

INFLUENCE OF EUROPEAN UNION DIRECTIVE ON THE USE OF LIQUID BIOFUEL IN THE TRANSPORT SECTOR

Keio Küüt

7th International Symposium on Energy

Estonian University of Life Sciences



<http://www.pollumajandus.ee/uudised/2016/09/19/maulikooli-aastapaev-toob-kokku-ligi-3000-tootajat-ja-vilistlast>

Foto: Meelika Sander-Sõrmus. <http://www.tartu.ee/et/majad-ja-hooned>

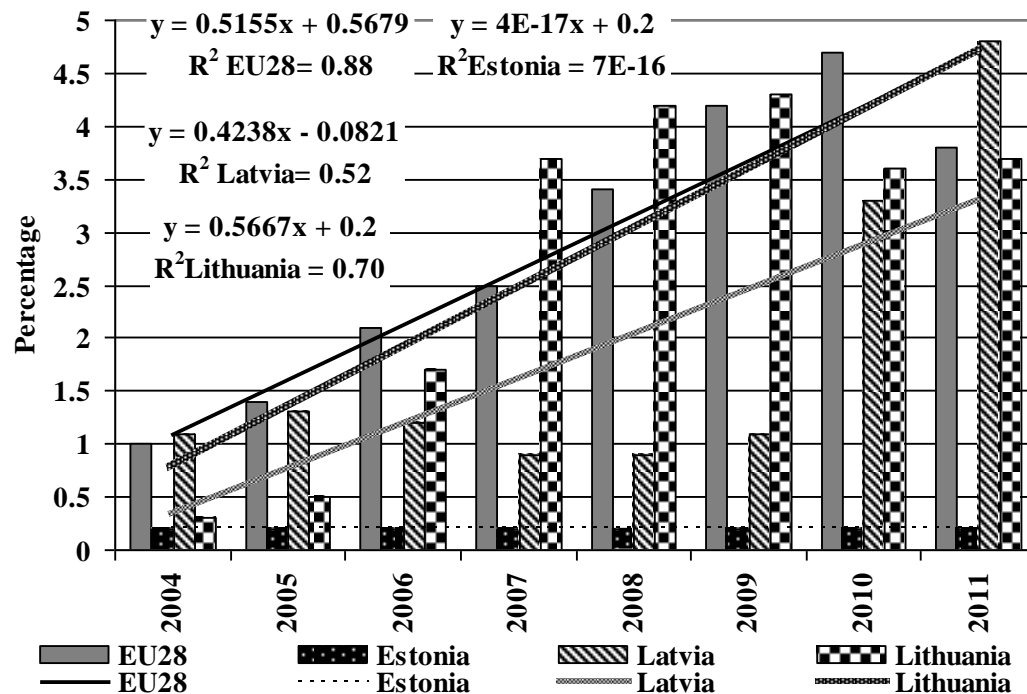
Introduction

Biofuels consumption for transport in the European Union in 2015 (in toe)*

Country	Bioethanol	Biodiesel***	Biogas fuel	Total consumption	% certified sustainable
France	433 839	2 562 445	0	2 996 284	100%
Germany	756 449	1 780 716	41 798	2 578 964	100%
Italy	21 926	1 131 175	0	1 153 101	100%
Sweden	136 270	849 181	105 933	1 091 384	100%
Spain	181 850	788 667	0	970 518	0%
United-Kingdom	405 020	520 270	0	925 289	100%
Poland	159 461	587 150	0	746 611	100%
Austria	57 771	444 498	0	502 268	94%
Finland	69 897	364 636	1 911	436 444	100%
Portugal	22 087	329 034	0	351 121	100%
Czech Rep.	78 617	265 484	0	344 101	100%
Netherland	141 875	178 514	0	320 388	100%
Belgium	37 692	229 426	0	267 118	100%
Hungary	87 015	122 653	0	209 668	98%
Denmark**	0	205 909	0	205 909	100%
Romania	41 917	125 490	0	167 407	100%
Greece	0	143 164	0	143 164	22%
Slovakia	30 954	105 164	0	136 118	100%
Ireland	30 426	97 575	0	128 001	100%
Bulgaria	14 832	93 675	0	108 508	100%
Luxembourg	7 203	73 856	0	81 059	100%
Lithuania	9 680	57 847	0	67 528	98%
Slovenia	5 804	36 233	0	42 037	100%
Croatia	0	29 354	0	29 354	100%
Latvia	6 449	17 675	0	24 123	100%
Cyprus	0	9 376	0	9 376	100%
Estonia	5 804	0	0	5 804	0%
Malta	0	4 818	0	4 818	83%
Total EU 28	2 742 837	11 153 985	149 642	14 046 464	92%

