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Biofuels and Mobility

Research on actual and potential utilization of Biofuels in the Automotive Sector.

Opportunities and problems

Torino, July 2008

Foreword

The need to switch gradually and economically to alternative fuels dates back to at least the first Petroleum crisis, 35 years ago, and the proposed solutions to displace fossil fuels , a part from nuclear, (that suffered a period of heavy restrictions in certain countries, especially in Europe after Chernobyl), were substantially sun and wind, and, in particular for mobility, electricity and hydrogen.
Recently, however, on the forefront of discussion on alternative fuels, Biofuels became one of the most important solution, especially for transport, and my research took off therefore focusing on the reasons underlining this trend.

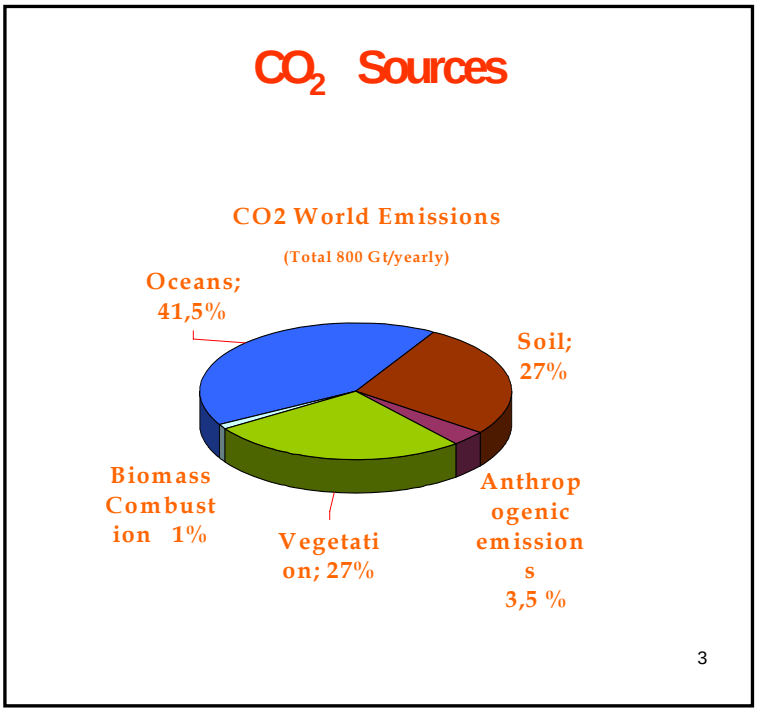
Needless to say the move towards these fuels has been tied, from time to time, to one or more political reasons: expanding the use of biofuels would support in fact several major policy objectives:

- Energy security. Biofuels can readily displace petroleum fuels and, in many countries, can provide a domestic rather than imported source of transport fuel, immediately usable on vehicles, without major technical or distribution problems.
- Agricultural benefits. Production of biofuels from crops such as corn and wheat (for ethanol) and soy and rape (for biodiesel) provides an additional product market for farmers and brings economic benefits to rural communities.
- Reductions in greenhouse gas emissions. Ethanol and biodiesel are in fact supposed to provide significant reductions in greenhouse gas emissions compared to gasoline and diesel fuel on a "well-to-wheels" basis.

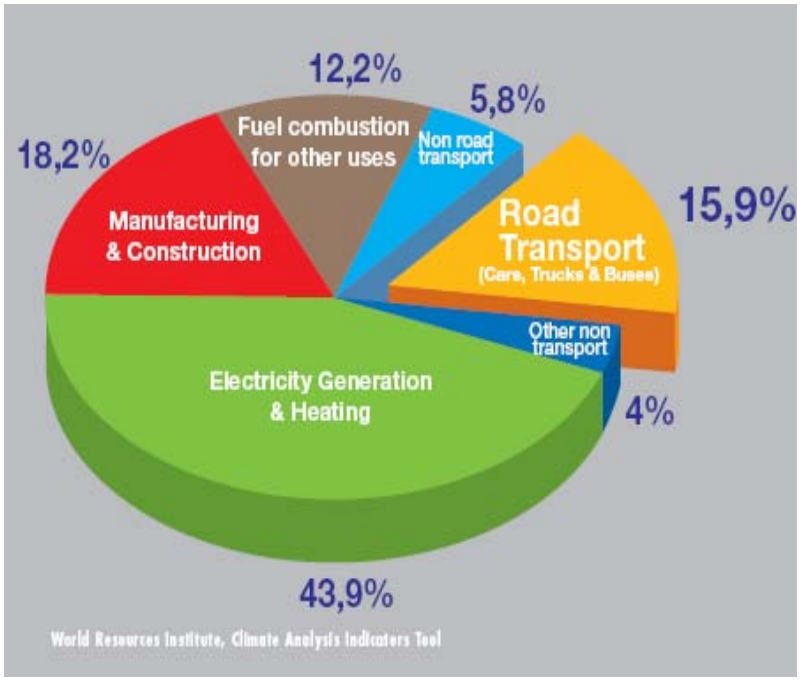
Let's start from this last one, of paramount importance nowadays, in discussions concerning mobility in particular.
But how serious is the CO2 problem created by road traffic?
What is the contribution of motor vehicles to its production?

That would also indicate whether biofuels are indeed the most efficient answer in terms of cost/benefit.

In this regard recent studies (VDA e Anfia), calculate that out of the 800 billion Tons of CO2 produced annually the share attributable to human activities is only of about 4%. (See chart)



At the occasion of the International Transport Forum in Leipzig, the Auto Industry's worldwide organization, OICA, published a brochure setting out the Industry's views on CO2 and Climate Change, which it describes as "probably the greatest challenge facing society in the twenty-first century".



"Automobiles are by no means the biggest CO2 contributor" says OICA, with road transport (car, truck and bus) accounting for less than 16% (around 13% of GHG).

Therefore CO2 attributable to vehicle is around 0,6% of total CO2 produced yearly.

But even this relatively small increase can shift the Earth's natural balance. That is why OICA believe "it is important to continue

to reduce CO2 emissions from all sources, including automobiles "

However "manufacturers want to be part of the solution to climate change, but they cannot solve the problem alone".

At the light of these figures one could definitively conclude that "**is not gold all that glisters"**

And then, all further analysis of problems and opportunities offered by biofuels should be measured against the real dimension of the problem and to the real potential that a wider utilization of biofuels can bring in terms of solution of CO2 problem, big or small it may be.
And this outlines the

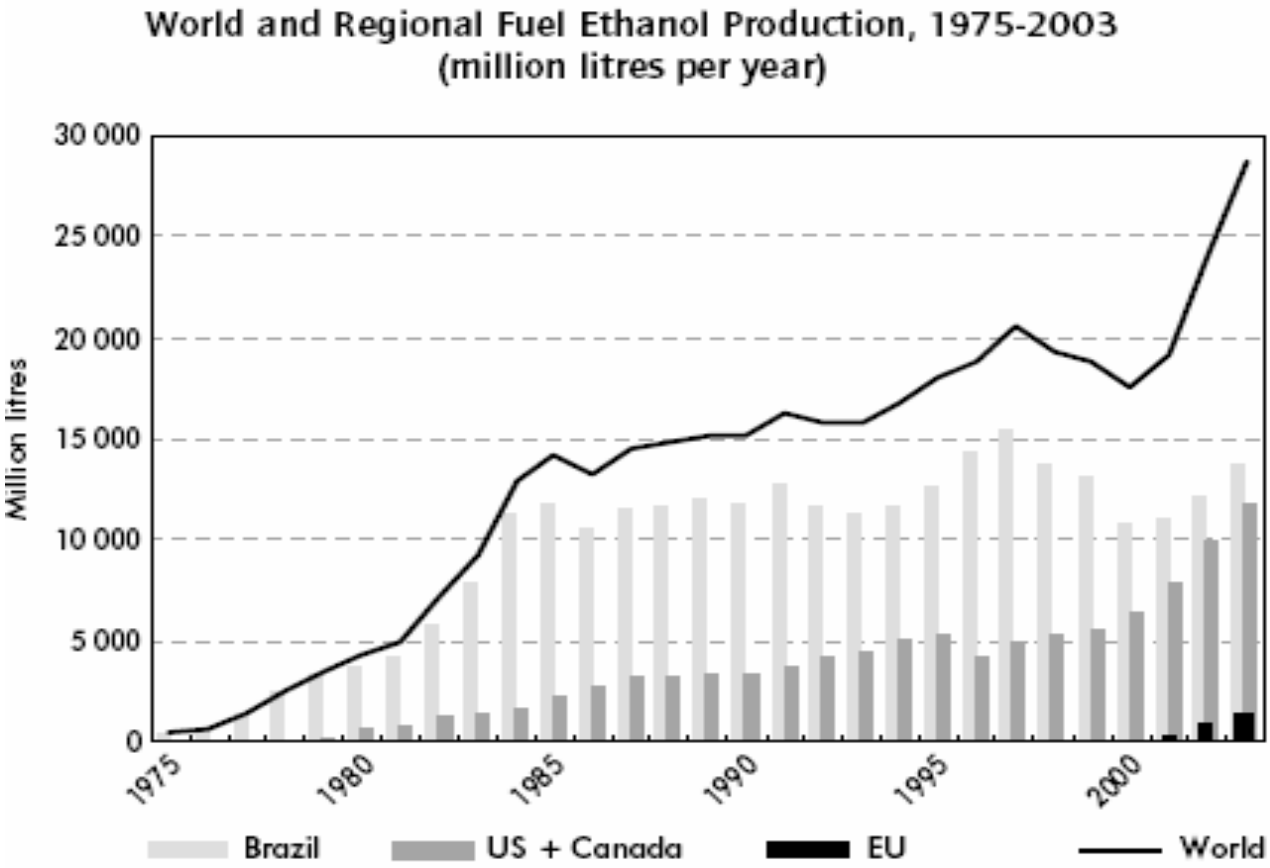
Scope of the Research

Aim of this study is in fact: find out biofuels potential, underline favourable and critical aspects, to assess whether their balance is positive **well-to-wheels**
In other word to try and define from the one side the actual dimension of the problems, and on the other the road that offers the best chance to solve them

