

Implementation of Management Measures for the reduction of the Carbon Footprint of a Concentrate Warehouse, Callao, 2016

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Resumen

El presente estudio tiene como objetivo determinar si la implementación de medidas gerenciales disminuye la Huella de Carbono de un Almacén de Concentrados de una empresa en Lima, Peru. Para ello, se hizo uso del Registro de datos y Hoja de Campo, los cuales son fundamentales para el cálculo de la Huella de Carbono. Los resultados muestran una disminución de 7.65 tCO₂eq en octubre a 7.03 tCO₂eq en noviembre del consumo de combustible (Alcance 1) y de 10.04 tCO₂eq en octubre a 8.91 tCO₂eq en noviembre del consumo de electricidad (Alcance 2). Con los resultados obtenidos se determinó que la Implementación de medidas gerenciales disminuye la Huella de Carbono de un almacén de Concentrados de una empresa.

Palabras clave: Combustible, Electricidad, Huella de Carbono.

Abstract

The objective of this study is to determine if the implementation of management measures decreases the Carbon Footprint of a Concentrate Store of a company in Lima, Peru. In order to do so, we made use of the Data Registry and Field Sheet, which are fundamental for the calculation of the Carbon Footprint. The results show a decrease from 7.65 tCO₂eq in October to 7.03 tCO₂eq in November of fuel consumption (Scope 1) and from 10.04 tCO₂eq in October to 8.91 tCO₂eq in November of electricity consumption (Scope 2). With the results obtained it was determined that the Implementation of management measures decreases the Carbon Footprint of a store of Concentrates of a company.

Keywords: Fuel, Electricity, Carbon Footprint.

1. Introduction

Lima owns industrial zones that use great amount of chemicals which generate the Greenhouse Gas emissions (GGE) that are discharged to the environment affecting public health and the environment.

The calculation of the Carbon Footprint is important, since it helps to reduce the Greenhouse Gas emissions (GGE). Although the Carbon Footprint is the total measure of the direct and indirect GGE released to the environment produced by human activity and the sea by the activities or processes (Viglizzo, 2010) and that is calculated through the elaboration of an inventory, which

details the source of pollution and its proportion over a given period of time (Reed and Ehrhart, 2007).

The carbon footprint is used to measure the emission of gasoline by the number of vehicles and by the consumption of fuel, and that to reduce its emissions must implement vehicular combustion systems based on natural gas in order to have greater efficiency energy for the operational development of an institution (Barragan, 2013). It is also used to measure emissions from the calcination furnace, cooling and burning wood for the manufacture of colored glass containers from the recycled glass (Mena, 2015).

2. Materials and Methods

The procedure carried out in the investigation was as follows:

i) Determination of boundaries:

The first action done, was to determine the limit of the organization, but for this purpose the approach was recognized, either that of shareholding or that of control, the last being the limit of the organization of the Concentrated Warehouse. The approach already defined, later it was determined what type of emission it is, without forgetting the definition of the scopes 1 and 2.

ii) Choice of base year:

A base year must be chosen and reported so that emissions can be tracked over time. In this case it is the year 2016.

Identification of GGE emission sources:

The sources of GGE emissions of each area must be identified. A route was made to the Concentrated Warehouse. All areas were noted and an inventory of equipment was made.

iii) Request and data collection:

We proceeded to request the activity data necessary for the respective calculation, which is why Scope 1 emissions were calculated based on the quantities of commercial fuel consumed, those of Scope 2 from electricity consumption.

iv) Calculation of GHG emissions:

For the respective calculation of the emissions of each scope, use is made of the documented emission factors multiplied by the activity data (Bermejo, 2015; Brito, 2011; Guzman, 2010; NIECC, 2005). With the results obtained, a report is made which will be presented to the Manager of the Company Concentrates Warehouse.

In the case of the calculation of:

- Scope 1:

To obtain the tCO₂eq generated by the consumption of each fuel per month, the first thing that must be done is to have the energy consumption in TJ for it multiplies the amount of fuel (gal) by the conversion factor (TJ/gal). Then the result of each fuel energy consumption must be multiplied by each emission factor and in this way will have the emissions expressed in tCO₂, tCH₄ and tN₂O. Once the emissions have been calculated, each one is multiplied by its global warming potential and they are added to obtain the results expressed in tCO₂eq.

