BioGas2020

Overview of available gas-driven vehicles in Denmark

Interreg

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1.1 Fiat – Doblò Cargo

Below the Fiat Dobló Cargo Eco is shown, which runs on CNG or petroleum. The van has a range of up to 660 km utilizing both diesel and natural gas. The car is relatively light and has a maximum load capacity of 980 kg. The 2 ton the car weighs makes it a lightweight in the delivery van category. [1]

Manufacturer:		Fiat
Performance		
Engine:		
	Type	Bi-Fuel: CNG or petrol (Euro VI) 1,4 litre
	Torque	206 Nm (CNG)
	Power	90 kW (120 Hp)
Acceleration:		
	Top speed	172 km/h
Fuel:		
	Storage	33 kg
	Range	Up to 750 km (incl. 300 km on petrol)
	Fuel Economy	CNG: 20,4 km pr. kg Petrol: 13,5 km/l
Operating limits:		
	Payload	980 kg
	Total Weight	2020 kg

Table 1: Main characteristics of Fiat Dobló Cargo

1.2 Fiat – Fiorino Natural Power

Below the Fiat Fiorino Natural Power is shown, which runs on CNG or petroleum. The van has a range of up to 960 km utilizing both diesel and natural gas. [2] Compared to the Fiat Dobló Cargo this van weighs even less, with a mere 1.3 tons, and since it has a smaller size and weight, the payload is half of the Dobló cargo. [3]

Manufacturer:		Fiat
Performance		
Engine:		
	Type	Bi-Fuel: CNG or petrol (Euro VI) 1,4 litre
	Torque	118 Nm (CNG)
	Power	57 kW (77 Hp)
Acceleration:		
	Top speed	162 km/h
Fuel:		
	Storage	CNG: 13.2 kg, petrol: 45 L
	Range	Up to 960 km (300 km CNG, 660 km petrol)
	Fuel Economy	CNG: 22.7 km/kg, with CO_2 emissions: 148 g/km
		Petrol: 14.7 km/l
Operating limits:		
	Payload	500 kg
	Total Weight	1345 kg

Table 2: Main characteristics of Fiat Fiorino Natural Power

1.3 Iveco – ECO Stralis NP (Natural Power)

Iveco ECO Stralis NP can be purchased as a LNG or CNG only version or a duel fuel configuration. Table 2 gives an overview of the three different types of the truck, and different Hp versions 400 and 460 respectively (here depicted 460 Hp). [4]

Three different types of fuel configuration can be chosen with three different final drive ratio (here the cheapest) and most expensive is 3.08 l/km. The Truck has the highest range of up to 1.500 km (930 miles) and CO2 savings potential of up to 4.770 kg of CO2 the first two years. [4]

Manufacturer:		Iveco
Performance		
Engine:		
	Type	Dual fuel CNG, LNG (Euro VI) 8,7 litre
	Torque	1.700 Nm
	Power	338 kW (450 Hp)
Acceleration:		
	Top speed	90 km/h
Fuel:		
	Storage	600 litres at 200 bar
	Range	Up to 1.500 km (LNG only) Up to 1.035 km (CNG+LNG) Up to 570 km (CNG only)
	Fuel Economy	2,64 l/km
Operating limits:		
	Payload	17.100 – 17.320 kg
	Total Weight	18.600 – 26.000 kg

Table 3: Main characteristics of Iveco Stralis NP

1.4 Iveco – Eurocargo

Iveco Eurocargo can be purchased as a CNG version only. Table 3 gives an overview of the different types of the truck, with different total weights (from 12.000 kg up to 19.000 kg). [5]

Manufacturer:	Iveco
Model	4x2
Performance	
Engine:	
Type	CNG
Torque	750 Nm
Power	150 kW (204 Hp)
Acceleration:	
Top speed	n.a. km/h
Fuel:	
Storage	480 litres
Range	400 km
Fuel Economy	n.a.
Operating limits:	
Total Weight	12.000 – 19.000 kg

Table 4: Main characteristics of Iveco Eurocargo

1.5 Iveco – Daily Natural Van

The Iveco Daily Natural van is a bi-fuel van meaning it can run on natural gas and petroleum. Its range is up to 350 km and maximum load of 965 kg [6]

It has mounted a 13-litre spare petroleum gas tank for emergencies, which enables it for extra range and capacity. [7] With a total payload of 965 kg it has a large storage space and can fulfil the day to day operations of a conventional delivery van.

