With synthetic HVO diesel fuel through southern Europe

Description and evaluation of the tour

Picture: eFuelsNow

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eFuelsNow e.V.

Möhringer Straße 79a
D-70199 Stuttgart
Germany

Email: info@efuelsnow.de

Homepage: https://efuelsnow.de/

HVO-map with gas stations:
https://efuelsnow.de/tankstellen-karte

Photos and illustrations

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Preface

Who is EfuelsNow?

EfuelsNow is a group of engineers and technology enthusiasts. We want to achieve more technological diversity and are more liberal market economy. That´s why we inform about synthetic fuels during our spare time. Climate protection can only be achieved with the whole society. That is why we need suitable concepts for every consumer. Targets should be set (in the interests of the citizen) (e.g. CO2=0). But only the users and the technology specialists decide individually on the way forward. customers and engineers decide alone. History has shown that environmental protection and progress can only be achieved quickly, cost-effectively and in line with customer requirements in a competitive market economy (not in a plan economy). New technologies need alternatives. Otherwise they are considered to be a restriction. And this reduces the excitement for the new product. That´s why synthetic fuels are so important for the social acceptance of emobility too. We need both technologies and not just one. If we want to reduce CO2 then we need a market-based way and solutions for the whole society.

Picture: eFuelsNow

Why we made this tour?

There are several narratives on the topics of individual mobility and synthetic fuels. These paradigms were analysed and corrected. We analysed the following topics:

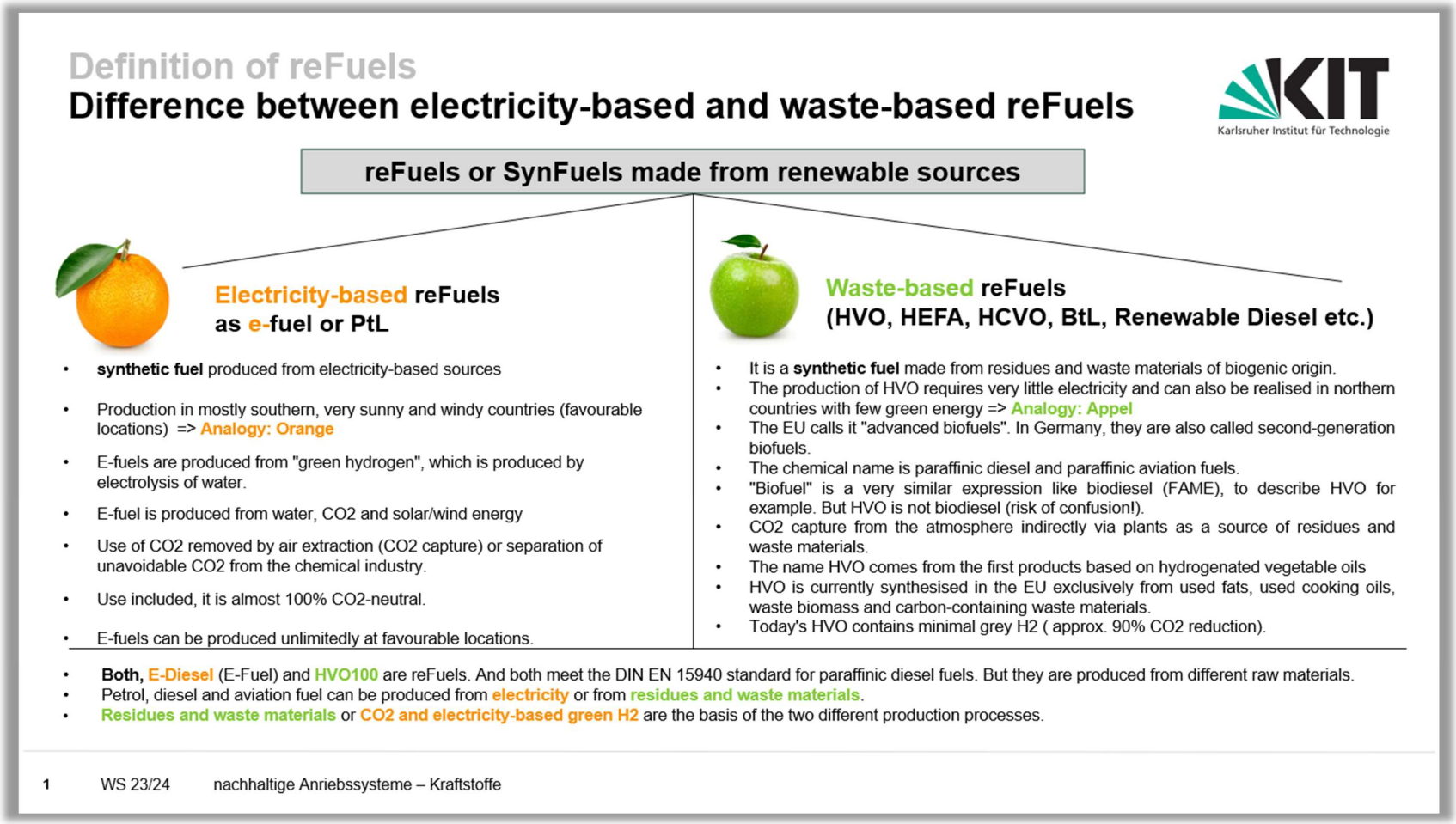
- Availability of synthetic fuels in the petrol station network
- Compatibility of synthetic fuels, also for non-approved vehicles
- Production volume
- Importance of individual mobility for quality of life and health
- Future prospects for cars with petrol and diesel engines
- Dependence of driving speed on fuel consumption and consequently emissions.
- What are the consequences for climate protection of allocating synthetic fuels to ships and aircraft only?

Sturucture of the document

- Chapter 1 - interesting facts and figures about travelling and fuel
- Chapter 2 - travel experiences and analyses on the subject of HVO and individual mobility
- Chapter 3 - general information on the topic of HVO
- Chapter 4 - Summary and conclusion
- Chapter 5 - Sources (numbered in the text)

What is HVO100?

This is a **waste-based, synthetic diesel fuel**. The pure fuel (HVO100) complies with the fuel standard DIN EN 15940, while HVO blends (up to approx. 26%) comply with the current diesel standard DIN EN 590 due to the slightly lower density (approx. 5% difference) compared to fossil diesel. HVO is not an e-fuel, but the two fuels cannot simply be separated from each other. Both fuels are synthetic fuels from the "refuels" category. HVO and e-diesel (e-fuel) both comply with DIN EN 15940. The characteristic of electricity-based e-fuels is the use of green hydrogen. E-fuel achieves almost 100% climate neutrality, HVO up to 90%. In the future, there will also be hybrid products. This is a waste-based e-fuel that is produced with green hydrogen. It will also achieve almost 100% climate neutrality.



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1.0 Journey figures

1.1 Tour figures

Start	27.Oct.2023,09:57 AM in Ludwigsburg (D)	
Mileage (Start):	362.984 km (225.548 miles)	
Destination	09.Nov.2023, 09:54 AM in Ludwigsburg (D)	
Mileage (Destination):	369.263 km (229.449 miles)	
Time duration	almost exactely 13 days	
Regenerative share	96,5% with synthetic HVO100	
Travel distance (on wheels)	6.279 km (3901,6 miles)	
Ø Daily Travel distance (on wheels)	483 km (300,1 miles)	
Travel distance in Germany	≈ 421km (261,6 miles)	6,70%
Travel distance in Austria	≈ 230km (143 miles)	3,66%
Travel distance in Italy	≈ 4064km (2525 miles)	64,72%
Travel distance in Albania	≈ 78km (48,5 miles)	1,24 %
Travel distance in Greece	≈ 1.132km (703 miles)	18,03%
Travel distance in Malta	≈ 74km (46 miles)	1,18%
Travel distance in Switzerland	≈ 280km (174 miles)	4,46%
Sea route - Italien- Griechenland	1x : 258km (160 miles)	2x : 516km (321 miles)
Sea route - Pozallo (I) - Malta	1x : 127km (79 miles)	2x : 254km (158 miles)
Sea route - „Strait of Messina“ Messina => Villa San Giovanni	1x : 6,6km (4,1 miles)	2x : 13,2km (8,2 miles)

Picture: eFuelsNow

Picture: eFuelsNow

Tour data was analysed with regard to the travel distance (on own wheels). The boat crossings are not included in the 6,279 kilometres. However, it can be stated that the use of synthetic fuels in road transport also has a positive impact on shipping. The more people refuel, the cheaper synthetic fuel becomes for ships and planes. Both are very cost-sensitive sectors that require far too little quantity on their own. Road transport needs more. More customers lead to a faster "return on invest" or a faster ramp-up of production. The climate doesn't care where CO2 is saved first. 99% of the world's car population [1) 2)] and the increasingly rare electricity[3)] , which industry also needs, leaves no other option.

