HIOKI

Application Note

Hioki Power and Data Logger for HVAC Power Consumption Saving



Wireless Voltage/Temp Logger
LR8515



Clamp On Power Logger
PW3360-21

What is HVAC?

HVAC stands for Heating, Ventilation, and Air Conditioning system. It provides heating or cooling and ventilation services to residential and commercial buildings [1] for thermal control and comfort. This system applies the principles of thermodynamics, fluid mechanics, and heat transfer for its functionality. The HVAC system consumes power to enable the heat transfer process to take effect. This article focuses on the air conditioning system in particular.

Air Conditioning System And Its Impact

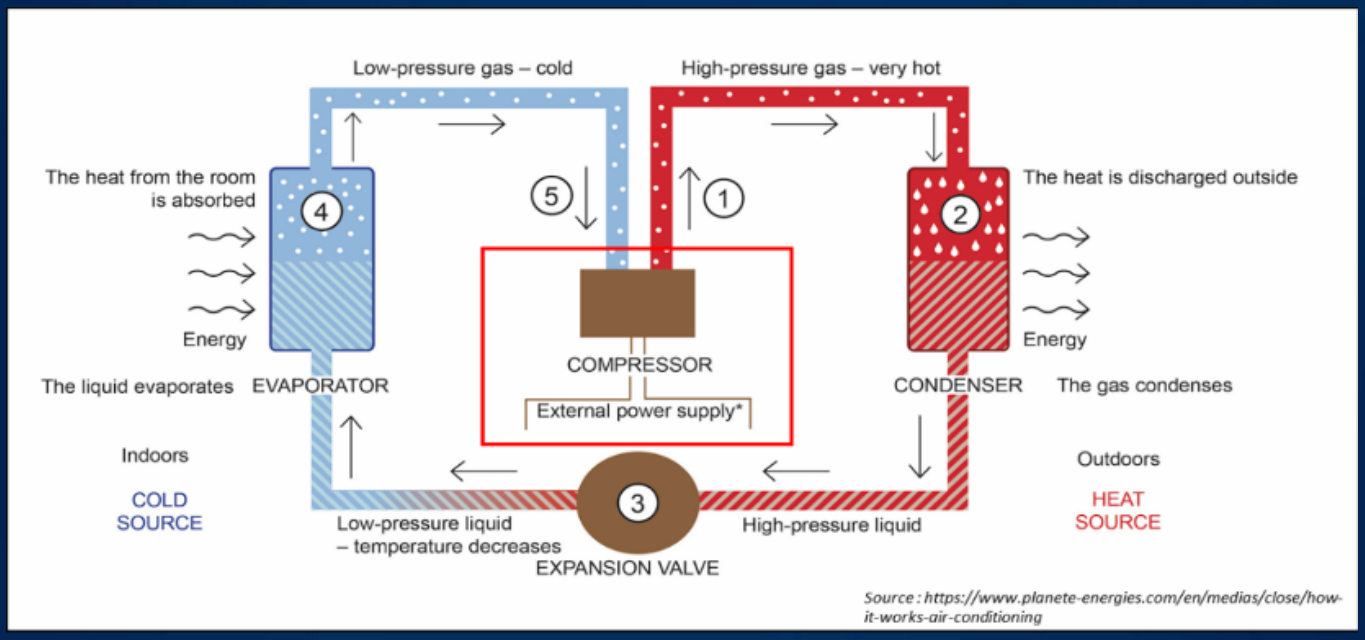


Figure 1.0 Air Conditioning System Components And Cycle

Figure 1.0 shows the components and cycle of the air conditioning system. The compressor utilizes an external power supply to compress the refrigerant for circulation to absorb and release heat in the system [2]. This power supply comes mainly from fossil fuel burning sources such as coal and natural gas [3]. Figure 2.0 demonstrates the impact cycle of increased use of air conditioning on our environment. A high workload of the compressor (to bring down the temperature to the desired level) means higher power consumption and indirectly higher energy cost and greenhouse gas emissions.

