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## Introduction

This document presents the results of second measures taken on Daikin chiller circuit in Barranquilla Airport after treatment water plant was installed. The results have been compared with the baseline defined in baseline. The objective is to establish the energy savings achieved by treatment water implementation. Additionally, GHG reduction has been calculated for direct emissions.

## Results

Measurements in Daikin circuit was taken from 16:00 of 16/09/22 to 08:00 of 19/09/22. The results can be seen in Figure 1, with a minimum load of 105,7 kW, a maximum load of 116,5 kW and an average of 111,3 kW. This shows a load relatively constant where the average can be compared with baseline defined in Report 1. The baseline defined was 119,3 kW. Even the maximum current load is less than the baseline. Comparing the baseline with the average current load, the difference is 6,75%.

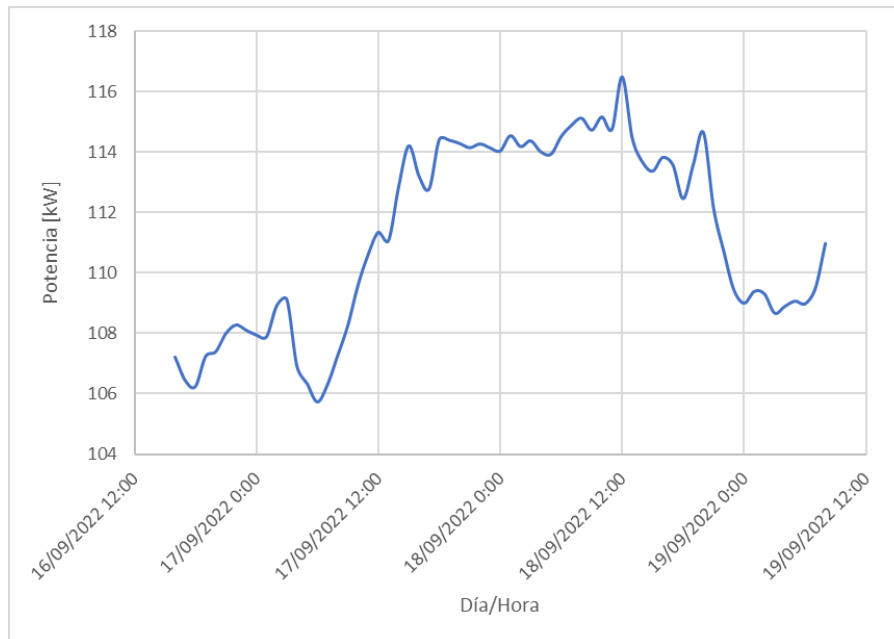


Figure 1. Daikin chiller load.

Energy savings calculation was developed comparing the baseline and the current measures. The load saving is equal to 6,75% with an energy saving of 193,25 kWh per day. Although no cooling tower measures have been carried on after treatment implementation, it is possible to assume an energy saving for the condenser circuit. With the same 6,75% found for chiller, the cooling tower could have an energy saving of 62,28 kWh per day. It is expected to have a minimum of savings in total of 255,53 kWh per day. The cooling loop with new treatment has capacity for a simultaneous load of two cooling towers and two chillers. This saving calculation was determined with only one chiller and one cooling tower working on. This indicates a possible greater net energy saving along the year of operation.

With energy savings calculated, it is possible to establish a total annual energy saving of 93,27 MWh per year, between chiller and cooling tower. Meanwhile, it is possible to calculate the GHG direct emissions reduction. Both, the chiller and the tower, have electrical source energy. In Colombia, the emission factor for electrical distribution in the interconnected system is 0,126 tonCO<sub>2</sub>eq/MWh. For water treatment implementation in Barranquilla Airport, the GHG direct emissions reduction is at least 11,75 tonCO<sub>2</sub>eq per year.

## Water treatment and Algae control.

Having a system of cooling towers( 2X) of 500 TR Ph of operation 8,6 working close to 6 cycles of concentration with potable water make up , alcalinity of 200 ppm, hardness of 240 ppm and total solids of 800 PPM.