Let's start with a bit of history:
Ethanol is produced since the thirties of last century in Brazil, where it was blended with gasoline (5 to 25%), partly to compensate for the volatily of sugar market.
From 1975 to 2006, Brazil (when it produced 18 billion litres) remained the first ethanol producer (from sugar cane).
Ethanol represents there today more than 30% of all motor vehicle fuels (86% of all vehicles uses ethanol, including Fuel Flex). Blends at 19/25% are mandatory on all fuels sold.

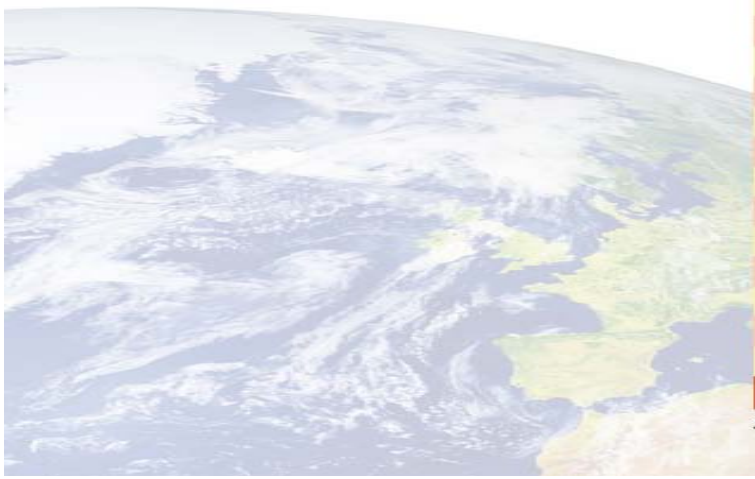
Since 1980 Ethanol is produced from corn in the U.S., today first world ethanol producer; represents today 3% of all motor vehicles fuels, also sold through 2000 E85 pumps; FVV in production since many years (more than 6 mil. units). Today almost 50% of all gasoline has ethanol in some %.
Only recently Europe started ethanol production from cereals, rape, and soy. Low blends (5-10%) prevail today, but the trend is for higher percentage of ethanol, to reach the targets set by individual countries and EU, with relative problems in distribution.

The graph shows the production trend in the world, in the past 30 years.



Source: F.O. Lichts (2003). Does not include beverage ethanol production.

Next chart shows last year's results in the world, showing the quota of the



2007 WORLD FUEL ETHANOL PRODUCTION

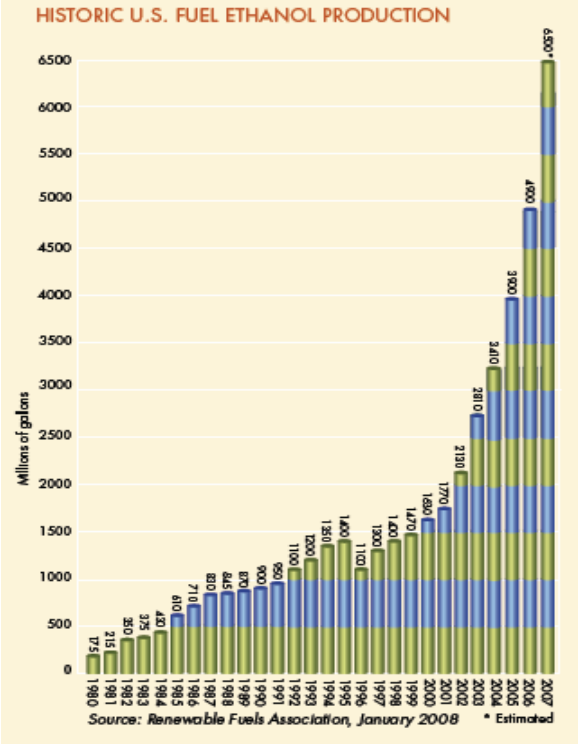
In Millions of Gallons

U.S.A.	6498.6
Brazil	5019.2
European Union	570.3
China	486.0
Canada	211.3
Thailand	79.2
Colombia	74.9
India	52.8
Central America	39.6
Australia	26.4
Turkey	15.8
Pakistan	9.2
Peru	7.9
Argentina	5.2
Paraguay	4.7
Total	13,101.7

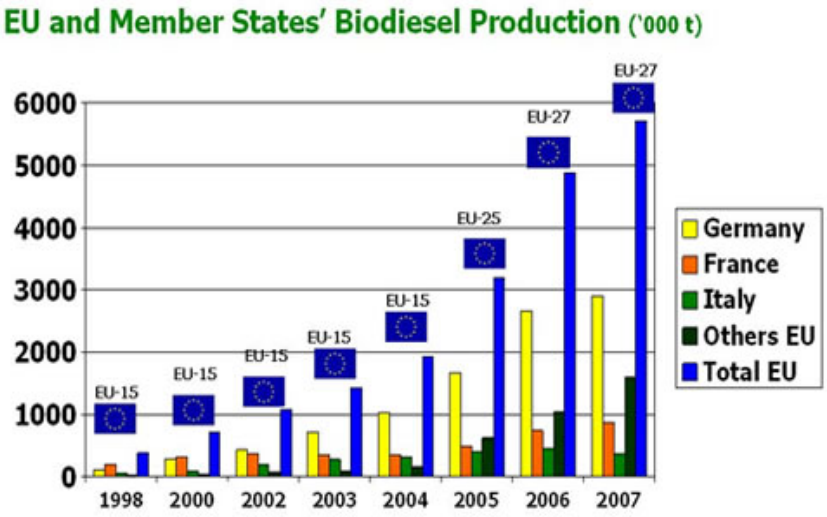
Source: F.O. Licht

two major countries, USA and Brazil, close to date respectively to 50% and 38 % of world production , as compared to only a 4% of European Union.

Particularly impressive the progression shown by production in the U.S.A. in the last 8 years, with an increase of more that 4 times in the period, to develop even more as a direct consequence of the Energy Policy promoted by U.S. Government in recent years .
That latest program is intended to Improve America's energy security by displacing 11.3 billion barrels of crude oil between 2008 and 2022 and reduce the outflow of dollars to foreign oil producers by $817 billion between 2008 and 2022. (*Source: Economic Impact of the Energy Independence and Security Act of 2007, John M. Urbanchuk, Director, LECG LLC, January 2008.*



Since early '90 Europe developed Biodiesel production instead (mainly from rape seeds and sunflower).



In 2005 EU biodiesel production was 90% of world total; in 2007 total production reached 5,7 million metric tonnes, 16,8 % increase over 2006. Germany alone represented more than 50% of EU.
Only small quantities are for non-transport use.

Slide 9 The interest for biofuels is rapidly increasing around the world. While traditional leaders like Brazil, Canada and the European Union continue to increase both the production and use of biofuels, new players in the global industry are beginning to emerge.

Nations like China, seeking solutions to the growing energy needs of its expanding population, are boosting ethanol production and looking for new feedstocks to fuel the industry's growth. Japan, historically only an importer of ethanol, is developing technology to use indigenous feedstocks like rice to produce ethanol domestically.
And countries like India, Australia, and the Philippines are looking to ethanol and other renewable fuels for a more sustainable energy future.
Some examples are shown below.