Introduction

Biofuel usage, requirements and problem



Materials and method

EU requirements

- *Renewable Energy Sources directive* (RES-D, [Directive 2009/28/EC](#))

by the year 2020 the share of biofuels in the end consumption in each transport type should be at least 10%

- *Fuel Quality Directive* (FQD, [Directive 2009/30/EC](#))

emissions of GHGs per energy unit must decrease by at least 6% by 31st December 2020

Materials and method

Problems and solution

- Problems for fuel suppliers:

- requirements for fuel (standards)

- technical level of car fleet

- economical aspects (biofuel cost)

- Solution – min. required biofuel amount

Materials and method

RES-D

Minimum volume of bio-component to be added V_{ba} , l
(liter):
$$V_{ba} = \frac{E_{hb}}{E_b \cdot \rho_b}$$

E_{hb} , [J] - energy amount of the bio-component:

$$E_{hb} = \frac{B_{fr} \cdot E_{hr}}{1 - B_{fr}}$$

E_b - the volume of bio-component [J/kg]

ρ_b - the density of bio-component [kg/l]

E_{hr} - total energy amount of fuel [J]

B_{fr} - bio-component's energy (0.1)



Material and methods

FQD

Minimum amount of bio-component to be replaced V_{b2} [l]:

$$V_{b2} = \frac{E_{hr} \cdot V_{bfe}}{100 \cdot E_{bv}}$$

V_{bfe} [%] - minimum energy based balance of the bio-component: $V_{bfe} = \frac{E_g \cdot E_{gr}}{(E_{gr} - E_{gb})}$

E_{gr} - amount of GHG arising from the cultivation, processing, transport and distribution of traditional fuel [gCO₂eq/MJ] (83.8 gCO₂eq/MJ)

