BIOENERGÍA Y BIOCOMBUSTIBLES: HACIA UN TRANSPORTE SOSTENIBLE

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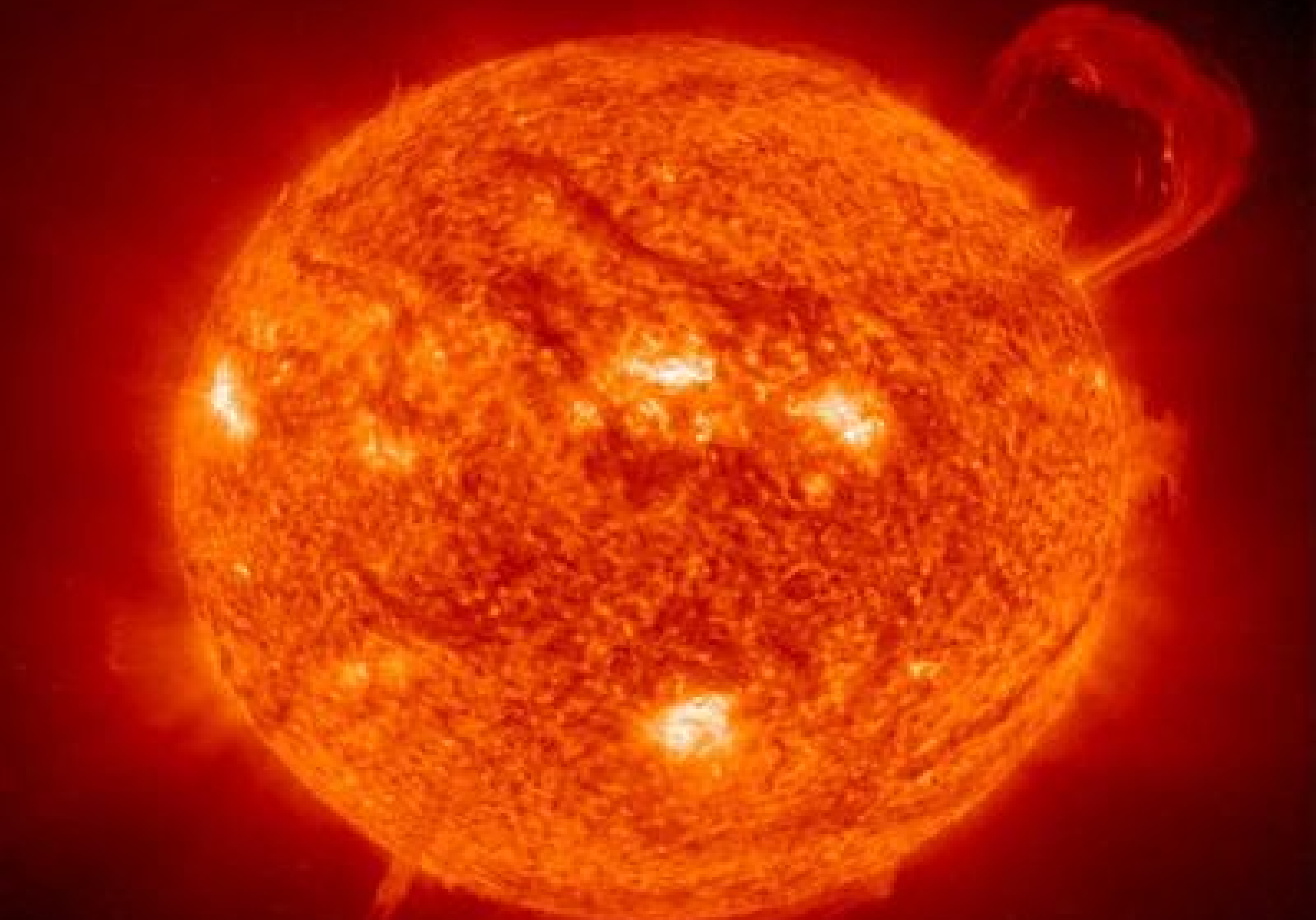
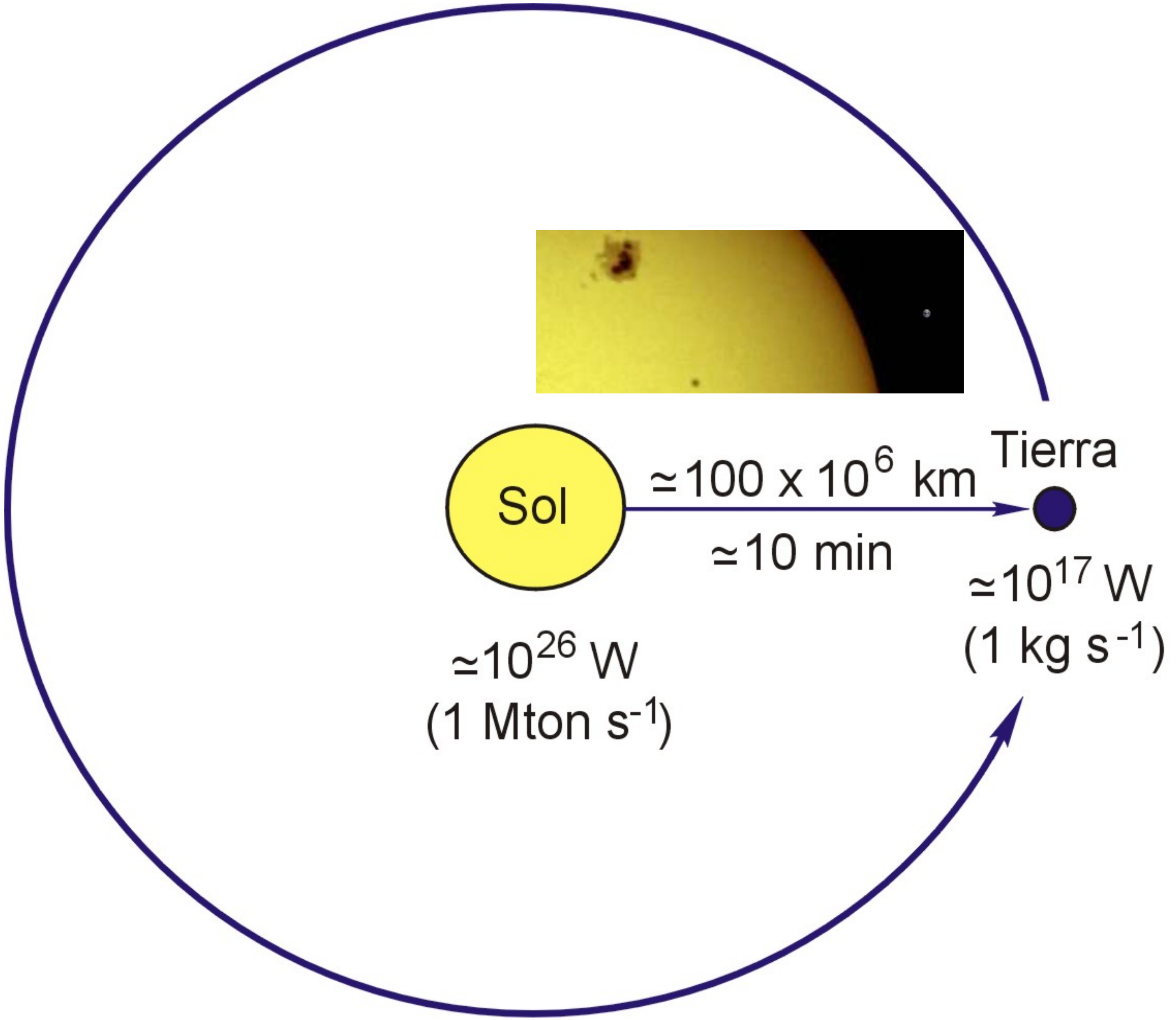
Fundación General CSIC

UIMP Sevilla, 11 Marzo 2015



El sol, fuente de energía y vida

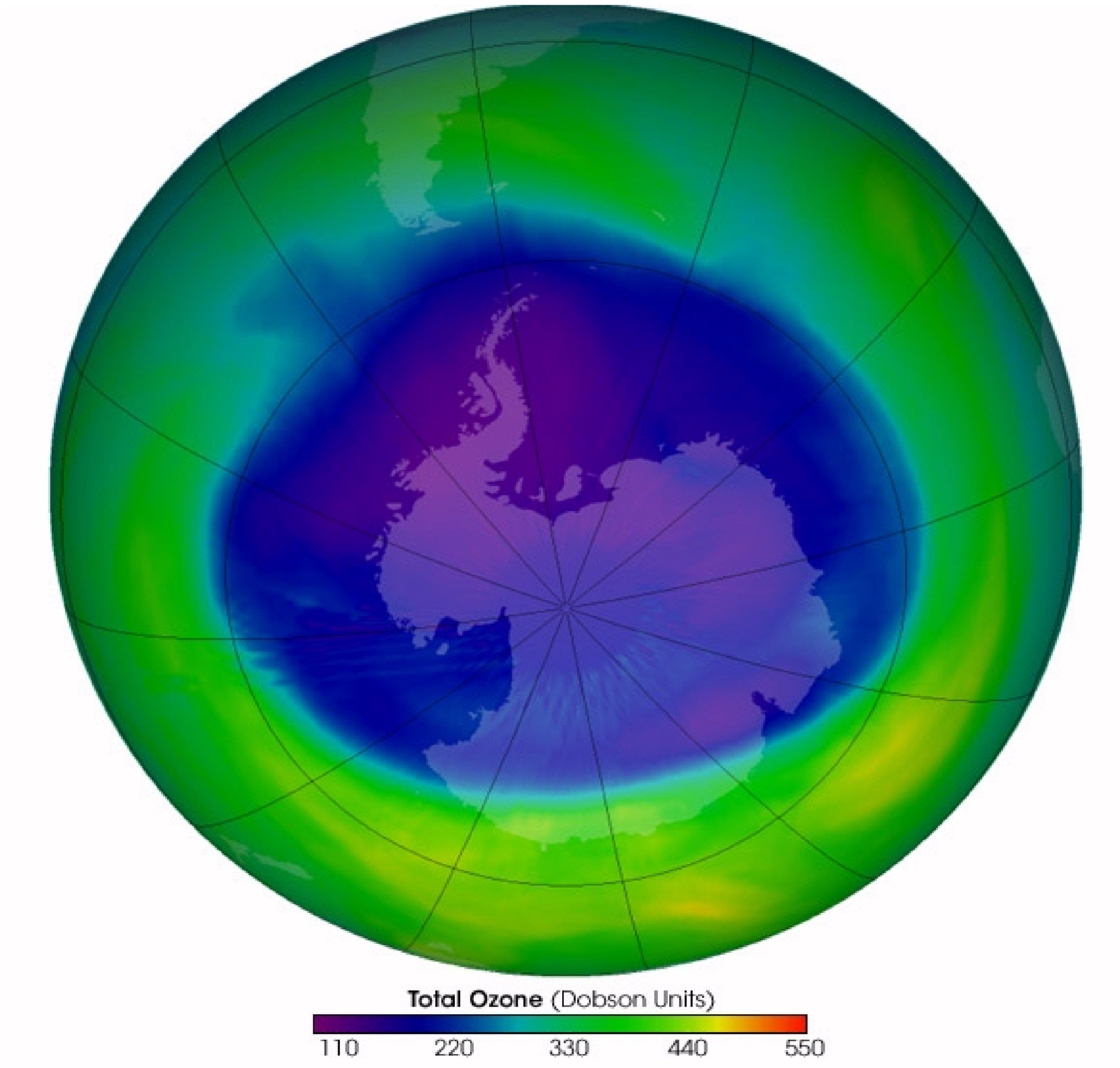
El sol, central nuclear de fusión



Sistemas para la captación de energía solar y su conversión en otras formas de energía

Sistema de conversión	Forma de energía resultante
Fototérmico	Calor → electricidad
Fotovoltaico	Electricidad
Fotoquímico	Compuestos energéticos
Fotobiológico (Fotosíntesis)	Alimentos
	Compuestos energéticos
	Materiales
	Oxígeno