1.2 Vehicle data and figures

Vehicle type	**Alfa Romeo 159 2.0 JTDm Sportwagon**
Date of construction	June 2011
Power of engine	125KW / 170HP
Emission standard	Euro 5
Mileage (Start)	362.984km (225.548 miles)
Mileage (destination)	369.263km (229.449 miles)
Tank-filling-volume	65 litres
Maximum range	≈1.100km (683 miles), filling time: 1Min 50Sek.
Driven with HVO100 until Nov 2023	ca. 180.000km (111.847 meiles)
Oil consumprion during the trip	ca. 0,3 liters
Waer parts during the trip	2 incandescent bulps
Tyres	Dunlop SP Winter 225/50 R17
Use of production- / lifetime footprint	More than 2 times
Use of electricity for HVO production (5Litres/100km) 100km = 62,14 miles	≈5KWh/100km (waste-to-fuel) *(Calculated Prof. Willner HAW Hamburg, Faculty of Process Engineering, Fuel Research)*[5) 6)] There is already a lot of energy inside the waste. Little electricity needs to be added for production.

About the car:

The car was purchased in Italy in 2017 with 80,000 kilometres (49.710 miles) for approx. 9000 euros. The Alfa has the first engine and the second clutch. It is in complete standard condition, without any conversions or chip tuning. The engine runs much more smoothly with HVO100. The particulate filter regenerates less frequently. It feels like the car accelerates slightly better. There is no recognisable difference in fuel consumption. At almost 400,000 kilometres (248.548 miles), the car has more than doubled its calculated lifespan. In combination with HVO100, this results in an extremely climate-friendly lifecycle and a very small CO2 footprint. On top of this the materials are simple and can be produced and recycled in a resource-friendly way.

HVO/XtL release (DIN EN 15940):

Alfa Romeo has not yet approved the Type 159 for fuels complying with the DIN EN 15940 standard. The car has already travelled approx. 180,000 km on HVO100 (by Nov 23). In the near future, the car will reach 400,000km. Then about half of the kilometres driven will be on HVO100. A similar engine, constructed during a Fiat-GM-partnership, was used in several Saab models (9-3 and 9-5). You find it also in different Opel and Vauxhall models (Astra, Zafira, Vectra, Insignia).

Picture: eFuelsNow

1.3 Petrol station network with HVO

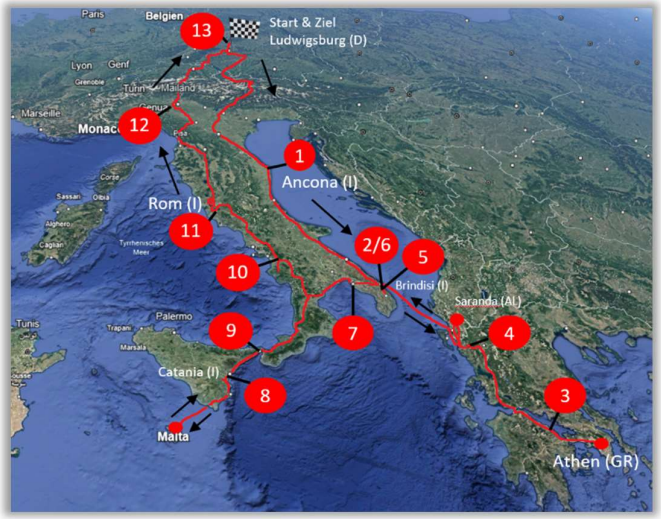
Number of refuellings	13 refuellings
Petrol stations along the whole tour corridor (6279km) , approx. 8km left and right of the route (Nov 2023)	In total: • 967 Stations (HVO100 + HVO Blends) • 246 Stations (HVO100)
HVO100	Ø every 25km (15,5 miles)
HVO Blends und HVO Blends	Ø every 6,5km (4 miles)
during the Italian route, approx. 4064 km (2525 miles)	
HVO100	Ø every 16,7 km (10,37 miles)
HVO100 und HVO Blends	Ø every 4,35km (2,7 miles)

Summary:

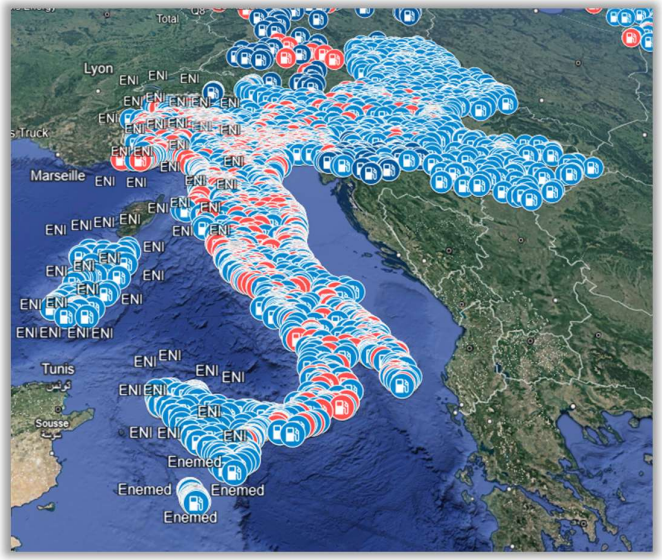
The distance of 6,5km to 25km (4 to 15,5 miles) between the HVO filling stations shows that it is already possible to make holiday trips to southern Europe extremely climate-friendly with a normal diesel car. The long distance that can be travelled and the short refuelling time makes travelling very comfortable. Vehicles that rarely need to refuel also need fewer pumps. This allows quicker and more cost-effective implementation of climate friendly mobility.

HVO stations along the route:

Basically, there are (in Nov 2023') petrol stations for HVO100 in Germany, Austria and Italy. HVO blends with blending (maximum 26%) exist in Germany, Austria, Italy and Malta. There may be HVO also in Greece (EKO Avio Diesel ?). But we are not sure yet. However, these petrol stations are not listed. Known for sure is that there are significantly more HVO blends in Germany than the map suggests. Aral offers 7 to 15% blends in Aral Ultimate across the country, and also offers 26% HVO in Aral Futura. Most of these petrol stations are not listed at the moment (Nov 23). If they had been included, we would probably have found an HVO blend every 5km along the route (over the whole trip).



Both pictures: eFuelsNow, Picture above: Stops on petrol stations



The map in the picture below shows the HVO situation in Nov 2023. You can find the current map here:

https://efuelsnow.de/tankstellen-karte

1.4 Time for refuelling

Maximum tank filling volume (Alfa 159)	65 liters
Total refuelling time for 6279km, measured and calculated 10x fuel pump 1x with canister	≈26min (refuelled 13 times, 1x by canister, only at fuel pumps it would have taken about ≈21 Min)
1x full tank (65 litres, pure filling time, measured)	1Min 50Sec (energy transfer: 35L/Min)
1x full tank (65L with pay and walking times, measured)	2Min 50 Sec
Single time (only for walking, measured)	30 Sec
Single time (for machine with card-payment, measured)	40 Sec
Power output, petrol pump, passenger car station (35L/Min) [6)]	approx. 18 Megawatt [6)]
Power output, petrol pump, truck station (bis zu 130L/Min) [7)]	Up to 66 Megawatt (calculated)
Power output, canister, (12L/Min) measured	approx. 6,2 Megawatt (calculated)

Summary:
The importance of short refuelling times became obvious several times during the journey.

1)
The journey included some special highlights: During the section Brindisi - Pozallo (to the ferry to Malta) there was only about 9 hours for a ride of almost 700 kilometres. During this section, we also had to cross the Strait of Messina by ferry. Everyone remembers enough of these situations where there is only very little time for refuelling. It could be on the way to the pregnancy clinic or in holiday or during rush-hour traffic (e.g. after a long traffic jam). Reality is usually not 100% predictable. A machine is only an advantage for people if it is always ready for use and the loss of time is minimal.

2)
The picture (right) was taken in Reggio di Calabria. I had actually planned to take a photo of the Alfa refuelling behind the beautiful cactus. However, the lorry behind me was in a hurry. The time factor is particularly important for delivery traffic and commercial travellers. Long refuelling stops are comparable to long setup times on a production machine. Prosperity means high productivity. And prosperity is essential to be able to finance green technologies for environmental protection.

3)
Considering the total refuelling time for the average car driver (mileage: approx. 12,500 km / year): In the shortest case, he spends less than one hour per year at petrol stations, unless he buys a few sweets. Based on the 13-day trip (6279km in total), it was less than 2 minutes a day (approx. 26 minutes in total).

