ISSN No:-2456-2165

Potential Impact of the Consumption of Fossil Energy Resources and the Activities of Industrial Quarries in the West Region of Cameroon

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Abstract:- The exploitation of industrial quarries is an economic activity that requires huge quantities of fossil fuels. This article attempts to determine the potential impact of fossil fuel consumption on the environment during industrial quarrying activities in the west of Cameroon. The environmental significance of TESSE's industrial quarry has been considered and described through the relationship between diesel consumption and environmental impacts. Confronting greenhouse gas emissions and average daily consumption of diesel gives indications on the state of the environment.

Keywords:- *Industrial Quarry, CO_2 Emission, Fossil Energy, West Cameroon.*

I. INTRODUCTION

Industrial quarrying is an activity that consumes huge amounts of fossil fuel for its operation. These include, in particular, hydrocarbons such as diesel fuel, lubricating oils and greases (Thomas, 2008). For the operation of any industrial quarry installations, all vehicles are major consumers of hydrocarbons particularly when demographic and economic growth is on the rise. Hence, energy consumption and gas emissions induced by industrial quarry potentially influence the environment. According to Nkue et al (2007) fossils fuels fulfilled global primary energy demand for more than 80%. Oil is the primary source of energy, which provides 33% of global needs, followed by coal (27%) and gas (21%).

In Africa, growing energy demand rates is above 2.5% (IEA, 2019). This continent emerges as a key driver of global energy demand growth as well as home to abundant reserves of fossil fuels, solar power and minerals that will be vital for clean energy transitions worldwide (IEA 2019). Cameroon, one of the countries of major infrastructure projects, is not on the margins of the very strong demand for hydrocarbons in the industrial sector, for example. Activities related to the exploitation of industrial quarries in the West region of Cameroon are booming due to the increasing demand for construction materials. The expansion of these activities is not without danger both for the stock shortage of fossil energy resources and for the environment, particularly through greenhouse gas emissions. The objective of this article is to study the diesel consumption in the industrial quarries of the West region of Cameroon and to determine its potential influence on the environment.

➢ *Location Of Quarries In The West Region Of Cameroon*

Researchers investigated nine industrial quarries in five of the eight Divisions of the West Region of Cameroon. (Fig. 1).

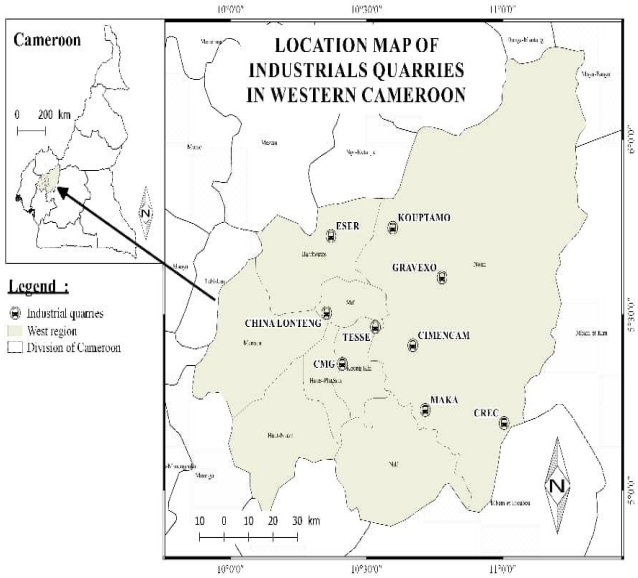

Fig 1: Location of industrial quarries in the West region of Cameroon

In the Noun Division, we have four quarries which are: MAKA, KOUOPTAMO, GRAVEXO and CAPITSA. The Nkoung-khi Division has two industrials quarries which are TESSE and Cameroon Mining Group. Concerning the Mifi Division we have CHINA-LONGTENG, the Bamboutos Division has ESER and the Ndé Division has CREC; all of them have only one quarry in their Division.

II. METHODOLOGY

➢ *Data Collection And Analysis*

Researchers visited the various quarries with a view of collecting data on their hydrocarbon needs. Due to some technical difficulties, only TESSE quarry provides reliable data. Therefore, researchers decided to extrapolate to other quarries, and generated a daily consumption sheet for each machine during a period of 50 days. This data derived from the daily reports of the consumption of machines in the

ISSN No:-2456-2165

industrial quarry. For calculate the amount of CO_2 emitted, we applied the formula of authors Marie-Pier and Leandro, (2017), shows that the combustion of 1 liter of gas oil (diesel) produces approximately 2.66 kg of CO_2. The data collected was processed and analyzed with Excel 2010 software.

