POSITIVE ENVIRONMENTAL IMPACTS DERIVED FROM FILTRATION OF DIESEL

BASIS FOR CARBON FOOTPRINT CALCULATIONS

Strategy: Reduction of particulate pollution in diesel with FMS Premium filtration systems

Annual consumption: 1,000,000 gallons (diesel)

Estimated reduction in diesel fuel consumption: 15%

Annual reduction in GHG emissions (CO2e): 1,527.25 metric tons of greenhouse gases (GHG) = carbon dioxide equivalent (CO2e) = Carbon footprint

Equivalent in trees planted per year: 127,270.63 trees

AUTOMATIC TABLE FOR CO_2E CALCULATION

		GALLONS / YEAR	LITERS / YEAR		
	ANNUAL CONSUMPTION FUEL	1,000,000.00	3,785,000.00		
(Source: Power Loss)	DECREASE IN FUEL CONSUMPTION	15.00%	567,750.00	NOTE 1	EXPLANATION
(Federal Register USA 2010)	EF FUEL	2.69	CO_2e / Liter	NOTE 2	EXPLANATION
				NOTE 3	EXPLANATION

$$CO_2E = (C * EF\ FUEL) / 1000$$

(Source: TARAM 2007)

WHERE:

CO_2e = Metric tons of CO_2e

C = 567,750.00 liters of fuel not consumed in a year

EF fuel = Diesel emissions factor = 2,69 kg CO_2e / liter

CO_2E (TON) = 1,527.25 METRIC TONS OF CO_2E NOT BROADCASTED

1 Tree /Year Catch 12 kg of CO_2 (Government of Mexico)

83.33 trees/year offset 1 metric ton of CO_2

NOTE 4 — EXPLANATION

127,270.63 TREES NEEDED TO CAPTURE THE TOTAL OF CO_2E

ENVIRONMENTAL CONCLUSIONS

1. The use of Premium diesel (ultra-clean and ultra-dry) with ISO 4406 cleanliness codes in **optimal parameters 11/8/7 or better,** has evidenced a 15% savings (@The Americas) in diesel fuel consumption of engines, which represents to stop emitting to the environment 1,527.25 metric tons of emission gases or CO2 per million gallons. Using the calculated factor in Mexico of 83.33 trees per metric ton of CO2, this would be interpreted as the equivalent of planting 127,270.63 trees per year.

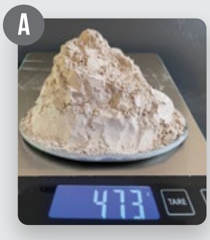
2. Based on an annual consumption of 1'000,000 US gallons and contemplating an average code of 22/21/18, which represents **473 grams of contamination for every 10,000 gallons of diesel, 47,300 grams of contamination would be removed from the diesel annually**. If on average an estimated 10% of this contamination passes into the engine lubrication system through the rings in the compression chambers, it would mean that at least 4,730 grams would NOT deteriorate the engine oil, causing oil filter saturation, premature oil deterioration and high internal wear of the engines in the first instance. And the remaining 42,570 grams of particles would not clog OEM on-board engine diesel filters, injection systems (injectors, injection pumps, etc.), aftertreatment systems, catalytic converters, etc. without leaving aside all the air pollution and environmental contamination.

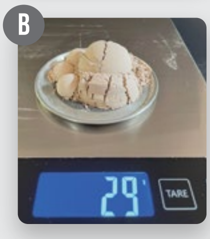
3. A motor consuming 10 gallons per hour will burn 10,000 gallons of fuel in 1,000 hours of operation and will have undergone an average of 4 oil changes every 250 operating hours. For a diesel with ISO 22/21/18 contamination levels of 473 grams per 10,000 gallons, this means it will burn 118.25 grams every 250 hours or oil change interval. Just 1.5 grams contaminating 10 gallons of oil can increase fuel consumption by over 3% and lead to premature wear and compression loss. In contrast, the same engine using fuel with ISO 11/8/7 contamination levels will burn less than 0.06 grams every 250 hours or oil change interval. This illustrates that "extending engine oil life extends engine life." The lifespan of motor oil is directly related to the quality/contamination of the diesel fuel we use.

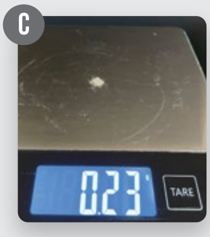
If an operation decreases 15% of its annual fuel consumption as a benefit derived from the use of a Premium Diesel (ultra-clean and ultra-dry), in 1 million gallons, the positive environmental impact would be equivalent to having planted 127,270 trees. It will stop expelling 1,527.25 metric tons of emission gases and 47,300 grams of polluting particles of suspended matter into the air (PM).