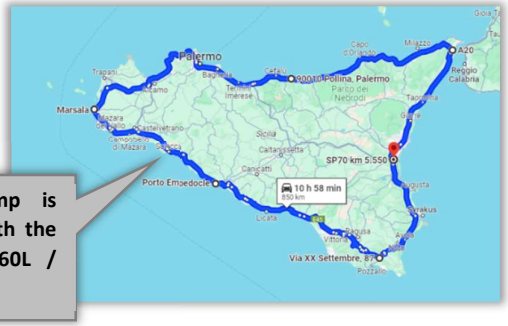
Picture: eFuelsNow

1.5 The importance of a high energy density

The energy transfer (volume rate) is illustrated in this chapter using a 1 litre bottle (picture right). At a fuel pump for passenger cars, 35 of these bottles are filled into the tank every minute. A "mandatory slowing down" of this filling process (by using a different powertrain technology) is currently being discussed politically.	
	Volumen rate:
canister	12 litres / min (measured)
Truck station	50 bis 66 liters / min [7)]
Passenger car station	35 litres / min [6)]
In just under 30 sec. it is possible to fill up the Alfa with energy for a range of 300 km (volume rate 35 litres/min). Slowing down the energy transfer achieves the following volume rates (interpolated).	
700km (435 miles) in 10 Min corresponds to…	≈4 liters / min (Ein Kanister liegt 3x höher !)
300km (186 miles) in 30Min corresponds to…	≈0,6 liters / min
300km (186 miles) in 9 hours corresponds to…	≈0,033 liters /Min (less than a 50mL glass !)
Energy density illustrated by two glasses (50 mL und 1L), picture left	
Calculation with: 5L / 100km consumption	Alfa 159 (app. 1.600kg), Motorway
Kilometers with 1 litre bottle of HVO	≈ 20 km (12,4 miles)
Kilometers with 50 millilitre glass of HVO	≈ 1 km (0,62 miles)

Example, tour around Sicily:

In Sicily, almost only HVO blends were available in Nov 23. There was only one HVO100 station in Catania. Even with this single station, it would be possible to drive around the entire island (850 kilometres) with the Alfa. It achieves a consumption of 5L/100km on the motorway). This allows a range of approx. 1,100km. Travelling through urban areas (Stop&Go) reduces the range to 900-1000km. The tank of the Alfa is 65 litres. This means: approx. 60 bottles (as shown in the picture) allow a trip around Sicily, depending on the driving profile (city / country road / motorway).



Only one HVO pump is necessary, to drive with the Alfa around Sicily (≈60L / ≈850km).

All pictures: eFuelsNow

1.6 Overview – refuelling, CO2 reduction, consumption and costs

- **CO2-balance**: **between 27 and 57g/km**. We achieved around 27g/km using HVO with 90% climate neutrality. HVO100 had a 96.5% share during the whole journey. A maximum of approx. 20g/km would have been achievable by using only HVO100 during the entire journey. According to ENI, the climate neutrality of the fuel can fluctuate (on average 75%). This would result a CO2 reduction of approximately 72% and emissions of 57g CO2 /km. However, it´s still a very good value. Fuel transport is included in all cases. We are in close contact with specialised faculties and universities. The basic figures of the calculation were provided by the reFuel department of the Karlsruhe KIT (Institute of Technology in Karlsruhe) [8)]

- The **average price** at the petrol station was around 1.81Eu/liter (between 1.714 and 2.099Eu/liter)

- The **fuel consumption** was between 5.0 and 7.3 litres/100 km, according to the on-board computer. The consumption values in the table (on the following page) were obtained from the local fuel gauges at the petrol stations. Therefore, the consumption values, shown there, may contain inaccuracies. It was apparent, for example, that different filling volumes were charged in some cases. And this despite the fact that the vehicle's fuel gauge showed the same level as before the last refuelling. The real consumption is probably approx. 0.5 litres lower than calculated in the table. Maybe the dial gauge was not calibrated correctly.

- The **share of HVO100** during the whole trip was 96.5%. Why? Before the section through Albania and Greece (approx. 1200 km), we refuelled with HVO100 just before driving to the ferry in Brindisi. And we filled also a 20-litre canister with HVO100. The following section included mountainous terrain and some city rides (Saranda, Patras, Piraeus, Athens). In Xylokastro, on the Corinthian Sea, the tank Alfa was empty after app. 900km. So the car was refuelled with the 20 liter canister (more details on chapter 2.2). So the harbour of Igoumenitsa was barely reached with HVO. For safety reasons, ≈15,8 litres of fossil fuel were added 10 kilometers before reaching the harbour. The ramps outside and inside the ship are very steep. And diesel vehicles should not be run empty. This can cause damages. HVO can be mixed with fossil diesel without any problems.

Picture: eFuelsNow

The following table shows an overview of the refuelling stops. Climate neutrality was calculated with figures from the KIT Karlsruhe. The following points should be noted:

- The tour started with a full tank of HVO100. The car was refuelled 13 times during the trip (Including refuelling after return)
- You don't know for sure from which refinery the HVO you are refuelling has been produced. However, I assume that the first 1043km (16.6%) were driven with NesteMy, the rest of the journey with ENI HVOlution. Q8-Italy will presumably also sell HVO100 from ENI.
- The consumption values were calculated according to the fuel gauge on the stations. The fuel gauges are probably not always properly calibrated. This may have resulted discrepancies to the real consumption. I suspect that the true consumption was between 5 liters and 7.3 liters, depending on the driving profile (city, country, motorway).
- Basic values for the caluculation of the CO2 emissions, KIT Karlsruhe, Prof Thomas Koch and Dr Olaf Toedter. [8)]

Refuelling process	fuelling (Place)	Driving profile	Volume (L) according to the pump's gauge	Price (Eu/L)	total price (Eu)	mileage (km)	Distance since the last refuelling (km)	Verbrauch since the last refuelling (Lters /100km)	fuel type	CO2 emissions (g) for the refueled Diesel Basis HVO: 300g CO2 / L Fossil Diesel (B0) : 3000g CO2 / L (calculated with fuel transport) *
x	Ludwigsburg, Germany **(at the start of the journey, 100% tank full)**		65	1,99	129,35	362.984			HVO100	19500
Start of journey	**From here, the used fuel was refilled**									
1	Ancona	Motorway through the Alps to Italy	56,83	1,719	97,69	364.030	1.046	5,43	HVO100	17.049
2	Lecce 1	Motorway / country road / villages	56,85	1,724	98,01	364.768	738	7,70	HVO100	17.055
3	Golf v Korinth **(not fully fuelled, by canister)**	Motorway / country road / villages	20	1,9	38,00	365.613			HVO100	6.000
4	Igoumenitsa **(not fully fuelled, fossil Diesel, tank nearly empty)**	Motorway / country road / villages	12	1,8	21,60	365.970			**fossile Diesel****	**36.000**
5	Brindisi **(not fully fuelled, fossil, tank nearly empty)**	Motorway / country road / villages	4,8	1,81	8,69	365.990			**fossile Diesel****	**14.400**
6	Lecce 2	Motorway / country road / villages	52,49	1,714	89,97	366.021	1.253	7,13	HVO100	15.747
7	Taranto	Motorway from Lecce to Taranto	4,69	1,714	8,04	366.124	103	4,55	HVO100	1.407
8	Catania **(not fully fuelled, because of price)**	Motorway / city traffic Malta	30,39	2,099	63,79	366.907			HVO100	9.117
9	Reggio Calabria	Motorway / country road / villages	42,31	1,749	74,00	367.119	995	7,31	HVO100	12.693
10	Polla	Motorway / country road / villages	39,03	1,764	68,85	367.666	547	7,14	HVO100	11.709
11	Castel Gandolfo	Motorway / country road / villages	25,78	1,749	45,09	368.039	373	6,91	HVO100	7.734
12	Milan	Motorway / city traffic in Rome	54,78	1,789	98,00	368.745	706	7,76	HVO100	16.434
13	Ludwigsburg, Germany **(fuelled until the tank was full)**	Motorway through Switzerland	28,5	1,99	56,72	369.263	518	5,50	HVO100	8.550
Evaluation	**in total**		**428,45**	**1,81**	**768,44**		**6.279**	**6,82**	use of 96,1% HVO (90% CO2 neutral) - CO2 (g)	173.895
				average price	total price		total distance		CO2 /km (g)	27,69
									CO2-reduction (%)	86,47
									Comparison 100% Fossil - CO2 (g)	1.285.350
									CO2/km (g)	205
									CO2-reduction (%)	0'
									Comparison 100% HVO (72% CO2 neutral) - CO2 (g)	359.138
									CO2/km (g)	57,20
									CO2-reduction (%)	72,06
* Figures from Karlsruhe Institute of Technology, KIT, Department for refuels									**Comparison 100% HVO (90% CO2 neutral) - CO2 (g)**	128.535
HVO100 is up to 90% CO2 neutral (sometimes up to 95%)									CO2 /km (g)	20,47
** fossile diesel B7 or B0. I assume B0 Diesel									CO2-reduction (%)	90,00

2.0 Travelling experiences in Southern Europe

2.1 Prices for HVO100 and HVO Blends in Italy

Prices before the campaign:
Even before the campaign, HVO100 was no "champagne fuel", picture from an earlier trip in Verona in summer 2023.

100% HVO, Q8 Catania

B7, fossil

15% HVO

100% HVO

Prices during the campaign:
During a promotion at ENI, HVO100 cost around 10 cents LESS than fossil diesel. Petrol station in Ancona, in early November 2023).

