Current status and future of certified biofuels in renewable mobility

2nd COMSYN WORKSHOP
Future of BTL products in the EU

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In Prague, 23th May 2019

Agenda

- Background
  - LEGISLATION
    - Mandates in CZ
    - Mandates in GER
    - RED II
  - CHARACTERISTICS OF BIOFUELS
  - RENEWABLE ENERGY IN TRANSPORT
    - In CZ
    - In EU
- Balance of biodiesel in CZ
- Balance of ethanol in CZ
- Balance of sugar beet and cereals
- Technology overview
- E-Fuels
- Conclusion

Biofuel and energy from renewable sources for transport mandates in the CZ, 2016 – 2020

	Shares of biofuels and renewable electricity in transportation of total consumption (% cal)	Obligation to reduce total GHG emissions by [1), 5)] (%)	Biodiesel [1), 6)] (% vol)	Bioethanol [1), 6)] (% vol)	Double counting [1)]
2014 - 2016		2	6	4.1	No
2017		3.5			
2018		3.5			
2019		3.5 [3), 4)]			Yes [2)]
2020	10	6 [3), 4)]			

- ILUC, RED, FQD Directive
- Not implemented in the law

[1)] According to act No. 201/2012 coll., on air protection, as amended by act No. 172/2018 coll.
[2)] Double counting for: biofuels from used cooking oil, animal fats classified as categories 1 and 2 accordance with Regulation (EC) No. 1069/2009 of the EP and of the Council, and low indirect land-use change-risk biofuels (advance biofuels).
[3)] The possibility of using liquefied petroleum gas (LPG), compressed natural gas (CNG), liquefied natural gas (LNG), high-percentage blends of bio- and fossil fuels and pure biofuels, electricity, hydrogen.
[4)] To take into account upstream emission reduction (UER) of greenhouse gases claimed by a supplier – max. 1 %.
[5)] Penalty – failing to meet the obligations (reduce total GHG emissions) in sanctioned 10 CZK per kg CO2eq the failure to fulfil obligations which caused.
[6)] Penalty – 40 CZK per liter of non-delivered certified biofuel

Current excise tax rates for transport fuels in CZ in CZK/thousand litres

Petrol fuel	Diesel fuel	High FARME diesel fuel B30	Ethanol E85 fuel *)	Vegetable oil	FAME /FARME	High HVO diesel fuels HVO 30 *)
12 840	10 950	8 515	10 970	1 610	2 190	7 665

*) This is the amount of tax refund that corresponds to the bioethanol content of petrol and HVO (min. 30% V/V) in diesel after being put into free tax circulation.

Biofuel and energy from renewable sources for transport mandates in Germany, 2014 – 2025

	% Cal	% GHG reducing (BImSchG)*	Cap on crop based biofuel (% cal)	2nd Generation (% cal)	Double counting
2009-2014	6.25 overall 4.4 biodiesel 2.8 bioethanol	-	-	-	2011-2014 HVO, UCOME only; TME excluded
2015-2016		3.5			No
2017		4.0			
2018-2019			6.5		
2020		6.0		0.05 a)	
2021				0.1 b)	
2022-2023				0.2 c)	
2025 and onwards				0.5	

Failing to meet the mandates is sanctioned with the following penalties:

Year	Penalty
2009-2014[1]:	Biodiesel: 19 Euro per GJ underallocated Bioethanol: 43 Euro per GJ underallocated
2015 [2]	0.47 Euro per kg CO_{2eq} underallocated

Source: § 37c (2) Federal Act on Protection against Air Pollution (Bundes-Immissionsschutzgesetz)

Sources:

§ 37a Federal Act on Protection against Air Pollution (Bundes-Immissionsschutzgesetz) http://www.gesetze-im-internet.de/bimschg/__37a.html

§13 +14 of the 38th Implementation Ordinance on the Federal Act on Protection against Air Pollution
http://www.gesetze-im-internet.de/bimschv_38_2017/__13.html
http://www.gesetze-im-internet.de/bimschv_38_2017/__14.html

** Percentage of GHG savings of total fuel use (fossil and renewable) compared to the hypothetic GHG emissions had all the fuel been of fossil origin*

a) Companies that put on the market 20 PJ or less of biofuels in the previous year are exempted

b) Companies that put on the market 10 PJ or less of biofuels in the previous year are exempted

c) Companies that put on the market 2 PJ or less of biofuels in the previous year are exempted

Double counting expired at the end of 2014 with the transition to a GHG reduction mandate. Since then, HVO and UCO based biodiesel enjoy competitive advantages only based on their higher GHG reduction compared to first generation biofuels.

Only in Germany and Czech Republic GHG reduction stated by law.

Background – LEGISLATION – RED II

	EU Directive 2018/2001-RED II
Share of renewable energies in total energy consumption by 2030	32 % e.o.
Share of renewable energies in transport by 2030 in total energy consumption in transport	14 % e.o.
Share out of it - biofuels produced from feedstock and advanced biofuels and e-fuels listed in Part A of Annex IX	1,75 % e.o. multiplier 2
Share out of it - biofuels produced from biowaste feedstock and other biofuels listed in Part B of Annex IX	1,7 % e.o. multiplier 2
Share out of it - conventional biofuels from food and feed feedstock (1st generation)	Basis 2020 + 1% e.o. Cap max. 7 % e.o.
Other multipliers for counting to the transport target	Renewable elektricity in road transport - multiplier 4. Renewable energy in rail and other transport - multiplier 1,5 Renewable energy in aviation and shipping - multiplier 1,2
65% GHG mitigation potential for new plants by 2021	
Sub-target for advanced biofuels from Part A of Annex IX: 2x0,1% in 2022 and at least 2x0,5% in 2025 and at least 2x1,75% in 2030	