They reported algae problems, in the past but they were using a water treatment for scale, corrosion and microbiological control with the following products:

NCH MB\_1563 Microbicide of large spectrum ( Glutaldehyde we inquiry in our investigations).

NCH ACTICHLOR Microbiocide oxidant ( hypochlorite of Na as per our investigations).

NCH Chem Aqua 999 corrosion inhibitor.

From the incomplete reports received from the airports we can conclude for the current system operation the following:

- 1- At the current Ph of operation ( 8,6) the addition of NCH ACTICHLOR Microbiocide oxidant ( hypochlorite of Na) doesn't do anything, it gets immediately deactivated ( works from 7-8 Ph). In that size of tower the dose needs should be at least 5 Lts per day ( 150 LTs a month per tower ) 300 LTs per month. That may explain why they do have such an algae issue. With the ELGRECY system , this chemical won't be needed. We can consider the energy and CO<sub>2</sub> embodied in the product as a saving for the system.
- 2- The complement of the microbiological control the glutaldehyde for the size of the tower will need 200 ppm 3 times a week per tower, which result in a addition of 24 KG per month per tower. It helps on the microbiological control but it is not enough . . With the ELGRECY system , this chemical won't be needed. We can consider the energy and CO<sub>2</sub> embodied in the product as a saving for the system.
- 3- Having potable water for the tower reposition, scaling and corrosion shouldn't be that hard to treat. So we can consider that the product chem aqua 999 should work if added in the proper dose , but we the system el GRECY the cooling tower can concentrate more and less chemical will be needed. We haven't got any

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information on chemical doses provided by the airport , so we cannot make that calculation on chemical use reduction and its CO<sub>2</sub> reduction emissions.

- 4- Algae There's some research out there that says that blue-green algae produces methane, but most species don't. In fact, most species of algae consume CO<sub>2</sub> and emit oxygen, which makes algae a net positive with regard to GHG emissions. That said, algae isn't helpful when it's in a cooling system. It clogs distribution decks, fouls tower fill and can contribute to growth of anaerobic bacteria that can grow beneath an algal biomass. That problem fouling the systems will dramatically will impact direct on the system efficiency and energy consumption, that definitely will cause a much higher impact on CO<sub>2</sub> emissions than any effect on the algae production. ON the analysis attached on Algae ( green or Blue) and microorganism the accounts were none on feed water and at the water basin. We suspect that the basin and the towers were clean just before the sample analysis were taken, because on the first visit , the towers were very dirty .Please find the analysis in a separate document.





## Conclusions

- The water treatment plant has generated an energy saving of 6,75% equivalent to 193,25 kWh per day. This energy saving only includes energy in chiller circuit. It is necessary to calculate the energy saving in the condenser circuit based on the procurement established in the Report 1. Despite of, the principal energy consumption is produced in the chiller and the projection determines a minimum total saving of 255,53 kWh per day.
- This report will be updated with energy savings in the condenser circuit when measures be taken.
- It is probable that energy savings could be greater if pumps energy in the primary and secondary circuit could be considered.
- Total energy saving is at least 93,27 MWh per year, equivalent to 11,75 tonCO<sub>2</sub>eq of GHG reduction per year.
- The co<sub>2</sub> of GHG reduction per the no necessity for chemicals for microbiological control of the cooling tower and the reduction on use of chemicals since a higher cycles concentration were no estimated, since the provider wasn't able to give us the amounts and the CO<sub>2</sub> prints for each chemical, but this have to be added to the GHG reduction emission balance.
- Related to Algaes, some type do have a GHG potential for the methane emissions , but we weren't able to identify the species in the analysis provided by the lab. Their most harmful effect will be on fouling the systems with other types of contamination and reducing the efficiency in all the system. When talking on cooling towers the higher effect on loss of efficiency and increasing on energy consumption and GHG emission related to . The the emissions of algaes by it selves is depreciable compared to the harm the can cause on systems.