Manufacturer:		Iveco
Model:		35S14-CNG
Performance		
Engine:		
	Type	Bi-fuel: CNG or petrol, 4 cylinder (Euro VI) 3 litre
	Torque	350 Nm (CNG) 230 Nm (petrol)
	Power	CNG: 100 kW (136 Hp) Petrol: 60 kW (82 Hp)
Acceleration:		
	Top speed	150 km/h
Fuel:		
	Storage	138 litre (CNG) 13 litre petrol reserve
	Range	Up to 350 km
	Fuel Economy	7,65 – 10,65 l/km
Operating limits:		
	Payload	650- 965 kg
	Total Weight	3.500 – 7.000 kg

Table 5: Main characteristics of Iveco Daily

1.6 Mercedes Benz Econic NGT

Below are shown the main characteristics of Mercedes-Benz Econic NGT. Exclusive performance shows Mercedes-Benz Econic NGT competitiveness with its diesel-powered counterparts. Moreover, either it runs on fossil based natural gas or renewable biogas, it ensures benefit to the environment due to the engine technology complying with Euro VI standards. Around 20% lower CO_2 emissions are produced in case of truck powered by CNG. [8]

Manufacturer:	Mercedes-Benz
Performance	
Engine:	
Type	Dedicated CNG (Euro VI), 7,7 litre
Torque	1200 Nm
Power	222 kW
Acceleration:	
Top Speed	90 km/h
Fuel:	
Storage	560 – 700 l at 200 bar
Range	Up to 350 km
Operating Limits:	
Payload	11.500 – 18.500 kg
Total weight	18.000 – 26.000 kg

Table 6: Main characteristics of Mercedes –Benz Econic

1.7 Mercedes-Benz Sprinter NGT

Mercedes-Benz Sprinter NGT can be purchased as a van or a flatbed. Table 7 gives an overview of the gas driven van, which can be both with the standard or long axle distance, 3.665 and 4.325 mm respectively. [9]

Both manual and automatic gearbox can be chosen, which determines fuel economy. The case of automatic gearbox is given. In addition, the van with a normal, high or extra high roof is available.

Manufacturer:	Mercedes-Benz	
Performance		
Engine:		
Type	Bi-fuel: CNG or petrol, 4 cylinder, 1.796 cm^3 (Euro IV)	
Torque	240 Nm	
Power	115 kW	
Fuel:		
Storage	CNG: 208 l Petrol: 100 l	
Range	CNG: 330 km Petrol: 740 km Total: 1070 km	
	Urban driving	**Mixed driving (urban and highway)**
Fuel economy	CNG: 4,9 – 5,0 km/m^3 Petrol: 5,5 – 5,6 km/l	CNG: 6,8 – 7,0 km/m^3 Petrol: 7,2 – 7,5 km/l
CO_2 emissions	254 – 263 g/km	317 – 329 g/km
	3.665 mm axle	**4.325 mm axle**
Operating Limits:		
Payload	1.230 – 1.300 kg	1.070 – 1.105 kg

Table 7: Main characteristics of Mercedes-Benz

Mercedez-Benz Sprinter NGT is based on bi-fuel technology, enabling to run either on gas or on petrol. Petrol should be used only to start the engine, which is then followed by the automatic shift to gas. On the other hand, petrol can also be used in case of running out of gas or to prolong the driving range. A shift to another type of fuel can be done manually by pressing a button. A driving range of up to 330 km on natural gas can be obtained. Since gas storage tanks are mounted under the floor, the cargo space is not reduced. [9]