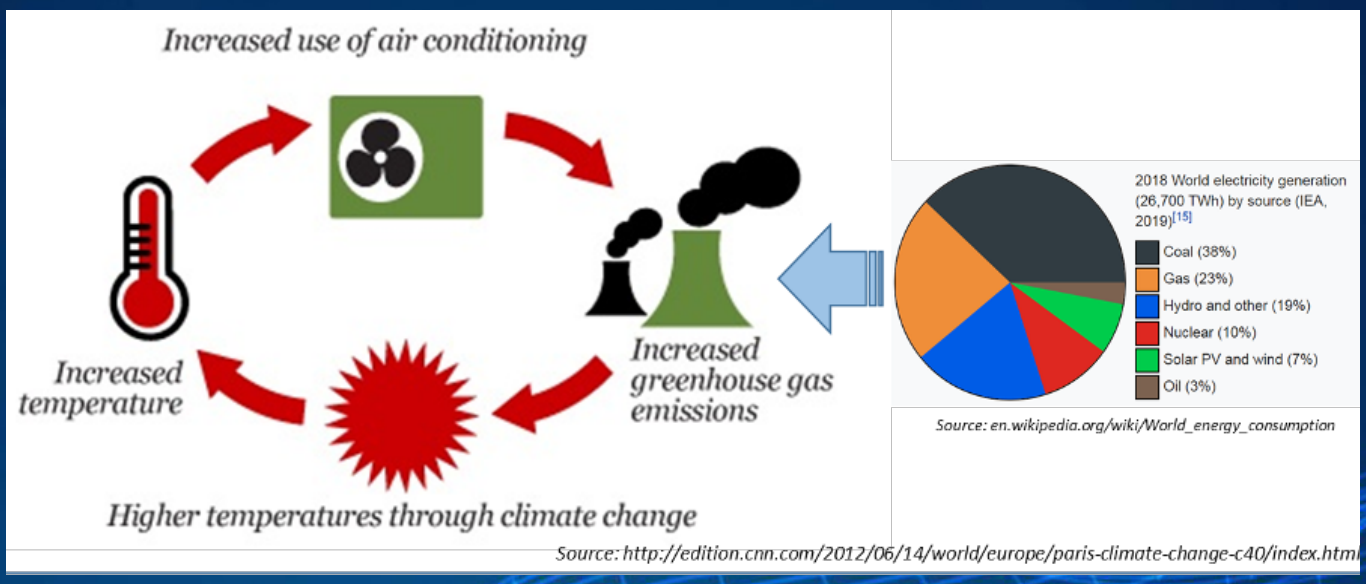


Figure 2.0 Air Conditioning Impact On The Environment

Air Conditioner Power Consumption Saving

A few factors are known to affect the power consumption of the air conditioner as follow [4]:

1. **Indoor air temperature**
2. **Outdoor air temperature**
3. **Thermal insulation of room**
4. **Air conditioner temperature setting**

As there's little or no control over the first three factors above, only the air conditioner temperature setting can help in power consumption saving. Hioki's Clamp On Power Logger PW3360-21 is used to record the power consumption of a ceiling cassette air conditioner by different temperature settings and subsequently calculate the cost of electricity usage. At the same time, Hioki's Wireless Voltage/Temp Logger LR8515 records the concurrent temperature readings during each setting period. The temperature settings are evaluated at the same location and period of the day over different days.

Figure 3.0 and Figure 4.0 show the integrated active power, and cumulative energy cost respectively on an hourly basis. The temperature setting of 22°C gives a consistent lower power consumption and cost compared to other temperature settings*.