VISUAL COMPARISON OF CLEANLINESS IN CODES

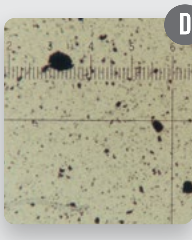
ISO 4406







DIRT REMOVAL	GRAMS PER 10,000 gls	PARTICLES ABOVE 4 MICRONS	LIFE EXTENSION	ISO 4406:99	TARGET
94% 443 gr	473 grams	20,000-40,000	-	22/20/17	CURRENT CONDITION
	236.5 grams	10,000-20,000	1.3X	21/19/16	
	118.3 grams	5,000-10,000	1.6X	20/18/15	
	59.1 grams	2,500-5,000	2X	19/17/14	
	29.6 grams	1,300-2,500	3X	18/16/13	MAXIMUM LIMIT
6% 29.77 gr	14.8 grams	640-1,300	4X	17/15/12	
	7.4 grams	320-640	5X	16/14/11	
	3.7 grams	160-320	6X	15/13/10	
	1.8 grams	80-160	7X	14/12/9	
	0.9 grams	40-80	8X	13/11/8	
	0.45 grams	20-40	9X	12/10/7	
	0.23 grams	10-20	10X	11/8/7	OPTIMUM INJECTOR



A
Visual expression on a digital scale of a code 22 with 473 grams of polluting solid particles in ten thousand gallons of oily fluid.

B
Visual expression on a digital scale of a code 18 with 29 grams of polluting solid particles in ten thousand gallons of oily fluid.

C
Visual expression on a digital scale of a code 11 with only 0.23 grams (less than a quarter of a gram) of particles in ten thousand gallons of oily fluid.

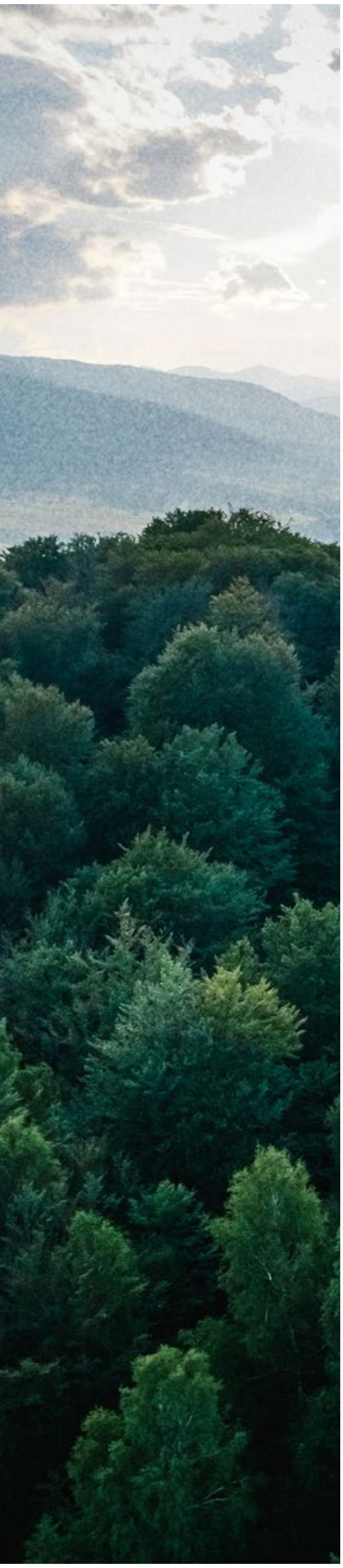
D
Microscope image of a code 22 where we see a large amount of particle contamination in different sizes.

E
Microscopic image of a code 18 where a small number of particles can be seen, however, very large particles are still present.

F
Microscope image of a code 11 Premium Ultra Clean where literally no particles present in the fluid can be seen.

DIESEL 22/20/17	VS	DIESEL 11/8/7
AVERAGE IN LATIN AMERICA AND AFRICA*		PREMIUM ULTRA CLEAN

*TWO THOUSAND TIMES DIRTIER.



DOUBLY GREEN

PER 1 MILLION GALLONS OF DIESEL CONSUMED ANNUALLY

It stops emitting 1,527.25 metric tons of greenhouse gases (CO2) and 47,300 grams of particulate matter in suspension (PM), this could be interpreted as having planted 127,270 trees per year.