1.8 Scania P Series

Scania takes the largest part of the Danish market regarding heavy-duty vehicles powered by natural gas. In Table 8, several models are presented with a difference in fuel economy and payload capacity. The same configurations are available for the trucks with the 250 kW/1600 Nm engine. [10]

Scania trucks are equipped with automatic gearbox. Trucks have 8 fuel tanks, 4 on each side. Each tank contains 80 l of CNG, resulting in 640 l in total, which is equivalent to 130 l diesel. The tank is made of composite material and is 400 kg lighter than a steel tank. [11]

Manufacturer:	Scania		
Model:	P280LA4x2	P280LB4x2	P280LB6x2
Performance			
Engine:			
Type	Dedicated CNG (Euro VI)		
Power	205 kW		
Torque	1350 Nm		
Acceleration:			
Top Speed	120 km/h		
Fuel:			
Storage	128 m^3	128 m^3	128 m^3
Pressure	220 bar	220 bar	220 bar
Range	275 km	325 km	275 km
Fuel economy	2,5 km/m^3	3 km/m^3	2,5 km/m^3
Operating Limits:			
Payload	10.000 kg	9.000 kg	15.000 kg
Total weight	18.000 kg	18.000 kg	26.000 kg
CO_2 emissions	825 g/km	687 g/km	825 g/km

Table 8: Main characteristics of Scania P-series

1.9 Scania P 280 CNG

The Scania P-series for waste collection trucks is a great alternative to the conventional P 280 model. Its main characteristics of performance can be seen in table 9. [12]

Scania's gas motors are developed to drive on both compressed natural gas (CNG) and liquid natural gas (LNG), plus a variable mix between the two. This means that when biogas becomes accessible to the transport sector via. the natural gas supply chain, customers can achieve a C02 reduction of up to 90% by switching the use of heavy transport vehicles, compared to conventional diesel trucks. [13]

Manufacturer:	Scania
Performance	
Engine:	
Type	CNG and LNG (Euro VI), 9 litre
Torque	1350 Nm (CNG)
Power	208 kW (280 hp)
Fuel:	
Storage	640 l at 200 bar
Range	450 km
Fuel Economy	CNG: 1,70 km/m3 v. 8,84 DKK/m3
Operating limits:	
Payload	18.000 - 26.000 kg

Table 9: Main characteristics of Scania P 280 CNG

1.10 Volkswagen (VW) –Caddy Van TGI Bluemotion

The Volkswagen Caddy Van TGI Bluemotion is a dual-fuel vehicle utilizing both gasoline and CNG, its main characteristics are presented in the table below. It has different fuel consumption patterns for urban, highway and mixed driving types. To optimize is fuel economy different driving styles is recommended for each type. [14, 15]

Manufacturer:		Volkswagen		
Performance				
Engine:				
	Type	Bi-fuel: CNG or petrol, 4 cylinder (Euro VI) 2 litre		
	Torque	200 Nm		
	Power	81 kW (110 Hp)		
Acceleration:				
	Top speed	174 km/h		
Fuel:				
	Storage	37 kg (CNG) 13 litre petrol reserve		
	Range	Up to 634-884 km (CNG)		
		Urban Driving	Highway Driving	Mixed Driving
	Fuel Economy	CNG: 5,3-5,7 kg/100 km or 8,1 -8,7 m3/100 km	CNG: 3,7-4,1 m3/100 km or 5,4 - 6,2 m3/100 km	CNG: 4,6-4,2 kg/100 km or 6,4 -7,2 m3/100 km
Operating limits:				
	Payload	684 kg		
	Total Weight	2.225-2.345 kg		

Table 10: Main characteristics of Volkswagen Eco

1.11 Volvo FE CNG

Volvo is about to launch their Volvo FE CNG, which is a counterpart of the conventional FE model. The main characteristics of performance can be seen in Table 11. [16]

Volvo FE CNG has 2x4 or 2x3 fuel tanks mounted on both sides of the chassis. Due to the fully automatic gearbox, it has similar productivity and driving performance as its diesel FE counterpart. Finally, it has a spark-ignition engine, which is suitable for running short distances with many starts and stops. Therefore, it is being applied for waste collection and urban distribution tasks.