- U.S.A.: 2017 Biofuels target 9% (35 billion gallons).
- Brazil: All gasoline must contain between 20 and 25% anhydrous ethanol. Currently, the mandate is 23%. 5% biodiesel on all gasoils within 2013.
- Canada: By 2010, 5% of all motor vehicle fuel must be ethanol or biodiesel.
- Lithuania: Gasoline must contain 7-15% ETBE. The ETBE must be 47% ethanol.
- Poland: Mandatory "National Biofuel Goal Indicators" calling for biofuels to represent a set percentage of total transportation fuel use. 2008's standard is 3.45%, on an energy content basis.
- Argentina: Requires the use of 5% ethanol blends by 2010.
- Thailand: Gasoline in Bangkok must be blended with 10% ethanol.
- India: Requires 5% ethanol in all gasoline.
- China: Five Chinese provinces (representing 16% running park) require 10% ethanol blends
- The Philippines: Requires 5% ethanol blends in gasoline beginning in 2008. The requirement expands to 10% in 2010.
- Bolivia: Expanding ethanol blends to 25% over the next five years. Current blend levels are at 10%.
- Colombia Requires 10% ethanol blends in cities with populations over 500,000.
- Japan: 20% biofuels or liquefied gas within 2030.
- Africa: Productive and consumption targets in many countries (South Africa, Ethiopia, Nigeria, Kenya, Mozambique, Guinea, etc.)
-

Slide 10 As to Europe, within the framework of an ambitious Energy and Environment Policy, approved last year, European Union, with Directive 2003/30/Ce, **has set for herself a first biofuel target of 5,75%** of total demand for transport fuels, by 2010.

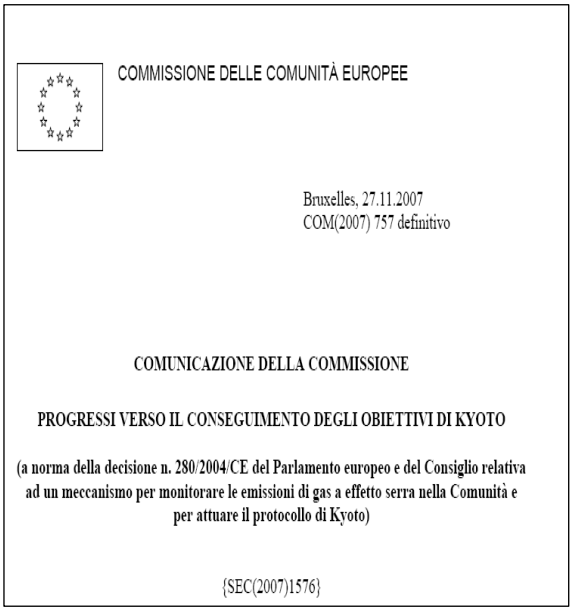
The target was further increased in March last year to 10% by 2020, subject however to sustainability standards, availability on the market of second generation biofuels and amendments of Directive on Fuels Quality, to assure adequate blending levels.

Last January EU Commission has eventually approved a set of legislative proposals for the achievement of those targets. Such proposals need the approval of the European Parliament, followed by approvals from Member States. Given however the costs involved and relative discussions, it will be a great success to get all approvals by the end of 2008.

Recently however, the problems created by rising commodities prices induced by increased production of biofuels (problems that we will analyze further on in the presentation) convinced some European countries (in particular France, Great Britain and Italy) to ask for a reduction of the target, or delay in the anticipated date of implementation.
EU official Commissioner for Environment, Stavros Dimas declared that the target should be maintained only if environmental sustainability can be completely assured.

As a first consequence the Environment Committee of the European Parliament, voting in Strasbourg on July 7, agreed to reduce the proposed 10 per cent target for the use of biofuels in transport by 2020 to 4 per cent by 2015, followed by a major review. The MEPs also supported the incorporation of electric or hydrogen cars into the target to potentially reduce the use of biofuels even further.

In the meantime results achieved to date are quite modest.
A progress report published by EU at the beginning of 2007 shows unsatisfactory results:
Only Germany (3,8%) and Sweden (2,2%) were in line with the 2005 objective (2%).
All other counties were below 50% of Target.
In particular Biodiesel was only 1,6% of di esel market, with Germany first producer and consumer.
Ethanol was only a bare 0,4% of gasoline.


COMMISSIONE DELLE COMUNITÀ EUROPEE

Bruxelles, 27.11.2007
COM(2007) 757 definitivo

COMUNICAZIONE DELLA COMMISSIONE

PROGRESSI VERSO IL CONSEGUIMENTO DEGLI OBIETTIVI DI KYOTO

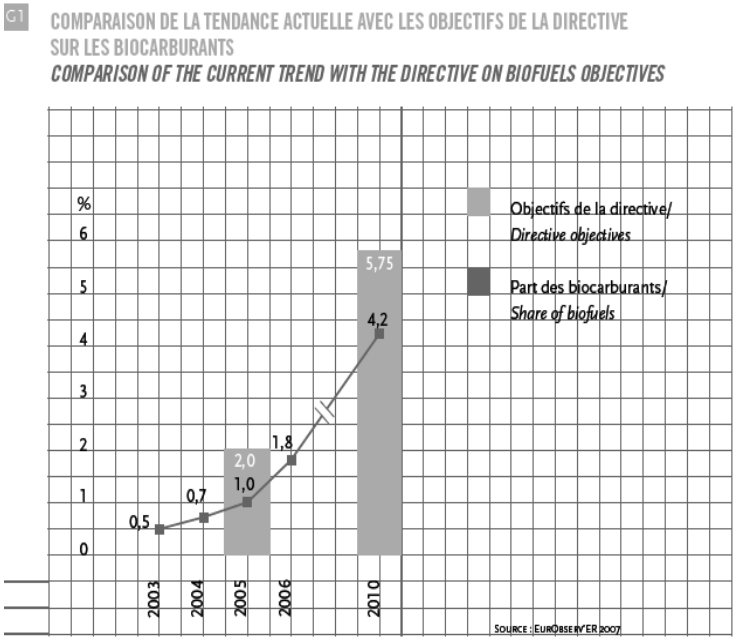
(a norma della decisione n. 280/2004/CE del Parlamento europeo e del Consiglio relativa ad un meccanismo per monitorare le emissioni di gas a effetto serra nella Comunità e per attuare il protocollo di Kyoto)

{SEC(2007)1576}

Only 8 Member States had made plans or made mandatory biofuels use. 19 had set targets for 2010, but in many instances lower than the 5,75% target. Slide 12 The previously cited Progress Report of the Commission underlines the factors that favored the good results in Germany and Sweden, to be followed by other European countries if they really intend to achieve targets:

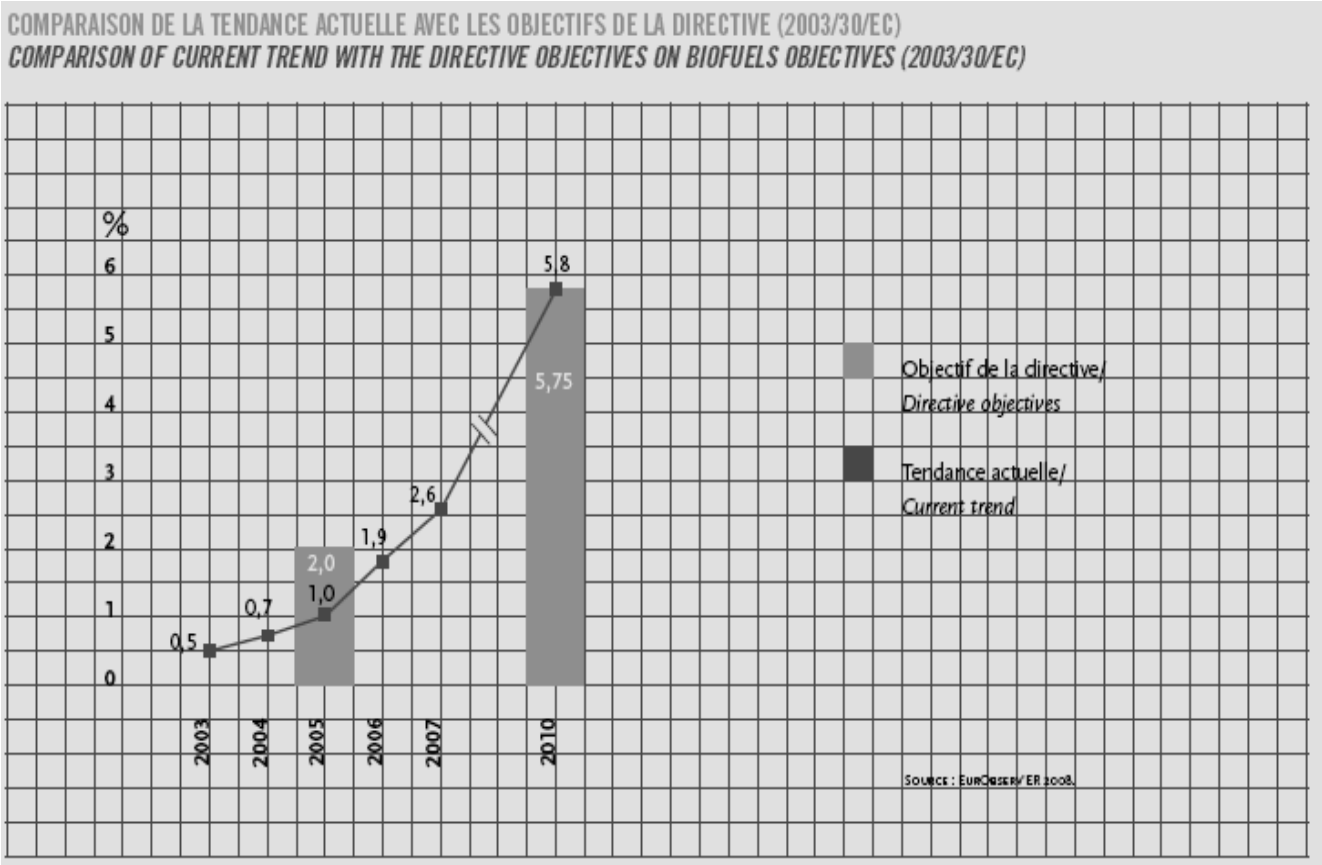
- The two countries are active in the sector since many years (Germany in biodiesel – Sweden in ethanol).
- They promote both the use of biofuels pure or in high blends, or low blends compatible with present distribution channels, and with engines presently marketed.
- Tax exemptions are granted without quantitative limits.
- They combine domestic production with imports (Sweden from Brazil, and Germany from other community members).
- They both invest in research on biofuels, considering what available today as a bridge towards the second generation.