All living creatures became dependent on photosynthesis for food, air and protection from destructive radiation… (DI Arnon)



Energía solar, bioenergía y energía fósil

Consumo mundial de energía	**5 x 10^{20} J/año***
Energía solar recibida por la tierra	**3 x 10^{24} J/año**
Energía solar fijada por el reino vegetal (fotosíntesis)	**3 x 10^{21} J/año**
Energía almacenada en la biomasa (90% árboles)	**3 x 10^{22} J**
Energía almacenada en los combustibles fósiles	**3,3 x 10^{22} J*** (1, petróleo; 0,45, gas natural; 1,9, carbón)

* Datos 2011

Biocombustibles

- Los combustibles en los que basamos nuestra civilización y desarrollo son principalmente productos de la fotosíntesis acontecida en el pasado (combustibles fósiles)

- Resulta cada vez más obvia la necesidad de remplazar los combustibles fósiles por otros de generación renovable (a expensas de la energía solar)

- La fotosíntesis genera biocombustibles (o sus precursores) sólidos, gaseosos y líquidos

Biocombustibles. Oportunidades/ventajas

En relación al medio ambiente:

- Menores emisiones de CO_2
- Posible aprovechamiento de residuos

Con respecto a aspectos económicos y sociales:

- Mayor seguridad energética (reducción de dependencia y diversificación de suministro)
- Menor volatilidad de costes
- Impulso al sector agrícola

En cuanto a aspectos técnicos:

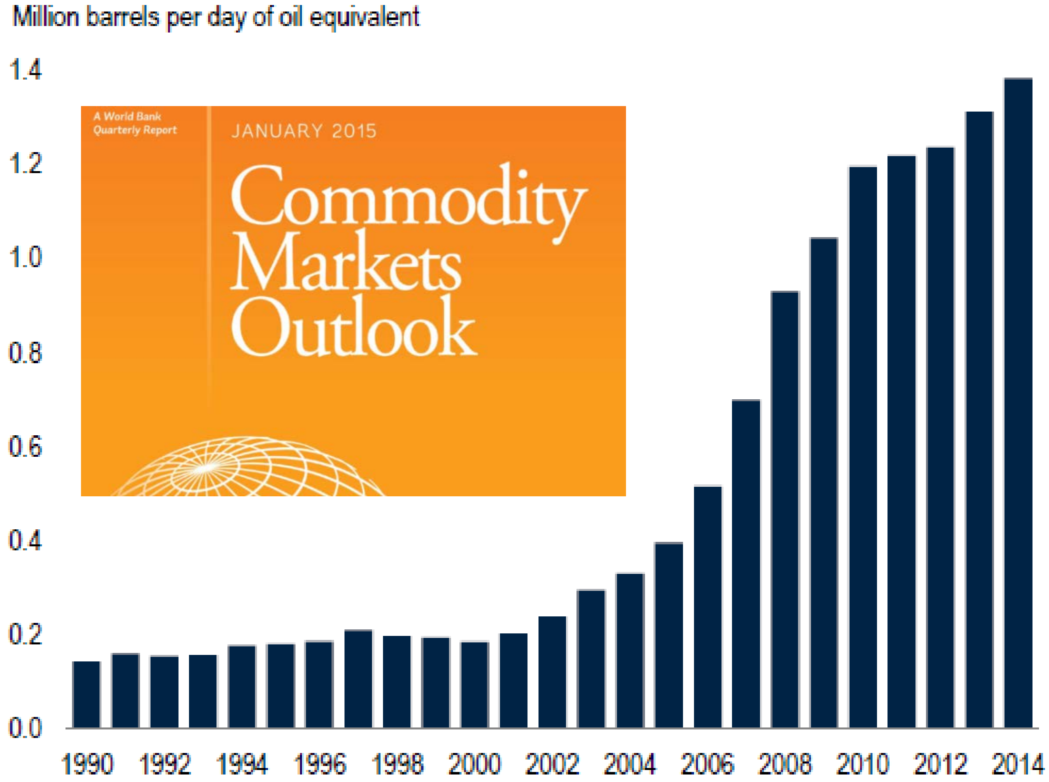
- A baja proporción, compatibilidad con motores convencionales

Procesos para la producción de combustibles a partir de biomasa

Proceso	Materia prima	Productos principales
Térmicos		
Combustión	Biomasa seca	Calor, electricidad
Gasificación	Biomasa seca	Gases combustibles
Gasificación + catálisis	Biomasa seca	Metanol, hidrocarburos, amoniaco
Pirólisis	Biomasa seca	Comb. líquidos y gaseosos, carbón
Biológicos		
Digestión anaeróbica	Biomasa húmeda	Metano
Fermentación	Azúcares	**Etanol**
Hidrólisis + Fermentación	Celulosa	**Etanol**
Químicos		
Transesterificación	Triglicéridos (AG)	**Biodiésel (FAME)** + glicerol
Hidrogenación	Triglicéridos (AG)	**Hidrobiodiésel (HVO)** + parafina

Evolución de la producción mundial de biocombustibles

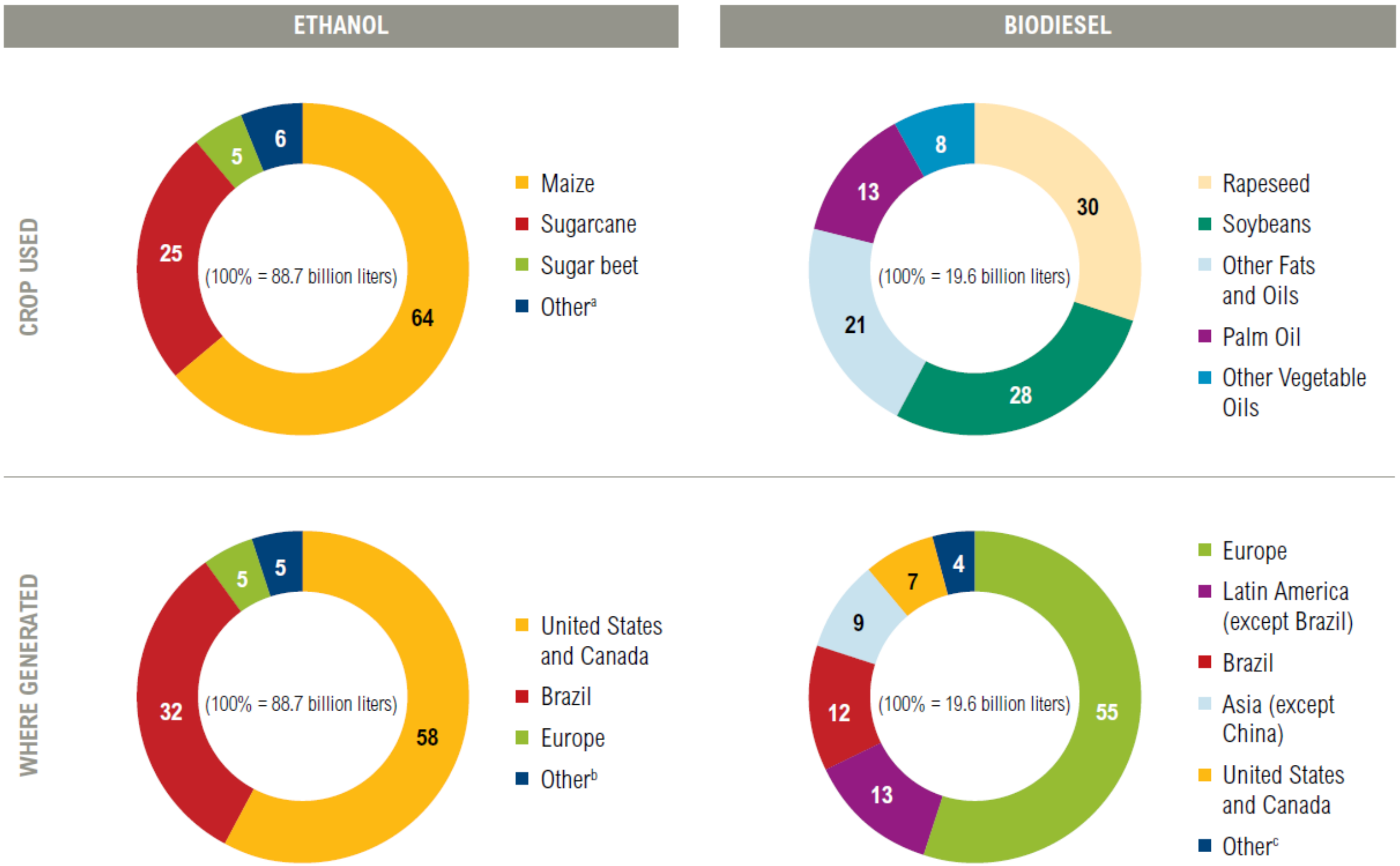
FIGURE F.12 Global biofuels production



Source: BP Statistical Review, IEA, World Bank.

Biocombustibles: Principales materias primas y áreas de producción

Figure 1 | **Biofuel Production in 2010 Was Concentrated in a Few Regions and a Few Crops** (Percent)



Source: EIA (2014a).

Notes:

a. Includes wheat (4%), cassava (1%), and other feedstocks (1%).

b. Includes China (2%) and other regions (3%).

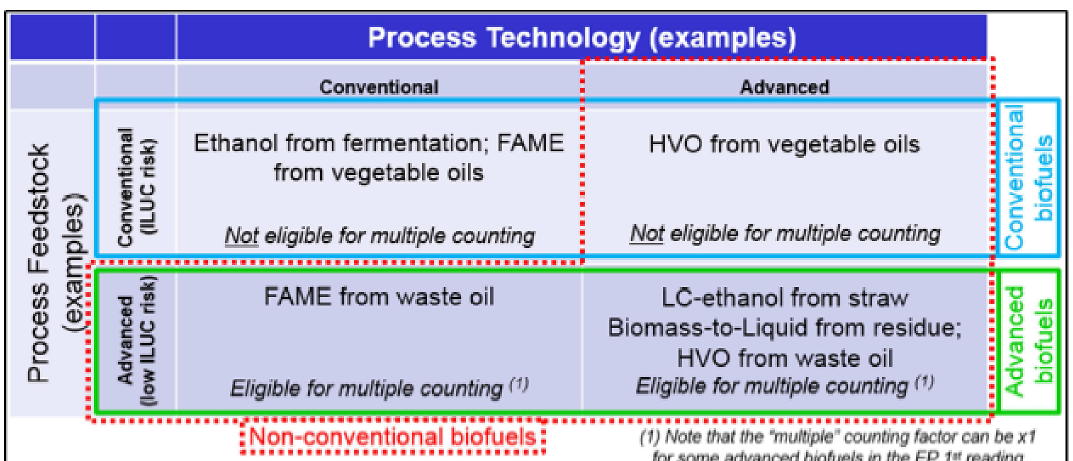
c. Includes China (2%) and other regions (2%).


SORRY, I'M BUSY SAVING THE PLANET
Bio Ethanol
PURE CORN
GO GREEN

Terminologías en biocombustibles líquidos

Tipo de biocombustible	Características	Desarrollo en término de I+D+i
Bioetanol 1G	Utilización directa en algunos motores de combustión preparados para ello o mezcla con combustibles fósiles (E10).	Fase de competición, se producen sin ayudas en algunos casos, aunque a menudo existen medidas de promoción a la producción.
	Más utilizado actualmente a nivel mundial.	
	Se obtiene de productos agrícolas también destinados a la alimentación.	
Biodiésel 1G	Segundo más utilizado a nivel mundial.	Fase de competición. Tanto por costes y volumen de producción, se considera al bioetanol 1G en una situación más avanzada que el biodiésel 1G.
	Se obtiene a partir de aceites vegetales procedentes de semillas oleaginosas de soja, colza, girasol, palma.	
Etanol ligno-celulósico 2G	Los azúcares necesarios para su producción se obtienen a partir de biomasa celulósica.	Aún muy lejos de ser competitivo. Fase precomercial con mínima introducción en el mercado.
	La producción de su biomasa es más sostenible, abundante y barata y no compite con las cosechas alimenticias.	
Biodiésel 2G	Biodiesel sintético o avanzado que se produce a partir de la biomasa ligno-celulósica.	En una posición de introducción en el mercado más avanzada que el etanol ligno-celulósico, aunque aún muy lejos de ser competitivo.
Hidrógeno de biomasa 3G	Se basa en la obtención de hidrógeno a partir de la biomasa.	Fase pionera, aunque el proceso con hidrógeno puede que se encuentre más cerca de ser introducido en el mercado.
Biodiesel de microalgas 3G	Biocombustible procedente de las algas.	Fase pionera, la tecnología se encuentra alejada aún de la puesta en funcionamiento de prototipos.
	El esfuerzo principal se centra en las microalgas, dada su alta concentración de lípidos.	

