

1. Scope of Work

In order to investigate the electrical power demand of the M&M Chiller Room at Waterbom Bali, a load study was carried out by Mantra between the 17th of October 2017 and the 2nd of November 2017.

To accurately determine the load and electricity consumption of the compressor of the Walk-in refrigerator, a PEL-103 an energy logger was installed to log the electrical power demand every second.

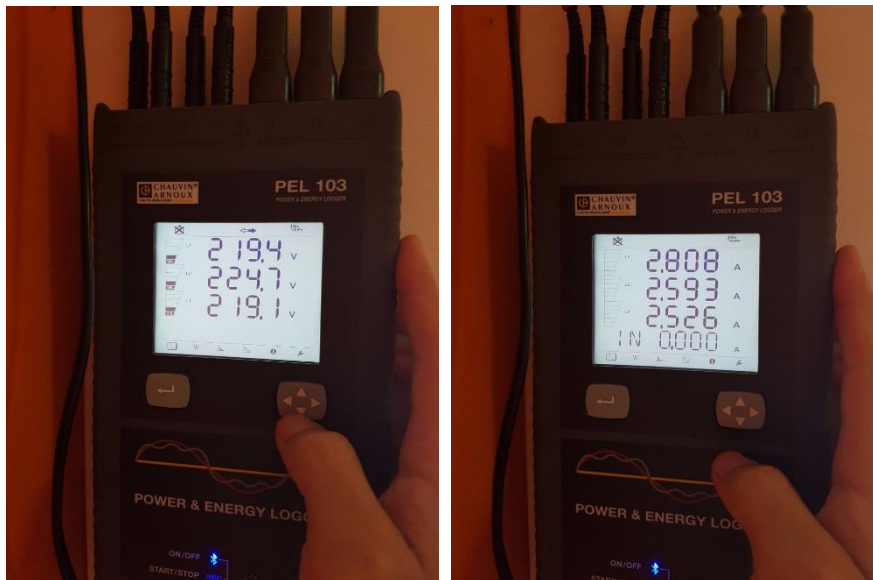


FIGURE 1: INSTALLED PEL, LOGGING VOLTAGE (V), AMPS (A) AND POWER FACTOR (PF)

During the logging period, the usage of the energy saving technology COOLNOMIX® control system was tested.

Additionally, the Walk-in refrigerator room temperature was also measured with a temperature and humidity logger. This was carried out to investigate any effects the COOLNOMIX® device might have on the Walk-in refrigerator room temperature.

2. Findings

Figure 2 below shows the electrical power demand as well as the Walk-in refrigerator room temperature during the logging period.