III. RESULTS AND DISCUSSION

➢ *Gasoil Consumption*

TESSE quarry uses large quantities of diesel both, for electricity production and the functioning of the industry. The daily consumption of diesel changes depending on the importance of the activities, production or even bad weather (Fig. 2). Peaks in consumption correspond to onsite intense activities.

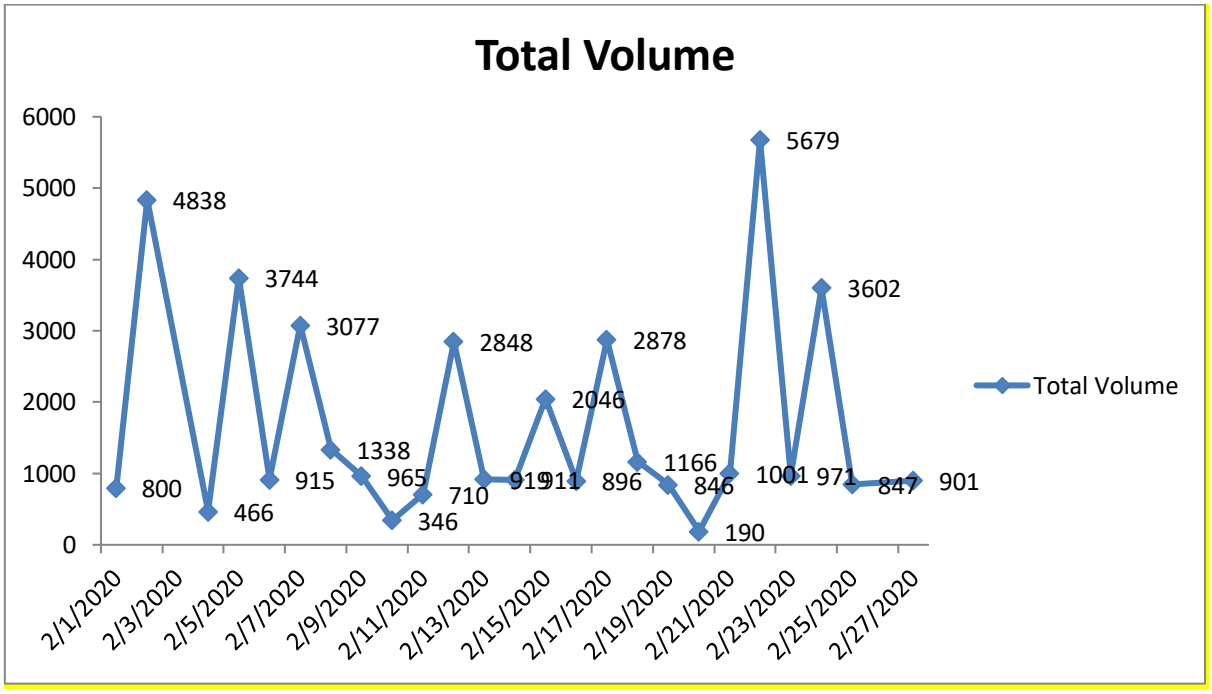

Fig 2: The daily consumption of diesel in the quarry

The elevation of the curves is because, all activity segments are functioning while the values indicates the opposite. In both cases, the volumes drop from 5.679 liters per day to 2.201.36 liters. Crushing, power generation and rolling stock operations mostly consume diesel. However, it is possible to get an idea of the volume of diesel consumed by machine and its operating time. (Fig. 3).