R. Guerrero et al (2012). Cuadernos económicos de ICE, 83, 141-163



JEC Biofuel Study 2013

Palma aceitera o africana *(Elaeis guineensis* Jacq.)

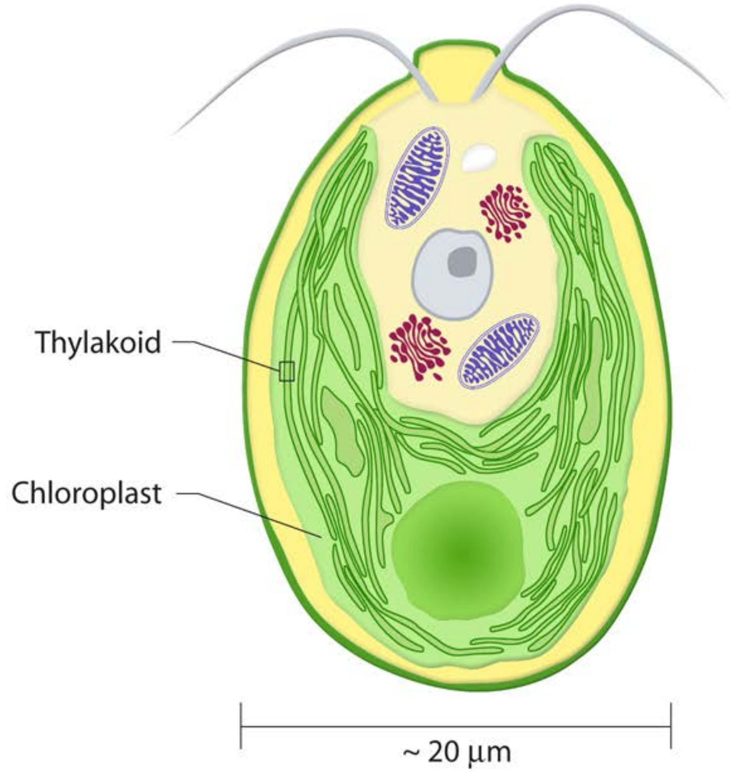
Jatrofa (*Jatropha curcas*)

Pongamia (*Pongamia pinnata*)

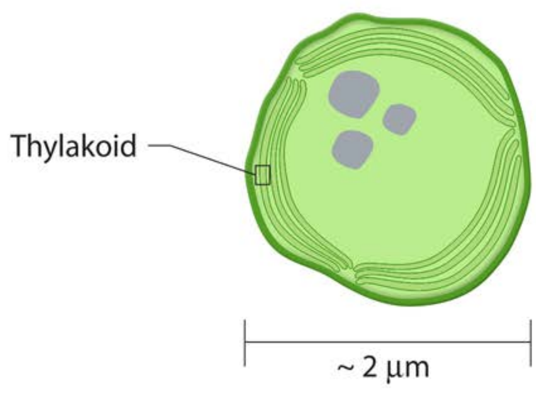
Mijo perenne
(*Panicum virgatum*)

Miscanthus giganteus

Microalga

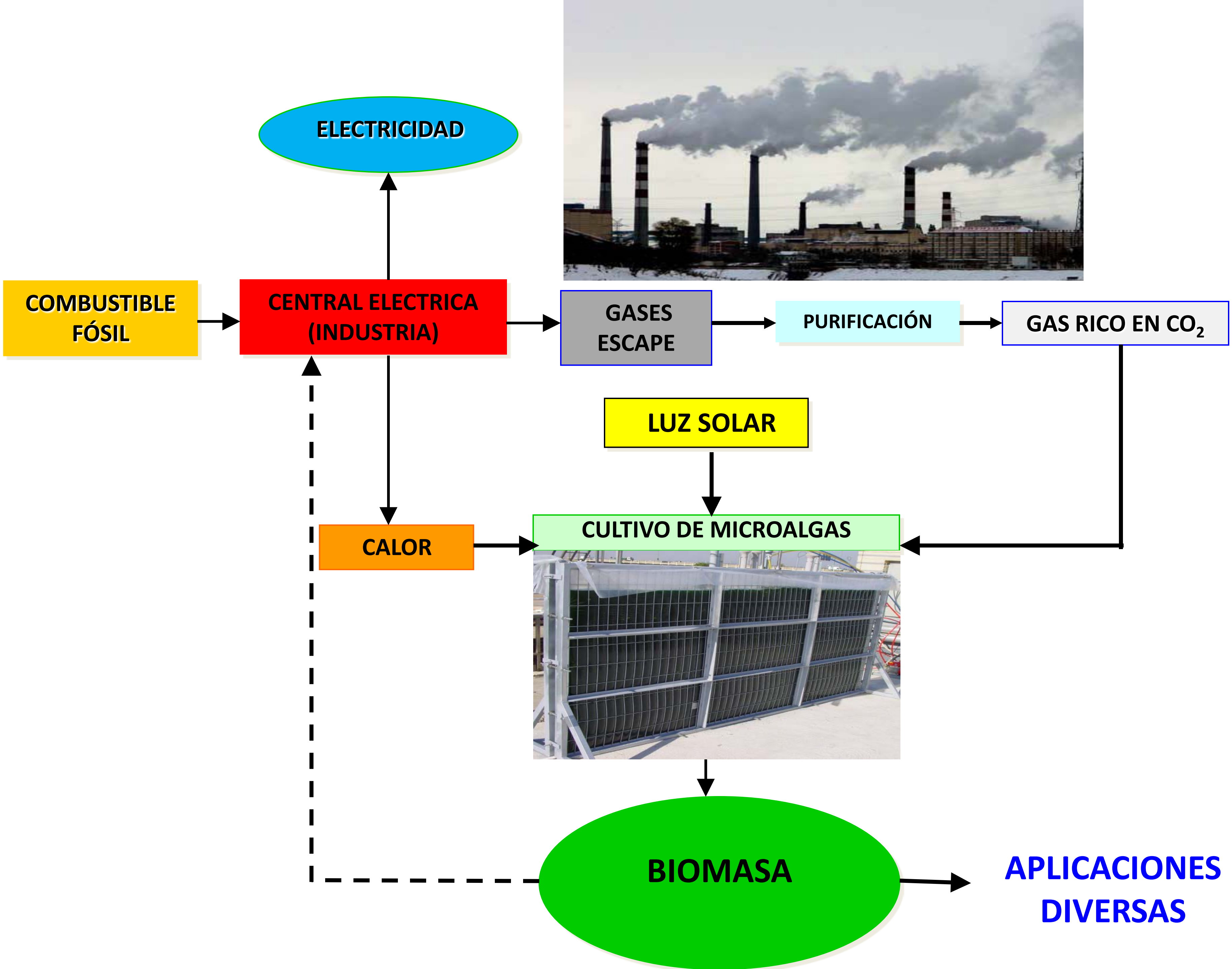


Cianobacteria



Ventajas de las microalgas sobre los cultivos agrícolas para la producción de biocombustibles

- Crecimiento más rápido
- Mayor productividad
- Pueden alcanzar elevado nivel de aceite y/o azúcares
- No compiten con la agricultura tradicional
- Pueden usar agua dulce, salobre, de mar (o residual?)
- Mayor facilidad para manipular condiciones
- Posibilidad de emplear gases de escape como fuente de CO_2
- UE: incentivación 4X del biocombustible de microalgas sobre el de 1ª generación


ELECTRICIDAD
COMBUSTIBLE FÓSIL
CENTRAL ELECTRICA (INDUSTRIA)
GASES ESCAPE
PURIFICACIÓN
GAS RICO EN CO_2
LUZ SOLAR
CALOR
CULTIVO DE MICROALGAS
BIOMASA
APLICACIONES DIVERSAS

Microalgas como fuente potencial de carbohidratos

Cosecha	Productividad (L etanol ha^{-1} $año^{-1}$)
Trigo	2.000
Maíz	4.000
Remolacha azucarera	6.000
Caña de azúcar	6.500
Microalgas (proyección)	***20.000***

Microalgas como fuente potencial de aceite para biodiesel

Cosecha	Productividad (L aceite ha^{-1} $año^{-1}$)
Maíz	180
Soja	450
Jatrofa	1.900
Coco	2.700
Palma aceitera	4.000-6.000
Microalgas (proyección)	***20.000-30.000***

La escasez de conocimiento científico-técnico y experiencia práctica limita la disponibilidad de:

- **Estirpes (cepas) adecuadas,** en las que se combinen altos valores de productividad de biomasa y elevado nivel celular de lípidos o carbohidratos

- **Condiciones de cultivo apropiadas,** en las que se maximice la productividad de lípidos o carbohidratos

- **Sistemas de producción y procesamiento idóneos,** con bajos costes de inversión, operación y consumo energético

- **Criterios fiables para el escalado a nivel industrial de los sistemas de producción y procesamiento**

CONSECUENCIA: ELEVADO COSTO DE PRODUCTO

Proyecciones de precios de producción para microalgas

Norsker et al (2011) Biotechnology Advances 29: 24–27

Unit biomass production cost (in cts, eurocents) from various capital and operating cost elements for raceway ponds, tubular photobioreactors and flat panel photobioreactors.

(Base case)	Raceway ponds		Tubulars		Flat panels	
	cts kg^{-1} DW		cts kg^{-1} DW		cts kg^{-1} DW	
	1 ha	100 ha	1 ha	100 ha	1 ha	100 ha
Major equipment + power						
PVC liner	49.33	40.45				
Centrifuge	118.66	44.45	43.26	9.54	38.61	7.23
Power	17.02	19.12	3.65	3.96	2.54	2.99
Medium preparation	81.31	44.66	29.29	9.29	19.31	7.01
Power	3.80	4.20	0.84	0.81	0.64	0.61
Harvest buffer tank	25.11	18.84	6.28	3.89	4.09	2.94
Culture circulation pump			73.74	73.33		
Power			47.06	47.06		
Steel framework					11.73	11.73
Blower/paddle wheel	4.52	4.53	6.91	0.99	73.55	69.30
Power	3.17	3.18	5.83	5.79	240.67	240.67
Other capital						
Installation costs	41.84	22.94	47.84	29.11	44.19	29.46
Instrumentation costs	27.89	15.29	15.95	9.70	14.73	9.82
Piping	83.68	45.88	47.84	29.11	44.19	29.46
Buildings	83.68	45.88	47.84	29.11	44.19	29.46
Variable costs (ex. power)						
Polyethylene tubing/sheet			12.76	12.76	9.76	9.76
Culture medium	44.00	44.00	44.00	44.00	44.00	44.00
Carbon dioxide	33.67	33.67	33.67	33.67	33.67	33.67
Medium filters	44.42	44.42	18.39	18.39	13.88	13.88
Labour	579.55	12.56	289.78	6.28	188.58	4.09
Salary overhead	144.89	3.14	72.44	1.57	47.15	1.02
Maintenance	42.91	23.53	49.07	29.86	45.32	30.22
General plant overheads	342.35	19.85	93.39	17.09	128.65	18.87
Sum	1772	495	990	415	1049	596

