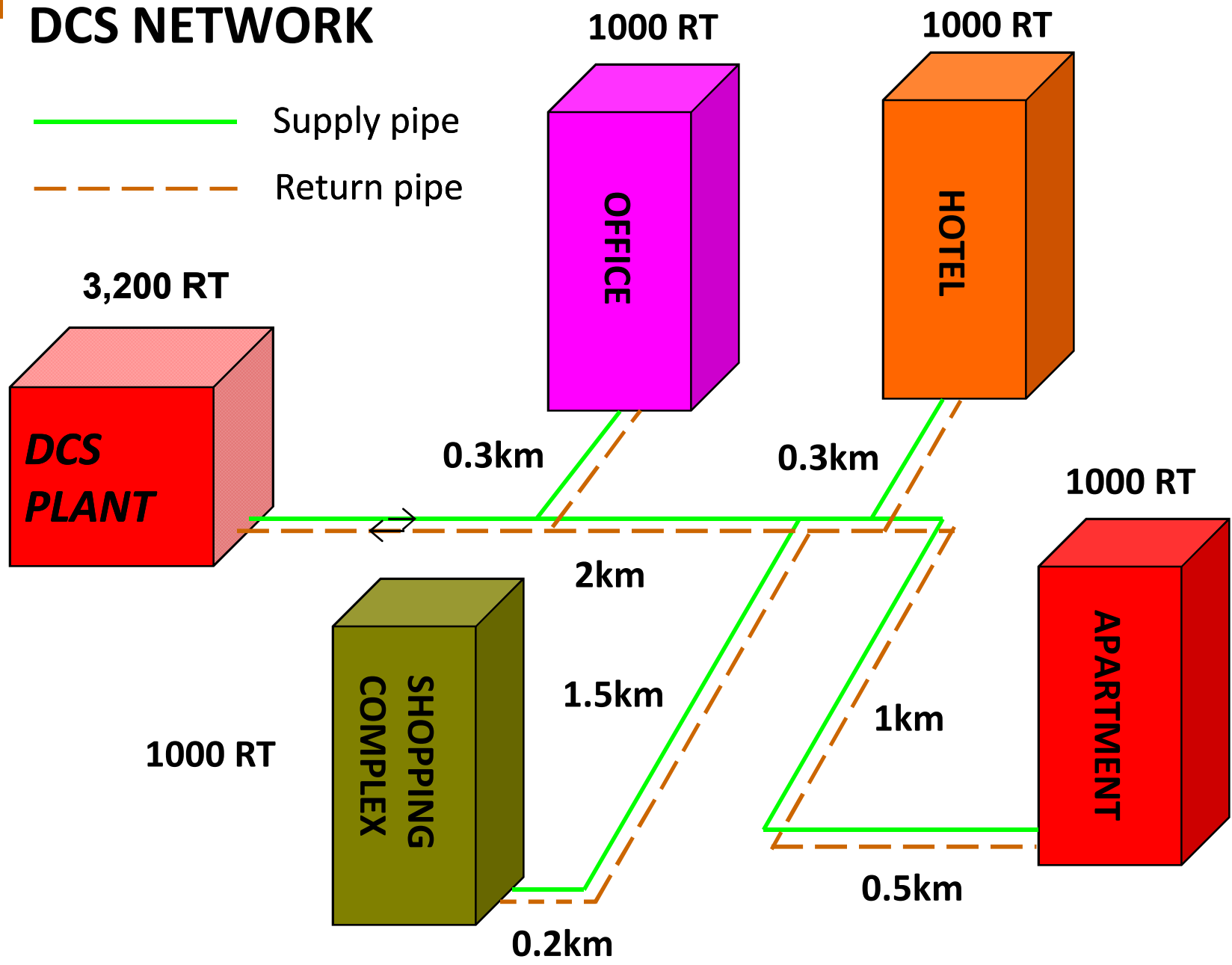
**In summary:**

***Benefits derived from economies of scale***



# DCS NETWORK

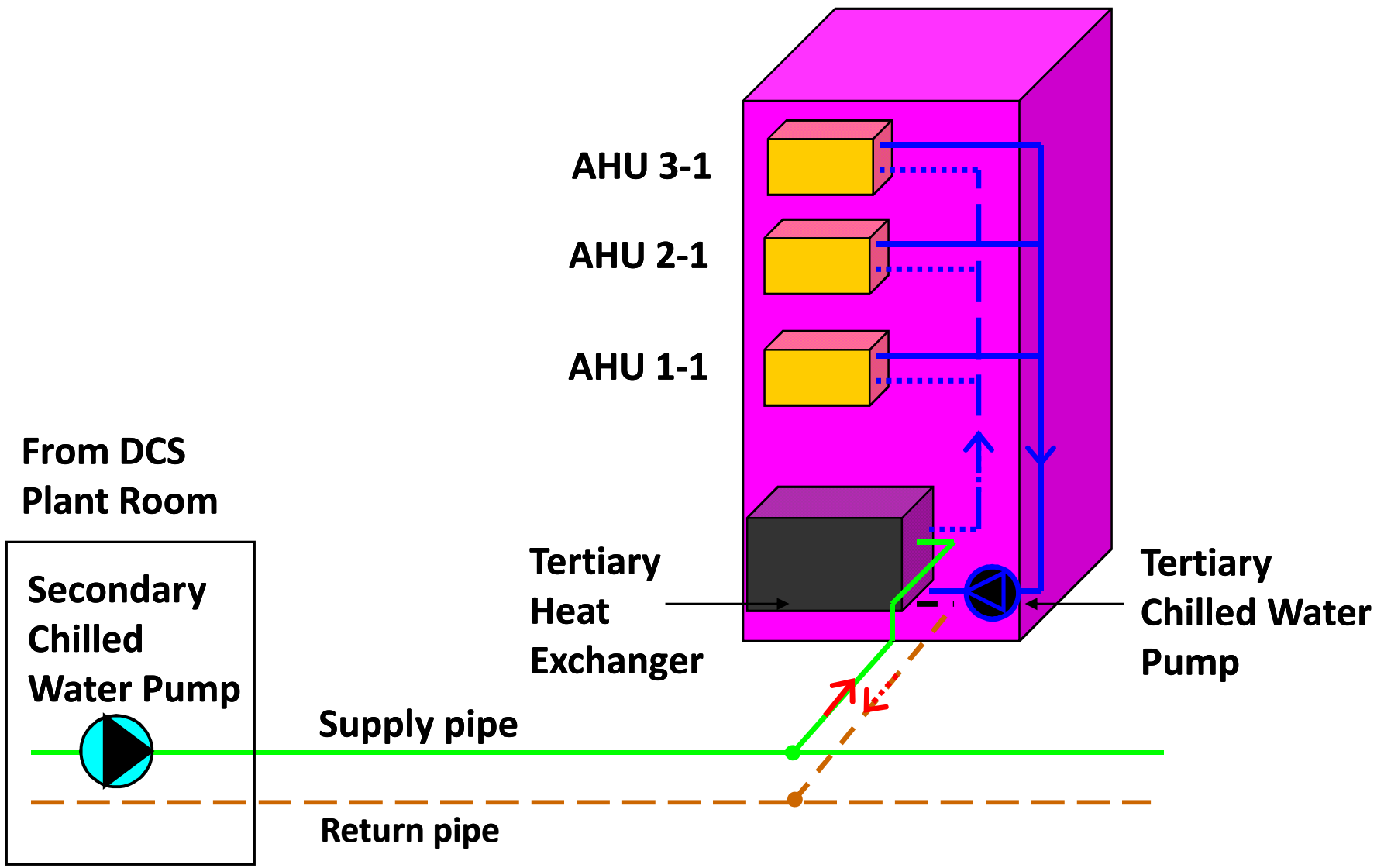
— Supply pipe  
- - - Return pipe