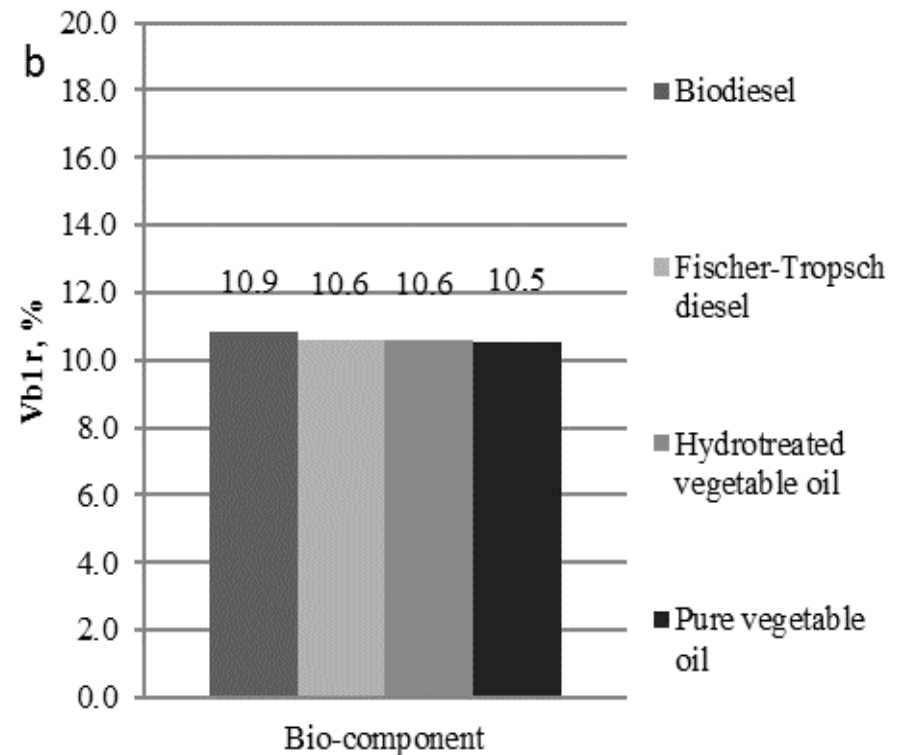
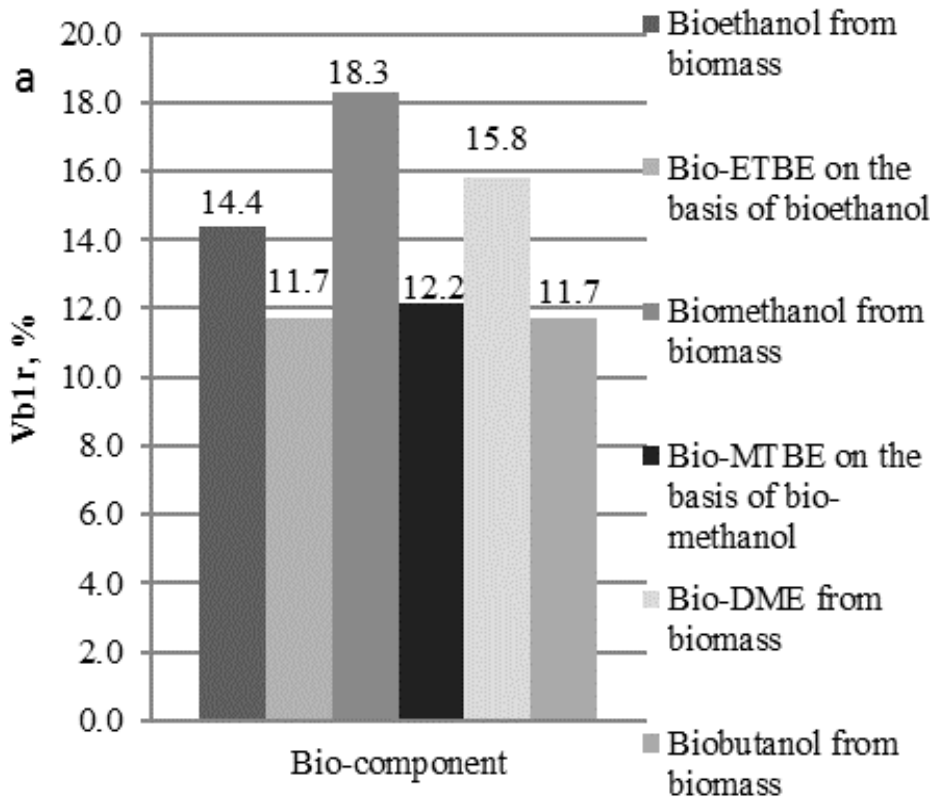
E_{gb} - amount of GHG arising from the cultivation, processing, transport and distribution of biofuel [gCO₂eq/MJ]

E_{hr} - total energy amount of fuel [J]

E_{bv} - calculated energy content of the bio-component [J/l]