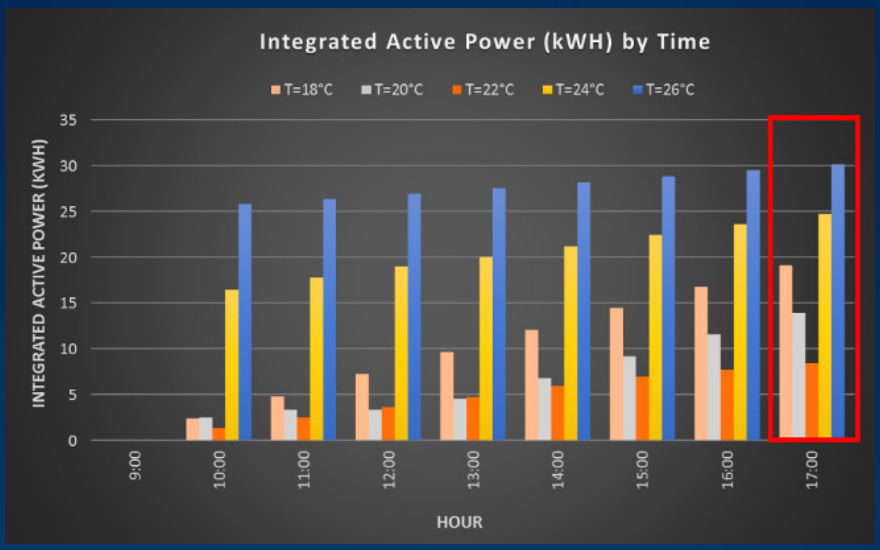


Figure 3.0 Integrated Active Power By Time

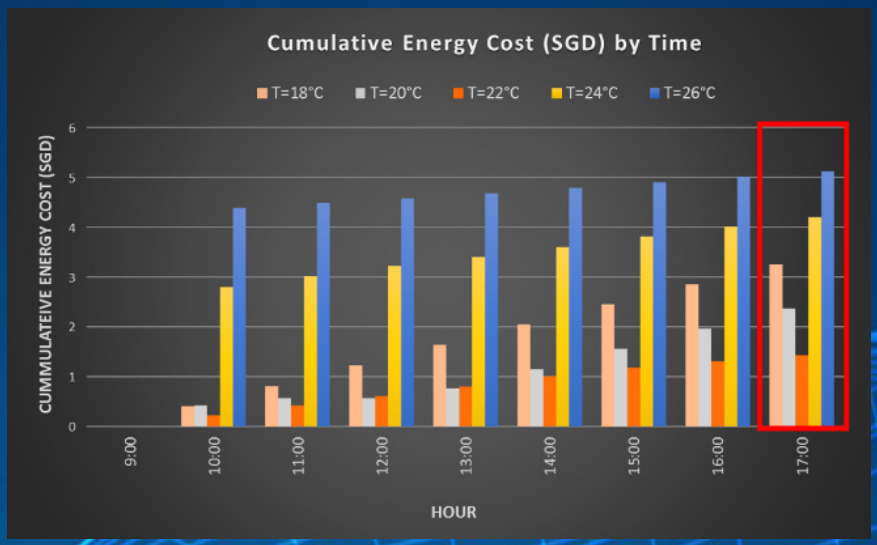


Figure 4.0 Cumulative Energy Cost By Time

Air- Conditioner Power consumption saving

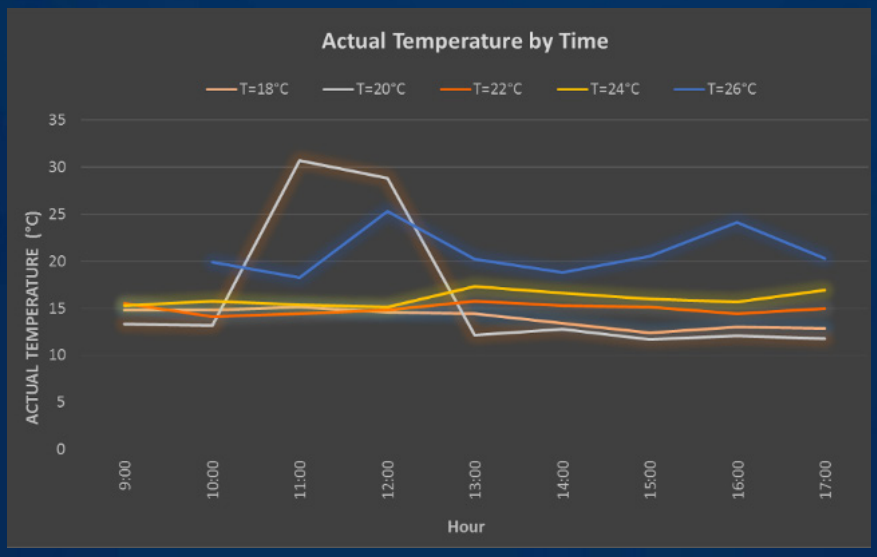


Figure 5.0 Temperature Data Log For Different Air Conditioner Temperature Setting

The temperature logging data (Figure 5.0) shows a steady temperature trend with low hour-to-hour fluctuations for the 22°C setting.

