

RED, FQD, and EU Biofuels Policy

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TRB Annual Meeting ADC-70/80

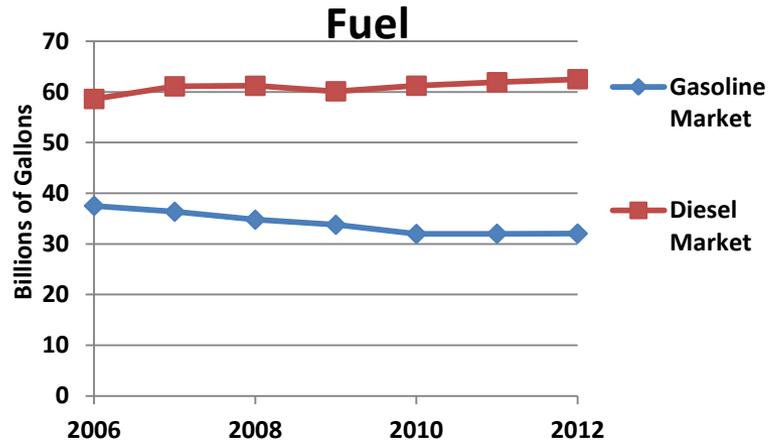
January 13, 2014

Outline

- **Overview of the EU Market**
 - Gasoline vs diesel market
 - Biofuels types
- **Renewable Energy Directive**
 - Description
 - Current status
- **Indirect Land Use Change (ILUC)**
- **Fuel Quality Directive**
 - Description
 - Compliance Options
- **Fuel Quality Directive and Transportation fuel markets**
 - Impact on biofuels
 - Petroleum