The most expensive was the HVO100 at Q8 in Catania Sicily (2,099Eu/L). The cheapest was at ENI, e.g. in Taranto and Lecce (1.714Eu/L or in Ancona 1.719 Eu/L (picture right). On average, the HVO100 cost in average 1.81Eu/L. ENI sells HVO100 10 cents cheaper than fossil diesel. Usually HVO costs 10 cent more than normal diesel in Italy, just as much as ENI Diesel+ (HVO15), as shown in the the picture in the middle. The fuel price for the entire journey of 6,279 km in total was 768.44Eu (428.45L according to petrol receipts). In Austria (Vorarlberg) it would also have been possible to fill up with HVO100 for 1.78Eu/L. But we did it later in Italy.

All pictures: eFuelsNow

2.2 Influence of the driving characteristic on consumption and range

Influence of driving characteristics on consumption

The importance of the driving characteristics became very clear during the various stages. When driving purely on the motorway (e.g. between Ludwigsburg and Ancona), consumption was between 5 and 5.4L/100km. On sections with city traffic and country roads (stop & go), consumption rose to over 7 liters/100 km.

- Ancona-Ludwigsburg (1045km / 649 miles) with a full tank 65 liters, average consumption app. 5,4L/100km
- Lecce – Albania – Athens – Igoumenitsa (app. 1200km / 745 miles) with 85 liters (tank full + 20 liter canister) => consumption little bit 7 liters/100km

Both pictures: eFuelsNow

Summary:

- The general statement that a speed limit on motorways automatically reduces local CO2 emissions is not correct. Otherwise motorway consumption should be higher.
- It makes much more sense to reduce the stop & go phases in traffic, e.g. by implementing roundabouts or long green phases at traffic lights. If the car has to accelerate again, this increases fuel consumption and so CO2 emissions.
- If the fuel is defossilised, then consumption doesn't matter. An 8-cylinder off-road vehicle fuelled with climate-friendly fuel is more climate-friendly than a small car with 3 l/100 km consumption, which is fuelled with fossil diesel. A greater climate impact is achieved if the diesel market is 50% defossilised, like in California [10]. It is wrong to propagate the speed limit with climate protection arguments. If people really want it, then other arguments must be presented. The reality also becomes visible considering that Germany only emits 1.8% of the world's CO2. Cars driving on the motorway only represent a very small proportion of this. And there is another argument. CO2 is reduced during the production of fossil oil, and not during its use. The oil that is extracted from the ground is always burnt. If it is not used in Europe, then in another country on the planet. For this reason alone, synthetic fuels make a lot of sense. They enable the oil-producing countries to substitute fossil incomes. (analysed by Prof Sinn, IFO-Institute [9]). In this case, the oil remains in the ground and does not emit any CO2.

Where does the 3.5% fossil fuel in the overview (chapter 1.6) come from?

There is no HVO100 in Albania and Greece. The section of approx. 1210 km was driven with a full tank from Italy and a 20 litre HVO reserve canister. This shows the importance of the driving profile (city, country, mountain routes...) and its effects on consumption. The mountain stage in Albania and the stop-and-go phases in Patras and Athens were particularly noticeable.

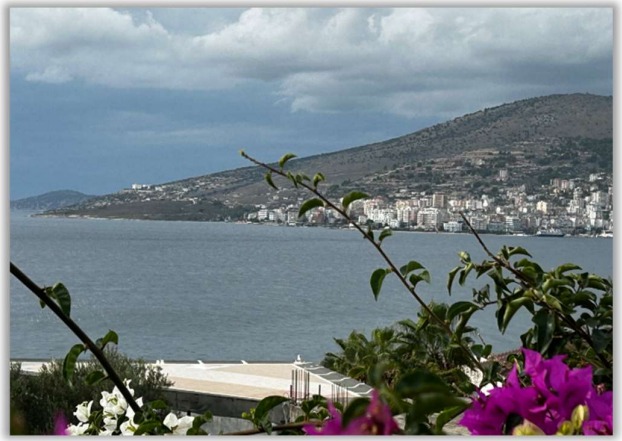
The Alfa barely reached the harbour of Igoumenitsa with HVO100 to catch the ferry back to Italy. To be on the safe side, the car was refuelled with fossil fuel about approx.15 km before the habour. The reason for this were the steep ramps at the entrance to the ship and inside the ship. Diesel vehicles should not be run empty. Shortly before the harbour we refuelled with approx. 12 litres, then again in Italy with approx. 4.8 litres. However, the car's fuel gauge remained down at the last mark. It only swings out from a certain filling level. The range was used very extensively, but the driving profile allowed for a lower kilometer range. Instead of 1043km (649 miles) on the motorway during the first section, it was under 925km (575 miles). The 20 litre canister added 284 km (176,4 miles) on top.

If we had travelled directly on the motorway from Italy to Athens, we could have easily managed with a 65-litre tank without a canister. You could even have crossed from Piraeus to Crete and drove 50 km (31 miles) there. And then we would still have had enough HVO in the tank to get back to the harbour in Brindisi.

After refuelling, the fuel gauge remained at the last mark. It only swings out again from a certain filling level of over 10 liters.

Pictures: eFuelsNow

2.3 The influence of the car on the average human age and on health



Picture: eFuelsNow

Holiday trips provide an opportunity to learn about the history of foreign countries. The former People's Republic of Albania has a very unusual history, especially in the context of mobility. Until 1991, Albania was a country that was even more closed than other Eastern Bloc countries. The Albanian situation could be compared with North Korea. Until the early 1990s, Albanians were not allowed to own a private car. The standard of living was at an extremely low level. The consequences of this time still exist today. If there were cars at all, they were only reserved for officials and the state leadership. The leadership drove Mercedes. This is probably one of the reasons why Albania is now the country with the highest proportion of Mercedes cars in Europe. The Mercedes star was considered unreachable. Today, however, it has become achievable for many people. The W123 and W124 series in particular, which symbolised the typical "farmer's Benz" in Western Germany, is still a very common car. But electricity, which can be used at any time of the day, is still less common in rural areas. During the journey, I saw people washing clothes by hand at the (natural) "washing machine". This is how my grandparents passed it on to me. People who could buy a car and a washing machine in the 50s and 60s were very lucky. Technological progress which some people (especially in Germany) would like to stop again today. This chapter and the following chapters analyse the consequences.

Image: eFuelsNow

The following aspects were analysed:

1) Does the car really have a negative impact on general life expectancy?
2) Germany is a western industrialised country. Does Germany have a "car problem". Are there really more cars in Germany than elsewhere? There are about as many cars in the UK as there are in Germany per 1000 inhabitants (546 cars, 2021).

The table lists the figures for some countries for the years 1990 and 2023 (change in %). Life expectancy is averaged (m/f). The sources can be found in chapter 5.

	≈ 1990		≈ 2023		Changes (1990 to 2023) calculated	
	Life expectancy	**Cars / 1000 citizens**	**Life expectancy**	**Cars / 1000 citizens**	**Life expectancy**	**Cars / 1000 citizens**
Germany	75,8 years [22)]	479,4 cars [24)] BRD 1989	81,0 years [11)]	583 cars [17)]	+ 6,8%	+ 21,6%
Malta	76 years [13)]	337 cars [25)]	83,8 years [13)]	786 cars [19)]	+ 10,2%	+ 233,2 %
Albania	73,1 years [12)]	0 cars (1990) 11 cars (1992) [23)]	78,1 years [12)]	192 cars [21)]	+ 6,8%	+ 1745 % (compared to 1992)
Italy	77 J years [14)]	483 cars [26)]	84,2 years [14)]	675 cars [17)]	+ 9,3%	+ 39,75%
Poland	70,7 years [15)]	138 cars [27)]	78,6 years [15)]	687 cars [17)]	+ 11,2%	+ 497%

Results:

a) Germany's level of vehicles corresponds approximately to the EU average of 567 vehicles [18]. It is clearly visible that the number of cars per 1000 citizens has increased moderately over the period of approx. 33 years. Although a large number of manufacturers and suppliers are located in the country, the number of cars is not on a particularly high level. The comparison with Poland and Malta is particularly remarkable. Although there was greater demand in these countries than in West Germany after 1990, the number of vehicles per 1000 citizens is significantly higher there today. But the same developments can also be seen in Italy. It´s a country that belongs also to the western industrialised nations since long time. The total number of cars per 1000 citizens has grown much more and is on a significantly higher level than in Germany.

b) Diesel driving bans are not being discussed in southern Europe in the same way as in Germany or a few northern European countries. A few cities have regulations. In 2023, this affected significantly fewer cities and much older vehicles than in Germany (only valid up to Euro 3 almost everywhere). [16]

c) Looking at life expectancy, it is also noticeable that Germany does not perform exceptionally well in compared with other countries. It is interesting to note that countries like Malta and Italy also achieve a higher life expectancy despite a significantly higher number of vehicles per 1000 citizens.

Conclusion:

- The number of vehicles per 1000 inhabitants has no influence on life expectancy. The negative effects of car traffic have no influence. They are completely overcompensated by the positive influences. Explanatory example: Of course there are road accidents. But these are decreasing. Cars also help to save lives, not just in ambulances. For example, transporting medicines or a quick trip to hospital in a neighbour's car if you don't have one at home. It is particularly interesting to consider rural areas, where the way to the doctor can be a long trip. Transporting goods is no longer so arduous. The car also protects against physical injury. It supports people. And, of course, individual mobility also creates much happiness in life (holiday trips). Mental health always creates physical health as well. This is a particularly important factor for older people in rural areas. Many of them are still active retired people. They prefer to travel by car to visit their friends. But only a few of them risk cycling. This context is becoming more and more important as the population is ageing all over Europe.