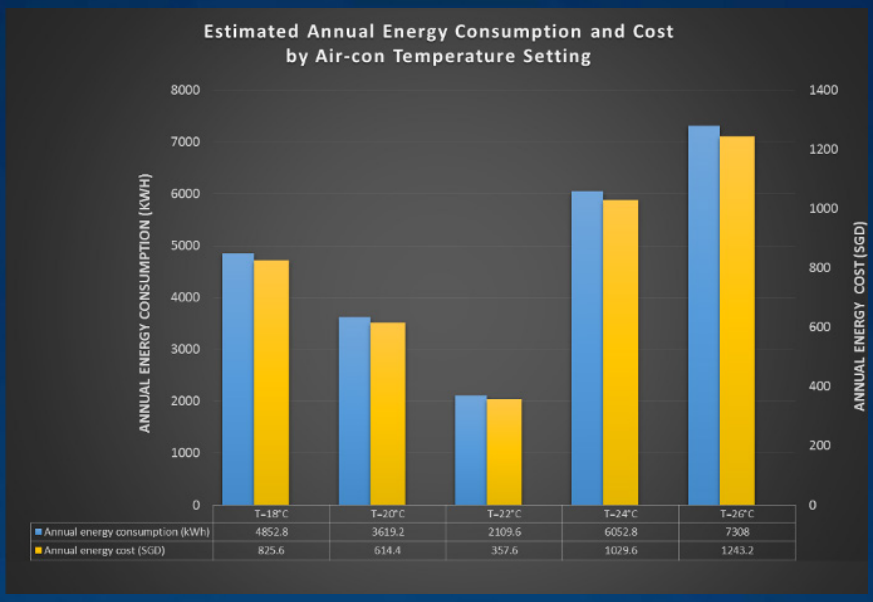


Figure 6.0 Estimated Annual Energy Consumption And Cost By Temperature Setting

Using this data, the estimated annual energy consumption and cost (Figure 6.0) is the lowest at the setting of 22°C*. This is a staggering 42% lower than the 20°C setting and 65% lower than the 24°C setting. The significant impact on energy cost shows the importance of finding the optimum temperature setting of an air conditioning system. Hence, Hioki's Clamp On Power Logger PW3360-21 is a highly beneficial tool to determine the best temperature setting for the power consumption saving of a HVAC system.

Other than HVAC power consumption saving, the following can also be done at manufacturing facilities for energy saving efforts [6]:

1. **Lighting usage – Switch off lights when not in use or install an automated lighting system based on room occupancy or daylight availability**
2. **Turn off and run equipment only on-demand – Air compressor, in particular, can use up to 20% of power usage [7] which have significant cost impact**
3. **Shade windows – This reduces heat from the direct sun from entering the building and thus reducing the air-conditioning requirements**
4. **Replace existing lights with LED – LED lights, especially ENERGY Star rated products, use 75% less energy and last 25 times longer than incandescent lighting [8]**

In summary, energy consumption saving helps energy cost reduction and reduces the global warming effect. HVAC best setting for maximum power consumption saving can be easily determined using Hioki's Clamp On Power Logger PW3360-21 and Wireless Voltage/ Temp Logger LR8515 for temperature monitoring.

Also Available



Clamp On Power Logger
PW3365

World's first non-metallic contact power meter and energy logger

Advanced Energy Analysis



Power Quality Analyzer
PQ3198



Power Quality Analyzer
PQ3100

For more advanced surveys of power quality, we recommend the HIOKI PQ3198 or the PQ3100.

Disclaimer: The concluded 22°C temperature setting is based solely on our study of a ceiling cassette air conditioner and one compressor type in a commercial office. Readers should not misconstrue this value to represent the universal best temperature setting for air conditioner energy cost-saving purposes. The temperature ranges of 22°C to 25°C are known to give both comfort and cost-saving [5] . Kindly approach our sales representatives for more information on studying the power consumption at your facility using Hioki's power logger and data logger.

References

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