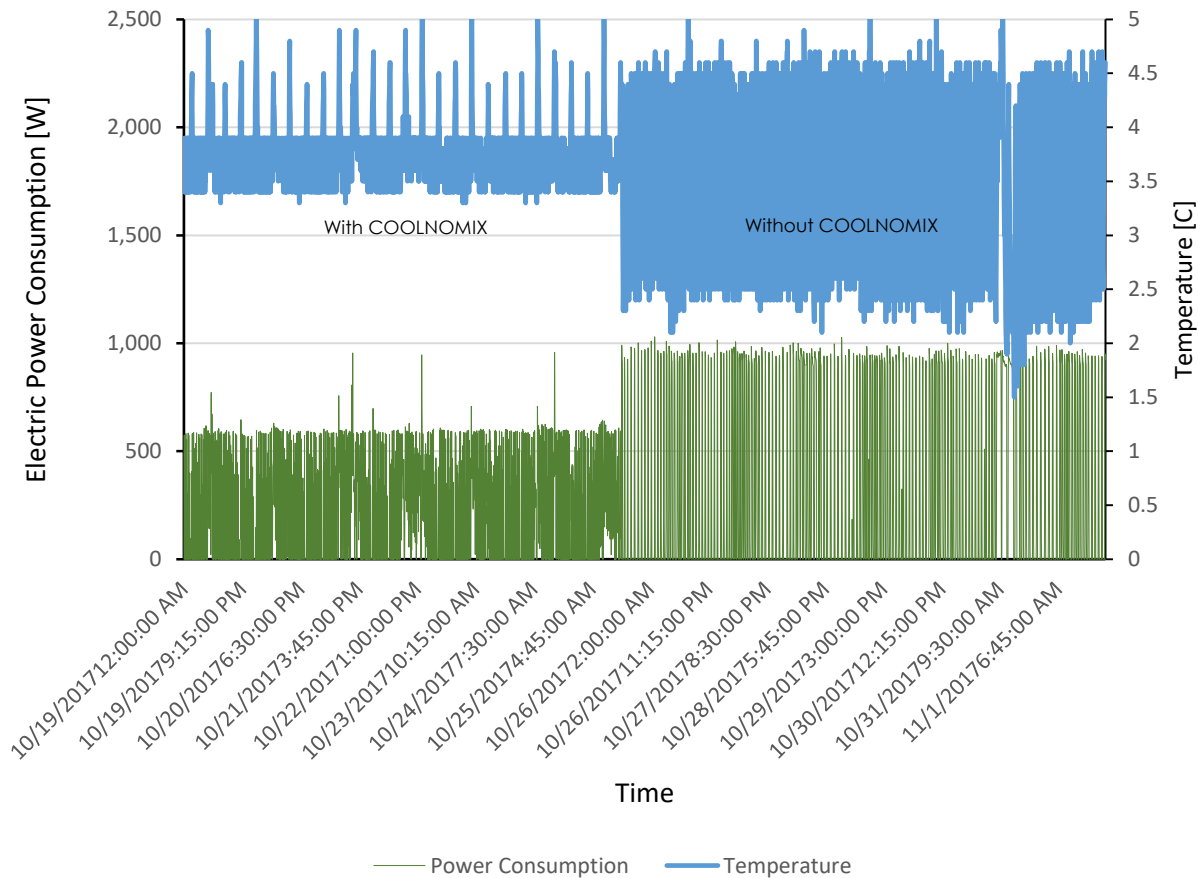


FIGURE 2: LOGGED POWER CONSUMPTIONS AND TEMPERATURE OVER THE WHOLE LOGGING PERIOD.

The COOLNOMIX® control system was installed on the 19th October 2017 - 25th October.

On the 26th, the COOLNOMIX® control system was uninstalled. Thus, the period between the 26th October – 1st November represent normal operations.

It is evident that the average power demand is reduced while the COOLNOMIX® control system is installed, 600 Watts, compared to 900 W without COOLNOMIX®.

Furthermore, the fluctuation of the cool room air temperature is significantly reduced, indicating that the refrigeration unit set point temperature is better controlled and maintained.

The following graph shows the logged data in more detail for two sample days:

- A. One day with the installed COOLNOMIX® system (19th October 2017)
- B. One day without COOLNOMIX® system (30th October 2017)