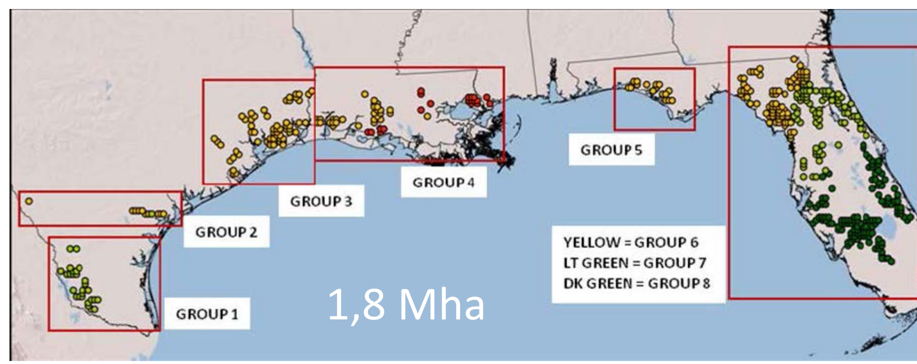
Argonne NATIONAL LABORATORY — NREL NATIONAL RENEWABLE ENERGY LABORATORY — Pacific Northwest NATIONAL LABORATORY, Proudly Operated by Battelle Since 1965

Renewable Diesel from Algal Lipids: An Integrated Baseline for Cost, Emissions, and Resource Potential from a Harmonized Model

Coordinating Authors: Ryan Davis,[3] Daniel Fishman,[2] Edward D. Frank,[1] Mark S. Wigmosta[4]

Contributing Authors: Andy Aden,[3] Andre M. Coleman,[4] Philip T. Pienkos,[3] Richard J. Skaggs,[4] Erik R. Venteris,[4] Michael Q. Wang[1]

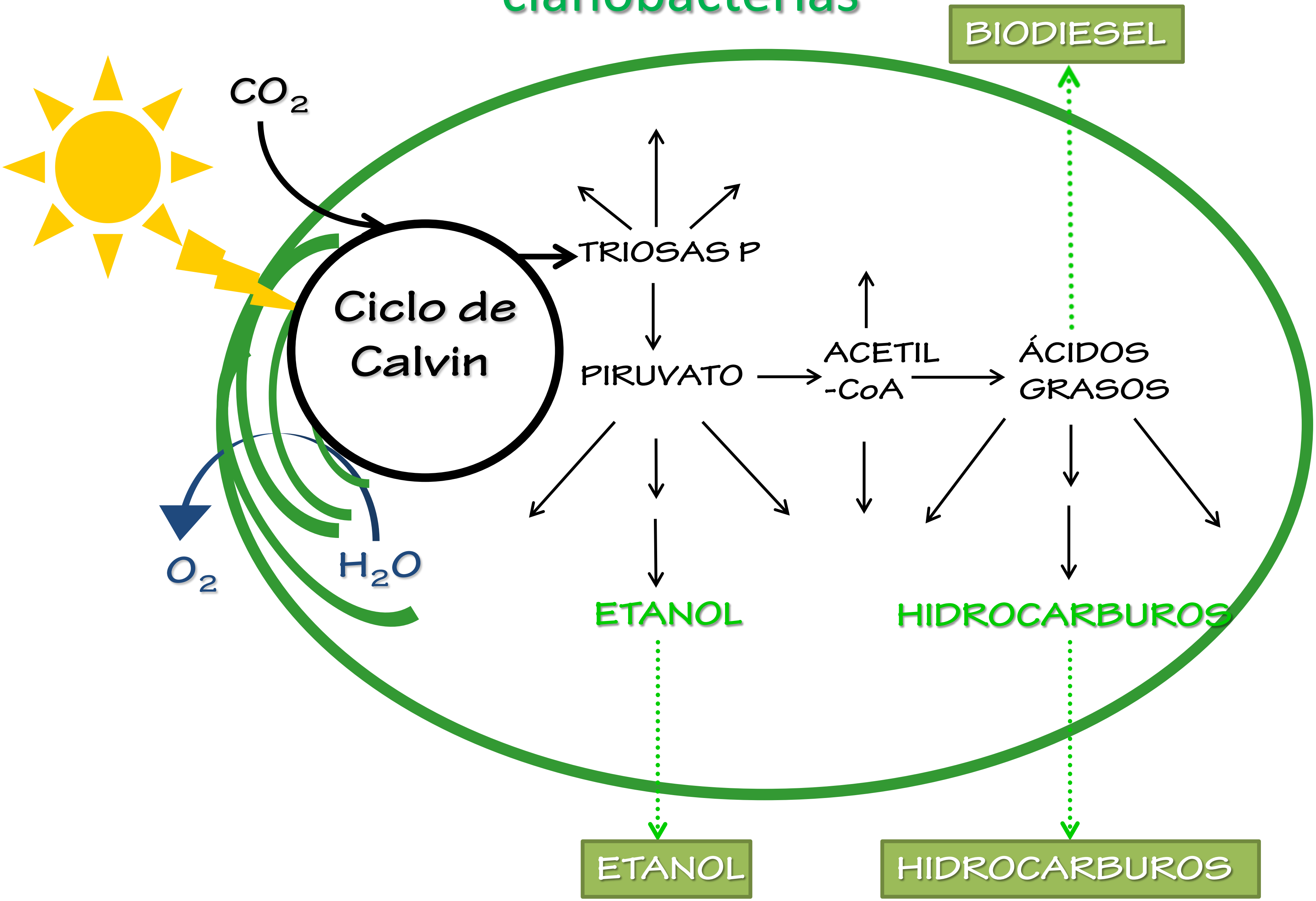
Technical Report
ANL/ESD/12-4
NREL/TP-5100-55431
PNNL-21437
June 2012
Prepared for the U.S. Department of Energy Biomass Program



Productividad media, 13,2 g por m^2 y día; contenido en aceite, 25%

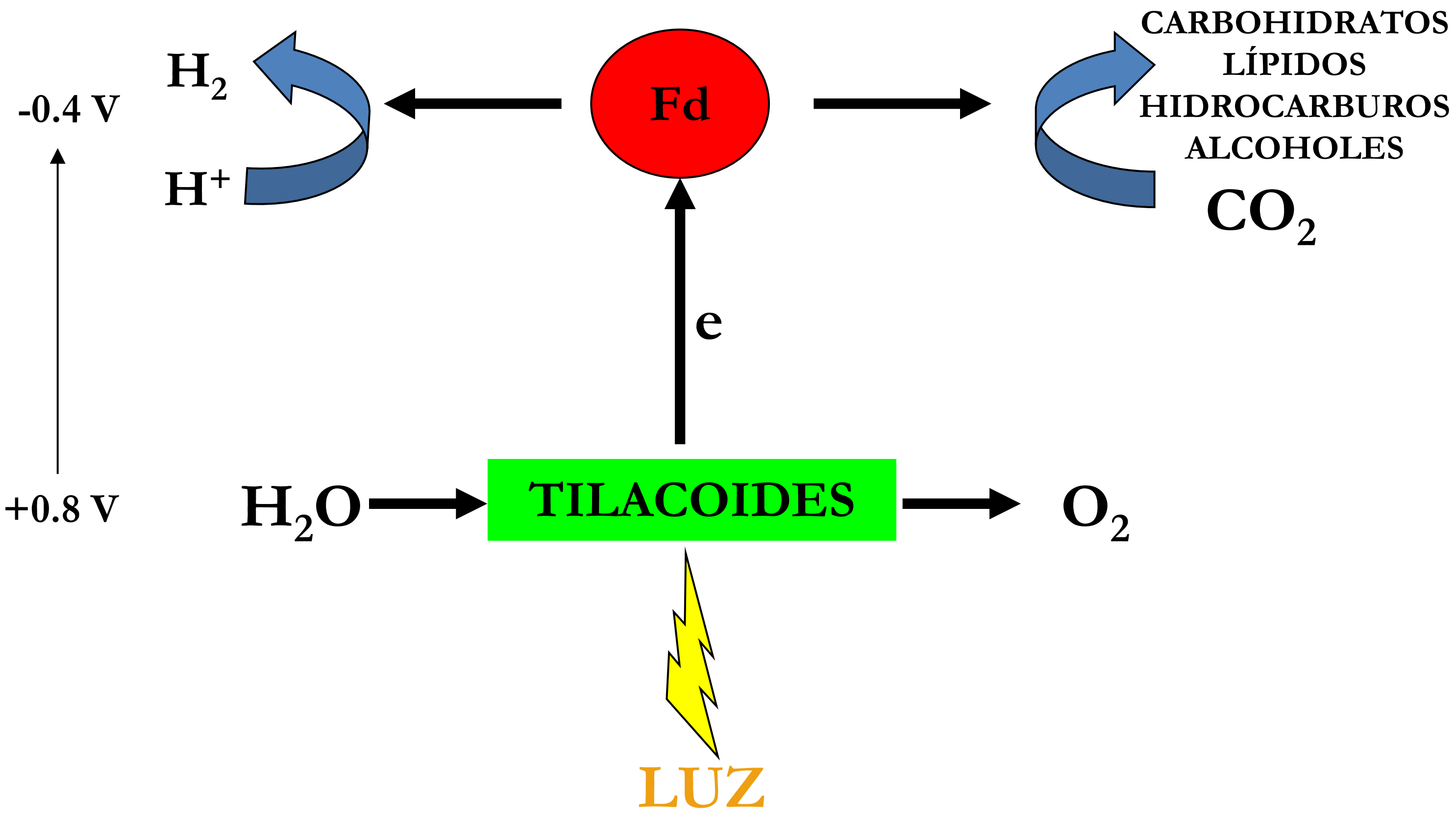
Precio: 17,5 $/gal aceite: ~4 €/L (1€/kg biomasa)

Fotoproducción de biocombustibles por cianobacterias

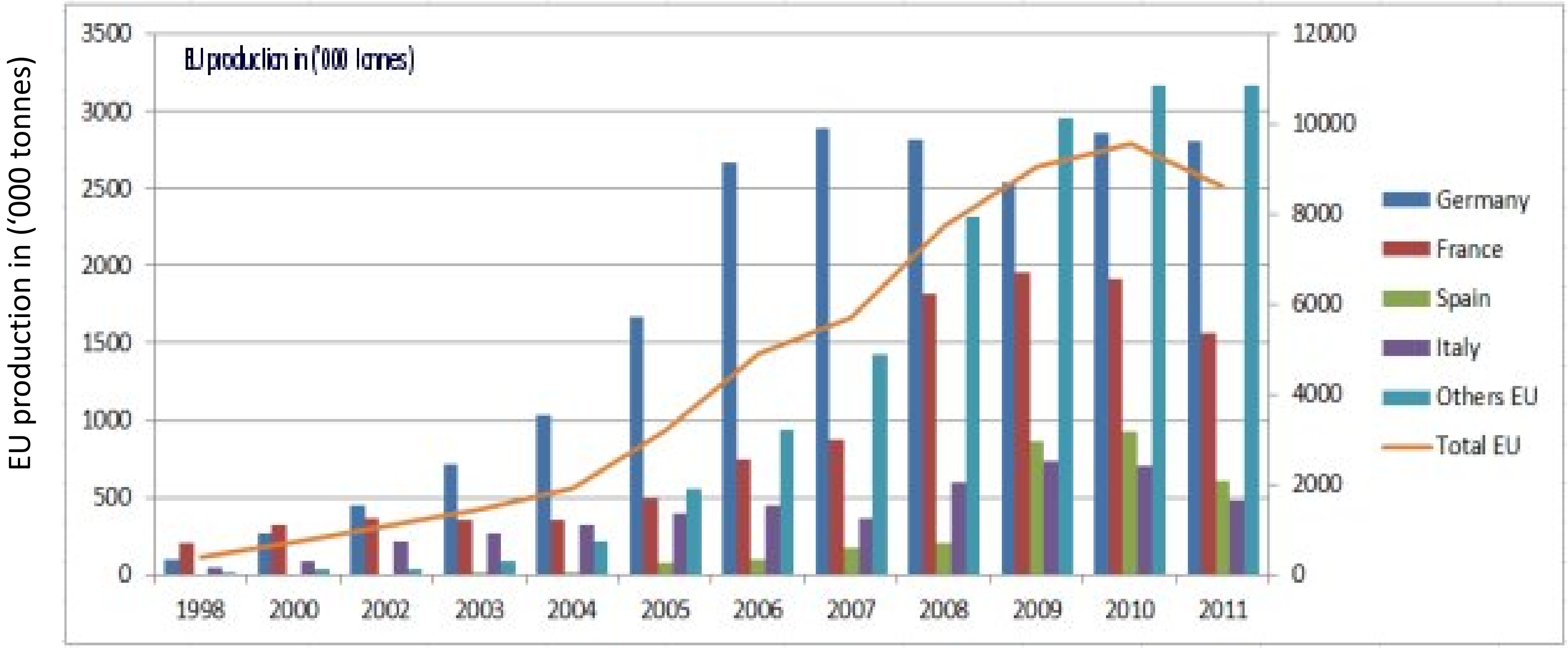


Producción fotosintética de biocombustibles

En la fotosíntesis se utiliza la energía de la luz solar para sintetizar compuestos ricos en energía a partir de sustratos oxidados, con bajo contenido energético



