GLOBAL ENVIRONMENTAL ISSUES CONCERNING LARGE SCALE BIODIESEL PRODUCTION

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Abstract: *Fossil fuels that mankind burns today in a single year were made from organic matter containing* 44×10^{15}*kg of carbon, which is 400 times the net primary productivity of the planet's current biota. Such large consumption of fossil fuels introduced biodiesel as one of the alternative sources of energy that is needed for decreasement of dependence on fossil hydrocarbons and lowering of* CO_2 *emissions into the atmosphere. Therefore, EU goal is to achieve biodiesel share of 5,75% in transportation sector until 2010. Biodiesel is often called clean, ecological and renewable alternative fuel. If whole situation is viewed globally, biodiesel could easily be named as one of the most dangerous sources of energy for Earth's ecosystem. Main threat from large scale biofuel utilization comes from deforestation of land needed for cultivation of crops. Every year large areas of rainforests in South East Asia and South America are irretrievably lost due to world biofuel demand. Millions of hectares are turned into large palm and sugarcane plantation endangering ecosystem and survival of many species. Furthermore, large scale deforestation is often being conducted with forest fires and drying swamp areas of rainforests. Combustion of wood and oxidation of peat during drying emits enormous quantities of* CO_2 *into the atmosphere which is contrary to biodiesel appellation as "*CO_2 *balanced fuel". Every energetic process and fuel must be viewed through complete production cycle and 4E principle: ecology, efficiency, economy and education.*

Croatia, with large present, but vacant, agricultural area could be example that biodiesel, only in small scale production could contribute to some decrement of fossil hydrocarbons dependence but not on today's perceptions and demands, without large impact on environment.

Key words: biodiesel, CO_2 emission, deforestation,

1. INTRODUCTION

The use of biodiesel in automotive engines has been known for a long time, but in Europe the production and use of these fuels has been developing more seriously only just the past five to ten years. This is partly due to European and national environmental policies aiming at the reduction of CO2 emissions. Target is to decrease emissions from transport sector, as biodiesel do not lead to any additional CO2 emissions released to the air, apart from the emissions due to production and transport of the biomass and biofuels. Various studies have estimated that the use of 1 kg of biodiesel leads to the reduction of some 3 kg of CO2 [11].

In the Kyoto protocol, the European Union member countries have committed to a reduction of their CO_2 emissions by 8% relative to 1990 levels by the year 2010. Furthermore, EU directive proposal obliges the Member States to establish a minimum percentage of 2% by 31. December 2005, by volume of biofuels to be sold in their respective national markets. This amount is to increase every year by 0.75% to 5.75% in the year 2010. [7] Prior to the Kyoto commitment, energy consumption was predicted to increase from 1,366 Mtoe (million tons of oil equivalent) in the year 1995 to 1,583 Mtoe in the year 2010 (European Commission, 1998). The increased energy consumption was predicted to be supplied entirely by renewable energy sources, increasing their share from 8.1% in 1995 to 14.6% in 2010. The increased use of biomass requires careful consideration of all environmental impacts.

Table 1: Rough guidelines of alternative fuels in EU according to European commission in 2001. [2]

Year	Biofuels	Natural gas	Hydrogen	Total
2005.	2%			2%
2010.	6%	2%		8%
2015.	7%	5%	2%	14%
2020.	8%	10%	5%	23%

While positive impacts such as reduction in fossil CO_2 emissions at the combustion stage are evident, the indirect impacts such are deforestation, the danger of reducing biodiversity, contamination of land and water with nitrates, phosphates and pesticides are more complex and have global impact on environment as well. As such, an increased use of biodiesel in Europe is comprehended as an important step for the European Union to meet its emission reduction target as agreed under the Kyoto agreement.