Therefore, given the past trends and the lack of lawful obligations to their achievement in some countries, it appears most unlikely that 2010 target be achieved.



In fact last year's estimates of Biofuels Barometer (chart on the left) ranged from a maximum of 4,2% to a minimum of 2,4%. Many Member states shared these forecasts: consequently a revision of targets during 2008 appeared probable, also for political reasons we will discuss later.

This year report however is much more optimistic, as you can see in the following chart, with comments to the new forecast as follows: "Respecting the directive on biofuels, which targets increasing the share of biofuels to 5.75% in energy content of total fuel consumption in 2010, is a matter of national policy decision-making.



The follow-up reports, transmitted by most of the member States, make it possible to be optimistic in this, all the more so as certain EU countries, among the largest consumers like France, Germany and Austria, have decided to move ahead of the objective. Others, like the UK and Italy, still don't have sufficient incentive legislation to respect the directive. It is also probable that those countries with very low incorporation rates today and which have chosen to not sufficiently develop local production capacities are going to turn to imports in order to fulfil their objectives in terms of the directive".

The following chart shows in fact that things start moving, and progressions made last year are evident. The research of "Le journal des énergies renouvelables (BIOFUEL S BAROMETER – JUNE 2008)" underlines that "After more than four years of implementation, the European directive for promotion of biofuels intended for transport has made it possible to reach biofuel consumption of approximately 7.7 Mtoe in 2007).

This consumption represents 2.6% of the energy content of all the fuels used in road transport, i.e. less than half of the directive's target of 5.75% in 2010", but the increase over 2006 is of 37%, 33%, for ethanol and 40% for biodiesel.

BIOFUELS CONSUMPTION FOR TRANSPORT IN EUROPEAN UNION IN 2007 (IN TOE)*

Pays/ *Countries*	Bioéthanol/ *Bioethanol*	Biodiesel/ *Biodiesel*	Autres/ *Other***	Consommation totale/ *Total consumption*
Allemagne/*Germany*	293 078	2 957 463	752 207	4 002 748
France/*France*	272 937	1 161 277	0	1 434 215
Autriche/*Austria*	21 883	367 140	0	389 023
Espagne/*Spain*	112 640	260 580	0	373 220
Royaume-Uni/*UK*	78 030	270 660	0	348 690
Suède/*Sweden*	181 649	99 602	n.a.	281 251
Portugal/*Portugal*	0	158 853	0	158 853
Italie/*Italy*	0	139 350	0	139 350
Bulgarie/*Bulgaria*	66 160	46 336	0	112 496
Pologne/*Poland*	85 200	15 480	0	100 680
Belgique/*Belgium*	0	91 260	0	91 260
Grèce/*Greece*	0	80 840	0	80 840
Lituanie/*Lithuania*	11 600	41 000	0	52 600
Luxembourg/*Luxembourg*	865	34 098	0	34 963
Rép. tchèque/*Czech Rep.*	180	32 660	0	32 840
Slovénie/*Slovania*	794	12 993	n.a.	13 787
Slovaquie/*Slovakia*	13 262	n.a.	0	13 262
Hongrie/*Hungary*	9 180	0	0	9 180
Pays-Bas/*The Netherlands*	8 670	n.a.	0	8 670
Irlande/*Ireland*	2 352	4 612	1 410	8 374
Danemark/*Denmark*	6 025	0	0	6 025
Lettonie/*Latvia*	1 738	2	0	1 740
Malte/*Malta*	n.a.	0	0	0
Finlande/*Finland*	n.a.	n.a.	n.a.	n.a.
Chypre/*Cyprus*	n.a.	n.a.	n.a.	n.a.
Estonie/*Estonia*	n.a.	n.a.	n.a.	n.a.
Roumanie/*Romania*	n.a.	n.a.	n.a.	n.a.
Total UE/*EU*	**1 166 243**	**5 774 207**	**753 617**	**7 694 097**

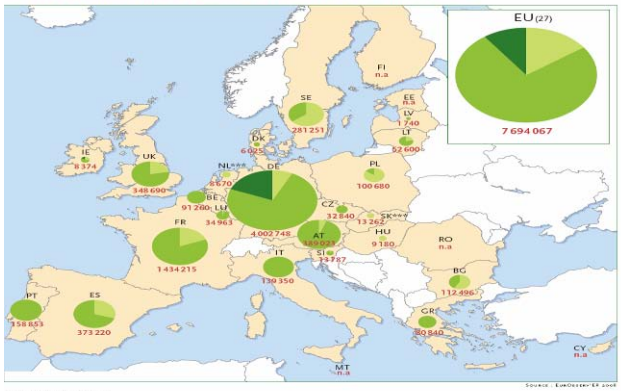
* Estimation/*Estimation*.

** Huile végétale consommée pure pour l'Allemagne, l'Irlande et les Pays-Bas et biogaz pour la Suède/*Vegetable oil consumed as such in Germany, Ireland and The Netherlands, and biogas for Sweden.*

n.a. : Non disponible/*Not available.*

Source : EurObserv'ER 2008.

CONSOMMATION DE BIOCARBURANTS DESTINÉS AU TRANSPORT DANS L'UNION EUROPÉENNE EN 2007*
*BIOFUELS CONSUMPTION FOR TRANSPORT IN EUROPEAN UNION IN 2007**



Source : EurObserv'ER 2008

LÉGENDE/KEY

Consommation de biocarburants destinés au transport dans l'Union européenne en 2007 (en tep)*, avec les parts respectives de chaque filière/*Biofuels consumption for transport in European Union in 2007 (in toe)* with respective shares of each sector.*

Bioéthanol/*Bioethanol* Biodiesel/*Biodiesel* Autres/*Other*

Les chiffres en rouge indiquent la consommation totale/*Red figures show total consumption*

The same results can be shown in a chart of Europe that stresses visually the most important places where biofuels are used. Germany, France and Austria appear as the leaders.

Vehicle performance and product availability

Let's now give a look to the problematic raised by biofuels around the world, and the most important answers from the manufacturers and the market.

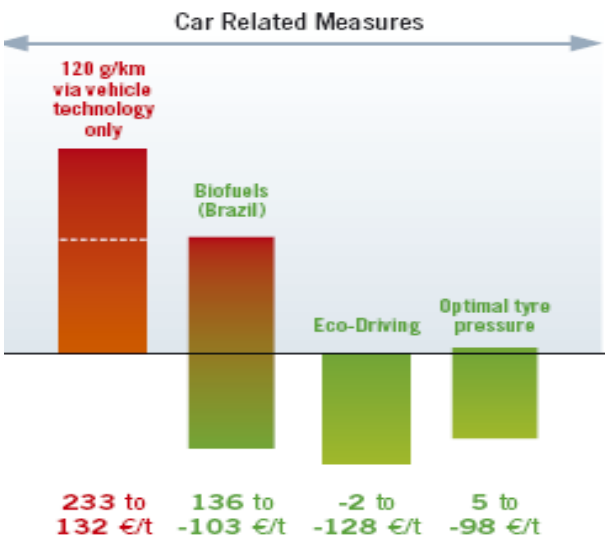
- Efforts to introduce ethanol into the transport fuel market has, in most countries, focused on low-percentage blends, such as ethanol E10.
- Nearly all recent-model conventional gasoline vehicles produced for international sale are fully compatible with 10% ethanol blends (E10). These vehicles require no modifications or engine adjustments to run on E10.
- Following on the successful applications of E10 in several countries and E22- 26 in Brazil, considerable interest surrounds the use of much higher-level blends, particularly E85 (85% ethanol, 15% gasoline), on engines purposely designed , the so called Fuel Flex Vehicles.
- The FFV are manufactured and sold in USA and Brazil and recently marketed in Europe (Germany, Sweden, France, etc). High-level ethanol blends can be distributed through existing refuelling infrastructure with relatively minor changes, but with adequate investments.
- Ethanol blended with gasoline increases its octane number. The higher % of oxygen improves engine performance.
- Biodiesel from fatty acid methyl esters (FAME) is generally accepted to be fully blendable (20%) with conventional diesel, except for certain considerations when using high-percentage biodiesel blends or neat (pure) biodiesel
- Biodiesel can improve diesel lubricity and raise the cetane number, aiding fuel performance. However can reduce engine durability and create problems in cold weather.