- It´s a fact that the number of vehicles and life expectancy will have increased significantly in almost all countries worldwide between 1990 and 2023. Mobility and health are a sign of an improved living standard and progress.

- Albania is a particular example. Nowhere else in Europe is it so clear that energy and mobility are essential for development and prosperity. The car makes work easier and faster. It relieves the body. And it also makes work more productive. Ploughshares and horses were still common in 1990. Today there are tractors, lorries and vans for delivery. Prosperity is based on such tools. Ultimately, this also finances a well-developed social system and an advanced healthcare system. This is also particularly important for environmental protection. Environmental protection needs money for green technology. However, "environmental protection" that attacks the financial basis is not environmental protection. It is definitely anti-environmental activism.

Summary:

The current debate in Germany (and few other countries) shows : The understanding of simple facts (how to achieve prosperity, health and environmental protection) currently seems to be completely reversed by some people in media. In some cases, the ideas are adopted by people who don´t think about the consequences. In most cases, it is not the generation that knew hunger and misery. Because they were resistant to such narratives. Most of them are dead now or very old. The environmental pollution of the old communist countries has also been completely forgotten in large parts of Western Countries. Some people don´t know any more about the importance of a free market and its difference to a socialistically planned economy. Sometimes we can speak of a Marie Antoinette effect. Nevertheless, many people are increasingly recognising reality now. We need to become more realistic again and learn to think in a sophisticated way. We should consider more different greyscales. And we need to listen more to logic, to the sciences and to experts. The current anti-car debate is certainly a typical German discussion. We tend to exaggerate. But it is also the result of a special era. The (geopolitical?) background of this time is not completely clarified yet.

All pictures: eFuelsNow

2.4 Is a car necessary on the small island of Malta?

During the previous chapter used figures to explain why cars have a positive impact on quality of life and health. However, people should not only drive. In this chapter, the reflections will be analysed in a more practical way.

1) The author spent a day without car and went on a 25km hike. How is life in practice without a car? How good is local public transport in Malta, and can it completely replace the car?

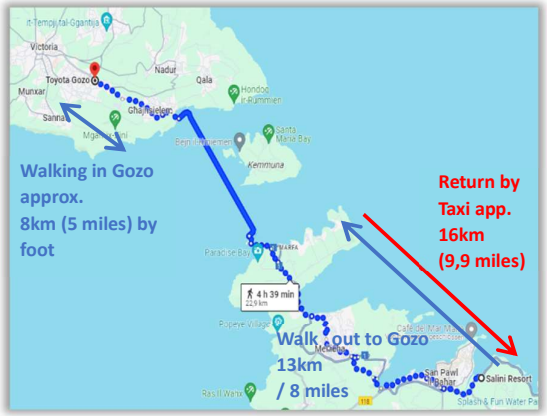
2) What are the reasons for the large number of cars on the small island of Malta?

Analysis:

- Malta is an island with the same size as the city of Munich (or approx. 2/3 of West Berlin). This area is home to approximately as many citizens as Lyon or Edinburgh (approx. 519,000 inhabitants).
- In Malta, there are approximately 786 vehicles per 1000 inhabitants. The number has risen rapidly since 1990 (over 233%).

Hiking data	
Track	**Distance**
Hiking by foot	21km (13 miles)
By ship	5,3km (3,3 miles) one way (10,6km (6,6 miles) time = app.45-60Min)
Taxi	app. 16km (9,9 miles) => from the harbour back to the Hotel
Whole track	42,3km (26,3 miles)
Start time	4.11.23 at 2:45 PM
Return time	5.11.23 3:00 AM
Time for the whole track	Insgesamt 8h 30Min (21km / 13 miles)
Average speed	2,5km/h (1,5 miles per hour)

All pictures: eFuelsNow

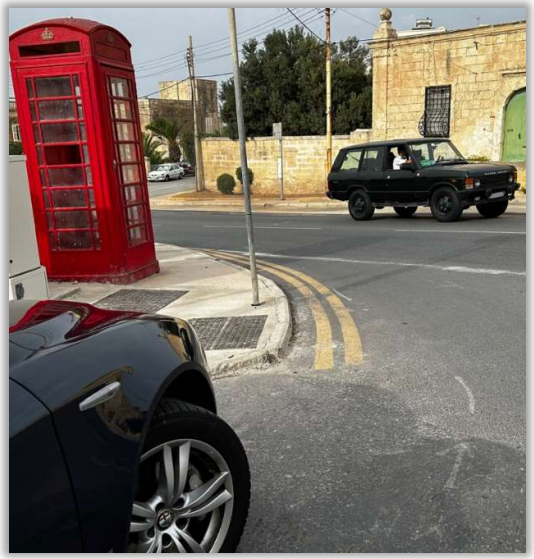


The walk was done at a normal speed. It was a comfortable walk, not a tough hike. It was interrupted by a 2-hour stop at a restaurant with a meal and two boat trips to Gozo and back to the main island. It took about 5 hours to walk 21 kilometres. That already gives an idea of why there are cars on Malta. But there are even more reasons.

- Malta is not as small as people think. It is possible to travel up to 50 kilometres in one direction (both islands combined).
- There is a fixed ferry connection to Sicily (approx. twice a day). Some online retailers do not deliver to Malta at all. Some residents therefore have postal addresses in Sicily. The nearest IKEA is also there, in Catania. Furthermore, a lot of food is imported from Italy. Imagine how it would be to transport such heavy goods over bumpy roads on foot or by bike.
- Particularly in summer, travelling in a car with air conditioning is much less stressful, especially in hot summer. Physical exertion at high temperatures is also bad for the health.
- Malta also has an ageing population. For many of these people, driving is usually safer than cycling.
- The bus service in Valetta is well organised. However, there are no buses in the countryside at night, only taxis. That's the moment when you really need a car. But even the total number of buses and taxis will never be enough to get all Maltese people to their destinations on time.

Conclusion: It is neither possible nor necessary to ban all cars in Malta. Solutions are described later in the text.

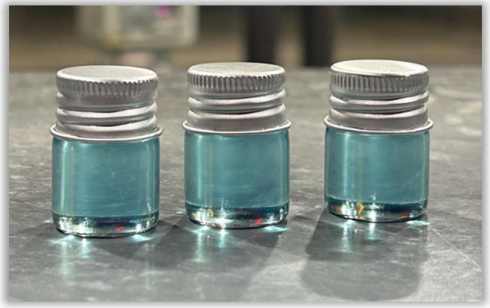
2.5 Driving and refuelling in Malta



In the further text, the Maltese car traffic will be described in more detail, also considering the local energy situation. Everyone knows that Malta, as a former British overseas territory, still has left-hand traffic. It is a paradise for classic car enthusiasts. Although the vehicle fleet is newer today than it was a few years ago, enthusiasts of British car models will be very lucky here. The climatic conditions are very favourably for a long life time. Old British Leyland, Ford and Vauxhall models can be seen. And there are many Land Rover models from all model years on the sunny roads of Malta.

In 2023, the shares of existing vehicles were splited as follows:

- 58,4% with petrol engine [20)]
- 36,2% with Diesel engine [20)]
- 3,3% with Hybrid powertrain (with petrol engine or Diesel Mildhybrid) [20)]



Diesel still represents over 1/3 of all registered cars in Malta (in 2023). This also corresponds to the level in other southern European countries, such as Italy. The impact for CO2 reduction through renewable fuels is correspondingly high. Although Malta is not a pioneering country in the field of regenerative fuels, it has already a much higher developed standard than Germany. While the standard 7% biodiesel blend is still typical in Germany, 12% synthetic HVO is already being blended throughout Malta (in 2024). The fuel is coloured blue (like on the picture) and an approx. 1% increase can be expected every year. This has been the case in the recent years. All petrol stations in Malta sell this partially synthetic diesel blend, which makes even an old Land Rover Defender more than 10% CO2 neutral and reduces local emissions as well. German biodiesel (FAME) does not achieve this climate neutrality (only approx. 3 to 4% reduction with 7% blending). In some, much larger, countries in Northern Europe and in California, between 20 and 50% of the entire diesel market already consists of HVO.

All pictures: eFuelsNow

At approximately 1.20 to 1.50Eu for 1 litre of diesel, the price level is very low. Normally with synthetic HVO, the fuel should be much more expensive for the customer, if you believe the media. By the way, in California consumers can get almost 100% HVO for (HVO95) for nearly the same price. By 2030, California wants to defossilise the entire diesel market to 100%, almost all with HVO. That fact leads up to another interesting question.

2.6 In which time Malta´s diesel market could be defossilised?

California has 5300 Diesel stations [28)], Malta only 77 [29)]. We are aware of 57 diesel filling stations (approx. 1% of California). There, 50% of the diesel is already made from HVO [10)]. Something that is possible in a state with 40 million inhabitants like California and in some northern European countries should be possible much more quickly in Malta too. By the way, a large HVO refinery is located in nearby Gela in Sicily.