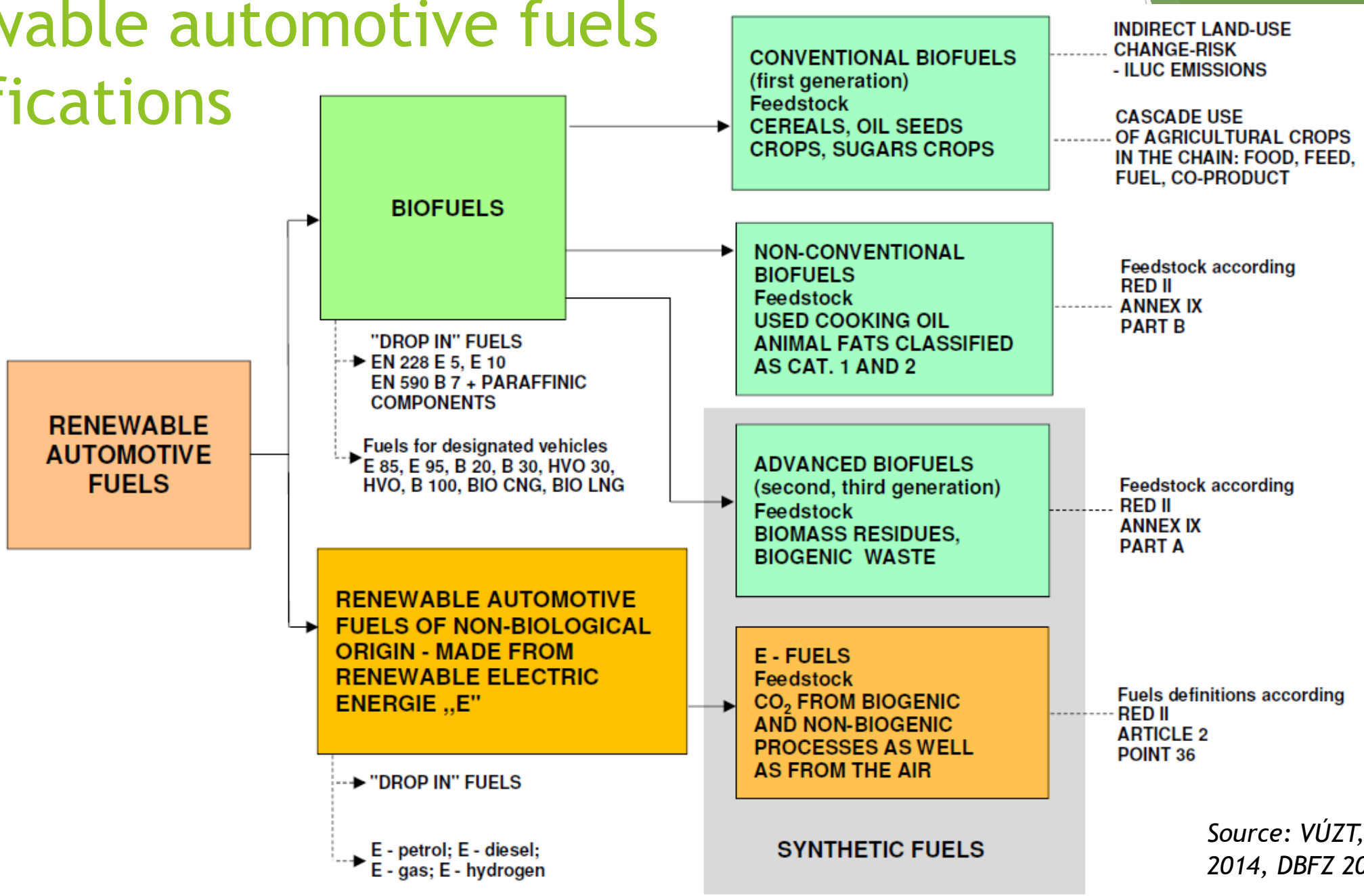
Fig. 2: Positive list for residual and waste materials as per Annex IX Part A and B RED II

Part A. Raw materials for producing modern biofuels with double counting of the energy content
Biological waste in the sense of Article 3 Paragraph 4 of the directive 2008/98/EC from private households; Biomass share of industrial waste which is unsuitable for use in the food or animal feed chain, including material from wholesale and retail, the agri-food industry as well as the fish and aquaculture industry and exclusively the raw materials listed in Part B of this Annex; Straw, dung/manure and sewage sludge; wastewater from palm oil mills and palm empty fruit bunches; tall oil and tall oil pitch; raw glycerol; bagasse; grape marc and wine lees; nut shells; husks, cobs; biomass shares of waste and residues from the forestry sector and forest-based industries, i.e. bark, branches, pre-commercial thinning material, leaves, needles, treetops, sawdust, wood shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil
Part B. Raw materials for producing biofuels that can be counted with double their energy content:
- used cooking oil - animal fats, Categories 1 and 2

Source: EU Commission, 2016/0382 (COD) / Status: 21.06.2018

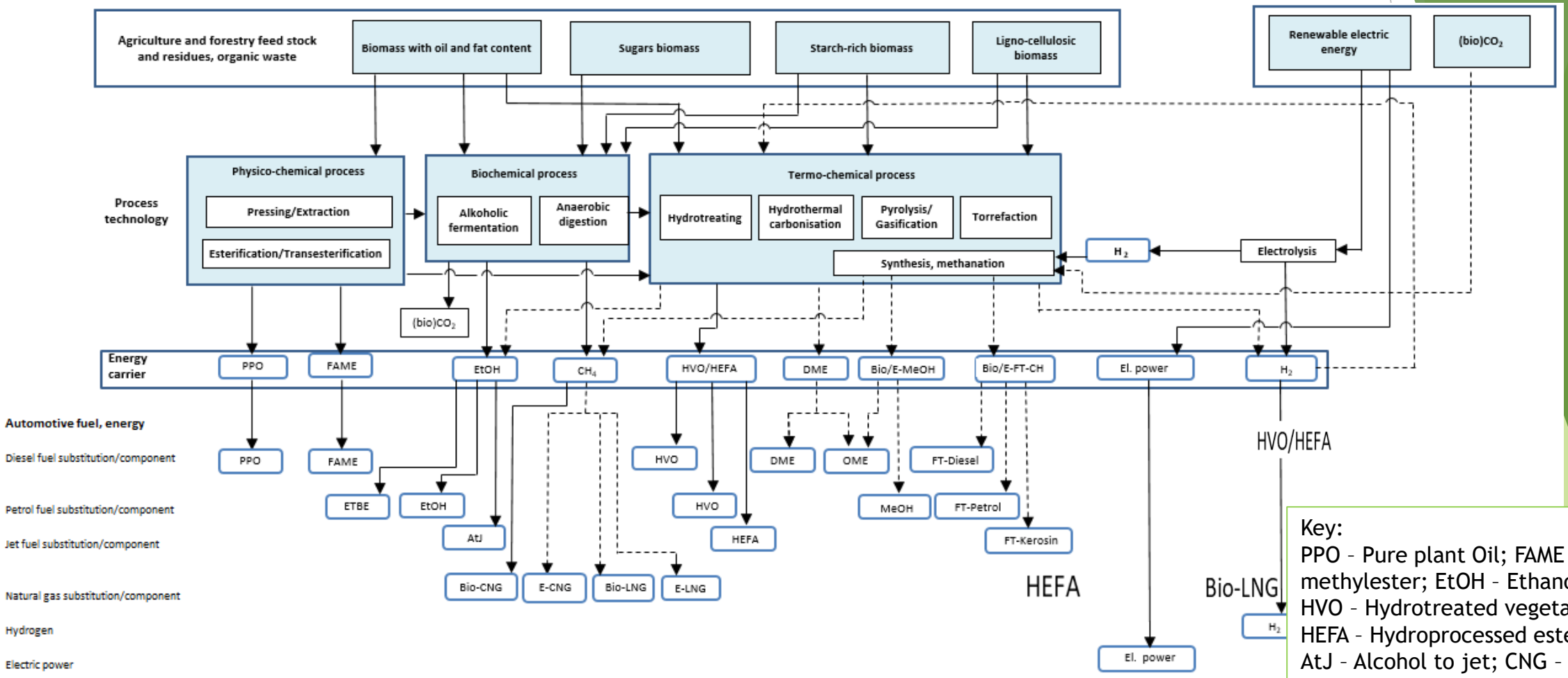
Background – CHARACTERISTICS OF BIOFUELS

Renewable automotive fuels specifications



Source: VÚZT, v. v. i. (RIAE) 2014, DBFZ 2016, 2019

Pathways and synergies sustainable biofuels and renewable transport fuels of non biological origin production



Key:
PPO – Pure plant Oil; FAME – Fatty acid methylester; EtOH – Ethanol; CH_4 – Methan; HVO – Hydrotreated vegetable oil; HEFA – Hydroprocessed esters and fatty acids; AtJ – Alcohol to jet; CNG – Compressed natural gas; LNG – Liquefied natural gas; DME – Dimethylether; OME – Oxymethylenether; ETBE – Ethyl-tertio-butyl-ether; MeOH – Methanol; FT-CH – Fischer Tropsch hydrocarbon; H_2 – Hydrogen