As previously indicated Vehicle Manufacturers reacted immediately to Policy Makers indications, and offer today a complete range of vehicles that can use ethanol in the highest possible blends. (E85 for Flex Fuel Vehicles).
But what happened in the USA is very interesting to underline how policies not rationally devised and implemented, taking into account not only the pros but also the eventual negative consequences, can lead to contradictory results.
In the study Biofuels – at what cost, prepared in 2006 for The Global Subsidies Initiative (GSI) we can read that "the costly obsession of policymakers with E85 and the flex-fuel vehicles (FFVs) that can run on it, was based on the belief that building E85-capable vehicles would lead to an increase in the availability of the fuel. It didn't. FFVs got built in any case, because they helped automobile manufacturers obtain generous credits towards meeting their CAFE standards, with the perverse consequence of actually increasing gasoline consumption. When oil prices started to rise in 2005, policy-makers decided that, given there were now several million FFVs

on the road, it would be a good idea to get infrastructure in place so that they could actually run on the alternative fuel these vehicles were designed to use. That has meant yet more subsidies to pay for the rapid expansion in the number of filling stations with E85 pumps. Yet even if one accepts that there are net benefits for the country of using ethanol in place of gasoline, E85 is not needed: the same benefits could be achieved through more widespread use of E10 (a blend of 10 per cent ethanol and 90 per cent gasoline), which any car built since 1980 can safely run on.
To the extent that there are any benefits for national security, regional economies, and greenhouse-gas emissions from consuming biofuels, it is the overall displacement rate of petroleum fuels rather than the specific blends in which it is consumed that matters.
Meanwhile, most of the six million or so FFVs on the road continue to run mainly on gasoline, with subsidies that appear to be unsustainable ($3 billion at a minimum, and probably closer to $4 billion, each year), and disproportionate to the benefits achieved."
Such example is also interesting because some European countries seem to be moving in similar direction (see French initiative approved last year, but that as of today does not seem to progress as originally planned). FFV are now produced in Europe too.

Let's now have a look to **European Vehicle Industry position.**
Car manufacturers are definitively in favour of biofuels, also because their increased utilization can help in achieving the levels of CO2 that EU Commission intend to impose, together with technical progress and contribution from tires, lubricants, and air conditioning manufacturers, improved quality of traditional fuels, ecodriving etc. (**integrated approach – that should also address infrastructure flaws, enforcement of traffic law and CO2-related taxation).**

In fact vehicle technology alone is not sufficient and very expensive: it is calculated that it can cost up to 10 times more than use of biofuels or adoption of adequate driving styles, with relative consequence, in the end, to the cost of final products. (In the chart various costs of reducing emission to 120 g, per ton of CO2 – ACEA).



Technologies and products for the use of biofuels are available in all major

European Car Manufacturers: the last one coming into the picture Ferrari…, which in 2008 Detroit and Geneva Motor Shows introduced the F 430 biofuel.

But looking at other countries' experiences, one could question whether it would be more convenient to increase FFV production (US approach) or the blending of all gasoline with 10% ethanol, a blend that most of the vehicles today on the road (and produced after 1980) can safely use.

Biofuels and CO2: Real solution to the problem?

We began our presentation underlining that expanding the use of biofuels would support in fact several major policy objectives and Energy security is definitively one . Biofuels can in fact readily displace petroleum fuels and, in many countries, can provide a domestic rather than imported source of transport fuel, immediately usable on vehicles, without major technical or distribution problems. At today's price of petrol that seems very promising, a part from some critical consequences that we will analyse further on.
But probably the most important goal is the reductions in greenhouse gas emissions. Ethanol and biodiesel are said to provide significant reductions in greenhouse gas emissions compared to gasoline and diesel fuel on a "well-to-wheels" basis.
This statement, however, has been challenged by leading International Organizations and researchers.
Among them the International Transport Forum, which in the Report on the Round Table organized with OECD that brought together 50 leading researchers on the science and economics of biofuels to examine the potential for these fuels to fulfil the policy expectations (**Biofuels – linking Support to Performance**), stated that:

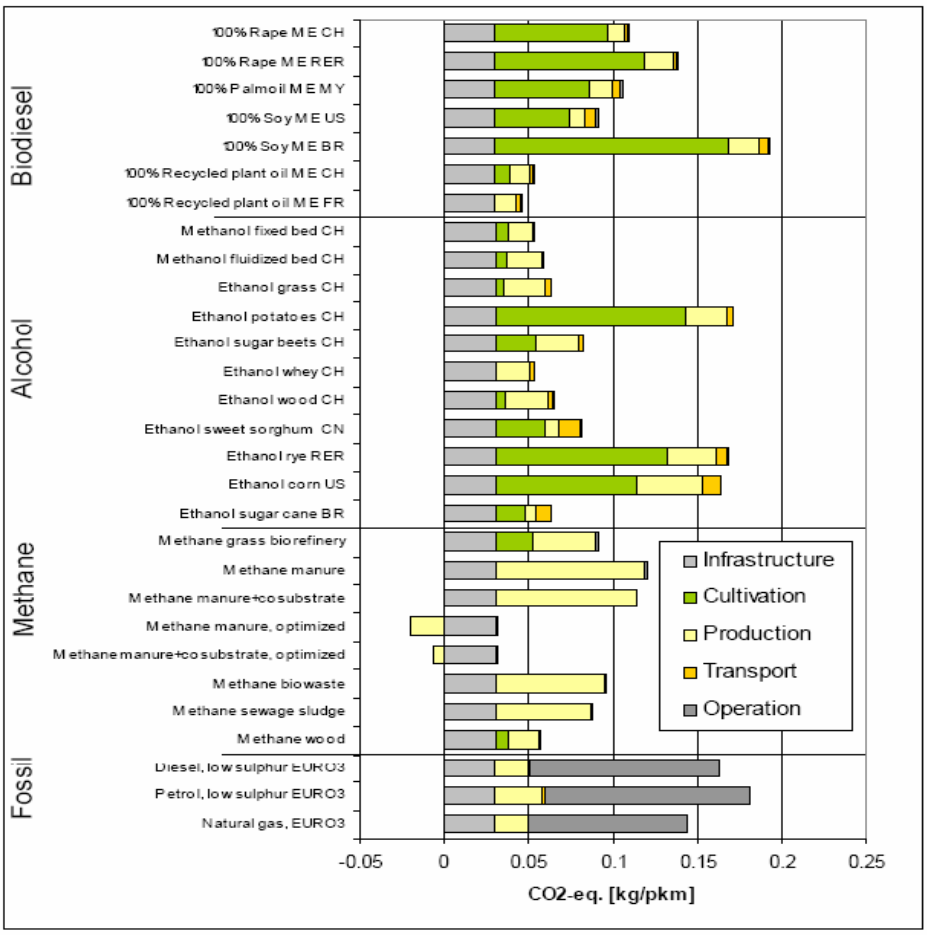
- Only "few biofuels seem to offer much in the way of climate protection or oil security and are a very expensive way of addressing these concerns.
- Furthermore there is a high degree of uncertainty over the net greenhouse gas emissions from producing and consuming biofuels in place of gasoline or diesel. Some may even produce higher emissions than petroleum. Of currently produced fuels ethanol from sugar cane produced in Brazil is by far the best, partly because sugar is easier to turn into alcohol than starch (from wheat or corn) and partly because waste cane pulp is used to fuel Brazil's distilleries. Distillation takes a lot of energy and in many other countries ethanol is produced using natural gas or coal to heat the stills – emitting large quantities of CO_2. Biodiesel performs no better.
- The cost of this production is high. In 2007, four billion dollars in the US, fully one quarter of the total farm subsidy budget, and expected to grow to 16 billion dollars under current biofuels targets. Support for biofuels already totals around 15 billion dollars a year in the OECD as a whole. Much cheaper ways of saving fuel and CO2 emissions are available in the transport sector and elsewhere in the economy.
- Of course if the present petrol price is to stay or even increase the picture may change and make biofuels much more convenient and less subsidies may be necessary, but in that case other great risks would worsen, as we will see later on.

The same concepts were reaffirmed recently in Leipzig (May 28/30, 2008), where the world's largest transport summit released its findings, at the end of a three day Conference with Transport Ministers and leading Transport Organization and Scientists.
"Transport must *urgently* address the long-term supply of energy. In the shorter term, opportunities should be seized to promote the significant fuel-efficiency improvements to existing technology, attained through combinations of instruments such as regulations, economic and fiscal incentives and information campaigns designed to encourage consumers to opt for the most fuel efficient technologies. As one example, training in ecodriving and equipment of vehicles with feedback instrumentation to support fuel-efficient driving has been shown to be a "promising way forward". "Transport policy must give incentives for more energy-efficient behaviour", stressed the ITF Secretary General.