Analysis:

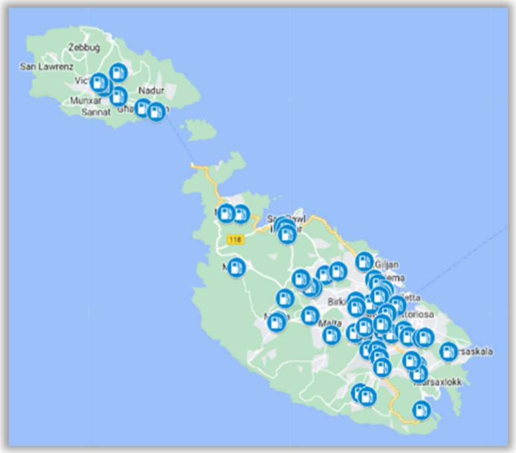
In Italy alone, we registered almost 800 new petrol stations with fully synthetic HVO100 diesel fuel on our EfuelsNow map within 9 months. Based on interpolations, 100% of all Maltese petrol stations could be equipped with an HVO100 pump in around 2-3 weeks. This should not be a problem in terms of volume either.

Examples:

- Monaco has already switched completely to HVO100. The only petrol station (Romano Energies) was already converted in 2021. The price has not changed. In 2022 it was just under 2Eu/L. In Monaco you can now only refuel with HVO100. Since then, thousands of cars have refuelled there. No problems with vehicles are known. Even the local gendarmerie is filling up there police cars there.

- A similar situation can also be found on the British Channel Islands. Around 220,000 people live there (approx. 55% of the population of Malta). We estimate that over 30% of the "road diesel" there already is HVO. This fact at least can be seen from the fuelling infrastructure on our eFuelsNow HVO map. Almost all petrol stations there offer HVO100 as premium Diesel. We do not know exactly how much fossil diesel is still in the market there.

Reason for the current situation: In Malta, the regulations have not yet been modified. It is one of the last countries where DIN EN 15940 diesel fuels are not yet allowed to be sold. Nevertheless, Germany will finally be further ahead from April 2024. Even if we are one of the last countries in Europe. Of course, Malta is only a small island. But even in larger countries, HVO already accounts for a high proportion of the diesel market.



All pictures: eFuelsNow

2.7 Alternative powertrain technologies in southern Europe

All pictures: eFuelsNow

It is necessary to categorise the different types of powertrain. An alternative powertrain concept needs climate-friendly energy in order to be an "alternative" for the enviroment. We consider the following categories:

1) Electric vehicles (BEV)
2) Vehicles fuelled with synthetic HVO diesel fuel
3) Vehicles with petrol engines that run on natural gas / biogas
4) Motorisation à l'hydrogène (moteur à combustion ou pile à combustible)

At the same time, you have to look at the situation in the new car sector. The most interesting of the four countries (Italy, Greece, Albania and Malta) is Italy. The conclusions can be transferred to the other countries too. The share of new registrations in Italy in 2022-23 is as follows [30]:

- Petrol engine 27,6%
- Diesel engine 19%
- Full- and mildhybrid powertrain (with petrol and Diesel engine) 34%
- Plug-in-hybrid 5,1% (mostly combined with a petrol engine)
- LPG 9% (with petrol engine)
- 0,8% Methan (with petrol engine)
- Battery electric vehicles (BEV) 3,8%

⇨ Approx. 71% cars with petrol engine
⇨ 25% diesel vehicles estimated, either without electrification or as (mild) hybrid

Unfortunately, the absolute figures for diesel and petrol cannot be taken from the market shares, as petrol and diesel hybrids have been combined in some categories. There is a large number of diesel vehicles, some of them even plug-in hybrids and in the mild hybrid segment. The real diesel share can be estimated at around 25%. However, over 70% of new cars should be petrol cars. In total, over 96% of the new car market consists of combustion vehicles. In Greece, Albania and Malta, the figure should be even higher. The high number of hybrids is not so much the result of customer needs. It is due to the sales portfolio of the manufacturers, who have to sell more and more electric vehicles due to fleet laws and ESG guidelines.

The market shares show what can be seen on the road. There are very few electric vehicles on the road south of Verona. If you see any at all, they are mostly tourist vehicles from Germany or the Netherlands. The proportion of new electric cars in Italy is at 3-4%. The latest reports also show that the proportion has not increased. An article reported high stocks of the Fiat 500 (BEV), which is exported abroad. These facts are not meant to criticise electric mobility. However, it shows the importance of a market-based, diversified approach. After all, the primary focus should be on climate protection and not on the drive system. And the customer must always be involved.

Vehicle categories [31] :

- A and B-segment (Micro cars and small cars) 30%
- SUVs (Sports-utility-vehicles) 57,7% (all segments)
- C, D und E-segment Mid-range cars and sports cars 12,2%

It is noticeable that Italy is a country of small cars. However, off-road vehicles are also very popular. The smaller models (Fiat 500X, VW T-Roc, Alfa Romeo Tonale, Mini Countryman, Jeep Renegade, etc.) are particularly popular here. Smaller vehicles have great advantages in terms of handling in southern Europe. Italy in particular is characterised by villages with narrow

streets. Such villages can also be located on mountainous terrain. The Fiat Panda 4x4 was invented in Italy for obvious reasons. Geography and age structure have a clear influence on the choice of vehicle. An increasingly older driver also prefers higher seating.

Why are cars with petrol and diesel engine so poular?

- They are cheaper to produce and to buy.
- The construction of a complete new infrastructure is much too expensive (for Italy and Germany)
- Refuelling takes too long. Just think of a full petrol station during rush hour in Rome.
- In Southern Europe, cheap small cars that are also usable for travelling are very popular. However, the compact space of a small car is limited. A liquid fuel with a high energy density shows its advantages here. It combines cheap purchase costs with a small "battery" (= tank), a long range and fast "charging times".
- Alternative fuels are already widely available in Italy. Besides HVO diesel fuels, there is also a huge LPG refuelling network. A natural gas vehicle saves at least 20% CO2. With biogas, even 90% climate neutrality can be achieved.=> https://www.youtube.com/watch?v=kfnL-NZm5cc&t=2s LNG costs around 70 cents per litre. CNG costs approx. 1.40Eu/kg. Around 9% of the Italian car fleet runs on CNG or LNG (3.5 million cars [33]). And there are also more new cars registered, even compared to electric cars (approx. 9 - 10% market share [30]). The HVO refuelling network is also very well developed. Together with Sweden, Italy is one of the pioneering countries in terms of alternative fuels.
- Due to the many small parts, the risk of a very expensive repair is minimised. The technology is well known. Compared to an electric car, owners can do a lot of repair work themselves. Oil changes are not expensive. If the car is serviced regularly, with oil changes and rust removal, it will almost always last 20 years and 500,000 kilometres (310.000 miles) and even more. Even a new, used engine is not expensive.

Picture: eFuelsNow

Conclusion:

Even if some media are still propagating a different vision of the future: It is extremely implausible that the market for new cars in southern Europe will be dominated by electric vehicles in the coming decades.

It´s because of…

- physical
- geographical
- social
- infrastructural

… reasons

In countries like Albania, it is even more difficult. Here, most vehicles enter the country as used cars. A lack of supply also causes serious economic problems for such a country. It is also important here that the car can be repaired at low cost. Albania does have a high proportion of hydroelectricity. But the electricity is not available at all times of the day. Electromobility also makes little sense in Malta, as electricity is generated almost exclusively from fossil fuels (97% gas, 2.5% oil)[47]. And in Italy [48], too, electricity is mainly generated from coal and gas. Furthermore, the Association of German Engineers (VDI)[49] repeatedly underlines that electricity distribution sets limits and that an electric-only strategy is therefore not realistic.

Due to the catastrophic social consequences and the physical limits, it is quite sure that the ban on combustion engines will be dropped. However, staying on the current path for much longer time will causes very negative consequences. In the worst-case scenario, it means that we will have to import combustion technology from China and Japan and. We will become more and more dependent. Some models from Chinese manufacturers can already be seen on the roads of Southern Europe. The Italian company DR Automobiles is already doing the final assembly for vehicles of the Chinese brand Cherry. In Mexico, the market share of Chinese combustion models has reached 20% [43].

2.8 Circular economy in Italy

Circular economy is already more developed in Italy than in Germany. This could have something to do with the waste problems in southern Italy. Due to the special situation, more attention is paid on this topic. We have been informed that some local authorities in the provinces of Lombardy, Marche and Alto-Adige (etc...) have already installed waste containers (as shown in the picture). These containers are used to collect used fats. The residues are also used for fuel production. Furthermore, it was notable that the use of green plastic is already widely more common, e.g. for pizza forks. Such materials can also be transformed into fuels. ENI currently produces HVO diesel fuels in Venice and Gela (Sicily). The Livorno site should be converted as well.