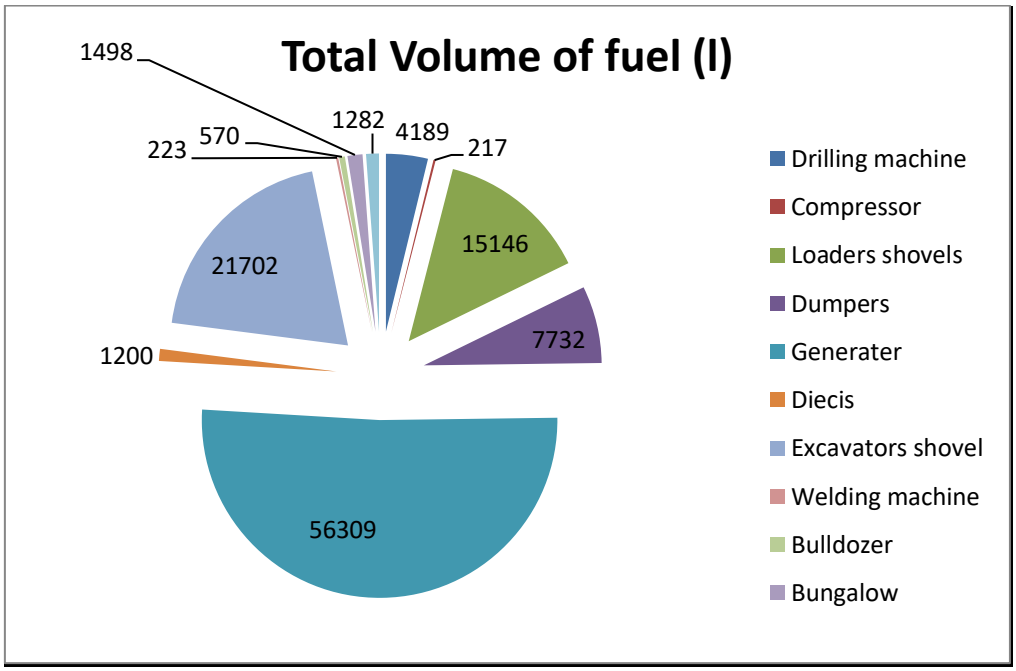

Fig 3: Total volume of fuel consumed per machine over a month

ISSN No:-2456-2165

Figure 3 indicates that fuel consumption increases and varies depending on the equipment. It is necessary to remember that, the rate of consumption here depends on the role of each machine. Depending on the level of diesel consumption, we can prioritize the machinery used in the quarry although their uses for proper operation are interdependent. The more the machine is used, the more its consumption level rises, reaching 56.309 liters per month and even more. The reverse of the action considerably lowers the level of fuel consumption to around 217 liters or even less.

➢ *Simulation Of Gasoil Consumption In Industrials Quarries In The West Of Cameroon*

A fossil resource or non-renewable resource is a natural resource whose rate of consumption is much greater than its rate of renewal. Hydrocarbons in this case, the gasoil used for the operation of quarries are a natural resource derived from petroleum, which is a non-renewable resource. According to the encyclo-écolo newspaper, in 2012 the world oil reserve was estimated at 300 billion barrels. International Energy Agency forecasted 1.7% increase in world oil demand for 2025, with a demand of 86.3 million barrels per day (mbd). Ritmo (2015) and EDF (2021) suggested, "Fossil energy production still represents more than 80% of the total primary energy production in the world today. However, the planet's fossil energy reserves seems inexhaustible with new discoveries. Nevertheless, at the current rate of consumption, oil will run out in 54 years, gas in 63 years and coal in 112 years (Ritmo (2015) and EDF (2021). Therefore, this demand will have to be more and more increasing with the population growth. Thus in the specific case of the TESSE quarry, we obtained an average daily diesel consumption of 2201.36 liters, that is approximately 13.84 barrels of diesel per day (1 barrel substantially equal to 159 liters). Therefore, we deduct a consumption of about 415.2 barrels per month. Assuming constant consumption every month, presents a forecast of consumption over one year. (Fig. 4)