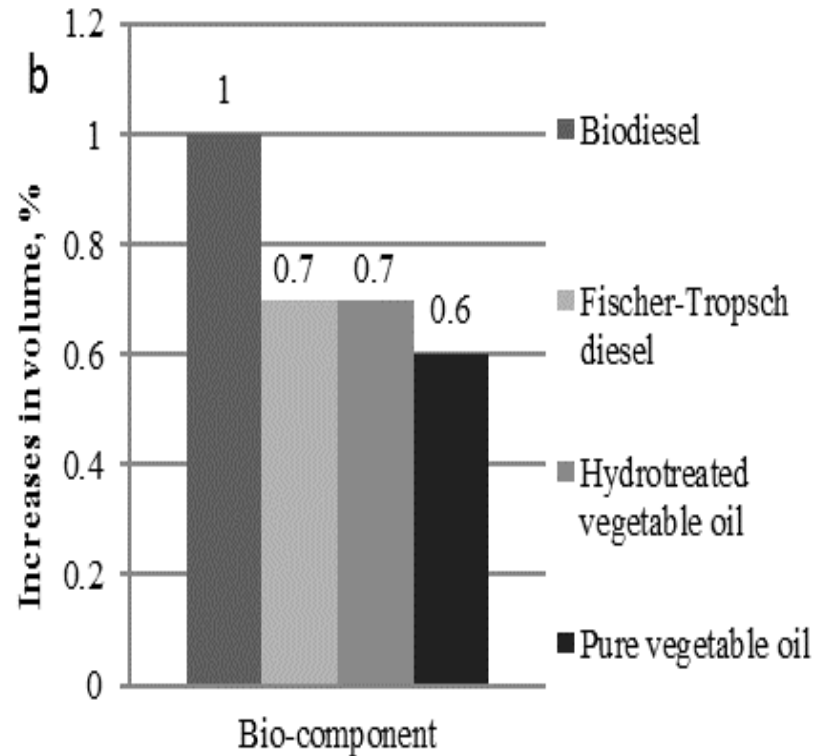
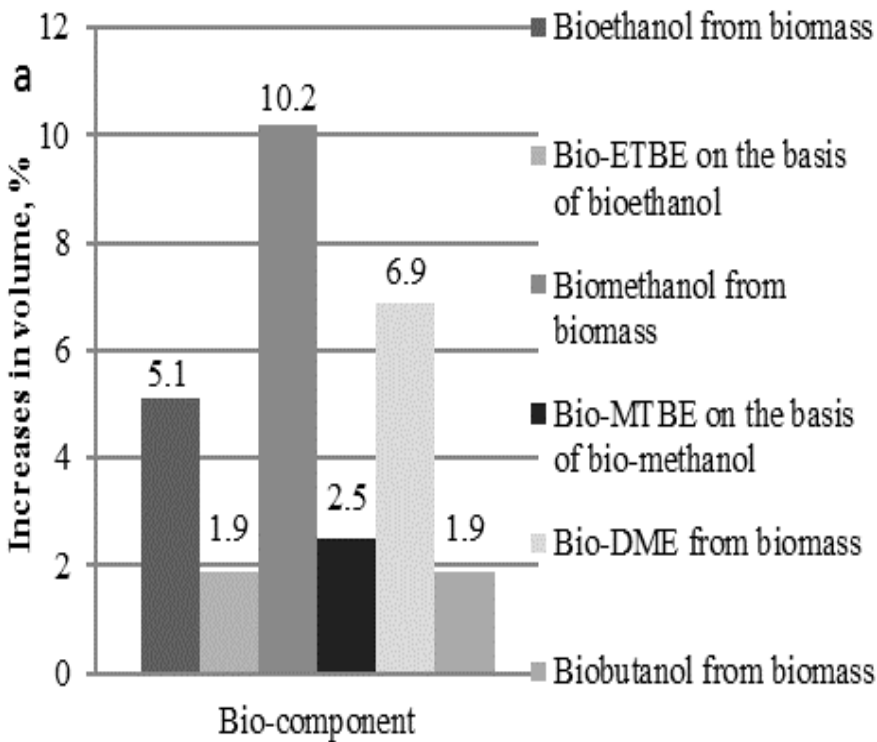