# TERTIARY LOOP

OFFICE  
1000 RT





# Advantages of TES

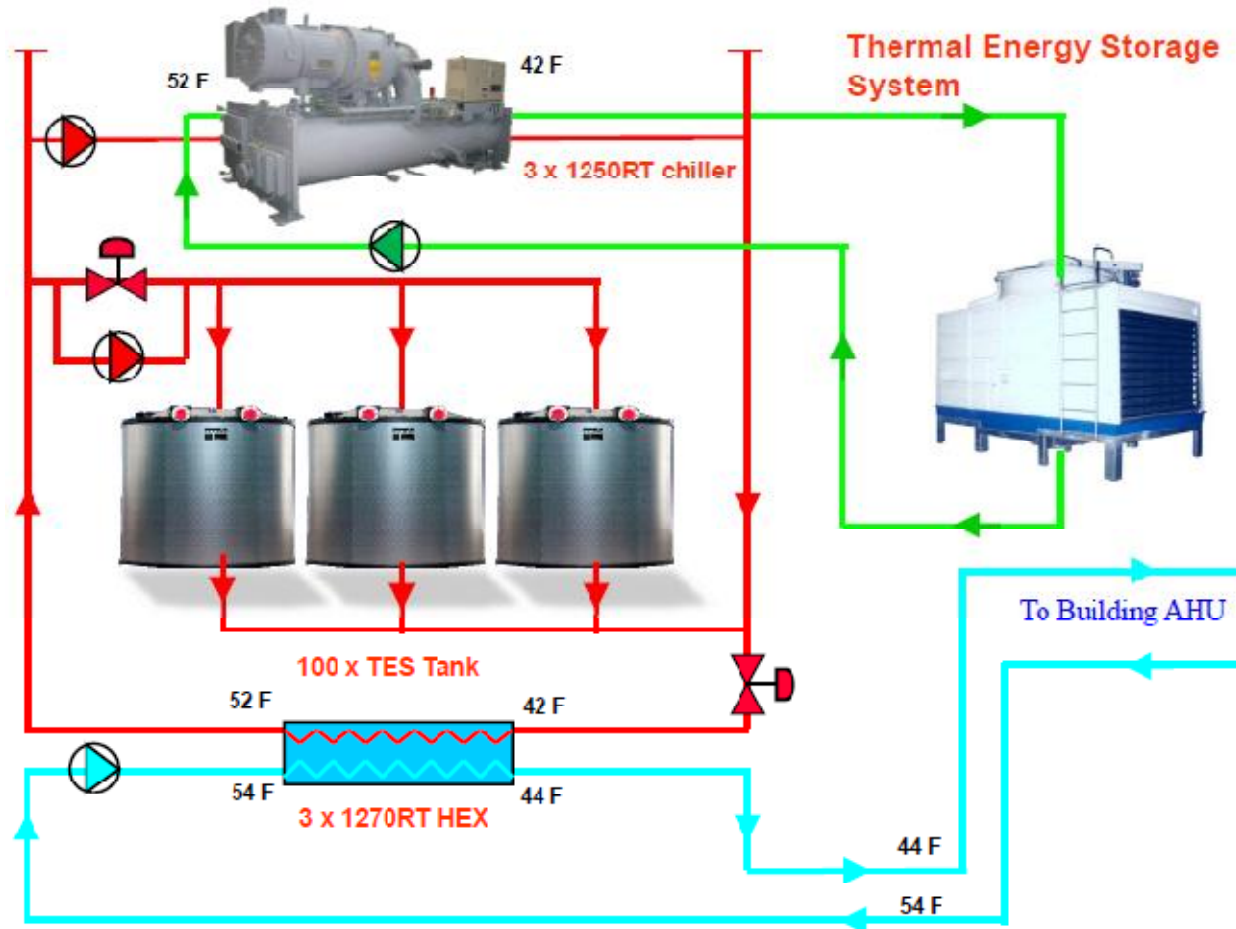
- Substantial savings in energy costs can be obtained by implementing DCS with Ice Thermal Energy Storage (TES) to optimize the economic balance in long term.
- Typically 20 to 30% of bill reduction can be enjoyed with Ice TES DCS.
- The payback period for investing in Ice TES DCS system is about 5 - 7 years.