Also biofuels can play a useful role in reducing CO2 emissions. But production of biofuels must be pursued in an environmentally, economically and socially sustainable way".

In recent environmental assessments of biofuels, prepared for the Swiss government by the Empa Research Institute (Zah et al., 2007 – included in "**Biofuels – linking Support to Performance**"), comprehensive indicators for environmental impacts along with life-cycle assessments for greenhouse gas emissions for a wide range of biofuels and biofuel production systems, in a series of countries, have been developed.

The study assumed the fuels were for use in Switzerland but, as the transport-to-market component of overall greenhouse gas emissions for finished fuels is relatively small; this affects the figures only slightly.

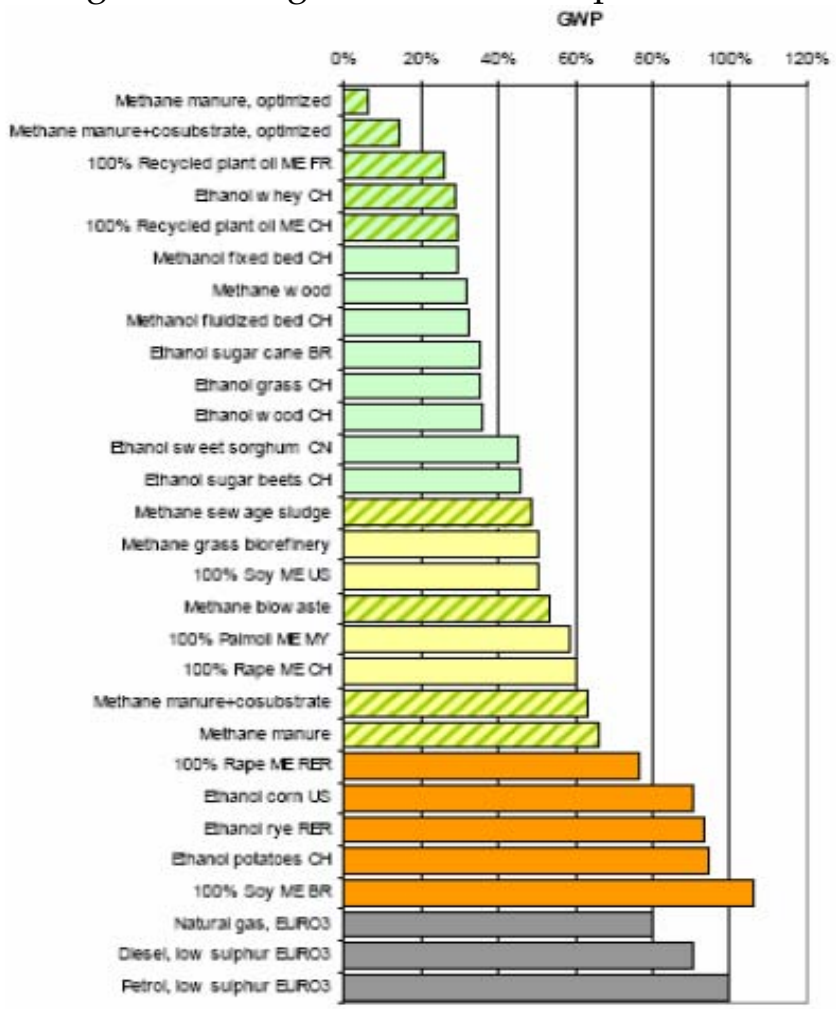


The results, summarised in the chart on the right, illustrate the importance of emissions during cultivation in determining life-cycle greenhouse gas emissions, together with the amount of carbon in the organic matter returned to the soil after harvesting.

Next chart shows a ranking of the most important biofuels in terms of environmental impact, and relative GHG reduction compared to gasoline and diesel.

To this regard we can quote Empa remarks, confirming points made by Farrell et al:

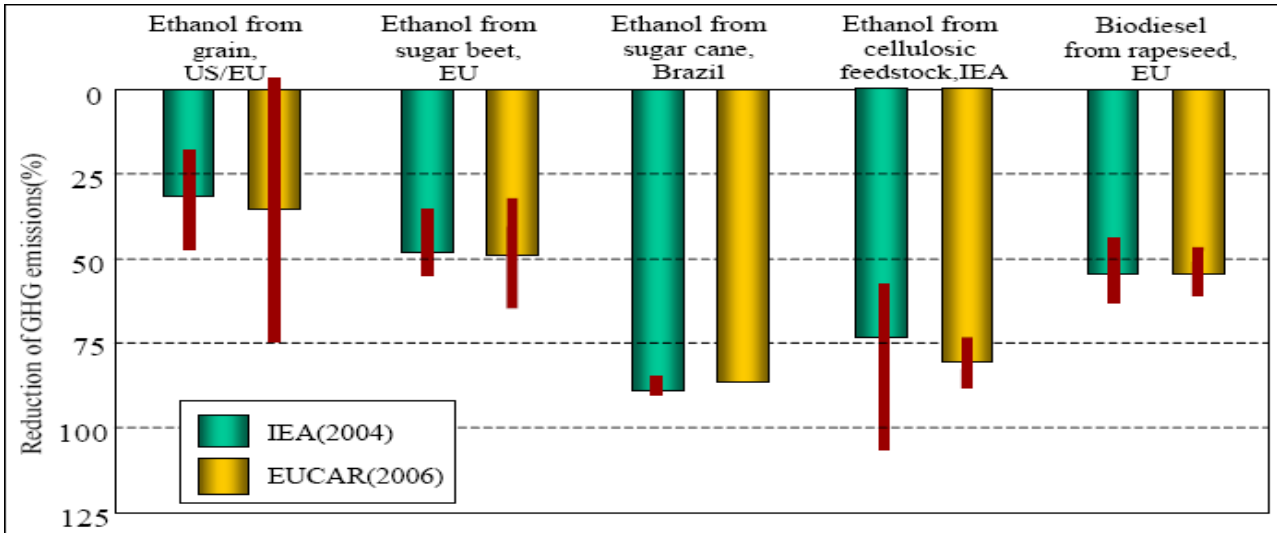
- The large range in Greenhouse gas performance between different fuels and feedstocks.
- Corn-ethanol and ethanol produced from rye and potatoes appears to provide no greenhouse gas benefits.
- Ligno-cellulosic ethanol produced from both grass and wood offers potentially far superior greenhouse gas benefits.
- Ethanol produced from whey and biodiesel produced from recycled vegetable oil also show favourable GHG performance.
- Fuels providing unambiguous greenhouse gas benefits (over 50% reductions) are ethanol from Brazilian sugar cane, from Canadian sorghum and from sugar beet.
- Good results from Biodiesel from US soy, Malaysian palm-oil and Swiss rapeseed also perform reasonably well with 30- 40% reductions of greenhouse gas emissions compared to conventional diesel.



Rapeseed biodiesel, produced in the European Union, performs less well according to the study.

Note:
- **Green: reduction >50% versus petrol**
- **Yellow: reduction > 30%**
- **Orange: reduction < 30%.**
  - **Cross-hatched: production from waste materials or residues**

Much more optimistic the forecast of the United Nations, that in the 2007 Inter-Governmental Panel on Climate Change (IPCC) 4° Assessment Report on climate change mitigation policies foresees a potential for biofuels from agricultural crops and wastes to replace 5% to 10% of road transport fuels by 2030, with an economic potential for net greenhouse gas reductions ranging from 0.6 to 1.5 Gt CO2-eq at carbon prices of up to $US 25/t CO2-eq. It bases these projections on assessments of the life-cycle greenhouse gas emissions by the IEA, EUCAR-CONCAWE-JRC,GM-ANL and Toyota



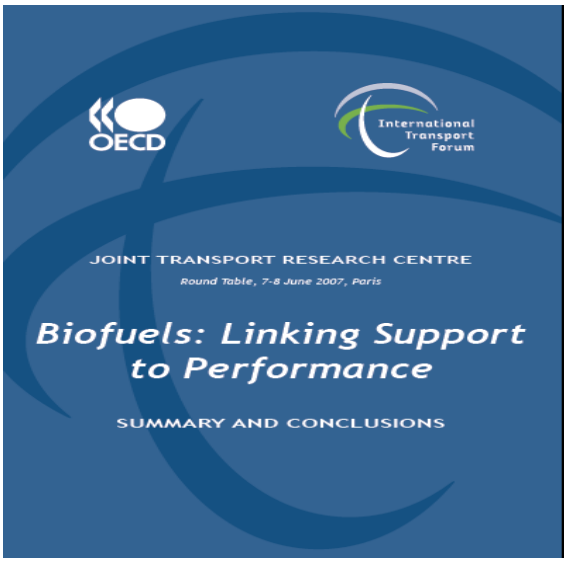
But the uncertainties surrounding estimates of the greenhouse gas emissions reduction potential previously analyzed suggest that the IPCC may be too optimistic.