Los biocombustibles en la UE: Biodiésel



Fuente: European Biodiesel Board

Producción europea de biodiesel

(European Biodiesel Board)

2011 Production By Country

COUNTRY	'000 TONNES*
Germany	2800
France	1559
Spain	604
Italy	479
Belgium	472
Netherlands	370
Poland	363
Portugal	287
Austria	226
Denmark/Sweden	225
Finland *	225
UK	218
Czech Republic	154
Hungary	150
Slovakia	103
Romania	101
Lithuania	79
Greece	78
Latvia	56
Ireland *	26
Bulgaria	26
Cyprus	6
Estonia	0
Luxemburg	0
Malta	0
Slovenia	0
TOTAL	**8,607**

** Data include hydro-diesel production*

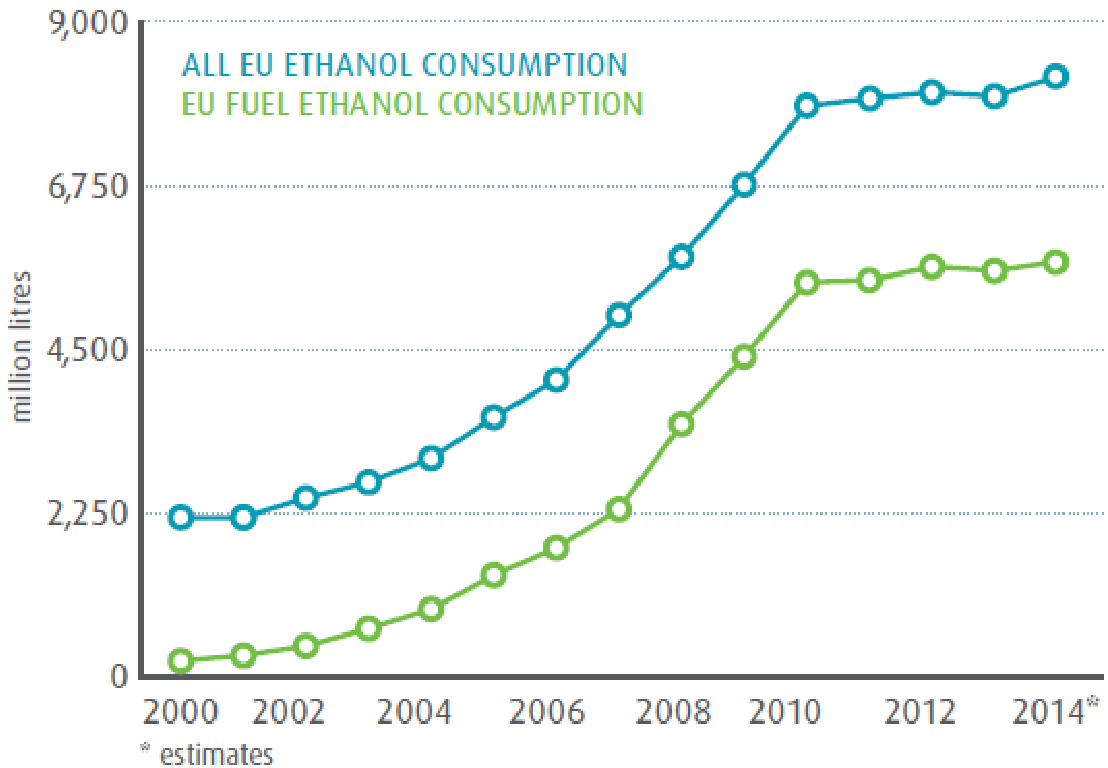
2011 production was decreased by 10.06% compared to 2010. Subject to a +/- 5% margin of error.

2012 Production Capacity

COUNTRY	'000 TONNES*
Austria	535
Belgium	770
Bulgaria	408
Cyprus	20
Czech Republic	437
Denmark	250
Estonia	110
Finland*	340
France	2 456
Germany	4 968
Greece	812
Hungary	158
Ireland*	76
Italy	2 310
Latvia	156
Lithuania	130
Luxemburg	20
Malta	5
The Netherlands	2 517
Poland	884
Portugal	483
Romania	277
Slovakia	156
Slovenia	113
Spain	4 391
Sweden	182
UK	574
TOTAL	**23,538**

Los biocombustibles en la UE: Bioetanol

ETHANOL CONSUMPTION IN THE EU



ePURE
european renewable ethanol

Renewable ethanol: driving jobs, growth and innovation throughout Europe

STATE OF THE INDUSTRY REPORT

2014

2013 ETHANOL BALANCE (billion litres)

	Production capacity	Production	Consumption	Imports	Imports % of consumption	Exports
U.S.A.	56	51	50	1.6	3.2%	2.9
Brazil	40.7	23.5	20.9	0.3	1.4%	3.6
EU	8.8	6.7	7.9	1.2	15.2%	0.1

Source: F.O. Licht

JEC Biofuel Study 2013

European Commission

JRC SCIENCE AND POLICY REPORTS

EU renewable energy targets in 2020: Revised analysis of scenarios for transport fuels

JEC Biofuels Programme

Authors: Heather D.C. HAMJE (CONCAWE), Heinz HASS (EUCAR), Laura LONZA (JRC), Heiko MAAS (EUCAR), Alan REID (CONCAWE), Kenneth D. ROSE (CONCAWE), Tom VENDERBOSCH (CONCAWE)

2014

concawe

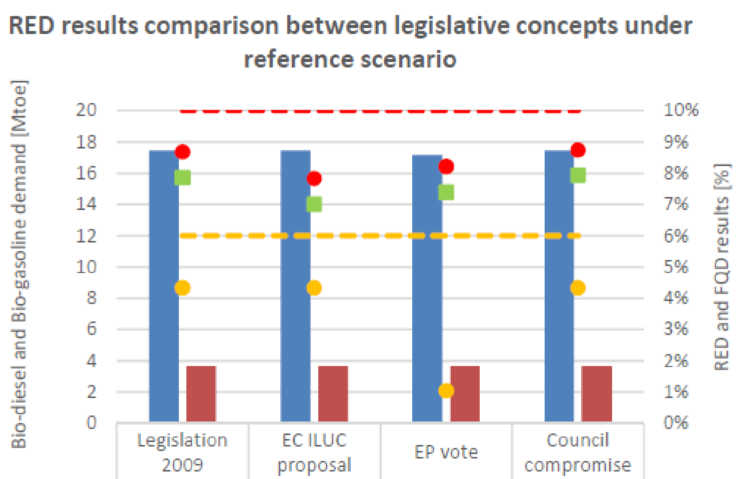
EUCAR

EUROPEAN COUNCIL FOR AUTOMOTIVE R&D

European Commission

Proyecciones europeas a 2020

For Reference Scenario		RED	FQD [w/o ILUC]	FQD [w/ ILUC]
TARGET		10%	6%	NA
2011 JEC Biofuel Study	2009 RED & FQD	9.7%	4.4%	NA
2013 JEC Biofuel Study	2009 RED & FQD	8.7%	4.3%	NA
	2012 EC Proposal	7.8%	4.3%	1.0% [7]
	2013 EP 1st Reading	8.2%	NA	1.0%
	2013 Council Text	8.7%	4.3%	1.0% [7]



	Legislation 2009	EC ILUC proposal	EP vote	Council compromise
Bio-diesel [Mtoe]	17.46	17.46	17.16	17.46
Bio-gasoline [Mtoe]	3.7	3.7	3.7	3.7
RED: Road	7.9%	7.0%	7.4%	7.9%
RED: all sectors	8.68%	7.83%	8.22%	8.75%
FQD: all sectors	4.3%	4.3%	1.0%	4.3%
RED target	10%	10%	10%	10%
FQD target	6%	6%	6%	6%

Figure 5-8. Legislative comparison results on RED & FQD

RED: Renewable Energy Directive
FQD: Fuel Quality Directive

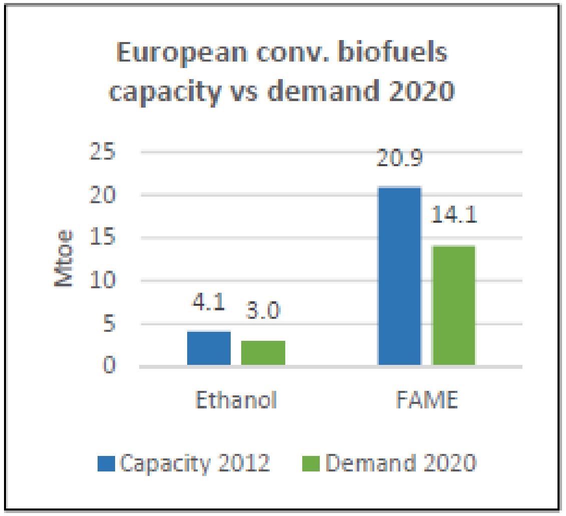
JEC Biofuel Study 2013

Biocombustibles convencionales en EU27

JEC Biofuel Study 2013

Bio-ethanol (EU27)	2010		2012
Production capacity installed	3.4 Mtoe		4.1 Mtoe
Actual production	1.5 Mtoe		2.2 Mtoe
Utilization	43%		54%
Production capacity under construction	0.9 Mtoe		0.2 Mtoe
Bio-diesel (EU27)		**2011**	**2012**
Production capacity installed	18.4 Mtoe in 2009	19.7 Mtoe	20.9 Mtoe
Actual production	6.9 Mtoe in 2009	7.6 Mtoe	-
Utilization (2008 and 2011)	37% in 2008	39%	-
Production capacity under construction	-	-	-

Capacidad actual de producción y grado de utilización



Capacidad actual de producción y previsión demanda 2020

Objetivos mínimos biocarburantes

	Objetivo global	Objetivo en gasolinas	Objetivo en gasóleos
Francia	7,57%	7,00%	7,70%
Polonia	7,10%		
Eslovenia	7,00%		
Suecia	6,41%	3,20%	8,78%
Alemania	6,25%	2,80%	4,40%
Finlandia	6,00%		
Lituania	5,80%	3,34%	6,45%
Austria	5,75%	3,40%	6,30%
Dinamarca	5,75%		
Portugal	5,50%		6,22%
Países Bajos	5,50%	3,50%	3,50%
Bélgica	5,09%	2,66%	5,53%
Irlanda	4,94%		
Bulgaria	4,94%	3,34%	5,53%
Hungría	4,90%	4,90%	4,90%
Rumanía	4,79%	3,00%	5,53%
Luxemburgo	4,75%		
República Checa	4,57%	2,73%	5,53%
Eslovaquia	4,50%	2,73%	6,27%
Italia	4,50%		
Malta	4,50%		
España	4,10%	3,90%	4,10%
Reino Unido	3,90%		
Grecia	2,64%		6,45%
Croacia	2,06%		
Promedio	**5,15%**	**3,58%**	**5,81%**