- Range 2:

These data are obtained by multiplying the consumption data (kWh) by the emission factor (KgCO₂eq/kWh). But in order to obtain the consumption data, the following must be done:

- In the case of luminaires, lighting poles, panels, among others, the number of luminaires was multiplied by the power of the lamps (kW) per operation (Hours/Days) per month (number of days on) and as a result the total energy consumption (kWh) was obtained.
- The same process should be applied to air conditioning, office equipment, other equipment.

v) Implementation of management measures:

Finally, the management measures for the reduction of the Carbon Footprint were implemented and a final calculation was made to determine if there has been an increase or a decrease.

3. Results and discussion

Results before the implementation of management measures:

In Fuel Consumption (Scope 1) the result is as follows:

Table 1. Results of fuel consumption of Scope 1 (January – August 2016).

Year	Month	Fuel oil	Amount of Fuel oil (gal)	Conversion factor (TJ/gal)*	Energy consumption (TJ)	EF CO ₂ (tCO ₂ /TJ)**	Emission tCO ₂	EF CH ₄ (tCH ₄ /TJ)**	Emission tCH ₄	EF N ₂ O (tN ₂ O/TJ)**	Emission t N ₂ O	Partial emission
2016	January	DIESEL B5 S-50 UU	566.41	1.39E-04	0.079	70.395	5.54228761	0.0037	0.00029131	0.00371	0.00029209	5.9236
		GASOLINA 90 OCT	34.39	1.21E-04	0.004	69.3	0.28837047	0.0033	0.00013732	0.0032	1.3316E-05	4.0600
	February	DIESEL B5 S-50 UU	408.62	1.39E-04	0.057	70.395	3.99830788	0.0037	0.00021015	0.00371	0.00021072	3.6584
	March	DIESEL B5 S-50 UU	368.20	1.39E-04	0.051	70.395	3.60280202	0.0037	0.00018937	0.00371	0.00018988	8.9523
	April	DIESEL B5 S-50 UU	901.00	1.39E-04	0.125	70.395	8.81619941	0.0037	0.00046338	0.00371	0.00046464	13.5169
	May	DIESEL B5 S-50 UU	1360.40	1.39E-04	0.189	70.395	13.3113848	0.0037	0.00069965	0.00371	0.00070154	13.5169
	Jun	DIESEL B5 S-50 UU	1360.40	1.39E-04	0.189	70.395	13.3113848	0.0037	0.00069965	0.00371	0.00070154	9.5783
	July	DIESEL B5 S-50 UU	964.00	1.39E-04	0.134	70.395	9.43264842	0.0037	0.00049579	0.00371	0.00049713	6.9949
August	DIESEL B5 S-50 UU	704.00	1.39E-04	0.098	70.395	6.88857312	0.0037	0.00036207	0.00371	0.00036305	9.1212	
Total emission												66.2013

Source: Adaptation of the Carbon Footprint Calculator of a Spanish Government Organisation. Version 4.2015

* Conversion factor obtained from infocarbon.

** Emission factor obtained from the 2006 IPCC Guidelines corroborated by Guide No. 2, Elaboration of the Annual Report on Greenhouse Gases in the Energy Sector. Category: Mobile Combustion. MINAM.

The emissions generated before the implementation of management measures in the Concentrated Warehouse was 66,2013063 tCO₂eq, being the months of May and June the largest generators of GHG emissions with 13,51688441 tCO₂eq. And the month of lowest emissions generation was March with a consumption of 368.20 gallons of Diesel B5 S-50.

In the Consumption of electricity (Scope 2) the result is as follows

Table 2. Results of electricity consumption of Scope 2 (January – August 2016).