Source: VÚZT, v. v. i. (RIAE) 2014, DBFZ 2016, 2019

BACKGROUND – RENEWABLE ENERGY IN TRANSPORT

- IN CZECH REPUBLIC
- IN EU

Background – Fuels and biofuels balance from GHG emissions Report in 2017 in CZ – Part 1

	Delivered to the market	Net calorific value
Diesel fuel	5 073 494 152.00 (l)	35.9 (MJ)
Petrol fuel	2 017 440 602.80 (l)	32.2 (MJ)
LPG	112 866 000.00 (kg)	46.0 (MJ)
CNG	43 912 367.00 (kg)	45.1 (MJ)
Biodiesel [1)]	334 462 261.90 (l)	33.0 (MJ)
Bioethanol [2)]	97 515 463.10 (l)	21.0 (MJ)
HVO	3 608 372.00 (l)	34.0 (MJ)

Source: Ministry of the Environment

[1)] Customs officers: 340 274 319.00 (l)

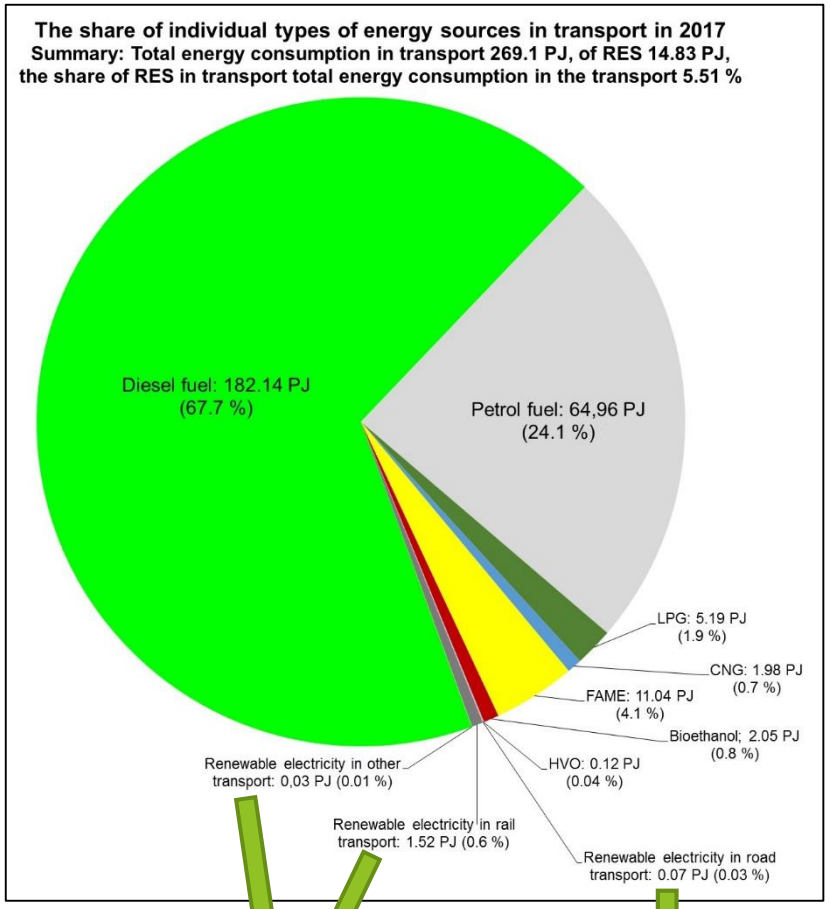
[2)] Customs officers: 95 515 412.74 (l)

The balance of renewable electricity in transport in 2017

Renewable electricity in road transport	0.0682 (PJ)
Renewable electricity in rail transport	1.5184 (PJ)
Renewable electricity in other transport	0.0306 (PJ)

Source: Ministry of Industry and Trade

Background – Fuels and biofuels balance from GHG emissions Report in 2017 in CZ – Part 2



RED II multiplier 1,5x

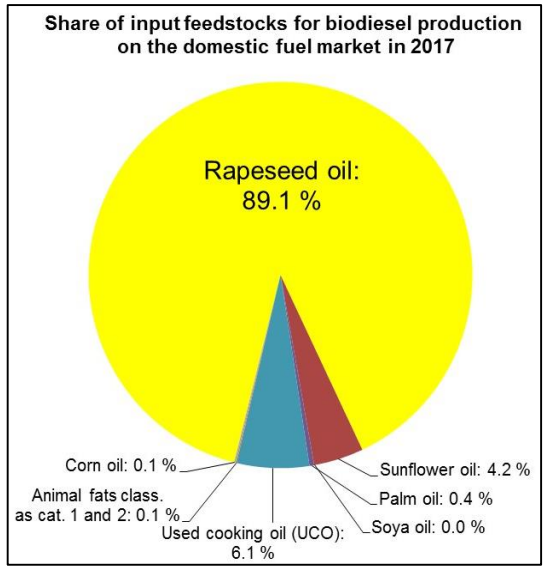
RED II multiplier 4x

Diesel fuel	182.14	PJ	67.68%	94.49%	94.49%
Petrol fuel	64.96	PJ	24.14%		
LPG	5.19	PJ	1.93%		
CNG	1.98	PJ	0.74%		
Biodiesel	11.04	PJ	4.10%	5.51%	4.91%
Bioethanol	2.05	PJ	0.76%		
HVO	0.12	PJ	0.05%		
Renewable electricity in road transport	0.07	PJ	0.03%		0.60%
Renewable electricity in rail transport	1.52	PJ	0.56%		
Renewable electricity in other transport	0.03	PJ	0.01%		
Total	269.10	PJ	100.00%	100.00%	100.00%

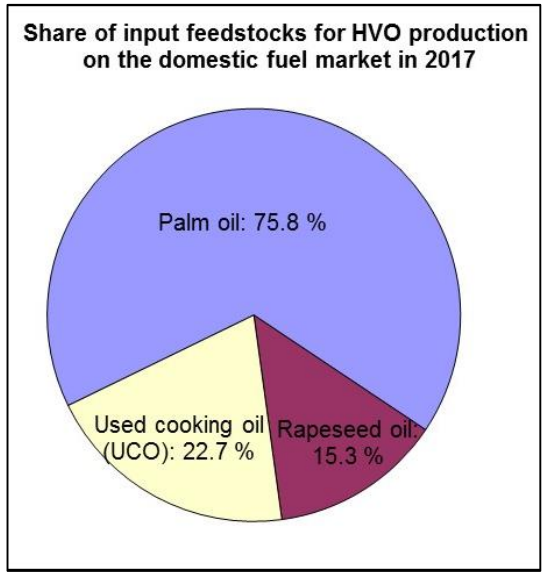
- Share of RES in transport total energy consumption in transport = 5,51%
  - Related to 10% transport target by 2020 in RED Directive
  - Related to 14% in RED II incl. multiplier
- Share of electricity 0,601% in total
  - Road transport 0,07 x 4 = 0,28 PJ
  - Other and rail (1,52+0,03) x 1,5 = 2,32 PJ