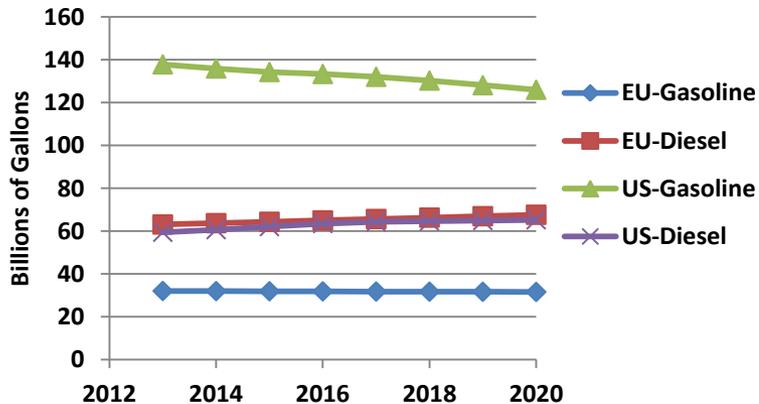
Transport Fuel Projections

EU Historical Transportation



- Continued drop in EU gasoline; consumption $\frac{1}{4}$ of US

US EU Transport Fuel

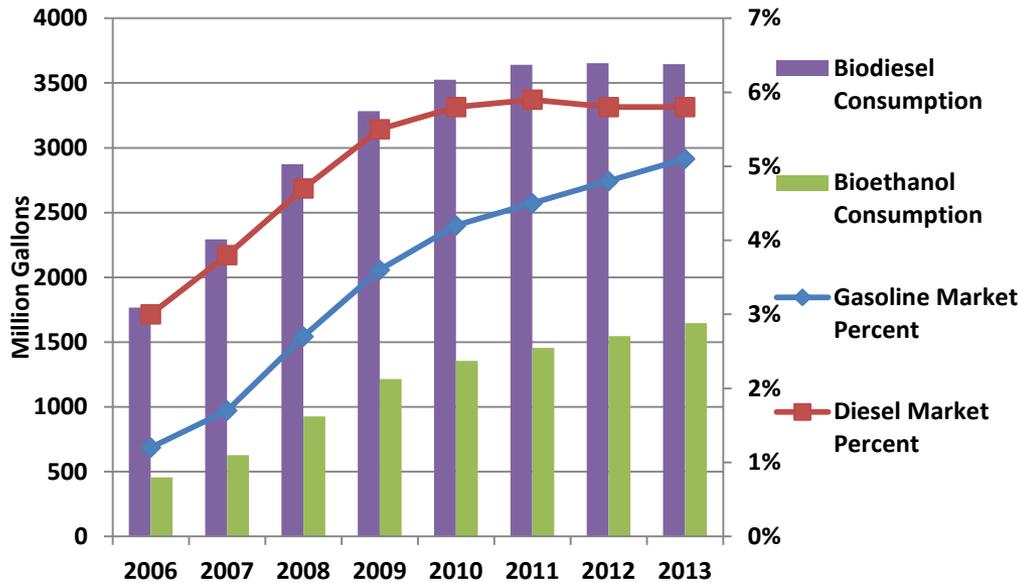


- Both markets decline; US faster
- Diesel markets very similar size

Source: USDA/FAS and EIA
AEO 2014

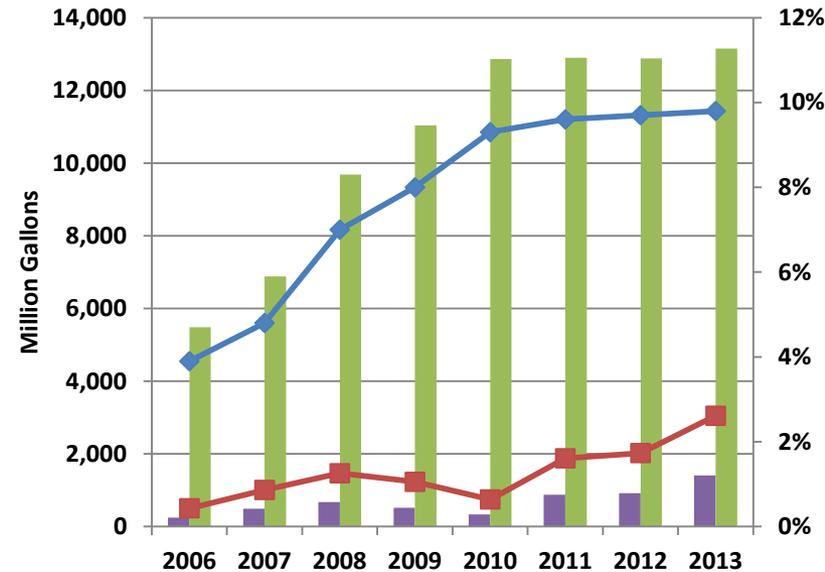
Historical EU Biofuel Consumption

EU Biofuel Consumption



Source: USDA/FAS

US Biofuel Consumption



Source: EIA STEO Dec 2013

- Ethanol market roughly one quarter to one fifth of US
- Biodiesel larger than US
- Ethanol averages almost at E5 level
- Biodiesel market at about 6 percent

EU Advanced Biofuel Plants

Advanced Biofuels Plants in the EU					
Country	Process	Biofuel	Feedstock	Capacity (million liters per year)	Year of opening
<i>Thermochemical</i>					
Finland	H	HVO	Oils and fats	430 (two lines)	2009
The Netherlands	H	HVO	Oils and fats	960	2011
The Netherlands	P/FT	Methanol	Glycerine	250	2010
Germany	G/FT	BtL	Wood Waste	18	2011
<i>Biochemical</i>					
Italy	HL/F	Ethanol	Wheat straw	20	2013

Source: US FAS Biofuels Annual Report

BtL=Biomass to Liquid, DME=Dimethyl Ether, F=fermentation, FT=Fischer Tropsch synthesis, G=gasification, H=hydrogenation, HVO=Hydrotreated Vegetable Oils, HL=hydrolysis, OS=oxygenate synthesis, P=pyrolysis

Biofuels, GHG and EU Transport Policy

- **Renewable Energy Directive (RED) Directive 2009/28/EC**
- **Fuel Quality Directive (FQD) Directive 2009/30/EC GHG reduction**
- **Sustainability and Indirect Land Use (ILUC) factors**

Renewable Energy Directive

- **EU Energy and Climate Change Package adopted by European Council April 9, 2009**
- **Key Elements: 20/20/20**
 - 20 percent reduction in GHG from 1990
 - 20 percent increase in efficiency
 - 20 percent of all energy from renewables, including 10 percent for transportation
- **Biofuel must meet sustainability criteria to count towards goal**