Year	Month	Operating area (kWh)	Administrative area (kWh)	Detail (kWh)*	Emission factor (Kg CO ₂ eq/kWh)**	Partial emission (KgCO ₂ eq)	Partial emission (tCO ₂ eq)
2016	January	12,114.61	3,307.79	15,422.40	0.569	8,775.35	8.78
	February	9,626.49	2,682.51	12,309.00	0.569	7,003.82	7.00
	March	14,510.41	4,180.79	18,691.20	0.569	10,635.29	10.64
	April	13,867.60	5,701.00	19,548.60	0.569	11,123.15	11.12

May	14,755.15	4,890.09	19,665.24	0.569	11,189.52	11.19
Jun	17,318.45	4,171.56	21,490.00	0.569	12,227.81	12.23
July	19,208.06	5,385.94	24,594.00	0.569	13,993.99	13.99
August	16,775.18	5,878.82	22,654.00	0.569	12,890.13	12.89

Source: Adapted from of Carbon Footprint Calculator of an Organization of the Spain Government. Version 4.2015

* Company invoices.

** Emission factor in the Eco-efficiency Guide from MINAM.

The total emissions before the implementation of Scope 2 measures is 87.84 tCO₂eq, showing an increase in energy use from March and therefore an increase in emissions, with July being the highest emission generation of 13.99 tCO₂eq and January the lowest with 8.78 tCO₂eq.

Results after the implementation of management measures:

The results obtained after the implementation of management measures are detailed below:

In Fuel Consumption (Scope 1) the result is as follows

Table 3. Results of fuel consumption of Scope 1 (September – November 2016).

Year	Month	Fuel oil	Amount of Fuel oil (gal)	Conversion factor (TJ/gal)*	Energy consumption (TJ)	EF CO ₂ (tCO ₂ /TJ)**	Emission tCO ₂	EF CH ₄ (tCH ₄ /TJ)**	Emission tCH ₄	EF N ₂ O (tN ₂ O/TJ)**	Emission t N ₂ O	Partial emission
2016	September	DIESEL B5 S-50 UU	918.00	1.39E-04	0.128	70.395	8.98254279	0.0037	0.00047213	0.00371	0.0004734	9.121214264
	October	DIESEL B5 S-50 UU	770.40	1.39E-04	0.107	70.395	7.53829081	0.0037	0.00039622	0.00371	0.0003973	7.654666088
	November	DIESEL B5 S-50 UU	707.60	1.39E-04	0.098	70.395	6.92379878	0.0037	0.00036392	0.00371	0.0003649	7.030687596
Total emission												23.8065679

Source: Adaptation of the Carbon Footprint Calculator of a Spanish Government Organisation. Version 4.2015

* Conversion factor obtained from infocarbon.

** Emission factor obtained from the 2006 IPCC Guidelines corroborated by Guide No. 2, Elaboration of the Annual Report on Greenhouse Gases in the Energy Sector. Category: Mobile Combustion. MINAM.

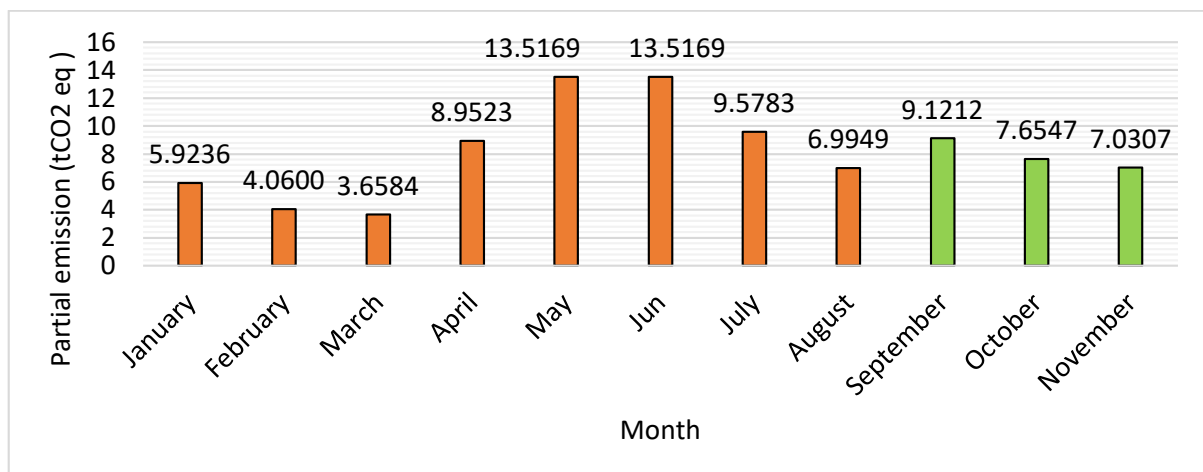


Figure 2. Partial emissions from scope 1.