The forecast does assume significant advances in biofuel production but the figures for corn-ethanol production in the studies reviewed by Farrell et al. (2006 *Ethanol Can Contribute to Energy and Environmental Goals)* suggest more radical change would be required, with the abandonment of current land-intensive feedstocks such as corn and wheat.

Furthermore, discussions at the ITF/OECD Round Table previously mentioned suggested that projections that biofuels production will grow to contribute a large share of energy supply are unrealistic. For example the projection by the University of Texas of solid and liquid fuels derived from biomass covering 25% of US energy supply by 2025 would require 50% of all ecosystem production in the US (natural ecosystems as well as food and fibre crops) to be replaced with biofuel crops.

The discussion on the economics of biofuels at last year ITF/OECD Round Table suggests that, "even if the IPCC's assumption that biofuels could be competitive with oil in 2030 proves to be the case, hundreds of billions of

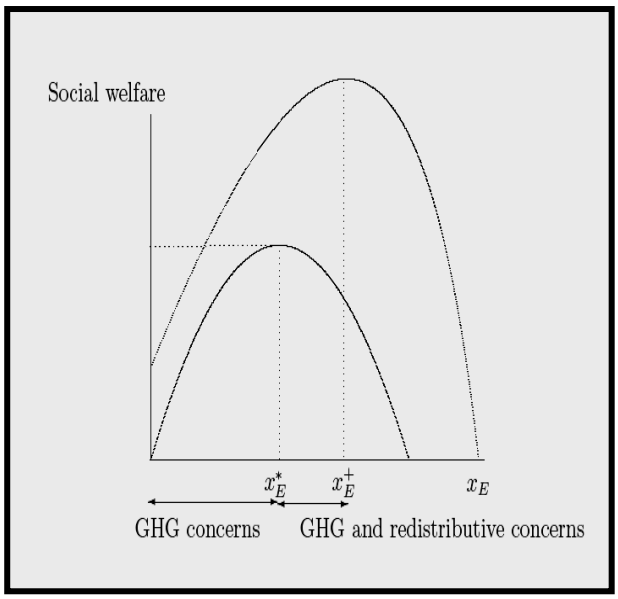
dollars of subsidy will be spent on the production of biofuels in the interim, if proposed EU and US targets to cover 10% of transport sector fuel consumption before 2020 are to be met. Only very small quantities of biofuels are currently produced without support and even the best performing biofuel industry, Brazilian sugar cane ethanol production, requires around USD 1 billion a year in support through excise tax and VAT exemptions".



From the above report, a very important document that, as mentioned previously, summarized the work of a group of 50 leading economic, environmental and transport scientists and researchers, I like to underline a final quote on subsidies and their strategic role on the subject.
"Subsidising large-scale production and consumption of conventional biofuels fails to deliver a significant contribution to the strategic goals of reducing greenhouse gas emissions or improving the security of supply of fuels for transport. It is an inefficient way of providing income support to rural communities and it consumes large amounts of taxpayers' money (USD 4 billion in 2007 in the USA in tax subsidies alone; USD 4 billion in 2006 in the European Union in tax subsidies; and between USD 13 billion and USD 15 billion in the OECD as a whole for support overall), without commensurate benefits".

To put it in a nutshell:
Biofuels policies have large impacts on agricultural markets. The new demand for feedstock led already to sharp price increases of agricultural products, in a contest of increasing demand for food worldwide.
A particular aspect of subsidies is the one analysed by Bourgeon and Tréguer who propose a model of competition between food and energy uses of agricultural products to evaluate the effects of a biofuel subsidy policy. The model brings together the main stakeholders of the policy under scrutiny: taxpayers, farmers, and the biofuel and agro-food industries. The State has committed itself to develop a biofuel sector, while maintaining a minimal guaranteed income to farmers. The increase of farm incomes made possible by the price hike in the agricultural markets enables the State to diminish the decoupled payments, while ensuring a parity income to farmers.

As the chart shows the main result is that the country might benefit from the redistribution effects of the biofuel subsidy policy. "Taking account of the redistributive aspect and the environmental positive externality of mitigation, the optimal quantity of biofuels, xE +, is greater than the optimal quantity derived neglecting the redistributive advantages, xE*. Equivalently, we might say that the financial burden of the biofuel subsidy policy should not be calculated on the whole quantity of biofuels, but only on the residual quantity xE+ - xE* where xE* is the target that the State would have set up for environmental purposes only".



Furthermore impacts on land fertility, soil erosion, water abstraction, water pollution and biodiversity can be severe unless the very best farming practices are employed. Only relatively small amounts of biofuels are being produced today but vast amounts of land – needed for food, timber and wildlife – would be required to make the significant contribution to oil substitution and security.
Finally there is a high degree of uncertainty over the net greenhouse gas emissions from producing and consuming biofuels in place of gasoline or diesel. Some may even produce higher emissions than petroleum.

Socio-Economics consequences of agricultural products price increase
Apart from scientific speculation, it is a fact that prices of agricultural products, have globally sharply and risen, and that has recently started to produce heavy social consequences.
A clear example is offered by Dan Sperling, Director of the Institute of Transportation, University of California – 2007, who, among other facts, says:
"Diverting corn to fuel distorts agricultural markets and raises food prices. In 2006-07, the diversion of corn to fuel contributed to the sharp (50%) increase in corn prices — not just in the United States but also internationally - from historical levels of around $2.25 per bushel to about $3.75. The price effects reverberated far afield. Beef prices increased because cattle are fed corn, farmland prices doubled in many areas, soy prices increased as fields were diverted to corn, and corn tortilla prices more than doubled in Mexico, provoking riots*.

Sir John Holmes, undersecretary general for humanitarian affairs and the UN's emergency relief coordinator, told a conference in Dubai that "escalating prices would trigger protests and riots in vulnerable nations. He said food scarcity and soaring fuel prices would compound the damaging effects of global warming. Prices have risen 40% on average globally since last summer.

The security implications [of the food crisis] should also not be underestimated as food riots are already being reported across the globe," Holmes said. "Current food price trends are likely to increase sharply both the incidence and depth of food insecurity."

The UN's food and agriculture organization (FAO) estimates suggest that the world ran down its stocks of grains by about 50 m. tons during the past year.
They also reported that cereals stocks are at the lowest levels in 20 years and today's availability is barely sufficient to meet actual demand, grown rapidly due to increase in biofuels production
The 100 m. tons of maize to be used by US ethanol refineries in 2008 are double last year's global grain shortfall. Without ethanol production, supply would exceed demand and price inflation might have been kept in check. The IMF largely agrees with this view, saying that growth in biofuels has caused 70% of the increase in maize prices over the last few years.
In The Economist' opinion (Food Index - December 2007), food prices increased by 75% since 2005.
But, to remain at home, isn't true that bread and pasta underwent severe price increase in the past months in Italy and further hikes are expected?

Ruth Davis, in The Guardian of June 11, 2008, says that "requiring 10% of the EU's transport fuel to come from biofuels in the next decade will not help. It will increase demand for conventional crops, push up food prices, and drive production into forests and grasslands, destroying precious wildlife and releasing stored carbon into the atmosphere. Behind all the arguments about biofuels, she continued, there is a moral choice. High food prices punish the less well off. Smaller cars with more efficient engines and lower fuel costs, coupled with a move away from policies that increase food prices, are, on the

other hand, truly socially progressive. How we go forward from here, will depend largely on Gordon Brown, because without the UK's intervention there is no chance that Europe will step away from the 10% target".

"Food is now worth more as petrol than on the table", says Chris Goodall (The Guardian – May 2008), and the unpalatable truth is that only a long and painful attack on oil consumption will reverse the spiral in food prices
"Rising food and fuel prices, competition between biofuels and food, increased demand for food by countries with emerging economies and erratic weather are hitting hardest those on the poverty line" so says the World Food Programme.
The International Food Policy Research Institute has conservatively estimated that biofuels are responsible for 30% of recent food price rises, and the IMF has made similar claim. (The Guardian-July 4, 2008)

More recently, **in a unofficial note, prepared by an economist of the World Bank**, their index of food prices was reported increasing by 140% from January 2002 to February 2008. This increase was caused, as can be seen from a copy of the draft shown to the left, and reported by The Guardian of July 11, 2008, "by a confluence of factors, **but the most important was the large increase in biofuels production in the US and EU**. Without the increase in biofuels, global wheat and maize stocks would not have declined

April 8, 2008

A Note on Rising Food Prices[1]