Sustainability Requirements

EU

- **Minimum GHG emission saving;**
- **Not grown on land with high biodiversity value such as primary forests and highly biodiverse grasslands;**
- **Not on land with high carbon stocks:**
 - wetlands
 - continuously forested lands
 - peat land

US

- **GHG savings by category (renewable, advanced and cellulosic)**
- **Cannot be grown on virgin agricultural land**
- **No tree crops, residue, or biomass from Federal lands**
- **Specifically included indirect land use (ILUC)**

Other Sustainability Conditions (2012)

- **Baseline**
 - 35 percent GHG reduction
 - New plants require 60 percent GHG reduction
 - Grandfathered plants must be at 50 percent reduction by 2018
 - ILUC for reporting only

ILUC Status (2013)

- **8th Revision proposal from European Council Presidency released October 2013**
- **Cap on cereal, starch or oil-based feedstocks now 7%**
- **Double counting for certain feedstocks (waste grease, etc)**
- **Electricity for transport (rail counted as 2.5, EV power counted as 5)**
- **No sub-category for advanced biofuel**
- **ILUC for reporting purposes only**
- **Amendments passed; but without negotiating authority**
- **Next step EC: in December member states did not agree on a common position**
- **Will be delayed until after EP elections in 2014, likely in 2015**

ILUC CHANGES GHG FOOTPRINT

Feedstock	Direct GHG (GCo2e/MJ)	ILUC (GCO2e/MJ)	Percent Reduction Against 2020 metric (90.3)	Percent Reduction Against 2020 Metric (90.3) with ILUC
Sugar beet ethanol	40	13	56%	41%
Wheat ethanol (energy not specified)	70	12	22%	9%
Wheat ethanol (natural gas)	55	12	39%	26%
Sugarcane ethanol	24	12	73%	60%
Rape seed HVO	44	55	51%	-10%
Soybean biodiesel	58	55	36%	-25%
Waste vegetable or animal oil	14	0	84%	84%
HVO palm (methane captured)	29	55	68%	7%

Source: Hart Consulting, EU 2012/0288

- **Current (2010) petroleum metric is 80.3 GCO2e/MJ**
- **2020 petroleum metric estimated as 90.3**
- **Only waste vegetable oil and sugar cane ethanol qualify with ILUC adder**

Fuel Quality Directive

- **Complements RED**
- **Includes sustainability criteria**
- **Elements of FQD**
 - 6 percent reduction in GHG intensity by 2020
- **2009 fuel types**
 - dual E5/E10; ETBE up to 22%
 - E15 is not an approved fuel, though it is sold in Lithuania and the Netherlands
 - Limits on FAME diesel (7%)

Fuel Quality Directive Compliance (8th Revision proposal)

- **Compliance Strategies**
 - **Biofuels**
 - E10 with advanced biofuels
 - Algae
 - Waste grease and other by-products such as straw
 - HVO biodiesel (not counting ILUC)
 - **Electricity: Rail and vehicles**
 - **Petroleum GHG footprint reduction**
 - Crude slate change
 - Reduce flaring

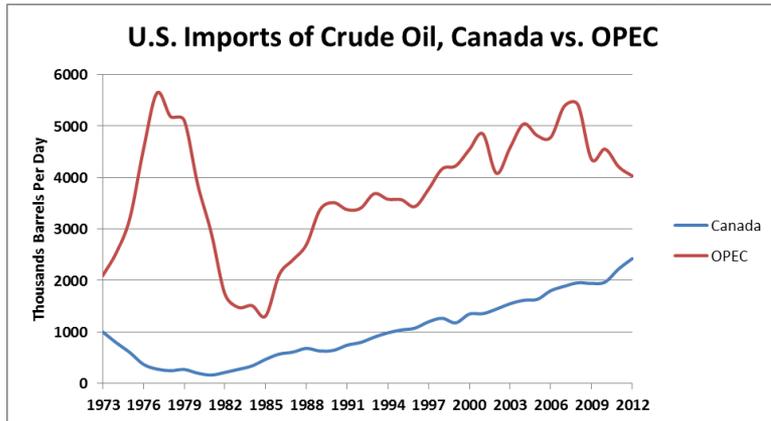
EC 2011 Proposal FQD

LCA GHG Emissions (GCO₂e/MJ)

Type	Gasoline	Diesel
Conventional	87.5	89.1
Oil Sands	107	108.5
Oil Shale	131.3	133.7
GTL	97	97