Therefore, it can be seen that after the change of filters there has been a reduction in emissions of scope 1 of 1.466548 tCO₂ eq with respect to the month of October and 0.62397849 tCO₂ eq in the month of November.

In electricity consumption (Scope 2) the result is as follows:

Table 4. Results of electricity consumption of Scope 2 (September – November 2016)

Year	Month	Operating area (kWh)	Administrative area (kWh)	Detail (kWh)*	Emission factor (Kg CO ₂ eq/kWh)**	Partial emission (KgCO ₂ eq)	Partial emission (tCO ₂ eq)
2016	September	16,092.69	3,551.31	19,644.00	0.569	11,177.44	11.18
	October	14,745.71	2,906.29	17,652.00	0.569	10,043.99	10.04
	November	12,944.90	2,709.10	15,654.00	0.569	8,907.13	8.91

Source: Adapted from of Carbon Footprint Calculator of an Organization of the Spain Government. Version 4.2015

* Company invoices.

** Emission factor in the Eco-efficiency Guide from MINAM.

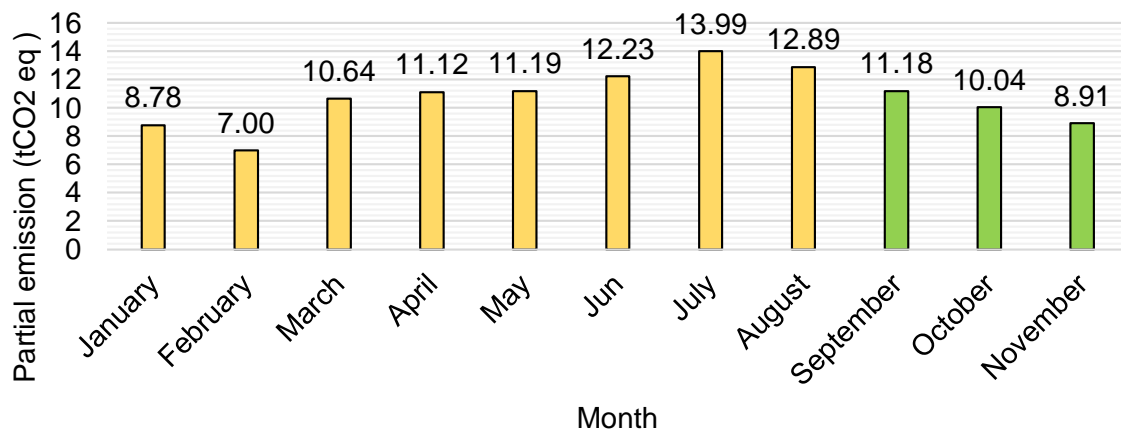


Figure 2. Partial emissions from scope 2

4. Conclusions

It is concluded that the implementation of management measures has partially decreased the Carbon Footprint originating from a company's Concentrate Store.

- The fuel consumption is not higher after the implementation of management measures in the Concentrate Store. It occurs by changing filters and maintenance through the daily verification of the mini loaders, industrial sweepers and heavy machinery. These measures were reduced from 7.65 tCO₂eq in October to 7.03 tCO₂eq in November.
- The consumption of electricity is not greater because of the luminaires maintenance was with replacement of LED luminaires in the passageways, talks to raise awareness about good energy use, disconnection of equipment, among others has generating a decrease from 10.04 tCO₂eq in October to 8.91 tCO₂eq in November.
- It is concluded that due to lack of sufficient information for the respective calculation, Scope 3 (office supplies) is excluded.

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