Results and Discussion RES-D



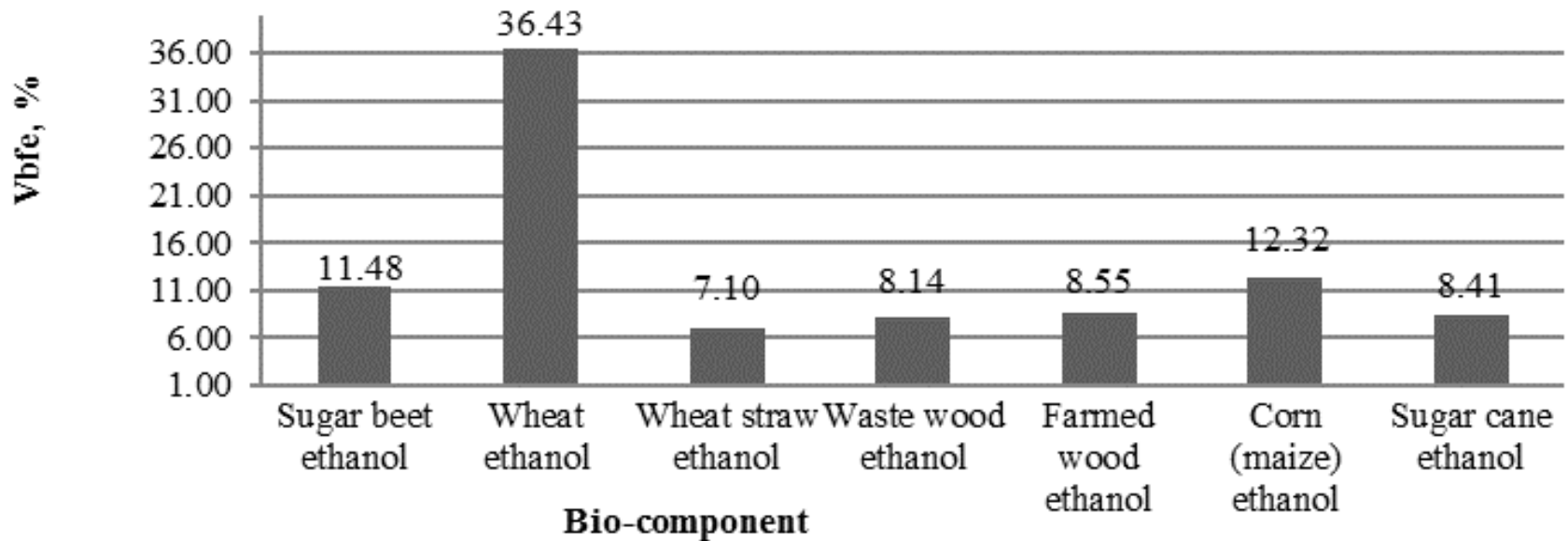
- (a) formation of bio-components of alcohol-based fuel mixtures for 10% biofuel by energy content;
- (b) formation of fuel component ratios for 10% bio-oil content fuel by energy content.