0,965%

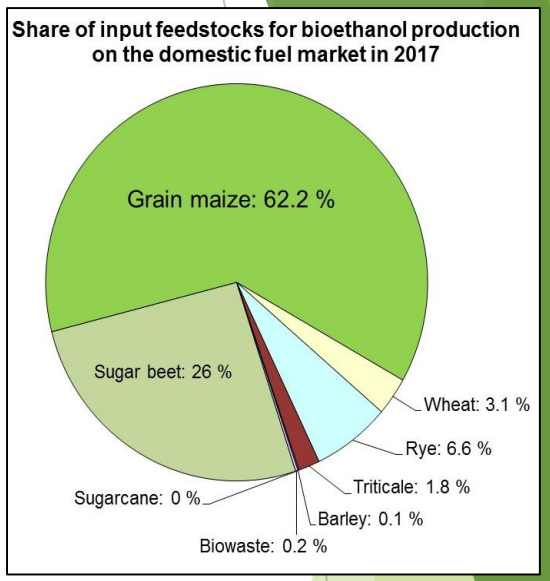
Background – Fuels and biofuels balance from GHG emissions Report in 2017 in CZ – Part 3



83,6 %



0,9%



15,5%

CONVENTIONAL	NON-CONVENTIONAL	CONVENTIONAL	NON-CONVENTIONAL	CONVENTIONAL	NON-CONVENTIONAL
PJ	%	PJ	%	PJ	%
10.331	93.60%	2.043	99.76%	0.095	77.33%
0.706	6.40%	0.005	0.24%	0.028	22.67%

CONVENTIONAL	12.47	4.63%
NON-CONVENTIONAL	0.74	0.27%
TOTAL	13.21	4.91%

Others biofuels

- Conventional — RED II — cap max 7%
- Non-conventional – Other biofuels — RED II (Annex IX, PART B) — 1,7%, multiplier 2
  - 0,74 x 2 = 1,48 PJ

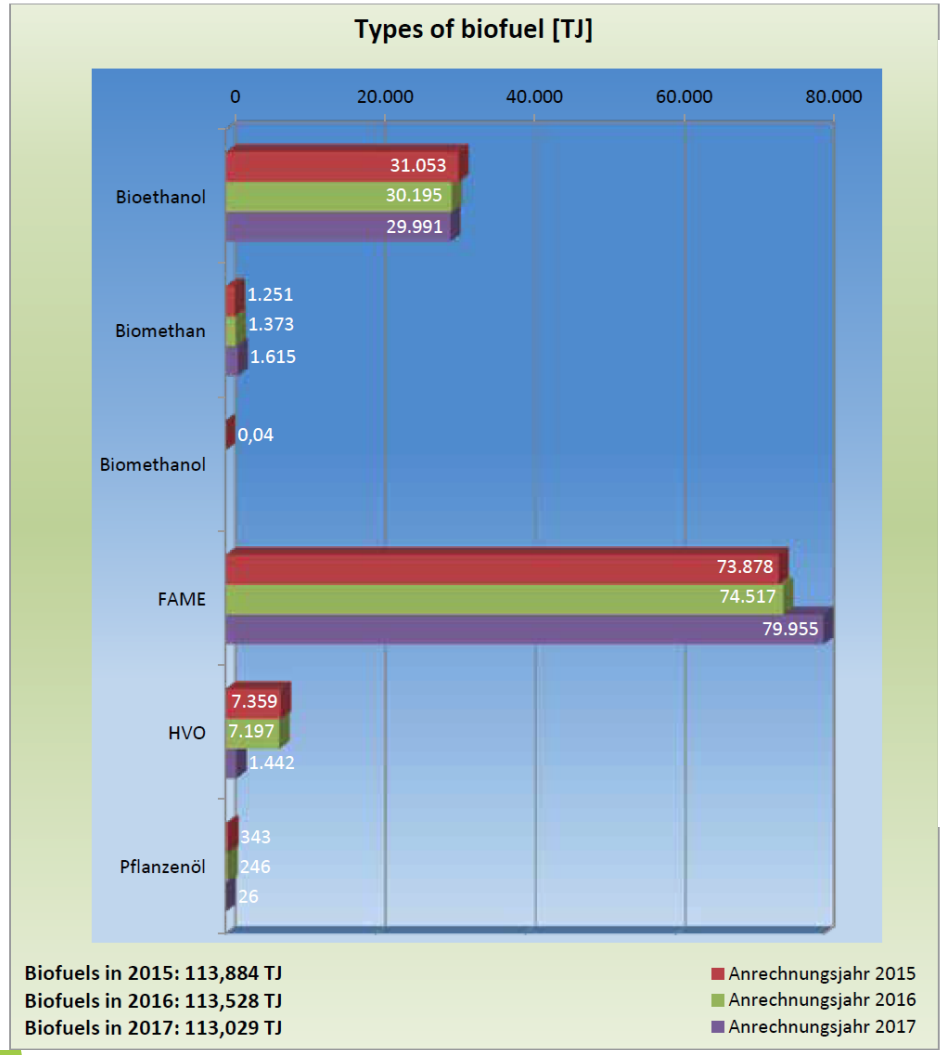
0,55%

4,63%+0,55%+0,965%= **6,145%**

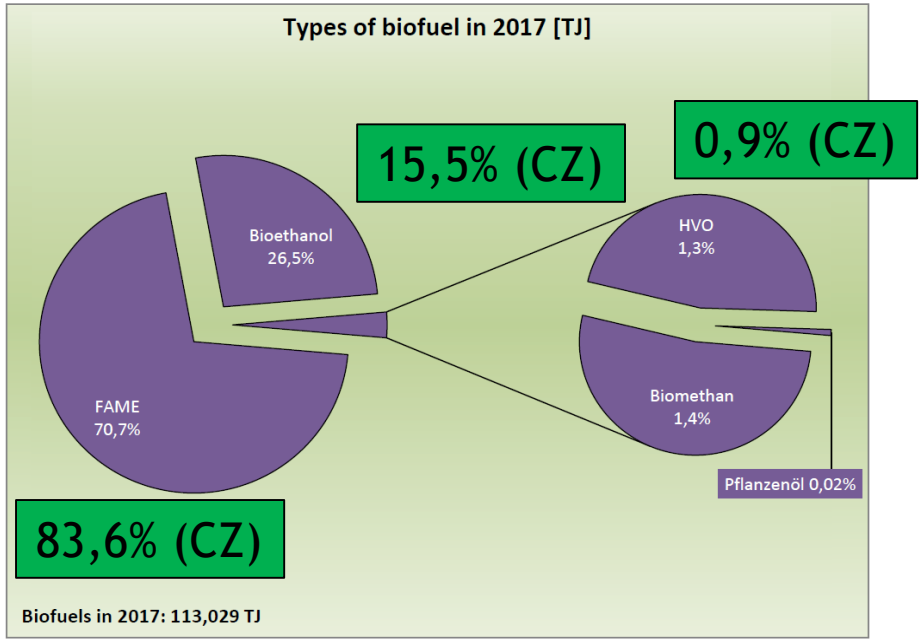
Fuels and biofuels balance from GHG emissions Report in 2017 in EU

The proportion of FAME (biodiesel) increased by 7.3% compared to the previous year. The proportion of bioethanol on the other hand decreased slightly, by 0.7%.

The most significant change was the 80% decline in hydrogenated vegetable oil (HVO).