6,5% 4,1% 7,0% hasta 2013

Los biocombustibles en España

Biocarburantes: energía renovable para una movilidad sostenible

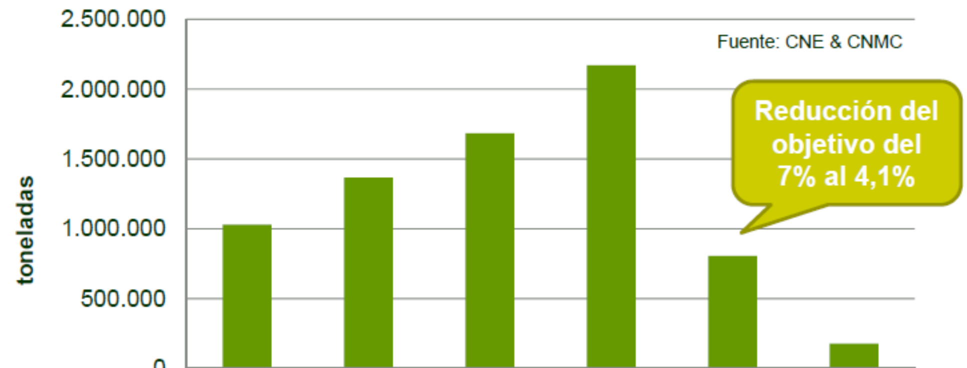
Óscar García
Presidente
APPA Biocarburantes

Jornada "Retos y oportunidades en las ciudades ante la Directiva 2014/94 de implantación de una infraestructura para combustibles alternativos"

GENERA - 25 de febrero de 2015 - Madrid

III. Situación del biodiésel en España

Consumo de biocarburantes en gasóleos en España

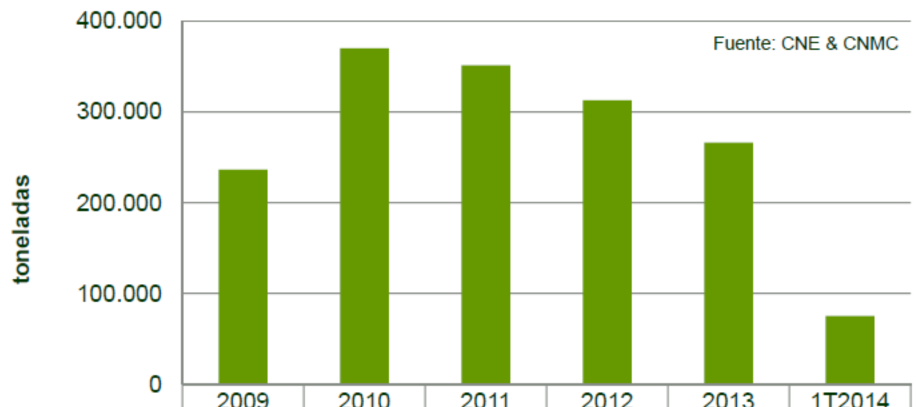


	2009	2010	2011	2012	2013	1T2014
Biocarburantes (t)	1.029.271	1.367.660	1.682.702	2.171.872	805.771	179.550

El consumo de biodiésel se ha reducido drásticamente debido a la rebaja de los objetivos nacionales de biocarburantes en 2013.
El incentivo fiscal finalizó en 2012. Desde 2010 la mayoría del consumo se ha venido cubriendo con importaciones.

III. Situación del bioetanol en España

Consumo de biocarburantes en gasolinas en España



	2009	2010	2011	2012	2013	1T2014
Bioetanol (t)	236.335	370.091	351.388	312.536	265.907	74.865

La continua disminución del consumo de gasolinas ha provocado, junto con la reducción de objetivos, la caída del consumo de bioetanol en España.

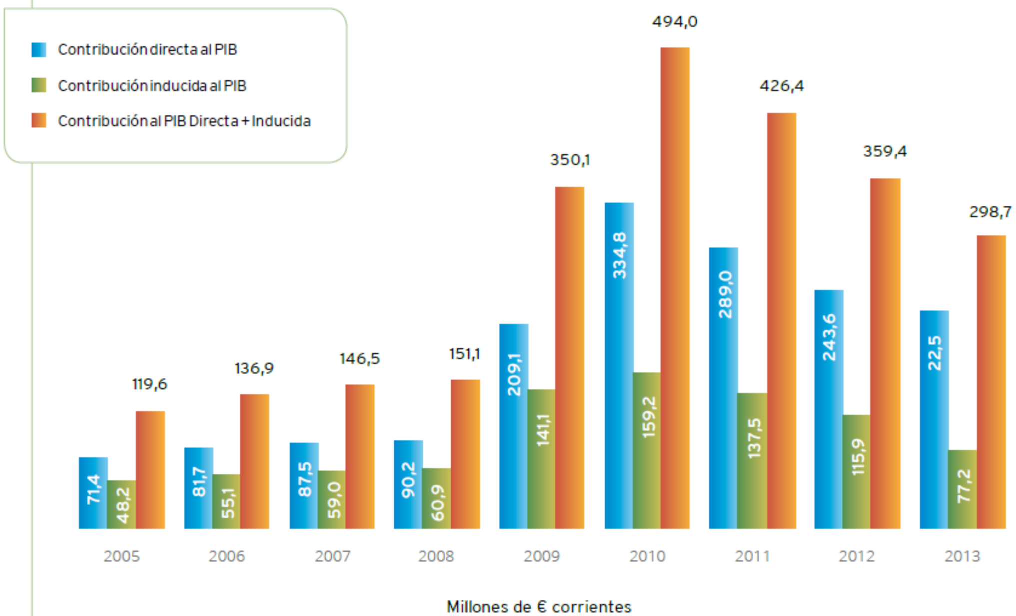
APPA
Asociación de Empresas
de Energías Renovables

Gráfico 4.1.4
Cuota de mercado real en términos energéticos de los biocarburantes

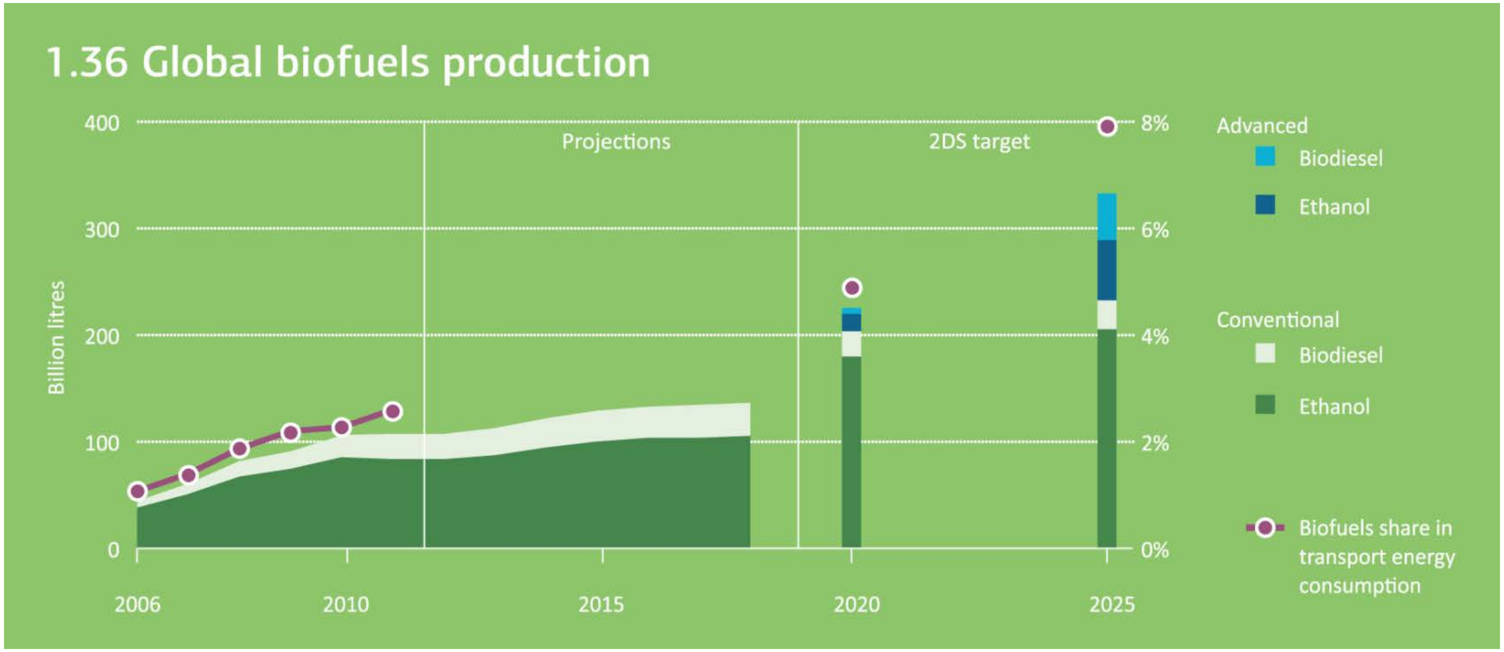
Fuente: CNMC

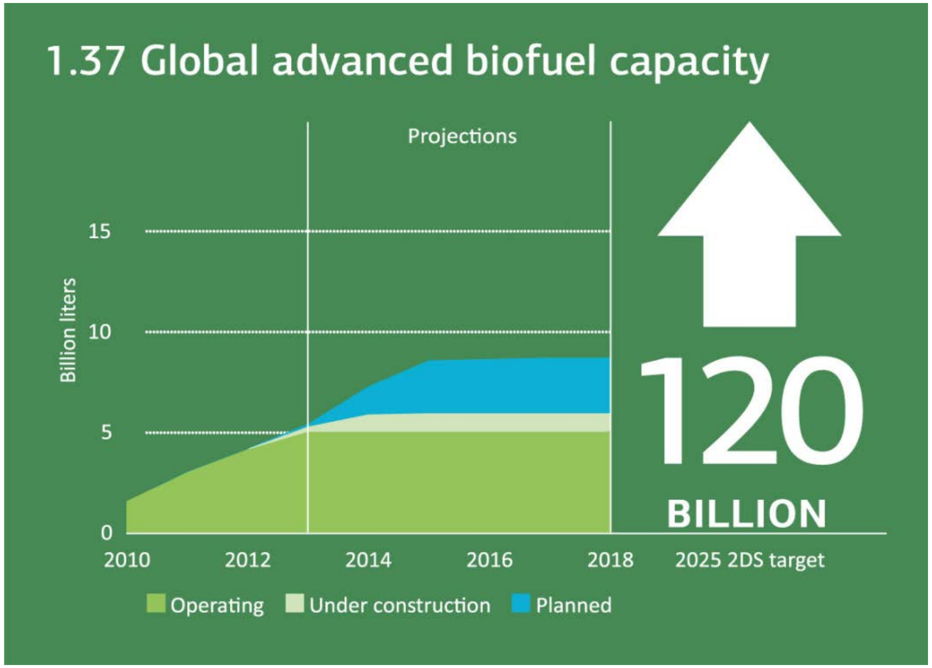
Gráfico 4.1.1
Aportación al PIB de los sectores del biodiésel y del bioetanol

Fuente: APPA



Proyecciones globales

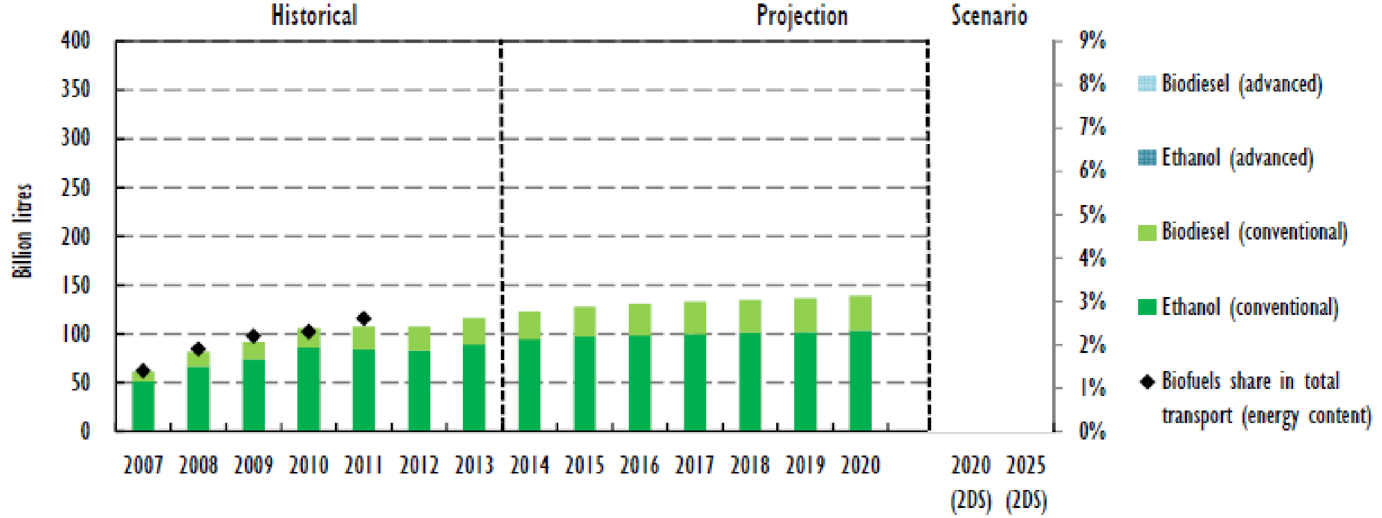




Tracking Clean Energy Progress 2014. IEA

Transition to advanced biofuels for transport threatened by policy uncertainty

Projected biofuel production versus targets in IEA 2°C Scenario (2DS)



- Conventional biofuel production continues to grow, and will provide 4% of road transport fuel demand in 2020
- First commercial-scale advanced biofuel plants coming on line
  - Without adoption of long-term policy framework, advanced biofuels sector faces grim future

MIT
Technology
Review

Kevin Bullis

November 15, 2013

Oil Companies Happy, Biofuels Companies Distraught Over New EPA Rules

EPA says it wants to lower the amount of ethanol oil companies are required to blend with their fuel.