Results and Discussion RES-D



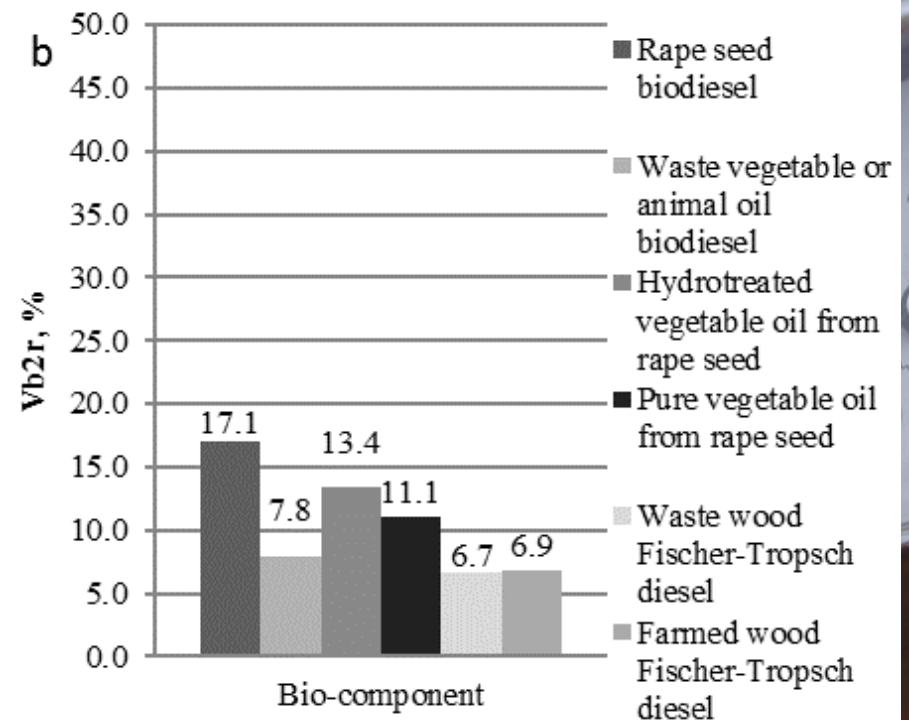
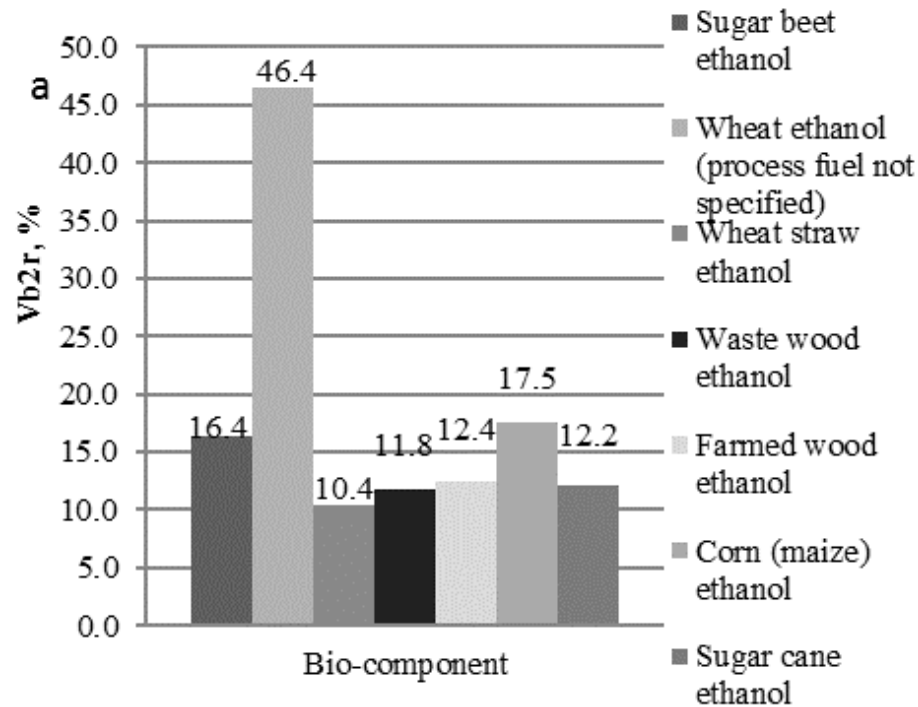
- (a) biofuel amount difference compared to traditional fuel while using alcohols;
 (b) biofuel amount difference compared to traditional fuel while using bio-oils

Results and Discussion_{FQD}



Minimum ratio of the bio-component's energy content in total fuel energy according to the requirement of FQD

Results and Discussion_{FQD}



(a) relative amount of ethanol in petrol by volume according to production method and raw material; (b) relative amounts of bio-oil and biodiesel by volume in traditional diesel fuel according to the production method and raw material of ethanol.

Conclusion

- Second or third generation biofuels in fuel mixtures with traditional fuels
- Requirements for biofuel infrastructure
- Directives disadvantages



INFLUENCE OF EUROPEAN UNION DIRECTIVE ON THE USE OF LIQUID BIOFUEL IN THE TRANSPORT SECTOR

Keio Küüt

7th International Symposium on Energy

Thank You!