- The production capacity in Venice and Gela is currently around 1.1 megatonnes [32)] This corresponds to around 5% of Italy's diesel demand (approximately 1800 megatonnes per month). That's not very much, of course. But it is a significant increase in a relatively short time, and the aim is to increase it further. By 2025, they want to reach 2 megatonnes. [32)] and 6 megatonnes from 2030 [32)]. Palm oil is no longer used [32].
- It can be assumed that in Italy approx. 12-13% of the diesel market currently consists of HVO and biodiesel (B7), (approximate estimate).
- In addition to HVO and e-fuels (PtL) will cover further capacities. Even if this development takes time, it is the most time-efficient way. We should consider the time it took to build the current global petrol station infrastructure.
- HVO100 or HVO Blends are available at 3,750 stations in Italy. Along our route (within Italy) there were stations with HVO Blends every 4 kilometres and stations with HVO100 every 16 kilometres (in Nov 2023).

All pictures: eFuelsNow

3.0 General information on HVO diesel fuel

3.1 Production volume and content materials

HVO production – From 2020 bis 2025, production increase (x4), (Greenea) https://www.qcintel.com/article/global-hvo-production-to-quadruple-by-2025-greenea-1234.html	
Production (2020) **wordwide**	7 megatonnes
Production geschätzt (2025) **wordwide**	29.5 megatonnes
Production (2020) in **Europe**	3,5 megatonnes
Production geschätzt (2025) in **Europe**	11,3 megatonnes
Production (2020) in the **USA**	1,9 megatonnes
Production estimated (2025) in the **USA**	12,6 megatonnes

Neste - reference:

https://www.youtube.com/watch?v=Yuj_oeZMi-8

https://www.nfz-messe.com/de/news/menschen-personalien-koepfe-der-branche-joerg-huebeler-von-neste-ueber-alternative-kraftstoffe-aus-altfetten-und-holzresten-3824.html

Contact partner: Neste Germany – Jörg Hübeler

Picture: Neste

A frequent point of criticism is that HVO allegedly cannot be produced in sufficient quantities to supply a large proportion of the vehicles on the road. This argument is not valid for the following reasons:

- In California, for example, road and air transport is already supplied with waste-based fuels [44)].
- There is no alternative to synthetic fuels even for passenger cars and trucks:
  - 99.5% of the world's vehicles have a petrol or diesel engine. Otherwise, these vehicles continue to run on fossil fuels.
  - We don't have enough green electricity. Only 20% [46)] of Germany's primary energy is electricity. 62% [45)] of the world's electricity production is fossil and is also needed for industry.
- According to the biofuel trader Greenea, the production volume will increase up to four fold between 2020 and 2025
- Some countries in northern Europe and California already already supply between 20 and 50 per cent of the whole diesel market with HVO.
- HVO can be produced from a wide variety of waste materials.
- A Neste calculation shows that a total volume of 1070 megatonnes could be produced by 2040 if all global HVO refinery capacities are operated with all suitable waste. This corresponds to around 40% of global transport requirement (ship, aircraft, road transport). Links above. Furthermore, e-fuels (PtL) are another way for the rest. They are not included in this calculation.
- Jatropha oil from desert regions alone could be used to produce around 260 megatonnes per year (HAW Hamburg, Prof Willner). This would be enough to supply the entire EU with fuel.
- Italian ENI wants to achieve a production capacity of 6 megatonnes by 2030.[32)]

Neste says (see Youtube film and text below, links above):

„Neste continues to work towards increasing the availability of lower-quality waste and residue raw materials, while developing technologies to diversify our portfolio with completely new types of raw materials. We plan to introduce new sustainable raw materials, such as agricultural and forest harvesting waste and residues and suitable renewable materials from municipal solid waste streams. **By using these new raw materials, global renewable fuel production could reach over 1000 megatons of oil equivalent by 2040, which would be enough to replace all fossil fuels used in aviation and maritime transport, as well as a substantial part of road transport.“**

Ingredients:

In the European Union, HVO is mostly produced from waste fats, tall oils, forestry waste, inedible waste from the food industry, etc. Almost all waste can be used as long as it does not contain fossil carbon. Essentially is, the waste does not contain any fossil carbon. Palm oil has been banned in the EU since 2023 [34)]. All major manufacturers such as Neste [36)] and ENI [32)] etc. no longer use it. Furthermore, waste can´t grow on agricultural land. So there are no tank-plate conflicts.

Blending and upscaling of defossilised diesel fuel in California

CALIFORNIA AIR RESOURCES BOARD

CARB: regenerative share now at 57%

≈50% Renewable Diesel

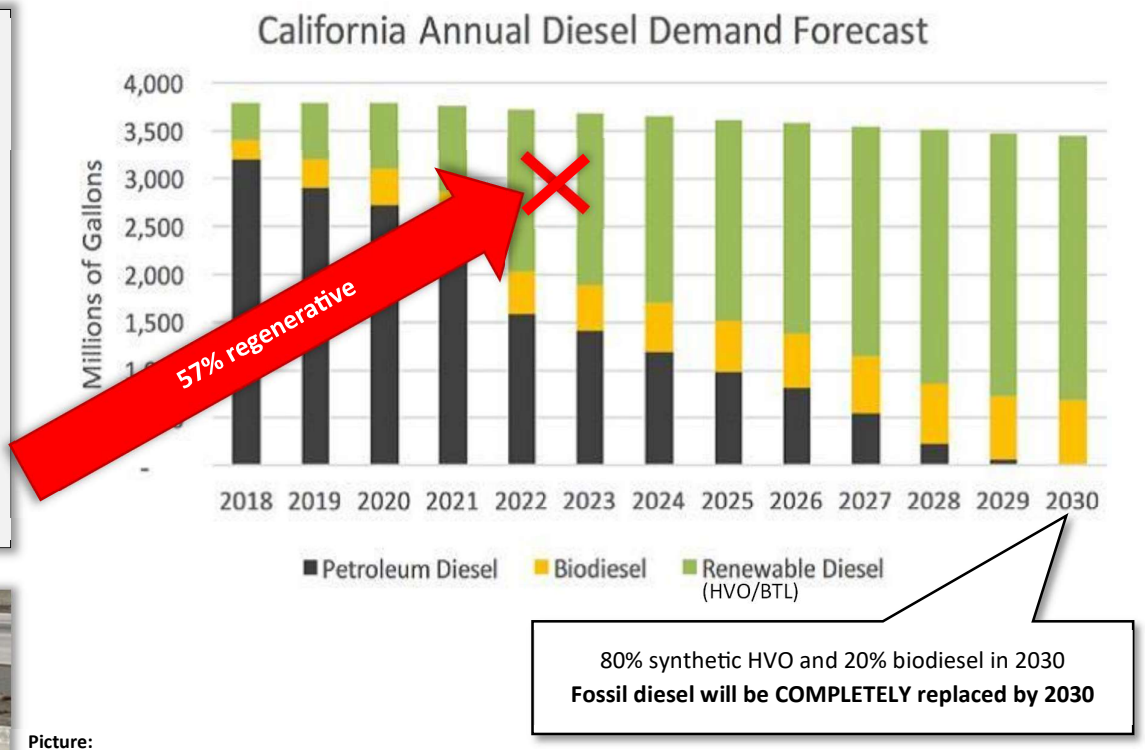
and **≈7% Biodiesel** in 2022/23

Situation in 2022:

https://ww2.arb.ca.gov/news/first-time-50-california-diesel-fuel-replaced-clean-fuels#:~:text=California%20Air%20Resources%20Board,-Main%20navigation&text=SACRAMENTO%E2%80%94%20California%20hit%20an%20important,the%20first%20quarter%20of%202023

https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard

Picture: eFuelsNow



Picture above, Ramp-up graphic: California Advanced Biofuel Alliance

https://biodieselmagazine.com/articles/2516583/biodiesel-renewable-diesel-set-to-replace-petro-diesel-in-calif

Does it make sense to restrict the supply of synthetic fuels only to the shipping and aviation sectors?

Answer: Clearly NO! Why? On the one hand, these two sectors are very small in terms of volume requirements. Secondly, they are cost-sensitive sectors that require a "volume propeller". More users make the fuel cheaper. The limitation to two small sectors blocks an important customer impulse. This is important for the development of large production facilities and the return on investment. Banks will only provide credits if they can be repaid quickly. A planned economy is a big handicap. A fixed distribution obstructs rapid defossilisation and blocks climate protection. Moreover, the climate does not care where CO2 is saved first. Considering the fact that over 99% of the world's motor vehicles are dependent on these fuels and that almost 70% of the global electricity mix is fossil based, there is no alternative. We don't have enough electricity. The example of waste-based HVO fuel shows that road and air transport can already be supplied with this fuel. Fuels for road transport are automatically produced as a by-product of cerosene production. Why should these fuels be thrown away?

3.2 Engine compatibility

Status Nov.2023: The Alfa 159 2.0 JTDm is running with HVO100 for almost 180,000km, although there is no official manufacturer approval. The compatibility was proven once again during the tour of southern Europe. The 6279 kilometres (3901 miles) correspond to about 50% of the average annual mileage of a car. The "inventor" of the fuel (Neste) says that such fuels are compatible with every diesel engine. This is particularly noticeable in some northern European countries and in California, where 20 to 50% of the diesel market is already supplied with HVO. In these countries you can't fill up with anything else on many stations. Problems are not known. This fuel is of higher quality. There is less contamination inside the engine. The motor runs more smoothly and the DPF regenerates less due to the cleaner combustion. Even the engine oil keeps better quality. HVO is resistant to diesel pest. This aspect is very important when the vehicle is parked for long periods.