Today the U.S. Environmental Protection Agency today proposed lowering the amount of biofuel required under the Renewable Fuels Standard.

The decision is a blow to biofuels companies, but drew praise from some odd bedfellows – the American Petroleum Institute and the Union of Concerned Scientists.

Last year the EPA required refiners and importers to blend 16.55 billion gallons of renewable fuel into the fuel supply. This year, it proposes to lower that number to 15.21 billion, which will have the effect of shrinking the amount of biofuel that’s sold.

SCIENCE — 245 COMMENTS

New Report Urges Western Governments to Reconsider Reliance on Biofuels

By JUSTIN GILLIS JAN. 28, 2015

WORLD RESOURCES INSTITUTE

Working Paper

Installment 9 of "Creating a Sustainable Food Future"

AVOIDING BIOENERGY COMPETITION FOR FOOD CROPS AND LAND

TIM SEARCHINGER AND RALPH HEIMLICH

SUMMARY

What is the role of bioenergy in a sustainable food future? The answer must recognize the intense global competition for land, and that any dedicated use of land for bioenergy inherently comes at the cost of not using that land for food, feed, or sustained carbon storage.

The world needs to close a 70 percent gap between the crop calories that were available in 2006 and the calorie needs anticipated in 2050. During the same period, demand for meat and dairy is projected to grow by more than 80 percent, and demand for commercial timber and pulp is likely to increase by roughly the same percentage. Yet three-quarters of the world's land area capable of supporting vegetation is already managed or harvested to meet human food and fiber needs. Much of the rest contains the world's remaining natural ecosystems, which need to be conserved and restored to store carbon and combat climate change, to protect freshwater resources, and to preserve the planet's biological diversity.

A growing quest for bioenergy exacerbates this competition for land. In the past decade, governments have pushed to increase the use of bioenergy—the use of recently living plants for energy (Box 1)—by using crops for transportation biofuels and increasingly by harvesting trees for power generation. Although increasing energy supplies has provided one motivation, the belief that bioenergy use will help combat climate change has been another. However, bioenergy that entails the dedicated use of land to grow the energy feedstock will undercut efforts to combat climate change and to achieve a sustainable food future.

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Most working papers are eventually published in another form and their content may be revised.

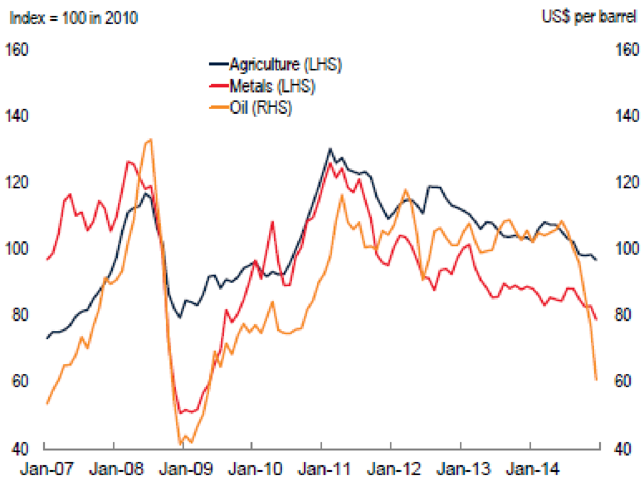
Suggested Citation: Searchinger, T. and R. Heimlich. 2015. "Avoiding Bioenergy Competition for Food Crops and Land." Working Paper, Installment 9 of *Creating a Sustainable Food Future*. Washington, DC: World Resources Institute. Available online at http://www.worldresourcesreport.org.

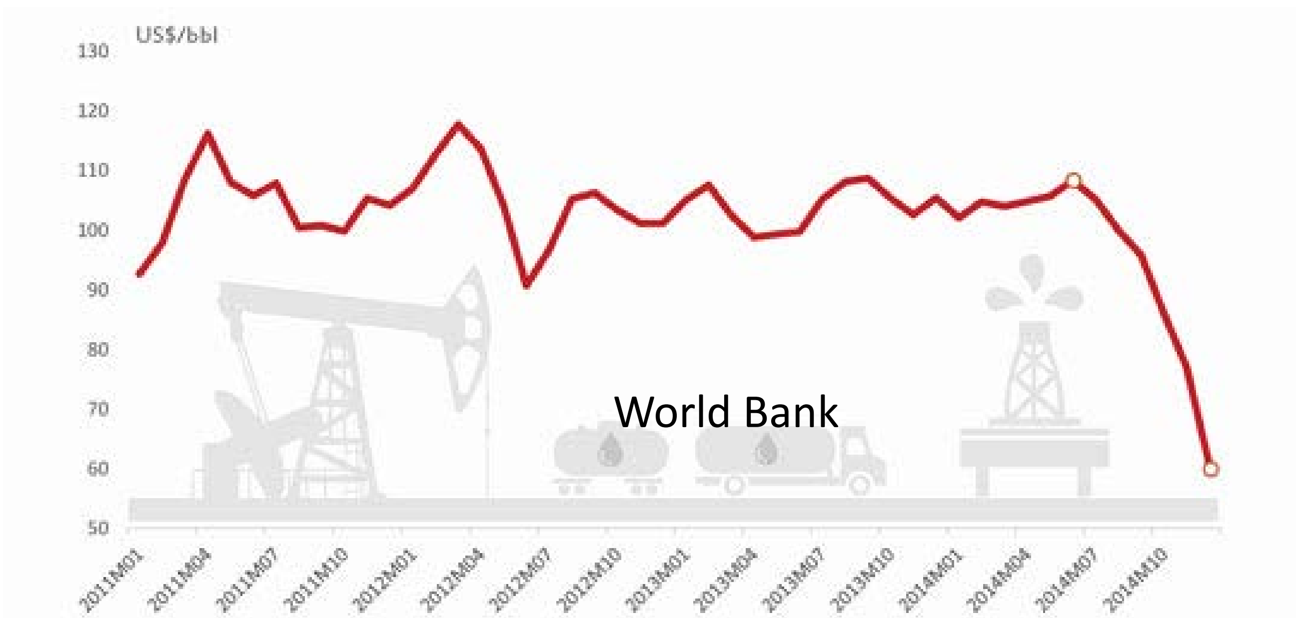
RECOMMENDATIONS

Using land to produce bioenergy is likely to compete with food production and carbon storage. This competition makes feeding the planet more difficult, likely triggers conversion of natural landscapes, and increases greenhouse gas emissions.

We therefore recommend phasing out the dedicated use of land to generate bioenergy, including biofuels, while reserving some efforts to generate bioenergy from true wastes.

FIGURE F.2 **Oil, agriculture, and metal prices**





Global Food Security 2 (2013) 82–88

Contents lists available at SciVerse ScienceDirect

Global Food Security

journal homepage: www.elsevier.com/locate/gfs

ELSEVIER

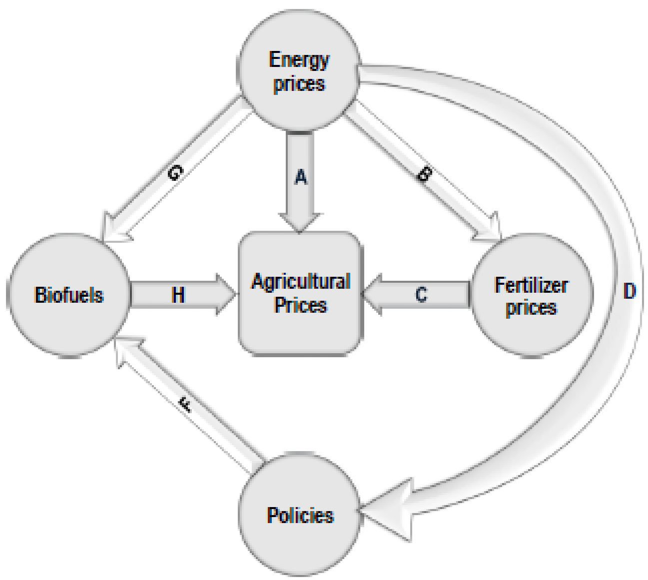
How biofuels policies affect the level of grains and oilseed prices: Theory, models and evidence

CrossMark

Harry de Gorter *, Dusan Drabik, David R. Just

Charles H. Dyson School of Applied Economics and Management, Cornell University, United States

FIGURE F.8 Energy and agricultural markets



Source: Baffes (2013)

Note: A: Crude oil; B/C: Natural gas; D/F: Policy-driven; Biofuels

G: Profitable biofuels

Production of biofuels is largely policy-driven and its profitability has been questioned, even at oil prices above 100 US $/bbl

World Bank Commodities Price Data (The Pink Sheet)

3-Mar-2015

Commodity	Unit		Annual Averages Jan-Dec 2012	Jan-Dec 2013	Jan-Dec 2014	Quarterly Averages Oct-Dec 2013	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Monthly Averages Dec 2014	Jan 2015	Feb 2015
Energy													
Coal, Australia	$/mt	a/	96.4	84.6	70.1	82.0	77.1	72.7	67.9	62.9	62.4	62.1	61.4
Coal, Colombia	$/mt		84.0	71.9	65.9	71.1	68.4	64.8	66.8	63.7	63.8	56.7	57.8
Coal, South Africa	$/mt		92.9	80.2	72.3	83.0	78.4	75.0	70.2	65.8	66.1	62.2	63.3
Crude oil, average	$/bbl		105.0	104.1	96.2	104.5	103.7	106.3	100.4	74.6	60.7	47.1	54.8
Crude oil, Brent	$/bbl	a/	112.0	108.9	98.9	109.4	107.9	109.8	102.1	76.0	62.3	48.1	57.9
Crude oil, Dubai	$/bbl	a/	108.9	105.4	96.7	106.7	104.4	106.1	101.5	74.6	60.5	46.0	55.8
Crude oil, WTI	$/bbl	a/	94.2	97.9	93.1	97.4	98.7	103.1	97.5	73.2	59.3	47.3	50.6
Natural gas, Index	2010=100		99.2	112.1	111.7	111.9	127.8	115.5	102.0	101.6	99.0	90.2	83.0
Natural gas, Europe	$/mmbtu	a/	11.5	11.8	10.1	11.4	11.3	10.2	9.2	9.5	9.8	9.3	8.3
Natural gas, US	$/mmbtu	a/	2.8	3.7	4.4	3.9	5.2	4.6	3.9	3.8	3.4	3.0	2.8
Natural gas, LNG Japan	$/mmbtu	a/	16.6	16.0	16.0	15.7	16.7	16.4	15.4	15.7	15.6	14.9	13.4

The Commodities Note

January 9, 2015 8:29 am

Oil price fall adds to biofuel's woes

Jonathan Kingsman

Survival of the sector will depend on political support

Low oil prices may be good news for the world's oil consumers but they are bad news for the world's biofuel producers.