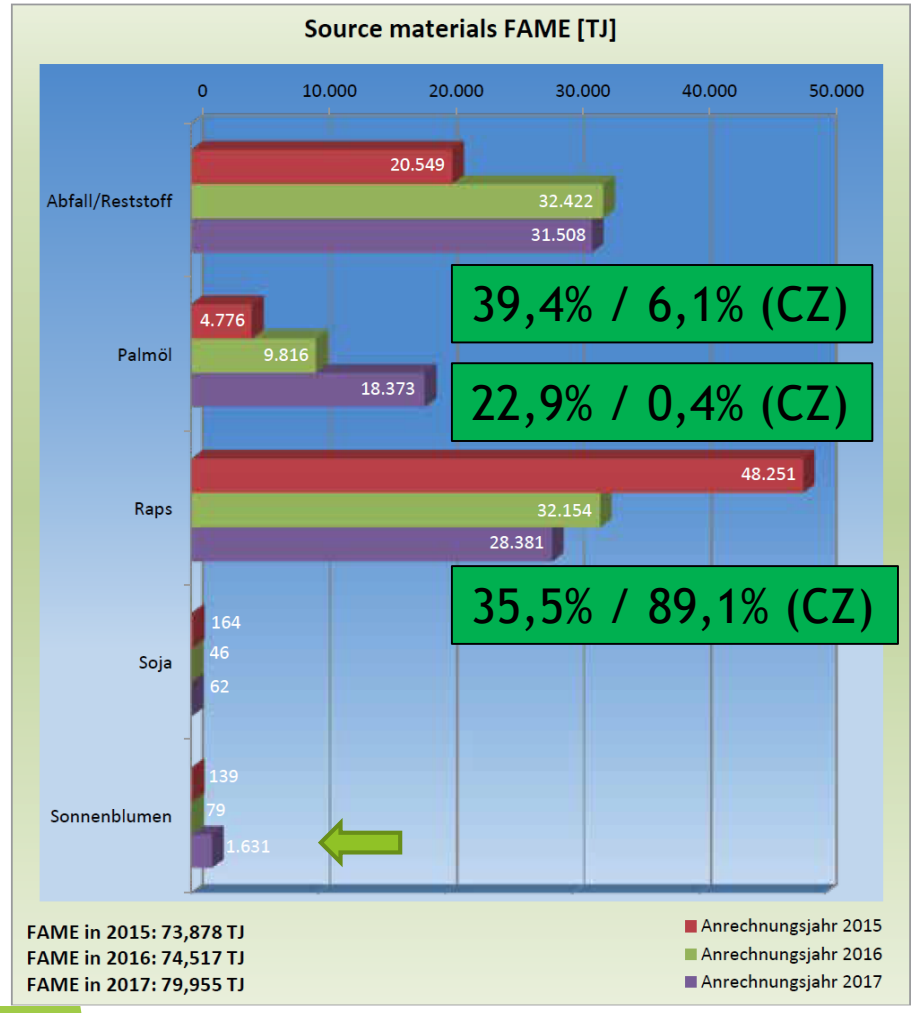
The following diagram shows the percentages of biofuel types in 2017.



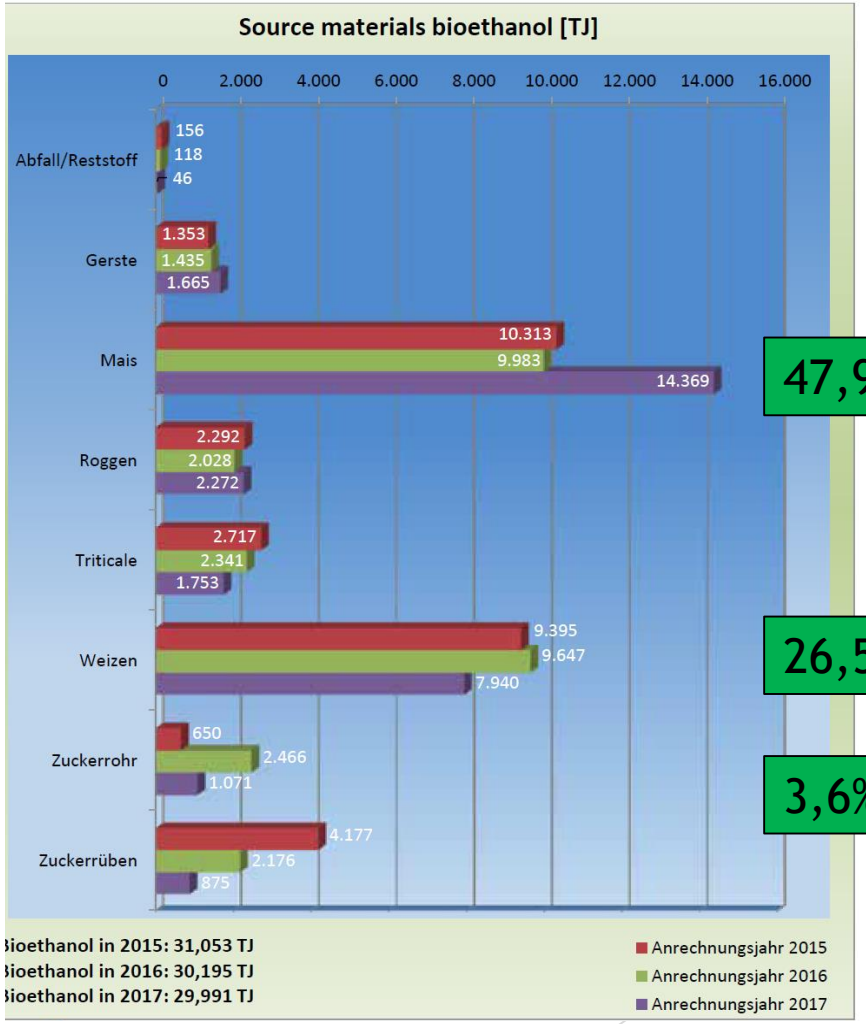
Source: Federal Office for Agricultural and Food, Germany, 2018, Sept.

Fuels and biofuels balance from GHG emissions Report in 2017 in EU

As in the previous year, the highest proportion of **FAME (biodiesel)** came from waste and residues (-2.8%). The proportion from rapeseed declined, though it was once again the second most important source material (-11.7%). The proportion of FAME made from palm oil increased massively – by 87.2% – having already doubled its share the previous year. Sunflowers also grew in terms of their importance in the reporting year, with volumes increasing by a factor of more than twenty.



Less bioethanol was used in the reporting year. Maize was already used as the major urce material for bioethanol production in the previous year, but increased signifintly by 43.9% in the reporting year. However, the proportion of the second most gnificant source material, wheat, fell slightly, by 17.7%. The three other cereals – e, triticale and barley – remained at the same level as in the previous year, when ken together. On the other hand, the reduction in sugar cane (-58,8%), sugar beet (-,8%) and waste and residues materials (-60,7%) is striking.



Source: Federal Office for Agricultural and Food, Germany, 2018, Sept.

Fuels and biofuels balance from GHG emissions Report in 2017 in GERMANY

Compared with the previous year, only about one-fifth of the hydrogenated vegetable oil (HVO) was counted towards the greenhouse gas reduction quota. The proportion of palm oil fell by 80.3%. The proportion of waste and residues also declined, by 70.3%. They consisted of effluent from the treatment of palm oil (POME) and represented 5.5 % of the total volume of HVO.