After the warranty ends, everyone is free to decide for himself which fuel to buy. Numerous studies at universities confirm the positive results. Testing was also carried out by the refuels department of the Karlsruhe KIT and at the HTW in Saarbrücken. In Northern Europe, energy companies are also advertising explicitly for the use of HVO100 in vehicles without homologation. The photo shows the Estonian Neste website translated in German.

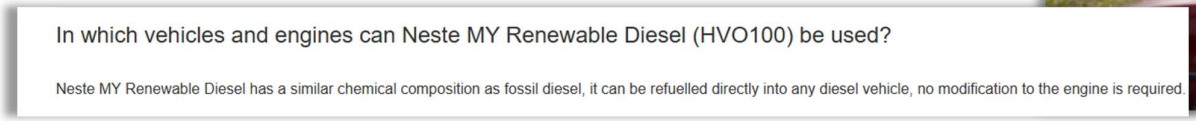
EfuelsNow cannot give HVO100 approvals, but can report from private experience. We have no reservations about using HVO100 in every diesel car. The following vehicles from our private circle of friends and followers already use it regularly or have been refuelled with HVO100 several times:

- Alfa 159 2.0 JTDm / 2011
- Alfa 147 1.9 JTD / 2004
- Mercedes E220 CDI (S213) / 2018
- Mercedes B200 CDI (W246) / 2016
- Mercedes 200D (W123) /1982
- Mercedes E270 CDI (S212) / 2007
- Mercedes G320 CDI (W463) / 2007
- Audi A4 3.0 TDI (B9) / 2018
- Audi RS4 TDI (B9) / 2019
- VW Sharan TDI / 2016
- VW Caddy TDI 75HP, / 2018
- VW Golf 4 TDI 90HP / 1998
- VW Golf 5 1,9 TDI Pumpe-Düse 105PS / 2004
- BMW 320d Touring (E46) / 2004
- BMW 330d Coupé (E46) / 2003
- BMW 330d (E93) Cabrio
- BMW 520d Touring (G31), / 2021
- BMW 550d (F10)
- Mini (F56) 3-cyl (B37) / 2015
- Opel Zafira B CDTI / 2009
- Volvo V70 Kombi / 2019
- Volvo XC60 / 2017
- Volvo 240 Diesel / 1992
- …

All pictures: eFuelsNow

Inspection of a non-approved vehicle after 50,000km (31.100 miles) with HVO100:

Film (in German language) => https://www.youtube.com/watch?v=8E95VcRPEXw



Both pictures: Neste, above: „Don´t change the car. Change the fuel."

3.3 Emission reduction

In Italy, there are no bans on diesel vehicles in most cities. If they do exist, they mainly relate to much older models (Euro 0 - Euro3)[16]. Measurements during the low-traffic months (during corona, 2020) showed that air quality did not change [38] [39] [40]. Conversely, the question is why HVO fuel was so strongly attacked by people who wanted cleaner air in the cities. HVO significantly reduces local emissions, especially in older diesel vehicles up to EU6c. Newer diesels with EU6d emission standard already offer very good cleaning technology. The only thing you notice there is a lower AdBlue consumption.Depending on the surrounding air quality, a cleaning effect is even achieved in many operating modes. Many studies on this have been done by universities [41], but also by the German car magazine "Auto-Motor-Sport" [37].

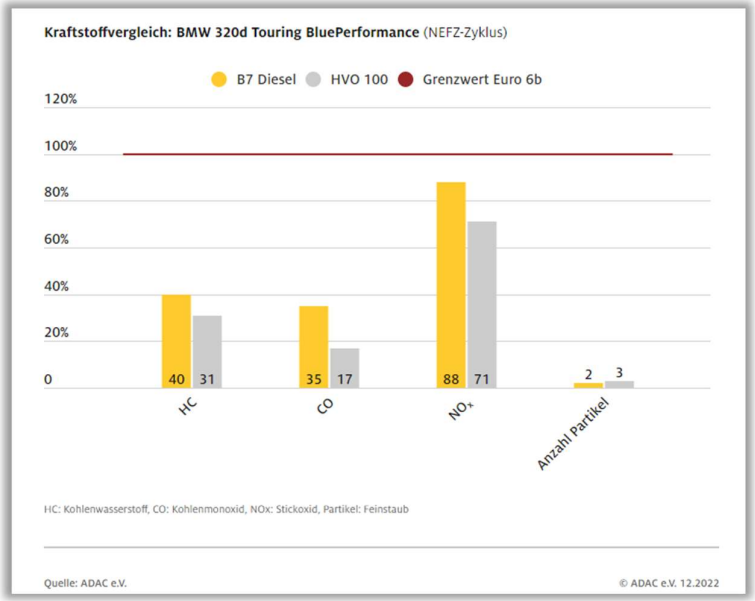
Picture: ToolFuel

HVO is clear like water, with neutral smell and contains no aromatics. Another characteristic is the changed flame behaviour with less black smoke. As a result, there is less contamination inside the engine. Neste provides the following emission reduction values [35]. Even much higher reduction values have been measured in practice (by the German Motorist Club ADAC).

- 33% lower levels of fine particles
- 9% lower nitrogen oxides (NOx)
- 30% less hydrocarbons (HC)
- 24% lower carbon monoxide (CO)
- reduced levels of polyaromatic hydrocarbons (PAH)

The Alfa is permanently driven with HVO100, so that no reference with fossil fuel was possible. A BMW 320d (E91) of about the same age, which has already run 280,000 kilometres (174.000 miles), was tested by ADAC and ÖAMTC [42] (picture below) and shows the emission reduction. A newer VW Touran with EU6d emissions standard achieved the same very low values as with fossil diesel. From our own experience, we detected about 10 to 20% lower Adblue consumption in some comparable vehicles. The reduction may fluctuate and depend on the model of vehicle.

Picture: eFuelsNow



Source: ADAC

4.0 Summary and conclusion

Summary:

- The 6279km tour journey was completed with 57g CO2/km (27g CO2/km in the best case). This corresponds to 72% climate neutrality (best case 86.5%).

- HVO100 and HVO blends are already very common in some parts of Europe and have a very wide refuelling network. HVO blends are available at most petrol stations in Italy. There were HVO100 stations every 16 km during the journey through Italy (in Nov 2023). On the entire route there was one HVO100 station every 25km and HVO Blends every 6km.

  The 6,279 km trip corresponds to half a year's mileage of an average car. The example of the non-approved Alfa Romeo demonstrates that refuelling with HVO100 is unproblematic. We had similar experiences with other models in the EfuelsNow fleet and even analysed an engine after 50.000km (31.100 miles) with HVO. In Northern Europe, petrol stations are also advertising the use of HVO100 in older vehicles, without homologation.

- A car with almost 400,000 kilometres (249.000 miles) on the clock. Almost 50% of this was travelled on synthetic fuel. That's extremely sustainable. And this is already possible today and shows that the diesel car, with its wide range of regenerative fuels, has the most sustainable powertrain concept. This applies even more to modern diesel (Eu6d).

- The refuelling costs for the customer remain within acceptable limits (approx. 1.81Eu/L, Nov 2023). Consumption also remains at a relatively similar level (± 0,3L).

- The energy requirement for the production of fuel and for the construction of vehicles and infrastructure is very low (page 7, and notes [5) and 6)])

- The extremely high energy density of a diesel fuel offers significant advantages in practice. This provides a pump capacity of 18 megawatts and enormously long driving distances of well over 1000 kilometres (621 miles) in less than 2 minutes filling time. It also offers advantages in vehicle packaging and regarding the transport and storage of energy.

- Energy sources are cheaper if they are produced as a co-product and can be used in different transport sectors. Furthermore, an allocation to small individual sectors (ships and aircraft) makes a rapid ramp-up and quick defossilisation more difficult.

- A general ban on cars not only has catastrophic economic consequences. It also reduces the standard of living and life expectancy.

- Petrol and diesel engines will remain irreplaceable in the future. This also includes small cars, which are very common in southern Europe.

- Not only in Scandinavia and California, also Italy is much further ahead in terms of green energy and the circular economy. Hopefully, this gap will be reduced when HVO100 is released for sale in Germany in 2024.

Picture: eFuelsNow

Conclusion:

Climate protection often works differently than you might think. Why always follow such complicated ways when it can also work quickly, cost-effectively and in a user-friendly way? Real environmental protection that makes people and nature happy can only be achieved with market-based competition. And that doesn't mean "either or", but "both". Synthetic fuels are a "small addition" that can defossilise 99.5% (!) of all cars worldwide. Synthetic diesel is already widely available and represents a significant share (up to 50%) of the diesel market in a number of countries already today. It is the most time-, cost- and energy-efficient way.

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