- All conventional crudes the same with the exception of oil sands
- No way of compensating for higher GHG crudes with lower ones

EU FQD Impacts on Petroleum



Source: EIA



Source: EIA

- Without biofuels, GHG reductions will be extremely hard to achieve
- Crude slate changes will then be critical
- US exports of distillate growing (potentially from Canadian crude)

Summary

- **EU GHG transport policy in flux**
- **Relatively little movement in cellulosic biofuels**
- **Cap on food-based biofuels continues to increase as new proposals occur**
- **At this point, introduction of ILUC factors will nearly eliminate domestic EU biofuel production**
- **Already stringent GHG footprint standards leave little room for changes in crude**

Backup Slides

EU Biofuel Production by Country

Fuel Ethanol Production – Main Producers (million liters)								
Calendar Year	2007 ^r	2008 ^r	2009 ^r	2010 ^r	2011 ^e	2012 ^f	2013 ^f	2014 ^f
Benelux	33	73	220	415	675	873	1,089	1,114
Germany	397	580	752	765	730	776	823	823
France	539	746	906	942	846	759	759	759
Spain	359	346	465	471	462	381	450	462
United Kingdom	44	70	70	278	427	253	280	443
Austria	15	89	175	199	216	228	230	230
Poland	120	114	165	194	167	211	215	228
Other	296	798	800	1,004	869	1,139	1,296	1,321
Total	1,803	2,816	3,553	4,268	4,392	4,620	5,190	5,380

r = revised / e = estimate / f = forecast EU FAS Posts. Source: EU FAS Posts

EU Biodiesel Production – Main Producers (million liters)									
Calendar Year	2006	2007	2008	2009	2010 ^r	2011 ^r	2012 ^e	2013 ^f	2014 ^f
Germany	2,730	3,280	3,250	2,600	2,880	3,400	3,180	3,180	3,180
France	650	1,090	2,000	2,610	2,270	2,060	2,040	2,040	2,040
Benelux	50	290	430	840	910	950	1,000	1,050	1,090
Poland	100	60	310	420	430	410	670	720	740
Italy	680	530	760	900	830	700	570	570	570
Spain	140	170	280	700	1,370	740	510	400	400
Others	1,060	1,250	2,520	1,790	2,020	2,660	1,695	2,320	2,260
Total	5,410	6,670	9,550	9,860	10,710	10,920	9,665	10,280	10,280

Source: FAS EU Posts

EU Biofuel Consumption by Country

EU Biodiesel Consumption – Main Consumers (million liters)									
Calendar Year	2006	2007	2008	2009	2010^r	2011^r	2012^e	2013^f	2014^f
Germany	3,270	3,560	3,060	2,860	2,930	2,756	2,816	2,840	2,840
France	720	1,480	2,390	2,620	2,580	2,584	2,499	2,500	2,500
Spain	70	330	590	1,170	1,550	1,727	1,585	1,040	1,040
Poland	20	40	550	600	780	1,079	909	965	980
Italy	250	230	810	1,310	1,500	1,853	761	770	770
Benelux	30	420	410	740	580	627	682	730	770
Austria	370	420	460	590	600	576	574	575	580
UK	250	470	1,020	910	970	1,022	511	455	455
Portugal	90	170	170	290	420	394	375	365	365
Sweden	70	140	100	170	190	303	318	340	365
Others	340	469	840	1,010	1,170	998	1,301	1,290	1,335
Total	5,480	7,730	10,400	12,270	13,270	13,920	12,330	11,870	12,000

Fuel Ethanol Consumption – Main Consumers (million liters)								
Calendar Year	2007^r	2008^r	2009^r	2010^r	2011^e	2012^f	2013^f	2014^f
Germany	584	791	1,142	1,475	1,568	1,581	1,646	1,709
United Kingdom	94	152	354	582	696	1,013	1,139	1,266
France	539	814	805	782	777	759	759	759
Italy	0	176	232	306	480	482	482	482
Benelux	168	234	357	366	396	420	435	450
Other	990	1,342	1,713	1,742	1,589	1,378	1,239	1,094
Total	2,375	3,509	4,603	5,253	5,506	5,633	5,700	5,760

r = revised / e = estimate / f = forecast EU FAS Posts. Source: EU FAS Posts