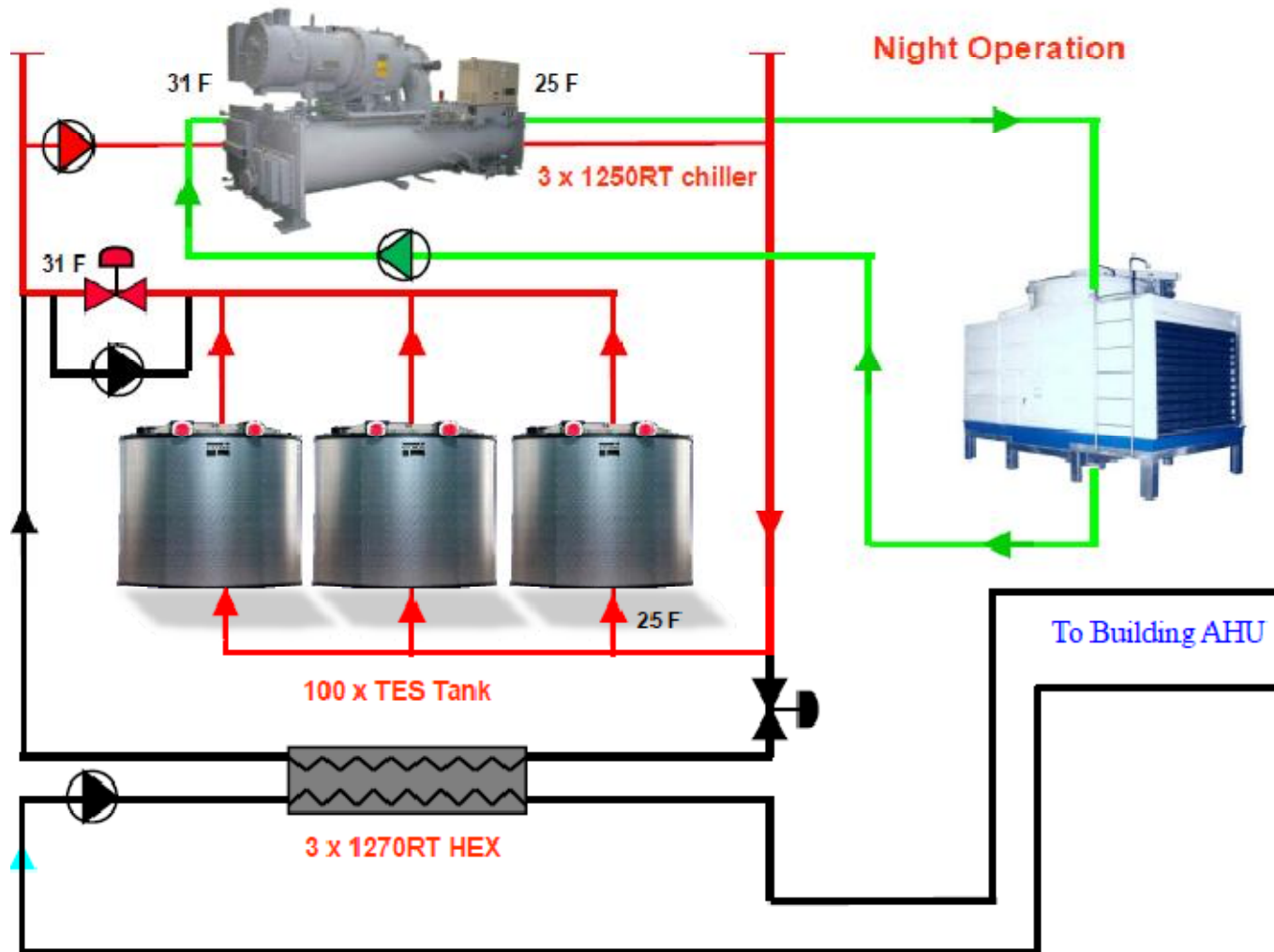
# Advantages of TES

- Low energy cost – typically 20-30% lower (compared to conventional)
- Low TNB maximum demand (MD) charges – typically 30% lower
- Lower production cost per unit of cooling energy and electricity cost compared with conventional
- Overall typically 25% on electricity saving
- Chillers can be made to run continuously at/near full load for maximum efficiency
- Accessible and convenience for future upgrading