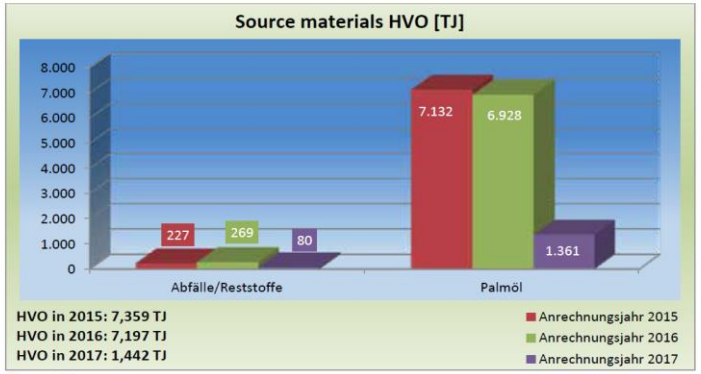
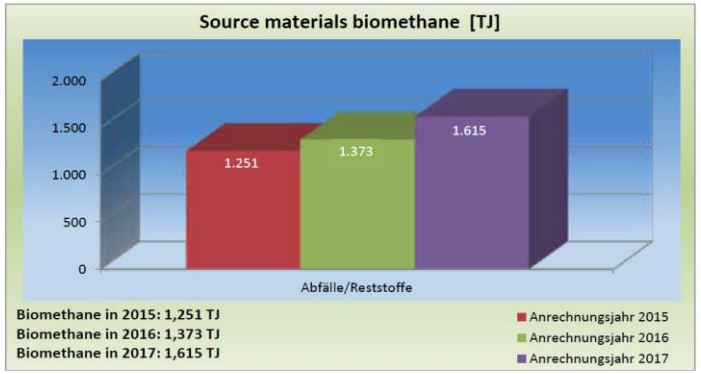


Figure33

The biomethane counted towards the German greenhouse gas reduction quota consisted solely of waste and residues. The volume increased by 17.6% compared to the previous year.



- Methan higher usage then HVO

Source: Federal Office for Agricultural and Food, Germany, 2018, Sept.

Balance FAME/FARME B100, B30 and HVO/HEFA of the Czech Republic in 2010 – 2018

	2010 (t)	2011 (t)	2012 (t)	2013 (t)	2014 (t)	2015 (t)	2016 (t)	2017 (t)	2018 (t)	Index 2018/2017
Domestic production of FAME/FARME [1)]	197 988	210 092	172 729	181 694	219 316	167 646	148 832	157 429	194 278	1.23
Import of FAME/FARME	84 609	99 661	119 873	125 815	119 033	201 899 [4)]	163 658 [4)]	164 668 [4)]	194 348	1.25
Export of FAME/FARME [1)]	35 232	16 796	6 703	43 216	35 221	67 623	40 823	18 196	74 448	4.09
Gross domestic consumption of FAME/FARME [2), 3)]	247 090	290 583	283 825	268 348	301 168	303 329 [4)]	271 196 [4)]	303 531 [4)]	314 324	1.04
FARME/B100 as pure fuel [2)]	25 150	31 669	56 312	63 467	107 112	108 480	173	36	1 000	27.78
High FARME diesel fuel B30 [2)]	105 960	155 812	131 023	124 125	157 404	135 106	86	44	0	-
HVO/HEFA for blending [2)]	-	199	1 034	1 246	1 273	1 371	1 718	2 171	2 547	1.17

2nd highest import

highest export

constantly growing

[1)] Source: Ministry of Industry and Trade - Eng (MPO) 6-12
[2)] Source: General Customs Directorate
[3)] Take into account beginning and ending stocks
[4)] Revised
Notice: For this balance of use value the density at 15 oC: FAME/FARME: 891.9 kg/m3, B30: 853.6 kg/m3, diesel fuel: 837.2 kg/m3.
HEFA: Hydrogenated Esters of Fatty Acids

Balance of oilseed rape used for production of FARME of the Czech Republic in 2010 – 2018

	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	Index 18/17
Production of FAME: [1]	t	197 988	210 092	172 729	181 694	219 316	167 646	148 832	157 429	194 278	1.23
of which FARME		186 268	197 492	159 979	181 694	217 315	167 646	148 432	152 291	140 463	0.92
Oilseed rape consumption for FARME production [2]	t	460 082	487 805	395 148	448 784	536 768	414 086	366 627	376 159	346 944	0.92
Rape harvest area [3]	ha	368 824	373 386	401 319	418 808	389 298	366 180	392 991	394 262	411 802	1.04
Oilseed rape yield [3]	t/ha	2.83	2.80	2.76	3.45	3.95	3.43	3.46	2.91	3.43	1.18
Oilseed rape production [3]	t	1 042 418	1 046 071	1 109 137	1 443 210	1 537 320	1 256 212	1 359 125	1 146 224	1 410 769	1.23
Oilseed rape field area, with the given yield, allocated for the production of FARME	ha	162 573	174 216	143 170	130 082	135 891	120 725	105 962	129 264	101 150	0.78
Share of oilseed rape field area used for FARME production out of the total oilseed rape field area	%	44.1	46.7	35.7	31.1	34.9	33.0	27.0	32.9	24.6	0.74

lowest production

significant decrease

lowest share

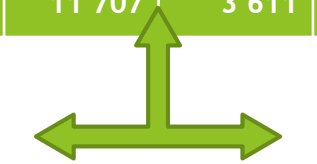
[1] Source: Ministry of Industry and Trade - Eng (MPO) 6-12

[2] Source: RIAE, p.r.i. & ABP with regard to effectiveness of obtaining of rapeseed oil and its transesterification - oilseed rape 2.47 kg for production of 1 kg FARME

[3] Source: Czech Statistical Office

Balance bioethanol, ETBE and ethanol E85 of the Czech Republic in 2010 – 2018

	2010 (t)	2011 (t)	2012 (t)	2013 (t)	2014 (t)	2015 (t)	2016 (t)	2017 (t)	2018 (t)	Index 2018/2017
Domestic production [1)]	94 523	54 412	102 195	104 488	104 112	99 725 [4)]	110 740 [4)]	86 900 [4)]	75 096	0.86
Import	15 441	30 411	5 184	1 980	4 010	14 531	12 535	19 704	3 055	0.16
Export [1)]	36 556	7 378	37 940 [4)]	40 782 [4)]	37 812 [4)]	37 066 [4)]	52 489	30 160	3 071	0.10
Gross domestic consumption [2), 3)]	74 118	73 676	68 295	63 125	70 700	68 633	63 312	75 848	79 835	1.05
ETBE for blending [2)]	15 352	6 609	8 190	6 863	8 629	5 279	10 223	19 747	26 497	1.34
Automotive ethanol E85 fuel [2)]	4 266	7 807	15 094	21 553	22 585	11 707	3 611	3 412	2 865	0.84



[1)] Source: Ministry of Industry and Trade - Eng (MPO) 6-12
[2)] Source: General Customs Directorate
[3)] Take into account beginning and ending stocks
[4)] Revised
Notice: For this balance of use value the density at 15 °C: bioethanol 777.8 kg/m³, ETBE 750 kg/m³, ethanol E85 (77.27 % V/V bioethanol) 770.2 kg/m³, gasoline 744.2 kg/m³

Balance of sugar beet and cereals used for the production of bioethanol fuel in 2010 – 2018 – Part 1