2. PRODUCTION AND IMPORT OF BIODIESEL IN EU

At present, the biofuel producing countries in the European Union only have a small share in global production of biofuels, namely a little less than 6%. Most of the global biofuel production consists of ethanol and the main ethanol producers are the USA and Brazil, whereas the share of Europe is rather small. However, Europe is the most important producer of biodiesel on the global market. As from the year 1993, the European production level of biodiesel increased by almost ten times, from 80000 tons in 1993 to 780000 tons in 2001 and further to 3184000 tons in 2005. (Table 2) [2]. Germany is the leading European producer, followed by France, Italy and Czech Republic. Throughout the European Union, biodiesel is applied in automotive engines in various blends with regular diesel. In Germany, Austria and Sweden, it is used in pure form in adapted captive fleet vehicles. Currently, only biodiesel (mainly Rapeseed Methyl Ester, RME) and ethanol (and its derivative ETBE) produced from food crops are applied on a commercial basis on the European market.

Somewhat 12% of total biodiesel volume is imported from East Asia (Malaysia and Indonesia) in form of crude palm oil. Biodiesel production currently uses around 1.4 million hectares of arable land in the EU. Today, there are approximately 40 plants in the EU producing up to 3 184 000 tonnes of biodiesel annually. These plants are mainly located in Germany, Italy, Austria, France and Sweden.

Table 2.: EU biodiesel production and import in 2005. [6] [11]

COUNTRY	Production of biodiesel in 2005. (×1000 tonnes)	Production capacity in 2005. (×1000 tonnes)
Germany	1 669	2 681
France	492	775
Italy	396	857
Czech Republic	133	203
Poland	100	150
Austria	85	134
Slovakia	78	89
Spain	73	224
Denmark	71	81
UK	51	445
Other EU states	368	430
TOTAL	**3 184**	**6 069**
Imports of biodiesel palm oil from East Asia	≈500	-

3. NATIONAL INDICATIVE TARGETS OF EU MEMBER STATES CONCERNING PRODUCTION OF BIODIESEL

Although the importance of the use of biofuels in transport has already been stressed in the EU White Paper on renewable sources of energy (1997) and the Green Paper on a European strategy for the security of energy supply (2000), this has not led to the development of concrete biofuel specific national policies in many EU Member States. Some countries support the use of biofuel by exempting them from excise duties or environmental taxes. However, in June 2001, the discussion on biofuels did result in two EU Directive proposals on the promotion of biofuels. The first draft Directive obliges the EU Member States to sell a certain amount of biofuels on their national markets in the period 2005 - 2010. In order to support this, the second draft Directive provides the opportunity to the Member States to adjust their national excise duty systems for automotive fuels in favour of biofuels.

Table 3: Overview of submitted national indicative targets of EU countries for 2005. [6]

Country	2003 (%)	2004 (%)	2005 (%)	Differentiation (<2% in 2005)	Argument for differentiation
Austria	-	-	2,50	Y	-
Cyprus	0	-	-	Y	-
Czech Republic	2,10	2,20	3,03	N	-
Denmark	0	0	0	Y	Loss of government revenue, Allocation of resources to other uses, High production cost
Estonia	0	0	0	Y	Limited national potential for production of biodiesel, Low starting point
Finland	0,10	-	0,10	Y	Allocation of resources to other uses, High production cost, Limited national potential for production of biodiesel, Low starting point

France	-	1,60	2,0	N	-
Germany	1,40	-	2,0	N	-
Greece	0	-	-	Y	-
Hungary	-	-	0,5	Y	Limited national potential for production of biodiesel
Ireland	-	-	0,06 %	Y	High production cost, Limited national potential for production of biodiesel, Emissions of other GHG
Latvia	0,30	1,25	2,0	N	-
Lithuania	-	-	2,0	N	-
Malta	0,02	-	-	Y	Limited national potential for production of biodiesel
Netherlands	0	0	-	Y	Limited national potential for production of biodiesel
Portugal	0	-	1,0	Y	Low starting point, Limited national potential for production of biodiesel
Slovakia	0,24	0,50	2,0	N	-
Spain	1,09	-	2,0	N	-
Sweden	1,80	2,0	3,0	N	-
United Kingdom	-	-	0,30	Y	Low starting point