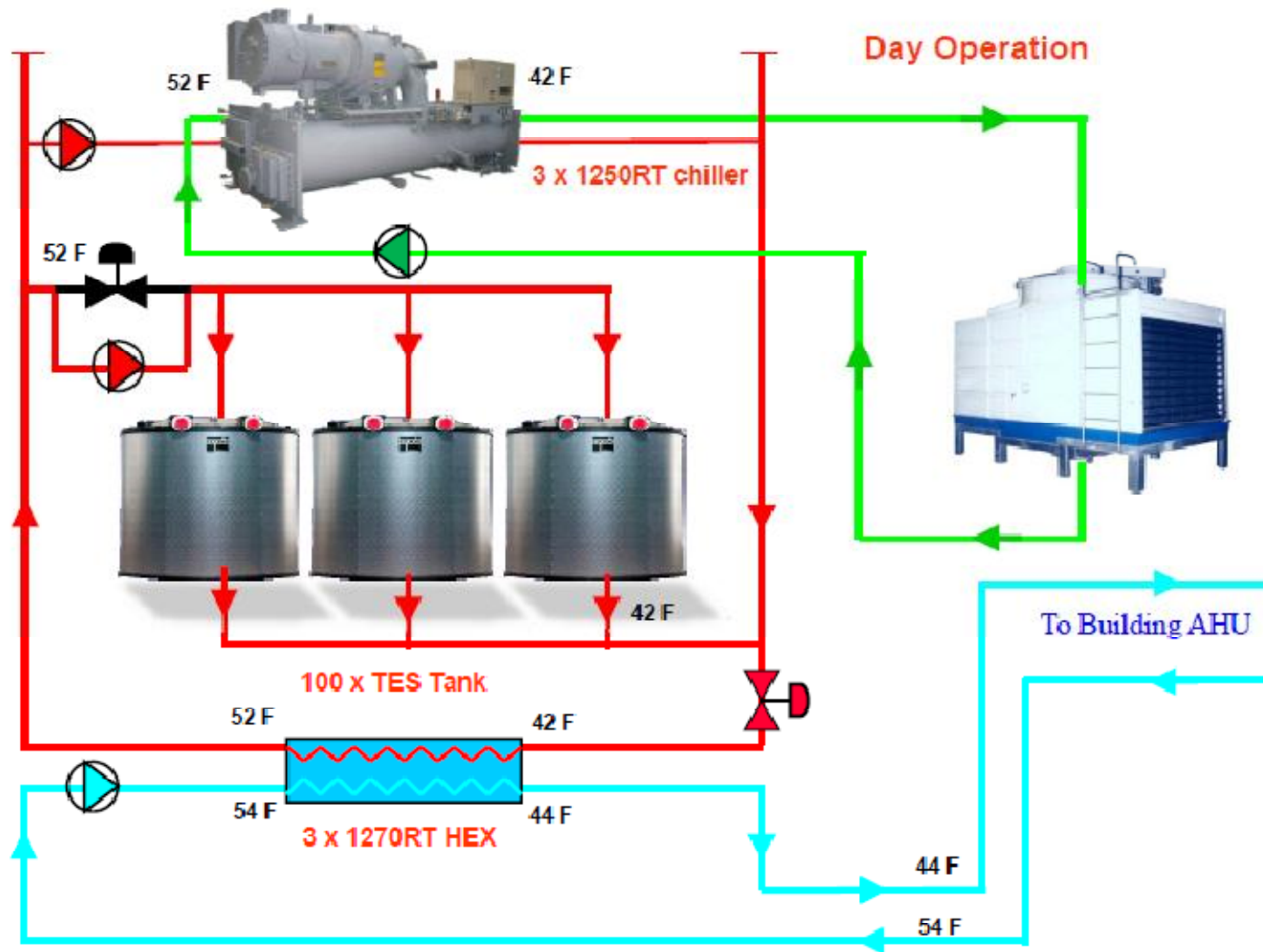
# Thermal Energy Storage (TES)