POLLUTANTS PRESENT IN EMISSIONS

COMBUSTION		
CO_2	CO	SOOT
Non-gas pollutant	It is a Pollutant gas	It is a pollutant
It is food for plants, natural gas	It is produced by incomplete combustion	It is produced by contaminated diesel.
The imbalance = greenhouse effect	It causes death and is considered a harmful/poisonous gas	It is considered an assault on the environment.
It is necessary to decrease or plant more trees	It is eliminated with clean diesel and technologies such as Tier IV or Euro 5.	It is eliminated with clean diesel and technologies like Tier IV or Euro 5

NOTE 1

¿Why we use 15% as a goal to reduce fuel consumption?

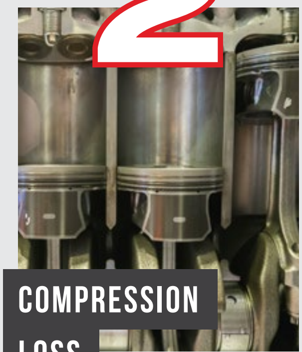
4 STAGES OF POWER LOSS

1

SUITCASE DOSAGE

Injection systems require ISO 11/8/7 diesel to optimally dose the fuel. Poor dosing of the injector due to the presence of particles is synonymous with loss of power and therefore higher fuel consumption of up to **5%**.

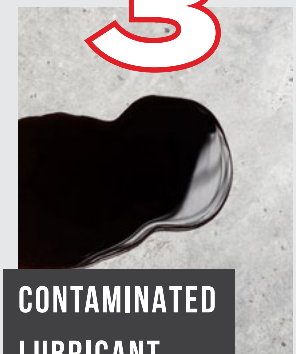
2



COMPRESSION LOSS

The particles in the combustion chamber will cause premature wear in the cylinders, generating premature compression loss that is synonymous with loss of power and higher fuel consumption throughout the useful life of the engine of up to **7%**.

3



CONTAMINATED LUBRICANT

Particulate contaminated lubricant raises friction and temperature, causing up to **2-3%** loss of power and increased fuel consumption.

4

PREMATURE DPF SATURATION

The pressure drop of particulate filters causes up to **2%** power loss and increased fuel consumption due to burned particles.

CONCLUSION

When an engine experiences a compression loss, it affects both the power and overall performance of the engine, leading to decreased efficiency and increased fuel consumption. The extent of the increase in fuel consumption can vary depending on the case and would require a specific analysis of the engine in question. It's important to note that compression loss is not the only factor affecting fuel consumption in an engine. Other factors such as proper maintenance, fuel quality, and operating style can also influence engine performance and fuel consumption.

It seems like you're discussing the benefits of using ultra-clean and ultra-dry diesel with ISO 11/8/7 specifications, which prevents the four described issues. This clean engine environment promotes optimal performance, delivering maximum power with the added benefit of up to a 15% reduction in fuel consumption.

NOTE 2

¿Why We Use an Emission Factor of 2.69?

The Joint Environmental Protection Agency and U.S. Department of Transportation regulations established on May 7, 2010 the initial fuel economy (Source) standards, agreeing to use an emission factor (EF) of 10,180 grams of CO2 emissions per gallon of diesel consumed (Federal Register 2010), equivalent to 2.69 kg of CO2 per liter of diesel consumed.

NOTE 3

¿What is the formula for calculating the carbon footprint?

TARAM: Tool for Afforestation and Reforestation Approved Methodologies, developed in 2007 by the World Bank's BioCarbon Fund, is a calculation tool that estimates ex before Emission reductions, according to afforestation and reforestation methodologies.

Our carbon footprint calculation consists of applying the following TARAM formula:

CARBON FOOTPRINT = ACTIVITY DATA x EMISSION FACTOR

WHERE:

- The activity data is the parameter that defines the level of activity that generates greenhouse gas (GHG) emissions. For example, the amount of diesel used in an internal combustion engine.
- The emission factor (EF) is the amount of GHG emitted by each unit of the "activity data" parameter. These factors vary depending on the activity in question. For example, in relation to the activity described above (diesel consumption in internal combustion engines), the emission factor is 2.69 kilograms of CO2e per liter of diesel (see Note 2).

NOTE: It is important to note that the emission factor per diesel may vary according to the exact composition of the diesel fuel used, the combustion conditions, and according to the regulations and emission standards applicable in each country or region.