4. GLOBAL ENVIRONMENTAL ISSUES CONCERNING PRODUCTION OF BIODIESEL FROM PALM OIL

The usage of bio-fuels creates a dilemma in terms of the net environmental benefits of using low-carbon fuels. Increased demand for this fuel over standard diesel is beneficial in terms of carbon emissions, but under current land-conversion patterns, increased production in South-East Asia to meet higher global demand (especially EU) would inevitably involve extensive forest clearance. Europe is currently short of biodiesel as some member states have underinvested in refinery production in recent decades while motorists are increasingly switching to the diesel instead of gasoline. Experts estimates that palm oil bio-diesel in a few years could account for 20 percent of Europe's automotive consumption and cause the destruction of some of the most valuable forests of the world. Reason of increased share of palm-oil in total EU biodiesel consumption lies in greater yield per hectare of palm plantation (Table 3) and lower cost production which influences final purchase price.

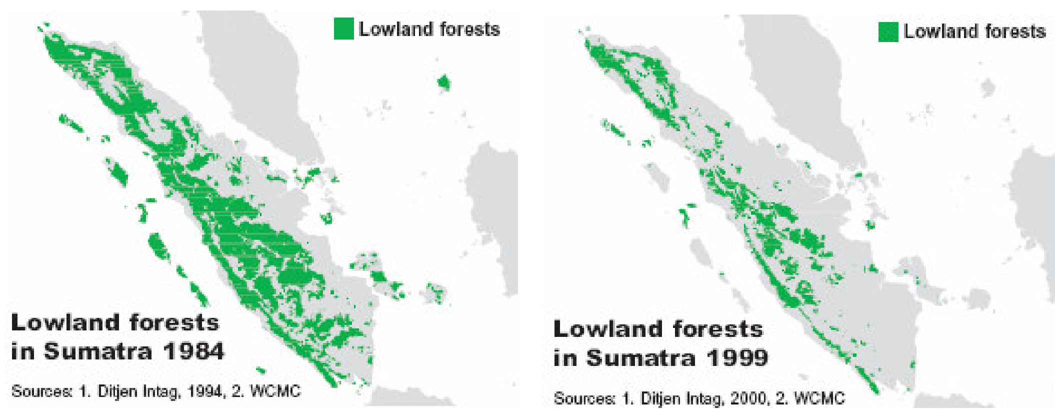
Table 4: Yield of bio-oil for different cultures [11]

Plant		**Soybean**	**Rapeseed**	**Jatropha**	**Palm**
Yield of bio-oil	m^3/km^2	35 - 45	100 - 130	160	580
	L/hectare	350 - 450	1000-1300	1600	5800
	GJ/km^2	1165-1500	3330-4330	5330	19315

Until today, rapeseed is still dominant source for biodiesel in EU with share of some 80% but competition with food sector has driven its price to somewhat 600€ per tonne in 2005. At the same time, price of crude palm-oil was around 33% cheaper, making it about 400€ per tonne.

4.1. Deforestation in South Asia caused by cultivation of palm oil needed for biodiesel production and export to EU

Between 1989 and 2000, the area of oil palm harvested in Indonesia more than tripled, with an inevitable associated rise in the total production of palm oil. In 2003, 75 per cent of Indonesia's 5.2 million hectares of oil-palm plantations were located in Sumatra, with a further 18 per cent in Kalimantan [4]. It is expected that this total will more than triple to approximately 20 million hectares in Indonesia and 10 million hectares in Malaysia by 2020. Between 1985 and 2000 the development of oil-palm plantations was responsible for an estimated 87 per cent of deforestation in Malaysia, and an estimated 66 per cent of Indonesia's plantations have involved forest conversion. By the beginning of 2004, there were 6.5 million hectares of oil-palm plantations across Sumatra and Borneo. Of this total area, almost 4 million hectares had previously been forested. Currently, every year about 2 million hectares of Indonesian virgin forest, a total area half the size of Belgium, are turned over to palm oil production.