# TES : Nighttime Operations



# TES : Daytime Operations



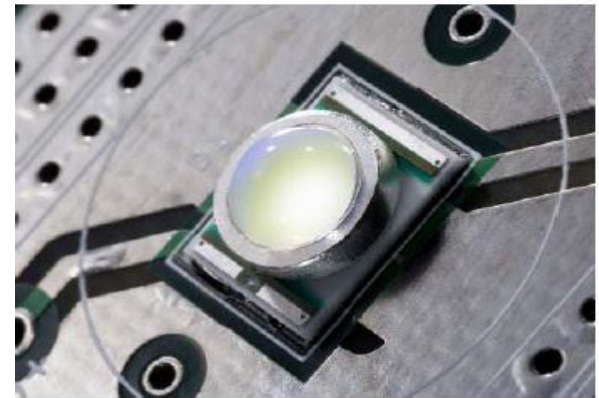


# LED LIGHTING

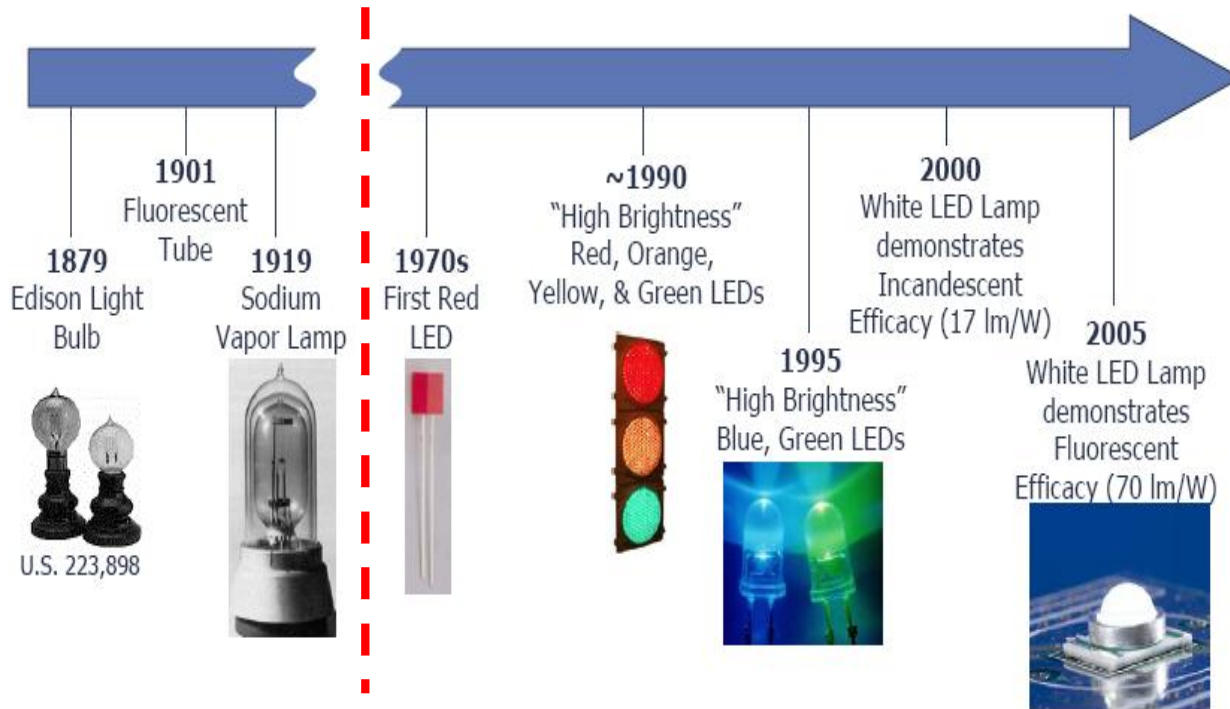
# LED LIGHTING

LEDs began as simple indicators but are now poised to become the **most efficient** and **longest lasting** light source ever created in the market!

- Energy Efficient → Up to 160 Lumens per Watt
- Long Lifetime → 50,000 hours
- Directional → No wasted light
- Rugged → No Glass / No Filament to Break
- Zero Toxicity → No Mercury / Lead / Phosphor
- Starts Instantly → Nanoseconds vs. minutes (HID)
- Operation Flexibility → -25°C to 50°C
- Infinitely Dimmable → Controllable lighting features