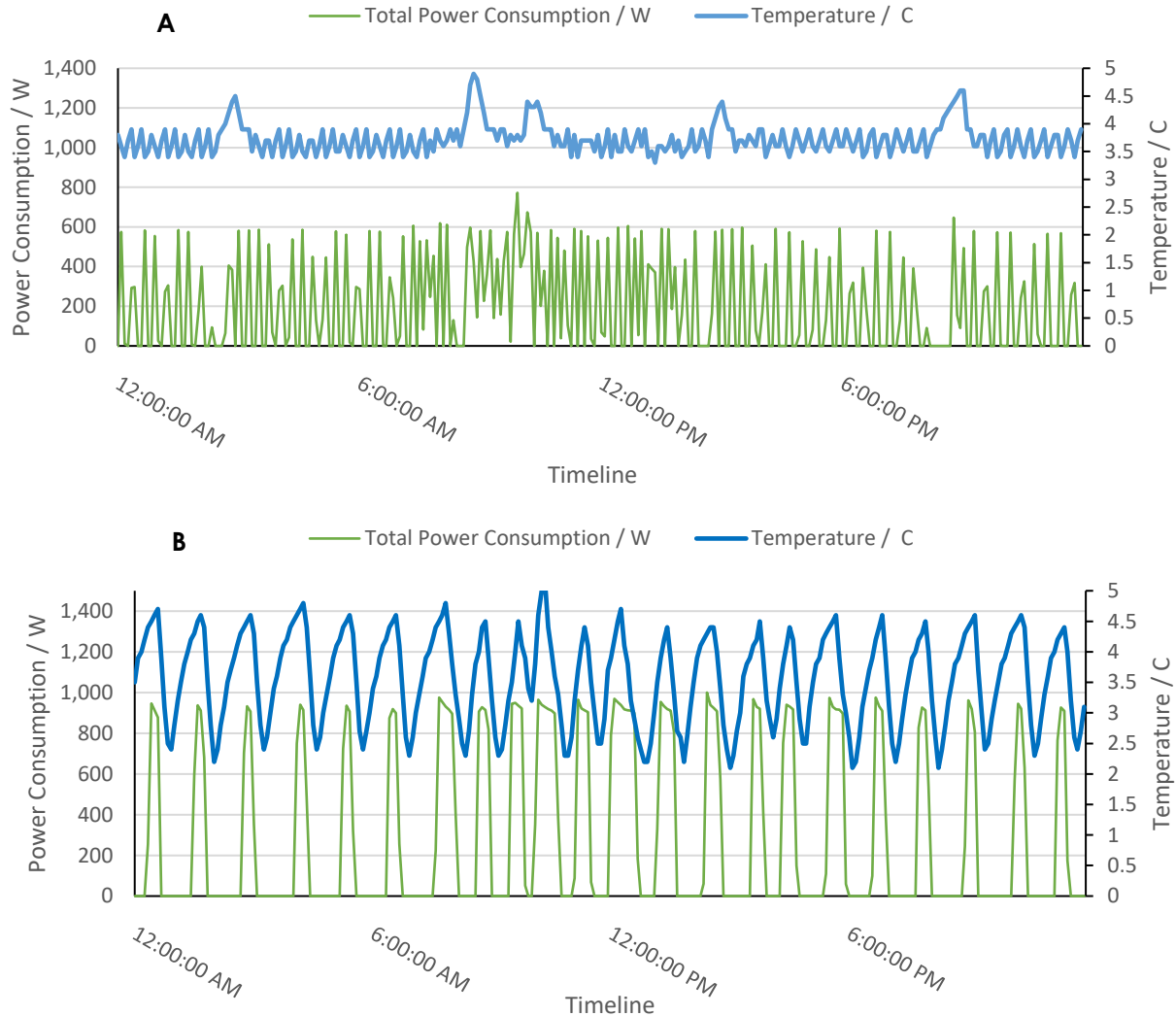


FIGURE 3: LOGGED DATA WITH COOLNOMIX® (A) AND NORMAL OPERATION (B)

It is evident that the power consumption is reduced by the COOLNOMIX® control system and the cooling room temperature is maintained more constant. Furthermore, the data shows that compressor cycling (ON-Off Switches) increases while using the COOLNOMIX® control system. This is likely due to the increased sensitivity of the COOLNOMIX® control system, switching on and off in a narrower temperature band, leading to a more stable cool room temperature.

3. Savings

Figure 4, below, summarizes the average daily energy consumption in kWh and the average temperature in C for the entire logging period¹.