Picture1.: Example of Indonesia's rainforest destruction due to palm-oil production expansion [12]

The palm-oil business is often advertised by governments and companies as making an important economic contribution to development. However, this analysis is often one-sided, and fails to take into account the substantial social and environmental costs. These include the ecological price of removing rainforest such, as well as pollution and damage to water and air that are rarely taken into account. However, the area released for conversion does not necessarily reflect the real area planted, and the palm-oil industry is habitually associated with deforestation beyond establishing oil-palm estates on previously forested land. The amount of forest removed under the auspices of plantation development, regardless of whether palms have ever been planted, may be as much as 10 million hectares. Around 40 per cent of Indonesia's legal timber supply results from land clearance for conversion to plantations. In the past, if the remaining timber stands are not commercially valuable, burning has been a widely-used method of land clearance. The forest fires of 1997/98 were responsible for the devastation of over 5 million hectares of forest and often the major fires are in oil-palm plantations [9].

Table 5: Plantation area and estimated forest area cleared based on industry estimates [12] (Mha.)

	Oil Palm plantation area (2002)	Share of oil palm plantations involving forest conversion	Forest area cleared for oil palm (end of 2002)	Total oil palm area target / allocation (2003)	Additional area to be established (after 2004)	Additional forest to be cleared (after 2004)
Malaysia	3,67	33%	1,21	3,74	0,07	0,02
Indonesia	3,10	66%	2,05	9,13	6,03	3,98
Total	**6,77**	**48%**	**3,26**	**12,87**	**6,10**	**4,00**

Peat-swamp forests, including those in Tripa, Singkil, and Kluet in Sumatra, and Sebangau, Mawas, and Tanjung Puting in Borneo, play a major role in carbon sequestration and biodiversity. This forest type is being promoted as a carbon sink and used in international carbon offset agreements, while palm oil is concurrently publicised as a carbon emission-reducing fuel. Peat-swamp forests, however, are increasingly becoming prime targets for oil-palm expansion, despite regulations against the development of deep peats and lower productivity relative to other soils. It is crucial that the expansion of oil-palm plantations does not lead to the clearance of forests and, in particular, peat forests. It is difficult to cultivate oil palms on peat land greater than 1 metre thick [10], and the costs of establishing a plantation on this soil type tend to be 40 per cent higher than on dry land but nevertheless, numerous companies continue to apply for licences to allow the conversion of deep peat land.

4.2. Carbon-dioxide emissions from deforestation and peat-swamps drying

In table CO_2 emissions are shown, as well as total green house gases GHG presented as CO_2 equivalent, for three transportation fuels: biodiesel, fossil diesel and natural gas.

Table 6: CO_2 emissions for various transport fuels [11].

	Biodiesel	***Diesel***	***Compressed natural gas***
Lower calorific value, MJ/kg (MJ/L)	*37,8 (33,3)*	*42,7(35,44)*	*33,3*
CO2 emission due to combustion process, kg/kg (kg/MJ)	*0**	*3,15(0,074)*	*2,38(0,050)*
CO2 emission due to production process, kg/kg (kg/MJ)	*0,92 (0,024)*	*0,56(0,013)*	*0,56(0,012)*
Total CO2 emission, kg/kg (kg/MJ)	*0,92 (0,024)*	*3,71(0,087)*	*2,94 (0,062)*
Total emission of green house gases (GHG) shown as CO2 equivalent, kg/kg (kg/MJ)	*1,55 (0,040)*	*4,06(0,095)*	*3,05 (0,064)*
Energy needed for fuel production, MJ/MJ(MJ/kg)	*0,45 (17,01)*	*1,26(53,80)*	*1,26(61,28)*

**Biodiesel is CO^2 neutral fuel because whole emission of CO^2 from combustion process is absorbed by crop during it's growth*

4.2.1. Emission of CO_2 due to forest fires as method of land clearing. If we look at the South Asia case of deforestation for palm-oil cultivation purposes it is possible to derive amount of CO^2 that is emitted during forest fire. According to [1] CO_2 emission factor for tropical rainforest biomass (EF_F) burning is approximately:

$EF_{F\,CO2}$ = 1,580 kg per kilogram of dry matter burnt

Total emission factor of GHG shown as CO_2 equivalent would be [1]:

$EF_{F\,GHG} \approx$ 1,600 kg per kilogram of dry matter burnt

Determined quantity of biomass dry matter in typical tropical rainforest (M) in tropical forests of Malaysia and Indonesia according to [3] [5] is approximately:

$M \approx 200\ t/ha \approx 20\ 000\ t/km^2$

Now, it is possible to derive total GHG emission during forest fire (ε_F) that is carried out for land clearance and beginning of palm cultivation, taking into account assumed combustion efficiency of tropical forest fire (η_F) [8] [5] of approximately 25%:

$\varepsilon_F = EF_{F\,GHG} \times M \times \eta_F$

$\varepsilon_F = 1{,}600 \times 20\ 000 \times 0{,}25$

$\varepsilon_F = 8\ 000\ t/km^2 = 8\ 000\ 000\ kg_{GHG}/km^2$

From table it is seen that yield of palm-oil plantation is somewhat 580 000 L/km^2 of biodiesel. To calculate savings in GHG emission of this amount of biodiesel produced from km^2 of palm plantation, oppose to fossil diesel, it is necessary to convert volume units into available fuel energy because of different densities and calorific values of biodiesel and fossil diesel.

Consequently, gained fuel energy (E_b) from km^2 of palm-oil plantation in form of biodiesel taking into account calorific value of biodiesel of 33,3 MJ/L (table) is:

$E_b = 580\ 000 \times 33{,}3 = 19\ 314\ GJ/km^2$

Since emission of GHG CO_2 equivalent for 1MJ energy used from biodiesel fuel is $0{,}040 kg_{GHG}/MJ$ (table), total annual emission of GHG (ε_{bio}) through production, transportation and combustion stage, for $1 km^2$ yield of palm-oil plantation, is:

$\varepsilon_{biodiesel} = 0{,}040 \times 19\ 314 \cdot 10^3 = 772\ 560\ kg_{GHG}/km^2$/annually

Hence, emission of GHG from equivalent amount of energy used from fossil diesel, taking into account GHG emission of $0{,}095 kg_{GHG}/MJ$ (table), would be:

$\varepsilon_{diesel} = 0{,}095 \times 19\ 314 \cdot 10^3 = 1\ 834\ 830\ kg_{GHG}/km^2$/annually

This means that with biodiesel utilization, savings in GHG emission on annual basis, for km^2 of palm-oil plantation yield would be:

$\Delta\varepsilon = \varepsilon_{diesel} - \varepsilon_{biodiesel} = 1\ 834\ 830 - 772\ 560 = 1062270 kg_{GHG}/km^2$/annually

However, with tropical forest clearance to cultivate palm-oil crop for biodiesel production it is seen that biodiesel becomes "CO_2 balanced fuel" only then when emissions from large forest fires are compensated with emission savings that biodiesel offers oppose to fossil diesel utilization. For $1 km^2$ yield of palm-oil plantation this period (t_F) would be:

$t = \varepsilon_F / \Delta\varepsilon = 8\ 000\ 000/1\ 062\ 270 = 7{,}5$ years

4.2.2. Emission of CO_2 due to forest fire and drying of peat swamp as a method of land clearing

If the palm-oil plantation is planned on peat swamp tropical forest, which is promoted as large carbon sink, situation for biodiesel as CO_2 balanced fuel gets even worse. According to [10], drained peat-swamp land will release about 50-100 tons/ha/year of GHG emissions, mostly CO_2. It is estimated that in the whole of SE Asia about 7 million ha of peat lands are drained now, mainly for palm-oil cultivation purposes. In that case the drained peat lands used for agriculture in SE Asia will contribute to about 0.35-0.7 gigaton CO2/year, or about 5-10% of the total yearly worldwide CO2 emissions [10].