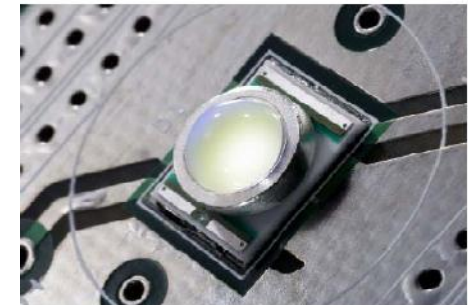


# LED from 1970 ~ 2010



## 2010

White LED Lamp reaches 100 lm/W



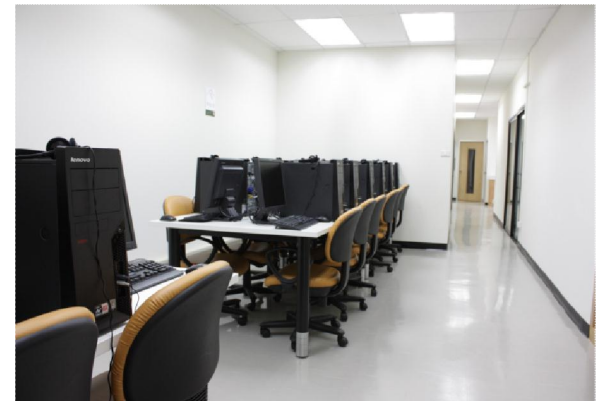
- **Current lighting technology is about 100 years old!**

# ADVANTAGES OF LED LAMPS

## 1. Energy Savings

	<u>Energy Consumption</u>	
	<u>Existing</u>	<u>LED</u>
Decorative Lighting	20W	vs. 3W
Down Lighting	36W	vs. 9W
Fluorescent Tubes	47W	vs. 18W
Street Lighting	250W	vs. 60W
High Bay Lighting	450W	vs. 150W

**Savings alone > 60%**



# ADVANTAGES OF LED LAMPS

## Standard T8 Fluorescent Tube



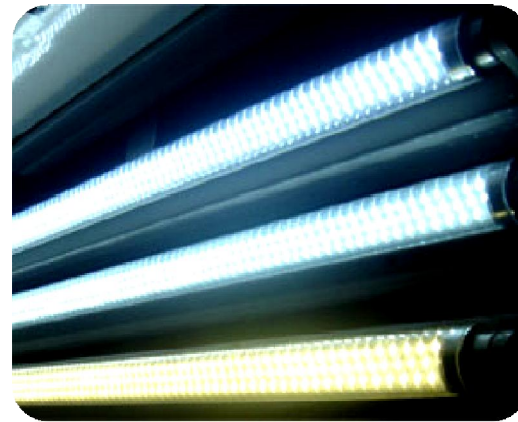
Power Consumption: **47W**\*

\* Power Consumption Calculation  
Standard Fluorescent Tube  
+ Ballast + Starter + Capacitor

36W + 9W



## T8 LED Lighting Tube



Power Consumption: **18W**

\*\* No Ballasts or Starters Required  
Existing Cabling Can Be Used

# ADVANTAGES OF LED LAMPS

**Regular Highbay Lamps**



**Power Consumption: 450W**



**LED+ Highbay Lighting**



**Power Consumption: 150W**

\* Power Consumption Calculation  
Metal Halide Lamp + Control Gear  
400W + 50W



# ADVANTAGES OF LED LAMPS

## 2. Makes Renewable Energy Affordable

LEDs are particularly effective when combined with Renewable Energy Solutions:  
(Solar – PV and Wind Power Systems)

- i. Reduces the size of RE investment
- ii. DC powered options discourages theft of lighting luminaires



# ADVANTAGES OF LED LAMPS

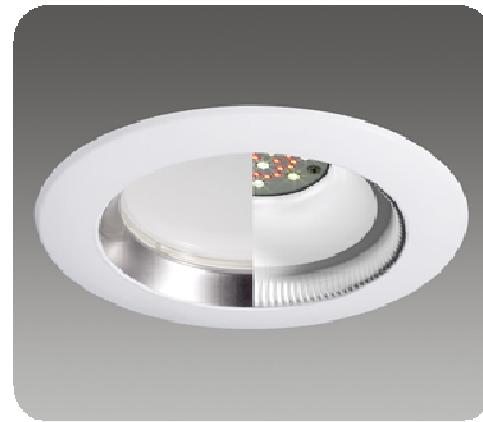
**Standard Compact  
Fluorescent Down Lights**