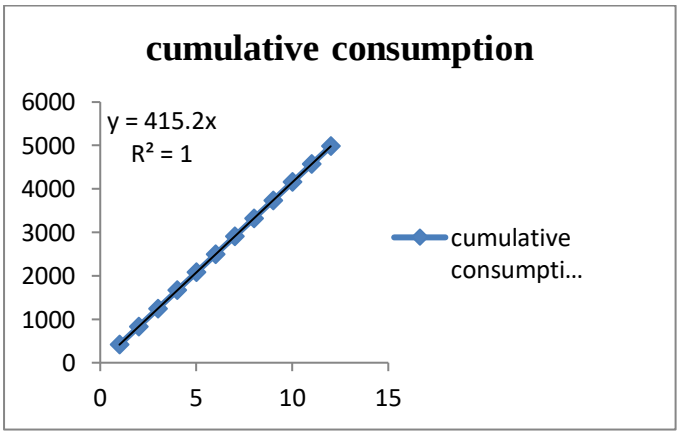

Fig 4: Forecast of annual fuel consumption (diesel) by the TESSE quarry

Figure 4 indicates that the less quarry activities are the more the consumption will decrease. In fact, the cumulative consumption of diesel over one year by the TESSE quarry alone is sufficiently high at around 4.982.4 barrels. In the West region of Cameroon, we carried out a survey on nine industrials quarries. By analogy if we consider this value of diesel consumption of the industrial quarry of TESSE as substantially equal to the consumption of diesel over one year for each quarry, then in the West region of Cameroon, we will have a consumption of approximately 44 841.6 barrels per year. The value and forecast of diesel consumption by industrials quarries in the West region of Cameroon over time, that means ten years. (Fig. 5)

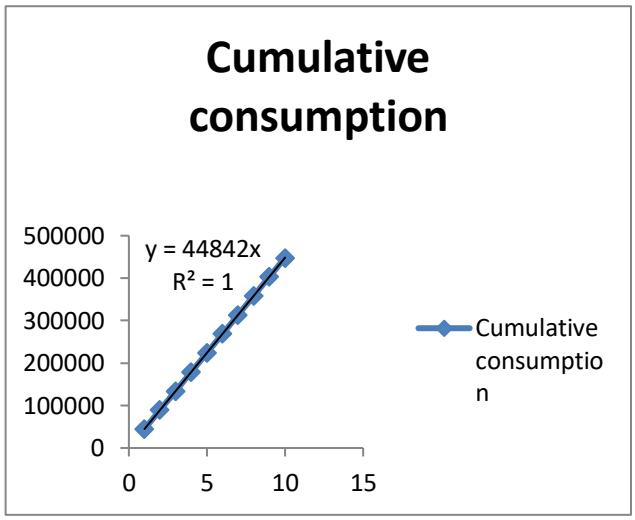

Fig 5: Forecast of fuel consumption (diesel) for quarries in the West region of Cameroon over ten years

Figure 5 shows a simulation of diesel consumption over the years. Here we can see a right-hand equation of the type y = ax + b. in this equation, y represents the volume in barrels of diesel consumed cumulatively in a given year, and x the number of years of operation so if we take the example of 10 years of operation we will have a consumption of approximately 448 420 barrels. We found that this cumulative consumption for a single growing region is very high and will only increase over time, due to the creation of new quarries each year in the region. Therefore, we can clearly appreciate the impact that the activity of industrial exploitation of quarries can have on the depletion of the oil reserve.

➢ *Potential Environmental Impacts Related To The Use Of Fossil Energy*

The use of fossil fuels is not without danger for the environment. The level of impact of the use of fossil resources for the exploitation of quarries, can be classified into two categories namely, the impact on the out of stock resource and the impact linked to greenhouse gas emissions.

➢ *Potential Environmental Impact Of The Use Of Gasoil: Case Of Greenhouse Gas Emissions*

Fuel (diesel) is a compound derived from petroleum. It is used to operate diesel-type combustion engines. From a chemical point of view, this liquid is mainly composed of heavy hydrocarbons. According to the journal Natural Resource Canada (2014), and Marie-Pier & Leandro, C. (2017), the combustion of 1 liter of gas oil (diesel) produces approximately 2.66 kg of CO_2. This is in line with the

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statement by Government of Canada (2020) which states "globally nearly 80% of greenhouse gas emissions from anthropic sources come from the combustion of fossil fuels and industrial processes". Therefore and in order to estimate the variation in CO_2 emissions researchers collected, and processed data on diesel consumption and emissions in the TESSE quarry (Fig. 6).