If we take look at the 1km^2 of drained peat-swamp and suppose cultivation of palm-oil, emission of GHG (ε_{PS}) would be:

$\varepsilon_{PS} \approx 75$ t/ha $\approx 7\ 500\ 000$ kg$_{GHG}$/km^2/year

Since palm-oil cultivation require drainage depth below surface of at least 70 cm, the process could last a couple of years. (Table 7)

Table: Total subsidence depths for 10 , 20 and 40 years after reclamation [10]

Land Use	Required drainage depth below surface	Initial mechanical peat soil compaction	Total subsidence including soil compaction after 10 years	Total subsidence including soil compaction after 20 years	Total subsidence including soil compaction after 40 years
Oil Palm	70 cm	40 cm	120 cm	200 cm	350 cm

If we assumed that the complete process of drainage would last for as much as five years for complete soil compaction and ability to plant palm-oil crop, emitted GHG in that period would be:

$\varepsilon_{PS} \approx 7\ 500\ 000 \times 5 \approx 37\ 500\ 000$ kg$_{GHG}$/km^2

This means, likewise as forest fires GHG emission calculation method in previous section, that utilization of biodiesel from SE Asia would equalize emitted GHG, oppose to utilization of fossil diesel, after:

$t = \varepsilon_F / \Delta\varepsilon = 37\ 500\ 000/1\ 062\ 270 = 35$ years

This roughly calculated data shows that biodiesel imported from SE Asia isn't "CO_2 balanced fuel" as one could think, yet extremely environmental aggressive fuel.

5. CONCLUSION

Today's perception of biodiesel as qualitative partial substitution of fossil fuels and ecologically acceptable source of energy is very doubtful. European traditional crop for biodiesel production, rapeseed, because of competition with food sector for land area, expensive labour and lower yield can't compete with SE Asia palm oil in view of cost per tonne of oil. Regardless to limited land area in Europe for further development of rapeseed plantation it is logical to conclude that the import of palm oil from SE Asia would be increased with every upcoming year. This could lead to total devastation of most valuable rainforests in the world and distinction of some species like orang-utan. On Europe is to decide would it continuously be responsible for destruction of rainforests in Asia to satisfy it's biofuel needs or the import of palm oil will be banned. Until the hydrogen would be economically ready to substitute oil derivates in transportation sector, biodiesel isn't the best global solution. It could be promoted in public transportation but only from domestic resources and capacities, not from SE Asia which is ecologically intolerable. The fuel that could replace this imported palm oil could easily be compressed natural gas, which also has CO2 decrement ability in view of fossil diesel. Furthermore, technology is economically justifiable and in high stage of technological development.

REFERENCES:

[1] Andreae, M. O.; Merlet, P.: *Emission of trace gases and aerosols from biomass burning*, Global Biogeochemical cycles, Vol. 15, No. 4, p. 955–966, December 2001

[2] Bendz, K.: *EU-25 Oilseeds and Products Biofuels situation in the European Union 2005*, USDA Foreign Agricultural Service, Global Agriculture Information Network-GAIN Report - E35058, pp.11, www.useu.be/agri

[3] Brown, S: *Estimating Biomass and Biomass Change of Tropical Forests: a Primer*, Department of Natural Resources and Environmental Sciences, University of Illinois, A Forest Resources Assessment publication – 134 ISBN 92-5-103955-0, USA, 1997.

[4] Buckland, H.: *The oil for ape scandal*: *How palm oil is threatening orang-utan survival*, Research report for Friends of the Earth Society, London, September 2005., pp.50, http://www.foe.co.uk/resource/reports/oil_for_ape_full.pdf

[5] Carvalho Jr. J. A.; Higuchi N.; Araújo T.M.; Santos J.C.: *Combustion completeness in a rainforest clearing experiment in Manaus, Brazil*, Journal of Geophysical Research, Volume 103, 1998, Issue D11, p. 13195-13200

[6] Internet source: *Chapter 2 - Analysis of biofuel policies in a selection of EU memeber states*, pp.44, www.klimaat.be/pdfs/Biofuels_2.pdf