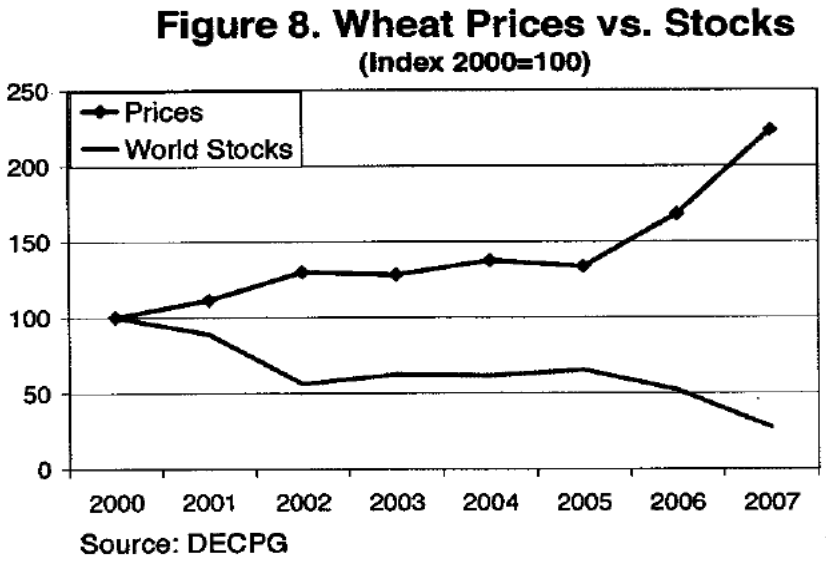
Prepared by Donald Mitchell[2]

Summary

The World Bank's index of food prices increased 140 percent from January 2002 to February 2008. This increase was caused by a confluence of factors but the most important was the large increase in biofuels production in the U.S. and EU. Without the increase in biofuels, global wheat and maize stocks would not have declined appreciably and price increases due to other factors would have been moderate. The export bans and speculative activity would not have occurred because they were responses to rising prices. Higher energy and fertilizer prices would have still increased crop production costs by about 15 percent in the U.S. and lesser amounts in other countries with less intensive production practices. The back-to-back droughts in Australia would not have had a large impact because they only reduced global grain exports by 4 percent and other exporters would normally have been able to offset this loss. The decline of the dollar has contributed about 20 percentage points to the rise in food prices. Thus, the combination of higher energy prices and related increases in fertilizer prices, and dollar weakness caused food prices to rise by about 35 percent from January 2002 until February 2008 and the remaining three-quarters of the 140 percent actual increase was due to biofuels and the related consequences of low grain stocks, large land use shifts, speculative activity, and export bans. The growth in global grain consumption (excluding biofuels) was 1.7 percent from 2000 to 2007 while yields grew 1.3 percent and area grew by 0.4 percent.

appreciably and price increases due to other factors would have been moderate."

In particular " the decline of the dollar has contributed about 20 percentage points to the rise in food prices. Thus, the combination of higher energy prices and related increases in fertilizer prices, and the dollar weakness caused food prices to rise by about 35 percent from January 2002 until February 2008 and **the remaining three-quarters of the 140 percent (or a 105% increase) was due to biofuels and the related consequences of the low grain stocks, large land use shifts, speculative activity, and export bans**. The growth in global grain consumption (excluding biofuels) was 1.7 percent from 2000 to 2007 while yields grew 1.3 percent and area grew by 0.4 percent".



Development economist Paul Collier, writing in the Times newspaper, comments: "one SUV tank of biofuel uses enough grain to feed an African family for a year", and conclude:

Biofuels versus the Bottom Billion?

U.S. Producers point of view

Of course the producers of biofuels have a different point of view: as an example we can quote some statements taken from 2008 Report, published by the Renewable Fuels Association (national trade association for the U.S. ethanol industry):

"While ethanol demand is providing American farmers a better value for their grain, it is not the sole culprit or even a major reason for rising food prices.

Factors like $100 per barrel of oil, record global demand for food and feed grains, and a weak U.S. dollar play more significant roles in determining consumer food prices than the price of corn or the growth of the U.S. ethanol industry.

The displacement of 228 million barrels of oil in 2007 saved Americans $16.5 billion. That is an average of $ 45 million a day.
The production and use of 6.5 billion gallons of ethanol in the U.S. reduced CO2-equivalent greenhouse gas (GHG) emissions by approximately 10.1 million tons in 2007, the equivalent of removing more than 1.5 million cars from America's roadways".

Second Generation Biofuels.

But without entering into a detailed analysis of pros and cons, that is not the aim of this study, a potential answer to the severe problematic discussed above can result from the development of second generation biofuels and that should be a key focus of future efforts for both government and business. In the opinion of BIAC (Organization representing Industry and Business within OECD) "they are expected to deliver more energy and environmental benefits than current technologies, with a far reduced impact on food prices".
Second generation biofuels are made from non-food feedstocks, such as wood and straw. The production process for second generation biofuels uses the entire plant, contrary to first generation biofuels, which rely on the plant starches or sugar. While the technology is still being developed for large-scale production, they stand to bring substantial economic, social and environmental improvements in comparison with first-generation biofuels. Second-generation biofuels production, if successful, would not put pressure on the prices of certain food crops. Moreover, such feedstocks could be successfully grown on poorer quality land, meaning biofuels production should not come into direct competition for land currently used to produce food.
If second-generation biofuels are to realise this potential, BIAC advises that, instead of continuing to subsidize traditional biofuels production and distribution "Governments should allocate funding towards the development and introduction of cost-effective second-generation biofuels in a balanced and considered manner. While the benefits of second-generation biofuels are expected to be considerable, government support should nonetheless cover the broad range of possible future energy technologies and energy sources, and should be based upon sound science and tangible costs and benefits over a total energy chain.

Will Road Transport at least fiscally benefit from Biofuels production and use?

For sure the high price of petroleum leads towards increased production and use of biofuels.

But, in the opinion of Robert Bailey (The Guardian - July 4, 2008), "for the moment we are paying twice: once in taxes, and again at the supermarket cash register for more expensive food. At current subsidy rates EU taxpayers will be forking out € 22bn a year to support biofuels by 2020". It is easy to anticipate that at least part of that cost will be paid by vehicle users.

A first and clear indication in that sense comes from declaration of EU Commission President on costs of the Climate Change Project (23/1/2008) till 2020, anticipate at at least **160 € yearly pro capita, only to put the program under way.**

CONCLUSIONS

To conclude this brief report I'd like to make once more reference to the conclusions made in Bali last December by Jack Short, Secretary General of ITF, in his Presentation to United Nations Climate Change Conference: "The substantial growth in traffic anticipated over the next decades in all modes of transport under a business as usual scenario will likely double world transport emissions by 2030".

Global demand for oil is expected to increase from currently 84 mb/d (million barrels per day) to 116 mb/d by 2030. The IEA 4 (IEA Mid Term Oil Market Report - July 2007) is warning of shrinking oil capacity and slowing production, at the same time as demand for oil in fast growing regions such as Asia and the Middle East is expected to rise 3 times more than in the OECD area, causing a tightening of supply and likely high oil price levels post 2010.

Therefore "wide ranging and integrated policy packages are needed" to reduce transport emissions. According to J. Short (ITF Secretary General) "these include significant advances in vehicle and vehicle component technology supported by a range of policy measures aimed at increasing fuel efficiency. It is also necessary to act on the demand side, "not to restrict mobility, but to manage it."

Given the dimension of the challenge for the sector to reduce its CO2 emissions, neither industrial nor developing countries can afford to get priorities wrong.

By achieving the required emission reductions at the lowest overall cost, it is possible to protect the climate with minimal damage to welfare and economic growth."

As to Vehicles Manufacturers, they certainly "want to be part of the solution to climate change, but they cannot solve the problem alone" (Acea Statement – May 2008).
They face a number of challenges and needs therefore action by governments, other industries and consumers to make its own efforts effective.

- Governments should provide a stable, predictable political and fiscal environment in which automakers can have the confidence to implement long-term plans to improve fuel efficiency.
- Governments also must ensure that vehicles remain affordable and that the replacement of the current fleet by modern, safe and efficient vehicles is not slowed down, but accelerated.
- Action is needed on road infrastructure, to reduce the terrible waste of energy caused by road congestion. In the USA alone, it is estimated that 20 million tonnes of CO2 could be avoided every year by relieving the worst traffic bottlenecks.
- Consumers themselves have a major role to play, by driving in an environmental efficient way. So-called "eco-driving" could save up to 10% of surface transport sector emissions.

In a nutshell Automotive Manufacturers believe that it is essential to find the most cost-effective way to achieve the maximum result in reducing CO2 emissions from cars. Cost-analysis by independent researchers show that larger CO2 emission reductions can be achieved without endangering manufacturing in the EU.
That is why automobile industry proposes to combine different methods, including:

1. changing driver behaviour,
2. infrastructure measures,
3. alternative fuels (including Biofuels, of course),
4. CO2-related taxation

   together with

5. vehicle technology, (considering that the costs of reducing down to 130 g CO2/km are still prohibitively high at € 2500 per vehicle, not talking of the 120 g that would cost € 3500 per vehicle) endangering car production in Europe.

Biofuels are not the panacea to the problems induced by Fossil Fuels consumption, but one of the possible alternative to overcome the most dangerous ones. And since at least for a few years to come Petroleum will remain the main resource to move the economies of the world, we have only to act in the most sensible way, to make it as sustainable as possible, having care of social-economic welfare of the citizen of this world.

Emilio di Camillo
Turin, 14/7/2008

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