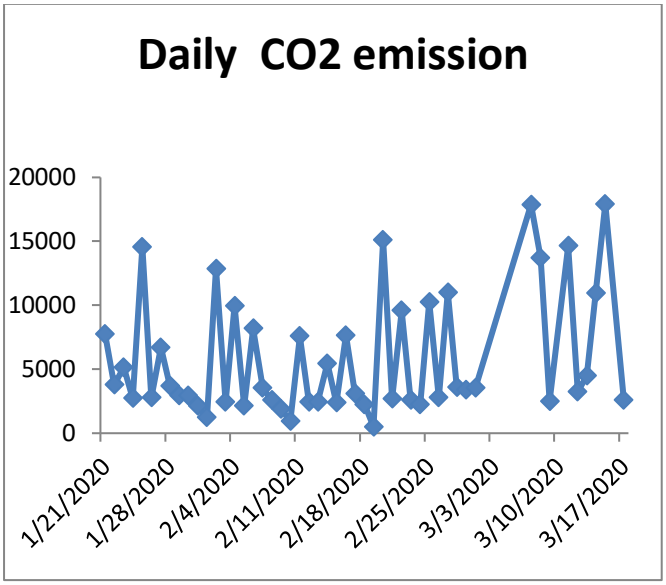

Fig 6: Change in CO_2 emissions over 50 days

Figure 6 depicts a sharp variation in CO_2 emissions ranging from 505.4 Kg to 17.923.08 Kg. This strong variation in emissions is because the diesel consumption within the quarry is a function of the level of the activities in fact, the longer the period of activity, the more diesel consumption is high and consequently, the emission rate is high. Therefore, the quantity of CO_2 emitted on average each day, which is approximately 5855.6176 Kg or 5.85 tonnes of CO_2. This high daily average value in CO_2 emissions derived from the type of machine present in the TESSE quarry. The distribution of CO_2 emissions according to gear. (Fig. 7)

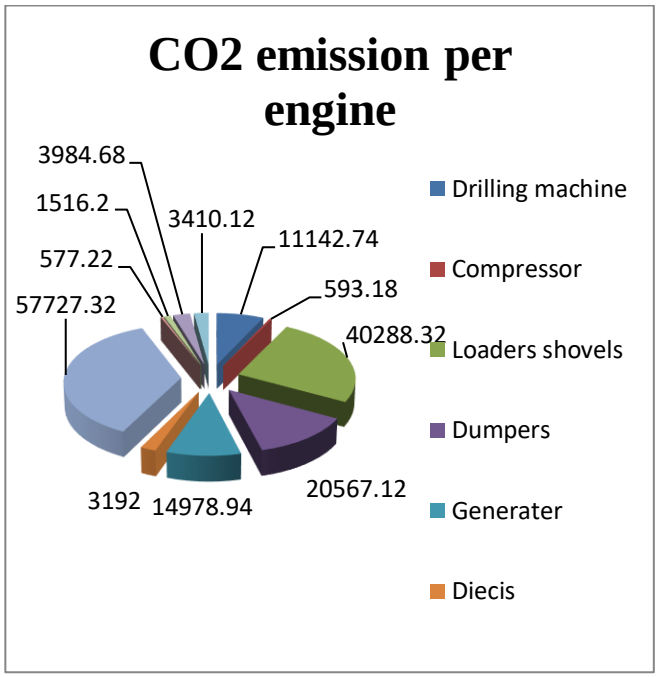

Fig 7: CO_2 emissions per engine

Figure 7 indicates that during 50 days of quarry operation, which corresponds to our data collection period within the TESSE quarry, the amounts of CO_2 emitted per engine are relatively considerable. Indeed, as mentioned above, the quantities emitted depends on the volumes of diesel consumed, so the emissions can vary between 577.22 Kg or approximately 0.57 tonnes of CO_2 and 149781.94 Kg or 149.78 tonnes of CO_2 and even more in depending on the use of the engine as well as its condition. Thus, for all the quarries we have a total emission of 292 780.08 kg, or approximately 292.78 tonnes of CO_2. It is important to remember that the older the engine, the higher the pollution is here in the specific case of the TESSE quarry, we obtained an average daily CO_2 emission of around 5.85 tonnes. Assuming this emission average is relatively constant, a monthly emission average of approximately 175.5 tonnes is predictable. Figure 8 gives the forecast of emissions within the quarry over one year.