It was never intended to be this way. Back when governments first mandated legal minimums for biofuel content in transport fuels, "peak oil" was on everyone's lips and there was a general fear that oil prices could head towards $200 per barrel. Now that oil prices are closer to $50 those mandates are tougher to justify economically.

LATEST FROM fastFT

Fast New York Open: Jobs on the mind
Inflation expectations for Europe rise again
Russian rouble gains as oil price ticks higher
European equities drift despite ECB tub thumping
Nikkei 225 approaches 19,000 in Super Mario rally

Markets data

ENERGY | METALS | AGRICULTURE

Brent Crude Oil	60.79	+0.51 %
WTI Crude Oil	50.54	-0.43 %
RBOB Gasoline	1.89	+0.33 %
Natural Gas	2.81	-1.16 %

MIT
Technology
Review

Cheap Oil Could Kill Off Cellulosic Ethanol

Inexpensive oil could increase the pressure to reduce mandates for biofuels.

By David Talbot on December 3, 2014

The plunge in oil prices, accelerated by a recent OPEC decision to maintain production targets, will deal a new blow to efforts to commercialize advanced biofuels such as ethanol made from woody plant waste, or diesel made from plant oils. Lower oil prices may also help strengthen the case for scaling back the federal regulations requiring the use of biofuels.

Progress in commercializing advanced biofuels such as cellulosic ethanol has been slow despite federal rules mandating the use of such fuels. Earlier this year a few large-scale cellulosic ethanol plants, including ones operated by Poet-DSM, DuPont, and Abengoa, became operational. All were planned when oil was above $100 a barrel. A number of other projects were canceled even before the recent oil price plunge.

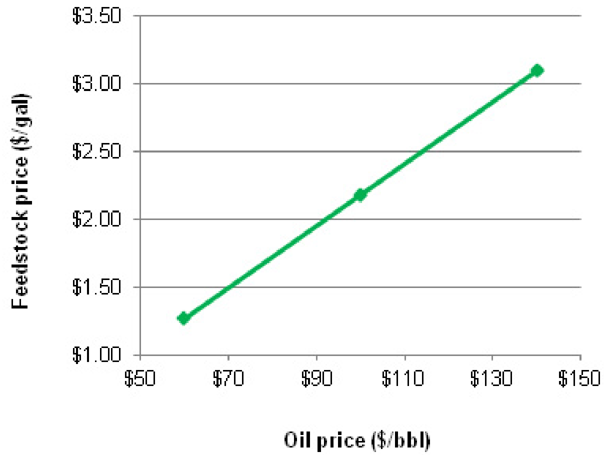
AgBioForum, 15(4): 79-87. ©2013 AgBioForum.

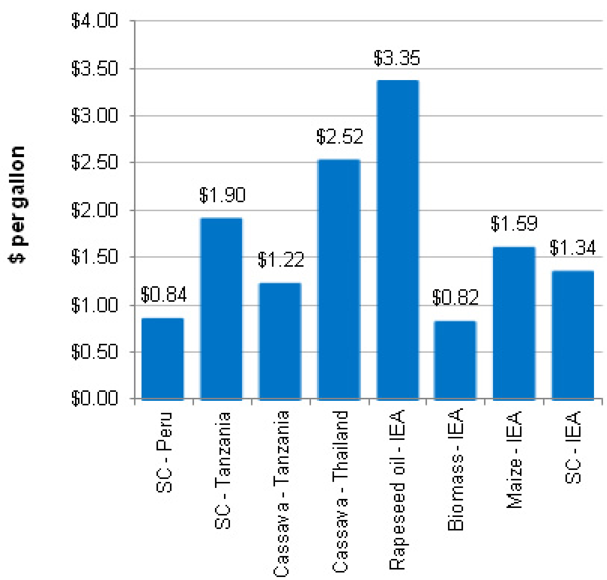
Long-term Biofuel Projections under Different Oil Price Scenarios

John Miranowski
Iowa State University

Alicia Rosburg
University of Northern Iowa

With rapid expansion of biofuel production, major concerns have arisen over higher food costs and competition between food, feed, and biofuel for energy-rich commodities. Most projections are based on short- and intermediate-term commodity price shocks. We estimate long-term biofuel demand and cost-minimizing supply functions for feedstock and biofuel in developed and developing countries. We assume input and output coefficients and substitution elasticities adjust over time in response to changing prices in a dynamic market environment with productivity growth. Three alternative oil price scenarios are considered for biofuel feedstock production and conversion. The price of oil puts both a floor and ceiling on feedstock price. We conclude that global biofuel expansion will be limited in the absence of government incentives and mandates, unless high real oil prices prevail. Countries and regions need large, excess feedstock supplies (price-elastic response) if biofuel expansion is to be competitive with oil or other liquid fuels.



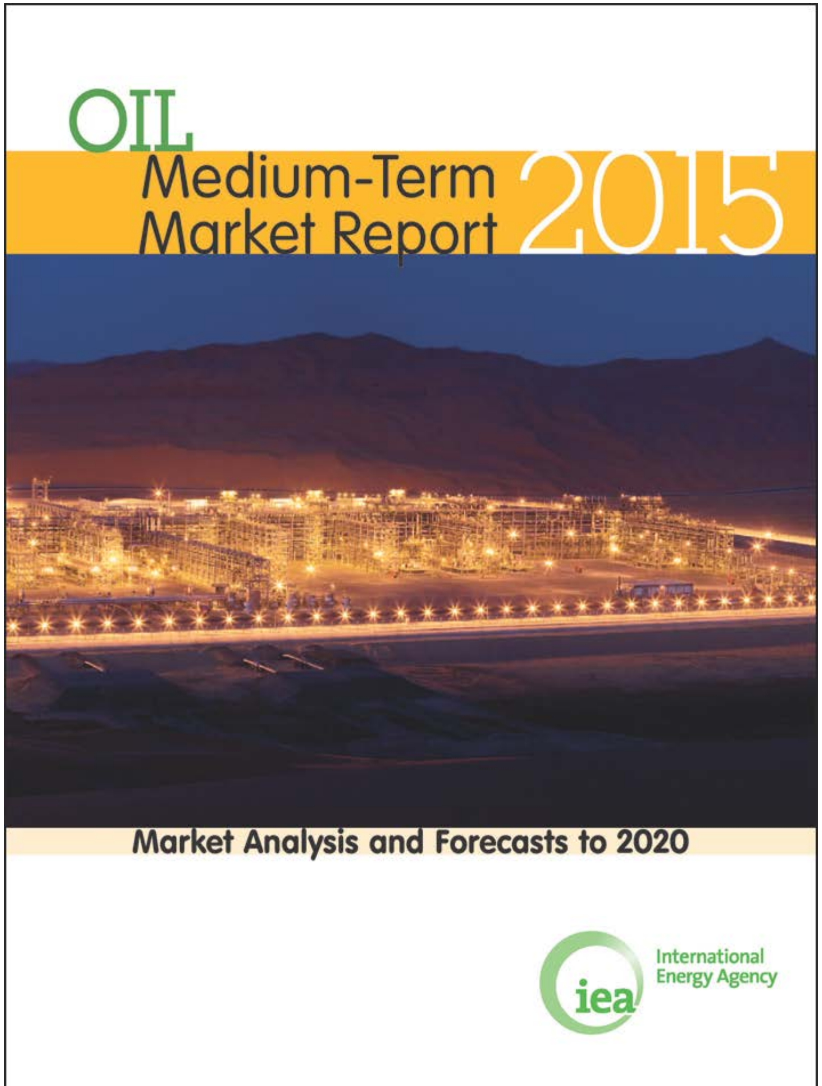


Oil price functions both as a floor and ceiling on high-energy crop use for feedstock (Brazil ethanol/sugar).

Global, market-based expansion of biofuel production will be limited in the absence of high oil prices or government incentives and mandates.

For advanced biofuels (e.g. LC-ethanol):
A high oil price that significantly exceeds feedstock cost ($140/bbl) will have to prevail to incentivize commercial industry development and deployment.

¿Hay lugar para la esperanza?



From the Executive Summary:

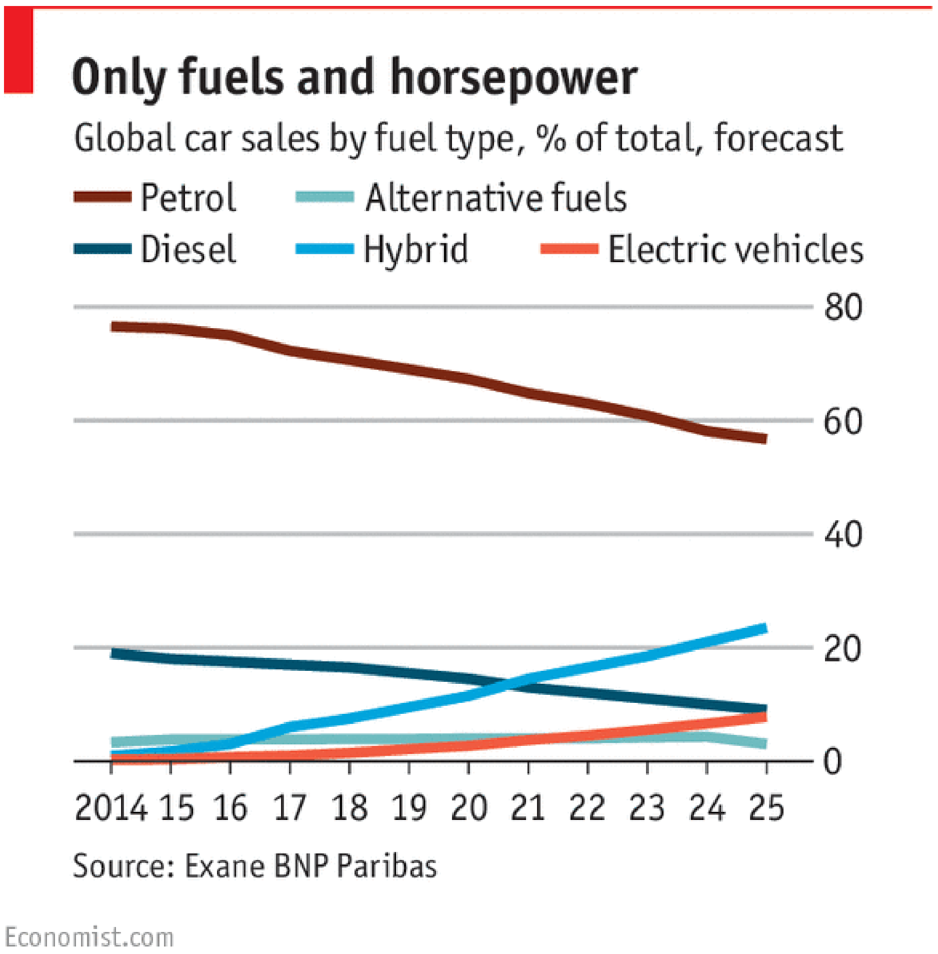
As with previous editions of this *Report*, the price *assumptions* (not forecasts) used as modelling input are derived from the futures curve. These averaged roughly USD 55/bbl for 2015, ramping up gradually to USD 73/bbl in 2020.

While lower oil prices may theoretically cause biofuels to grow less competitive against hydrocarbon fuels in mature markets, in practice production is expected to remain unaffected as biofuel consumption remains largely mandate-driven. Indeed, world biofuel production is projected to rise slightly faster than previously expected, reaching 2.4 mb/d by 2020, up from roughly 2.2 mb/d in 2014.

The Economist

Why the low oil price will not harm sales of electric cars

Feb 24th 2015, 9:53 BY S.W.



BIOENERGÍA Y BIOCOMBUSTIBLES: HACIA UN TRANSPORTE SOSTENIBLE

Miguel García Guerrero

Instituto de Bioquímica Vegetal y Fotosíntesis

Fundación General CSIC

UIMP Sevilla, 11 Marzo 2015