Power Consumption: **36W**\*



**LED  
Down Lights**



Power Consumption: **9W**

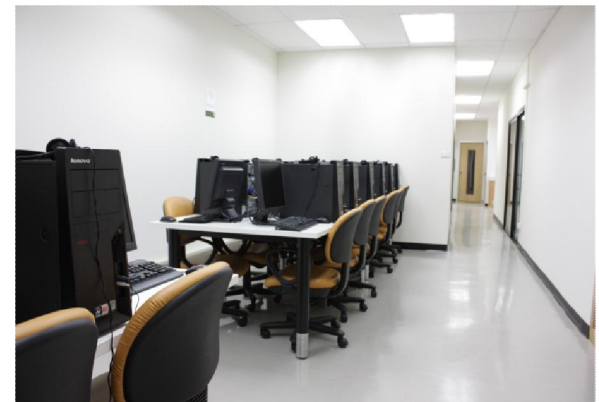
\* Power Consumption Calculation  
CFL Down Light  
 $18W * 2$



# ADVANTAGES OF LED LAMPS

## 3. Material Use

- “ No Toxic Vapor (e.g. mercury, phosphor)
- “ No Glass or Moving Parts
- “ Disposable Friendly



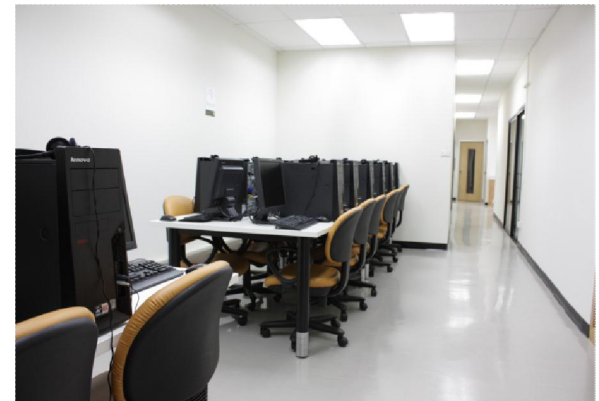
# ADVANTAGES OF LED LAMPS

## 4. Sustainable

**LED Lifespan  $\approx$  50,000 hours /  
approx. 5 years**

\* assumption based on 24/7/365 operation

” **Reduce regular replacements**



# ADVANTAGES OF LED LAMPS

## 5. Dimmable

Commonly used lamps today  
e.g. fluorescent tubes are not easy to dim.


LED will set the standards for dimmable  
lighting.





# **VERTICAL AXIS WIND TURBINE (VAWT)**




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- VAWT were introduced to Malaysia in the year 2008 by a Malaysian company, iWind Energy (M) Sdn Bhd.
  - The product was invented, and produced in Taiwan in early 2008.
  - To-date, over 30 units of VAWT of various capacities have been installed in Malaysia



## Advantages Of VAWT

The major advantages of VAWT over conventional horizontal axis wind turbines are:-

- “ VAWT can catch winds from all directions (360 degrees) as well as vertical up and down draughts. Hence, it can start-up at low wind speed of about 0.8 m/s and cut-in (generate power) at wind speed of 2.5 m/s.
  - “ In particular, iWind VAWT have the following superior features:
    - a. Turbine rotor blades are made from FRP composites which are light weight. The rotor surface smoothness is 0.9 micron.
    - b. The rotor blades are anti-UV, acid and alkaline resistant and heat and cold resistant.
- They are suitable for installation in most area and climates.

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- ” Since they are very low in noise and comparatively light in weight, they can be installed in urban/metropolitan area, including on flat roofs of high rise buildings
  - ” The Permanent Magnet Generators have the following superior features :
    - a. High flux concentrations for high efficiency
    - b. Low speed high torque for low noise
    - c. No cogging torque for cutting in at low wind speed
    - d. Direct-driven extends product life
    - e. Porcelain coated chromium dioxide bearings for long life without greasing



## **Installation Of VAWT To Recover Energy From AC Cooling Tower Fans**

In Malaysia, there are thousands of high rise buildings (both Government and Private) with big central air-condition systems. Most of them have cooling towers with blower fans exceeding 3m in diameter. On site measurements have shown the blower wind speed 1-2 m from the fan range from 12-16 m/s. If a 2 kW VAWT unit is installed down stream of the exhaust air, 2 to about 2.5 kW of power can be recovered and injected back to the power grid.



In remote areas such as rural schools and villages, beaches and islands where costs of bringing in electricity from the national grid are high, it is viable to consider VAWT. Of course, it is also worthwhile to consider VAWT in hybrid with Solar PV in most of these areas.



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**THANK YOU**

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