	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production of bioethanol fuel from [1]	t	94 523	54 412	102 195	104 488	104 112	99 725 [4]	110 740 [4]	86 900 [4]	75 096
- technical sugar beet		57 814 [2]	54 412	69 920	80 852	66 000	51 813 [4]	64 928 [4]	34 554 [4]	53 395
- wheat		36 709 [2]	-	-	-	2 875	-	-	-	-
- corn grains		-	-	32 275	23 636	35 234	47 912 [4]	45 812	52 346	21 701
Consumption of starting materials for bioethanol from	t	676 424	636 620	818 064	945 968	772 200	606 212 [4]	759 658 [4]	404 282 [4]	624 722
- technical sugar beet		121 140	-	-	-	9 497	-	-	-	-
- wheat		-	-	103 603	75 872	113 101	153 798 [4]	147 057	168 031	69 660
- corn grains										
Harvest areas of [3]	ha									
- technical sugar beet		56 400	58 300	61 161	62 401	62 959	57 612	60 736	66 101	64 760
- wheat		833 600	863 100	815 381	829 393	835 941	829 820	839 710	832 062	819 690
- grain maize		103 300	109 700	119 333	96 902	98 749	79 972	86 407	85 995	81 851
Yield: [3]	t/ha									
- technical sugar beet		54.36	66.84	63.26	60.00	70.28	59.38	67.81	66.56	57.51
- wheat		4.99	5.79	4.32	5.67	6.51	6.36	6.50	5.67	5.39
- corn grains		6.71	8.12	7.78	6.97	8.43	5.54	9.79	6.84	5.98

Balance of sugar beet and cereals used for the production of bioethanol fuel in 2010 – 2018 – Part 2

	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production: [3]										
- technical sugar beet	t	3 065 000	3 899 000	3 868 829	3 743 772	4 424 619	3 421 035	4 118 356	4 399 521	3 724 309
- wheat		4 161 600	4 993 400	3 518 896	4 700 696	5 442 349	5 274 272	5 454 663	4 718 205	4 417 841
- corn grains		692 600	890 500	928 147	675 380	832 235	442 709	845 765	588 105	489 154
Area:										
- technical sugar beet		12 443	9 525	12 932	15 766	10 987	10 209 [4]	11 203 [4]	6 074 [4]	10 863
- wheat		24 277	-	-	-	1 459	-	-	-	-
- grain maize	ha	-	-	13 317	10 886	13 416	27 761 [4]	15 021	24 566	11 649
whit the given yield, allocated for the production of bioethanol										
Share of area										
- technical sugar beet		22.0	16.3	21.1	25.3	17.5	17.7 [4]	18.4 [4]	9.2 [4]	16.8
- wheat		2.9	-	-	-	0,2	-	-	-	-
- grain maize	%	-	-	11.2	11.2	13.6	34.7	17.4	28.6	14.2
used for bioethanol production out of the total area										

[1] *Source: Ministry of Industry and Trade - Eng (MPO) 6-12*
[2] *Source: The Union of Ethanol Producers of the Czech Republic*
[3] *Source: Czech Statistical Office*
[4] *Revised*

TECHNOLOGY - Overview conversion for advanced biofuels production and development

	Technological process	Input feedstock	Product	Development status and traffic	Wearer or knowledge about technology
Biomethan	Anaerobic fermentation and purification	Residual biomass, biowaste	CH_4	Production in operation	Many operating technologies
	Pyrolysis, gasification				
PtG - Power to Gas	Electrolysis by renewable electricity	H_2O CO_2 H_2		Pilot	DECHEMA
PtL - Power to Liquid	Electrolysis by Renewable Electricity, FT synthesis (catalysis)	H_2O, CO_2, H_2	Diesel fuel, aviation fuels	Pilot	Sunfire
GtL - Gas to Liquid	Partial oxidation + FT synthesis	Methan - CH_4, O_2	Diesel fuel, aviation fuels	Production in operation	Shell, Sasol, Air Liquide
	Fermentation	CO_2, CO, H_2	Ethanol	Demonstration	LanzaTech (USA)
BtL - Biomass to Liquid	Pyrolysis + gasification + synthesis	Ligno-cellulose, especially residual stalks	Dimethyl-ether, petrol fuel	Demonstration	KIT, Air Liquide, CAC
	Torefication + gasification + FT synthesis	Ligno-cellulose, especially residual wood	Diesel fuel, aviation fuels	Pilot	Total, Thyssen-Krupp
	Gasification + FT synthesis	Ligno-cellulose	E.g. diesel	Pilot	CUTEC
				Demonstration	TU Freiberg, Air Liquide, CAC
WtL - Waste to Liquid	Gasification + synthesis	Residual biomass, biowaste	Methanol, ethanol	Demonstration	Enerkem (Kanada)
DL - Direct Lique-faction	Rapid pyrolysis - hydrotreating	Residual biomass	Petrol fuel	Demonstration	Ensym (Kanada)
				Pilot	BTG Bioliquids
	Hydropyrolysis				GTI (USA)

	Technological process	Input feedstock	Product	Development status and traffic	Wearer or knowledge about technology
Lipids- oils and fats	**Rafination + hydro-treating**	**UCO, waste oils and fats, free fatty acids, tall oil**	**Diesel fuel (HVO/ HEFA), aviation fuels**	**Production in operation**	**Neste Oil, UOP, ENI, UPM, Dynamic Fuels LLC**
	Cracking vegetable oils CVO			Pilot	Nexxoil, HAW Hamburg
Bio-refinery	Hydrolysis + fermen-tation	Ligno-cellulose	Ethanol	Demonstration	Clariant, DECHEMA
				Production in operation	BIOCHEM-TEX

Source: DECHEMA e.V., 2018

Available technologies on commercial basis:

- Biomethan from biogas
- Diesel from methan
- HVO/HFA from FFA, biowaste
- Bioethanol from Lignocellulosis

All other in pilot/demonstrated phase

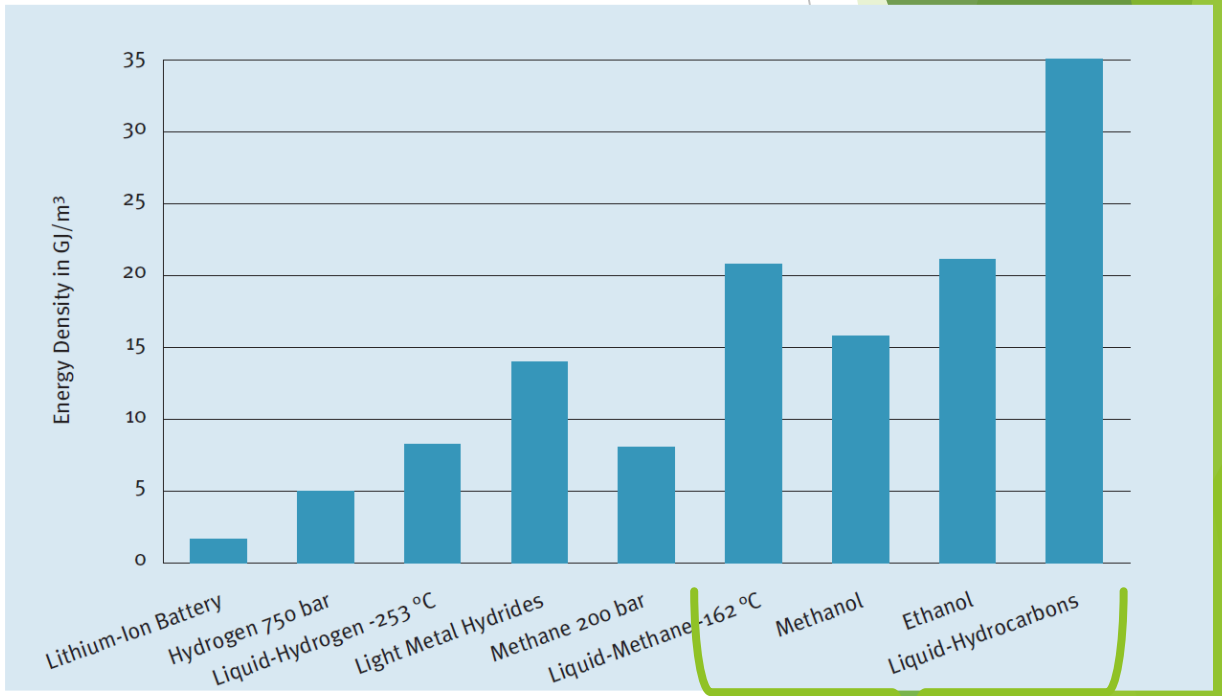
Example/Project:	Lignocellulosic ethanol
Capacity production	50 000 MT / year
Feedstock	350 000 MT / year
Investment	180 mil EUR