Manufacturer:		Volvo
Performance		
Engine:		
	Type	Dedicated CNG (Euro VI), 9 litre
	Torque	1356 Nm
	Power	239 kW
Fuel:		
	Storage	Up to 160 m^3
	Range	400 km
Operating Limits:		
	Payload	19.000 – 26.000 kg

Table 11: Main characteristics of Volvo FE CNG

1.12 Volvo FH/FM

Even though LNG fuelled vehicles do not operate in Denmark, its market exists in several other European countries. Volvo FH and FM running on LNG or LBG is a huge step towards the liquefied gas roll-out. The main characteristics of performance can be seen in Table 12. [17, 18, 19]

Finally, it has a strong environmental profile and contributes significantly to reducing emissions. Replacing conventional diesel, Volvo predicts 20% reduction in emissions in case of using natural gas and 100% reduction in case of biogas, which is the most preferable. [17]

Manufacturer:	Volvo
Performance	
Engine:	
Type	G13C Euro 6, six cylinder, 13-liters
Torque	2100/2300 Nm (LNG)
Power	420/460 hp
Fuel:	
Storage	115 kg (275 l)/ 155 kg (375 l)/205 kg (495 l)
Range	550/750/1000 km
Fuel Economy	n.a.
Operating limits:	
Payload	n.a.

Table 12: Main characteristics of Volvo FM Methane-Diesel

1.13 Iveco URBANWAY CNG

This bus type runs on Compressed Natural Gas (CNG). The bus is available in different configurations, with lengths ranging from 10.5 m to 18 m. The buses are silent and have lower emissions, especially if fuelled with biogas [20,21]

Manufacturer:		Iveco
Performance		
Engine:		
	Type	C U R S O R 8 C N G E U R O V I
	Torque	1100-1300 Nm
	Power	213 kW (290 Hp) - 243 kW (330 Hp)
	Top Speed	100 km/h
	Range	700 km
Configurations:		
	Length	10.5 to 18 meters
	Fuel Economy	Depending on the type
	Fuel Storage	1280-1550 liters
Operating limits:		
	Passengers	Up to 93-163 passengers
	CO2 emission	n.a.
	Total weight	19.000-30.000 kg

Table 13: Main characteristics of Iveco Urbanwav

1.14 MAN Lions City A45 C LE

This bus type runs on Compressed Natural Gas (CNG). It can be purchased in two models Low Entry (LE) and Low Floor (LF). Here is depicted the Low Entry model, its main characteristics are shown below in table 14. [22]

The Lion's City low floor city buses are an answer to the questions facing us in the future. They are cleaner and more fuel-efficient than ever before and use the environmentally friendly Euro 6 exhaust technologies that currently apply from legislation. [23] Its CO^2 emissions are as such less than diesel-powered busses of 1.139 g/km, whereas the average CO_2 emission for all buses is 822 g /km. [24]

This shows that some busses are over and under this limit, so there are diesel busses with a higher level than the average as well, therefore CNG is still a more sustainable option for the future.

Manufacturer:		MAN
Performance		
Engine:		
	Type	CNG (Euro VI), 9 litre
	Torque	1100 - 1600 Nm
	Power	228 kW (310 Hp)
	Top Speed	85 km/h
	Range	700 km
Configurations:		
	Length	10.5 to 18.75 meters
	Doors	2-2-2
	Fuel Economy	CNG: 2.3-3 km/kg
	Fuel Storage	CNG: 410 Nm^3
Operating limits:		
	Passengers	Up to 83 passengers
	CO2 emission	CNG: 1139 g/km
	Total weight	24.000 kg

Table 14: Main characteristics of MAN Lions City A45 C LE

1.15 Mercedes-Benz Citaro NGT (Natural Gas Technology)

This bus type runs on natural gas technology or compressed natural gas (CNG). It can be purchased in two models the Citaro NGT rigid bus and the Citaro G NGT articulated bus. The Citaro NGT rigid bus's main characteristics can be seen in table 15. [25]