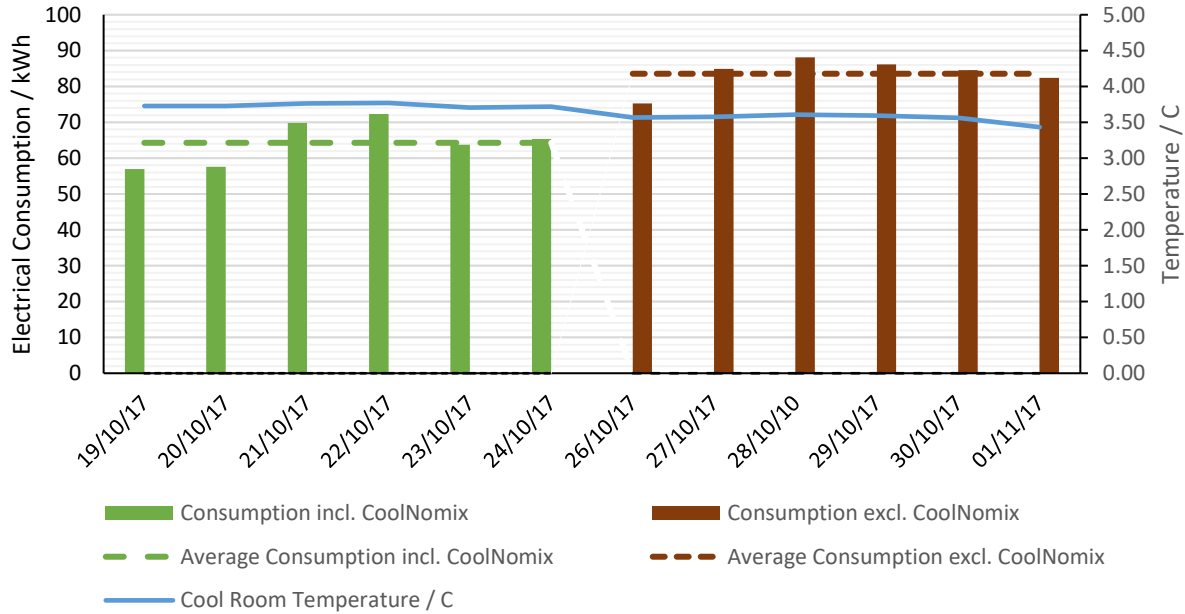


FIGURE 4: EVALUATION OF THE LOGGED PARAMETER IN COMPARISON

As shown in Figure 4, the average electrical consumption of the compressor is reduced from 84 kWh/day to 64 kWh/day while using the COOLNOMIX® control system. This is equivalent to an **average energy savings of 23%**.

TABLE 1: AVERAGE CONSUMPTION AND ENERGY SAVINGS

	Incl. COOLNOMIX	Excl. COOLNOMIX
Average Daily Consumption [kWh/day]	64	84
Average Energy Savings	23%	

¹ Data from the 31st October 2017 was excluded as an outlier because a marked increase in energy consumption was measured. It is assumed that on the 31st of October, unusually high energy consumption by the cool room was due to added catering events.

3.1. Financial Evaluation

Based on the identified daily energy savings, the financial viability of the COOLNOMIX® control system is determined. Table 2 reveals **annual financial savings of approx. 9,700,000 IDR per year**, which leads to a **return of investment of 1.1 years**.

TABLE 2: COST SAVINGS AND ROI OF COOLNOMIX® CONTROL SYSTEM

ROI for COOLNOMIX® control system	
CAPEX – cost of COOLNOMIX [IDR]	5,500,000
Energy Savings [kWh/a]	7,031
Electricity Cost [IDR/kWh]	1,380.00
Cost Savings [IDR/a]	9,702,101
Return of Investment [months]	6.5

4. Discussion and Conclusion

The cold storage – chiller rooms of MnM consist of 2 compartments. Each compartment runs an independent but identical refrigeration system. This trial only covered the colder of both rooms to determine the minimum savings.

The adjacent, warmer cool room was not tested but it is expected to provide higher savings than the cooler cold room as COOLNOMIX® provides more savings for higher temperature set cold storage rooms². We expect 35 to 40 % in energy savings for the adjacent, warmer cold storage room, however, we also expect less energy consumption by the warmer unit. In total we estimate similar savings, in monetary value between the two units.

Table 3 below provides our total cost and savings calculations expected for installing COOLNOMIX® on both walk-in units.

TABLE 3. COST SAVINGS AND ROI OF COOLNOMIX® CONTROL SYSTEM INSTALLED ON BOTH WALK-IN UNITS.

ROI for COOLNOMIX® control system on both compressors	
CAPEX – cost of COOLNOMIX [IDR]	11,00,000
Energy Savings [kWh/a]	14,062
Electricity Cost [IDR/kWh]	1,380.00
Cost Savings [IDR/a]	19,404,202
Return of Investment [months]	6.5

A total savings of IDR 19,400,000 per year, with an ROI of 6.5 months is expected if both walk-in cool rooms are retrofitted.

² Claimed by the supplier of COOLNOMIX®.