- 514 EUR/t of feedstock
- conversion 7kg feedstock / 1kg ethanol

Facts about advanced alternative liquid fuels

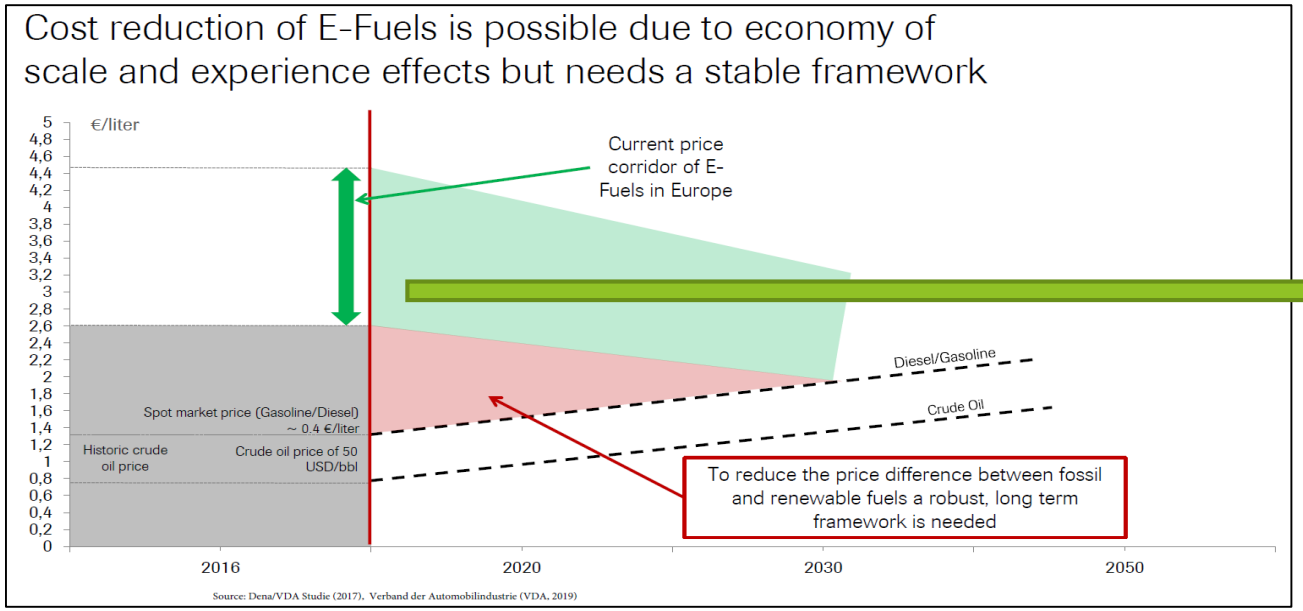
- Highest energy density
- Handling, transport and storage
- Use of existing infrastructure
- Compatibility with conventional fuels
- High level of development of optimized emission minimization
- Quality improvement due to admixture
- Quality assurance with regard to stability
- Important basis for certain transport sectors
- Etc.

Volumetric energy densities of alternative energy sources



Source: DECHEMA e.V./VD1, Willner, T., 2017

Competitiveness of E-fuels



-emission factor
-fuel price - range 2,6 Eur/l – 4,5 Eur/l
-EU quality standard
-electricity standard emission factors

Product	GHG savings	Density t/m^3	Net calorific value GJ/t	Price EUR/t	Term of delivery	Price EUR/GJ	EUR/l
FAME-10	65%	0.892	37.0	806.50	DAP CZ	21.80	0.719
RME	65%	0.892	37.0	835.50	DAP CZ	22.58	0.745
FAME 0	65%	0.892	37.0	749.00	DAP CZ	20.24	0.668
UCOME	90%	0.892	37.0	895.00	DAP CZ	24.19	0.798
TME	90%	0.892	37.0	877.50	DAP CZ	23.72	0.783
HVO	65%	0.7791	44.0	1290.00	DAP CZ	29.32	1.005
HVO	75%	0.7791	44.0	1370.00	DAP CZ	31.14	1.067
Bioethanol	70%	0.7778	27.0	698.55	DAP CZ	25.87	0.543
E fuel	90%						2.6 - 4.5
Diesel		0.8372	43.0	659.00	DAP CZ	15.33	0.552
Petrol		0.755	43.0	698.00	DAP CZ	16.23	0.527

Source: E-fuel – VDA Study, others: prices in weeks 10-20, 2019

- E-fuels are needed for reaching the log-term climate protection goals in transport (and other sectors) **but**…
  - E-fuels are not inherently sustainable
    - Additional RES generation required – purchase of green power not sufficient
    - Comprehensive sustainability criteria must be the basis for support strategies
    - No estimate of global potential for sustainable efuels available
  - E-fuels are the most expensive GHG mitigation measure in transport
  - Standard emission factors in kg CO_{2eq}/kWh_{el}
    - Electricity mix EU 0,46
    - Mix CZ 0,637, wind electricity 0,01, solar 0,06

CONCLUSION

- Increasing the share of renewable energies in total energy consumption to 32 per cent and in the transport sector to 14 per cent by 2030 is the key at the core of RED II. The Commission is to review these targets.
- Biofuels currently make the largest contribution to CO2 savings in the transport sector due to constantly improved greenhouse gas balance.
- Improved efficiency means lower biofuels volumes in diesel and petrol, as the current greenhousegas reduction obligation is too lax and must be made more stringent promptly.
- Market established, affordable biofuels from cultivated biomass, residues and waste are the most important building blocks for further reducing CO2 emissions in the transport sector, along with improved engine efficiency, alternative drive technologies and optimized transport infrastructure.
- E-fuels are needed for reaching the long-term climate protection goals in transport, but…
- Priorities until 2030:
  - Reducing energy demand in transport (eg. E-mobility)
  - Cost reduction and upscaling of e-fuel technologies

Thank you for attention!

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Supported by National Agency for Agriculture Research (NAZV), Project No QK1820175