[7] Schnepf R.: *European Union Biofuels Policy and Agriculture: An Overview*, CRS Report for Congress, EC, "An EU Strategy for Biofuels," Com(2006) 34, Annex V., pp.6

[8] Steininger, M.K.: *Net carbon fluxes from forest clearance and regrowth in Amazon*, Ecological Applications, 14(4) Supplement, 2004, p. S313–S322, Ecological Society of America

[9] UNEP (1999). Levine, J.S.; Bobbe, T.; Ray, N.; Singh, A.; Witt R.G.: *Wildland Fires and the Environment: a Global Synthesis*, UNEP/DEIAEW/TR.99-1, Division of Environmental Information, Assessment and Early Warning (DEIA&EW) United Nations Environment Programme (UNEP), pp.52

[10] Van den Eelaart, A.: *Ombrogenous Peat Swamps and Recommended Uses in Tropical Areas*, A Web site by Adriaan van den Eelaart in support of ISDP (Integrated Swamp Development Project) IBRD Loan 3755-IND, http://www.eelaart.com/, pp.8

[11] Van Thuijl, E.; Roos, C.J.; L W.M. Beurskens: *An overview of biofuel technologies, markets and policies in Europe*, Energy Research Centre of the Netherlands, Project no. ECN 7.7449.02.01., January 2003., pp. 64

[12] Wakker, E.: *Greasy Palms: The social and ecological impacts of large-scale oil palm plantation development in Southeast Asia*, Research for Friends of the Earth Society, March 2004., London, pp.49 www.foe.co.uk/resource/reports/greasy_palms_impacts.pdf,

GLOBALNI EKOLOŠKI PROBLEM U POGLEDU MASOVNE PROIZVODNJE BIODIZELA

Sažetak: *Količina fosilnog goriva koje danas čovječanstvo potroši u jednoj godini bilo je stvoreno od organske materije koja je sadržavala 44×10^{15} kg ugljika što je 400 puta više od sadašnjeg Zemljinog biološkog proizvodnog kapaciteta. Ovakva velika potrošnja fosilnih goriva dovela je do uvođenja biodizela kao jednog od alternativnih izvora energije kao nužnosti smanjenja ovisnosti o fosilnim gorivima kao i smanjenju emisije CO_2 u atmosferu. Stoga je EU postavila cilj udjela biodizela od 5,75% u transportnom sektoru do 2010. Biodizel je često nazivan čistim, obnovljivim ekološki prihvatljivim alternativnim gorivom. Ako se cijala situacija promatra globalno, biodizel se isto tako može nazvati jednim od najopasnijih izvora energije za Zemljin ekosustav. Glavna opasnost od proizvodnje biodizela dolazi zbog iskrčavanja šuma zbog potrebne površine za uzgoj uljarica. Svake godine, velike površine tropskih prašuma SI Azija i J. Amerike su nepovratno izgubljene zbog svjetske potražnje za biogorivom. Milijuni hektara prašuma bit će pretvoreno u velike plantaže palmi i šećerne trske ugrožavajući tako ekosustav i opstanak mnogih životinjskih i biljnih vrsta. Nadalje, iskrčavanje šuma velikih razmjera se često provodi izazivanjem šumskih požara i isušivanjem tresetnih močvarnih predjela. Izgaranje drveta i oksidacija treseta prilkom isušivanja emitira velike količine CO_2 u atmosferu što je u suprotnosti sa apelacijom biodizela kao "CO_2 neutralnog goriva". Svaki energetski proces i gorivo mora biti gledano kroz kompletni proizvodni ciklus i 4E princip: ekologija, efikasnost, ekonomija i edukacija.*
Hrvatska, sa velikom agrarnom površinom, ali i dobrim dijelom zapuštenom, može biti primjer kako biodizel u manjim obujmima proizvodnje može pridonijeti djelomičnom smanjenju ovisnosti o uvozu fosilnih goriva, ali ne na današnjim percepcijama i potražnji, a bez masivnog negativnog utjecaja na ekosustav.

Ključne riječi: biodizel, CO_2 emisija, iskrčavanje šuma