

## HVO: The New Fuel for Yachts

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### 1. Calculating Annual CO<sub>2</sub> emissions for the yacht using conventional diesel as fuel

Known information

1. Assumed fuel consumption: 300 litre/hour
2. Assumed annual operation: 1,500 hours/year
3. Emission factor: 3,206 t CO<sub>2</sub> per ton of fuel (Reference; EU, commission delegated regulation (EU) 2016/2071)
4. Diesel density : Approximately 0.835 kg/L

#### Calculations

Fuel consumption per year = 300L/hour \* 1,500 hours = 450,000L/year

Convert litres to tons of fuel

- Fuel mass = 450,000 L \* 0.835 kg/L = 375,750 kg
- Fuel mass in tons = 375,750 / 1000 = 375.75 t/year

Calculating CO<sub>2</sub> emissions using the emission factor above

- CO<sub>2</sub> emissions = 375.75 t fuel/year \* 3.206 t CO<sub>2</sub>/ t fuel
- CO<sub>2</sub> emissions = 1,205.38 t CO<sub>2</sub>/year which is 1,205,380 kg CO<sub>2</sub>/year

### 2. Calculating equivalent emission in car

- Average CO<sub>2</sub> emission per EU car is 106.4g CO<sub>2</sub>/km (2023 EU average for new passenger cars, source: European Environmental Agency, EEA)
- Average distance driven per European car is 12,540 km (2021 EU average, source: European Automobile Manufacturer's Association, ACEA)

Annual CO<sub>2</sub> per car = 106.4 g CO<sub>2</sub>/km \* 12,540 km/year. Annual CO<sub>2</sub> per car = 1,334,256 g CO<sub>2</sub>/year = 1,334.26 kg CO<sub>2</sub>/year. Carbon emission equivalent to EU cars is Number of cars = Total CO<sub>2</sub> emission per year / Annual CO<sub>2</sub> per car = 1,205,380 kg CO<sub>2</sub>/ year / 1,334.26 kg CO<sub>2</sub>/year = 903 cars.

Thus the yacht emission is comparable to those of 903 new passenger EU cars

### 3. calculating equivalent in European citizen

- Average annual CO<sub>2</sub> emissions per European citizens is 7, 259 kg CO<sub>2</sub>/year (EU average, including transport, energy use etc., source; Eurostat)

$1,205,380 \text{ kg CO}_2/\text{year} / 7,259 \text{ kg CO}_2/\text{year} = 166$ . The yacht's emission is equal those of 166 EU citizen per year

### 4. CO<sub>2</sub> savings when using HVO are calculated as follows:

HVO emissions are 10% emission of diesel (90% CO<sub>2</sub> saving as assumed by NESTE, the biggest biofuel producers). But for this calculation we assume a 20% emission with respect to diesel to be conservative.

HVO CO<sub>2</sub> emission =  $(375.75 \text{ t fuel/year} * 3.206 \text{ t CO}_2/\text{t fuel}) * 0.2 = 241.08 \text{ t CO}_2/\text{year}$  which is 241,080 kg CO<sub>2</sub>/year

Calculating Carbon savings: diesel CO<sub>2</sub> emissions – HVO CO<sub>2</sub> emissions à  $1,205,380 \text{ kgCO}_2/\text{year} - 241,080 \text{ kg CO}_2/\text{year} = 964,300 \text{ kg CO}_2/\text{year}$ .

**Calculating Carbon saving emissions equivalency per car** : Number of cars = total carbon savings per year/Annual CO<sub>2</sub> per car à  $964,300 \text{ kg CO}_2/\text{year} / 1,334.3 \text{ kg CO}_2/\text{year} = 723 \text{ cars}$

**Calculating carbon saving emissions equivalency per EU citizen**: number of citizens = total carbon savings per year/ Annual CO<sub>2</sub> per EU citizen à  $964,300 \text{ kg CO}_2/\text{year} / 7,259 \text{ kg CO}_2/\text{year} = 133 \text{ Eu citizens}$

Thus carbon savings equivalent to new EU passenger cars: 723 cars per year. Carbon savings equivalent to EU citizens is 133 per citizens.