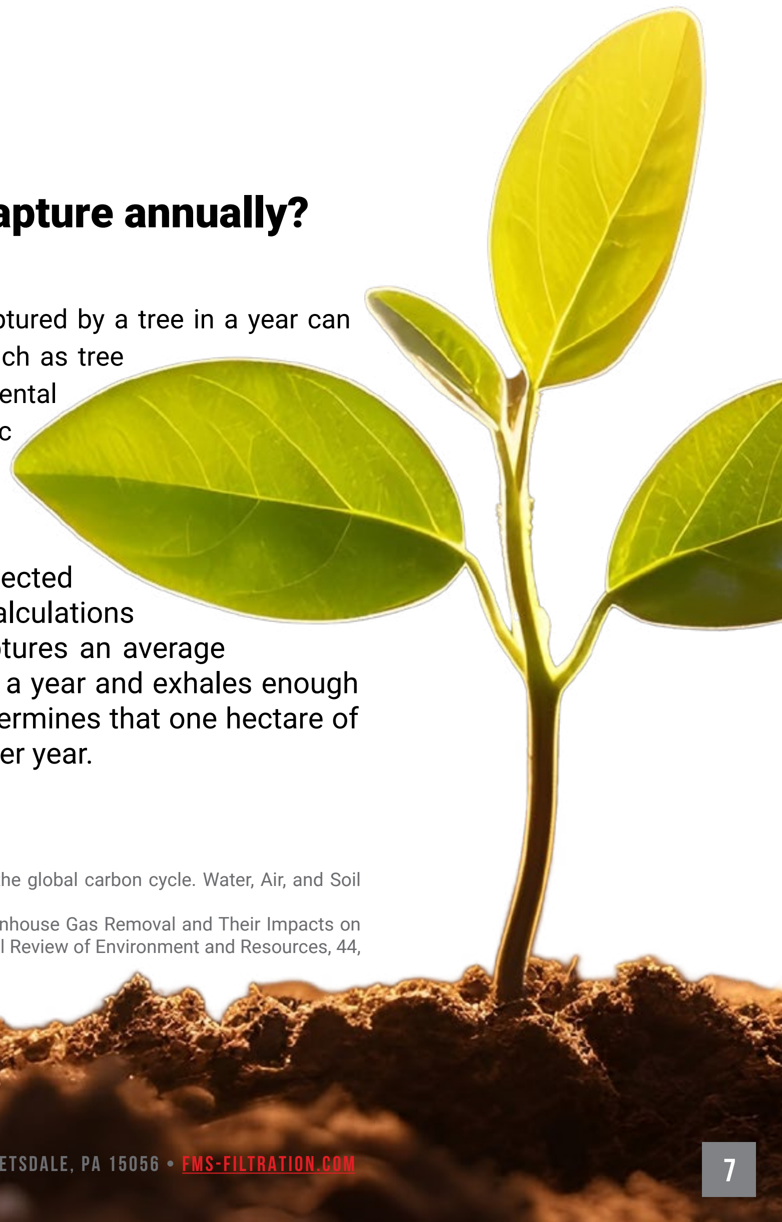
As a result of this formula, we will obtain a given amount (kilograms, tons, etc.) of carbon dioxide equivalent (CO_2e)

NOTE: The term carbon dioxide equivalent (CO_2e), is the unit used to display the results in terms of GHG emissions. The gases that the Kyoto Protocol indicates as the most responsible for the greenhouse effect and that contribute to global warming are: carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and, since COP 181 held in Doha at the end of 2012, nitrogen trifluoride (NF_3). However, CO_2 is the GHG that has the greatest influence on global warming, which is why GHG emissions are measured in terms of this gas.

Source: LCA4Regions, Interreg Europe, October 2020, page 5 (LINK), by the European Union- European Regional Development Fund.

NOTE 4

How much CO_2 does a tree capture annually?



The exact amount of carbon dioxide (CO_2) captured by a tree in a year can vary according to different factors (source), such as tree species, size, geographic location and environmental conditions. However, according to scientific studies, a mature tree can capture approximately 10 to 30 kilograms of CO_2 per year (source).

The National Commission of Natural Protected Areas of the Government of Mexico for its calculations establishes (source) that a single tree captures an average of 12 kilograms of carbon dioxide (CO_2) in a year and exhales enough oxygen for a family of 4 people. Also, it determines that one hectare of trees can absorb 6 tons of carbon dioxide per year.

Other bibliographic sources:
- O'Sullivan, D. W., & Thomson, A. J. (1991). The role of forests in the global carbon cycle. Water, Air, and Soil Pollution, 56(1), 7-23.
- Moomaw, W. R., et al. (2019). Land-Management Options for Greenhouse Gas Removal and Their Impacts on Ecosystem Services and the Sustainable Development Goals. Annual Review of Environment and Resources, 44, 255-286.