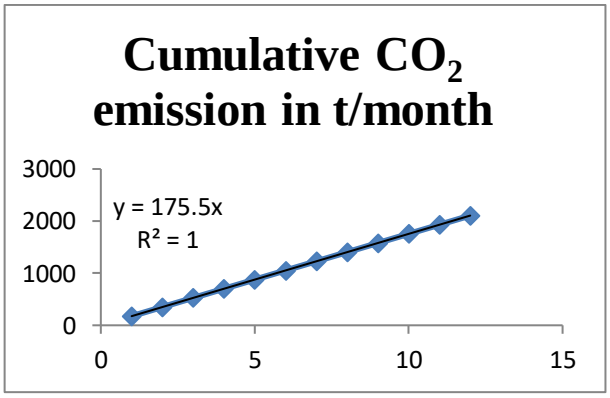

Fig 8: Forecast of CO2 emissions from the TESSE quarry for 1 year

Figure 8 illustrates the cumulative CO_2 emissions over one year by the TESSE quarry are sufficiently high, in the order of around 2106 tonnes of CO_2. In the West region of Cameroon, we surveyed nine industrials quarries. It is worthy to remember that the amount of emission depends on to the quantity of diesel consumption and the condition of the engine of the machine. Assuming the amount of CO_2 emissions from the industrial quarry of TESSE is equal to the CO_2 emissions over one year for each quarry in West Cameroon, consequently we will have a total emission quantity of approximately 18.954 tonnes of CO_2 per year. Figure 9 indicates the forecast amount of CO_2 emissions from industrials quarries in the West region of Cameroon over time, i.e. ten years.

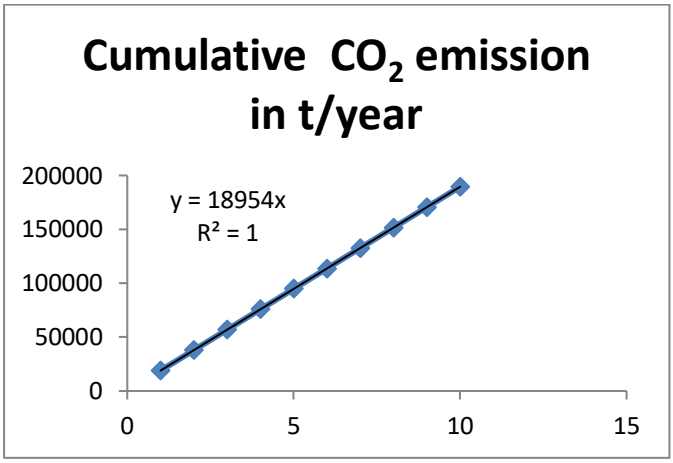

Fig 9: Forecast of diesel consumption in quarries in the West region of Cameroon over ten years

Figure 9 shows a simulation of CO_2 emissions over the years. Here we can observe a right-hand equation of type y = ax + b. In this equation, y represents the quantity of CO_2 emitted cumulatively in a given year and x the number of years of operation, so if we considered the example of 10 years of operation, we will have an emission quantity of 189.540 tonnes of CO_2. We found that this cumulative amount of CO_2 emitted for a single growing region is very high and will only increase over time due to the creation each year of new quarries in the region. In this regard, we can clearly appreciate the impact of the industrial quarrying activity on the global warming.

IV. CONCLUSION

This research aimed at evaluating the potential impact of the use of fossil energy resources in the industrial exploitation activities of quarries in the West region of Cameroon. Analysis shows that, although this activity has many advantages from a socio-economic point of view and in terms of land use planning, it also may causes serious damage from an environmental point of view. In fact, for a single quarry, we obtained an annual volume of approximately 4982.4 barrels and after 10 years for the 9 quarries in the West region of Cameroon. In terms of CO_2 emissions, linked to the use of this hydrocarbon, our survey shows around 2106 tonnes of CO_2 per year for a single quarry, or about 189.540 tonnes of CO_2 for the 9 quarries surveyed after 10 years of operation. We can thus notice that the activity of industrial exploitation of quarries in the West region Cameroon has potential impact on the environment, particularly in terms of stock shortage of fossil fuel resources and global warming. However, although this has a negative effect on the environment for socio-economic development reasons, quarries must function and their numbers will continue increasing. It is therefore necessary to set up compensation measures in order to minimize or even eliminate these various impacts in order to project to sustainable development that takes into account all the pillars, more specifically the ecological sector.

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