The natural-gas engine from Mercedes-Benz sets new standards in terms of environmental friendliness – its CO2 Life Cycle Assessment improves on that of a diesel engine by more than 20 percent. Using biogas to power, the bus makes the CO2 situation even more attractive because driving it becomes almost CO2-neutral, because of biogas returning to the natural life cycle. [26]

Manufacturer:		Mercedes-Benz
Performance		
Engine:		
	Type	CNG (Euro VI), 7,7 litre
	Torque	1200 Nm (CNG)
	Power	CNG: 222 kW (302 Hp)
Configurations:		
	Length	11,9 – 17,9 meters
	Doors	2-2-0
Operating limits:		
	Passengers	Up to 96 seated
	Total weight	19.000 kg

Table 15: Main characteristics of Mercedes-Benz Citaro NGT

1.16 Scania Interlink LD

There are three types in the new Scania Interlink-family: Low Decker (LD), Medium Decker (MD) and High Decker (HD). The characteristics for the LD version is in Table 16 below. [27]

Common to all three types are that they have Scania characteristic design in the front and back. The uniquely designed front, which reduces weight and turning circle, will lower the fuel consumption and the noise level. All busses are designed with the intention to use the cabinet best possible, so the highest achievable passenger capacity in its class can be reached. As an addition to this, the trunk capacity also aims for best in class. [28]

The bus is certified with the environmental friendly Euro 6-gasmotors, which is in line with the strictest EU requirements. This Euro 6-gasmotor has great performance and is highly stabile in operation. [28]

Manufacturer:		Scania
Performance		
Engine:		
	Type	CNG, LNG and Biodiesel (Euro VI), 9 litre
	Torque	1350 Nm (CNG) 1250 (Biodiesel)
	Power	CNG: 208 kW (280 hp) Biodiesel: 186 kW (250 hp)
Configurations:		
	Length	10,9 - 13,2 meters
	Doors	1-2-0
Operating limits:		
	Passengers	Up to 71 seated

Table 16: Main characteristics of Scania Interlink LD

1.17 Scania Citywide LE

This bus type runs on Bioethanol, Biodiesel and Compressed Natural Gas (CNG). It can be purchased in two models Low Entry (LE) and Low Floor (LF). Here is depicted the Low Entry model, its main characteristics are shown below in table 17. [29]

Operators and the authorities prefer Biogas because of several reasons; emissions are low and the engine's noise level are reduced considerably. Scania development section has optimized the gas motor, so the efficiency is almost identical to that of a conventional diesel engine. CO2 reductions are therefore 100% by using 100% pure biogas. [30]

Manufacturer:		Scania
Performance		
Engine:		
	Type	CNG, Bioethanol and Biodiesel (Euro VI), 9 litre
	Torque	1350 Nm (CNG) 1200 (Bioethanol) 1600 (Biodiesel)
	Power	CNG: 208 kW (280 hp) Bioethanol: 208 kW (280 hp) Biodiesel: 240 kW (320 hp)
Configurations:		
	Length	12 – 18.1 meters
	Doors	2-2-1
	Fuel Storage	CNG: 1.280 liter
Operating limits:		
	Passengers	Up to 93 seated
	Total weight	18.800 kg

Table 17: Main characteristics of Scania Citywide LE

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About Biogas2020

Biogas2020 is a partnership project within the EU-program Interreg Öresund-Kattegat-Skagerrak. The goal is to build strong networks throughout the biogas value chain. To reach this goal, one objective of the project is to develop a Scandinavian biogas platform where industry players can grow in partnership.
The project encompasses three countries and three regions taking a major step forward together, despite being in different situations and different stages in developing their biogas industry. The project 34 partners work on expanding biogas production, improving processes and creating infrastructure.
Within the project, NTU ApS is the lead partner of Work Package 5 concerning the use of biogas for heavy transport. The activities within this WP include, among others, examining national and international funding opportunities, mobilizing the stakeholder network, setting up a biogas station map, presenting best practices, analyzing business models, disseminating knowledge on biogas use through articles.

http://biogas2020.se/

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